### ENGLISH TO METRIC CONVERSION TABLE

<table>
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<th>MULTIPLY</th>
<th>BY</th>
<th>TO GET</th>
<th>MULTIPLY</th>
<th>BY</th>
<th>TO GET</th>
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<tbody>
<tr>
<td>acres</td>
<td>0.404 687 3</td>
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<td>ounce(force)</td>
<td>0.278 013 9</td>
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<tr>
<td>board feet</td>
<td>0.002 359 74</td>
<td>cubic meter</td>
<td>pint(liq.)</td>
<td>0.473 176</td>
<td>liters=l</td>
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<tr>
<td>cubic ft.</td>
<td>0.028 316 85</td>
<td>cubic meter</td>
<td>pint(dry)</td>
<td>0.550 61</td>
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<tr>
<td>cubic yd.</td>
<td>0.764 554 9</td>
<td>cubic meter</td>
<td>pound( wt.)</td>
<td>0.453 592 37</td>
<td>kilogram</td>
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<tr>
<td>feet</td>
<td>0.304 8</td>
<td>meters</td>
<td>pound( force)</td>
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<td>newtons=N</td>
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<tr>
<td>footcandles</td>
<td>10.763 91</td>
<td>lux=lumens/m²</td>
<td>pound/sq.ft</td>
<td>47.880 26</td>
<td>pascal=N/m²</td>
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<tr>
<td>ft.-lb_f</td>
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<td>N=m=joule</td>
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<tr>
<td>gallon (US)</td>
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<td>quart(liq.)</td>
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<td>horsepower*</td>
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<td>sq. feet</td>
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<tr>
<td>* horsepower=550 ft-lb/sec</td>
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<td></td>
<td>sq. in.</td>
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<td>ton( short)</td>
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<td>metric ton</td>
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</tbody>
</table>

### FOR TEMPERATURE CONVERSION USE

°C = 5/9(°F - 32)

### METRIC TO ENGLISH CONVERSION TABLE

<table>
<thead>
<tr>
<th>MULTIPLY</th>
<th>BY</th>
<th>TO GET</th>
<th>MULTIPLY</th>
<th>BY</th>
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<tbody>
<tr>
<td>cubic meter</td>
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<td>cubic yard</td>
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<td></td>
<td>35.314 7</td>
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<td>1.056 7</td>
<td>quart</td>
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<td></td>
<td>61.024</td>
<td>cubic inch</td>
<td>2.113 4</td>
<td>pint</td>
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<td></td>
<td>264.172</td>
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<td>kip</td>
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<td>Newton</td>
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<td>kilonewton</td>
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<td>kip(f)</td>
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<tr>
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<td>foot pound</td>
<td>megapascal</td>
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<td>8.849 5</td>
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<td>kg/m³</td>
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<td>km/hr</td>
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<td></td>
<td>watt (J/second)</td>
<td>0.001 341</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>0.737 56</td>
<td>ft-lb/second</td>
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### FOR TEMPERATURE CONVERSION USE

°F = 9/5 °C + 32
STANDARD SPECIFICATIONS

May 4, 2006

STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION

Additional copies of this book, and many other Department publications, may be obtained from:

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Charles Torre, P.E.                      Pratip Lahiri, P.E.
Specifications and Standards Section     Specifications and Standards Section

Daniel D’Angelo, P.E.
Director, Design Quality Assurance Bureau

Philip Clark, P.E.
Director, Design Division
This publication has been prepared to provide a compilation of standard requirements, called specifications, used by the New York State Department of Transportation for construction contracts. These specifications are written to the Contractor. They define the Contractor’s responsibility in meeting each specification, enumerate the Department’s expectations and how they are going to measure and pay, and explain what the Contractor is expected to provide.

When this publication, entitled Standard Specifications and dated May 4, 2006, is incorporated by reference into the Department’s construction contracts, it is made a part of that document. The requirements stated herein may be revised or amended from time to time by notes or special specifications or documents of any description that would be furnished as part of a construction contract.
STATE OF NEW YORK

DEPARTMENT OF TRANSPORTATION

OFFICE OF ENGINEERING

Contained herein are:
General Provisions of Contract;
Contract forms of Proposal, Agreement and Bonds;
General Construction Specifications;
Materials of Construction;
Payment Items

Adopted
by

The Commissioner of Transportation
and Short Titled

"STANDARD SPECIFICATIONS"

of

May 4, 2006

Note: While these specifications may be used for general construction work, they have been compiled in metric units with particular emphasis placed upon their use for highways, parkways, bridges and similar work. Necessary modifications of the contents hereof will be incorporated in the "Contract Documents" covering dissimilar work.
# TABLE OF CONTENTS

## SECTION 100 - SCOPE OF WORK

### GENERAL PROVISIONS

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>100-01</td>
<td>Introductory Paragraph</td>
<td>15</td>
</tr>
<tr>
<td>100-02</td>
<td>Purpose Of Work</td>
<td>15</td>
</tr>
</tbody>
</table>

## SECTION 101 - ABBREVIATIONS AND DEFINITIONS OF TERMS

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>101-01</td>
<td>Abbreviations Of Terms</td>
<td>15</td>
</tr>
<tr>
<td>101-02</td>
<td>Definitions Of Terms</td>
<td>16</td>
</tr>
</tbody>
</table>

## SECTION 102 - BIDDING REQUIREMENTS AND CONDITIONS

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>102-01</td>
<td>Location Of Regional Offices</td>
<td>25</td>
</tr>
<tr>
<td>102-02</td>
<td>Examining The Contract Documents And The Work Site</td>
<td>25</td>
</tr>
<tr>
<td>102-03</td>
<td>Cooperation Between Contractors</td>
<td>26</td>
</tr>
<tr>
<td>102-04</td>
<td>Proposal Content</td>
<td>27</td>
</tr>
<tr>
<td>102-05</td>
<td>Proposal Submission</td>
<td>28</td>
</tr>
<tr>
<td>102-06</td>
<td>Bid Deposit</td>
<td>28</td>
</tr>
<tr>
<td>102-07</td>
<td>Modification Or Withdrawal Of Proposal</td>
<td>28</td>
</tr>
<tr>
<td>102-08</td>
<td>Standard Clauses For All New York State Contracts</td>
<td>29</td>
</tr>
<tr>
<td>102-09</td>
<td>Standard Clauses For Non Federal-Aid New York State Contracts</td>
<td>33</td>
</tr>
<tr>
<td>102-10</td>
<td>Labor And Employment</td>
<td>34</td>
</tr>
<tr>
<td>102-11</td>
<td>Equal Employment Opportunity Requirements</td>
<td>37</td>
</tr>
<tr>
<td>102-12</td>
<td>D/M/Wbe Utilization</td>
<td>42</td>
</tr>
<tr>
<td>102-13</td>
<td>State And Local Sales Tax Exemption</td>
<td>50</td>
</tr>
<tr>
<td>102-14</td>
<td>Form Of Contract And Bid Bond</td>
<td>51</td>
</tr>
<tr>
<td>102-15</td>
<td>Sample Form Of Bid Bond</td>
<td>51</td>
</tr>
<tr>
<td>102-16</td>
<td>Sample Contract Pay Item Format</td>
<td>53</td>
</tr>
<tr>
<td>102-17</td>
<td>Sample Form Of Itemized Proposal/Jurat</td>
<td>53</td>
</tr>
</tbody>
</table>

## SECTION 103 - CONTRACT AWARD AND EXECUTION

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
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</thead>
<tbody>
<tr>
<td>103-01</td>
<td>Contract Award</td>
<td>58</td>
</tr>
<tr>
<td>103-02</td>
<td>Execution Of Contract</td>
<td>59</td>
</tr>
<tr>
<td>103-03</td>
<td>Contract Bonds</td>
<td>59</td>
</tr>
<tr>
<td>103-04</td>
<td>Canceling Award</td>
<td>60</td>
</tr>
<tr>
<td>103-05</td>
<td>Partnering</td>
<td>60</td>
</tr>
<tr>
<td>103-06</td>
<td>Sample Form Of Contract Agreement</td>
<td>61</td>
</tr>
<tr>
<td>103-07</td>
<td>Sample Form Of Faithful Performance Bond</td>
<td>65</td>
</tr>
<tr>
<td>103-08</td>
<td>Sample Form Of Labor And Material Bond</td>
<td>68</td>
</tr>
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## SECTION 104 - SCOPE OF WORK

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>104-01</td>
<td>Work Required</td>
<td>69</td>
</tr>
<tr>
<td>104-02</td>
<td>Changes, Contingencies, Extra Work And Deductions</td>
<td>70</td>
</tr>
<tr>
<td>104-03</td>
<td>Differing Site Conditions</td>
<td>70</td>
</tr>
<tr>
<td>104-04</td>
<td>Significant Changes In The Character Of Work</td>
<td>71</td>
</tr>
<tr>
<td>104-05</td>
<td>Suspensions Of Work Directed By The Engineer</td>
<td>73</td>
</tr>
<tr>
<td>104-06</td>
<td>Notice And Recordkeeping</td>
<td>74</td>
</tr>
<tr>
<td>104-07</td>
<td>Site Housekeeping</td>
<td>75</td>
</tr>
<tr>
<td>104-08</td>
<td>Maintaining Traffic</td>
<td>75</td>
</tr>
<tr>
<td>104-09</td>
<td>Contractor’s Retention Of Records</td>
<td>75</td>
</tr>
<tr>
<td>104-10</td>
<td>Value Engineering Change Proposal (VECP)</td>
<td>76</td>
</tr>
</tbody>
</table>

## SECTION 105 - CONTROL OF WORK

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>105-01</td>
<td>Engineer’s Authority</td>
<td>82</td>
</tr>
<tr>
<td>105-02</td>
<td>Character Of Workers</td>
<td>82</td>
</tr>
<tr>
<td>105-03</td>
<td>Methods And Equipment</td>
<td>82</td>
</tr>
<tr>
<td>105-04</td>
<td>Interpretation Of Contract Documents</td>
<td>83</td>
</tr>
</tbody>
</table>
## CONTENTS

<table>
<thead>
<tr>
<th>Section Number</th>
<th>Section Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>105-05</td>
<td>Reasonable Close Conformity With Contract Documents</td>
<td>83</td>
</tr>
<tr>
<td>105-06</td>
<td>Cooperation With Utilities And Other Contractors</td>
<td>83</td>
</tr>
<tr>
<td>105-07</td>
<td>Termination</td>
<td>84</td>
</tr>
<tr>
<td>105-08</td>
<td>Removal Of Unacceptable And Unauthorized Work</td>
<td>84</td>
</tr>
<tr>
<td>105-09</td>
<td>Work Affecting Railroads</td>
<td>85</td>
</tr>
<tr>
<td>105-10</td>
<td>Survey And Stakeout</td>
<td>88</td>
</tr>
<tr>
<td>105-11</td>
<td>Inspection</td>
<td>88</td>
</tr>
<tr>
<td>105-12</td>
<td>Load Restrictions</td>
<td>89</td>
</tr>
<tr>
<td>105-13</td>
<td>Maintenance And Protection Of Traffic For Mobile Operations</td>
<td>89</td>
</tr>
<tr>
<td>105-14</td>
<td>Disputed Work And Dispute Resolution</td>
<td>89</td>
</tr>
<tr>
<td>105-15</td>
<td>Furnishing Right Of Way</td>
<td>95</td>
</tr>
<tr>
<td>105-16</td>
<td>Shop Drawing Approval</td>
<td>95</td>
</tr>
<tr>
<td>105-17</td>
<td>Contract Records</td>
<td>95</td>
</tr>
<tr>
<td>105-18</td>
<td>Manufacturer Warranties And Guaranteans</td>
<td>96</td>
</tr>
<tr>
<td>105-19</td>
<td>Contractor Warranties</td>
<td>96</td>
</tr>
<tr>
<td>105-20</td>
<td>Opening Highway To Traffic Prior To Acceptance</td>
<td>96</td>
</tr>
<tr>
<td>105-21</td>
<td>Civil Rights Reporting</td>
<td>96</td>
</tr>
<tr>
<td>106-01</td>
<td>Sources Of Supply</td>
<td>98</td>
</tr>
<tr>
<td>106-02</td>
<td>Quality Requirements</td>
<td>98</td>
</tr>
<tr>
<td>106-03</td>
<td>Plant Inspected Materials</td>
<td>99</td>
</tr>
<tr>
<td>106-04</td>
<td>Material Certification And Approved List</td>
<td>100</td>
</tr>
<tr>
<td>106-05</td>
<td>Recycled Materials</td>
<td>101</td>
</tr>
<tr>
<td>106-06</td>
<td>Storage And Handling Of Materials</td>
<td>101</td>
</tr>
<tr>
<td>106-07</td>
<td>Basis For Measurement</td>
<td>101</td>
</tr>
<tr>
<td>106-08</td>
<td>Rejected Materials</td>
<td>101</td>
</tr>
<tr>
<td>106-09</td>
<td>Equivalents</td>
<td>101</td>
</tr>
<tr>
<td>106-10</td>
<td>Independent Assurance Sampling And Testing</td>
<td>101</td>
</tr>
<tr>
<td>106-11</td>
<td>Buy America</td>
<td>102</td>
</tr>
<tr>
<td>107-01</td>
<td>Laws, Rules, Regulations And Permits</td>
<td>103</td>
</tr>
<tr>
<td>107-02</td>
<td>Patented Devices, Materials And Processes</td>
<td>103</td>
</tr>
<tr>
<td>107-03</td>
<td>Federal Aid Participation</td>
<td>104</td>
</tr>
<tr>
<td>107-04</td>
<td>Sanitary Code</td>
<td>104</td>
</tr>
<tr>
<td>107-05</td>
<td>Safety And Health Requirements</td>
<td>104</td>
</tr>
<tr>
<td>107-06</td>
<td>Insurance</td>
<td>115</td>
</tr>
<tr>
<td>107-07</td>
<td>Protection Of Underground Facilities</td>
<td>116</td>
</tr>
<tr>
<td>107-08</td>
<td>Protection And Restoration Of Property And Landscape</td>
<td>118</td>
</tr>
<tr>
<td>107-09</td>
<td>Damage</td>
<td>119</td>
</tr>
<tr>
<td>107-10</td>
<td>Managing Surplus Material And Waste</td>
<td>121</td>
</tr>
<tr>
<td>107-11</td>
<td>Air Quality Protection</td>
<td>124</td>
</tr>
<tr>
<td>107-12</td>
<td>Water Quality Protection</td>
<td>125</td>
</tr>
<tr>
<td>108-01</td>
<td>Progress Schedule</td>
<td>126</td>
</tr>
<tr>
<td>108-02</td>
<td>Completion Date</td>
<td>126</td>
</tr>
<tr>
<td>108-03</td>
<td>Failure To Complete Work On Time</td>
<td>127</td>
</tr>
<tr>
<td>108-04</td>
<td>Delay Provisions</td>
<td>129</td>
</tr>
<tr>
<td>108-05</td>
<td>Subletting Or Assigning The Contract</td>
<td>130</td>
</tr>
<tr>
<td>108-06</td>
<td>Commencement Of Actions On State Public Works Contracts</td>
<td>131</td>
</tr>
<tr>
<td>108-07</td>
<td>Seasonal Shut-Down</td>
<td>132</td>
</tr>
<tr>
<td>109-01</td>
<td>Measuring Quantities</td>
<td>132</td>
</tr>
<tr>
<td>109-02</td>
<td>Compensation For Altered Quantities</td>
<td>132</td>
</tr>
<tr>
<td>109-03</td>
<td>Scope Of Payment</td>
<td>132</td>
</tr>
<tr>
<td>109-04</td>
<td>Partial Payments</td>
<td>133</td>
</tr>
<tr>
<td>109-05</td>
<td>Extra Work And Time Related Compensation</td>
<td>134</td>
</tr>
<tr>
<td>Section</td>
<td>Description</td>
<td>Page</td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
<td>------</td>
</tr>
<tr>
<td>200</td>
<td>EARTHWORK</td>
<td>143</td>
</tr>
<tr>
<td>201</td>
<td>Clearing And Grubbing</td>
<td>143</td>
</tr>
<tr>
<td>202</td>
<td>Removal Of Structures And Obstructions</td>
<td>145</td>
</tr>
<tr>
<td>203</td>
<td>Excavation And Embankment</td>
<td>156</td>
</tr>
<tr>
<td>204</td>
<td>Controlled Low Strength Material (CLSM)</td>
<td>176</td>
</tr>
<tr>
<td>205</td>
<td>(Vacant)</td>
<td>178</td>
</tr>
<tr>
<td>206</td>
<td>Trench, Culvert And Structure Excavation</td>
<td>178</td>
</tr>
<tr>
<td>207</td>
<td>Geotextiles And Prefabricated Composite Drains For Structures</td>
<td>181</td>
</tr>
<tr>
<td>208</td>
<td>(Vacant)</td>
<td>183</td>
</tr>
<tr>
<td>209</td>
<td>Soil Erosion And Sediment Control</td>
<td>184</td>
</tr>
<tr>
<td>210</td>
<td>Removal And Disposal Of Asbestos Containing Material (Buildings, Bridges And Highways)</td>
<td>192</td>
</tr>
<tr>
<td>300</td>
<td>BASES AND SUBBASES</td>
<td>201</td>
</tr>
<tr>
<td>301</td>
<td>(Vacant)</td>
<td>201</td>
</tr>
<tr>
<td>302</td>
<td>Bituminous Stabilized Course</td>
<td>201</td>
</tr>
<tr>
<td>303</td>
<td>Optional Flexible Shoulder</td>
<td>204</td>
</tr>
<tr>
<td>304</td>
<td>Subbase Course</td>
<td>205</td>
</tr>
<tr>
<td>305</td>
<td>And 306 (Vacant)</td>
<td>209</td>
</tr>
<tr>
<td>307</td>
<td>Hydrated Lime Stabilized Subgrade</td>
<td>209</td>
</tr>
<tr>
<td>308</td>
<td>Soil Cement Course</td>
<td>212</td>
</tr>
<tr>
<td>400</td>
<td>HOT MIX ASPHALT</td>
<td>217</td>
</tr>
<tr>
<td>401</td>
<td>Plant Production</td>
<td>217</td>
</tr>
<tr>
<td>402</td>
<td>Hot Mix Asphalt (HMA) Pavements</td>
<td>239</td>
</tr>
<tr>
<td>403</td>
<td>Hot Mix Asphalt (HMA) Pavements For Municipalities</td>
<td>256</td>
</tr>
<tr>
<td>404</td>
<td>(Vacant)</td>
<td>262</td>
</tr>
<tr>
<td>405</td>
<td>Cold Mix Bituminous Pavement (Open Graded)</td>
<td>262</td>
</tr>
<tr>
<td>406</td>
<td>(Vacant)</td>
<td>264</td>
</tr>
<tr>
<td>407</td>
<td>Tack Coat</td>
<td>264</td>
</tr>
<tr>
<td>408</td>
<td>And 409 (Vacant)</td>
<td>266</td>
</tr>
<tr>
<td>410</td>
<td>Bituminous Surface Treatment - Single Course</td>
<td>266</td>
</tr>
<tr>
<td>411</td>
<td>Stabilized Gravel Surface Course</td>
<td>271</td>
</tr>
<tr>
<td>412</td>
<td>Thru 489 (Vacant)</td>
<td>273</td>
</tr>
<tr>
<td>490</td>
<td>Cold Milling</td>
<td>273</td>
</tr>
<tr>
<td>491</td>
<td>Thru 499 (Vacant)</td>
<td>275</td>
</tr>
<tr>
<td>500</td>
<td>PORTLAND CEMENT CONCRETE</td>
<td>277</td>
</tr>
<tr>
<td>501</td>
<td>Portland Cement Concrete - General</td>
<td>277</td>
</tr>
<tr>
<td>502</td>
<td>Portland Cement Concrete Pavement</td>
<td>294</td>
</tr>
<tr>
<td>503</td>
<td>Portland Cement Concrete Foundation For Pavement</td>
<td>313</td>
</tr>
</tbody>
</table>
CONTENTS

Sections 504 Thru 549 (Vacant) ................................................................................................................................. 315

Section 550 ................................................................................................................................................................. 317
STRUCTURES................................................................................................................................................................. 317

Section 551 - Piles And Pile Driving Equipment ........................................................................................................ 317
Section 552 - Support And Protection Systems ........................................................................................................ 322
Section 553 - Cofferdams And Waterway Diversion Structures ................................................................................ 325
Section 554 - Mechanically Stabilized Earth System ................................................................................................. 328
Section 555 - Structural Concrete .................................................................................................................................. 334
Section 556 - Reinforcing Steel For Concrete Structures .......................................................................................... 347
Section 557 - Superstructure Slabs, Sidewalks On Bridges, And Structural Approach Slabs 352
Section 558 - Longitudinal Sawcut Grooving Of Structural Slab Surface .................................................................. 363
Section 559 (Vacant) ....................................................................................................................................................... 364
Section 560 - Masonry .................................................................................................................................................... 364
Sections 561 (Vacant) ..................................................................................................................................................... 371
Section 562 - Reinforced Concrete Three-Sided Structures ......................................................................................... 371
Section 563 - Prestressed Concrete Units (Structural) ................................................................................................. 374
Section 564 - Structural Steel ........................................................................................................................................ 375
Section 565 - Bridge Bearings ....................................................................................................................................... 379
Section 566 - Modular Expansion Joint Systems ....................................................................................................... 386
Section 567 - Bridge Joint Systems .................................................................................................................................. 390
Section 568 - Bridge Railing ........................................................................................................................................ 397
Section 569 - Permanent Concrete Traffic Barrier For Structures ............................................................................. 401
Section 570 - Paint Removal Operations .................................................................................................................... 407
Section 571 - Treatment And Disposal Of Paint Removal Waste ............................................................................. 417
Section 572 - Structural Steel Painting: Shop Applied ............................................................................................... 420
Section 573 - Structural Steel Painting: Field Applied - Total Removal ................................................................... 426
Section 574 - Structural Steel Painting: Overcoating And Localized ....................................................................... 432
Section 575 (Vacant) ..................................................................................................................................................... 437
Section 576 - Bridge Drainage System ......................................................................................................................... 437
Section 577 (Vacant) .................................................................................................................................................... 441
Section 578 - Bonded Concrete Overlay For Structural Slabs ..................................................................................... 441
Section 579 - Structural Slab Reconstruction Preparation ......................................................................................... 442
Section 580 - Structural Concrete Removal ............................................................................................................... 446
Section 581 - Removal Of Bridge Overlays ................................................................................................................ 449
Section 582 - Removal And Replacement Of Structural Concrete ........................................................................... 449
Section 583 - Shotcrete .................................................................................................................................................. 452
Section 584 - Specialized Overlays For Structural Slabs .......................................................................................... 457
Section 585 - Structural Lifting Operations ................................................................................................................. 462
Section 586 - Miscellaneous Structural Reconstruction ........................................................................................ 464
Section 587 - Bridge Railing Reconstruction ........................................................................................................... 467
Section 588 (Vacant) ..................................................................................................................................................... 470
Section 589 - Removal Of Existing Steel ...................................................................................................................... 470
Section 590 - Adjustment Of Bridge Appurtenances ................................................................................................. 471
Sections 591 Thru 593 (Vacant) ................................................................................................................................... 472
Section 594 - Timber And Lumber ............................................................................................................................. 473
Section 595 (Vacant) ..................................................................................................................................................... 474
Section 596 - Open Steel Floor ...................................................................................................................................... 474
Section 597 - Timber Bridge Railing And Transitions ............................................................................................. 475
Sections 598 And 599 (Vacant) .................................................................................................................................. 477
Section 600

INCIDENTAL CONSTRUCTION

Section 601 (Vacant)
Section 602 - Rehabilitation Of Culvert And Storm Drain Pipe
Section 603 - Culverts And Storm Drains
Section 604 - Drainage Structures
Section 605 - Underdrains
Section 606 - Guide Railing
Section 607 - Fences
Section 608 - Sidewalks, Driveways And Bicycle Paths
Section 609 - Curb And Curb & Gutter
Section 610 - Turf And Wildflower Establishment
Section 611 - Planting
Section 612 - Sodding
Section 613 - Topsoil
Section 614 - Care, Thinning And Removal Of Trees
Section 615 - Landscape Miscellaneous
Sections 616 And 617 (Vacant)
Section 618 - Bituminous Material
Section 619 - Maintenance And Protection Of Traffic
Section 620 - Bank And Channel Protection
Sections 621 And 622 (Vacant)
Section 623 - Screened Gravel, Crushed Gravel, Crushed Stone, Crushed Slag
Section 624 - Paved Gutters
Section 625 - Survey Operations, Row Markers, & Permanent Survey Markers
Sections 626 Thru 629 (Vacant)
Section 630 - Barricades
Section 631 (Vacant)
Section 632 - Cribbing
Section 633 - Conditioning Existing Pavement Prior To Hot Mix Asphalt (HMA) Overlay
Section 634 (Vacant)
Section 635 - Cleaning And Preparation Of Pavement Surfaces For Pavement Markings
Section 636 (Vacant)
Section 637 - Engineer's Office And Laboratory Building
Section 638 - White Synthetic Resin Binder Concrete
Section 639 (Vacant)
Section 640 - ReflectORIZED Pavement Marking Paints
Section 641, 642 And 643 (Vacant)
Section 644 - Overhead Sign Structures
Section 645 - Signs
Section 646 - Delineators, Reference Markers And Snowplowing Markers
Section 647 - Removing, Storing And Relocating Signs
Section 648 - Subsurface Explorations
Section 649 (Vacant)
Section 650 - Jacking Reinforced Concrete Pipe
Section 651 - Communication Facilities
Section 652 - Furnishing And Applying Salts
Section 653 (Vacant)
Section 654 - Impact Attenuators
Section 655 - Frames, Grates And Covers
Section 656 - Miscellaneous Metals
CONTENTS

Section 657 - Painting Galvanized And Aluminum Surfaces .......................................................... 655
Section 658 (Vacant) .................................................................................................................... 658
Section 659 - Telecommunication Utilities .................................................................................. 658
Section 660 - Utilities .................................................................................................................... 659
Section 661 - Electric Utilities ....................................................................................................... 659
Section 662 - Gas, Oil & Steam Utilities ....................................................................................... 660
Section 663 - Water Supply Utilities ............................................................................................. 660
Section 664 - Sanitary Sewer Utilities .......................................................................................... 671
Section 665 - Waterways ............................................................................................................. 671
Section 666 (Vacant) ..................................................................................................................... 671
Section 667 - Local Road Gravel Surface, Base, And Subbase Courses .................................... 671
Section 668 And 669 (Vacant) ..................................................................................................... 674
Section 670 - Highway Lighting System ...................................................................................... 674
Sections 671 Thru 679 (Vacant) .................................................................................................. 685
Section 680 - Traffic Signals ........................................................................................................ 685
Section 681 Thru Section 684 (Vacant) ....................................................................................... 703
Section 685 - Epoxy Reflectorized Pavement Markings .............................................................. 703
Section 686 (Vacant) .................................................................................................................. 706
Section 687 - Thermoplastic Reflectorized Pavement Markings ............................................... 706
Section 688 - Preformed Reflectorized Pavement Markings ....................................................... 709
Sections 689 Thru 696 (Vacant) ................................................................................................ 713
Section 697 - Field Change Order ............................................................................................... 713
Section 698 Price Adjustments .................................................................................................... 714
Section 699 - Mobilization ........................................................................................................... 718

Section 700 .................................................................................................................................. 719

MATERIALS and MANUFACTURING ......................................................................................... 719

SECTION 701 - HYDRAULIC CEMENTS ....................................................................................... 719
701-01 Portland Cement ................................................................................................................. 719
701-02 Masonry And Mortar Cement ............................................................................................ 720
701-03 Blended Portland Cement .................................................................................................. 720
701-04 Concrete Repair Material .................................................................................................... 722
701-05 Concrete Grouting Material .............................................................................................. 722
701-06 Cement Based Grout Materials For Shear Keys .............................................................. 723
701-07 Anchoring Materials - Chemically Curing ...................................................................... 724
701-08 Vertical And Overhead Patching Material ....................................................................... 725
701-09 Rapid Hardening Concrete Repair Material (Normal Weather) ................................... 726
701-10 (Vacant) ............................................................................................................................ 726
701-11 Elastomeric Concrete ......................................................................................................... 726

SECTION 702 - BITUMINOUS MATERIALS .................................................................................. 727

SECTION 703 - AGGREGATES ....................................................................................................... 732
703-01 Fine Aggregate .................................................................................................................. 732
703-02 Coarse Aggregate ............................................................................................................. 734
703-03 Mortar Sand ....................................................................................................................... 738
703-04 Grout Sand ........................................................................................................................ 738
703-05 Fine Aggregate For White Portland Cement Concrete ................................................. 739
703-06 Cushion Sand ..................................................................................................................... 739
703-07 Concrete Sand .................................................................................................................... 739
703-08 Mineral Filler ..................................................................................................................... 740
703-09 Reclaimed Asphalt Pavement (RAP) .............................................................................. 740
703-10 Lightweight Aggregates ................................................................................................... 742

SECTION 704 - MASONRY UNITS .............................................................................................. 743
704-01 Common Brick ................................................................................................................... 743
## CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>707-01</td>
<td>(Vacant)</td>
<td>788</td>
</tr>
<tr>
<td>707-02</td>
<td>Corrugated Steel Pipe</td>
<td>788</td>
</tr>
<tr>
<td>707-03</td>
<td>Ductile Iron Pipe (Non-Pressure)</td>
<td>791</td>
</tr>
<tr>
<td>707-04</td>
<td>Ductile Iron Pipe (Pressure)</td>
<td>791</td>
</tr>
<tr>
<td>707-05</td>
<td>Tunnel Liner Plate (Relining)</td>
<td>792</td>
</tr>
<tr>
<td>707-06</td>
<td>Thru 707-08 (Vacant)</td>
<td>793</td>
</tr>
<tr>
<td>707-09</td>
<td>Corrugated Structural Steel Plate For Pipe, Pipe Arches And Underpasses</td>
<td>793</td>
</tr>
<tr>
<td>707-10</td>
<td>Galvanized Steel End Sections</td>
<td>793</td>
</tr>
<tr>
<td>707-11</td>
<td>Aluminum End Sections</td>
<td>794</td>
</tr>
<tr>
<td>707-12</td>
<td>(Vacant)</td>
<td>794</td>
</tr>
<tr>
<td>707-13</td>
<td>Corrugated Aluminum Pipe</td>
<td>794</td>
</tr>
<tr>
<td>707-14</td>
<td>Corrugated Aluminum Structural Plate For Pipe And Pipe Arches</td>
<td>796</td>
</tr>
<tr>
<td>707-15</td>
<td>Thru 707-19 (Vacant)</td>
<td>796</td>
</tr>
<tr>
<td>707-20</td>
<td>Anchor Bolts For Corrugated Culverts</td>
<td>796</td>
</tr>
<tr>
<td>708-01</td>
<td>Structural Steel Paints Class 1</td>
<td>797</td>
</tr>
<tr>
<td>708-02</td>
<td>Structural Steel Paints Class 2</td>
<td>797</td>
</tr>
<tr>
<td>708-03</td>
<td>(Vacant)</td>
<td>798</td>
</tr>
<tr>
<td>708-04</td>
<td>Zinc Chromate Primer</td>
<td>798</td>
</tr>
<tr>
<td>708-05</td>
<td>Standard Paint Colors</td>
<td>799</td>
</tr>
<tr>
<td>708-06</td>
<td>Paint For Galvanized Surfaces</td>
<td>799</td>
</tr>
<tr>
<td>708-07</td>
<td>Paint For Aluminum Surfaces</td>
<td>799</td>
</tr>
<tr>
<td>708-08</td>
<td>Thru 708-29 (Vacant)</td>
<td>799</td>
</tr>
<tr>
<td>708-30</td>
<td>Wood Preservative - Creosote Oil</td>
<td>799</td>
</tr>
<tr>
<td>708-31</td>
<td>Wood Preservative - Waterborne</td>
<td>800</td>
</tr>
<tr>
<td>708-32</td>
<td>Wood Preservative - Oil Borne</td>
<td>800</td>
</tr>
<tr>
<td>709-01</td>
<td>Bar Reinforcement, Grade 420</td>
<td>800</td>
</tr>
<tr>
<td>709-02</td>
<td>Wire Fabric For Concrete Reinforcement</td>
<td>801</td>
</tr>
<tr>
<td>709-03</td>
<td>(Vacant)</td>
<td>801</td>
</tr>
<tr>
<td>709-04</td>
<td>Epoxy-Coated Bar Reinforcement</td>
<td>801</td>
</tr>
<tr>
<td>709-05</td>
<td>Stud Shear Connectors</td>
<td>804</td>
</tr>
<tr>
<td>709-06</td>
<td>Low-Relaxation Prestressing Steel, Grade 1860</td>
<td>805</td>
</tr>
<tr>
<td>709-07</td>
<td>Stone Curb Anchor Bars</td>
<td>805</td>
</tr>
<tr>
<td>709-08</td>
<td>Epoxy Coated Wire Fabric Reinforcement</td>
<td>805</td>
</tr>
<tr>
<td>709-09</td>
<td>Cold-Drawn Wire For Concrete Reinforcement</td>
<td>807</td>
</tr>
<tr>
<td>709-10</td>
<td>Mechanical Connectors For Reinforcing Bar Splices</td>
<td>807</td>
</tr>
<tr>
<td>709-11</td>
<td>Galvanized Bar Reinforcement</td>
<td>808</td>
</tr>
<tr>
<td>709-12</td>
<td>Stainless-Clad-Bar Reinforcement</td>
<td>809</td>
</tr>
<tr>
<td>709-13</td>
<td>Stainless Steel Bar Reinforcement</td>
<td>810</td>
</tr>
<tr>
<td>709-14</td>
<td>Bar Reinforcement, Grade 520</td>
<td>810</td>
</tr>
<tr>
<td>710-01</td>
<td>Aluminum Fence Fabric</td>
<td>810</td>
</tr>
<tr>
<td>710-02</td>
<td>Galvanized Steel Fence Fabric</td>
<td>811</td>
</tr>
<tr>
<td>710-03</td>
<td>Vinyl Coated Steel Fence Fabric</td>
<td>811</td>
</tr>
<tr>
<td>710-04</td>
<td>Aluminum Coated Steel Fence Fabric</td>
<td>812</td>
</tr>
<tr>
<td>710-05</td>
<td>Coated Steel Fence Fabirc, (95% Zinc 5% Aluminum - Mischmetal Alloy)</td>
<td>812</td>
</tr>
<tr>
<td>710-06</td>
<td>Thru 710-09 (Vacant)</td>
<td>812</td>
</tr>
<tr>
<td>710-10</td>
<td>Steel And Iron Posts, Rails, Braces, And Fittings For Chain Link Fence</td>
<td>812</td>
</tr>
<tr>
<td>710-11</td>
<td>Aluminum Posts, Rails, Braces And Fittings For Chain Link Fence</td>
<td>812</td>
</tr>
<tr>
<td>710-12</td>
<td>Plastic Coated Posts, Rails, Braces And Fittings For Chain Link Fence</td>
<td>815</td>
</tr>
<tr>
<td>710-13</td>
<td>Wood And Timber Posts And Timber Blockouts</td>
<td>816</td>
</tr>
<tr>
<td>710-14</td>
<td>Galvanized Steel Barrier Posts</td>
<td>816</td>
</tr>
<tr>
<td>710-15</td>
<td>Thru 710-19 (Vacant)</td>
<td>816</td>
</tr>
<tr>
<td>710-20</td>
<td>Corrugated Beam Guide Railing And Median Barrier</td>
<td>817</td>
</tr>
<tr>
<td>710-21</td>
<td>Box Beam Guide Railing And Median Barrier</td>
<td>818</td>
</tr>
</tbody>
</table>
711-13 Calcium Nitrite Based Corrosion Inhibitors .............................................................. 836
711-12 Ground Granulated Blast Furnace Slag ................................................................. 835
711-11 Microsilica ........................................................................................................... 834
711-10 Fly Ash .................................................................................................................. 834
711-09 Emulsified Carbon Black ..................................................................................... 833
711-08 Admixtures ......................................................................................................... 831
711-07 Inertial Barrier Modules ....................................................................................... 831
711-06 Mobile Construction Zone Impact Attenuators ..................................................... 839
711-05 Precast Concrete Right-Of-Way Markers ............................................................ 838
711-04 Hydrated Lime ...................................................................................................... 838
711-03 Sodium Chloride .................................................................................................. 838
711-02 Calcium Chloride ................................................................................................. 837
711-01 Water .................................................................................................................. 836

SECTION 712 - MISCELLANEOUS .................................................................................. 836
712-22 Cable Guide Railing ............................................................................................ 819
712-21 Steel Bridge Railing ............................................................................................. 819
712-20 Box Beam Guide Rail End Assembly, Type III; And Box Beam Median Barrier End
    Assembly, Type C ........................................................................................................ 821
712-19 Guide Rail And Median Barrier Systems (Rustic) ................................................ 823
712-18 Plastic And Synthetic Block-Outs For Heavy Post Guiderail Systems ............... 826
712-17 Thrie Beam Type With Expendable Modules ...................................................... 849
712-16 Corrugated Beam Type With Metal Tearing Strips ............................................ 848
712-15 Impact Attenuator, HDPE Cylinder And Cable Type .......................................... 846
712-14 Impact Attenuator, Quad Beam Type With Expendable Modules ...................... 847
712-13 Impact Attenuator, Corrugated Beam Type With Metal Tearing Strips ............. 848
712-12 Impact Attenuator, Thrie Beam Type With Expendable Modules ...................... 849
712-11 Plastic And Synthetic Block-Outs For Heavy Post Guiderail Systems .............. 826
712-10 Inertial Barrier Modules ..................................................................................... 840
712-09 Thru 712-11 (Vacant) ........................................................................................... 840
712-08 Asphalt Roofing Felt ........................................................................................... 840
712-07 Timber And Lumber ............................................................................................ 841
712-06 Mobile Construction Zone Impact Attenuators ..................................................... 839
712-05 Precast Concrete Right-Of-Way Markers ............................................................ 838
712-04 Hydrated Lime ...................................................................................................... 838
712-03 Sodium Chloride .................................................................................................. 838
712-02 Calcium Chloride ................................................................................................. 837
712-01 Water .................................................................................................................. 836

SECTION 713 - LANDSCAPE DEVELOPMENT MATERIALS ........................................ 852
713-08 Materials For Protection Of Plants ...................................................................... 859
713-07 Rolled Erosion Control Products And Soil Stabilizers ....................................... 858
713-06 Trees, Shrubs And Vines ..................................................................................... 856
713-05 Wood Chips ......................................................................................................... 856
713-04 Seeds .................................................................................................................... 854
713-03 Fertilizer ............................................................................................................... 854
713-02 Limestone ............................................................................................................ 853
713-01 Topsoil .................................................................................................................. 852

SECTION 711 - CONCRETE CURING MATERIALS AND ADMIXTURES ................. 827
711-09 Emulsified Carbon Black ..................................................................................... 833
711-08 Admixtures ......................................................................................................... 831
711-07 Inertial Barrier Modules ..................................................................................... 831
711-06 Mobile Construction Zone Impact Attenuators ..................................................... 839
711-05 Membrane Curing Compound .......................................................................... 829
711-04 Polyethylene Curing Cover (White Opaque) ...................................................... 829
711-03 Plastic Coated Fiber Blankets (For Curing) ......................................................... 829
711-02 Quilted Covers (For Curing) ................................................................................ 827
711-01 (Vacant) ............................................................................................................... 827

STANDARD SPECIFICATIONS of May 4, 2006

NEW YORK STATE DEPARTMENT OF TRANSPORTATION
STANDARD SPECIFICATIONS of May 4, 2006
# CONTENTS

713-15 Organic Material ........................................................................ 862
713-16 And 713-17 (Vacant) ................................................................. 863
713-18 Hay ......................................................................................... 863
713-19 Straw ...................................................................................... 863

**SECTION 714 - CURBING AND GUTTER** ........................................... 864
714-01 Stone Curb .............................................................................. 864
714-02 And 714-03 (Vacant) ................................................................. 866
714-04 Precast Concrete Curb .............................................................. 866
714-05 (Vacant) ................................................................................. 866
714-06 Asphalt Concrete Curb .............................................................. 866
714-07 Precast Concrete Gutter ........................................................... 867

**SECTION 715 - CASTINGS, FORGINGS AND METALS** .................... 868
715-01 Structural Steel .......................................................................... 868
715-02 Steel Castings ........................................................................... 869
715-03 Aluminum Castings .................................................................. 870
715-04 Wrought Aluminum .................................................................. 871
715-05 Iron Castings ............................................................................ 872
715-06 Steel Forgings ........................................................................... 872
715-07 Proof Loaded Iron Castings ....................................................... 873
715-08 (Vacant) .................................................................................. 874
715-09 Malleable Iron Castings ............................................................ 874
715-10 (Vacant) .................................................................................. 874
715-11 Metal Bin Type Retaining Wall ................................................ 875
715-12 (Vacant) .................................................................................. 875
715-13 Prefabricated Adjustment Rings, Frames And Utility Valve Risers For Drainage Units, Manholes And Utilities ................................................................. 875
715-14 High Strength Bolts, Nuts And Washers .................................. 877
715-15 Pins And Rollers ...................................................................... 878
715-16 Stainless Steel Connecting Products ....................................... 878

**SECTION 716 - BEARINGS AND EXPANSION PLATES** .................... 879
716-01 Thru 716-04 (Vacant) ................................................................. 879
716-05 Self-Lubricating Bronze Plates ............................................... 879
716-06 Disc-Design Structural Bridge Bearings ................................. 880
716-07 Pot-Design Structural Bridge Bearings ................................. 884
716-08 And 716-09 (Vacant) ................................................................. 888
716-10 Plain Elastomeric Bridge Bearings ........................................... 888
716-11 Steel Laminated Elastomeric Bridge Bearings........................ 889
716-12 Elastomeric Bridge Bearings With External Load Plates ......... 892

**SECTION 717 - CONCRETE PROTECTIVE COATINGS** ........................ 895
717-01 And 717-02 (Vacant) ................................................................. 895
717-03 Penetrating Type Protective Sealers ......................................... 895
717-04 Coating Type Protective Sealers .............................................. 896

**SECTION 718 - PRESTRESSED CONCRETE UNITS** ........................ 896
718-01 Prestressed Concrete Units (Structural) .................................... 896
718-02 Thru 718-04 (Vacant) ................................................................. 904
718-05 Prestressed Concrete Form Units ............................................ 905
718-06 High Performance Concrete For Precast And Prestressed Bridge Beams ................................................................. 906
718-07 Thru 718-29 (Vacant) ................................................................. 909

**SECTION 719 - METAL COATINGS** .................................................. 909
719-01 Galvanized Coatings And Repair Methods ............................. 909
719-02 Aluminum Anodic Coatings .................................................... 910
719-03 Aluminum Coating (Hot Dip) .................................................. 911

**SECTION 720 - PILES** .................................................................... 911
720-01 Untreated Timber Piles ........................................................... 911
720-02 Treated Timber Piles ............................................................... 911
720-03 Casings For Cast-In-Place Concrete Piles ............................... 912
**SECTION 722 - WATER SUPPLY** ................................................................. 920
- 722-01 Ductile Iron Water Pipe, Fittings And Encasement .......................... 920
- 722-02 Steel Water Pipe And Fittings ......................................................... 920
- 722-03 Concrete Water Pipe ........................................................................ 921
- 722-04 Water Valves And Hydrants ............................................................. 921
- 722-05 Plastic Water Pipe And Fittings ......................................................... 922
- 722-06 Water Service Pipe, Service Valves And Fittings ............................... 922
- 722-07 Wedge Type Mechanical Restraint Glands ........................................ 923
- 722-08 Insulation For Water Mains ............................................................... 923
  
**SECTION 723 - LIGHTING** ........................................................................ 923
- 723-01 Aluminum Light Standards And Arms .............................................. 923
- 723-02 High Mast Pole, Head Frame Assembly With Luminaire Ring And Lowering Device ................................................................. 926
- 723-03 Portable Power Drive For High Mast Luminaire Lowering System .... 928
- 723-04 Thru 723-09 (Vacant) ..................................................................... 928
- 723-10 Anchor Base (Aluminum) ................................................................. 928
- 723-11 Thru 723-14 (Vacant) .................................................................... 928
- 723-15 Breakaway Transformer Base (Aluminum) ......................................... 928
- 723-16 Thru 723-18 (Vacant) .................................................................... 929
- 723-19 Rigid Plastic Conduit ..................................................................... 929
- 723-20 Metal Steel Conduit, Zinc Coated ..................................................... 930
- 723-21 And 723-22 (Vacant) .................................................................... 930
- 723-23 P.V.C. Coated Galvanized Steel Conduit ........................................... 930
- 723-24 Flexible Liquid-Tight Steel Conduit .................................................. 931
- 723-25 And 723-26 (Vacant) .................................................................... 931
- 723-27 High Pressure Sodium Vapor Luminaires (Standard Mount) ............ 931
- 723-28 Low Pressure Sodium Vapor Luminaires (Underdeck Mount) ......... 932
- 723-29 High Pressure Sodium Vapor Luminaires (Underbridge Mount) ....... 933
- 723-30 Mercury Vapor Luminaires (Standard Mount) .................................... 934
- 723-31 Mercury Vapor Luminaires (Underbridge Mount) ............................ 934
- 723-32 Thru 723-39 (Vacant) .................................................................... 934
- 723-40 Cast-Iron Junction Box ................................................................. 935
- 723-41 Thru 723-44 (Vacant) .................................................................... 935
- 723-45 Precast Reinforced Concrete Foundations And Pullboxes ............... 935
- 723-46 Thru 723-49 (Vacant) .................................................................... 935
- 723-50 Photoelectric Control .................................................................... 935
- 723-51 Thru 723-59 (Vacant) .................................................................... 936
- 723-60 Anchor Bolts ................................................................................. 936
- 723-61 Thru 723-69 (Vacant) .................................................................... 936
- 723-70 Single Conductor Cable ................................................................. 936
- 723-71 Single Conductor Direct Burial Cable ............................................... 937
- 723-72 Thru 723-74 (Vacant) .................................................................... 937
- 723-75 Ground Wire ................................................................................. 937
  
**SECTION 724 - TRAFFIC SIGNALS** ............................................................. 937
- 724-01 Signal Cable .................................................................................. 937
- 724-02 Span Wire .................................................................................... 938
<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>724-03</td>
<td>Traffic Signal Poles</td>
<td>938</td>
</tr>
<tr>
<td>724-04</td>
<td>Traffic Signal Heads</td>
<td>943</td>
</tr>
<tr>
<td>724-05</td>
<td>Thru 724-07 (Vacant)</td>
<td>957</td>
</tr>
<tr>
<td>724-08</td>
<td>Shielded Communication Cable</td>
<td>957</td>
</tr>
<tr>
<td>724-09</td>
<td>Signal Cable With Integral Messenger</td>
<td>958</td>
</tr>
<tr>
<td>724-10</td>
<td>Shielded Communication Cable With Integral Messenger</td>
<td>958</td>
</tr>
<tr>
<td>724-11</td>
<td>Thru 724-14 (Vacant)</td>
<td>958</td>
</tr>
<tr>
<td>724-15</td>
<td>Fire Pre-Emption Tell-Tale Light</td>
<td>958</td>
</tr>
<tr>
<td>724-16</td>
<td>Thru 724-19 (Vacant)</td>
<td>958</td>
</tr>
<tr>
<td>724-20</td>
<td>Inductance Loop Wire</td>
<td>958</td>
</tr>
<tr>
<td>724-21</td>
<td>Shielded Lead-In Cable</td>
<td>959</td>
</tr>
<tr>
<td>724-22</td>
<td>Roadway Loop Embedding Sealer</td>
<td>959</td>
</tr>
<tr>
<td>724-23</td>
<td>Pedestrian Push Button And Sign</td>
<td>960</td>
</tr>
<tr>
<td>725-01</td>
<td>Copper Flashing</td>
<td>960</td>
</tr>
<tr>
<td>725-02</td>
<td>Steps For Manholes</td>
<td>960</td>
</tr>
<tr>
<td>727-01</td>
<td>White And Yellow Thermoplastic Reflectorized Pavement Markings</td>
<td>961</td>
</tr>
<tr>
<td>727-02</td>
<td>White And Yellow Removable Reflectorized Pavement Markings</td>
<td>963</td>
</tr>
<tr>
<td>727-03</td>
<td>White And Yellow Epoxy Reflectorized Pavement Markings</td>
<td>965</td>
</tr>
<tr>
<td>727-04</td>
<td>White And Yellow Preformed Reflectorized Pavement Markings</td>
<td>968</td>
</tr>
<tr>
<td>727-05</td>
<td>Glass Beads For Reflectorized Pavement Marking Paints</td>
<td>969</td>
</tr>
<tr>
<td>728-01</td>
<td>Rubber Impregnated Woven Cotton-Polyester Fabric</td>
<td>970</td>
</tr>
<tr>
<td>728-02</td>
<td>Rubber Impregnated Random Fiber Pad</td>
<td>971</td>
</tr>
<tr>
<td>728-03</td>
<td>Plain Rubber Pad</td>
<td>971</td>
</tr>
<tr>
<td>728-04</td>
<td>Sheet Lead</td>
<td>971</td>
</tr>
<tr>
<td>728-05</td>
<td>(Vacant)</td>
<td>971</td>
</tr>
<tr>
<td>728-06</td>
<td>Sheet Gasket (Treated Both Sides)</td>
<td>971</td>
</tr>
<tr>
<td>730-01</td>
<td>Aluminum Sign Panels</td>
<td>972</td>
</tr>
<tr>
<td>730-02</td>
<td>Plywood Sign Panels</td>
<td>973</td>
</tr>
<tr>
<td>730-03</td>
<td>And 730-04 (Vacant)</td>
<td>974</td>
</tr>
<tr>
<td>730-05</td>
<td>Reflective Sheeting</td>
<td>974</td>
</tr>
<tr>
<td>730-06</td>
<td>Thru 730-08 (Vacant)</td>
<td>976</td>
</tr>
<tr>
<td>730-09</td>
<td>Tubular Markers</td>
<td>976</td>
</tr>
<tr>
<td>730-10</td>
<td>Acrylic Plastic Reflex Reflectors</td>
<td>977</td>
</tr>
<tr>
<td>730-11</td>
<td>Reflectorized Sheeting Sign Characters (Type III)</td>
<td>978</td>
</tr>
<tr>
<td>730-12</td>
<td>Reflectorized Sheeting And Sign Characters (Type IV)</td>
<td>979</td>
</tr>
<tr>
<td>730-13</td>
<td>Reflectorized Sheeting Sign Characters (Type V)</td>
<td>979</td>
</tr>
<tr>
<td>730-14</td>
<td>Reflectorized Sheeting Sign Characters (Type VI)</td>
<td>979</td>
</tr>
<tr>
<td>730-15</td>
<td>Thru 730-19 (Vacant)</td>
<td>980</td>
</tr>
<tr>
<td>730-20</td>
<td>Sign Posts And Footings</td>
<td>980</td>
</tr>
<tr>
<td>730-21</td>
<td>Flexible Delineator Posts</td>
<td>981</td>
</tr>
<tr>
<td>730-22</td>
<td>Stiffeners, Overhead Brackets And Miscellaneous Hardware</td>
<td>981</td>
</tr>
<tr>
<td>730-23</td>
<td>Fiberglass Reinforced Plastic Sign Panels</td>
<td>982</td>
</tr>
<tr>
<td>730-24</td>
<td>Type A Sign Supports</td>
<td>983</td>
</tr>
<tr>
<td>730-25</td>
<td>Type B Sign Posts</td>
<td>984</td>
</tr>
<tr>
<td>730-26</td>
<td>Breakaway Bases And Hinge Assemblies</td>
<td>984</td>
</tr>
<tr>
<td>730-27</td>
<td>Permanent Variable Message Signs</td>
<td>985</td>
</tr>
<tr>
<td>731-01</td>
<td>Drill Rigs</td>
<td>989</td>
</tr>
</tbody>
</table>

**NEW YORK STATE DEPARTMENT OF TRANSPORTATION**

**STANDARD SPECIFICATIONS of May 4, 2006**
CONTENTS

732-02 Drive Pipe ............................................................................................................................ 990
732-03 Casing ............................................................................................................................... 990
732-04 Samplers........................................................................................................................... 990
732-05 Thin Wall Sample Tubes ................................................................................................. 990
732-06 Coring Bits ...................................................................................................................... 991
732-07 Sample Storage Bags ....................................................................................................... 991
732-08 Sample Jars ...................................................................................................................... 991
732-09 Jar Cartons ...................................................................................................................... 991
732-10 Boulder And Rock Core Boxes ....................................................................................... 992
732-11 Open Well Piezometer .................................................................................................... 992
732-12 Grout .............................................................................................................................. 992

SECTION 733 AND 734 (VACANT) .......................................................................................... 993

SECTION 735 - CONCRETE CYLINDER CURING BOX .......................................................... 993
735-01 Concrete Cylinder Curing Box ....................................................................................... 993

SECTION 736 - PERMANENT CORRUGATED METAL FORMS FOR BRIDGE SLABS ............ 993
736-01 Permanent Corrugated Metal Forms For Bridge Slabs ..................................................... 993

SECTIONS 737 THRU 799 (VACANT) ....................................................................................... 994

INDEX ............................................................................................................................................ 995
Section 100
GENERAL PROVISIONS

SECTION 101 - ABBREVIATIONS AND DEFINITIONS OF TERMS

Wherever in these specifications or in other contract documents the following terms or pronouns in place of them are used, the intent and meaning shall be interpreted as follows:

101-01 ABBREVIATIONS OF TERMS.

Wherever the following abbreviations are used in these specifications or on the plans, they are to be construed the same as the respective expressions represented. Some of these abbreviations may be acronyms and some may appear with periods.

AAN - American Association of Nurserymen
AASHTO - American Association of State Highway and Transportation Officials
AISI - American Iron and Steel Institute
ANSI - American National Standards Institute, Inc
APA - Adirondack Park Agency
AREA - American Railway Engineering and Maintenance-of-Way Association
ASME - American Society of Mechanical Engineers
ASTM - American Society for Testing and Materials
AWPA - American Wood-Preservers Association
AWWA - American Water Works Association
AWS - American Welding Society
CADD - Computer Aided Design and Drafting
CPM - Critical Path Method
CFR - Code of Federal Regulations
CRU - Contract Review Unit
DCED - Deputy Chief Engineer for Design
DCES - Deputy Chief Engineer for Structures Design and Construction
DCETS - Deputy Chief Engineer for Technical Services
EEI - Electrical Engineering Institute
EPA - U.S. Environmental Protection Agency
FHWA - Federal Highway Administration
MM - Materials Method
MP - Materials Procedure
MSDS - Material Safety Data Sheet
MURK - Manual for Uniform Record Keeping
MUTCD - Manual of Uniform Traffic Control Devices
NEMA - National Electrical Manufacturers Association
NYCRR - Official Compilation of Codes, Rules and Regulations of the State of New York
NYSDEC - New York State Department of Conservation
NYSDOL - New York State Department of Labor
OEODC - Office of Equal Opportunity Development and Compliance
OSHA - Occupational Safety and Health Administration, US Department of Labor
PCCM - New York State Prestressed Concrete Construction Manual
PCCP - Painting Contractor Certification Program
RME - Regional Materials Engineer
SCM - New York State Steel Construction Manual
SPN - Standardized Plant Names adopted by The American Joint Committee on Horticultural Nomenclature
SSPC - Steel Structures Painting Council
VECP - Value Engineering Change Proposal
USACOE - U.S. Army Corps of Engineers
USC - United States Code
101-02 DEFINITIONS OF TERMS.

Wherever the following terms are used in these specifications or on the plans, they are to be construed the same as the respective definitions represented.

A+B Bidding. A+B Bidding is an time-related form of bidding used by the Department for contracts that are time sensitive, either in overall contract duration, or the duration of a task or tasks. The total contract bid price consists of the amount bid that will be paid for the work (the “A portion”), plus the number of days for completion of the specified work multiplied by the user cost specified in the contract documents, (the “B portion”).

Addenda. Supplemental additions, deletions, and modifications to the provisions of the Standard Specifications which are in effect on the date of advertisement for receipt of bids.

Amendment. A formal alteration by addition, deletion or modification of a proposed contract, issued subsequent to the initiation of the sale of proposals and prior to the opening of bids.

Approved List. List of materials, equipment, Manufacturers, Fabricators or Material Suppliers approved by the Materials Bureau under a particular specification. The Approved Lists are published periodically and are available from the Materials Bureau or on the Department web site.

Award. The decision of the Department to accept the proposal of the lowest responsible bidder for the work, subject to the execution and approval of a satisfactory contract therefor and bond to secure the performance thereof, and to such other conditions as may be specified or otherwise required by law.

Base Line Data. The relevant contract specific information and engineering data used to develop the contract plans and proposal. The relevant information and data will be listed as available on Form CONR-9 Supplemental Information Available to Bidders included in the contract proposal.

Bid Deposit. The security furnished by the bidder with their proposal for a contract, as guarantee the bidder will enter into a contract for the work if their proposal is accepted.

Bidder. An individual, firm or corporation formally submitting a proposal for the work contemplated acting directly or through a duly authorized representative.

Bridge. The term “bridge” shall apply to any structure whether single or multiple span construction with a clear span in excess of 6 096 mm (legally 20 feet) when measurement is made horizontally along the center line of roadway from face to face of abutments or sidewalls immediately below the copings or fillets; or, if there are no copings or fillets, at 152 mm (6 inches) below the bridge seats or immediately under the top slab, in the case of frame structures. In the case of arches, the span shall be measured from spring line to spring line. All measurements shall include the widths of intervening piers or division walls, as well as the width of copings or fillets.

Calendar Day. Every day shown on the calendar. The calendar day begins at 12:00AM (Midnight).


Chief Engineer. The Chief Engineer of the New York State Department of Transportation.

Closed Drainage System. A collection system of enclosed channels for stormwater runoff which carries water to a discharge point. Typically has drainage structures for inlet(s) and may include intermediate drainage structures at junction points.

Commissioner. The Commissioner of the New York State Department of Transportation.
Comptroller. The head of the New York State Office of the State Comptroller.

Contract. A binding agreement between the Department and a contractor to complete a specified scope of work. The contract includes, but is not limited to an executed contract agreement, a set of contract documents and contract bonds.

Contract Agreement. The agreement covering the performance of the work and furnishing of labor and materials in the construction of the work in conformance with the requirements of the contract documents.

Contract Bond. The approved form of security, executed by the Contractor and its Surety or Sureties, guaranteeing complete execution of the contract and all supplemental agreements pertaining thereto and the payment of all legal debts pertaining to the construction of the contract.

Contract Documents. The contract documents shall include the advertisement for proposals; the contract proposal, including Special Notes and Special Specifications contained therein; the Contractor’s proposal; the Disadvantaged/Minority/Women’s Business Enterprise (D/M/WBE) participation goals; the equal employment opportunity (EEO) participation goals; the contract agreement; the Base Line Data; Standard Specifications, including all addenda thereto identified in the contract proposal; the Standard Sheets; the plans; any amendments to the contract proposal or the contract plans issued prior to the date of receipt of proposals; and all provisions required by law to be inserted in the contract whether actually inserted or not.

Whenever separate publications are referenced in the Contract Documents it shall mean those, as amended, which are current on the date of advertisement for bids.

Contract Limits. The limits shown in the contract documents, in which all work occurs, including advanced signing and detours covered under an individual contract. The Contractor shall be responsible for the highway within the contract limits. For contracts with multiple sites, this may be defined as a single larger limit if the sites are in close proximity, or as multiple sets of contract limits if the sites are widely separated. On-site contract work cannot be conducted outside the contract limits.

Contract Pay Item. A specifically described unit of work for which a price is provided in the contract. The basic format of a standard specification contract pay item number is a three digit root number, a decimal point, and then either a two, four, or six digit extension number (XXX.XX, XXX.XXXX, or XXX.XXXXXXXXX). The three digit root number denotes the standard specifications section to which the contract pay item relates (i.e. 564 – Structural Steel).

The format of a special specification contract pay item number is the same as the standard specification contract pay item number, but a two digit origin code number (that was previously shown as a prefix) is added as a suffix. The special specifications will be contained in the contract proposal. The origin code number (RR) denotes the NYSDOT Region, Division, or Group that originate the special specification. Regardless of the length of the extension number, the suffix is always in the seventh and eighth decimal place after decimal point. For special specification contract pay item numbers with only a two or four digit extension number, blank spaces, hyphens or lowercase “b”s are used to bridge the space between the end of the extension number and the origin code number (XXX.XX----RR or XXX.XXXX--RR or XXX.XXXXXXRR or XXX.XXbbbbRR or XXX.XXXXXbbRR or XXX.XX RR or XXX.XXXX RR).

Contractor. The individual, firm, or corporation undertaking the execution of the work under the terms of the contract and acting directly or through his, her, their, or its agents or employees.

Culvert. An enclosed channel open at both ends carrying water from a stream or water course through an artificial barrier such as a roadway embankment. The term “culvert” shall apply to any structure whether of single or multiple span construction with an interior width of 6096 mm (legally 20 feet) or less when measurement is made horizontally along the center line of roadway from face to face of abutments or sidewalls immediately below the copings or fillets, or, if there are no copings or fillets, at points 152 mm (6 inches) below the bridge seats or immediately under the top slab in the case of frame structures.
In the case of arches, the span shall be measured from spring line to spring line. All measurements shall include the widths of intervening piers or division walls, as well as the widths of copings or fillets.

Day. A calendar day unless otherwise defined or modified.

Department. The New York State Department of Transportation, including staff and managers who have been delegated certain contractual and technical authority by the Commissioner. The Department maintains a web site at www.dot.state.ny.us.

Departmental Geotechnical Engineer. The Regional Geotechnical Engineer or his/her authorized representative, or a Geotechnical Engineer of the Geotechnical Engineering Bureau acting at the request of the Regional Geotechnical Engineer.

Departmental Engineering Geologist. An Engineering Geologist of the Geotechnical Engineering Bureau authorized by the Director of Geotechnical Engineering Bureau to perform the duties required under these specifications.

Director, Construction Division. The Director of the Construction Division of the Department of Transportation.

Division. Any of the divisions of the New York State Department of Transportation.

Drainage Structure. A structure that collects and/or redirects stormwater runoff, including catchbasins, manholes, leaching basins and similar structures, but not structures for sanitary sewers.

Employee. Any person working on the project mentioned in the contract documents, and who is under the direction or control, or receives compensation from the Contractor or Subcontractor.

Engineer OR Engineer-In-Charge. The Engineer representing the Department of Transportation having direct supervision of the execution of the contract under the direction of the Regional Director.

Equipment. All machinery and equipment, together with the necessary supplies for upkeep and maintenance, and also tools and apparatus necessary for the proper construction and acceptable completion of the work.

Erosion and Sediment Control. Erosion and sediment control is any action taken or item used as part of a contract or as a separate action to minimize the destructive effects of wind and water on surface soil. The use and placement of berms and dams, rolled erosion control products, grasses, sod, mulches, slope drains, sediment basins and drainage systems may be temporary and used throughout construction, or permanent and installed for the anticipated life of the facility.

Extra Work. Work not provided for in the contract as awarded but found essential to the satisfactory completion of the contract within its intended scope.

Fabricator. A Fabricator assembles, constructs or otherwise substantially alters materials or supplies into assemblies, components or finished items for inclusion into the work prior to resale.

Federal-Aid. Joint cooperative construction or reconstruction of State highways and bridges or grade crossing elimination work with monies contributed to the State by the Federal Government under Title 23, United States Code, Highways, and amendments thereto.

Federal-Aid Project. An identification applied to federally aided work for the purpose of the records of the FHWA. Federal-Aid contracts are denoted “F.A. Project” on the proposal cover and on the title page.
§101

Field Change Order (FCO). A contract contingency that allows for the timely payment of authorized extra work that is necessary to fulfill the intent of the plans and specifications without the preparation of an order-on-contract during construction. FCO funds are limited to the amount in the item at award and shall not be increased nor replenished. A “clean-up” order-on-contract is processed after contract final acceptance to reconcile all FCO payments.

Final Agreement. Agreement between the State of New York, Department of Transportation and the Contractor, stating the net increase or decrease of the cost of work completed from the total cost of work authorized under the contract. The Final Agreement includes the Final Estimate as an attachment.

Geotechnical Engineering Bureau. The Department’s Geotechnical Engineering Bureau has the responsibility for providing all Geotechnical Engineering Services including laboratory testing of earthwork materials.

Highway. The whole strip of land bounded by the right of way lines.

Incentive/Disincentive (I/D). Predetermined adjustment to the total contract amount for each day or portion thereof that the work is completed ahead of or behind a specific milestone, phase or contract completion date.

Inspector. The Department of Transportation representative assigned to inspect methods and materials relating to work both on and off the site of the contract.

Land Surveyor. A Land Surveyor licensed or otherwise authorized to practice surveying under Article 145 and registered or otherwise authorized under Article 130 of the New York State Education Law.

Landscape Development. Landscape development is any development or item used as part of a project or as a separate action through the use, placement and management of land and elements for aesthetic enhancement, such as decorative surfaces and wall faces, benches, waste receptacles, tables, etc., and plant materials consistent with a specific landscape architectural design plan.

Landscaping. Landscaping is the use and placement of plant materials (trees, shrubs, vines and certain ground covers) consistent with a landscape architectural design plan. Planting vegetation for screening and erosion control purposes does not constitute landscaping.

Lane Rental. An amount identified as the value of a lane or lanes to be occupied by the Contractor in performance of the contract. The total amount bid for lane rental is the total value that can be used by the Contractor in performance of the contract. If additional value is used by the Contractor, that amount will be deducted from the payments to be made to the Contractor.

Laying Length of Pipe. Meters (laying length) of pipe shall be measured by multiplying the number of whole units by the nominal length of each unit and adding thereto the length of any fractional units incorporated in the work. The nominal length of a unit or fractional unit shall be the inside measured length from butt end to butt end and exclusive of the bell or groove on the female end.

Major Item. Any contract pay item for which the original unit bid price multiplied by the original item quantity exceeds the following minimum major item value based on total contract bid price or 2% of the total contract bid price, whichever is greater:

<table>
<thead>
<tr>
<th>Total Contract Bid Price</th>
<th>Minimum Major Item Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ $1,000,000.</td>
<td>$20,000</td>
</tr>
<tr>
<td>&gt; $1,000,000 - $5,000,000</td>
<td>$50,000</td>
</tr>
<tr>
<td>&gt; $5,000,000 - $20,000,000</td>
<td>$200,000</td>
</tr>
<tr>
<td>&gt; $20,000,000</td>
<td>$500,000</td>
</tr>
</tbody>
</table>

NOTE: The total contract bid price shall not include the value of any Field Change Order item. For contracts subject to A+B Bidding, the total contract bid price will include only the “A” portion of the bid. For contracts containing Incentive/Disincentive
provisions, Lane Rental provisions, or any similar provisions, the total contract bid price will exclude any incentive/disincentive, lane rental, or similar items.

**Manual for Uniform Record Keeping on Construction Contracts (MURK).** Manual(s) containing uniform contract record keeping forms and procedures to be followed by the Engineer, current on the date of contract award. MURK Part 1A is the Contract Administration Manual (CAM), Part 1B is the Construction Inspection Manual (CIM), Part 1C is the Safety and Health Program Manual, and Part 2A is the Materials Inspection Manual (MIM). The MURK manuals are guidance documents, and are not a part of the contract documents.


**Manufacturer.** A Manufacturer operates or maintains a factory or establishment that produces, on the premises, materials or supplies of the general character described by the specifications.

**Material.** Any approved material acceptable to the Commissioner and conforming to the requirements of the specifications.

**Material Supplier.** A Material Supplier, also known as a regular dealer, is a firm that owns, operates, or maintains a store, warehouse, or other establishment in which the materials or supplies required for the performance of the contract are bought, kept in stock, and regularly sold to the public in the usual course of business. A Material Supplier is a firm that engages in, as its principal business, and in its own name, the purchase and sale of the products in question. A Material Supplier who deals in bulk items such as steel, cement, gravel, stone and petroleum products need not keep such products in stock, if it owns or operates distribution equipment. Packagers, brokers, manufacturer’s representatives or other persons who arrange or expedite transactions are not Material Suppliers.

**Materials Bureau.** The Department’s Materials Bureau has a responsibility in the quality assurance program for materials to be used on the contract and maintains a testing facility in Albany, New York.

**Materials Details.** That information, unique to a particular product, that is necessary to adequately identify it or to describe the proper handling, installation, or use of that product.

**Metric Ton.** Metric ton of 1000 kilograms. The metric ton is also referred to as the Megagram (Mg).

**Minor Item.** Any contract pay item that does not meet the definition of a Major Item.


**Near.** When used in reference to an underground facility, within 4.5 m (15 feet) of the outside perimeter or diameter of an underground facility or its encasement.

**NYCRR.** Official Compilation of Codes, Rules and Regulations of the State of New York, written TT NYCRR PPP. TT refers to the Title, and PPP refers to the Part of the official compilation.

**One-Call Notification System.** Organization(s) whose purpose is to establish and carry out procedures to protect underground facilities from damage due to excavation and demolition, including receiving notices of intent to perform excavation and/or demolition and transmit the notices to the operators of underground facilities in the specified area.
Order on Contract. Written order issued by the Commissioner covering contingencies, extra work, deductions, increases or decreases and additions, alterations or omissions to the plans or specifications.

Owner/Operator. A single individual who operates a vehicle or other piece of equipment as an independent contractor and does not have any employees. The Owner/Operator is responsible for all costs incurred in the ownership and operation of the vehicle/equipment including, but not limited to: licensing/registration, insurance, taxes, permits, repairs and fuel. Payments to the Owner/Operator are for both the vehicle/equipment and an operator, and may be made on a time, distance, load or other basis.

Partial or Monthly Contract Payments. Payments to the Contractor for work satisfactorily performed, prescribed by subdivision 7, section 38 of the Highway Law.

Payment Limit. A payment limit defines the boundary beyond which no quantities will be measured for payment. Whenever payment limits are indicated, only the work which is actually directed and completed within these limits will be measured and computed for payment. Payment limits may be revised in writing by the Engineer prior to performing the work.

Payment Line. Defines the exact line from which the work quantity will be computed. Whenever payment lines are indicated, quantities representing work completed will be computed from these lines only. No other lines or locations will be used to compute quantities. Payment lines may be revised with the recommendation of the Engineer through an approved order-on-contract prior to performing the work.

Plans. The official contract drawings and applicable standard sheets, which show the location, character, dimensions and details of the work to be performed.

Prestressed Concrete Construction Manual (PCCM). The New York State Prestressed Concrete Construction Manual published by the Structures Design and Construction Division, which is current on the date of advertisement for bids. The Prestressed Concrete Construction Manual is a mandatory supplement to the contract documents for contracts which include Prestressed Concrete Units (Structural).

Professional Engineer. A Professional Engineer licensed or otherwise authorized to practice engineering under Article 145 and registered or otherwise authorized under Article 130 of the New York State Education Law.

Project. The construction work to be performed under one or more construction contracts to complete an undertaking.

Project Limits. The limits in which the improvements associated with a specific project have been designed.

Proposal. The offer of the bidder for the work, when executed and submitted on the prescribed form.

Proposal Form. The approved form on which the Department requires formal bids to be prepared and submitted for the work.

Reasonable Close Conformity. Reasonable close conformity means compliance with reasonable and customary manufacturing and construction tolerances where working tolerances are not specified. Where working tolerances are specified, reasonably close conformity means compliance with such tolerances. Without detracting from the complete and absolute discretion of the Engineer to insist upon such tolerances, the Engineer may accept variations beyond such tolerances as reasonable close conformity where they will not materially affect the value or utility of the work and the interests of the State.

Region. One of eleven geographical subdivisions of the State used to designate or identify the location of the proposed work.
Regional Director. The Director, acting through the Commissioner, who is delegated the authority and responsibility to execute the total Department prescribed work plans for his/her respective region.

Right of way or R.O.W. A general term denoting land, property or interest therein, usually in a strip, acquired for or devoted to a highway.

Roadbed. The graded portions of a highway within top and side slopes, prepared as a foundation for the pavement structure and shoulders.

Roadway. The portion of a highway included between the outside edges of the shoulders.

Road Section. That portion of a highway included between the top of the slope in cut and the bottom of slope in fill.

Service. For the purposes of determining whether subcontractor approval is required, and for determining reimbursement for extra work, a Service is specialized work consisting of less than an entire contract pay item, conducted for an aggregate of less than 5 days, provided to the Contractor for a fee or other basis not generally accounted for through labor, materials and equipment billing. Services include, but are not limited to professional fees, testing fees, dumping fees, utility charges, fuel supply delivery, vehicle towing called out for the public, and crane lifting operations.

Shoulder. The portion of the roadway contiguous with the traveled way for accommodation of stopped vehicles, for emergency use, and for lateral support of base and surface courses.

Site. The specific area adjacent to and including the area upon which construction work is to be performed. Generally such area may be considered as defined by the right of way or property made available to the Contractor for construction operations.

Special Notes. Special directions, provisions, or requirements peculiar to the contract under consideration.

Specifications. The body of directions, requirements, etc., contained in this present volume, together with all special specifications and documents of any description and agreements made (or to be made), pertaining to the methods (or manner) of performing the work or to the quantities and quality as shown by the test records of accepted materials to be furnished under a contract.

Within these specifications there are two formats for numbering. One is used for the specification sections and subsections portion and the other for contract pay items. (See definition - Contract Pay Item.)

A specification section is written using the word Section xxx Section Title (e.g., Section 564 Structural Steel) and subsections are written with a subsection symbol, the core section number, a dash, another and may include a decimal (e.g., §107-05 Safety and Health Requirements or §608-3.03E.2.).

Standard Sheets. The standard drawings, issued by the Department, approved for repetitive use, showing details to be used where appropriate. Applicable standard sheets are referenced on the Contract Plan Title Sheet, and comprise a part of the Contract Documents. Standard sheets are available on the NYSDOT web site in both Adobe Acrobat (pdf) and Bentley Systems MicroStation (dgn) formats.

State. When used, means the State of New York, represented by the Department of Transportation through the Commissioner of Transportation.

Steel Construction Manual (SCM). The New York State Steel Construction Manual published by the Structures Design and Construction Division, which is current on the date of advertisement for bids. The Steel Construction Manual is a mandatory supplement to the contract documents for contracts which include contract pay items which require the Contractor to furnish or rehabilitate structural metals.
§101

Structures. Bridges, culverts, retaining walls, cribbing, manholes, drainage structures, endwalls, buildings, sewers, service pipes, underdrains, foundation drains and other features which may be encountered in the work and not otherwise classed herein.

Subcontractor. Any individual, firm or corporation to whom the Contractor, with the written consent of the Department, sublets any part of the contract.

Surety. The corporate body bound with and for the Contractor, guaranteeing the full and complete performance of the contract, and for the payment of all debts pertaining to the work.

Test. Methods adopted by the Commissioner to ascertain the quality, character and acceptability of materials and processes utilized in performing the contract.

Tolerance Zone. When used in reference to an underground utility, the tolerance zone shall be a distance of 0.6m on either side of the designated centerline, plus one-half of the utility diameter, if the utility diameter is known.

Traveled Way. Portion of the roadway for the movement of vehicles, exclusive of the shoulders. Through traveled way is the portion of the roadway for the movement of vehicles, exclusive of shoulders and auxiliary lanes.

Utility. Person, corporation, municipality or public authority engaged in the distribution of electricity, gases, petroleum products, water, steam, the collection of wastewater, the operation of traffic control systems, or the provision of telecommunication service. For the purposes of these Specifications, the term Utility will apply to organizations that operate utilities owned by others.

Work. Work shall be understood to mean the furnishing of all labor, materials, equipment, and other incidentals necessary or convenient to the successful completion of the contract and the carrying out of all the duties and obligations imposed by the contract.

Work Day. A calendar day, on which weather and other conditions not under the control of the Contractor, will permit construction operations on the principal item or items of work which would normally be in progress at that time to proceed for the major part of the day. Work days exclude Sundays, and days on which the Contractor is specifically prohibited from working, as identified in the contract documents. Days on which the Contractor is prohibited from closing a lane or lanes or impeding traffic are considered work days unless otherwise noted in the contract documents.

For the purposes of determining allowable time periods for submittals, reviews and approvals, State recognized public holidays are not considered work days. The public holidays observed by the State are as follows:

<table>
<thead>
<tr>
<th>New York State Public Holidays</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>New Years Day</td>
<td>January 1</td>
</tr>
<tr>
<td>Martin Luther King Day</td>
<td>3rd Monday in January</td>
</tr>
<tr>
<td>President’s Day</td>
<td>3rd Monday in February</td>
</tr>
<tr>
<td>Memorial Day</td>
<td>Last Monday in May</td>
</tr>
<tr>
<td>Independence Day</td>
<td>July 4</td>
</tr>
<tr>
<td>Labor Day</td>
<td>1st Monday in September</td>
</tr>
<tr>
<td>Columbus Day</td>
<td>2nd Monday in October</td>
</tr>
<tr>
<td>Veteran’s Day</td>
<td>November 11</td>
</tr>
<tr>
<td>Thanksgiving Day</td>
<td>4th Thursday in November</td>
</tr>
<tr>
<td>Christmas Day</td>
<td>December 25</td>
</tr>
</tbody>
</table>

If the holiday occurs on a Saturday, it will be observed the Friday before. If the holiday occurs on a Sunday, it will be observed the Monday after.
### SECTION 102 - BIDDING REQUIREMENTS AND CONDITIONS

#### 102-01 LOCATION OF REGIONAL OFFICES.

The Regional Offices and counties covered are located as follows:

<table>
<thead>
<tr>
<th>Region Number</th>
<th>Including Counties:</th>
<th>Regional Office Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Albany Rensselaer Warren</td>
<td>NYS Office Building 328 State Street Schenectady, N.Y. 12305 (518) 388-0388</td>
</tr>
<tr>
<td></td>
<td>Essex Saratoga Washington</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Greene Schenectady</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Fulton Madison Hamilton Montgomery Herkimer Oneida</td>
<td>NYS Office Building 207 Genesee Street Utica, N.Y. 13501 (315) 793-2447</td>
</tr>
<tr>
<td>3</td>
<td>Cayuga Oswego Cortland Seneca Onondaga Tompkins</td>
<td>NYS Office Building 333 E. Washington St. Syracuse, N.Y. 13202 (315) 428-4351</td>
</tr>
<tr>
<td>4</td>
<td>Genesee Ontario Wayne Livingston Orleans Monroe Wyoming</td>
<td>1530 Jefferson Road Rochester, N.Y. 14623 (585) 272-3310</td>
</tr>
<tr>
<td>5</td>
<td>Cattaraugus Niagara Chautauqua Erie</td>
<td>NYS Office Building 100 Seneca Street Buffalo, N.Y. 14203 (716) 847-3238</td>
</tr>
<tr>
<td>6</td>
<td>Allegany Steuben Chemung Tioga Schuyler Yates</td>
<td>NYS Office Building 107 Broadway Street Hornell, N.Y. 14843 (607) 324-8404</td>
</tr>
<tr>
<td>7</td>
<td>Clinton Lewis Franklin St. Lawrence Jefferson</td>
<td>NYS Office Building 317 Washington Street Watertown, N.Y. 13601 (315) 785-2333</td>
</tr>
<tr>
<td>8</td>
<td>Columbia Putnam Westchester Dutchess Rockland Orange Ulster</td>
<td>NYS Office Building 4 Burnett Boulevard Poughkeepsie, N.Y. 12603 (845) 431-5750</td>
</tr>
<tr>
<td>9</td>
<td>Broome Otsego Chenango Schoharie Delaware Sullivan</td>
<td>NYS Office Building 44 Hawley Street Binghamton, N.Y. 13901 (607) 721-8116</td>
</tr>
<tr>
<td>10</td>
<td>Nassau Suffolk</td>
<td>NYS Office Building 250 Veterans Memorial Highway Hauppauge, N.Y. 11788 (631) 952-6632</td>
</tr>
<tr>
<td>11</td>
<td>Bronx Richmond Kings Queens New York</td>
<td>1 Hunters Point Plaza 47-40 21st Street Long Island City, N.Y. 11101 (718) 482-4526</td>
</tr>
</tbody>
</table>

#### 102-02 EXAMINING THE CONTRACT DOCUMENTS AND THE WORK SITE.

Detailed plans of the work, standard sheets and contract proposals may be examined at the office of the NYS Department of Transportation, Plan Sales Unit, 50 Wolf Road, Albany, New York 12232 (518) 457-2124 and at the Regional Office where the work is located.
The attention of persons intending to make proposals is specifically called to Article 3, Examination of Documents and Site of the contract agreement wherein the bidder agrees that it has examined the contract documents and the site of the work and has fully informed itself from personal examination of the same regarding the quantities, character, location and other conditions affecting the work to be performed including the existence of poles, wires, pipes, ducts, conduits, and other facilities and structures of municipal and other public service corporations on, over or under the site. Particular attention is called to contract plans and the contract proposal, which contains special notes and special specifications, which may contain contract requirements at variance with standard specifications and standard sheets and may include information concerning the existence of poles, wires, pipes, ducts, conduits, and other facilities and structures of municipal and other Utilities on, over or under the site.

The Bidder agrees that its proposed contract prices include all costs arising solely from existing conditions shown, or specified in the contract documents including the Base Line Data, and/or readily observable from a site inspection during the bidding period available under this contract, and/or generally recognized as inherent in the nature of the work. The Bidder shall take no advantage of any apparent error or omission in the contract documents.

**A. Base Line Data.** The Department will make available relevant project specific information and engineering data that were used to develop the contract documents. The material will be listed as available on a form in the contract proposal entitled "Supplemental Information Available to Bidders". The supplemental information could include, for example, earthwork cross section sheets, various subsurface information, record plans, special reports and other pertinent project data. The information or data listed as available on the form can be accessed by the Contractor for inspection or reproduction at the Regional Office where the work is located. This material will be the Base Line Data and together with other contract documents will be used to determine changes to the work. Base Line Data will be consistently provided in all Department projects.

**B. Contract Document Components.** The following components of the contract documents complement one another in the declining order of precedence listed below. The intent of the contract documents is to include all items/aspects of the work that are necessary for the proper initiation, execution, and completion of the work.

1. Plans.
2. Proposal - Special Notes.

**C. Subsurface Information.** Boring logs and other subsurface information made available for the inspection of bidders were obtained with reasonable care and recorded in good faith by the Department. The subsurface information shown was obtained for State design and estimate purposes. It is made available to bidders so that they may have access to the same information available to the State. It is presented in good faith, but as with all subsurface information it represents only a small fraction of the total volume of material at the site. The soil and rock descriptions shown are as determined by a visual inspection of the samples from the various explorations unless otherwise noted. The observed water levels and/or water conditions indicated thereon are as recorded at the time of the exploration. These levels and/or conditions may vary considerably, with time, according to the prevailing climate, rainfall and other factors. Interpolation between data points may not be indicative of the actual material to be encountered.

The locations of utilities or other underground man-made features were ascertained with reasonable care and recorded in good faith from various sources, including the records of municipal and other public service corporations, and therefore the location of known utilities may only be approximate. Subsurface utility quality level designations shown in the contract documents are defined in accordance with §107-07E. Quality Level Designations.

**102-03 COOPERATION BETWEEN CONTRACTORS.**
The Department reserves the right to let other contracts in connection with this work. The Contractor acknowledges that, from the contract documents and Base Line Data, it has been informed of such other contracts in the work area. The Contractor has carefully reviewed the contract documents and all other pertinent information made available by the Department that relate to the nature and scheduling of these other contracts that may be awarded and will submit a progress schedule that takes into account the need to coordinate its work with those other contractors. The Contractor shall coordinate its work with the work of these other contractors. There may be other contractors, subcontractors, utilities, or employees of the Department and its authorized representatives working at or adjacent to the work site during the performance of the contract by the Contractor. The Contractor may not have exclusive access to or occupancy of the territory within or adjacent to the limits of the contract. To the extent indicated in the Base Line Data and contract documents, the Department may also require that certain facilities and areas be used concurrently by the Contractor and others. Consistent with that indicated in the Base Line Data and contract documents, the Department will advise the Contractor of the schedules of others. The Contractor should anticipate that its work may be interrupted or delayed from time to time due to the concurrent activities of others.

The Contractor shall cooperate with other Contractors and Utilities and coordinate and arrange the sequence of its work to conform with the work operations of other parties indicated in the Base Line Data. Cooperation and adjustments with the Contractors already engaged and to be engaged upon the site is essential to properly coordinate the construction efforts of all contractors, Utilities, and Subcontractors engaged in the work within and adjacent to the construction area of this contract.

In the event that utility facility adjustments are to be made by a Utility’s forces in connection with and during the life of the contract, the Contractor will be required to cooperate with the Utilities and to coordinate and arrange the sequence of its work to conform with the progressive operations of the Utility’s work or proposed work.

102-04 PROPOSAL CONTENT.

Each proposal shall specify the correct gross sum, in the manner hereafter described for which the work will be performed according to the plans and specifications and any amendment to the specifications if the same are issued prior to the date of receipt of the proposal, together with a unit price for each of the specified separate items. The bidder’s attention is directed to the fact that it cannot exceed three (3) decimal positions in the cents column under unit bid price.

A. Fixed Price Items. Some of the contract pay items may be designated as Fixed Price or Dollars-Cents Items, for which the fixed prices are published in the proposal. These items can be identified in the Itemized Proposal by the words “Fixed Price: See Specification and §102-04” appearing beneath the description of the item, and preprinted entries in the “Unit Price” and “Bid Amount” columns. The bidder shall not change these entries. Should the amount shown be altered, the altered figures will be disregarded and the preprinted price and amount will be used to determine the total amount bid for the contract.

Some Fixed Price Items indicate the price that will be paid for certain work. These have been prepared taking into account the cost of all labor, materials, and equipment necessary to complete the work including an allowance for overhead and profit. Other Fixed Price Items indicate an estimate of payments, with actual payments to be based on actual costs and provisions of the controlling specification. In either case, payments made under Fixed Price Items shall be in accord with the provisions for the specification for that item.

B. Minimum/Maximum Bid Items. Similarly, one or more contract pay items may be designated as MINIMUM PRICE ITEMS or MAXIMUM PRICE ITEMS. When this is the case, the minimum (or maximum) prices are published in the proposal. These contract pay items can also be identified in the Itemized Proposal by the words “Minimum Bid___” or “Maximum Bid___” appearing beneath the description of the item. The price bid for Minimum Price Items shall not be less than the minimum price shown in the Itemized Proposal, but it may exceed that price.

Conversely, the price bid for Maximum Price Items shall be less than, or equal to, the maximum price shown in the Itemized Proposal. In the event a bid is less than the Minimum Price (or more than the Maximum Price) indicated in the Itemized Proposal, the Department will substitute the
appropriate minimum (or maximum) price and make the necessary adjustments to determine the total amount bid.

C. A+B Bidding. The itemized contract proposal provides space to individually list the number of consecutive calendar days for each stage or phase of work subject to A+B Bidding. The Contractor shall enter the number of consecutive calendar days bid for each phase or stage of work subject to A+B bidding individually in the space provided. Bids showing time for completion of B-portion work in excess of the maximum total number of calendar days that can be bid as specified in the Special Note entitled Description of B-Portion Work will be adjusted by the Department to the maximum time allowed.

102-05 PROPOSAL SUBMISSION.
Each proposal shall be submitted on the proposal form prepared by the Department for that individual contract. The deadline for submitting a proposal is found in the published notice calling for proposals. Any proposal received after the time specified in the published notice, as modified by any Amendment, will not be accepted. All blank spaces in the proposal form shall be filled in as noted, and no change shall be made in the phraseology of the proposal or in the items mentioned therein. Bidders shall use either black ink or typewriter (black ribbon) in completing the proposal form. Proposals that are illegible or that contain any omission, erasures, alterations, additions, or items not called for in the itemized proposal or that contain irregularities of any kind, may be rejected as informal.

The State is responsible for providing Amendments only to those persons or firms listed in its Plan Sales Ledger as having purchased plans and/or proposals from the Department, and those that made a specific request of the Department for Amendments. Persons or firms that obtain plans and/or proposals from sources other than the Department bear the sole responsibility for obtaining any amendments issued by the Department.

The Bidder shall sign, in the space provided in the proposal form, with its signature. An officer of a corporation or a member of a partnership signing for the bidder, shall place its signature and title after the word "By" under the name of the Contractor. The same procedure shall apply to the proposal of a joint venture by two or more bidders; however, if the signature is by an agent or attorney-in-fact for the joint venturers, then the proposal shall be accompanied by four (4) authenticated copies of the evidence of its authority to act on behalf of all of the joint venturers.

If the proposal is made by an individual, the individual’s address shall be given. If the proposal is made by a corporation, the names and addresses of the president, secretary and treasurer shall be given. If the proposal is made by a partnership, the names and addresses of the partners shall be given.

Any proposal which does not contain prices set opposite each of the items for which there is a quantity exhibited in the itemized proposal, or which shall in any manner fail to conform to the conditions of the published notice inviting proposals, will be deemed informal.

102-06 BID DEPOSIT.
THE BIDDER MUST SUBMIT A BID SECURITY WITH EACH BID. Every proposal shall be accompanied by (1) a bid bond or (2) a certified check or (3) a bank cashier's check payable to the State of New York. If the Bidder elects to submit a bid bond, it SHALL be on the Department's Bid Bond Form (CONR 391, a sample of which is included in §102-15, Sample Form of Bid Bond) that already contains language representing 25% of the total bid. If the Bidder elects to submit a certified check or bank cashier's check for a bid deposit, it shall be in the amount specified in the bid proposal. The retention and disposition of such bid bond or certified check or bank cashier's check by the Department shall be pursuant to and in conformity with §38(2) of the Highway Law, as amended.

102-07 MODIFICATION OR WITHDRAWAL OF PROPOSAL.
Permission will not be given to modify or explain by e-mail, telephone, letter or otherwise, any proposal or bid after it has been deposited with the Department. No proposal shall be withdrawn or canceled before the time designated for opening such proposals publicly except upon such conditions as the Commissioner may deem to be necessary.

No proposal shall be withdrawn or canceled after the time designated for opening such proposals publicly, except to exercise the option as provided herein. Any bidder or its duly authorized agent who has submitted proposals on more than one project of any one letting may, at its option and upon written
request, withdraw any or all of its additional proposals after the person who opens and reads the bids has announced that such bidder has submitted the lowest proposal on a project for which bids have last been read. When this option is exercised, the proposals for other projects in the letting will be returned to the bidder unopened. No returned proposals will be considered after the bidder has exercised its privilege to withdraw the same. Any bidder exercising the privilege of so withdrawing its bid or bids waives all claims that may arise should it be found that its opened proposal is informal or for any other reason is unacceptable to the Department. The Department will open and read proposals in the order in which they are drawn and not in the order in which the projects are advertised.

102-08 STANDARD CLAUSES FOR ALL NEW YORK STATE CONTRACTS.

The parties to the attached contract, license, lease, amendment or other agreement of any kind (hereinafter, "the contract" or "this contract") agree to be bound by the following clauses which are hereby made a part of the contract (the word "Contractor" herein refers to any party other than the State, whether a contractor, licensor, licensee, lessor, lessee or any other party):

1. EXECUTORY CLAUSE. In accordance with Section 41 of the State Finance Law, the State shall have no liability under this contract to the Contractor or to anyone else beyond funds appropriated and available for this contract.

2. NON-ASSIGNMENT CLAUSE. In accordance with Section 138 of the State Finance Law, this contract may not be assigned by the Contractor or its right, title or interest therein assigned, transferred, conveyed, sublet or otherwise disposed of without the previous consent, in writing, of the State and any attempts to assign the contract without the State's written consent are null and void. The Contractor may, however, assign its right to receive payment without the State's prior written consent unless this contract concerns Certificates of Participation pursuant to Article 5-A of the State Finance Law.

3. COMPTROLLER'S APPROVAL. In accordance with Section 112 of the State Finance Law (or, if this contract is with the State University or City University of New York, Section 355 or Section 6218 of the Education Law), if this contract exceeds $15,000 (or the minimum thresholds agreed to by the Office of the State Comptroller for certain S.U.N.Y. and C.U.N.Y. contracts), or if this is an amendment for any amount to a contract which, as so amended, exceeds said statutory amount, or if, by this contract, the State agrees to give something other than money when the value or reasonably estimated value of such consideration exceeds $10,000, it shall not be valid, effective or binding upon the State until it has been approved by the State Comptroller and filed in his office. Comptroller's approval of contracts let by the Office of General Services is required when such contracts exceed $30,000 (State Finance Law Section 163.6.a).

4. WORKERS' COMPENSATION BENEFITS. In accordance with Section 142 of the State Finance Law, this contract shall be void and of no force and effect unless the Contractor shall provide and maintain coverage during the life of this contract for the benefit of such employees as are required to be covered by the provisions of the Workers' Compensation Law.

5. NON-DISCRIMINATION REQUIREMENTS. To the extent required by Article 15 of the Executive Law (also known as the Human Rights Law) and all other State and Federal statutory and constitutional non-discrimination provisions, the Contractor will not discriminate against any employee or applicant for employment because of race, creed, color, sex, national origin, sexual orientation, age, disability, genetic predisposition or carrier status, or marital status. Furthermore, in accordance with Section 220-e of the Labor Law, if this is a contract for the construction, alteration or repair of any public building or public work or for the manufacture, sale or distribution of materials, equipment or supplies, and to the extent that this contract shall be performed within the State of New York, Contractor agrees that neither it nor its Subcontractors shall, by reason of race, creed, color, disability, sex or national origin: (a) discriminate in hiring against any New York State citizen who is qualified and available to perform the work; or (b) discriminate against or intimidate any employee hired for the performance of work under this contract. If this is a building service contract as defined in Section 230 of the Labor Law, then, in accordance with Section 239 thereof, Contractor agrees that neither it nor its Subcontractors shall, by reason of race, creed, color, national origin, age, sex or disability: (a) discriminate in hiring against any
§102

New York State citizen who is qualified and available to perform the work; or (b) discriminate against or intimidate any employee hired for the performance of work under this contract. Contractor is subject to fines of $50.00 per person per day for any violation of Section 220-e or Section 239 as well as possible termination of this contract and forfeiture of all moneys due hereunder for a second or subsequent violation.

6. WAGE AND HOURS PROVISIONS. If this is a public work contract covered by Article 8 of the Labor Law or a building service contract covered by Article 9 thereof, neither Contractor's employees nor the employees of its Subcontractors may be required or permitted to work more than the number of hours or days stated in said statutes, except as otherwise provided in the Labor Law and as set forth in prevailing wage and supplement schedules issued by the State Labor Department. Furthermore, Contractor and its Subcontractors must pay at least the prevailing wage rate and pay or provide the prevailing supplements, including the premium rates for overtime pay, as determined by the State Labor Department in accordance with the Labor Law.

7. NON-COLLUSIVE BIDDING REQUIREMENT. In accordance with Section 139-d of the State Finance Law, if this contract was awarded based upon the submission of bids, Contractor warrants, under penalty of perjury, that its bid was arrived at independently and without collusion aimed at restricting competition. Contractor further warrants that at the time Contractor submitted its bid, an authorized and responsible person executed and delivered to the State a non-collusive bidding certification on Contractor's behalf.

8. INTERNATIONAL BOYCOTT PROHIBITION. In accordance with Section 220-f of the Labor Law and Section 139-h of the State Finance Law, if this contract exceeds $5,000, the Contractor agrees, as a material condition of the contract, that neither the Contractor nor any substantially owned or affiliated person, firm, partnership or corporation has participated, is participating, or shall participate in an international boycott in violation of the Federal Export Administration Act of 1979 (50 USC App. Sections 2401 et seq.) or regulations thereunder. If such Contractor, or any of the aforesaid affiliates of Contractor, is convicted or is otherwise found to have violated said laws or regulations upon the final determination of the United States Commerce Department or any other appropriate agency of the United States subsequent to the contract's execution, such contract, amendment or modification thereto shall be rendered forfeit and void. The Contractor shall so notify the State Comptroller within five (5) business days of such conviction, determination or disposition of appeal (2 NYCRR 105.4).

9. SET-OFF RIGHTS. The State shall have all of its common law, equitable and statutory rights of set-off. These rights shall include, but not be limited to, the State's option to withhold for the purposes of set-off any moneys due to the Contractor under this contract up to any amounts due and owing to the State with regard to this contract, any other contract with any State department or agency, including any contract for a term commencing prior to the term of this contract, plus any amounts due and owing to the State for any other reason including, without limitation, tax delinquencies, fee delinquencies or monetary penalties relative thereto. The State shall exercise its set-off rights in accordance with normal State practices including, in cases of set-off pursuant to an audit, the finalization of such audit by the State agency, its representatives, or the State Comptroller.

10. RECORDS. The Contractor shall establish and maintain complete and accurate books, records, documents, accounts and other evidence directly pertinent to performance under this contract (hereinafter, collectively "the Records"). The Records must be kept for the balance of the calendar year in which they were made and for six (6) additional years thereafter or three (3) years after final payment, whichever is later. The State Comptroller, the Attorney General and any other person or entity authorized to conduct and examination, as well as the agency or agencies involved in this contract, shall have access to the Records during normal business hours at an office of the Contractor within the State of New York or, if no such office is available, at a mutually agreeable and reasonable venue within the State, for the term specified above for the purposes of inspection, auditing and copying. The State shall take reasonable steps to protect from public disclosure any of the Records which are exempt from disclosure under Section 87 of the Public Officers Law (the "Statute") provided that: (i) the Contractor shall timely inform an appropriate State official, in writing, that said records should not be disclosed; and (ii) said records
shall be sufficiently identified; and (iii) designation of said records as exempt under the Statute is reasonable. Nothing contained herein shall diminish, or in any way adversely affect, the State's right to discovery in any pending or future litigation.

11. IDENTIFYING INFORMATION AND PRIVACY NOTIFICATION:
(A) Federal Employer Identification Number And/or Federal Social Security Number.

All invoices or New York State standard vouchers submitted for payment for the sale of goods of services or the lease of real or personal property to a New York State agency must include the payee's identification number, i.e., the seller's or lessor's identification number. The number is either the payee's Federal employer identification number or Federal social security number, or both such numbers when the payee has both such numbers. Failure to include this number or numbers may delay payment. Where the payee does not have such number or numbers, the payee, on his invoice or New York State standard voucher, must give the reason or reasons why the payee does not have such number or numbers.

(B) Privacy Notification.
(1) The authority to request the above personal information from a seller of goods or services or a lessor of real or personal property, and the authority to maintain such information, is found in Section 5 of the State Tax Law. Disclosure of this information by the seller or lessor to the State is mandatory. The principal purpose for which the information is collected is to enable the State to identify individuals, businesses and others who have been delinquent in filing tax returns or may have understated their tax liabilities and to generally identify persons affected by the taxes administered by the Commissioner of Taxation and Finance. The information will be used for tax administration purposes and for any other purpose authorized by law.
(2) The personal information is requested by the purchasing unit of the agency contracting to purchase the goods or services or lease the real or personal property covered by this contract or lease. The information is maintained in New York State's Central Accounting System by the Director of State Accounts, Office of the State Comptroller, 110 State Street, Albany, New York 12236.

12. EQUAL EMPLOYMENT OPPORTUNITIES FOR MINORITIES AND WOMEN: In accordance with Section 312 of the Executive Law, if this contract is: (i) a written Agreement or purchase order instrument, providing for a total expenditure in excess of $25,000.00, whereby a contracting agency is committed to expend or does expend funds in return for labor, services, supplies, equipment, materials or any combination of the foregoing, to be performed for, or rendered or furnished to the contracting agency; or (ii) a written Agreement in excess of $100,000.00 whereby a contracting agency is committed to expend or does expend funds for the acquisition, construction, demolition, replacement, major repair or renovation of real property and improvements thereon; or (iii) a written Agreement in excess of $100,000.00 whereby the owner of a State assisted housing project is committed to expend or does expend funds for the acquisition, construction, demolition, replacement, major repair or renovation of real property and improvements thereon for such project, then:
(a) The Contractor will not discriminate against employees or applicants for employment because of race, creed, color, national origin, sex, age, disability or marital status, and will undertake or continue existing programs of affirmative action to ensure that minority group members and women are afforded equal employment opportunities without discrimination. Affirmative action shall mean recruitment, employment, job assignment, promotion, upgrading, demotion, transfer, layoff, or termination and rate of pay or other forms of compensation;
(b) At the request of the contracting agency, the Contractor shall request each employment agency, labor union, or authorized representative of workers with which it has a collective bargaining or other Agreement or understanding, to furnish a written statement that such employment agency, labor union or representative will not discriminate on the basis of race, creed, color, national origin, sex, age, disability or marital status and that such union or representative will affirmatively cooperate in the implementation of the Contractor's obligations herein; and
(c) The Contractor shall state, in all solicitations or advertisements for employees, that, in the performance of the State contract, all qualified applicants will be afforded equal employment opportunities without discrimination because of race, creed, color, national origin, sex, age, disability or marital status.

NEW YORK STATE DEPARTMENT OF TRANSPORTATION
STANDARD SPECIFICATIONS of May 4, 2006
Contractor will include the provisions of "a", "b" and "c", above, in every subcontract over $25,000.00 for the construction, demolition, replacement, major repair, renovation, planning or design of real property and improvements thereon (the "Work") except where the Work is for the beneficial use of the Contractor. Section 312 does not apply to: (i) work, goods or services unrelated to this contract; or (ii) employment outside New York State; or (iii) banking services, insurance policies or the sale of securities. The State shall consider compliance by a Contractor or Subcontractor with the requirements of any Federal law concerning equal employment opportunity which effectuates the purpose of this section.

The contracting agency shall determine whether the imposition of the requirements of the provisions hereof duplicate or conflict with any such Federal law and if such duplication or conflict exists, the contracting agency shall waive the applicability of Section 312 to the extent of such duplication or conflict. Contractor will comply with all duly promulgated and lawful rules and regulations of the NYS Department of Economic Development’s Division of Minority- and Women-Owned Business Development pertaining hereto.

13. CONFLICTING TERMS. In the event of a conflict between the terms of the contract (including any and all attachments thereto and amendments thereof) and the terms of this subsection, the terms of this subsection shall control.

14. GOVERNING LAW. This contract shall be governed by the laws of the State of New York except where the Federal supremacy clause requires otherwise.

15. LATE PAYMENT. Timeliness of payment and any interest to be paid to Contractor for late payment shall be governed by Article XI-A of the State Finance Law to the extent required by law.

16. NO ARBITRATION. Disputes involving this contract, including the breach or alleged breach thereof, may not be submitted to binding arbitration (except where statutorily authorized) but must, instead, be heard in a court of competent jurisdiction of the State of New York.

17. SERVICE OF PROCESS. In addition to the methods of service allowed by the State Civil Practice Law & Rules ("CPLR"), Contractor hereby consents to service of process upon it by registered or certified mail, return receipt requested. Service hereunder shall be complete upon Contractor's actual receipt of process or upon the State's receipt of the return thereof by the United State Postal Service as refused or undeliverable. Contractor must promptly notify the State, in writing, of each and every change of address to which service of process can be made. Service by the State to the last known address shall be sufficient. Contractor will have thirty (30) calendar days after service hereunder is complete in which to respond.

18. PROHIBITION ON PURCHASE OF TROPICAL HARDWOODS. The Contractor certifies and warrants that all wood products to be used under this contract award will be in accordance with, but not limited to, the specifications and provisions of State Finance Law Section 165. (Use of Tropical Hardwoods) which prohibits purchase and use of tropical hardwoods, unless specifically exempted, by the State or any governmental agency or political subdivision or public benefit corporation. Qualification for an exemption under this law will be the responsibility of the contractor to establish to meet with the approval of the State. In addition, when any portion of this contract involving the use of woods, whether supply or installation, is to be performed by any Subcontractor, the prime Contractor will indicate and certify in the submitted bid proposal that the Subcontractor has been informed and is in compliance with specifications and provisions regarding use of tropical hardwoods as detailed in Section 165 State Finance Law. Any such use must meet with the approval of the State; otherwise, the bid may not be considered responsive. Under bidder certifications, proof of qualification for exemption will be the responsibility of the Contractor to meet with the approval of the State.

19. PURCHASES OF APPAREL. In accordance with State Finance Law §162 (4-a), the State shall not purchase any apparel from any vendor unable or unwilling to certify that: (i) such apparel was manufactured in compliance with all applicable labor and occupational safety laws, including, but not limited to, child labor laws, wage and hours laws and workplace safety laws, and (ii) vendor will supply, with its bid (or, if not a bid situation, prior to or at the time of signing a contract with the State), if known,
the names and addresses of each Subcontractor and a list of all manufacturing plants to be utilized by the
bidder.

20. Contract Termination Provision. The State reserves the right to terminate this contract in the
event it is found that the certification filed by the Contractor in accordance with the requirements
contained in State Finance Laws §139j and §139k was intentionally false or intentionally incomplete.
Upon such finding, the State may exercise its termination right by providing written notification to the
Contractor in accordance with the written notification terms of the contract.

102-09 STANDARD CLAUSES FOR NON FEDERAL-AID NEW YORK STATE CONTRACTS.

employers doing business in Northern Ireland to employ principles relating to nondiscrimination in
employment and freedom of workplace opportunity which would:
• Increase the representation of individuals from underrepresented religious groups in the work
force, including managerial, supervisory, administrative, clerical and technical jobs;
• Take steps to promote adequate security for the protection of employees from underrepresented
religious groups both at the workplace and while traveling to and from work;
• Ban provocative religious or political emblems from the workplace;
• Publicly advertise all job openings and make special recruitment efforts to attract applicants from
underrepresented religious groups;
• Establish layoff, recall and termination procedures which do not in practice favor a particular
religious group;
• Abolish all job reservations, apprenticeship restrictions and differential employment criteria
which discriminate on the basis of religion;
• Develop training programs that will prepare substantial numbers of current employees from
underrepresented religious groups for skilled jobs, including the expansion of existing programs
and the creation of new programs to train, upgrade and improve the skills of workers from
underrepresented religious groups;
• Establish procedures to assess, identify and actively recruit employees from underrepresented
religious groups with potential for further advancement;
• Appoint a senior management staff member to oversee affirmative action efforts and develop a
timetable to ensure their full implementation.

Whenever the lowest responsible bidder has not agreed to stipulate to the conditions set forth in
the MacBride Act, and another bidder who has agreed to stipulate to such conditions has submitted a
bid within five percent of the lowest responsible bid for a contract to supply goods, services or
construction of comparable quality, the Department will refer such bids to the Commissioner of
General Services, who may determine, in accordance with applicable law and rules, that it is in the
best interest of the state that the contract be awarded to other than the lowest responsible bidder.

If the bidder conducts business operations in Northern Ireland and DOES NOT agree to stipulate
to the conditions set forth in the MacBride Act, so indicate by crossing out Item #5 on the signature
page of this bid proposal.

B. Omnibus Procurement Act. It is the policy of New York State to maximize opportunities for
the participation of New York State business enterprises, including minority and women-owned
business enterprises as bidders, subcontractors and suppliers on its procurement contracts.

1. New York State Contractor Participation. Information on the availability of New York
State subcontractors and suppliers is available from the Empire State Development Corporation,
Small Business Division, 30 S. Pearl Street, Albany, NY 12245 (800) 782-8369. Companies
requesting lists of potential subcontractors and suppliers are encouraged to identify the SIC code,
size and location of vendors.

A directory of certified minority and women-owned business enterprises is available from the
Empire State Development Corporation, Office of Minority and Women’s Business Development
Bidders located in foreign countries are hereby notified that New York State may seek to obtain and assign or otherwise transfer offset credits created by this procurement contract to third parties located in New York State. The successful contractor shall agree to cooperate with the state in efforts to get foreign countries to recognize offset credits created by the procurement contract.

The Omnibus Procurement Act of 1992 requires that by signing this bid proposal, contractors certify that whenever the total bid amount is greater than $1 million:

\(a\). The successful contractor shall document efforts to encourage the participation of New York State business enterprises as material suppliers and subcontractors on this project, and has retained the documentation of these efforts to be provided upon request to the State.

\(b\). Documented efforts by a successful contractor shall consist of and be limited to showing that such contractor has:

1. Solicited bids, in a timely and adequate manner, from New York State business enterprises including certified minority and women-owned businesses, or
2. Contacted the Empire State Development Corporation to obtain listings of New York State business enterprises, or
3. Placed notices for subcontractors and material suppliers in newspapers, journals and other trade publications distributed in New York State, or
4. Participated in bidder outreach conferences.
5. If the contractor determines that New York State business enterprises are not available to participate on the contract as subcontractors or suppliers, the contractor shall provide a statement indicating the method by which such determination was made.
6. If the contractor does not intend to use subcontractors on the contract, the contractor shall provide a statement verifying such intent.

c. The contractor has complied with the Federal Equal Opportunity Act of 1972 (P.L. 92-261), as amended.

d. The contractor agrees to make reasonable efforts to provide notification to New York State residents of employment opportunities on this project through listing any such positions with the Community Services Division of the New York State Department of Labor, or proving such notification in such manner as is consistent with existing collective bargaining contracts or agreements. The contractor agrees to document these efforts and to provide said documentation to the State upon request.

2. Reciprocity and Sanctions Provisions. Bidders are hereby notified that if their principal place of business is located in a country, nation, province, state or political subdivision that penalizes New York State vendors, and if the goods or services they offer will be substantially produced or performed outside New York State, the Omnibus Procurement Act 1994 and 2000 amendments (Chapter 684 and Chapter 383, respectively) require that they be denied contracts which they would otherwise obtain. NOTE: As of May 15, 2002, the list of discriminatory jurisdictions subject to this provision includes the states of South Carolina, Alaska, West Virginia, Wyoming, Louisiana and Hawai. Contact NYS Department of Economic Development for a current list of jurisdictions subject to this provision.

102-10 LABOR AND EMPLOYMENT.

The provisions of NYS Labor Law, as amended, and referred to in §102-08, Standard Clauses for All New York State Contracts, shall be applicable. On contracts financed with Federal-Aid, any provisions of NYS Labor Law that are in conflict with mandatory Federal-Aid construction contract compliance requirements, as contained in 23 CFR 635.117 are superseded. Any provisions of NYS Labor Law that are not in conflict with mandatory Federal-Aid construction contract compliance requirements or the Davis-Bacon Act, but are more restrictive, shall apply.
The Contractor shall directly employ those members of its own organization. Employee leasing and other similar arrangements under which workers are employed by another organization will only be considered under a subcontract approved in accordance with §108-05, Subletting or Assigning the Contract.

**A. Wages.** The Department will provide the Contractor with prevailing wage rate schedules. When both State and Federal wage rate schedules are provided, the Contractor shall pay the higher of the two wages and supplemental (fringe) benefits. If prevailing wage rate schedules are attached, all on-site work shall be paid prevailing wages. The Contractor shall ensure that workers are paid the appropriate wages and supplemental (fringe) benefits. The Contractor shall obtain periodic wage rate schedule updates from the NYS Department of Labor (NYSDOL). Wage rate amendments and supplements are available on the NYSDOL web site at www.labor.state.ny.us. All changes or clarification of labor classification(s) and applicability of prevailing wage rates shall be obtained in writing from the Office of the Director, NYSDOL Bureau of Public Work. The Contractor shall include the cost of changes in wage rate schedules and supplements (fringes) over the contract duration in the contract bid prices.

On-site Contractor or Subcontractor employees shall be paid prevailing wages required under the Davis-Bacon Act. In accordance with 29 CFR 5.2(l), “site of the work” is defined as the physical place or places where the construction called for in the contract will remain when work on it has been completed. Facilities such as fabrication plants, mobile factories, batch plants, borrow pits, etc. are part of the site of the work provided that they are dedicated exclusively to the performance of the contract. Not included in the site of the work are facilities whose continuance in operation are determined wholly without regard to a particular contract. Such permanent, previously established facilities are not a part of the “site of the work,” even where the operations for a period of time may be dedicated exclusively to the performance of a contract.

In accordance with NYS Labor Law, Sections 220 and 220-d:

1. No laborer, worker, or mechanic, in the employ of the Contractor, Subcontractor or other person doing or contracting to do the whole or any part of the work contemplated by the contract shall be permitted or required to work more than eight (8) hours in any one calendar day or more than five days in any one week, except in the emergencies set forth in the Labor Law.

2. The wages paid for a legal day's work shall be not less than the prevailing rate of wages as defined by law.

3. The minimum hourly rate of wages to be paid shall not be less than that stated in the contract documents, and any redetermination of the prevailing rate of wages after the contract is approved shall be deemed to be incorporated herein by reference as of the effective date of redetermination and shall form a part of these contract documents.

4. The contract may be forfeited and no sum paid for any work done thereunder on a second conviction for willfully paying less than:
   a. the stipulated wage scale as provided in Labor Law, §220 (3), as amended, or;
   b. the stipulated minimum hourly wage scale as provided in Labor Law, §220-d, as amended.

**B. Overtime Dispensation.** All bidders, in submitting their bids, should base their bids and work progression on the assumption that Overtime Dispensation pursuant to Article 8 of the New York State Labor Law, for any workers, laborers, and mechanics to work more than 8 hours in any one calendar day or more than 5 days in any one week will not be granted for any operation for the contract duration. Regardless of approval or disapproval of overtime by the NYSDOL, no adjustment will be made in any bid prices.

Subsequent to award, where the contract proposal has imposed specific scheduling and/or phasing requirements or where it is determined by the Department to be in the best interest of the public, the Department may process, for approval by the NYSDOL, requests for overtime dispensation on certain specific operations.
The Contractor shall submit requests for overtime dispensation to the Department on Form PW-30, Application for Dispensation for Hours, which will be provided by the Engineer upon request. The Department will review applications for overtime dispensation submitted by the Contractor associated with contracts subject to (A+B) Bidding, Incentive/Disincentive (I/D) or Lane Rental work favorably, but the application should not request more than 60 hours per week. The 60 hours per week may be either 6 - 10 hour days or 5 - 12 hour days. Overtime dispensations will be supported by the Department to advance Department goals and priorities, subject to specific circumstances and conditions associated with each contract.

The Department cannot guarantee that the NYSDOL will grant dispensation from restrictions pursuant to the provisions of Article 8 of the State Labor Law, however with the Department’s certification, it is anticipated that they will act favorably, provided that the Contractor is in compliance with Labor Law requirements at the time of application.

C. Payrolls. The Contractor shall furnish the Engineer, each week, a certified payroll and statement of compliance with respect to the wages paid each of its employees, (including apprentices, trainees, watch persons and guards) and a certified payroll from each Subcontractor engaged on work during the preceding weekly payroll period.

Certified payrolls shall contain work class, hours worked, wage rate, payroll taxes and withholdings. Certified payrolls shall be annotated by race and gender, and shall be submitted on Form WH-347 or Form HC-231-1 for Federal-Aid contracts, and on HC-231-1 for non Federal-Aid contracts. At the Contractor’s option, computer printed payroll records, which supply the required data and certifications may be used.

D. Training. An apprentice is defined as an individual who is enrolled in an apprenticeship training program that is registered with the NYS Department of Labor. A trainee is defined as an individual who is enrolled in an On-the-Job Training (OJT) program that is approved by the Federal Highway Administration (FHWA).

A number of sources to obtain training for apprentices/trainees are available. These include:
- A NYSDOL-approved apprenticeship program sponsored by a union or a temporary project level agreement with a union which has a NYSDOL approved apprenticeship program.
- A NYSDOL-approved apprenticeship program sponsored by a contractor.
- A NYSDOL-approved apprenticeship program sponsored by a contractor signatory with an apprenticeship sponsor consortium for certain services.
- An FHWA-approved OJT program (where applicable).

Approved OJT Programs are currently limited to apprenticeable occupations as determined by NYSDOL or USDOL. A list of approved OJT programs can be found in the On-the-Job Training and Apprenticeship Program Construction Catalogue which is available through the Department's Office of Equal Opportunity Development and Compliance.

Training under Training Special Provisions, if required, will be shown in the contract documents. In order to fulfill training requirements required under Training Special Provisions and/or §102-11 Equal Employment Opportunity Requirements, training should begin as early as possible during a construction contract. The Department recommends that all bidders have an approved apprenticeship or OJT program prior to bidding.

The Contractor shall furnish the apprentice/trainee a copy of the program to be followed in providing the training. The Contractor shall provide each apprentice/trainee with a certification showing the type and length of training satisfactorily completed.

When training is required under Training Special Provisions and/or §102-11 Equal Employment Opportunity Requirements, the Contractor shall designate to the Engineer, at the preconstruction meeting, a person (or persons) from its existing workforce as the Trainer and Training Coordinator for any apprentice(s)/trainee(s).

The Trainer shall:
1. Be located on the contract site generally on a daily basis; and
2. Be responsible for the day-to-day supervision and training of persons on the contract; and
3. Be responsible for the preparation and submission of a monthly training progress report, after consultation with designated apprentices/trainees.

The Training Coordinator shall:
1. Be knowledgeable about the contract and the Apprenticeship/OJT programs to be used; and
2. Be responsible for ensuring on-the-job orientation of apprentice/trainees; and
3. Be responsible for ensuring meaningful and effective training for the duration of training.

E. Public Notices. Before commencing any work on the site, the Contractor shall provide a satisfactory weather resistant surface, and post, in a location accessible to all workers, a copy of the NYSDOl schedules of prevailing wages and supplements for this contract, a copy of all redeterminations of such schedules for the contract, the Workers' Compensation Law notice, required safety notices, and all other notices required by law to be posted at the site. The Contractor shall maintain such notices in a legible manner and shall replace any notice or schedule which is damaged, defaced, illegible or removed for any reason. The Notices shall be maintained until all work on the site is complete.

F. Federal-Aid Requirements. No procedures or requirement shall be imposed by any state which will operate to discriminate against the employment of labor from any other state, possession or territory of the United States, in the construction of a Federal-Aid project. The selection of labor to be employed by the Contractor on any Federal-Aid project shall be of its choosing.

The Contractor shall not use convict labor unless performed by convicts who are on parole, supervised release, or probation for construction, maintenance or any other purpose at the site or within the contract limits of any Federal-Aid highway construction project from the time of contract award or the start of work on force account until final acceptance of the work by the Department.

102-11 EQUAL EMPLOYMENT OPPORTUNITY REQUIREMENTS.

The Department seeks to ensure nondiscrimination in employment under all Department contracts. The Contractor shall comply with the following Equal Employment Opportunity (EEO) requirements. The goals for a specific contract are contained in the Special Note Goals for Equal Opportunity Employment Participation in the contract proposal. The covered area is the county or counties in which the work is located.

For Federal-Aid contracts, Equal Employment Opportunity provisions are also found on Form FHWA 1273, Required Contract Provisions Federal-Aid Construction Contracts, or Form FHWA 1316, Required Contract Provisions Appalachian Development Highway System and Local Access Roads Construction Contracts, one of which is incorporated in the contract proposal.

Nothing herein provided shall be construed as a limitation upon the application of other laws which establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).


B. Definitions.
1. For Federal-Aid contracts, a minority group member is defined under this subsection as someone who is, and can demonstrate membership in, one of the following groups::

   a. Black (all persons having origins in any of the Black African racial groups not of Hispanic origin);
   b. Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish Culture or origin, regardless of race);
c. Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and

d. American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).

2. For non Federal-Aid contracts, a minority group member is defined under this subsection as a United States citizen or permanent resident alien who is, and can demonstrate membership in, one of the following groups:

a. Black persons having origins in any of the Black African racial groups;

b. Hispanic persons of Mexican, Puerto Rican, Dominican, Cuban, Central or South American descent of either Indian or Hispanic origin, regardless of race;

c. Asian and Pacific Islander persons having origins in any of the Far East countries, South East Asia, the Indian subcontinent, or the Pacific Islands;

d. Native American or Alaskan native persons having origins in any of the original peoples of North America.

C. Employment Goals. A goal(s) for minorities and a separate goal(s) for women are presented in the contract documents. The Contractor shall provide equal employment opportunity and shall take affirmative action for all minority groups, both male and female; and women, both minority and non-minority. If the Contractor performs work outside of the covered area, it shall apply the goals established for the county where the work is actually performed.

The goal(s) set for the contract are expressed as percentages of the total hours of employment and training of minority and female utilization the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. The Contractor is expected to make substantially uniform progress in meeting its goals in each trade. The hours of minority and female employment and training shall be substantially uniform throughout the length of the contract, and in each trade, and the Contractor shall make a good faith effort to employ minorities and women evenly on each of its contracts. The transfer of minority or female employees, apprentices, or trainees from contractor to contractor or from contract to contract for the sole purpose of meeting the Contractor’s goals is a violation of the contract.

The Department, in evaluating the Contractor’s good faith efforts to meet the goal(s), will analyze first the Contractor’s goal attainment on an individual contract. If the Contractor is not meeting the goal(s) for a single trade or contract, the Department will analyze, progressively, the Contractor’s goal attainment on all contracts held by the Contractor within the county, the Region, and/or the State. This method of analysis shall be applied primarily but not solely to contracts with small population numbers. Other factors to be considered include, but are not limited to the following: the location of the contracts, the relative proximity of the contracts to each other, and the nature of the work.

If the Contractor fails to meet the employment goal(s) for minorities or women specified in the contract documents, the Department may require training of minorities and women to satisfy the employment goals. The Contractor’s compliance with Executive Order 11246 and 41 CFR 60-4 shall be based on its implementation of this subsection, affirmative action obligations required by 41 CFR 60-4.3(a), and its efforts to meet the goals.

D. Contractor Obligations.

1. Non-Discrimination. The Contractor shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, national origin, age, disability or marital status. The Contractor shall take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, national origin, age, disability or marital status. Such actions shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor shall post in conspicuous places,
available to employees and applicants for employment, notices to be provided by the Department setting forth the provisions of this non-discrimination clause.

The Contractor shall not use the goals or affirmative action requirements to discriminate against any person because of race, color, religion, sex, national origin, age, disability or marital status.

2. EEO Officer. The Contractor shall designate to the Engineer, on Form AAP 15, an Equal Employment Opportunity (EEO) Officer who shall have the responsibility to and shall be capable of effectively administering and promoting an active contractor program of equal employment opportunity and who shall be assigned adequate authority and responsibility to do so.

3. Solicitations. The Contractor shall state in all solicitations or advertisements for employees placed by or on behalf of the Contractor, that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, national origin, age, disability or marital status.

4. Collective Bargaining Agreements. Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the Contractor has a collective bargaining agreement, to refer either minorities or women shall excuse the Contractor’s obligations.

5. Complaints of Alleged Discrimination. The Contractor shall promptly investigate all complaints of alleged discrimination made to the Contractor in connection with its obligations under this contract, shall attempt to resolve such complaints, and shall take appropriate corrective action within a reasonable time. If the investigation indicates that the discrimination may affect persons other than the complainant, corrective action shall include such other persons. Upon completion of each investigation, the Contractor shall inform every complainant of all available avenues of appeal.

6. Workforce and Training Utilization. At the pre-construction meeting, the Contractor shall submit a Workforce and Training Utilization Schedule covering the Contractor's workforce and the workforce of all its Subcontractors, together with the contract progress schedule with which the Workforce and Training Utilization Schedule has been coordinated.

At a minimum, the Workforce and Training Utilization Schedule shall address the following:

a. Equal Employment Opportunity goals in accordance with this subsection.
b. Training goals in accordance with this subsection, Training Special Provisions, and specifically:
   (1) A list of the approved OJT/apprenticeship program(s) the Contractor proposes to use;
   (2) The name of individual(s) proposed by the Contractor to be trained as soon as it is possible to provide the name. For registered apprentice(s), apprentice registration (NYSDOL Form AT 401) and the approved apprenticeship program(s);
   (3) The proposed training start dates for each individual, the operation(s) in which the individual is to begin training, and the proposed training duration.

The Contractor shall not start work until the Department and the Contractor have agreed upon the Workforce and Training Utilization Schedule. The Contractor shall submit a revised schedule when a significant work force build up or reduction will substantially affect goal attainment, or when a revised schedule is requested by the Department. Such revised Workforce and Training Utilization Schedule must be agreed upon by the Department or the original will remain in effect.

7. Reports and Records. The Contractor shall furnish information and reports as may be required and shall permit access to its books, records and accounts by the Department for purposes of investigating compliance with these requirements.

a. Employee Utilization Reports. The Contractor shall submit employee utilization reports for its workforce, for each Subcontractor with a subcontract exceeding $10,000, and a
composite report to the Engineer on a monthly basis and at contract completion. Cumulative records of total employee utilization from the start of the contract up to and including the current month showing hours worked for each trade and classification, by gender and ethnicity, shall be submitted with each report. Profile reports are not required.

b. Annual EEO Report. The Contractor shall submit an annual equal opportunity employment report to the Engineer not later than the second Friday in August covering the last payroll period in July, for all ongoing Federal-Aid contracts. The report shall show the number of minority, women, and non-minority employees currently engaged in each trade.

E. Affirmative Action Steps. The Contractor shall take specific affirmative actions to promote equal employment opportunity. The evaluation of the Contractor’s compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully, and shall implement affirmative action steps at least as extensive as the following:

1. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and in all facilities at which the Contractor’s employees are assigned to work. The Contractor, where possible, shall assign two or more women to each construction contract. The Contractor shall specifically ensure that all forepersons, superintendents, and other onsite supervisory personnel are aware of and carry out the Contractor’s obligation to maintain such a working environment, with specific attention to minority or female individuals.

2. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations’ responses.

3. Maintain a current file of the names, addresses and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the Contractor by the union or, if referred, not employed by the Contractor, this shall be documented in the file with the reason therefore, along with whatever additional actions the Contractor may have taken.

4. Provide immediate written notification to the Department when the union or unions with which the Contractor has a collective bargaining agreement has not referred to the Contractor a minority person or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor’s efforts to meet its obligations.

5. Develop on-the-job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor’s employment needs, especially those programs funded or approved by either the NYS Department of Labor or the US Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under E.2. above.

6. Disseminate the Contractor’s EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the Contractor in meeting its EEO obligations; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc.; by specific review of the policy with all management personnel and with all employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.

7. Review, at least annually, the company’s EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, layoff, termination or other employment decisions including specific review of these items with onsite supervisory personnel such as superintendents, forepersons, etc., prior to the initiation of construction work. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.
8. Disseminate the Contractor’s EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the Contractor’s EEO policy with other contractors and Subcontractors with whom the Contractor does or anticipates doing business.

9. Direct its recruitment efforts, both oral and written, to minority, female and community organizations, to schools with minority and female students and to minority and female recruitment and training organizations serving the Contractor’s recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source, the Contractor shall send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.

10. Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer and vacation employment to minority and female youth both on the site and in other areas of the Contractor’s work force.

11. Validate all tests and other selection requirements in accordance with state and Federal laws, rules and regulations.

12. Conduct, at least annually, an inventory and evaluation of all minority and female personnel for promotional opportunities. Encourage these employees to seek or to prepare for promotional opportunities through appropriate training, etc.

13. Ensure that seniority practices, labor classifications, work assignments and other personnel practices, do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that the EEO policy and the Contractor’s obligations under these specifications are being carried out.

14. Ensure that all facilities and company activities are non-segregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.

15. Document and maintain a record of all solicitations of offers for Subcontracts from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.

16. Conduct a review, at least annually, of all supervisors’ adherence to and performance under the Contractor’s EEO policies and affirmative action obligations.

F. Contractor Associations. Contractors are encouraged to participate in voluntary associations which assist in fulfilling one or more of their affirmative action obligations. The efforts of a contractor association, joint contractor-union, contractor-community, or other similar group of which the Contractor is a member and participant, may be asserted as fulfilling one or more of its obligations, provided that the Contractor actively participates in the group, makes every effort to ensure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the benefits of the program are reflected in the Contractor’s minority and female workforce participation, makes a good faith effort to meet its individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply, however, is the Contractor’s and failure of such a group to fulfill an obligation shall not be a defense for the Contractor’s noncompliance.

G. Enforcement. Enforcement of the provisions above includes, but is not limited to, monitoring the Contractor’s employment practices, requiring employment related reports to be filed by the Contractor in a timely manner in a form acceptable to the Department, determining the Contractor’s compliance with these specifications and taking such actions as authorized by law, rule, or regulation to enforce compliance by the Contractor.

Only the U.S. Department of Labor, Office of Federal Contract Compliance Programs (OFCCP) has the authority to determine compliance with Executive Order 11246 and its implementing regulations. In the event of the Contractor’s noncompliance with the nondiscrimination clauses of this contract or with any of the said rules, regulations, or orders, this contract may be canceled, terminated or suspended in whole or in part and the Contractor may be declared ineligible for further Federal-Aid contracts in accordance with procedures authorized in Executive Order 11246, and such other
sanctions may be imposed and remedies invoked as provided in Executive Order 11246, or by rule, regulation, or order of the U.S. Secretary of Labor, or as otherwise provided by law.

H. Hometown Plans (Federal-Aid Contracts Only). A Contractor participating (pursuant to 41 CFR 60-4.5) in a Hometown Plan approved by the USDOL, either individually or through an association, (including heavy highway affirmative action plans) shall comply with its affirmative action obligations, for those trades which have unions participating in the Plan, under Executive Order 11246 by complying with its obligations under the plan: Provided, that each Contractor participating in an approved plan is individually required to comply with the equal opportunity clause set forth in 41 CFR 60-1.4, to make a good faith effort to achieve the goals for each trade participating in the plan in which it has employees; and that the overall good performance by other Contractors toward a goal in an approved plan does not excuse any covered Contractor’s failure to take good faith efforts to achieve the Plan goals and timetables. Contractors participating in Hometown Plans shall be able to demonstrate their participation and document their compliance with the provision of the Hometown Plan.

If a Contractor is not participating in an approved Hometown Plan it shall comply with the specifications set forth in 41 CFR 60-4.3 of this part and with the goals and timetables for the appropriate area as listed in the notice required by 41 CFR 60-4.2 with regard to that trade. For the purposes of 41 CFR 60-4, a Contractor is not participating in a Hometown Plan for a particular trade if it:

1. Ceases to be signatory to a Hometown Plan covering that trade;
2. Is signatory to a Hometown Plan for that trade but is not party to a collective bargaining agreement for that trade;
3. Is signatory to a Hometown Plan for that trade but is party to a collective bargaining agreement with labor organizations which are not or cease to be signatories to the same Hometown Plan for that trade;
4. Is signatory to a Hometown Plan for that trade but is party to a collective bargaining agreement with a labor organization for that trade but the two have not jointly executed a specific commitment to minority and female goals and timetables and incorporated the commitment in the Hometown Plan for that trade;
5. Is participating in a Hometown Plan for that trade which is no longer acceptable to the OFCCP.
6. Is signatory to a Hometown Plan for that trade but is party to a collective bargaining agreement with a labor organization for that trade and the labor organization and the Contractor have failed to make a good faith effort to comply with their obligations under the Hometown Plan for that trade.

102-12 D/M/WBE UTILIZATION.

D/M/WBE is a general term that refers to a Disadvantaged Business Enterprises (DBEs), Minority Business Enterprises (MBEs) and Women's Business Enterprises (WBEs). The DBE program applies to Federal-Aid contracts, and the MBE/WBE (M/WBE) program applies to non Federal-Aid contracts. The Department seeks to:

- Ensure nondiscrimination in award and administration of Department contracts;
- Ensure that only firms that fully meet D/M/WBE eligibility standards are permitted to participate in the Department's D/M/WBE programs;
- Help remove barriers to the participation of D/M/WBEs in the performance of Department contracts;
- Create a level playing field on which D/M/WBEs can fairly compete for Department contracts; and
- Assist in the development of firms that can compete successfully in the construction industry outside the D/M/WBE programs.

The parties to this contract shall take all necessary and reasonable steps in accordance with the laws, rules and regulations cited in this subsection to promote the objectives outlined above. The Contractor shall comply with the applicable laws, rules and regulations and the D/M/WBE Program requirements stated below. The Contractor shall not discriminate on the basis of race, color, national origin, or sex in
§102

the award and performance of Department contracts. These requirements shall be made a part of all
subcontracts and agreements entered into as a result of this contract.

A. Statutory Authority.

1. Disadvantaged Business Enterprise (DBE) Program. The Federal statutory
authority for the DBE Program is contained in the Surface Transportation Assistance Act of 1982
(Public Law 97-424, §105(f)), the Surface Transportation and Uniform Relocation Assistance Act
of 1987 (Public Law 100-17, §106(c)), the Intermodal Surface Transportation Efficiency Act of
1991, and the Transportation Equity Act of the 21st Century. New York State has enacted Section
85 of the Highway Law and Section 428 of the Transportation Law. Regulations have been
promulgated under 49 CFR 26 and 17 NYCRR 35.

2. Minority/Women's Business Enterprise (M/WBE) Program. The State statutory
authority for the M/WBE Program is contained in Section 85 of the Highway Law, Section 428 of
the Transportation Law, and Executive Law Article 15A. Regulations have been promulgated
under 5 NYCRR 140. The parties to this contract shall comply with these laws, rules and
regulations and the M/WBE Program requirements stated below.

GENERAL PROVISIONS

B. Goal(s). Federal-aid contracts have a single DBE goal. Non Federal-Aid contracts have two
separate and distinct goals, one for MBEs and one for WBEs, which cannot be combined.

1. Established Goal(s). The Department may have established contract utilization goal(s) for
D/M/WBEs, which are expressed as a percentage of the total contract price. The goal(s) are
stated in the proposal and remain in effect throughout the life of the contract. In executing the
contract or bid documents the Bidder declares that it subscribes to the utilization goal(s) and shall
meet the goal(s) or demonstrate that it could not meet them despite its best efforts. Failure to
meet the established goal(s) for the contract and failure to meet the good faith efforts, as defined
in paragraph F Good Faith Efforts, may be grounds for rejection of the bid as non-responsive.
When the contract is awarded with D/M/WBE participation that is less than the contract goal(s),
the Contractor shall continue good faith efforts throughout the life of the contract.

2. Zero Percent Goal(s). When the Department has established zero goal(s) for participation
by D/M/WBEs and the Bidder proposes the use of a Subcontractor or the purchase of goods from
a material supplier at any time during the life of the contract, the Contractor shall promote the
objectives outlined in this subsection by providing opportunities for D/M/WBEs to participate in
these areas, with such participation to be credited towards the race-neutral component of the
Department's D/M/WBE Programs.

C. Counting D/M/WBE Participation Towards the D/M/WBE Goal(s). A D/M/WBE that
holds a Department contract may not count its own utilization in the contract toward the D/M/WBE
contract goal(s).

The value of work actually performed by the D/M/WBE will be counted toward the goal(s) in the
amounts set forth below. The proposed utilization must be considered to be a commercially useful
function, as defined in paragraph D(1) Commercially Useful Function. If the Department determines
that some or all of the D/M/WBE's work does not constitute a commercially useful function, only the
portion of the work considered to be a commercially useful function will be credited toward the
goal(s).

D/M/WBE participation will be counted toward meeting the D/M/WBE goal(s) in accordance
with the following:

1. Eligibility.
§102

a. DBE Eligibility. Only those DBE firms that are certified by the Department are eligible to be used for goal attainment on this contract. A DBE must be certified on the day the contract is let. DBE certification is not an endorsement of the quality or performance of the business but simply an acknowledgment of the firm's status as a DBE.

b. M/WBE Eligibility. Only those M/WBE firms that are certified by the NYS Department of Economic Development are eligible to be used for goal attainment on this contract. An M/WBE must be certified on the day the contract is let. M/WBE certification is not an endorsement of the quality or performance of the business but simply an acknowledgment of the firm's status as an M/WBE. The participation of a firm that is certified as both an MBE and a WBE will only be counted toward one goal, and cannot be divided between the two goals. Changes in the goal towards which participation applies after participation begins shall require Department approval in accordance with Paragraph J. Revisions in D/M/WBE Utilization.

2. Subcontracting. The total agreed value of work to be performed by the D/M/WBE's own forces is counted toward the D/M/WBE goal(s), except as provided in numbers 3 through 6 below.

3. D/M/WBE Joint Ventures. A D/M/WBE Joint Venture may be between a D/M/WBE and the Contractor, a majority Subcontractor or another D/M/WBE. The total dollar value of the contract equal to the distinct, clearly defined portion of the contract work that the D/M/WBE performs with its own equipment, with its own forces, and under its own supervision will be counted toward the D/M/WBE contract goal(s), subject to approval by the Department of the D/M/WBE joint venture agreement to be furnished by the Bidder before contract award. The D/M/WBE joint venture agreement shall include a detailed breakdown of the following:
   - Contract responsibility of the D/M/WBE for specific contract items of work;
   - Capital participation by the D/M/WBE;
   - Specific equipment to be provided to the joint venture by the D/M/WBE;
   - Specific responsibilities of the D/M/WBE in the control of the joint venture;
   - Specific staffing and skills to be provided to the joint venture by the D/M/WBE; and
   - Percentage distribution to the D/M/WBE of the projected profit or loss incurred by the joint venture.

4. Vendors. Expenditures for materials and supplies obtained from D/M/WBE Vendors, including Manufacturers, Fabricators, Material Suppliers, Brokers, and Manufacturers’ Representatives in the amounts noted below will be counted toward the D/M/WBE goal(s). The D/M/WBE Vendor shall assume the actual and contractual responsibility for the provision of the materials and supplies. The cost of supplies purchased or materials or equipment leased from the Contractor, other Subcontractors on the contract, or their affiliates will not be counted.

   The Bidder shall indicate on the D/M/WBE Utilization Worksheet, the 3 digit core specification section number(s) of the material to be supplied, manufactured, fabricated, or otherwise provided. If the material does not correspond to a Department contract pay item, use the following item numbers if applicable, and include in the description the contract pay item(s) to which the activity relates:

   00.00 Supply of Eligible Materials
   00.01 Provision of Eligible Manufactured or Altered Material
   00.02 Rental of Equipment
   00.05 Provision of Security Devices

a. Manufacturers/Fabricators. Count 100% of the expenditure to a D/M/WBE Manufacturer or Fabricator.

b. Material Suppliers. Count 60% (sixty percent) of the expenditure to a D/M/WBE Material Supplier, as defined in §101-02 Definitions of Terms. Packagers, brokers, manufacturers’
representatives, or other persons who arrange or expedite transactions are not Material Suppliers within the meaning of this paragraph.

c. *Brokers/Manufacturer’s Representatives.* With respect to materials or supplies purchased from a D/M/WBE which is neither a Manufacturer nor a Fabricator nor a Material Supplier, count the entire amount of fees or commissions charged for assistance in the procurement of the materials and supplies, or fees for transportation charges for the delivery of materials or supplies required toward the D/M/WBE goal(s), provided they are determined by the Department to be reasonable and not excessive as compared with fees customarily allowed for similar services. The cost of the materials and supplies themselves are not counted.

5. *Trucking Operations.* Count toward the D/M/WBE goal(s) the expenditure for trucking provided by certified D/M/WBEs in accordance with the following:

a. To satisfy the criterion of performing a commercially useful function, a D/M/WBE shall own and operate at least one registered, insured, and fully operational truck used on the contract and shall be responsible for the management and supervision of the entire trucking operation for which it is responsible on a particular contract, and there cannot be a contrived arrangement for the purpose of meeting the D/M/WBE goal(s).

b. The D/M/WBE receives credit for 100% of the value of the trucking operations it provides on the contract using trucks it owns or leases on a long-term basis that are registered, insured, and operated by the D/M/WBE using drivers it employs.

c. The D/M/WBE may lease trucks on a short-term basis from another D/M/WBE, including an owner/operator who is certified as a D/M/WBE. The D/M/WBE who leases trucks from another D/M/WBE receives credit for 100% of the value of the trucking operations that the lessee D/M/WBE provides on the contract.

d. The D/M/WBE may lease trucks on a short-term basis from a non-D/M/WBE, including an owner-operator. The D/M/WBE who leases trucks from a non-D/M/WBE is entitled to credit only for the fee or commission it receives as a result of the lease arrangement. The D/M/WBE does not receive credit for the value of the trucking operations provided by the lessee, because these services are not provided by a D/M/WBE.

e. The Bidder shall provide the following with the D/M/WBE Utilization Package:

1. Copies of all lease agreements utilized by the D/M/WBE; and
2. Calculations and any pertinent documentation that support the dollar value of the proposed D/M/WBE trucking operations; e.g., method of payment (hour, ton or load hauled), the number of trucks required to perform the trucking operations listed on the *D/M/WBE Utilization Worksheet,* and the duration of the trucking operations to be performed.

g. The D/M/WBE trucking firm of record is the firm that is listed on the *D/M/WBE Utilization Worksheet.* The D/M/WBE trucking firm of record must control the day-to-day trucking operations on the contract, and be responsible for:

1. Negotiating and executing rental/leasing agreements;
2. Hiring and firing the work force;
3. Coordinating the daily trucking needs with the Contractor; and
4. Scheduling and dispatching trucks.
6. **Partial Items.** The Bidder shall explain, in writing, the scope of work to be performed by the D/M/WBE for all items indicated as partial items on the *D/M/WBE Utilization Worksheet* at the time the Bidder submits the Utilization Package.

7. **Other.** Count the entire amount of fees or commissions charged by a D/M/WBE for providing a bona fide service, such as professional, technical, consultant, or managerial services, or for providing bonds or insurance specifically required for the performance of the contract, provided the fee is reasonable and not excessive as compared with fees customarily allowed for similar services.

**D. Conditions of Participation.** D/M/WBE participation will be counted toward meeting the D/M/WBE contract goal(s), subject to all of the following conditions:

1. **Commercially Useful Function.** A D/M/WBE is considered to perform a commercially useful function when it is responsible for the execution of a distinct element of work on a contract and carries out its responsibilities by actually performing, managing, and supervising the work involved in accordance with normal industry practice. Regardless of whether an arrangement between the Contractor and the D/M/WBE represent standard industry practice, if the arrangement erodes the ownership, control or independence of the D/M/WBE or in any other way does not meet the commercially useful function requirement, the Contractor shall receive no credit toward the goal(s) and may be required to backfill the participation in accordance with Paragraph I *Conformance to D/M/WBE Schedule of Utilization.* A D/M/WBE does not perform a commercially useful function if its role is limited to that of an extra participant in a transaction or contract through which funds are passed in order to obtain the appearance of D/M/WBE participation.

   A DBE may rebut a determination by the Department that the DBE is not performing a commercially useful function to the FHWA but the determination may not be appealed to USDOT. An M/WBE may rebut a determination by the Department that the M/WBE is not performing a commercially useful function to the NYS Department of Economic Development.

2. **Work Force.** The D/M/WBE must employ a work force, (including administrative and clerical) separate and apart from that employed by the Contractor, other Subcontractors on the contract, or their affiliates. This does not preclude the employment by the D/M/WBE of an individual that has been previously employed by another firm involved in the contract, provided that the individual was independently recruited by the D/M/WBE in accordance with customary industry practice. The routine transfer of work crews from another employer to the D/M/WBE shall not be allowed.

3. **Supervision.** All work performed by the D/M/WBE must be controlled and supervised by the D/M/WBE without duplication of supervisory personnel from the Contractor, other Subcontractors on the contract, or their affiliates. This does not preclude routine communication between the supervisory personnel of the D/M/WBE and other supervisors necessary to coordinate the contract work.

4. **Equipment.** D/M/WBE Subcontractors may supplement their equipment by renting or leasing additional equipment in accordance with customary industry practice. However, no more than 50% of the equipment required to perform the work of the Subcontractor may be obtained from the Contractor, other Subcontractors on the contract, or their affiliates. If the D/M/WBE obtains equipment from any of those sources, the D/M/WBE shall provide documentation to the Department demonstrating that similar equipment and terms could not be obtained at a lower cost from other customary sources of equipment. The required documentation shall include, but not be limited to, copies of the rental or leasing agreements, and the names, addresses, and terms quoted by other sources of equipment.

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**PRE-AWARD PROVISIONS**
E. Requests For Waiver. A potential bidder may request a waiver of all or part of a contract's D/M/WBE goal(s) by submitting a written request to OEODC. A potential bidder is defined as one who has purchased the contract documents. The request shall be submitted no later than twenty-five (25) calendar days prior to the contract letting, in order to allow sufficient time for a review and issuance of an amendment of the established goal(s), if necessary, in accordance with the Department's schedule for contract amendments. The request should contain sufficient justification as to why the goal(s) should be waived or reduced, and should at least address the following factors: the potential Bidder's method of accomplishing the work, the subcontracting opportunities associated with the proposed method, and the availability of certified D/M/WBEs for the work to be subcontracted.

F. Good Faith Efforts. To determine whether a bidder that has failed to meet the D/M/WBE contract goal(s) may receive the contract, the Department will decide whether the efforts the Bidder made to obtain D/M/WBE participation were "good faith efforts" to meet the goal(s). Efforts that are merely pro forma are not good faith efforts to meet the goal(s). Efforts to obtain D/M/WBE participation are not good faith efforts to meet the goal(s), even if they are sincerely motivated, if, given all relevant circumstances, they could not reasonably be expected to produce a level of D/M/WBE participation sufficient to meet the goal(s). In order to award a contract to a bidder that has failed to meet the D/M/WBE contract goal(s), the Department will determine that the Bidder's efforts were those that, given all relevant circumstances, a bidder actively and aggressively seeking to meet the goal(s) would make.

In order to evaluate the Bidder's conformance to this subsection, the Department will consider the quality, quantity, and intensity of the different kinds of efforts that the Bidder has made. The following is a list of the types of actions which the Department will consider as part of the Bidder's good faith efforts to obtain D/M/WBE participation. It is not intended to be a mandatory checklist, nor is it intended to be exhaustive or exclusive. Other factors or types of efforts may be relevant in appropriate cases.

The following is a list of the kinds of efforts that the Department will evaluate to determine if the Bidder has demonstrated a good faith effort:

1. Efforts to secure participation by certified D/M/WBE firms for work that they are listed to perform that is in the contract. Only DBEs certified by the Department shall be used to fulfill the established goal on Federal-Aid contracts. Only M/WBEs certified by the NYS Department of Economic Development shall be used to fulfill the established goal(s) on non Federal-Aid contracts.
2. Soliciting through all reasonable and available means (e.g., attendance at pre-bid meetings, advertising and/or written notices) the interest of all certified D/M/WBEs who have the capability to perform the work of the contract. The Bidder shall solicit this interest within sufficient time to allow the D/M/WBEs to respond to the solicitation. The Bidder shall determine with certainty if the D/M/WBEs are interested by taking appropriate steps to follow up on initial solicitations.
3. a. The Bidder shall, at a minimum, seek certified D/M/WBEs in the same geographic area where the contract is located. This is defined as a one hundred (100) kilometer radius around the city, town or borough where the contract is located as identified in the contract proposal. For specialty work such as pavement markings, guide rail, etc. (as defined in the contract proposal) the Bidder shall, at a minimum, solicit on an upstate or downstate basis, depending upon the location of the contract.
   b. The Department has facilitated identification of upstate, downstate and areas within a 100 km radius through its automated D/M/WBE solicitation program, which is accessible on the Internet on the Department's Web Page at www.dot.state.ny.us. For more information contact the NYSDOT Help Desk at (518) 485-8111. For bidders who do not have internet capability, a hard copy solicitation report for a specific contract can be requested by contacting the OEODC Construction Program Unit at (518) 457-1129.
4. Selecting portions of the work to be performed by D/M/WBEs in order to increase the likelihood that the D/M/WBE goal(s) will be achieved. This includes, where appropriate, either breaking down operations within the contract or combining like or related operations in the contract into logistically and economically feasible units to facilitate D/M/WBE participation,
even when the Contractor might otherwise prefer to perform these work items with its own forces.

5. Providing interested D/M/WBEs with adequate information about the plans, specifications, and requirements of the contract in a timely manner to assist them in responding to a solicitation.

6. a. Negotiating in good faith with interested D/M/WBEs. It is the Bidder’s responsibility to make a portion of the work available to D/M/WBE Subcontractors and material suppliers and to select those portions of the work or material needs consistent with the available D/M/WBE Subcontractors and material suppliers, so as to facilitate D/M/WBE participation. Evidence of such negotiation includes the names, addresses, and telephone numbers of D/M/WBEs that were considered; a description of the information provided regarding the plans and specifications for the work selected for subcontracting; and evidence as to why additional agreements could not be reached for D/M/WBEs to perform the work.

b. The fact that there may be some additional costs involved in finding and using D/M/WBEs is not in itself sufficient reason for a bidder’s failure to meet the contract D/M/WBE goal(s), as long as such costs are reasonable. The ability or desire of a bidder to perform the work of a contract with its own organization does not relieve the Bidder of the responsibility to make good faith efforts. Bidders are not, however, required to accept higher quotes from D/M/WBEs if the price difference is excessive or unreasonable.

7. Not rejecting D/M/WBEs as unqualified without sound reasons based on a thorough investigation of their capabilities.

8. Making efforts to assist interested D/M/WBEs in obtaining bonding, lines of credit or insurance as required by the Department.

9. Making efforts to assist interested D/M/WBEs in obtaining necessary equipment, supplies, materials, or related assistance.

10. Effectively using the services of available minority/women focused media, trade associations, and contractors’ groups; local, state, and Federal minority/women business assistance offices; and other organizations as allowed on a case-by-case basis to provide assistance in the recruitment and placement of D/M/WBEs.

11. All bidders shall keep records of efforts to solicit and negotiate with D/M/WBEs, using the Solicitation Log as a continuing record of pre- and post-letting solicitation activity. When submitting a D/M/WBE Schedule of Utilization to the Department, the Apparent Low Bidder will attach the log, together with the supplemental information specified in the instructions for the Solicitation Log as evidence of good-faith efforts when the established D/M/WBE goal(s) for the contract have not been met utilizing certified D/M/WBEs. Such supplemental efforts shall include at least the following:

   a. All envelopes of solicitation inquiries that were returned as undeliverable; and
   b. Any quotations submitted by D/M/WBEs that are not included in the D/M/WBE Schedule of Utilization with an explanation for the Bidder's action in each case.

12. Promptly executing an agreement with D/M/WBE Subcontractors/vendors.

G. D/M/WBE Utilization Package. Within seven (7) calendar days after bid letting, the Apparent Low Bidder shall submit a complete D/M/WBE utilization package consisting of:

1. D/M/WBE Schedule of Utilization;
2. D/M/WBE Utilization Worksheet (Co-signed by both the Contractor and the D/M/WBE); and
3. Documentation that substantiates good faith efforts.

If the Apparent Low Bidder has met or exceeded the established D/M/WBE goal(s) for the contract utilizing certified D/M/WBEs it is not necessary to submit documentation of good faith efforts. If the Apparent Low Bidder owns Department approved civil rights reporting software, the Bidder shall submit D/M/WBE Schedule of Utilization and D/M/WBE Utilization Worksheet forms generated by the approved software.
§102

H. Bidder's Failure to Comply. The Department's acceptance of the Apparent Low Bidder's proposal is conditioned upon the Apparent Low Bidder's fulfillment of the requirements of this subsection. If the Apparent Low Bidder fails to submit a complete D/M/WBE utilization package within seven (7) calendar days after the bid opening and/or fails to attain the D/M/WBE utilization goal(s), and to satisfactorily document its good faith efforts, the bid may be declared incomplete and the deposit may be subject to forfeiture pursuant to §103-02 Contract Execution. The Apparent Low Bidder, upon receipt of written notification of his/her failure to comply with the requirements of this subsection shall have five (5) work days to carry out the corrective action(s) described in the notification.

If the Department determines that the Apparent Low Bidder has failed to meet the good faith effort requirements, the Department will, before awarding the contract, provide the Apparent Low Bidder an opportunity for administrative reconsideration by an official who did not take part in the original determination that the Apparent Low Bidder failed to meet the goal(s) or make adequate good faith efforts to do so. As part of this reconsideration, the Apparent Low Bidder shall have the opportunity to provide written documentation or argument and to meet in person with the Department's reconsideration official concerning the issue of whether it met the goal(s) or made adequate good faith efforts to do so. The Department will send the Apparent Low Bidder a written decision on reconsideration, explaining the basis for finding that the Apparent Low Bidder did or did not meet the goal(s) or make adequate good faith efforts to do so.

POST AWARD PROVISIONS

I. Conformance to D/M/WBE Schedule of Utilization. The Contractor shall execute subcontracts or agreements with the D/M/WBEs identified on the approved D/M/WBE Schedule of Utilization, for work of the kind and amount identified therein. The Engineer will monitor the work of the contract to ensure that the D/M/WBEs identified on D/M/WBE Schedule of Utilization perform the work. Any direction by the Engineer to comply with the Schedule is a lawful direction under Article 8 No Estimate on Contractor's Non-Compliance of the contract agreement.

J. Revisions to D/M/WBE Utilization. After contract award, the Contractor shall obtain Department approval for significant revisions in D/M/WBE utilization prior to implementing any proposed change through submission of a revised D/M/WBE Schedule of Utilization, and a revised D/M/WBE Utilization Worksheet signed by both parties. Revisions shall be entered into, and generated from Department approved software in accordance with §105-21 Civil Rights Reporting.

The following modifications will be considered a significant revision in D/M/WBE utilization:

1. Adding, removing or substituting a D/M/WBE.
2. Adding new item(s) of work to a D/M/WBE within a core (3 digit) contract pay item number (i.e. 606 – Guide Railing) not currently approved.
3. Significantly reducing the dollar value of or eliminating the D/M/WBE's item(s) of work. Significant reduction will be determined by the Engineer by comparison to the total D/M/WBE contract goal.

In the cases of reduction, removal or substitution, the Contractor shall provide written justification with a substantive basis for the change. A Contractor's ability to negotiate a more advantageous contract with another Subcontractor will not be considered a valid basis for change.

If the reduction of the D/M/WBE's work or the removal of the D/M/WBE, including for reasons of commercially useful function violations, causes the D/M/WBE utilization to fall below the goal(s), the Contractor shall make good faith efforts to find another D/M/WBE to substitute for the original D/M/WBE to perform at least the same amount of work as the D/M/WBE that was terminated, to the extent needed to meet the contract goal(s).

A D/M/WBE may be substituted if its intended work is deleted or reduced by the Department and enough work remains to substitute an equal amount to the affected D/M/WBE. If not enough work remains, the Department may relieve the Contractor from attaining that portion of the goal(s).
After contract award, the Contractor is not required to submit hard copy forms for non-significant revisions in D/M/WBE utilization. The following modifications will not be considered a significant revision in D/M/WBE utilization:

1. Increasing the dollar value of an item(s) of work or adding new item(s) of work within the same core (3 digit) contract pay item number (i.e. 606 – Guide Railing) to a D/M/WBE.
2. Substituting similar dollar values of work within a currently approved core (3 digit) contract pay item number (i.e. 606 – Guide Railing).

K. Monitoring Contractor Compliance. The Contractor shall allow authorized representatives of the Department to conduct periodic inspections of the Contractor's D/M/WBE participation efforts during the performance of this contract. When a Contractor has been found to have failed to meet the contract goal(s), to exert a good faith effort, or otherwise failed to comply with this subsection, the contract may be canceled, terminated, or suspended in whole or in part in accordance with Article 11 Right to Suspend Work and Cancel Contract of the contract agreement and Section 40 of the Highway Law.

1. Measuring Goal Attainment. Goal attainment will be measured based on payments made to D/M/WBEs. In order to measure goal attainment and to gauge the effect of goals on the industry, the Contractor shall report payments made to all D/M/WBEs and all majority Subcontractors participating in the contract. Reports of payments shall be made on a monthly basis for all Subcontractors/Vendors due payment for which there is an Approval to Subcontract or a D/M/WBE Utilization Worksheet on file with the Department, and at completion of the contract, in accordance with §105-21 Civil Rights Reporting. Reports made at contract completion shall be signed and notarized by both the Contractor and the Subcontractor/Vendor.

2. DBE Program. In order to determine whether the Contractor has complied with the requirements of this subsection, the Commissioner may direct the Contractor to attend a hearing before the Contract Review Unit, or may follow any other lawful procedure upon due notice in writing to the Contractor. The Contractor may also be referred to the USDOT for possible suspension or debarment as provided in 49 CFR 29 and such other sanctions as may be imposed and remedies invoked as provided under the authority of 49 CFR 26, or by rule, regulation, or order of the Commissioner or as otherwise provided by law.

3. M/WBE Program. In order to determine whether the Contractor has complied with the requirements of this subsection, the Commissioner may direct the Contractor to attend a hearing before the Contract Review Unit, or may file a complaint with the NYS Department of Economic Development, Division of Minority and Women's Business Development pursuant to Executive Law, Article 15A, Section 316, or may follow any other lawful procedure upon due notice in writing to the Contractor. Such other sanctions may also be imposed and remedies invoked as provided under the authority of Executive Law Article 15A, 5 NYCRR 140 et seq., or by rule, regulation, or order of the Commissioner or as otherwise provided by law.

L. Prompt Payment. The Contractor shall pay the D/M/WBE in accordance with §109-06, Contract Payments and §109-07, Prompt Payments by the Contractor. Failure by the Contractor to do so may result in the withholding of future estimated payments by the Department.

M. Non-discrimination. The Contractor shall not use the requirements of these specifications to discriminate against any qualified company or group of companies.

N. Reporting Violations of Program Rules. If the Contractor becomes aware of any violations of this Specification, the Contractor shall promptly report the violations to the Engineer.

102-13 STATE AND LOCAL SALES TAX EXEMPTION.

In accordance with Section 1115 of the Tax Law, in connection with capital improvement contracts all tangible personal property which will become an integral component of a structure, building or real
property of the State, or any of its political subdivisions, is exempt from State and local retail sales tax and compensating use tax.

§102-14 FORM OF CONTRACT AND BID BOND.
The form of contract and bid bond, if given, shall be that provided by the Department.

All of the following sections which have the word “Sample” in the title are samples of the contract documents executed by the Contractor as a part of the bidding and/or award process. The executed bid documents control and have precedence over the samples presented herein.

A. Federal-Aid Contracts. Federal-Aid contracts are denoted “F.A. Project” on the proposal cover and on the title page. The following subsections of Section 102 apply to all Federal-Aid contracts:
1. §102-01 to §102-08
2. §102-10 to §102-14
3. §102-15 to §102-17 (Samples Only)

B. Non Federal-Aid Contracts. The following subsections of Section 102 apply to all Non Federal-Aid contracts:
1. §102-01 to §102-14
2. §102-15 to §102-17 (Samples Only)

102-15 SAMPLE FORM OF BID BOND.

KNOW ALL PERSONS BY THESE PRESENTS, That ____________________________________
(Name of Contractor)
_____________________________________________________________________________________
(Address)
(hereinafter called the "Principal") and the __________________________________________________
a corporation created and existing under the laws of the State of __________, having its principal office
in the City of ___________ (hereinafter called the "Surety"), are held and firmly bound unto The People
of the State of New York (hereinafter called the "State"), in the full just sum of [Twenty-Five Percent
(25%) of Attached Bid], good and lawful money of the United States of America, for the payment of
which said sum of money, well and truly to be made and done, the said Principal binds themselves
(himself/herself, itself), their (his/her, its) heirs, executors and administrators, successors and assigns, and
the said Surety binds itself, its successors and assigns jointly and severally, firmly by these presents:

WHEREAS, the said Principal has submitted to the Commissioner of Transportation of the State of
New York, a proposal for _______________________________________________________________
(Project Description), and

WHEREAS, under the terms of the Laws of the State of New York as above indicated, the said
Principal has filed or intends to file this bond to guarantee that the Principal will execute all required
contract proposal documents and furnish such faithful performance or other bonds as may be required by
law in accordance with the terms of the Principal's said proposal.

NOW, THEREFORE, the condition of the foregoing obligation is such, that if the said Principal shall
promptly execute and submit, and the Commissioner of Transportation shall accept, all required contract
proposal documents including such faithful performance bond or other bonds as may be required by law
in accordance with the terms of the Principal's said proposal, then this obligation shall be null and void,
otherwise to remain in full force and virtue.

IN TESTIMONY WHEREOF, the said Principal has hereunto set his/her (their, its) hand and the said
Surety has caused this instrument to be signed by its authorized officer, the day and year above written.

Signed and delivered this ____ day of ________________ 20____ in the presence of:

___________________________________________ )
(Company)
§102

___________________________________________ )  Principal
(Signature)

_____________________________________________ )
(Title)

_____________________________________________)
(Company)

By __________________________________________ ) Surety
(Signature)

_____________________________________________ )
(Title of Authorized Officer)

(The Surety Company shall append a single copy of a statement of its financial condition and a copy of
the resolution authorizing the execution of Bonds by officers of the Company to the bond(s.).)

(Acknowledgment of principal, unless it be a corporation)

STATE OF NEW YORK ss. :
COUNTY OF ______________

On this _____ day of ___________ 20__, before me personally came ______________________
to me known and known to me to be the person described in and who executed the foregoing instrument
and acknowledged that he/she executed the same.

_______________________________
Notary Public

(Acknowledgment of principal, if a corporation)

STATE OF NEW YORK ss. :
COUNTY ______________

On this _____ day of ___________ 20__, before me personally came ______________________
to me known and known to me to be the person, who being by me duly sworn, did depose and say that
he/she resides in __________________, that he/she is the __________ of __________________
the corporation described in and which executed the foregoing instrument; and that he/she signed his/her name thereto by order of the Board of Directors of said Corporation.

_______________________________
Notary Public

(Acknowledgment of Surety Company)

STATE OF NEW YORK ss. :
COUNTY OF ______________

On this _____ day of ___________ 20__, before me personally came ______________________
to me known and known to me to be the person, who being by me duly sworn, did depose and say that
he/she resides in __________________, that he/she is the __________ of __________________
the corporation described in the foregoing instrument; and that he/she signed his/her name thereto by order of the Board of Directors of said Corporation.

_______________________________
Notary Public
### 102-16 SAMPLE CONTRACT PAY ITEM FORMAT.

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### 102-17 SAMPLE FORM OF ITEMIZED PROPOSAL/Jurat.

**ITEMIZED PROPOSAL**

To the State Department of Transportation:

In submitting this bid the undersigned declares to be the only person or persons interested in the said bid; that it is made without any connection with any person making another bid for the same contract; that the bid is in all respects fair and without collusion, fraud or mental reservation; and that no official of the
§102

State, or any person in the employ of the State is directly or indirectly interested in said bid or in the supplies or work to which it relates, or in any portion of the profits thereof.

The undersigned also hereby declares to have carefully examined the plans, specifications and form of contract, and to have personally inspected the actual location of the work together with the local sources of supply, to be satisfied as to all the quantities and conditions, and understands that in signing this proposal waives all right to plead any misunderstanding regarding the same.

The undersigned further understands and agrees to furnish and provide for the respective item price bid all the necessary material, machinery, implements, tools, labor services and other items of whatever nature, and to do and perform all the work necessary under the aforesaid conditions, to complete the improvement of the aforementioned project in accordance with the plans and specifications for said improvement, which plans and specifications it is agreed are a part of this proposal, and to accept in full compensation therefore the amount of the summation of the products of the approximate quantities multiplied by the unit prices bid. This summation will hereinafter be referred to as the gross sum bid.

The undersigned further agrees to accept the aforesaid unit bid prices as compensations for any additions or deductions caused by variation in quantities due to more accurate measurement, and for use in the computation of the value of the work performed for monthly estimates.

The undersigned further agrees that at any time during the progress of work the State adds, alters or omits portions of the work it shall so perform such work and accept compensation in accordance with the Standard Specifications.

The undersigned further understands and agrees not to start any work until the contract agreement is signed by the Commissioner or the Commissioner's duly authorized representative. In case the undersigned voluntarily undertakes to start work, other than that expressly prohibited in this Subsection, after the contract agreement is signed by the Commissioner but prior to approval by the State Comptroller, the undersigned does so entirely at its own risk and without obligation or responsibility on the part of the State unless and until the awarded contract becomes effective pursuant to Section 112 of the State Finance Law by approval of the State Comptroller and filing in the office of the State Comptroller; and hereby agrees and warrants that, as a prerequisite to the start of any such voluntary work, accepts, assumes and undertakes all of the provisions of this proposal and of the plans and specifications of the proposed contract, including all of the provisions and responsibilities thereof relative to (1) damage, indemnification and holding the State harmless as set forth in said contract documents, and (2) actually furnishing in advance of any contract operations, the required insurance policies of each and every kind and amount as called for in said contract documents, particularly with relation to workers' compensation and liability insurance policies as set forth in the related specifications; and also agrees and warrants that all of such policies will be in force and effect on the date of the start of any such contract operations, whether or not the contract documents have been executed and filed as aforesaid. In no event shall the undersigned start any contract work which involves a disturbance of the contract site prior to execution of the contract by the Comptroller.

**Bid Deposit**

Accompanying this proposal is a bid bond, certified check or bank cashier's check for the specified amount of deposit required. In the event this proposal is accepted by the Department of Transportation and the undersigned shall fail to execute the contract and in all respects comply with the provisions of Section 38 of the Highway Law, as amended, or where applicable, Section 30 of the Canal Law, as amended, the moneys represented by such bid bond, certified check or bank cashier's check shall be regarded as liquidated damages and shall be forfeited and become the property of the State of New York; otherwise to be returned to the depositor in accordance with the provisions of said Section 38 of the Highway Law, as amended, or where applicable with Section 30 of the Canal Law, as amended.

On acceptance of this proposal for said work the undersigned does or do hereby bind herself/himself or itself/themselves to enter into written contract, within ten days of date of notice of award, with the said Department of Transportation, and to comply in all respects with §38(6) of the Highway Law, as amended, or where applicable with §30(7) of the Canal Law, as amended, in relation to security for the faithful performance of the terms of said contract.

**Non-Collusive Bidding Certifications (NYS Finance Law §139-D)**

1. Every bid hereafter made to the state or any public department, agency or official thereof, where competitive bidding is required by statute, rule or regulation, for work or services performed or to be
performed or goods sold or to be sold, shall contain the following statement subscribed by the bidder and affirmed by such bidder as true under the penalties of perjury:

(a) By submission of this bid, each bidder and each person signing on behalf of any bidder certifies, and in the case of a joint bid each party thereto certifies as to its own organization, under penalty of perjury, that to the best of his knowledge and belief:

(1) The prices in this bid have been arrived at independently without collusion, consultation, communication, or agreement, for the purpose of restricting competition, as to any matter relating to such prices with any other bidder or with any competitor;

(2) Unless otherwise-required by law, the prices which have been quoted in this bid have not been knowingly disclosed by the bidder and will not knowingly be disclosed by the bidder prior to opening, directly or indirectly, to any other bidder or to any competitor; and

(3) No attempt has been made or will be made by the bidder to induce any other person, partnership or corporation to submit or not to submit a bid for the purpose of restricting competition.

(b) A bid shall not be considered for award nor shall any award be made where (a)(1)(2) and (3) above have not been complied with; provided however, that if in any case the bidder cannot make the foregoing certification, the bidder shall so state and shall furnish with the bid a signed statement which sets forth in detail the reasons therefore. Where (a)(1)(2) and (3) above have not been complied with, the bid shall not be considered for award nor shall any award be made unless the head of the purchasing unit of the state, public department or agency to which the bid is made, or his designee, determines that such disclosure was not made for the purpose of restricting competition.

The fact that a bidder (a) has published price lists, rates, or tariffs covering items being procured, (b) has informed prospective customers of proposed or pending publication of new or revised price lists for such items or (c) has sold the same items to other customers at the same prices being bid, does not constitute, without more, a disclosure within the meaning of subparagraph 1.(a).

2. Any bid hereafter made to the state or any public department, agency or official thereof by a corporate bidder for work or services performed or to be performed or goods sold or to be sold, where competitive bidding is required by statute, rule or regulation, and where such bid contains the certification referred to in subdivision one of this section, shall be deemed to have been authorized by the board of directors of the bidder and such authorization shall be deemed to included the signing and submission of the bid and the inclusion therein of the certificate as to non collusion as the act and deed of the corporation.

Non-Collusive Bidding Certification (49 CFR 29)

The Contractor to whom the above identified contract is to be awarded does hereby tender to the New York State Department of Transportation this sworn statement pursuant to Section 112(c) of Title 23 U.S. Code Highways and does hereby certify, in conformance with said 23 USC 112(c) that the said Contractor has not, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding in connection with the above identified contract.

The signatory to this proposal, being duly sworn, certifies that, EXCEPT AS NOTED BELOW, its company and any person associated therewith in then capacity of owner, partner, director, officer, or major stockholder (five percent or more ownership):

1) is not currently under suspension, debarment, voluntary exclusion, or determination of ineligibility by any federal agency;
2) has not been suspended, debarred, voluntarily excluded or determined ineligible by any federal agency within the past three years;
3) does not have a proposed debarment pending; and
4) has not been indicted, convicted, or had a civil judgment rendered against it by a court of competent Jurisdiction in any matter involving fraud or official misconduct within the past three years.

EXCEPTIONS - List any relevant information, attaching additional sheets if necessary. (Exceptions will not necessarily result in disapproval, but will be considered in determining responsibility. For any exception noted, indicate below to whom it applies, the initiating agency, and dates of action. Providing false information may result in criminal prosecution or administrative sanctions.)

Lobbying Activity Certification [For Federal-Aid Contracts Only]
The prospective participant certifies, by signing and submitting this bid or proposal, to the best of his or her knowledge and belief, that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying", in accordance with its instructions.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by Section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

The prospective participant also agrees by submitting his or her bid or proposal that he or she shall require that the language of this certification be included in all lower tier subcontracts, which exceed $100,000 and that all such subrecipients shall certify and disclose accordingly.

UNITED STATES DEPARTMENT OF TRANSPORTATION HOTLINE

Persons with knowledge of bid collusion (i.e., contractors, suppliers, work persons, etc.), or other questionable contract related practices (inadequate materials, poor workmanship, theft of materials, etc.), are encouraged to report such activities by calling the U.S. DOT HOTLINE. The HOTLINE number is 1-800-424-9071 and calls will be answered from 8:00 A.M. to 5:00 P.M. EST, Monday through Friday.

This HOTLINE is under the direction of the U.S. DOT's Inspector General. All information will be treated confidentially and the caller's anonymity will be respected.

NEW YORK STATE INSPECTOR GENERAL HOTLINE

Reports of New York State Governmental Misconduct may be made in strict confidence to the New York State Inspector General on the Toll Free Statewide HOTLINE or by writing to the Office of the State Inspector General. The Toll-Free Statewide HOTLINE telephone number is 1-800-367-4448 and calls will be answered between 9:00 A.M. and 5:00 P.M., Monday through Friday. The address of the Office of the Inspector General is P.O. Box 9, One Commerce Plaza, Albany, New York 12260.

BY EXECUTING THIS PROPOSAL, THE CONTRACTOR AGREES TO:
1. Perform all work listed in accordance with the Contract Documents at the unit prices bid; subject to the Changed Conditions provisions if applicable;
2. All the terms and conditions of the non-collusive bidding certifications required by §139-d of the State Finance Law;
3. Certification of Specialty Items category selected, if contained in this proposal;
4. Certification of any other clauses required by this proposal and contained herein.
5. For Federal-Aid contracts only, Certification, under penalty of perjury, as to the current history regarding suspensions, debarments, voluntary exclusions, determinations of ineligibility, indictments, convictions or civil judgments required by 49 CFR, Part 29.
6. Contractor certifies that all information provided to the Department with respect to the requirements contained in State Finance Laws §139j and §139k is complete, true and accurate.

Dated___________________________, 20_____
Legal Name of person, firm or corporation

By

Signature (Title)

(Acknowledgment of individual contractor)
STATE OF NEW YORK
County of __________ ss.:
On this _____ day of ____________ 20____, before me personally came ______________________ to me known and known to me to be the person described in and who executed the foregoing instrument, and acknowledged that she/he executed the same.

Notary Public

(Acknowledgment of co-partnership contractor)
STATE OF NEW YORK
County of __________ ss.:
On this _____ day of ____________ 20____, before me personally came ______________________ to me known and known to me to be the person who executed the foregoing instrument, who being by me duly sworn, did for himself/herself depose and say that he/she is a member of the partnership of _______________________, consisting of himself/herself and _______________________, and that he/she executed the foregoing instrument in the firm name of _______________________, and that he/she had authority to sign same, and did duly acknowledge to me that she/he executed the same as the act and deed of said firm for the uses and purposes mentioned therein.

Notary Public

(Acknowledgment of contractor, if a corporation)
STATE OF NEW YORK
County of __________ ss.:
On this _____ day of ____________ 20____, before me personally came ______________________ to me known and known to me to be the person, who being duly sworn, did depose and say that she/he resides in _______________________, that she/he is the _______________________, of the _______________________, the corporation described in and which executed the foregoing instrument; and that she/he signed her/his name thereto by order of the Board of Directors of said Corporation.

Notary Public

Please Complete Information Requested Below:

The P.O. address of the bidder is:

____________________________ (Street) Federal Identification No ________________

____________________________ Contact Person ________________________

____________________________ Phone No. (    ) ________________________

City, State and Zip Code
§102

If a Partnership
Name
__________________________
Address
__________________________________________
__________________________
__________________________________________
__________________________
__________________________________________

If a Corporation
Name
__________________________
Address
__________________________________________, President
__________________________________________, Secretary
__________________________________________, Treasurer

SECTION 103 - CONTRACT AWARD AND EXECUTION

103-01 CONTRACT AWARD.

The award of contract will be made only to the lowest responsible bidder as will best promote the public interest as provided by Section 38 of the Highway Law. The lowest bid will be determined by the Commissioner on the basis of gross sum for which the entire work will be performed, arrived at by a correct computation of all contract pay items specified in the proposal, at the unit prices stated in the proposal.

The Department reserves the right to reject any proposal deemed non-responsive, or any contractor deemed non-responsible, and then, pursuant to Section 38 of the Highway Law, award to other than the low bidder, or waive minor informalities if, in its opinion, the best interest of the State will thereby be promoted.

The Commissioner reserves the right to reject any proposal in which any of the bid prices are unbalanced to the potential detriment of the Department. An unbalanced bid is considered to be one containing lump sum or unit bid prices which do not reflect reasonable actual costs plus a reasonable proportionate share of the bidder's anticipated profit, overhead costs, and other indirect costs which are anticipated for the performance of the work in question.

As a condition of award, the Contractor shall submit a completed Form CCA-1, New York State Uniform Contracting Questionnaire to the Contract Management Bureau. If requested by the Department, the bidder shall present additional evidence of ownership, corporate structure, ability and financial standing, as well as a statement as to equipment.

For contracts subject to A+B Bidding, the lowest bid will be determined by the Commissioner on the basis of the gross sum, which will be arrived at by a correct computation of all contract pay items specified in the proposal at the unit prices stated in the proposal (A portion), plus the total number of calendar days proposed by the bidder to complete the portion of work to which the incentive/disincentive is applicable, times the unit cost (B portion).

For contracts containing steel and/or iron, award of the contract will be made to the lowest responsible bidder who submits the lowest total bid based on furnishing domestic steel unless such total bid exceeds the lowest total bid based on furnishing foreign steel by more than 25 percent, in which case award will be made to the lowest responsible bidder based on furnishing foreign steel. The Bidder shall submit a bid based on permanently incorporating only domestic steel and/or iron materials in the construction of the contract. The Bidder may also submit a bid based on being allowed to permanently incorporate foreign steel and/or iron materials into the work of the contract. If the Bidder chooses to submit a bid based on the use of foreign steel and/or iron materials, the Bidder shall purchase an additional contract proposal and shall legibly print the following in ink on the proposal cover and at the bottom of the proposal sheet which contains the phrase “Total or gross sum written in words”: TOTAL
BID BASED ON USING FOREIGN STEEL AND/OR IRON MATERIALS. When bids are submitted based on domestic and foreign steel and/or iron materials, both bids shall be submitted in the same envelope.

For contracts containing structure paint removal and painting work except for: bridge superstructure removal and other demolition work under Section 202; paint removal that is incidental to the main work under an item; localized paint removal from structural steel necessary for safe progress of other work on the structural steel; localized painting of bare structural steel; and containment for localized steel repair and painting; as a condition of award, Contractors and/or Subcontractors performing structure paint removal and painting work shall be certified in accordance with the following requirements of the Painting Contractor Certification Program (PCCP), of the Steel Structures Painting Council (SSPC):
QP-1, Standard Procedure for Evaluating Qualifications of Painting Contractors: Field Application to Complex Industrial Structures;
QP-2, Standard Procedure for Evaluating Qualifications of Painting Contractors To Remove Hazardous Paint.

In lieu of SSPC/PCCP certification, the Contractor shall provide documentation that demonstrates that the low bidder has established equivalent processes and procedures conforming to the standards set forth in the procedures for SSPC/PCCP QP-1 and QP-2. The documentation shall be reviewed and approved by a Professional Engineer experienced in structural painting operations selected by the Contractor and approved by the Department. The cost for the review and approval shall be paid by the Contractor.

103-02 EXECUTION OF CONTRACT.

The person or persons whose proposal is accepted shall execute the contract and comply in all respects with the statutory provisions relating to the contract within ten days of the date of the delivery of the contract form. A sample of the standard contract agreement is shown in §103-06 Sample Form of Contract Agreement. In case of failure or refusal on the part of the bidder to deliver the duly executed contract to the Department within the ten day period herein mentioned, the amount of the deposit made may be forfeited and paid to the State of New York, Department of Transportation.

All of the following sections which have the word “Sample” in the title are samples of the contract documents executed by the Contractor as a part of contract award. The executed contract documents control and have precedence over the samples presented herein.

103-03 CONTRACT BONDS.

The Contractor shall provide the State with a Faithful Performance Bond and a Labor and Material Bond from a Surety Company listed on the US Department of the Treasury listing of Approved Sureties (Treasury Department Circular 570) and licensed to do business in New York State, and with a minimum rating by A.M. Best of (A−) in the “Best’s Key Rating Guide.” Treasury Department Circular 570 can be found on the US Department of the Treasury website at www.fms.treas.gov/c570/index.html. The Contractor shall procure and deliver bonds to the State and maintain them at its own expense and without expense to the State until contract final acceptance by the State. The Surety Company shall append a statement of its financial condition and a copy of the resolution authorizing the execution of Bonds by officers of the Company to the bond(s).

For contracts subject to A+B Bidding, the total contract bid price will include only the “A” portion of the bid. For contracts containing Incentive/Disincentive provisions, Lane Rental provisions, or any similar provisions, the total contract bid price will exclude any incentive/disincentive, lane rental, or similar items.

A. Faithful Performance Bond. The Contractor shall provide a bond in the form prescribed by the Commissioner, shown in §103-07 Sample Form of Faithful Performance Bond, with sufficient sureties, approved by said Commissioner, guaranteeing that the Contractor will perform the work in accordance with the terms of the contract documents, and that it will commence and complete the work within the time prescribed in the contract, and that it will provide against direct or indirect damages that shall be suffered or claimed on account of such construction or improvement, during the time thereof, until the contract is accepted. The amount of the Faithful Performance Bond shall be 100% of the amount of the total contract bid price.
§103

B. Labor And Material Bond. The Contractor shall provide a bond in the form prescribed by the Commissioner, shown in §103-08 Sample Form of Labor and Material Bond, with sufficient sureties, approved by said Commissioner, guaranteeing prompt payment of monies due all persons supplying the Contractor or Subcontractor with labor and materials employed and used in carrying out the contract, which bond shall inure to the benefit of the persons supplying such labor and materials. The amount of the Labor and Material Bond shall be 100% of the amount of the total contract bid price.

103-04 CANCELING AWARD.

The Department reserves the right to reject all proposals and advertise for new proposals, or proceed to do the work otherwise, if, in its opinion, the best interest of the State will thereby be promoted.

103-05 PARTNERING.

It is the Department's policy to use the principles of partnering to guide the management of construction contracts and the construction program, within the parameters covered by the laws, regulations and other policies that govern work in the public sector.

The partnering principles are intended to promote quality through continuous improvement at all stages of construction. The goal of the Department is to complete each contract in the most efficient, timely, safe, and cost effective manner, to the mutual benefit of the Contractor and the Department, meaning a quality contract delivered on time, within budget, and without significant disputes.

Partnering is defined as those actions taken to include all parties with an appropriate and vested interest in the management of a transportation project such that it is completed in the most efficient, timely, safe, and cost effective manner for the mutual benefit of all concerned. Those actions include, but are not limited to, communication, organization, establishing goals, continuous improvement, problem identification, conflict resolution, and managing change. Interested parties may include, but are not limited to, the Department, the Contractor, Subcontractors, Fabricators, Material Suppliers, the community within which the project is constructed, the community served by the project, Federal, State and local government or other public agencies, and utilities.

None of the actions identified as part of, or taken in the course of partnering shall be construed to alter, modify, delete or waive any of the provisions or requirements of the Department's Specifications or any applicable laws or regulations.

The Department with the Contractor will manage each contract in a cooperative manner utilizing the following principles of partnering:

- establish communications with all involved parties early in the partnering process;
- establish a relationship of shared trust, equity, and commitment;
- develop strategies for identifying mutual goals;
- develop strategies for timely communications and decision making;
- establish process for timely response to changes or variations in field conditions;
- solve potential problems, at the lowest level, before they create a negative impact;
- encourage the use of products, technology and processes that provide a demonstrated level of improved quality; and
- develop a plan for periodic joint evaluation based on mutually agreed goals.

The specifications are to be implemented in an equitable fashion that recognizes the problems that are inherent in construction, addresses the different-than-expected field conditions, resolves disputes in open communications manner, and makes contract adjustments in a timely, and fair manner consistent with the terms of the contract. These specifications are intended to fairly allocate risk, resulting in a balanced contractual approach to risk-sharing. The Department will provide information relevant to preparation of a bid for the contract, and in connection with submission of its bid, the Contractor has the right to rely on information provided by the Department in the contract documents.

A. Formal Partnering. Generally, an item for formal partnering will be included in the contract proposal for large, more complex contracts. In addition, the Department will accept requests by successful low bidders to incorporate formal partnering on any contract that requires coordination and cooperation with third parties such as Subcontractors, suppliers, utility companies and railroads, or as otherwise desired by the Contractor.
B. Informal Partnering. The Department is willing to informally partner with the Contractor on all other contracts. Informal partnering is defined as the application of partnering principles to the management of the contract by the mutual agreement of the interested parties. Although the principles of partnering are to be applied, there is no fixed organization or structure adopted for that purpose.

103-06 SAMPLE FORM OF CONTRACT AGREEMENT.

STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION
AGREEMENT

Contract No.
County

THIS AGREEMENT, entered into this day of 20___, by THE PEOPLE OF THE STATE OF NEW YORK, hereinafter referred to as "State", acting by and through the Department of Transportation, pursuant to the Highway Law, and [] an individual conducting business as
[] a partnership, consisting of
[] a corporation organized and existing under the laws of the State of ________

the location of whose principal office is __________________ hereinafter called the “Contractor”.

WITNESSETH: That the State and the Contractor, for the consideration hereinafter named agree as follows:

ARTICLE 1. WORK TO BE DONE. The Contractor shall (a) furnish all the materials, appliances, tools and labor of every kind required, and construct and complete in the most substantial and skillful manner, the construction, improvement or reconstruction of the project on or before the completion date of the ______ day of ____________, 20____ as further described in Article 4, and as generally identified and shown on the contract plans entitled:

in accordance with the “Standard Specifications" of the New York State Department of Transportation, which contain the information for bidders; proposal form, contract agreement, and bonds; and payment Items; and (b) do everything required by the Contract and/or Contract Documents as defined herein.

The Contractor further agrees their bid proposal is not based upon the assumption that any specifications, traffic restrictions, scheduling or phasing/staging requirements will be waived; an extension of Contract Completion Date will be granted; a labor dispensation will be granted; substitution of non-approved products, alternatives or claimed functional equivalents for specified construction materials and methods will be allowed; or any Value Engineering Change Proposals will be approved.

ARTICLE 2. DOCUMENTS FORMING THE CONTRACT. The Contract (and Contract Documents) shall be deemed to include the advertisement for proposals; the contract proposal, including Special Notes and Special Specifications contained therein; the contractor's proposal; the Equal Employment Opportunity (EEO) participation goals; the Disadvantaged/Minority/Women's Business Enterprise (D/M/WBE) participation goals; the contract agreement; the base line data; the "Standard Specifications" including all addenda thereto identified in the contract proposal; the Standard Sheets; the plans; any amendments issued prior to the date of proposal submission, and all provisions required by law to be inserted in the contract whether actually inserted or not. Whenever separate publications are referenced in the Contract Documents it shall mean those, as amended, which are current on the date of advertisement for bids.

ARTICLE 3. EXAMINATION OF DOCUMENTS AND SITE. The Contractor agrees that before making its proposal it carefully examined the contract documents, together with the site of the proposed work, as well as its surrounding territory, and is informed regarding all of the conditions affecting the work to be done and labor and materials to be furnished for the completion of this contract, including the existence of poles, wires, pipes and other facilities and structures of municipal and other public service
§103 corporations on, over or under the site, except latent conditions that meet the requirements of §104-03 *Differing Site Conditions*, and that its information was secured by personal and other investigation and research.

**ARTICLE 4. DATE OF COMPLETION.** The Contractor further agrees that it will begin the work herein embraced within ten days of the effective date hereof, unless the consent of the State, in writing, is given to begin at a later date, and that it will prosecute the same so that it shall be entirely completed and performed on or before the completion date shown in Article 1.

No extension beyond the date of completion fixed by the terms of this contract shall be effective unless in writing signed by the State. Such extension shall be for such time and upon such terms and conditions as shall be fixed by the State, which may include the assessment of liquidated damages and a charge for engineering and inspection expenses actually incurred upon the work, including engineering and inspection expenses incurred upon the work by railroad companies on contracts for grade crossing elimination. Notice of application for such extension shall be filed with the Regional Director of the Region within which the highway under construction is located at least fifteen days prior to the date of completion fixed by the terms of this agreement.

**ARTICLE 5. ALTERATIONS AND OMISSIONS.** The said work shall be performed in accordance with the true intent and meaning of the contract documents without any further expense of any nature whatsoever to the State other than the consideration named in this agreement.

The State reserves the right, at any time during the progress of the work, to alter the plans or omit any portion of the work as it may deem reasonably necessary for the public interest- making allowances for additions and deductions with compensation made in accordance with the Standard Specifications, for this work without constituting grounds for any claim by the contractor for allowance for damages or for loss of anticipated profits, or for any variations between the approximate quantities and the quantities of the work as done.

**ARTICLE 6. NO COLLUSION OR FRAUD.** The Contractor hereby agrees that the only person or persons interested as principal or principals in the bid or proposal submitted by the Contractor for this contract are named therein, and that no person other than those mentioned therein has any interest in the above mentioned proposal or in securing of the award, and that this contract has been secured without any connection with any person or persons other than those named, and that the proposal is in all respects fair and was prepared and the contract was secured without collusion or fraud and that neither any officer nor employee of the Department of Transportation has or shall have a financial interest in the performance of the contract or in the supplies, work or business to which it relates, or in any portion of the profits thereof. (See also §139-a and §139-b of the State Finance Law referred to in the Standard Specifications which are made a part of this contract.)

**ARTICLE 7. CONTRACT PAYMENTS.** As the work progresses in accordance with the contract and in a manner that is satisfactory to the State, the State hereby agrees to make payments to the Contractor therefore, based upon the proposal attached hereto and made a part hereof, as follows: The State shall once in each month and on such days as it may fix, determine the quantity of work completed and of material which has actually been put in place in accordance with the terms and conditions of the contract, during the preceding month, and compute the value thereof and pay to the Contractor the monies due as provided in §38(7) of the Highway Law. No monthly payment shall be rendered unless the value of the work completed equals 5% of the contract amount or $1,000, whichever is the lesser. Semimonthly payments may be rendered provided (a) the value of the work performed in two successive weeks is more than $50,000 or (b) the Commissioner of Transportation deems it to be in the best interests of the State to do so. The Contractor shall not hold any retainage from any Subcontractor.

**ARTICLE 8. NO PAYMENT DUE TO CONTRACTOR’S NON-COMPLIANCE.** It is further agreed that so long as any lawful or proper direction concerning the work or material given by the Commissioner of Transportation, or his/her representative, shall remain uncomplied with, the Contractor shall not be entitled to have said contract payment processed, nor shall any contract payment(s) be processed for work done or material furnished until such lawful or proper direction aforesaid has been fully and satisfactorily complied with.
ARTICLE 9. FINAL ACCEPTANCE OF WORK. When in the opinion of the Regional Director a Contractor has fully performed the work under the contract, the Regional Director shall recommend to the Commissioner of Transportation the acceptance of the work so completed. If the Commissioner accepts the recommendation of the Regional Director, he/she shall thereupon by letter notify the Contractor, with copies to other interested parties, of such acceptance. Prior to the final acceptance of the work by the Commissioner or his/her designee, the contract work may be inspected, accepted and approved by other agencies and/or municipalities who will have jurisdiction of the work after final acceptance.

Final acceptance shall be final and conclusive except for defects not readily ascertainable by the Department, actual or contributory, fraud, gross mistakes amounting to fraud or other errors which the Contractor knew or should have known about as well as the Department's rights under any warranty or guarantee. Final acceptance may be revoked by the Department at any time prior to the issuance of the final check by the Comptroller upon the Department's discovery of such defects, mistakes, fraud or errors in the work.

ARTICLE 10. FINAL PAYMENT. After the final acceptance of the work, the Engineer shall prepare a final agreement of the work performed and the materials placed and shall determine the value of such work and materials under and according to the terms of the contract. This final agreement shall be certified, as to its correctness, by the Engineer. Upon approval of such final agreement by the Regional Director, it shall be submitted to the Commissioner for final approval. The right, however, is hereby reserved to the Commissioner to reject the whole or any portion of the final agreement, should the said certificate of the Engineer be found or known to be inconsistent with the terms of the agreement or otherwise improperly given. All certificates upon which partial payments may have been made, shall be subject to correction in the final certificate or final agreement.

ARTICLE 11. RIGHT TO SUSPEND WORK AND CANCEL CONTRACT. It is further mutually agreed that if at any time during the prosecution of the work the Commissioner of Transportation shall determine that the work upon the contract is not being performed according to the contract or for the best interest of the State, the execution of the work by the Contractor may be temporarily suspended by the Commissioner of Transportation, who may then proceed with the work under his/her own direction in such manner as will accord with the contract specifications and be for the best interests of the State; or he/she may terminate the Contractor's employment under the contract while it is in progress, and thereupon proceed with the work, in affirmance of the contract, by contract negotiated or publicly let, by the use of his/her own forces, by calling upon the surety to complete the work in accordance with the plans and specifications or by a combination of any such methods; or he/she may cancel the contract and either readvertise or relet as provided in Section 38 of the Highway Law, or complete the work under its own direction in such a manner as will accord with the contract specifications and be for the best interests of the State; any excess in the cost of completing the contract beyond the price for which it was originally awarded shall be charged to and paid by the Contractor failing to perform the work or its surety; all in pursuance of the provisions of Section 40 of the Highway Law.

Whenever the State determines to suspend or stop work under the contract, a written notice sent by mail to the Contractor at its address and to the sureties at their respective addresses, shall be sufficient notice of its action in the premises.

ARTICLE 12. DETERMINATION AS TO VARIANCES. In any case of any ambiguity in the plans, specifications or maps, or between any of them, the matter must be immediately submitted to the Commissioner, who shall adjust the same, and his/her decision in relation thereto shall be final and conclusive upon the parties.

ARTICLE 13. SUCCESSORS AND ASSIGNS. This agreement shall bind the successors, assigns and representatives of the parties hereto.

ARTICLE 14. INTERNATIONAL BOYCOTT PROHIBITION. In accordance with §139-h of State Finance Law, the Contractor hereby promises, asserts and represents that neither the Contractor nor any substantially owned or affiliated person, firm, partnership or corporation has participated, is participating or shall participate in an international boycott in violation of the provisions of the United States Export
Administration Act of 1969, as amended, or the United States Export Administration Act of 1979, or the effective Regulations of the United States Department of Commerce promulgated under either act.

It is understood further that the State in awarding a contract does so in material reliance upon the promise and representation made by the Contractor in the foregoing paragraph and that such contract shall be rendered forfeit and void by the State Comptroller if subsequent to the bid execution date, the Contractor or such owned or affiliated person, firm, partnership or corporation has been convicted of a violation of the aforesaid Acts or Regulations or has been found upon final determination of the United States Commerce Department or any other appropriate agency of the United States to have violated such Acts or Regulations.

The Contractor agrees to and shall notify the Commissioner of Transportation, the Director of the Contract Management Bureau and State Expenditures in the Office of the State Comptroller of any such conviction or final determination of violation within five (5) days thereof.

IN WITNESS WHEREOF, this agreement has been executed by the State, acting by and through the Commissioner of Transportation, and the Contractor or its appointed representative, who has executed this agreement on the day and year first written above.

Recommended by ____________________________

Contract No. ____________

Agency Certification

(Signature) ____________________________________________________________________________

"In addition to the acceptance of this contract, I also certify that original copies of this signature page will be attached to all other exact copies of the contract."

ATTORNEY GENERAL:

________________________________________

Department of Transportation _______________

Approved ____________________________

(Date) ___________________________

(Signature) (Title)

For State Comptroller __________________________

(Contractor Firm Name)

THIS CONTRACT IS NOT TO BE EXECUTED OR BECOME EFFECTIVE UNTIL IT SHALL FIRST BE APPROVED BY THE STATE COMPTROLLER AND FILED IN HIS/HER OFFICE. (Section 112, State Finance Law.)

(Acknowledgment of individual contractor)

STATE OF NEW YORK ss. :
COUNTY OF __________________________

On this _____ day of ____________ 20 ____, before me personally came ______________________ to me known and known to me to be the person described in and who executed the foregoing instrument, and acknowledged that he/she executed the same.

Notary Public

(Acknowledgment of co-partnership contractor)

STATE OF NEW YORK ss. :
COUNTY OF __________________________

On this _____ day of ____________ 20 ____, before me personally came ______________________ to me known and known to me to be the person who executed the foregoing instrument, who, being duly
sworn by me, did for himself/herself depose and say that he/she is a member of the firm of
and that he/she executed the foregoing instrument and that he/she had authority to sign same, and he/she
did duly acknowledge to me that he/she executed the same as the act and deed of said firm for the uses
and purposes mentioned therein.

Notary Public

(Acknowledgment of contractor, if a corporation)
STATE OF NEW YORK ss.:
COUNTY OF ______________

On this ____ day of _____________ 20 ____, before me personally came ______________________
to me known, and known to me to be the person who being duly sworn, did depose and say that he/she
resides in _________________________ that he/she is the __________________________ of the
________________________ the corporation described in and which executed the foregoing instrument;
and that he/she signed his/her name thereto by order of the Board of Directors of said Corporation.

Notary Public

103-07 SAMPLE FORM OF FAITHFUL PERFORMANCE BOND.

KNOW ALL PERSONS BY THESE PRESENTS, that _____________________________________
(Name of Contractor)

(address)

(a corporation created and existing under the laws of the State of ______________ having its principal
office in the City of _________________________ (hereinafter called the “Surety”) are held and firmly
bound unto the People of the State of New York (hereinafter called the “State”), by and through its
Department of Transportation (hereinafter called the “Department”), in the full and just sum of [Total
Contract Bid Price or “A Portion” of Total Contract Bid Price Dollars (...............)] good and lawful
money of the United States of America, to the payment of which said sum of money, well and truly to be
made and done the said Principal binds itself, its heirs, executors, administrators or assignees and the said
Surety binds itself, its successors or assigns, jointly and severally, firmly by these presents:

WHEREAS, said Principal has entered into a certain written contract on the ____ day of
____________, 20____, with the Department of Transportation, 50 Wolf Road, Albany, New York
12232.

(Project Description)
In the county/counties of which constitutes Contract No.

NOW, THEREFORE, the condition of this obligation is such that if the said Principal shall well, truly
and faithfully perform the work in accordance with the terms of the contract and as said contract may be
modified or amended, and with the plans and specifications, and will commence and complete the work
within the time prescribed in the contract, and shall protect the said State against, and pay any excess of
cost as provided in said contract, and all amounts, damages, costs and judgments which may be recovered
against said State or its officers or agents of which the said State may be called upon to pay to any person
or corporation by reason of any damages, direct or indirect, arising or growing out of the doing of said
work, or from the negligence, nonfeasance, misfeasance or malfeasance of any officer, agent or employee
of the State or Department thereof, or suffered or claimed on account of said public works contract during
the time thereof or the manner of doing the same, or the neglect of the said Principal, or its agents, or
servants, or the improper performance of the said work by the said Principal, or its agents, or servants, or
§103

from any other cause, then this obligation shall be null and void, otherwise to remain in full force and
virtue.

In the event of a failure of performance of the contract by the Principal, which shall include, but not
be limited to, any breach or default of the contract by the Principal, or in case said contract is forfeited by
the Principal in the manner provided for in the contract and the said Surety, for value received, hereby
stipulates and agrees, if requested to do so by the State, has the option to either remedy the default, or
breach or forfeiture of the Principal or take charge and fully perform and complete the work, mentioned
and described in said contract and specifications, pursuant to the terms, conditions and covenants thereof
and as may be amended, at its own expense. The procedure by which the Surety undertakes to discharge
its obligations under the bond shall be subject to the advance written approval of the Department. If the
Surety completes the contract, it shall be paid for the actual items of work performed in accordance with
the Principal's contract terms and prices. In this event the Surety assumes the rights and obligations of the
Principal.

It shall be the duty of the Surety to give unequivocal notice in writing to the Department, within forty-
five (45) days after receipt of written notice from the Department to the Surety, of the Surety's election to
remedy default(s) or breach(es) or forfeiture(s) promptly or to perform and fully complete the contract
promptly as provided herein, time being of the essence of this bond. In said notice of election, the Surety
shall state the date on which the remedy or performance shall commence. During the period between the
Department's notice and Surety's performance of the contract or remedy of the default, breach or
forfeiture, the Surety shall be liable for and agrees to pay any and all reasonable and necessary costs as
determined by the Department to maintain the contract site safe and convenient to the public.

It shall also be the duty of the Surety to give prompt notice in writing to the Department upon the
completion of the remedy and/or correction of each breach or default or completion of the contract. The
Surety shall not assert solvency of its Principal or its Principals denial of default as justification for its
failure to give notice of election or for its failure to promptly remedy the breach or default or to complete
the contract.

In the event the Surety shall fail to exercise either option or to act promptly then the Department shall
give ten (10) days notice of such failure, both to Principal and Surety, and after the expiration of the 10
days the Department may cause the work to be completed pursuant to Section 40 of the Highway Law,
and the Surety and the Principal shall be jointly and severally liable for the amount of excess cost of
completing the contract work beyond the amounts remaining for this contract adjusted for the work
actually performed. When the cost of completion of performance by the Obligee is estimated, the
Principal and Surety shall pay, free from all liens and encumbrances, the State determined estimated
completion costs above the funds remaining for this contract, to the Department within 30 days of receipt
of the estimate. Adjustment of the Department's estimated completion cost will be made upon the
Department's final acceptance of the work and appropriate refunds, if any, will be promptly made to the
Surety. Any actual costs in excess of the estimated price shall be paid to the Department promptly on
demand. Additionally, Principal and Surety shall be liable for any applicable liquidated and/or
engineering costs or damages.

In addition, the said Principal and Surety further agree, as part of this obligation, to pay all damages
of any kind to person or property that may result from a failure in any respect to perform and complete
said contract including, but not limited to costs necessary to protect the traveling public or to avoid
inconvenience to the traveling public, (liquidated damages as provided above) all repair and replacement
costs necessary to rectify construction errors, architectural and engineering costs and fees, all consultant
fees, all testing and laboratory fees, and all interest, legal fees and litigation costs incurred by the
Department.

And the said Surety thereby stipulates and agrees that no change, extension, alteration, deduction or
addition in or to the terms of the said contract or the plans or specifications accompanying the same, shall
in any way affect the obligations of said Surety of its bond.

IN TESTIMONY WHEREOF, the said Principal has hereunto set his/her (their/its) hand and the said
Surety has caused this instrument to be signed by its authorized officer, the day and year above written.

Signed and delivered this _____ day of ______________, 20____, in the presence of:

___________________________________________ )

(Company)
(The Surety Company shall append a single copy of a statement of its financial condition and a copy of the resolution authorizing the execution of Bonds by officers of the Company to the bond(s.)

(Acknowledgment of principal, unless it be a corporation)

STATE OF NEW YORK ss. :
COUNTY OF ______________

On this _____ day of ______________ 20 ___, before me personally came _____________________ to me known and known to me to be the person described in and who executed the foregoing instrument and acknowledged that he/she executed the same.

Notary Public

(Acknowledgment of principal, if a corporation)

STATE OF NEW YORK ss. :
COUNTY ______________

On this _____ day of ______________ 20 ___, before me personally came _____________________ to me known and known to me to be the person, who being by me duly sworn, did depose and say that he/she resides in _______________ that he/she is the _______________ of the _____________________ the corporation described in and which executed the foregoing instrument; and that he/she signed his/her name thereto by order of the Board of Directors of said Corporation.

Notary Public

(Acknowledgment of Surety Company)

STATE OF NEW YORK ss. :
COUNTY OF ______________

On this _____ day of ______________ 20 ___, before me personally came _____________________ to me known and known to me to be the person, who being by me duly sworn, did depose and say that he/she resides in _______________. that he/she is the _______________ of the _____________________ the corporation described in the foregoing instrument; and that he/she signed his/her name thereto by order of the Board of Directors of said corporation.

Notary Public
State Of New York Office of the Attorney General

I hereby approve the foregoing contract and bond as to form and manner of execution.

103-08 SAMPLE FORM OF LABOR AND MATERIAL BOND.

KNOW ALL PERSONS BY THESE PRESENTS, that ____________________________________

(Name of Contractor)

____________________________________________________________________________________

(Address)

(hereinafter called the “Principal”) and the ____________________________________________

(hereinafter called the “Surety”), are held and firmly bound unto the People of the State of New York (hereinafter called the “State”) by and through its Department of Transportation (hereinafter called the “Department”), in the full and just sum of [Total Contract Bid Price or the “A Portion” of Total Contract Bid Price] Dollars ($.................) good and lawful money of the United States of America, for payment of which said sum of money, well and truly to be made and done, the said Principal binds itself, its heirs, executors and administrators, successors and assigns, and the said Surety binds itself, its successors and assigns jointly and severally, firmly by these presents:

WHEREAS, said Principal has entered into a certain written contract, on the ____ day of _____________, 20____ with the Department of Transportation, 50 Wolf Road, Albany, New York 12232.

<Project Description>

In the county/counties of ______________________ which constitutes Contract No. ______________________

NOW, THEREFORE, the condition of this obligation is such, that if the said Principal shall promptly pay all monies due to all persons furnishing labor or materials to it or its Subcontractors in the prosecution of the work provided for in said contract, then this obligation shall be void, otherwise to remain in full force and effect;

Provided, however, that the Comptroller of the State of New York having required the said Principal to furnish this bond in order to comply with the provisions of Section 137 of the State Finance Law, all rights and remedies on this bond shall inure solely to such persons and shall be determined in accordance with the provisions, conditions and limitations of said Section to the same extent as if they were copied at length herein; and

Further, provided, that the place of trial of any action on this bond shall be in the county in which the said contract was to be performed, or if said contract was to be performed in more than one county then in any such county, and not elsewhere.

IN TESTIMONY WHEREOF, the said Principal has hereunto set his/her (their, its) hand and the said Surety has caused this instrument to be signed by its authorized officer, the day and year above written.

Signed and delivered _____ day of _____________ 20____ in the presence of

___________________________________________ )

(Company)

By _________________________________________ )  Principal

(Signature)

___________________________________________ )

(Title)

___________________________________________ )

(Company)

By __________________________________________ )  Surety

(Signature)
(Title of Authorized Officer)

(The Surety Company shall append a single copy of a statement of its financial condition and a copy of the resolution authorizing the execution of Bonds by officers of the Company to the bond(s).)

(Acknowledgment of principal, unless it be a corporation)
STATE OF NEW YORK ss. :
COUNTY OF ________________

On this _____ day of _____________ 20 ___, before me personally came ______________________ to me known and known to me to be the person described in and who executed the foregoing instrument and acknowledged that he/she executed the same.

[Signature]
Notary Public

(Acknowledgment of principal, if a corporation)
STATE OF NEW YORK ss. :
COUNTY ______________

On this _____ day of _____________ 20 ___, before me personally came ______________________ to me known and known to me to be the person, who being by me duly sworn, did depose and say that he/she resides in _______________________, that he/she is the ___________________ of the ______________________ the corporation described in and which executed the foregoing instrument; and that he/she signed his/her name thereto by order of the Board of Directors of said Corporation.

[Signature]
Notary Public

(Acknowledgment of Surety Company)
STATE OF NEW YORK ss. :
COUNTY OF ______________

On this _____ day of _____________ 20 ___, before me personally came ______________________ to me known and known to me to be the person, who being by me duly sworn, did depose and say that he/she resides in _______________________, that he/she is the ___________________ of the ______________________ the corporation described in the foregoing instrument; and that he/she signed his/her name thereto by order of the Board of Directors of said Corporation.

[Signature]
Notary Public

State Of New York Office of the Attorney General
I hereby approve the foregoing contract and bond as to form and manner of execution.

SECTION 104 - SCOPE OF WORK

104-01 WORK REQUIRED.
The Contractor shall begin work within ten days of the date of the award notification by the Department, unless written consent of the Department is given to begin at a later date. The Contractor
shall perform all work enumerated under the terms of the contract and shall protect all adjoining properties, utility facilities and existing highway facilities within the right of way. The Contractor shall repair and/or replace any property, utility facility or highway facility damaged or destroyed by it or its employees through construction operations, within and adjacent to the right of way.

The Contractor shall coordinate the work of its Subcontractors, Manufacturers, Fabricators and Material Suppliers. Their operations shall be arranged and conducted so that delays will be avoided. Where the work of the Contractor, or Subcontractors, overlaps or dovetails with that of other Contractors, materials shall be delivered and operations shall be conducted so as to carry on the work continuously in an efficient and workmanlike manner.

During the life of this contract, Utilities may make changes in their facilities. These changes may be made by the Utility employees or by contract within the limits of or adjacent to this contract and may be temporary and/or permanent.

Delays or oversights on the part of the Contractor, Subcontractors or Utilities in properly completing any work, thereby requiring the removal and replacement of work already in place, will not be the basis for a claim of extra compensation. Such work will be performed at the cost and expense of the responsible Contractor, Subcontractor or Utility. Reference is made to General Obligations Law §11-102 which concerns the interference and/or delay of the Contractor's progress of work by Utilities.

104-02 CHANGES, CONTINGENCIES, EXTRA WORK AND DEDUCTIONS.

The provisions of Article 5, Alterations and Omissions of the contract agreement shall apply. Whenever the Department determines that from any unforeseen cause the terms of any contract should be altered to provide for changes, contingencies, extra work, or the deletion of work an order-on-contract may be issued to the Contractor shall promptly proceed with the performance of the work and the furnishing of the materials and equipment necessary for its accomplishment in accordance with the pertinent specifications. Such changes in quantities and alterations shall not invalidate the contract nor release the Surety, and the Contractor shall perform the work as altered.

No instructions, either written or verbal from any Department employee or agent shall be construed as an order for changes until receipt by the Contractor of written notification that an order-on-contract has been approved by the Department, or written notification from the Engineer that changes in the work are eligible and authorized for payment in accord with Section 697 Field Change Order. The Contractor may proceed with the work in advance of the approved order-on-contract if the Contractor has received an approved Authorization of Extra Work.

104-03 DIFFERING SITE CONDITIONS.

In accordance with 23 CFR 635.109(a)(1):

During the progress of the work, if subsurface or latent physical conditions are encountered at the site differing materially from those indicated in the contract or if unknown physical conditions of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in the work provided for in the contract, are encountered at the site, the party discovering such conditions shall promptly notify the other party of the specific differing site conditions before the site is further disturbed and before the affected work is performed.

Upon written notification, the Engineer will investigate the site conditions, and if it is determined that the conditions materially differ and cause an increase or decrease in the cost or time required for the performance of any work under the contract, an adjustment, excluding anticipated profits, will be made and the contract modified in writing accordingly. The Engineer will notify the Contractor, of the determination whether or not an adjustment to the contract is warranted.

No contract adjustment which results in a benefit to the Contractor will be allowed unless the Contractor has provided the required written notice.

The Department will administer the above Federal regulations as follows:

During the progress of the work, if subsurface or latent physical conditions are encountered at the site differing materially from those indicated in the contract or if unknown physical conditions of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in the work provided for in the contract, the party discovering such conditions shall promptly notify the other party of the specific differing site conditions before the site is further disturbed and before the affected
work is performed, with subsequent written notice to be provided later. The Contractor shall comply with
the notice and recordkeeping provisions of §104-06 Notice and Recordkeeping.

The Contractor or the State, as the case may be, must make written notice to the other party of the
existence of apparent subsurface or latent physical conditions if that party wishes to adjust the contract
price or time of performance, including direct costs and/or time related compensation, if applicable. Such
notice shall be given within ten (10) work days of the time at which the party had knowledge, or should
have had knowledge of the differing site condition. The Department will have no liability and no
adjustment will be made for any damages which accrued more than ten (10) work days prior to the filing
of such a notice with the Engineer.

Upon written notice, the Engineer will investigate the site conditions, and if it is determined that the
conditions materially differ and cause an increase or decrease in the cost or time required for the
performance of the work, an adjustment, excluding anticipated profits, will be made to the contract. The
Engineer will make an initial response in writing to the Contractor, within 15 work days, with a
determination whether or not an adjustment to the contract is warranted. Situations requiring examination
of the site or input from other Department personnel may require additional time to resolve. No contract
adjustment will be allowed unless the Contractor has provided the required written notice, or written
notice was provided to the Contractor by the State.

The Contractor shall keep daily records and make reports of all labor, material and equipment used in
connection with such work and the cost thereof as specified in §109-05C. Force Account Reports.

Compensation for increased costs of the work resulting from the differing site conditions will be made in
accordance with §109-05 Extra Work and Time Related Compensation. Compensation for time related
costs, if any, will be made in accordance with §109-05D. Time Related Dispute Compensation.

104-04 SIGNIFICANT CHANGES IN THE CHARACTER OF WORK.

In accordance with 23 CFR 635.109(a)(3):

The Engineer reserves the right to make, in writing, at any time during the work, such changes in
quantities and such alterations in the work as are necessary to satisfactorily complete the project. Such
changes in quantities and alterations shall not invalidate the contract nor release the Surety, and the
Contractor agrees to perform the work as altered.

If the alterations or changes in quantities significantly change the character of work under the
contract, whether such alterations or changes are in themselves significant changes in the character of
work, or by affecting other work cause such other work to become significantly different in character, an
adjustment, excluding anticipated profits, will be made to the contract. The basis for the adjustment shall
be agreed upon prior to the performance of the work. If a basis cannot be agreed upon, then an
adjustment will be made by the Department, either for or against the Contractor, in such amount as
determined to be fair and equitable.

If the alterations or changes in quantities do not significantly change the character of the work to be
performed under the contract, the altered work will be paid for as provided elsewhere in the contract.

The term ‘significant change’ shall be construed to apply only to the following circumstances: when
the character of the work as altered differs materially in kind or nature from that involved or included in
the original proposed construction; or when a Major Item of work, as defined elsewhere in the contract,
is increased in excess of 125 percent, or decreased below 75 percent of the original contract quantity.
Any allowance for a change in unit price shall apply only to that portion of work in excess of 125 percent
of the original contract item quantity, or in the case of a decrease below 75 percent, to the actual amount
of work performed.

The Department will administer the above Federal regulations as follows:

The Department may make, in writing, at any time during the work, any necessary changes in
quantities and alterations to the work in order to satisfactorily complete the project. If the Contractor or
the Department discovers a change that constitutes a significant change in the character of work as
defined below, the party discovering the change shall promptly provide the other party written notice of
the significant change in the character of work before additional work is performed. The Contractor shall
comply with notice and recordkeeping provisions of §104-06 Notice and Recordkeeping.

The Contractor or the State, as the case may be, must make written notice to the other party of the
existence of an apparent significant change in the character of work if that party wishes to adjust the
§104

contract price or time of performance, including direct costs and/or time related compensation, if applicable. Such notice shall be given within ten (10) work days of the time at which the party had knowledge, or should have had knowledge of an event, matter or occasion which results in a significant change in the character of work. The Department will have no liability and no adjustment will be made for any damages which accrued more than ten (10) work days prior to the filing of such a notice with the Engineer.

Upon written notice, the Engineer will investigate the changes and if it is determined that the alterations or changes in quantities significantly change the character of work, whether such alterations or changes are in themselves significant changes in the character of work, or by affecting other work, cause such other work to become significantly different in character, an adjustment, excluding anticipated profits, will be made to the contract. The Engineer will make an initial response in writing to the Contractor, within 15 work days, with a determination whether or not an adjustment to the contract is warranted. Situations requiring examination of the site or input from other Department personnel may require additional time to resolve. The basis for the adjustment shall be agreed upon prior to the performance of the work. If a basis cannot be agreed upon, then an adjustment will be made by the Department, either for or against the Contractor, in such amount as determined to be fair and equitable. No contract adjustment will be allowed unless the Contractor has provided the required written notice, or written notice was provided to the Contractor by the State.

The Contractor shall keep daily records and make reports of all labor, material and equipment used in connection with such work and the cost thereof as specified in §109-05C. Force Account Reports. Compensation for increased costs of the work resulting from significant changes in the character of work will be made in accordance with §109-05 Extra Work and Time Related Compensation. Compensation for time related costs, if any, will be made in accordance with §109-05D. Time Related Dispute Compensation.

A. Character of Work. The term ‘significant change’ shall be construed to apply only when the character of the work differs materially in kind or nature from that involved or included in the original proposed construction.

B. Major Items. The term ‘significant change’ shall be construed to apply to Major Items (as defined in §101-02 Definitions of Terms) only when the quantity of a Major Item is more than 125%, or is less than 75% of the original contract quantity. Any allowance for a change in the unit price shall apply only to that portion of work in excess of 125% of the original contract item quantity, or to the actual amount of work performed if the quantity decreases below 75% of the original contract item quantity. The Contractor or the State, as the case may be, must make written notice to the other party of the “significant change” in the quantity of a major item if that party wishes to adjust the contract price or time of performance. Knowledge of a “significant change” in quantity could result from receipt of an order on contract (approved or unapproved), a letter directing a change in the contract work, review of plan details and estimates, review of work completed or progress payment quantities, or a combination of the above. Payment for major items will be limited in accordance with §109-02 Payment for Altered Quantities.

C. Minor Items. The term ‘significant change’ shall be construed to apply to Minor Items (as defined in §101-02 Definitions of Terms) only when extra work both (1) increases the quantity of a Minor Item to more than 200% of the original contract quantity and (2) results in an increase of more than $1,000 from the original contract amount. Any allowance for a change in the unit price shall apply only to that portion of work both in excess of 200% of the original contract item quantity, and in excess of $1,000 from the original contract amount.

D. Composite Items. Composite items, for the purposes of this subsection, consist of rock and non-rock components, and are limited to unclassified excavation and trench and culvert excavation. The term ‘significant change’ shall be construed to apply only if the composite item is a Major Item, any individual component of the composite is less than 75% or more than 125% of the quantity stated in the Earthwork Summary Sheet used by the Department in preparing the contract, and the reasonable costs of the composite item either increases or decreases as a result of the change. The adjustment in payment shall be based on variance in quantity of the individual components from the
quantity stated in the Earthwork Summary Sheet. For contracts containing Major Items of unclassified excavation and/or trench and culvert excavation, the Contractor shall submit, at the request of the Engineer, its price breakdown of the bid price of the composite item for the rock and non-rock components.

**E. Fixed Quantity Items.** Certain items of work may be ‘fixed quantity’ items, and payment will be restricted to the quantity stated in the Estimate of Quantities. The term ‘significant change’ shall be construed to apply to fixed quantity items only if, during the progress of the work, the quantity of work is found to be less than 75% or more than 125% of the quantity stated in the Estimate of Quantities.

**F. Lump Sum Items.** Certain items of work may be Lump Sum items, wherein a single bid amount is intended to provide payment for all necessary work during the execution of the contract. The term ‘significant change’ shall be construed to apply to lump sum items only to the extent that changes in other contract work items result in a significant change in the character of work required to complete "Lump Sum" items of work.

### 104-05 SUSPENSIONS OF WORK DIRECTED BY THE ENGINEER.

In accordance with 23 CFR 635.109(a)(2):

> If the performance of all or any portion of the work is suspended or delayed by the Engineer in writing for an unreasonable period of time (not originally anticipated, not customary, or not inherent to the construction industry) and the Contractor believes that it is due additional compensation and/or contract time is due as a result of such suspension or delay, the Contractor shall submit to the Engineer in writing a request for adjustment within 7 calendar days of receipt of the notice to resume work. The request shall set forth the reasons and support for such adjustment.

Upon receipt, the Engineer will evaluate the Contractor's request. If the Engineer agrees that the cost and/or time required for the performance of the contract has increased as a result of such suspension and the suspension was caused by circumstances beyond the control of and not the fault of the Contractor, its Suppliers or subcontractors at any approved tier, and not caused by weather, the Engineer will make an adjustment (excluding profit) and modify the contract in writing accordingly. The Contractor will be notified of the Engineer’s determination whether or not an adjustment to the contract is warranted. No contract adjustment will be allowed under this clause to the extent that performance would have been suspended or delayed by any other cause, or for which an adjustment is provided or excluded under any other term or condition of this contract. No contract adjustment will be allowed unless the Contractor has provided the required written request for adjustment within the time prescribed.

The Department will administer the above Federal regulations as follows:

During the progress of the work, the Engineer may direct the Contractor in writing to suspend work due to circumstances beyond the Contractor's control. If the performance of all or any portion of the work is suspended or delayed by the Engineer for an unreasonable period of time (not originally anticipated, not customary, or not inherent to the construction industry) and the Contractor believes that it is due additional compensation and/or additional time to perform the work as a result of such suspension or delay, the Contractor shall promptly provide the Engineer written notice. The Contractor shall comply with the notice and recordkeeping provisions of §104-06 Notice and Recordkeeping.

The Contractor shall provide written notice to the Engineer of a request for adjustment within seven (7) calendar days of receipt of the notice to resume work. The Department will have no liability and no adjustment will be made for any damages which accrued more than seven (7) calendar days prior to the receipt of such a notice by the Engineer.

The Contractor shall keep daily records and make reports of all labor, material and equipment used in connection with such work and the cost thereof as specified in §109-05D. **Time Related Dispute Compensation.**

The Contractor shall then submit a request for contract adjustment and set forth the reasons and support for such adjustment. Upon receipt, the Engineer will evaluate the Contractor's request for contract adjustment, and if it is determined that the cost and/or time required for the performance of the contract has increased as a result of a suspension of work directed by the Engineer and the suspension was caused...
by circumstances beyond the control of and not the fault of the Contractor, its Subcontractors, Manufacturers, Fabricators or Material Suppliers and not caused by weather, an adjustment, excluding profits, will be made to the contract. The Engineer will notify the Contractor of the determination whether or not an adjustment to the contract is warranted. No contract adjustment will be made to the extent that performance would have been suspended or delayed by any other cause, or for which an adjustment is provided for or excluded under any other term or condition of this contract. No contract adjustment will be allowed unless the Contractor has provided the required written notice, or written notice was provided to the Contractor by the State.

Compensation for increased costs of the work resulting from a Suspension of Work Directed by the Engineer will be made in accordance with §109-05 Extra Work and Time Related Compensation. Compensation for time related costs, if any, will be made in accordance with §109-05D. Time Related Dispute Compensation.

104-06 NOTICE AND RECORDKEEPING.

The Contractor shall provide the Engineer written notice of its contentions regarding Differing Site Conditions, Significant Changes in the Character of Work, Suspensions of Work Directed by the Engineer, disputed work, time related disputes or any other dispute in accordance with the notice provisions of the pertinent subsection that establishes the notice requirements. After submitting the required notice, the Contractor shall complete its dispute submission in accordance with §105-14 Disputed Work and Dispute Resolution.

Failure of the Contractor to provide such written notice in a timely fashion will be grounds for denial of the dispute and the Department does not have to show prejudice to its interest before such denial is made. In the event the Contractor fails to provide the required written notice within the time limit established, and/or in the event the Contractor fails to maintain and submit such specified records, the dispute for compensation shall be deemed waived, notwithstanding the fact that the Department may have actual notice of the facts and circumstances which comprise such dispute and is not prejudiced by said failure.

A. Disputed Work. The Contractor shall provide written notice to the Engineer within ten (10) work days of receipt of a direction to complete work that the Contractor believes is not contract work, or that any direction of the Engineer that the Contractor believes exceeds the requirements of the provisions of the contract.

During the progress of such disputed work, the Contractor shall keep daily records in accordance with §109-05C.1. Daily Summary for all labor, material and equipment used for disputed work.

B. Time Related Disputes. If time related damages are presumed to have been incurred and after providing the Department written notice of a dispute for time related damages, the Contractor shall keep daily records of all labor, material, and equipment for effected work incurred due to the delay. Records shall identify each operation affected and the specific locations where work is affected.

If it has been agreed that a delay has or is occurring, beginning the week following the date written notice was provided of a time related dispute, the Contractor shall compile and submit records on a weekly basis for the preceding week. If a delay has not been determined until after it occurs, the Contractor shall compile records on a weekly basis. Costs that are incurred on a monthly or similar basis, such as field office expenses, shall be submitted within one week following the week of receipt.

The Contractor shall prepare and submit to the Engineer, if requested, weekly written reports until complete resolution of the dispute. Such reports shall be available at the next scheduled contract meeting, and provide the following information:
1. Potential effect on the Contractor's schedule caused by the time related dispute;
2. Identification of all operations that have been, are, or may be affected or delayed;
3. Explanation of how the Department's act or omission affected or delayed each operation, and estimation of how much more time is required to complete the work;
4. Itemization of all extra costs being incurred, including:
   a) An explanation as to how those extra costs relate to the effect or delay and how they are being calculated and measured.
   b) Identification of all employees for whom costs are being compiled.
   c) Identification of all items of equipment for which costs are being compiled.
104-07 SITE HOUSEKEEPING.

The contract site shall be cleaned up at the close of each work day, and be left in an orderly condition. Waste and debris shall be removed from the work site and surrounding areas cleaned of debris or waste generated from the work site. Containers shall be provided for the collection and separation of waste, and garbage and other waste shall be disposed of at frequent and regular intervals. Any salvaged material not specified to be disposed of otherwise, shall become the property of the Contractor and shall be removed from the site.

104-08 MAINTAINING TRAFFIC.

The Contractor shall maintain and protect traffic in accordance with the requirements of the MUTCD and the contract documents.

A. Closing of Highway. The legal closing of a highway to public travel in the manner provided by Section 104 of the Highway Law will be done by the Commissioner or by the County Superintendent of Highways when requested by the Department. Not all highways are legally closed during highway construction operations.

When a highway is legally closed and public travel diverted therefrom, adequate warning, danger and direction signs and lights shall be erected and maintained by the Contractor to properly protect and direct public travel by day and by night. Suitable barricades shall also be erected at the ends of such closed sections of highways and large signs displayed indicating such closure. All signs, barricades and other traffic control devices used shall conform to the MUTCD.

B. Use of Restricted Highway. With the award of a contract the Commissioner will, unless otherwise specified, designate the section of highway under contract a “Restricted Highway” pursuant to Section 104A of the Highway Law and Section 1625 of the Vehicle and Traffic Law. Pursuant to these legal sections, the Commissioner has the authority to (1) establish maximum and minimum speed limits at which vehicles may proceed along any such Restricted Highway; (2) establish weight and dimension limits of vehicles; (3) regulate the use of such Restricted Highway by pedestrians, equestrians, and animals; (4) regulate parking, standing, stopping, and backing of vehicles; (5) control persons and equipment engaged in work on such highway. When used on such Restricted Highways, all traffic control devices shall be considered as official traffic control devices and shall conform to the MUTCD.

The Commissioner will therefore cause signs indicating such restrictions to be placed at such points as deemed necessary for the safe use of the Restricted Highway. The traveling public and Contractor must observe and comply with these restrictions, as posted, except that the Contractor may be allowed greater latitude with respect to size and weight of construction equipment.

Construction Equipment or vehicles shall be operated on the Restricted Highway as provided under §105-12 Load Restrictions.

104-09 CONTRACTOR’S RETENTION OF RECORDS.

The Contractor shall retain all records for six years following the date of final contract payment. Required records shall include all payrolls, accounts, details that comprise its total cost pursuant to any of the provisions under §104-02 Changes, Contingencies, Extra Work and Deductions, records maintained pursuant to §105-14 Disputed Work and Dispute Resolution and §109-05 Extra Work and Time Related Compensation, papers, maps, photographs, or other documentary materials, regardless of physical form or characteristics, made or received by the Contractor in connection with the contract. Legible copies including microfilm copies, are acceptable, provided they are so arranged, identified, and indexed that any individual document, or component of the records, can be located with reasonable facility.

The Contractor shall make such records available to the Department for review and audit upon request, if deemed necessary by the Department. In case all or a part of such records are not made so available, the Contractor understands and agrees that any items not supported by reason of such unavailability of the records shall be disallowed, or if payment therefore has already been made, the Contractor shall, upon demand in writing by the Commissioner, refund to the Department the amount so disallowed.
104-10 VALUE ENGINEERING CHANGE PROPOSAL (VECP).

A. Purpose and Scope. The purpose of a Value Engineering Change Proposal (VECP) is to encourage the use of the Contractor’s ingenuity and experience in arriving at alternative construction designs, methods, and procedures that result in a lower direct cost to accomplish a contract requirement. It is the intent of this provision to share with the Contractor any substantial direct cost savings which may be generated as a result of a VECP offered by the Contractor and approved by the Department. A VECP is a Contractor-initiated change request. If approved, the changes and payments will be authorized through the order-on-contract process. Before a VECP can be implemented, it must pass through three approval processes: conceptual approval, formal approval, and order-on-contract approval. To expedite the review process, the Contractor has the option of jointly submitting the conceptual VECP and the formal VECP for simultaneous review. If the VECP receives formal approval, as part of the order-on-contract process the Contractor may request that the Department consider granting advanced authorization of extra work.

The VECP should produce direct cost savings to the Department and the public without, in the sole judgment of the Department, impairing essential functions and characteristics of the facility including but not limited to service life, economy of operation, ease of maintenance, desired appearance, and safety. The Contractor, when developing a VECP, shall address the designer’s objectives, environmental permit requirements and regulations, commitments made to the public to mitigate the impact of construction, and other such concerns.

The ‘direct cost savings’ is the difference of the ‘construction savings’ generated by implementing the VECP minus reasonable ‘design costs’ associated with the VECP. The ‘construction savings’ is the difference between what it would cost to complete all the contract work without implementing the VECP and the cost to complete all the contract work if the VECP is implemented. This includes any changes to quantities or unit prices across the entire contract if affected by the VECP. If the estimated cost to complete all the contract work without implementing the VECP differs from the contract bid amount for the work, supporting documentation to explain the variance shall be provided. Reimbursable ‘design costs’ are specific to engineering changes (examples: design changes, plan sheet revisions, and quantity estimating). Expenditures toward proposal preparation (examples: scheduling, documentation, cost analysis, material research, etc.) are not reimbursable.

Indirect cost savings (time, user delay, railroad force account costs, inspection costs, etc.), although considered when reviewing the merits of the VECP, are not reimbursed. A VECP may alter the progress schedule and milestone dates, which in turn could affect time-related contract provisions.

Proposals that reduce the time to complete the contract, and only result in indirect cost savings, may be accepted based on the mutual benefit derived. These proposals will be evaluated in accordance with §104-10F. Time Savings.

B. Submittal of Conceptual VECP. A conceptual proposal is required for all VECP. It should outline the general technical concepts associated with the VECP and the estimated direct cost savings which may result. Upon review by the Department, one of the following actions will be taken:

- Conceptual approval, and a request for the Contractor to submit a formal VECP.
- Request for additional information
- Rejection of the VECP

The Contractor shall submit an original and three copies of the conceptual VECP to the Engineer along with any additional information requested by the Department. The conceptual VECP should contain sufficient information for concept review and evaluation, including the following as a minimum:

1. Conceptual VECP Summary. A summary of the VECP identified as ‘Conceptual VECP’ which includes:
   a. Short title (description) of the VECP (10 or less words).
   b. Contract information (Contract D number, PIN, contract description, contractor, federal aid number if applicable, letting date, Region, and county).
   c. Original total contract bid price.
   d. Estimated contract cost. This may be different from the original total contract bid price due to addition or alteration of work (i.e., the estimated cost to complete the work if the VECP is not implemented). The Engineer must concur with the estimated contract cost.
e. Estimated contract cost if the VECP is implemented (excludes VECP design cost and any VECP construction savings reimbursement).

f. Estimated VECP construction savings (Item d. minus Item e.).

g. Estimated VECP design cost (Not all VECP will have design cost).

h. Estimated direct cost savings due to the VECP (Item f. minus Item g.).

i. Fifty percent (50%) of the estimated direct cost savings (This should equal the overall savings to the State).

j. Estimated total adjusted contract cost if VECP is implemented (includes VECP savings and design cost reimbursements).

k. The type of VECP (either ‘Cost Savings’ or ‘Time Savings Only’).

l. Date by which the authorization of extra work (order-on-contract) must be granted. (If time sensitive, requests for advance authorization of extra work per §104-02 Changes, Contingencies, Extra Work and Deductions will be considered.)

m. Identification of any new or existing contract pay items requiring agreed prices.

n. Identification of any materials with long lead times (to order, fabricate, deliver, etc.) that may require purchase authorization from the Engineer prior to formal approval/disapproval of the VECP, or may delay the implementation of the VECP. Identify any date by which authorization to order these materials must be received without affecting the progress schedule.

o. A basic description of the VECP and associated benefits and impacts (progress schedule, environmental, maintenance & protection of traffic, quality, etc.).


3. Design Criteria. If the VECP proposes design changes, supporting technical design criteria shall be provided.

4. Schedules.

a. The most recently approved baseline progress schedule.

b. The most recently approved construction progress schedule update.

c. A draft, proposed, revised progress schedule illustrating the impacts of the VECP. The schedule shall identify: (1) the time required to develop a formal VECP; (2) the time required to order, fabricate, and deliver materials with long lead times; (3) the time required to obtain any environmental permits or other required approvals; (4) any anticipated progress schedule changes (contract completion date, milestone dates, task durations, etc.); (5) the latest date by which authorization of the VECP order-on-contract work must be granted without affecting the schedule. The draft progress schedule should provide a sufficient level of detail upon which the reasonableness of the VECP can be determined.

Should the Department find that insufficient time is available for review and processing, it may reject the VECP solely on such basis. If the Department fails to respond to the VECP by the date specified, the Contractor will consider the VECP rejected and will have no basis for a dispute against the State as a result thereof. The Department may accept a VECP that requires a contract time extension if sufficient cost savings are anticipated.

5. Estimate of costs. The conceptual VECP estimate of costs should include sufficient information to determine the reasonableness of the VECP. If the proposal requires the ordering of materials, the Contractor needs to provide documentation from the suppliers to justify the cost of the materials.

6. Previous Use or Testing. A description of any previous use or testing of the VECP on another Department contract or elsewhere and the conditions and results therewith. The Contractor shall submit the technical aspects of the VECP in sufficient detail so the Department can determine the suitability of the VECP from an engineering perspective. If the technology is new, test information shall be provided to the Department's satisfaction. If a similar VECP was previously submitted on another Department contract, indicate the date, contract number, and the action taken by the Department.
C. Submittal of Formal VECP. Upon notification by the Engineer that the conceptual VECP is approved and a formal VECP is necessary, the Contractor will submit to the Engineer an original and three copies of the following materials and information for each formal VECP along with any additional information requested by the Department:

1. Formal VECP Summary. A summary of the VECP, identified as ‘Formal VECP’, which follows the conceptual VECP summary format and information requirements (Information and estimates may have changed since the conceptual VECP).

2. Complete Plans and Specifications. Complete plans and specifications, which meet Department standards, showing the proposed changes relative to the original contract features and requirements. The Department requires a Professional Engineer’s stamp and signature on any significant engineering changes.

3. Field Change Sheets. Field change sheets and/or shop drawings. If the VECP results in a field change, and those items affected require the submission of shop drawings, the shop drawings will not be accepted unless accompanied by corresponding field change sheets. Documents shall be developed in compliance with Department requirements. The Department requires a Professional Engineer’s stamp and signature on any significant engineering changes.

4. Schedules. The same information requirements as for the conceptual VECP apply, except that a formal, proposed, revised progress schedule in accordance with §108-01 Progress Schedule is required.

5. Cost Analysis. A complete cost analysis indicating quantity changes, unit price changes, and new contract pay items. As a minimum it shall include:
   a. An itemized comparison of estimated costs to complete all the contract work with implementing the VECP and without implementing the VECP.
   b. Proposed unit prices for any new contract pay items introduced by the VECP and appropriate documentation for review under the Agreed Price process.
   c. Proposed unit prices for any existing contract pay items for which agreed prices are sought due to a significant change in character of work (quantity or complexity), see §104-04 Significant Changes in the Character of Work. Appropriate documentation for review under the Agreed Price process is required.
   d. The cost of any items with long lead times (e.g., materials ordered) required after conceptual approval and before final approval shall be identified.

6. Differences. Full descriptions of the difference between the existing contract requirements and the proposed changes, and the comparative advantages and disadvantages of each, including considerations of service life, economy of operation, ease of maintenance, traffic flow, safety, desired appearance, progress schedule, and any increase/reduction of environmental impacts.

7. Technical Presentation. The Contractor may be required to conduct a technical presentation as part of the review process.

8. Cost Documentation. All formal VECP costs submitted shall be supported by documentation as required by §109-05 Extra Work and Time Related Compensation.

The Department will not formally approve any VECP until all required VECP documentation has been submitted and is acceptable to the Department.

A formal VECP may be submitted concurrently with the conceptual VECP, however, the Contractor assumes any costs associated with the formal VECP at its own risk. Reimbursable costs will be considered only if the conceptual VECP is approved. Clearly identify whether a VECP is being submitted for conceptual approval, formal approval, or both.

Once a formal VECP has been approved, the VECP will then be submitted as an order-on-contract and processed accordingly. If time sensitive, requests for advanced authorization of extra
work per §104-02 Changes, Contingencies, Extra Work and Deductions will be considered, but only after formal VECP approval. The Contractor is responsible for submitting all appropriate information to the Engineer in a timely manner.

**D. Conditions.** The Contractor shall not base any bid prices on the anticipated approval of a VECP and should recognize that any VECP may be rejected. The following terms and conditions apply to VECP:

1. A VECP will only be considered after the contract is awarded.
2. A VECP applies only to the contract for which it was submitted. One VECP shall not be submitted for multiple contracts. Approval or disapproval of a VECP on one contract does not guarantee approval or disapproval on another contract.
3. The VECP becomes the property of the Department and will contain no restrictions imposed by the Contractor on its use or disclosure. The Department will have the right to use, duplicate, and disclose in whole or in part any data necessary for the utilization of the VECP. The Department retains the right to utilize any accepted or rejected VECP or part thereof on any other project without any obligation to the Contractor.
4. Approval of the conceptual VECP in no way obligates the Department to approve the formal VECP. The Contractor will have no claim against the Department as a result of the rejection of any such conceptual or formal VECP except as otherwise provided in §104-10E.4. Payment.
5. When the Department is in the process of making design and specification revisions and a Contractor submits a VECP with similar revisions, the Department will reject the VECP and proceed without any obligation to the Contractor.
6. A VECP will be considered only if reasonable, cost-effective options are not provided in the contract documents.
7. The Department will be the sole judge as to whether a VECP qualifies for consideration and evaluation. It may reject any VECP that requires excessive time or costs for design review, evaluation, and/or investigations. The Department will be the sole judge in determining if the proposed VECP will result in a sufficient amount of direct or indirect cost savings to offset the Department's effort to review the VECP.
8. A VECP shall be consistent with the Department's design policies and basic design criteria, provide the same service life or more, facilitate economy of operations, ease of maintenance, and achieve the desired appearance and safety.
9. A VECP will not be allowed that changes the type and/or thickness of the pavement structure and material, or solely substitutes one material for another. Examples of materials that may fall into this inappropriate substitution situation are drainage pipes, bridge coatings, pavement markings, etc. The simple elimination of work does not necessarily constitute a VECP, however, a VECP which introduces a simple material substitution, or elimination of work, may be considered if it is accompanied by a design change or change in the construction method. A simple material substitution which introduces a new material to the Department may be also considered.
10. The VECP will not be experimental in nature, but will have been proven to the Department's satisfaction under similar or acceptable conditions on another Department contract or at another location acceptable to the Department.
11. If the Department requires any additional information to evaluate the VECP, this information shall be provided in a timely manner. Unless otherwise mutually agreed upon, failure to do so will result in the rejection of the VECP. An incomplete or a poor quality VECP which hinders the Department's review may also result in the rejection of the VECP.
12. The Contractor shall encourage submissions of VECP from an approved Subcontractor, provided that reimbursement is made by the Department to the Contractor and that the terms of payment to the Subcontractor are satisfactorily negotiated and accepted before the VECP is submitted to the Department. Subcontractors may not submit a VECP except through the Contractor.
13. A VECP approved by the Department is considered to be a revision to the contract documents and progress schedule. Consequently, if unsatisfactory results are being achieved or adjustments
are necessary during implementation of a VECP, the rejection of work, removal of work, addition of work, or revision of work shall be evaluated in accordance with the Standard Specifications.

14. All contract pay items and quantities referenced in the VECP construction savings analysis shall be Department-approved contract provisions. Any extra work, inclusion of an omission of work, or other field changes shall be authorized prior to use in VECP savings calculations.

15. No work related to a VECP will be performed under force account. Agreed prices must be reached for any contract pay items related to the VECP before the VECP is approved. If the Contractor is deemed to have taken reasonable diligence in determining the work involved but if during the construction of VECP work a significant change in the character of work occurs, the Department may consider new agreed prices.

16. The Contractor will receive written notification from the Department when the VECP is approved. Material orders placed prior to VECP approval shall be submitted at the Contractor's risk.

17. Once a VECP has been submitted, no work, whether it is the original contract work that might be affected by the VECP or the proposed VECP work, should be performed until the VECP has been formally approved or disapproved. If the Contractor opts to perform work during the approval process, they do so at their own risk. If a VECP is approved and implemented, no payments will be made toward any original contract work affected by the VECP which the Contractor may have performed at risk. If a VECP is disapproved or not implemented, no payments will be made toward any VECP work that the Contractor may have performed at risk. The Contractor should consider potential impacts to the progress schedule and work limitations during the VECP approval process before submitting a VECP.

E. Payment. If the VECP is accepted by the Department, the changes and payments will be authorized through an order-on-contract. Reimbursement to the Contractor will be made as follows:

1. A VECP introduces two individual payments, one for VECP construction savings, and one for VECP design cost. The contract pay item changes along with the VECP construction savings and design cost reimbursements to the Contractor should be submitted in one order-on-contract.

2. The Department will pay to the Contractor fifty percent (50%) of the VECP construction savings. The VECP construction savings is the difference between the actual contract costs with the VECP implemented and a detailed estimate of what it would have cost to complete the contract work without implementing the VECP, based on final construction. If final construction savings differs from the amount estimated in the formal VECP, an adjustment may be made and included in another order-on-contract. The VECP construction savings reimbursement to the Contractor will not be paid until the VECP work has been completed (progress payments on the completed VECP work are allowed). The Department may withhold all or a portion of the payment for the Contractor's share of the VECP construction savings until the final contract accounting. In the event that at final contract accountings the implementation of VECP actually results in no construction savings, then the Contractor will receive no VECP construction savings payment. The Department is the sole judge in deciding the construction savings due to the implementation of the VECP. The Department will withhold VECP construction savings reimbursement until the Contractor supplies all required VECP documents.

3. If a design cost is submitted for a VECP, the Department will pay to the Contractor a fifty percent (50%) share of the Contractor's reasonable cost for design incurred after conceptual VECP approval. If the design cost submitted for Department approval is deemed unreasonable, only fifty percent (50%) of the design cost deemed to be reasonable will be reimbursed. Not every VECP will have a design cost associated with it. The Department is the sole judge in determining the reasonableness of the design cost. Reimbursable design costs are for engineering changes. Preparation and submission of the proposal (e.g., savings analysis, progress scheduling, etc.) are not considered design costs and are not reimbursable. Reimbursable VECP design may be performed by a consultant or directly by the Contractor. The Contractor shall not be charged for, nor can the Contractor claim, any VECP design performed by the Department.

The design cost shall be submitted as a lump sum item with supporting documentation. The supporting documentation shall include itemized direct salary costs (rates & hours), overhead (only for consultant design), and direct non-salary costs. Payment for direct salary costs and
overhead will be limited to the current Department reimbursement policies for Consultant Engineering agreements.

For consultant design, reasonable overhead on the direct technical salaries will be reimbursed. For Contractor design, overhead is not reimbursable for direct salary costs. Overhead shall not be charged for direct non-salary costs whether incurred by the Contractor or by a consultant. Payment for direct non-salary costs will be made at actual cost paid. Although for certain direct non-salary costs (lodging, meals, mileage) there are prevailing maximum rates established by the State Comptroller which the reimbursement rates shall not exceed.

The subtotal of direct salary costs, overhead, and direct non-salary costs shall be considered a ‘professional service fee’ and reimbursed in accordance with §109-05B.3. Service Charges. A maximum five percent (5%) for the Contractor’s contract supervision and overhead is allowed, in addition to any overhead submitted for consultant direct salary costs. All design costs are subject to audit. Additional supporting documentation (receipts, time sheets, etc.) shall be supplied in a timely manner if requested by the Department.

In the case of a formal VECP being jointly submitted with the conceptual VECP, the Department will pay to the Contractor a fifty percent (50%) share of the Contractor’s reasonable cost for design specific to the development of the formal VECP (nothing toward the conceptual VECP) if the conceptual VECP is approved.

4. In the event of the Department’s conceptual approval of a direct cost savings VECP, and the Contractor is directed to proceed with the VECP implementation steps and final approval is not reached, regardless of whether due to the actions of the Department or the Contractor, fifty percent (50%) of the total reasonable design costs will still be reimbursed to the Contractor. If “advance” written approval was given to proceed with the work, procure materials, and begin fabrication; and rejection occurs, the work and fabrication costs will be reimbursed in accordance with §109-05, Extra Work and Time Related Compensation. Only those materials not incorporated and unique to the contract (i.e., not restockable) will be evaluated for payment.

5. There will be no reimbursement for any costs incurred for the conceptual VECP or prior preparations.

6. If more than one VECP is approved for a contract, construction savings and design costs shall be tracked separately for each VECP.

7. When multiple submittals of information for a VECP are required to satisfy the information needs of the conceptual or formal VECP procedure, and contract timing will be negatively impacted before review and subsequent approval can be given by the Department, then the VECP may be rejected. In such cases, there will be no claim by the Contractor for design costs or loss of anticipated savings and/or profits.

8. VECP payments only involve direct savings or costs. Indirect savings or costs (time, user delay, contract delay, etc.) are not included in VECP payment calculations. The calculations of VECP payments are independent from the payments or penalties for contract time related issues. If a VECP revises the progress schedule, the contract milestones upon which time related provisions are based may be affected. Time savings resulting from a VECP may be realized in a time related contract provision. Conversely, if a VECP negatively affects a progress schedule, time related contract provisions may be negatively affected.

F. Time Savings. The Department will consider proposals that result in time savings and at the same time may increase the cost of the contract. The Department will be the sole judge as to whether the benefits of completing the contract, or a phase, before the scheduled completion date or milestone offsets any increase in cost. These submittals, while not constituting a Value Engineering Change Proposal, will be reviewed using the VECP approval process. In addition to information required in §104-10B. Submittal of Conceptual VECP and §104-10C. Submittal of Formal VECP, the Contractor shall provide the Department the anticipated amount of time to be saved and sufficient information to enable the Department to calculate and evaluate the cost benefit of the savings in user delay. Time savings generated by the VECP may be claimed under an existing time related contract provision. If the time savings VECP increases the cost of the contract, the additional cost shall not be subtracted from any time related contract provision payments.
G. Significant Changes. The description of what will be considered a ‘significant change’ associated with a VECP are identified in §104-04 Significant Changes in the Character of Work. Once a VECP is approved, any future significant change is no longer based on the original contract bid conditions (quantity, nature or kind of a material involved), but rather on the conditions as adjusted by the VECP (adjusted quantities, anticipated site conditions and materials, etc.). Any item that was identified as a Major Item in the original contract documents is still considered a Major Item regardless of the change in quantity or price due to the VECP.

All significant changes shall be agreed upon prior to formal VECP approval. If after formal VECP approval, an unforeseen change in the VECP work causes a significant change in the character of work, quantities and prices may be adjusted and the VECP savings shall be adjusted accordingly.

SECTION 105 - CONTROL OF WORK

105-01 ENGINEER’S AUTHORITY.

The Engineer will make all decisions for the Department regarding the quality and acceptability of materials furnished, work performed, work progress, and contract interpretation. All communications by the Contractor with the Department, written or verbal, shall be in English. All references to costs, charges, prices, etc. shall be in United States dollars.

The Engineer may stop by written order any work or any part of the work under the contract if the methods or conditions are such that 1) unsatisfactory work might result; or 2) if improper material(s) or procedure(s) are being used; or 3) if the Contractor fails to comply with any requirement or provision of the contract documents or with any State or Federal law or regulation; or 4) conditions are considered to be sufficiently deficient as to seriously affect the safety of the public or the workers employed; or 5) non-conformance with the maintenance and protection of traffic provisions is causing serious disruptions to traffic operations. The Contractor will not be entitled to any additional monetary compensation for such a work stoppage. Any work completed in violation of a written stop order will not be paid for even if subsequently determined to be acceptable.

105-02 CHARACTER OF WORKERS.

The Contractor shall give its constant attention to the work while it is in progress or it shall place it in charge of a competent and reliable English speaking Superintendent, who shall have authority to act for the Contractor and who shall be acceptable to the Engineer.

The Contractor shall, at all times, employ sufficient workers to progress the work to completion in the manner and time specified. All workers shall have sufficient skill and experience to properly perform the work assigned them. All workers engaged on special or skilled work shall have had sufficient experience in such work to properly and satisfactorily perform it and operate the equipment involved. Any person employed by the Contractor whom the Engineer may deem unruly, disorderly, incompetent or unfit to perform the work shall be at once discharged, and shall not be again employed. In case of a disagreement with the Contractor regarding the discharge of such employees, the matter may be reviewed by the Director, Construction Division.

Whenever the Contractor or its superintendent is not present on any part of the work where it may be desired to give directions, orders will be given by the Engineer or his/her representative and shall be received and obeyed by the foreperson who may have charge of the particular work in reference to which the orders are given. All forepersons shall speak English.

105-03 METHODS AND EQUIPMENT.

Where particular methods or equipment are specifically required, the Contractor may apply in writing to the Regional Director to use alternate methods and equipment to provide the same results. Such alternates may be used only after favorable recommendation by the Regional Director and the written approval of the Director, Construction Division. When, in the opinion of the Regional Director, satisfactory results are not being obtained using the Contractor’s alternate methods and equipment, the methods and/or equipment shall be immediately modified to produce satisfactory results.

The Contractor may use the most efficient equipment that is consistent with conditions at the time of use. It is anticipated that seasonal or weather conditions combined with the nature of the terrain will often require the use of lighter and smaller equipment than might be used under optimum conditions.

Earthwork construction operations requiring compaction shall not be performed from November 1 to
April 1 except with the written permission of, and under such special conditions and restriction as may be imposed by the Regional Director.

§105

105-04 INTERPRETATION OF CONTRACT DOCUMENTS.

In case of any difference in the interpretation of the plans, special provisions, specifications, special specifications, standard sheets, or between them, the Contractor shall immediately submit the matter to the Engineer. The Engineer will consult with other Department personnel, as necessary, and provide the Contractor with an interpretation in a timely manner.

The detail plans and specifications for the contract have been prepared with care and are intended to show as clearly as is practicable the work required to be done. The Contractor shall realize, however, that construction details cannot always be accurately anticipated and that in executing the work, field conditions may require reasonable modifications in the details of plans and quantities of work involved. Contract work shall be carried out to meet these field conditions to the satisfaction of the Engineer and in accordance with his/her instructions and the contract documents.

In the event the Contractor discovers an error or omission in the contract documents, it shall immediately notify the Engineer. The Engineer will then make such corrections and interpretations as may be deemed necessary for fulfilling the intent of the contract documents.

105-05 REASONABLE CLOSE CONFORMITY WITH CONTRACT DOCUMENTS.

All work performed and all materials furnished shall be in reasonable close conformity with the lines, grades, cross sections, dimensions and materials requirements, including tolerances, shown in the contract documents.

Plan dimensions and contract specification values are to be considered as the target value to be strived for and complied with as the design value from which any deviations are allowed. It is the intent of the specifications that the materials and work quality shall be uniform in character and shall conform as nearly as realistically possible to the prescribed target value or to the middle portion of the tolerance range. The purpose of the tolerance range is to accommodate occasional minor variations from the median zone that are unavoidable for practical reasons. When a maximum or minimum value is specified, the production and processing of the material and the performance of the work shall be so controlled that material or work will not be preponderantly of borderline quality or dimension.

In the event the Engineer finds the materials or the finished product in which the materials are used not within reasonable close conformity with the plans and specifications, but that reasonably acceptable work has been produced, the Engineer shall then make a determination if the work shall be accepted and remain in place. In this event, the Engineer will document the basis of acceptance by contract modification which will provide for an appropriate adjustment in the contract price for such work or materials as he/she deems necessary to conform to his/her determination based on engineering judgment.

In the event the Engineer finds the materials or the finished product in which the materials are used or the work performed are not in reasonable close conformity with the plans and specifications, and have resulted in an inferior or unsatisfactory product, the work or materials shall be removed and replaced or otherwise corrected by and at the expense of the Contractor.

105-06 COOPERATION WITH UTILITIES AND OTHER CONTRACTORS.

The Contractor shall cooperate with Utilities and other contractors and coordinate and arrange the sequence of its work to conform with the operations of the work of other parties indicated in the Base Line Data. Delays and interferences to the Contractor's performance caused by activities of other Department contractors, which delays and/or interferences could not reasonably have been anticipated from the contract documents, may entitle the Contractor to an appropriate extension of time and/or time related damages.

The Contractor is responsible for cooperation and adjustments with the contractors already engaged and to be engaged upon the site to properly coordinate the construction efforts of all contractors, utilities, and subcontractors engaged in the work within and adjacent to the contract site. In the event that utility facility adjustments are to be made by a Utility's forces in connection with and during the life of the contract, the Contractor shall cooperate with the Utilities and coordinate and arrange the sequence of its work to conform with the progressive operations of the Utility's work underway or to be put underway.

In case of interference between the operations of the Utilities and contractors, the Department will adjust as necessary the schedule of each contractor and the sequence of work necessary to expedite the
§105

completion of the entire project. If it becomes necessary, coordination and access problems will be resolved by the Department.

If any part of the Contractor's work depends on the work of any other contractor and/or the Department for proper execution and/or results, that would render its work unsuitable for proper execution and/or results, the Contractor shall promptly notify the Department of any discrepancies and/or defects in said other work prior to proceeding with its own work.

105-07 TERMINATION.

The provisions of Article 11 Right to Suspend Work and Cancel Contract of the contract agreement shall apply.

The Commissioner may, by written notice, terminate the contract or any portion thereof after determining that for reasons beyond either Department or Contractor control it is not feasible to proceed with or complete the work originally contracted for, and that termination would therefore be in the public interest. Such reasons for termination may include, but need not be necessarily limited to, executive orders of the President relating the prosecution of war or national defense, national emergency which creates a serious shortage of materials, orders from duly constituted authorities relating to energy conservation, and restraining orders or injunctions obtained by third-party citizen action resulting from national or local laws or regulations, or where the issuance of such order or injunction is primarily caused by acts or omissions of persons or agencies other than the Contractor, or where the orderly progression of a project is interfered with or delayed by acts or omissions of persons or agencies other than the Contractor. The Contractor specifically understands that the issuance of such notice by the Commissioner shall be conclusive as to its necessity.

When the contract, or any portion thereof is terminated, for any of the above mentioned reasons, before completion of all items of work in the contract, payment will be made for the actual numbers of units or items of work completed at the contract unit price, or as mutually agreed for items of work partially completed, but no claim for loss of anticipated profits on uncompleted work shall be made by the Contractor nor shall the State of New York be liable for the loss of anticipated profits for such uncompleted work.

In such cases of termination, reimbursement for organization of the work (when not otherwise included in the contract) and moving equipment to and from the contract site will be considered where the volume of work completed is too small to compensate the Contractor for these expenses under the contract unit prices, the intent being that an equitable settlement will be made with the Contractor.

Acceptable materials, obtained by the Contractor for the work, that have been inspected, tested and accepted by the Engineer, and that are not incorporated in the work, shall be returned to the Manufacturer, Fabricator, or Material Supplier whenever it is possible to do so at nominal or no cost. Where the Contractor returns such materials to its Manufacturer, Fabricator, or Material Supplier, the State will pay the Contractor the actual documented costs connected with returning such materials to the extent such costs are reasonable as determined by the Department. In the event the Contractor is unable to return such material at reasonable or no cost, and provides documentation satisfactory to the Department that such material can not be economically returned, the State will be responsible for all such material and will either direct the manner of disposition or purchase such material from the Contractor at actual cost as shown by receipted bills and actual cost records to the extent such costs are reasonable as determined by the Department, at such points of delivery as may be designated by the Engineer.

Termination of a contract or a portion thereof shall not relieve the Contractor of its responsibilities for the completed work, nor shall it relieve its surety of its obligation for and concerning any just claims arising out of the work performed.

105-08 REMOVAL OF UNACCEPTABLE AND UNAUTHORIZED WORK.

All work which does not conform to the requirements of the contract shall be considered unacceptable unless otherwise determined acceptable under the provisions in §105-05, Reasonable Close Conformity with Contract Documents.

The Department may direct the Contractor to remove any portion of the work performed under this contract for inspection or for any other purpose. If such inspection shows that the work was constructed in accordance with the terms of the contract, payment shall be made to the Contractor for such removal and subsequent replacement at a fair and reasonable price for the work performed. No payment will be made for such removal or for replacement of the work to satisfactory condition if such inspection shows that the
work was not constructed in accordance with the contract requirements. No payment will be made for the removal or replacement of any work which may itself be satisfactory, but the removal of which is necessary for the replacement of unsatisfactory work. No payment shall be made in such removal and replacement situations if work was done or materials furnished without inspection by an authorized Department representative.

The above paragraph shall not apply to concrete foundation for pavement or portland cement concrete pavement rejected as a result of core tests. Work so rejected shall be removed and replaced at no additional cost to the State.

All work shall be in satisfactory condition at the time of contract acceptance. Any work done or materials used without inspection by an authorized Department representative may be ordered removed and replaced at the Contractor's expense.

Unacceptable work, whether caused by poor work, defective materials, damage through carelessness or any other cause found to exist prior to the final acceptance of the work, shall be removed immediately and replaced in an acceptable manner irrespective of the presence of, or lack of, a Department Inspector or representative. This clause shall have full effect regardless of the fact that the defective work may have been done or the defective materials used with the full knowledge of the Inspector. The fact that the Inspector or Engineer may have previously overlooked such defective work shall not constitute an acceptance of any part of it.

105-09 WORK AFFECTING RAILROADS.

Requirements and procedures for operations on or adjacent to railway facilities are found in a Special Note entitled “Special Provisions for Protection of Railway Interests”.

A. Railroad Clearances. No temporary bridge, falsework, staging or obstructions shall be erected over the track or tracks where the vertical underclearance is less than 6.71m (22 feet) over top of rail until the existing bridge warnings have been relocated or new or temporary bridge warnings are installed by the railroad company or companies affected and are in service.

An operated track, catenary or electrical facility is fouled when any object is brought closer than the clearances set forth by the railroad company. Vehicles or construction equipment shall be considered to be fouling the track when located in such a position that failure of same with or without load brings the equipment within the fouling limit. The Contractor shall conduct its work and handle its equipment such that no part of any material or equipment shall foul an operated track, catenary, electrical facility, or signal facility without written permission of the chief engineer of the railroad company or companies affected.

Information on required railroad clearances may be found in the contract documents in a Special Note entitled “Special Provisions for Protection of Railway Interests”. If fouling distances are provided by Special Note, the Contractor need not contact the railroad to verify fouling distances. If information on required railroad clearances is not provided in the contract documents, the Contractor shall contact the railroad facility owner prior to operation of any equipment or vehicles within 6.0 meters of the centerline of a track; within 4.5 meters of a catenary, electrical wire or other electrical facility; or within 4.5 meters of a signal wire or other signal facility to establish the fouling limits for that facility.

B. Supervision and Railroad Approval. All work on any contract affecting a railroad company’s property, right of way facilities, including temporary track detour, shall be carried out under the joint supervision of the Department and the railroad company or companies in a manner satisfactory to both agencies.

Information on required railroad notice and approvals may be found in the contract documents in a Special Note entitled “Special Provisions for Protection of Railway Interests”. If notice and approval provisions are provided by Special Note, the Contractor shall provide the railroad written notice as required therein. If notice and approval provisions are not provided in the contract documents, the Contractor shall provide written notice to the railroad facility owner prior to operation of any equipment or vehicles within 6.0 meters of the centerline of a track; within 4.5 meters of a catenary, electrical wire or other electrical facility; or within 4.5 meters of a signal wire or other signal facility to establish the fouling limits for that facility.

The Contractor shall obtain prior approval from the railroad company to use a railroad service road to access a site, and shall be responsible for any associated permit application and fees. The Contractor shall obtain the written approval of the chief engineer of the railroad company or
companies affected in respect to the details and methods to be employed in constructing any structures, track detours, falsework, removal of structures, allowable track clearances, and any or all other details that may in any manner affect the operation or maintenance of any or all railroad facilities. The requirement that written approval shall be obtained from the chief engineer of the railroad company shall be complied with before the Contractor starts work. The Contractor shall include in its unit prices bid for this work all the costs of these requirements including any expense occasioned by delay or interruption of its work by reason of the operation or maintenance of the railroad facilities. Approval by the chief engineer of the railroad company or companies affected does not absolve the Contractor from any liability resulting from its contractual operations.

C. Coordination of Work. The Contractor shall coordinate with the railroad company or railroad companies in carrying out railroad force account work. When the work of the Contractor or Subcontractor dovetails with the railroad force account work, the materials shall be delivered and the operations conducted so as to carry on the work continuously in an efficient and skillful order. Delays or oversight on the part of the Contractor or Subcontractors in getting any or all of their work done in the proper manner, thereby requiring removal and replacement of work already in place will not be the basis for a claim for extra compensation. Such work shall be done at the cost and expense of the responsible Contractor or Subcontractor.

D. Railroad Employees. When, in the opinion of the chief engineer of the railroad company or companies the Contractor’s normal operations in progressing its contract are such that an operated track is or might be fouled or railroad traffic endangered, the railroad company or companies will employ protective labor, when found necessary for railroad operations. Unless an item for railroad protection is included in the contract, payment for the services described above shall be made to the railroad company directly by the State pursuant to the terms of a State-Railroad agreement negotiated for the contract. When an item for railroad protection is included in the contract, the Contractor shall pay for such services.

All services for protective labor and similar protective service occasioned by the operation of the Contractor, except as noted in the preceding paragraph shall be at the sole expense of the Contractor and the Contractor shall include all such costs in its unit bid prices for such protection.

The Contractor shall, at its own expense, carry compensation and other insurance for protective labor furnished by the railroad company or companies.

It is agreed that the furnishing of any protective labor shall not relieve the Contractor from any liability of payment for any damage caused by its operations.

E. Protection of Railroad Service and Facilities. The Contractor shall take special care and vigilance to avoid damage to the trains, tracks or other facilities of the railroad company and shall conduct its work so as not to interfere with the movement of trains or other operations of the railroad company. Whenever work may affect the safety or movement of trains, the method of doing the work shall be submitted to the chief engineer of the railroad company affected for approval. No work affecting safety or movement of trains shall be commenced or prosecuted until written approval of the chief engineer of the railroad company is received. The approval of the chief engineer of the railroad will not release the Contractor from any responsibility for any damages to the railroad company caused by the acts of the Contractor or its employees and Subcontractors. If, during the carrying out of the contract work, the trains, tracks or other facilities of the railroad company are endangered, the Contractor shall immediately do such work as directed by the Engineer to restore safe conditions and, upon failure of the Contractor to carry out such orders immediately, the railroad company may, with the approval of the Engineer, take whatever steps are necessary to restore safe conditions. The cost and expense to the railroad company of restoring safe conditions or of any damage to the railroad company’s trains, tracks or other facilities caused by the Contractor’s operations shall, when approved by the Engineer, be considered a charge against the Contractor and shall be paid for by it, or upon its failure or refusal to pay such charge within a reasonable time after the railroad company submits the bill to it, the amount thereof may be deducted from any monies due or that may become due to it under its contract, and any such sum so deducted may be paid to the railroad company after an audit by the State of the items of such cost and expense.
In performing construction operations both on and off railroad right of way areas, the Contractor shall prevent the fouling of railroad track ballast with earth, mud, silt, or other foreign matter. To prevent fouling of the ballast, it may be necessary for the Contractor to construct temporary erosion control measures or sheeting or provide other precautionary measures that are required.

Where, in the opinion of the railroad company, demolition work, concreting or hauling along or across tracks will result in ballast becoming fouled, the Contractor shall take preventive measures to protect the entire ballast section by nailing canvas, plywood or similar material to the ties in the entire area to be affected. The protective material shall remain in place until there is no further possibility of fouling the ballast and then shall be removed by the Contractor.

The work required to protect the railroad track ballast shall be performed by and at the expense of the Contractor and under the supervision of and to the satisfaction of the chief engineer of the railroad company or its authorized representative. The railroad company will assume no responsibility for the adequacy of the work.

In the event that the railroad track ballast does become fouled after the aforementioned protective measures are taken, the railroad company, with its own forces, shall remove and replace the fouled ballast with clean ballast. The charges for this work will be billed by the railroad company against the Contractor.

F. Lifting. All lifting operations shall be conducted in accordance with §107-05(P), Lifting. In addition, equipment used for the erection or removal of structures over railroad facilities shall have a minimum lifting capacity of one hundred-fifty percent (150%) of the lift weight (operational capacity limited to sixty-six and two-thirds (66\(\frac{2}{3}\)%) of the tipping load).

G. Use of Explosives. Blasting shall be conducted in such a manner as not to endanger facilities or operation of the railroad. The Contractor shall furnish, while blasting, at its own cost and expense, watch persons and other protection necessary to protect the public and railroad. The Contractor’s attention is directed to §107-05, Safety and Health Requirements, with regard to blasting.

H. Foundations. Foundations may be extended or lowered if deemed necessary by the DCES and the chief engineer of the railroad company or companies affected only if such change is ordered by the DCES.

I. Telephone, Telegraph Telecommunications and Signals. The cost of all changes in telecommunication and signal facilities necessary to complete the contract work will be paid for by the State. The cost of all changes in telecommunication and signal facilities made for the convenience of the Contractor shall be paid for by the Contractor.

J. Contractor’s Private Grade Crossing. If the Contractor elects, and the railroad company or companies approve, to have installed for its own use, a private grade crossing at the site of the work, it shall make a formal request to the railroad company or companies for such a crossing. After it has entered into an agreement with the railroad company or companies pertaining to the size and type of crossing, the payment of the cost for installing, and removing the crossing, the obtaining of the necessary insurance for the protection of the railroad company or companies, and the agreement as to the required protection to railroad traffic when the crossing is in use, the railroad company or companies will install and remove the temporary crossing at the sole expense of the Contractor.

K. Sidetrack Facilities. When sidetrack facilities are required by the Contractor, it shall at its sole cost and expense, make the necessary arrangements for the use of existing sidings, tracks not in service or the construction of new sidings. The Contractor shall restore any and all existing sidings and tracks used for sidetrack facilities to the condition existing prior to use by the Contractor. The construction location and use of all sidetrack facilities are to be subject to the approval of the chief engineer of the railroad company affected.

The railroad company may move the Contractor's cars, placed on existing sidings, at any time, to permit the placing of cars for said railroad company's business.

When any turnouts from the main tracks are approved by the railroad company such turnouts will be furnished, installed and removed by the railroad company at the expense of the Contractor.
§105

signal work and derails necessary for sidetrack facilities will be furnished, installed and removed by the railroad company at the Contractor's expense.

L. Railroad Use of Completed Work. The railroad company affected may, prior to the completion of the work to be performed under contract and the acceptance thereof, enter upon and use any portion of said work without any compensation whatever to the Contractor for such use, and without any compensation or payment whatever to the Contractor for any delay in the work caused by such use. The taking possession and use shall not be deemed an acceptance of the work so taken and used or any part thereof.

M. Work Trains and Railroad Equipment. If the Contractor elects to use work trains or any railroad equipment which operates on the tracks of the railroad company, the operation of such trains and equipment is subject to any requirements determined by the chief engineer of the railroad company or companies affected. The cost of the services of any railroad employees required by the railroad company to operate such trains or equipment shall be paid by the Contractor, including the cost of necessary flaggers.

N. Operation of Railroad. The Contractor shall make every possible effort to reduce to a minimum the length of time that railroad company will have to operate over any track detour, and to this end it shall continue full operation throughout the winter months, if directed by the DCES on any and all works necessary to permit the railroad company to restore its tracks in their permanent location as quickly as possible. The Contractor shall conduct its work so that schedule speed can be maintained by the railroad at all times.

105-10 SURVEY AND STAKEOUT.

Prior to the start of related construction, all right of way, property and survey markers located in or adjacent to areas which may be disturbed during construction shall be properly tied to fixed points or located from established control. Upon the completion of the work, any right of way, property or survey markers that have been disturbed shall be properly re-set under the direction of a Land Surveyor. All survey control and boundary location work shall be performed in accordance with the Survey Standards and Procedures Manual under the direction of a Land Surveyor.

If the contract does not contain a contract pay item for Survey and Stakeout, the Contractor will be provided horizontal and vertical control throughout the length of the contract by properly marked offset or reference stakes placed by the Engineer. The Contractor shall carefully preserve all such stakes and marks. The Contractor shall furnish, free of charge, all labor, stakes, paint, marking devices, other materials and such temporary structures as may be necessary for the Engineer to provide horizontal and vertical control for the work and to make necessary measurements for payment and records. The Contractor shall keep the Engineer informed of its schedule in accordance with §108-01 Progress Schedule and shall clear survey lines in advance in order to permit unimpeded survey work. When the work is ready for fine grading, the Engineer will set grade on stakes or pins located in the roadway, furnished and driven by the Contractor. These pins shall be carefully preserved by the Contractor.

If a contract contains a contract pay item for Survey and Stakeout, the Contractor shall furnish, at no additional cost, all labor, stakes, paint, marking devices, other materials and such temporary structures as may be necessary for the Engineer to make necessary measurements for payment and records. The Contractor shall keep the Engineer informed of its schedule in accordance with §108-01, Progress Schedule and shall clear survey lines in advance in order to permit unimpeded survey work by the Engineer.

The Contractor may propose the use of remote sensing or other automated survey control methods to allow construction to proceed without the placement of grade stakes or other construction markings/controls. If approved by the Department, the Contractor will conduct a survey at designated cross sections and other locations at major contract milestones for the purposes of verification that the Contractor’s survey control system is producing desired accuracy.

105-11 INSPECTION.

Department Inspectors are authorized to inspect all work done and materials furnished, including all or any part of the work and the preparation, fabrication or manufacture of the materials to be used.
Department Inspectors may be Department employees, or agents acting for the Department. Department Inspectors are not authorized to either alter or waive the provisions of these specifications or the contract, or to issue instructions contrary to the plans and specifications, without written approval of the Engineer, or act as a foreperson for the Contractor. Department Inspectors have the authority to reject unacceptable work or materials.

The Department inspections and tests are for the sole benefit of the Department and do not (1) relieve the Contractor of the responsibility for providing adequate quality control measures; (2) relieve the Contractor of responsibility for damage to or loss of the material before acceptance; (3) constitute or imply acceptance; or (4) affect the continuing rights of the Department after acceptance of the completed work under Article 9 Final Acceptance of Work of the contract agreement.

The Engineer and the Inspector shall be allowed full work access and shall be furnished with necessary information and assistance by the Contractor to make a complete and detailed inspection. The Contractor shall carry out the provisions of the contract at all times, regardless of whether an authorized inspector is present or not. Any work or item that is, at any time, found to be out of specification or not in compliance with the plans shall remain the responsibility of the Contractor and shall be subject to such corrective measures that are approved in writing by the Engineer.

The Contractor shall transmit a copy of any audit or inspection report conducted by SSPC, OSHA, or EPA of the contract site to the Engineer within seven days of receiving such a report. If the Contractor has been disciplined by SSPC or placed on warning, probation, suspended or revoked status from the Painting Contractor Certification Program (PCCP) during the past 24 months, the Contractor shall provide a written explanation of the cause for such action, the corrective measures enacted, and the Contractor’s current PCCP status.

105-12 LOAD RESTRICTIONS.

Construction equipment or vehicles delivering materials or traveling to a site from outside the contract limits shall have all required permits issued through the established Department vehicle permit system in accordance with Section 385 of the Vehicle and Traffic Law (or 23 USC, Section 127 for Federal Aid Projects on the Interstate System). The permit will indicate the limits within which such equipment with over-legal gross weights or axle loadings may operate, the frequency of such passages and all other limiting factors.

Construction equipment or vehicles operating within the contract limits having gross weights or axle loadings within the legal limits Section 385 of the Vehicle and Traffic Law (or 23 USC, Section 127 for Federal Aid Projects on the Interstate System) may operate without specific approval.

Prior to the use of construction equipment or vehicles with over-legal gross weights or axle loadings on any structure, on any new pavement or on any resurfaced pavement within the contract limits, the Contractor shall submit a written request to the Engineer. This request shall be accompanied, upon request, by an appropriate analysis performed by a Professional Engineer, including the pertinent equipment data, and shall demonstrate that the operations will not result in detrimental effects on the highway or structure.

Use of over-weight construction equipment or vehicles within the contract limits other than listed above shall be subject to the approval of the Engineer. If it is determined that the use of construction equipment or vehicles is having a detrimental effect or will result in detrimental effects on the finished work, the Engineer will so notify the Contractor to modify or cease the operations.

105-13 MAINTENANCE AND PROTECTION OF TRAFFIC FOR MOBILE OPERATIONS.

For contracts that involve mobile operations, but do not include separate contract pay items for the maintenance and protection of traffic, a maintenance and protection of traffic sequence shall be provided by the Contractor in accordance with the MUTCD. When last following vehicle and/or trailing vehicles are required by these provisions, they shall meet the requirements of Section 619 for Shadow Vehicles. No separate payment will be made for this work, the cost shall be included in prices bid for the various contract items.

105-14 DISPUTED WORK AND DISPUTE RESOLUTION.

It is the goal of the Department to resolve disputes that may arise under the contract in a timely, just and fair manner consistent with the terms of the contract. The dispute resolution process may be undertaken at any time from the contract award to the issuance of the final payment by the Office of the
§105

State Comptroller. The dispute resolution process recognizes and will take into consideration the risks and controls inherent in construction which the Contractor or the Department have agreed to assume pursuant to the terms of the contract.

The term "dispute" shall mean a disagreement between the Contractor and the Department concerning a matter of contract performance or contract compensation. Dispute resolution may involve adjustments in compensation, adjustment of contract pay items, the addition of new contract pay items to the contract, and/or extension of time for performance. The Contractor shall continue the work during the pendency of the dispute.

Disputes of any nature shall be made in strict accordance with the contract provisions, including the notice and recordkeeping provisions of §104-06 Notice and Recordkeeping, which are a condition precedent to any recovery. If the Contractor fails to strictly comply with either the notice or the recordkeeping provisions, any claim of the Contractor with respect thereto shall be deemed waived, and the Department does not have to show prejudice to its interest before such denial is made. Timely notice and recordkeeping affords the Department the opportunity to initiate measures, including but not limited to modification of specifications or deletion of portions of the work, in order to mitigate damages to all parties and/or to agree to terms and conditions for timely payment for any eligible additional costs. The Contractor is encouraged, when initiating a dispute, to provide information concerning measures that may be taken to mitigate the damages. The Department reserves the option whether to consider contract adjustment for work which is substantially completed prior to the issuance of written notice.

A. Disputed Work. If the Contractor is of the opinion that any work directed by the Engineer to be completed as contract work is extra work and not contract work, or that any order of the Engineer exceeds the requirements of the provisions of the contract, the Contractor shall provide the Department written notice and maintain records in accordance with §104-06, Notice and Recordkeeping. After submitting the required notice, the Contractor shall complete its dispute submission as soon as such information is ascertainable by the Contractor.

1. Determined to Be Contract Work. If the Department determines that the disputed work is contract work and not extra work, or that the direction given to the Contractor and protested was proper, the Department will direct the Contractor to continue the disputed work and the Contractor shall promptly comply. The Contractor's right to further pursue a dispute for extra compensation or damages will not be affected in any way by the Contractor complying with the directions of the Department to proceed with the work, provided the Contractor continues to keep and furnish the Engineer with required records.

2. Determined to Be Extra Work. If the Department determines that the disputed work is extra work and not contract work, or that a direction given to the Contractor and protested was not proper, then a contract adjustment will be made. Compensation will be made for such work in accordance with §109-05 Extra Work and Time Related Compensation. The Contractor shall continue to maintain force account records until receipt of the order-on-contract approved by the Office of the State Comptroller. Documented, additional, actual and reasonable costs incurred by the Contractor pursuant to following a written order to perform work (that was subsequently contained in an order-on-contract which was disapproved) will be considered reimbursable. Eligibility for additional compensation shall cease upon notification of the disapproval of an order-on-contract.

B. Time Related Disputes. The term "time related dispute" shall mean any dispute arising from any event which affects the scheduled time of performance. This paragraph is intended to cover all such events which include major deductions or increases to quantities of work, suspension of work and cancellation of contract, and termination, as well as actions, forces or factors, such as "delay," "disruption," or "interference."

If the Contractor believes that it is or will be entitled to additional compensation for time related disputes, whether due to delay, extra work, disputed work, breach of contract, or other causes, the Contractor shall comply with the notice and recordkeeping provisions of §104-06 Notice and Recordkeeping. The Department will have no liability and no adjustment will be made for any damages which accrued more than ten (10) work days prior to the filing of written notice with the
Engineer. The primary tool used to evaluate the time of performance is the Contractor’s progress schedule. Department approval of a schedule or a revised schedule does not entitle the Contractor to a time extension or any time related damages. Compensation will be made for such work in accordance with §109-05D. Time Related Dispute Compensation.

C. Acceleration Disputes. The Contractor may not dispute costs associated with acceleration of the work unless the Department has given prior express written direction to the Contractor to accelerate its effort. The Contractor shall always have the basic obligation to complete the work in the time frames set forth in the contract. Lack of express written direction on the part of the Department shall never be construed as approval.

If the Contractor does accelerate its work efforts pursuant to written direction from the Department, compensation will be made in accordance with §109-05D. Time Related Dispute Compensation. The Department, in determining whether or not any compensation is warranted, will evaluate the facts and circumstances which led to the acceleration to determine whether they were in the Contractor's control.

D. Review Time Periods for Disputes. After providing written notice, the Contractor shall, as soon as the information is available or ascertainable, provide the Engineer with summary of its dispute contentions in accordance with §105-14E. Required Content of Dispute Submission, with sufficient detail so that the Engineer may make a determination. The Engineer will make an initial response, in writing, within 15 work days after the Contractor provides the dispute submission.

If a dispute is not resolved by the Engineer to the satisfaction of the Contractor, within 10 work days of receipt of the Engineer's written decision or the Engineer fails to reply within 15 work days, the Contractor shall notify the Regional Director, in writing, with a copy to the Engineer, of its contentions relative to the dispute.

If the dispute is not resolved by the Regional Director to the satisfaction of the Contractor, within 10 work days of receipt of the Regional Director's written decision, the Contractor shall notify the Commissioner, in writing, with copies to the Engineer and the Regional Director, of its contentions relative to the dispute, indicating the substance of previous communication on the issue with the Engineer and the Regional Director and its rebuttal of their previous findings. If the Regional Director, or his/her designee, fails to reply within 30 calendar days, the Contractor may take the dispute to the Commissioner.

1. Disputes to the Commissioner Up to $50,000. For all disputes to the Commissioner of $50,000 or less, the Department will respond in writing within 45 calendar days of receipt of the dispute. If any additional documentation supporting the dispute, or relating to the subject matter of the dispute is required, the Department may request said documentation in writing within 30 calendar days of receipt of the dispute. The Contractor will provide such information within 30 calendar days of the request unless another time period is agreed to. The Department's written response to the additionally documented dispute will be submitted to the Contractor within 15 calendar days after receipt of said additional documentation or within a period of time no greater than that taken by the Contractor in producing said additional documentation, whichever is greater. If the Contractor disputes the Department's written response, or the Department fails to respond within the time prescribed, the Contractor may so notify the Department in writing within 15 calendar days of receipt of the Department's response, or within 15 calendar days of the Department's failure to respond. Upon the Contractor's request, the Department shall schedule a meeting or conference. By agreement between the Department and the Contractor, such time periods may be modified.

2. Disputes to the Commissioner Over $50,000 to $250,000. For all disputes to the Commissioner over $50,000 and less than or equal to $250,000, the Department will respond in writing within 60 calendar days of receipt of the dispute. If any additional documentation supporting the dispute, or relating to the subject matter of the dispute is required, the Department may request said documentation in writing within 30 calendar days of receipt of the dispute. The Contractor shall provide such information within 30 calendar days of the request unless another time period is agreed to. The Department's written response to the additionally documented
dispute will be submitted to the Contractor within 30 calendar days after receipt of said additional documentation, or within a period of time no greater than that taken by the Contractor in producing said additional documentation, whichever is greater. If the Contractor disputes the Department's written response, or the Department fails to respond within the time prescribed, the Contractor may so notify the Department in writing within 15 calendar days of receipt of the Department's response, or within 15 calendar days of the Department's failure to respond. Upon the Contractor's request, the Department will schedule a meeting or conference and notify the Contractor within 30 calendar days of the scheduled date. By agreement between the Department and the Contractor, such time periods may be modified.

3. Disputes to the Commissioner Over $250,000 or of Undetermined Value. For disputes to the Commissioner over $250,000 or that have an undetermined value, the Department will respond in writing within 90 calendar days of receipt of the dispute. If any additional documentation supporting the dispute, or relating to the subject matter of the dispute, is required, the Department may request said documentation in writing within 30 calendar days of receipt of the dispute. The Contractor shall provide such information within 30 calendar days unless another time period is agreed to. The Department's written response to the additionally documented dispute will be submitted to the Contractor within 60 calendar days after receipt of the said additional documentation, or within a period of time no greater than that taken by the Contractor in producing said additional documentation, whichever is greater. If the Contractor disputes the Department's written response, or the Department fails to respond within the time prescribed, the Contractor may so notify the Department in writing within 30 calendar days after the receipt of the Department's response, or within 30 calendar days of the Department's failure to respond. Upon the Contractor's request, the Department will schedule a meeting or conference and notify the Contractor within 30 calendar days of the scheduled date. By agreement between the Department and the Contractor, such time periods may be modified.

E. Required Content of Dispute Submission. All disputes shall be submitted in writing to the Engineer, and shall be in sufficient detail to enable the Engineer to ascertain the basis and the amount of each dispute. If requested and as a minimum, the following information shall be provided when such information is ascertainable by the Contractor:

1. General.
   a. The date on which actions resulting in the dispute occurred or conditions resulting in the dispute became evident.
   b. A copy of the notice of dispute for the specific dispute by the Contractor.
   c. To the extent known, the name, function, and activity of each Department official, or employee or agent, involved in, or knowledgeable about facts that gave rise to such dispute.
   d. The name, function, and activity of each Contractor or Subcontractor official, or employee, involved in, or knowledgeable about facts that gave rise to such dispute.
   e. The identification of any pertinent documents, and the substance of any material communication relating to such dispute.
   f. A statement as to whether the additional compensation or extension of time if requested is based on the provisions of the contract or is an alleged breach of contract.
   g. If an extension of time is also requested, the specific days for which it is sought and the basis for such request as determined by an analysis of the construction progress schedule.

2. Time Related Dispute Submissions.
   a. A description of the operations that were delayed, the reasons for the delay, how they were delayed, including the report of all scheduling experts or other consultants, if any.
   b. The documented process of establishing, maintaining and updating the progress schedule, showing when the delay occurred and how it affected the schedule, in accordance with §108-01 Progress Schedule or a CPM specification, if applicable.
   c. The amount of additional compensation sought in accordance with §109-05D. Time Related Dispute Compensation.
3. Acceleration Dispute and Disputed Work Submissions.
   a. A detailed factual statement of the dispute providing all necessary dates, locations and items
      of work affected by the dispute.
   b. The specific provisions of the contract which support the dispute and a statement of the
      reasons why such provisions support the dispute.
   c. The amount of additional compensation sought and a breakdown of that amount shall
      conform to the requirements of §109-05B. Force Account Work except for acceleration disputes
      which shall conform to the requirements and categories specified in §109-05D. Time Related
      Dispute Compensation.

F. Required Certification of Disputes Over $50,000. When submitting any dispute over
   $50,000, the Contractor shall certify in writing, under oath and in accordance with the formalities
   required by the contract, as to the following:
   1. That supporting data is accurate and complete to the Contractor's best knowledge and belief;
   2. That the amount of the dispute and the dispute itself accurately reflects what the Contractor in
   good faith believes to be the Department's liability;
   3. The certification shall be executed by:
      a. The Contractor, if the Contractor is an individual.
      b. A senior company official in charge at the Contractor's plant or location involved or an
         officer or general partner of the Contractor having overall responsibility for the conduct of the
         Contractor's affairs, if the Contractor is not an individual.

G. Auditing of Records. A Contractor who has filed a dispute, or Subcontractor, Manufacturer,
   Fabricator or Material Supplier on whose behalf a dispute has been filed, shall have the following
   records available for audit at any time following the filing of such dispute, and shall cooperate with
   the auditors, whether or not such dispute is part of a suit pending in the courts of this State. The audit
   may be performed by employees of the Department or by an independent auditor appointed by the
   Department, and may begin on ten (10) work days notice to the Contractor, Subcontractor,
   Manufacturer, Fabricator or Material Supplier as is appropriate. The Contractor, Subcontractor,
   Manufacturer, Fabricator or Material Supplier shall cooperate with the auditors. The Department will
   maintain the audit, its backup, reports, schedules and conclusions as confidential material. Failure to
   maintain and retain sufficient records shall constitute a waiver of that portion of such dispute that
   cannot be verified and shall bar recovery thereunder. In the event the Contractor fails to substantially
   furnish the required reports and accounting records, such failure shall constitute a waiver of the
   dispute for payment other than for payment at contract unit prices for the work performed. Without
   limiting the generality of the foregoing, the auditors shall have available to them and the Contractor
   agrees to provide access to the following documents:
   1. All documents related to the preparation of the Contractor's bid including the final calculations on
      which the bid was based.
   2. All documents which relate to each and every dispute together with all documents which support
      the amount of damages as to each dispute.
   3. Daily time sheets, superintendent diaries or log sheets and foreperson's daily reports.
   4. Union agreements and reports, if any.
   5. Insurance policies, welfare and benefits records or plans for union and non-union personnel.
   7. Material invoices, purchase orders, and all material and supply acquisition contracts.
   9. Equipment records (list of company equipment, rates, depreciation schedules, daily equipment
      reports or logs, fueling logs or records, equipment lease purchase agreements, and equipment
      purchase invoices).
   10. Depreciation records on all company equipment whether such records are maintained by the
       company involved, its accountant, or others.
   11. If a source other than depreciation records is used to develop costs for the Contractor's internal
       purposes in establishing the actual cost of owning and operating equipment, all such other source
       documents.
   12. Vendor rental agreements, subcontractor invoices, agreements and back charge records.
13. Subcontractor payment certificates.
15. Job cost ledger or report and Job payroll ledger.
16. General ledger, general journal (if used), and all subsidiary ledgers and journals together with all supporting documentation pertinent to entries made in these ledgers and journals.
18. Audited and unaudited financial statements for all years during operations on this contract.
19. Documents which reflect the Contractor's actual overhead during the years contract work was performed.
20. Work sheets used to prepare the dispute establishing the cost components for items of the dispute including, but not limited to, labor, benefits and insurance, materials, equipment, subcontractors, and all documents which establish the time periods, individuals involved, the hours and the rates for the individuals.

H. Contract Closeout Process. A dispute, or a portion thereof, that has been previously submitted to the Department which remains unresolved to the satisfaction of the Contractor, may be submitted for Department review in connection with the closeout process. The records made, and recommendations or actions of a facilitator, a Dispute Review Board, or any other dispute resolution method, shall be off the record, non-binding, confidential, and may not be used in any future litigation.

1. Contract Closeout Meeting. If requested by the Contractor, the Department will schedule a contract closeout meeting with the Construction Division in Albany. The contract closeout meeting process involves meeting(s) with the Contractor and its representatives and Department personnel to amicably resolve all remaining disputes of the Contract. In lieu of pursuing the closeout meeting process, the Contractor may elect to utilize the Gatekeeper process.

2. Gatekeeper. The Chief Engineer of the Department of Transportation is the Gatekeeper. The Contractor may submit a single request per contract to the Department to have the Gatekeeper identify an alternate dispute resolution process to be used for unresolved dispute(s) in the contract closeout process. The Contractor shall provide to the Gatekeeper a brief description of the contract work and identify the Contractor's preferred method of dispute resolution. The Contractor shall document to the Gatekeeper that (a) the unresolved dispute involves unique, unusual or complex construction, engineering or legal issues; (b) the unresolved dispute has a monetary value in excess of $50,000 and (c) the Contractor has demonstrated a clear commitment to active participation in partnering during the conduct of this contract.

Upon conclusion of the review, the Gatekeeper will advise the Contractor how it should proceed with processing such dispute(s) in an attempt to resolve the matter. The Gatekeeper will advise the Contractor to proceed to one of the following: (1) a contract closeout meeting with the Construction Division, (2) a facilitated contract closeout meeting with the Construction Division or to (3) a Dispute Review Board (DRB). The decision of the Gatekeeper shall be final and shall not be subject to review under Article 78 of the New York Civil Practice Law and Rules. The expenses of the facilitator, a DRB, or any other method shall be equally shared by the Department and the Contractor.

a. Facilitated Closeout Meeting. A facilitator may be used to assist in resolving disputes arising out of the performance of the contract. The facilitator shall consist of one person, agreed to by the Department and the Contractor, who is knowledgeable in public works construction matters and who shall try to bring the parties to a mutually agreeable resolution of the disputes.

b. Dispute Review Board. A Dispute Review Board (DRB) may be established to assist in resolving disputes arising out of the performance of the contract. The DRB shall consist of one or three persons, agreed to by the Department and the Contractor, who are knowledgeable in public works construction matters. For a one person DRB, the person must...
be mutually acceptable to the Department and the Contractor. For a DRB of three persons, one will be selected by the Department, one will be selected by the Contractor and one will be mutually selected by the Department and the Contractor. The DRB will make a recommendation as to the resolution of the disputes.

3. **Claims.** If any dispute, or portion thereof, remains unresolved following the meeting(s) or conference(s) and the payment of the final agreement, the Contractor may file a claim in the New York State Court of Claims in accordance with law and the provisions of the Contract.

### 105-15 FURNISHING RIGHT OF WAY.

The Department will secure all rights-of-way in advance of construction. Any exception will be indicated prior to the award of the contract. The Contractor shall not enter upon any parcel until the proper rights of entry have been obtained.

The Contractor's attention is directed to the fact that Permanent Easements (P.E.), Temporary Easements (T.E.) and Temporary Occupancies (T.O.) are obtained by the Department for specific construction purposes. Contractors should not anticipate unlimited usage of such areas and shall confine construction activities to such purposes as are specifically described in the ROW appropriation maps and/or as shown on the plans unless separate agreements are made between the Contractor and the landowner permitting other usage of such areas. Such limitations and related costs shall be reflected in the bid prices.

### 105-16 SHOP DRAWING APPROVAL.

Approval by the Department of shop drawings, methods of installation or Contractor's construction detail(s) does not relieve the Contractor of the responsibility for compliance with the contract specifications, or relieve the Contractor of the responsibility for providing adequate quality control measures and does not relieve the Contractor of the responsibility for providing proper and sufficient materials, equipment and labor to complete the approved work in accordance with the contract documents.

Unless otherwise stated in the contract documents, no portion of the work requiring shop drawings or a sample of the work shall be commenced until the submission has been approved by the Department. Should, for any reason, the contract not be awarded, the Contractor will not be entitled to reimbursement for work performed prior to the contract award. Subsequent to award, the Contractor will not be entitled to reimbursement for changes made to the contract documents unless changes occur after approval of the submission.

Unless otherwise stated in the contract documents, review of shop drawings, erection plans and demolition plans will begin only after the submission of a complete set of information required to complete a discrete item of work. The review process will allow two work days per drawing submitted or a minimum of 10 days, unless stated otherwise in the contract documents. Unless otherwise stated in the contract documents, including the Steel Construction Manual or the Prestressed Concrete Construction Manual, a drawing shall be defined as a sheet of similar size and scale as the plan sheets prepared and offered for sale to potential bidders, or sheet provided on a different size media and using a proportional scale. Submission of materials directly to a reviewing unit shall be done only with the prior approval of the Engineer. Complete copies of all submissions shall be provided to the Engineer.

### 105-17 CONTRACT RECORDS.

The Engineer will keep contract records in accordance with the Manual for Uniform Record Keeping (MURK). Changes that are made in subsequent revisions of the Manual will be incorporated in the contract procedures and records unless authorized to the contrary in writing by the Director, Construction Division. The Contractor is invited to review the contract records with the Engineer if desired. The Contractor may request occasional or incidental copies of contract records in support of on-going construction activities, subject to the availability of staff to fulfill the Contractor’s request. If the Contractor desires significant or large numbers of copies of records, the Contractor shall file a Freedom of Information Law (FOIL) request with the Regional Director. In several instances, (such as Force Account work, application for approval of Subcontractors, etc.) the Contractor shall furnish such data and information on forms as established in MURK and furnished by the Department.
105-18 MANUFACTURER WARRANTIES AND GUARANTEES.

The Contractor shall provide to the Department or the authority having jurisdiction of the facility any manufacturer’s warranties and guarantees normally given as customary trade practice. For contracts involving the furnishing and/or installing of electrical and mechanical equipment, the Contractor shall guarantee the satisfactory in-service operation of mechanical and electrical equipment and related components for a period of 6 months following contract acceptance, at no cost to the State for either parts or labor. This requirement does not apply to mechanical and electrical equipment furnished by the State.

105-19 CONTRACTOR WARRANTIES.

The Department may make available, subject to express agreement in writing between the Department and the Contractor, with approval from the FHWA when required, warranties associated with the contract for limited circumstances. A prototype warranty specification is available from the Department for the purpose of the Contractor’s providing a warranty for a particular item, as opposed to providing a warranty for an entire contract. The product warranty will be developed between the Department and the Contractor with input from appropriate technical experts and the Office of Legal Affairs in conjunction with the Construction Division, and incorporated into the contract via order-on-contract. The warranty may be used in situations including, but not limited to, work performed not in full compliance with the contract documents, where initial testing does not indicate any deficiency in the end product.

105-20 OPENING HIGHWAY TO TRAFFIC PRIOR TO ACCEPTANCE.

When directed, in writing by the Regional Director, the Contractor shall open to traffic any portion of new pavement and/or structures before final acceptance of the contract. Traffic on these portions of highway so opened to travel by the Regional Director, shall be maintained and protected in accordance with all the provisions of the Maintenance and Protection of Traffic items in the contract.

Should the Contractor be dilatory in completing certain features of the work on the portion of the highway directed to be opened, the Regional Director may order all or a portion of the said highway open to traffic; and in this event the Contractor shall not be relieved of its liability and responsibility during the period the work is so opened prior to final acceptance.

These provisions apply not only to the reconstruction of existing highways, but also to work on new locations where traffic is not maintained during construction.

105-21 CIVIL RIGHTS REPORTING.

The Contractor shall use the current version of Department approved software for civil rights reporting, including workforce utilization data, D/M/WBE utilization, and tracking payments to Subcontractors and D/M/WBE Vendors on all contracts where the total contract bid price is equal to or greater than $100,000.

A. Contractor Proficiency. The Contractor shall become proficient in software use through a Department-approved vendor or by downloading the current Department software users guide at www.dot.state.ny.us/oeodc/ceieb.html. Other organizations may utilize software differently, and are not always compatible with Department requirements. Approved training vendors are listed on the Department website at www.dot.state.ny.us/oeodc/champ.html.

B. Reporting Requirements. The Contractor shall submit complete, accurate, readable and unaltered signed hard copy monthly reports produced from the electronic data, as well as a complete electronic data file, to the Engineer not later than the 15th of the following month. The Contractor shall ensure data submissions are made using the current approved version of the software listed on the Department website at www.dot.state.ny.us/oeodc/champ.html. Hard copy reports and D/M/WBE Subcontractor/Vendor signatures on non-significant revisions to utilization are not required, provided that the monthly electronic data submissions are up to date and accurate.
The following forms, when required to be submitted, shall be generated using the approved software:

1. Schedule of Utilization. The Contractor shall submit a schedule of utilization, with commitment dollar amounts for all D/M/WBE Subcontractors and D/M/WBE Vendors in accordance with §102-12G. D/M/WBE Utilization Package. The amounts shall agree with those
entered on the individual D/M/WBE utilization worksheets. Revisions shall be submitted in accordance with §102-12J. Revisions to D/M/WBE Utilization.

2. D/M/WBE Utilization Worksheet. The Contractor shall submit utilization worksheets, with commitment dollar amounts for all D/M/WBE Subcontractors and D/M/WBE Vendors in accordance with §102-12G. D/M/WBE Utilization Package. Revisions shall be submitted in accordance with §102-12J. Revisions to D/M/WBE Utilization.

3. Approval to Subcontract. The Contractor shall submit original and revised Subcontractor approval documents for all Subcontractors in accordance with §108-05 Subletting or Assigning the Contract. Commitment amounts by contract pay item shall be entered into the Department approved software for all Subcontractors. Printed reports of commitment amounts are not required.

4. Report of Payments to Subcontractors/Vendors. The Contractor shall submit a Report of Payments to Subcontractors/Vendors monthly to the Engineer in accordance with §102-12K.1. Measuring Goal Attainment, with dollar values current through the last day of the previous month, for all Subcontractors and D/M/WBE Vendors that are due a payment or have received a payment within the last month. The Subcontractors/Vendors certification and notarizations are not required for monthly submittals, but the Contractor shall provide the Subcontractor/Vendor with an informational copy. The Contractor shall submit a final report signed and notarized by both the Contractor and the Subcontractor/Vendor as soon as possible after the work is completed, but not later than 60 days after the Subcontractor/Vendor has completed its commitment.


C. Final Reports. At contract final acceptance, the Contractor shall update and submit a final revised Schedule of Utilization and final revised D/M/WBE Utilization Worksheets with final commitment dollar amounts for all Subcontractors and D/M/WBE vendors for all cumulative non-significant changes to utilization that have not been previously documented, signed by both parties. The commitment amount on the final D/M/WBE Utilization Worksheet should match the total payment due on the final Report of Payments to Subcontractors/Vendors.

D. Data Submission. The Contractor shall export the required contract data to an electronic file and generate a paper copy of the reports in consecutive operations so that the date/time stamp on the two data exports are nearly identical.

The Contractor shall submit concurrently to the appropriate Regional Compliance Specialist (RCS) with a copy (cc:) to the Engineer, the electronic data file via an e-mail attachment (or if submission via e-mail is unavailable, via an alternate approved method). The Contractor shall ensure that the electronic file is readable, complete and accurate, and the file has not been altered or corrupted in transmission. The file shall be attached to a message with the following subject line: [Month] Civil Rights Report D[123456].
E. Compliance Reviews. The Department typically conducts annual compliance reviews of at least two federal-aid contracts per region. A Contractor will typically not be selected for more than two compliance reviews per year statewide. A compliance review consists of a thorough review of all civil rights contract requirements, including non-discrimination in Labor/Employment, EEO, and DBE requirements. Based on contract monitoring and/or the results of compliance review(s), the Department may conduct a review of some or all ongoing contracts with a single Contractor, regardless of funding source.

SECTION 106 - CONTROL OF MATERIAL

106-01 SOURCES OF SUPPLY.
Within seven (7) days of contract award, the Contractor shall notify the Deputy Chief Engineer (Structures) of the name and address of the fabricator of all Prestressed Concrete Units (Structural), Structural Steel, Bridge Bearings, Armored Bridge Joint Systems, Bridge and Culvert Railings and Overhead Sign Structures. This notification shall list the actual shop or shops in which the materials will be manufactured and/or fabricated. It shall be the responsibility of the Contractor to notify the Engineer of the proposed sources of materials sufficiently in advance of their use so that proper tests may be made.

At the preconstruction meeting, the Contractor shall furnish in writing to the Engineer the proposed sources of supply, types and contract pay item(s) of materials which it proposes to use in the work in order to ensure that the materials are obtained from approved sources or that required inspection or approval will be completed in a timely manner. No change shall be made in the types of materials or sources of supply without written approval by the Engineer.

106-02 QUALITY REQUIREMENTS.
All materials used in the work shall meet the quality requirements described in Section 700 Materials and Manufacturing, unless the requirements are altered by a contract pay specification or by notes shown in the contract documents. Materials shall be inspected, sampled, and tested by the Department, or its designated representative, as described in Section 700 Materials and Manufacturing, as indicated by notes in the contract documents, or by procedural directives issued by the Department.

The Contractor shall provide to the Engineer a Material Safety Data Sheet (MSDS) for materials to be used in the work, before each material is first used in accordance with 29 CFR 1926 Subpart D. This applies to materials brought to the contract site to be incorporated into the work, as well as materials that are used at the contract site.

Test specimens shall be removed from sampled items in the presence of the Department representative, prepared for testing, and shipped to the Department as directed by the Department. The cost of all samples; shipment of samples; and any other expenses incurred in making materials or products ready for inspection, sampling and/or testing; shall be included in the unit prices bid for the various items in the contract. Where testing methods are not described in the specifications, details of test methods may be obtained by application to the Department.

The cost of all required inspection, sampling and testing performed in the 48 contiguous states of the United States and the provinces of Canada shall be paid for by the Department unless specifically excluded elsewhere in the contract documents or procedural directives.

The instructions for the use of all materials and products, as well as all identifying information required by the specifications (i.e., labels, tags, certifications, etc.) shall be in the English language. The U.S. Standard Screen Sieves meeting ASTM E11, shall be used on all materials requiring gradation tests.

Mechanical property measurements, dimensions, and all other numerical data included in documents such as shop drawings and computations prepared specifically for the contract, Material Details, and Manufacturer's Safety Data Sheets shall be presented in the International System (SI) of units, consisting of meters, kilograms, and seconds, but they may also include U.S. customary units as a second set of measurements. Shop drawings prepared for bridge rehabilitations, however, shall include both SI Units and U.S. Customary Units. Submissions in dual units shall be completely dimensioned in both systems. The SI Units will take precedence and reviews will be based on these units. The SI Units should be the units listed first, and the U.S. Customary Units should be included within parenthesis. Failure to adhere to this convention may result in the rejection of the drawing.

Documents which are relevant to the production and acceptance of hot mix asphalt (HMA) and portland cement concrete (PCC) mixtures shall be submitted in SI Units only. This refers to mix design
forms, production monitoring (QC) forms, batching tickets, delivery tickets, and all other mix design and production related documents.

Unless otherwise directed by the Department, no materials shall be used until the Engineer has received written notification of acceptance of that material and such material shall be used only so long as the quality remains equal to that of the accepted sample. This initial acceptance of a material will in no way preclude further examination and testing of a material at any time the Engineer suspects that the material is no longer properly represented by the accepted sample. The acceptance at any time of any materials will not bar its future found to be defective in quality or uniformity.

Unless otherwise designated, when a reference is made in these specifications to a specification or test designation either of the AASHTO, ASTM, Federal Specifications, or any other recognized non-proprietary national organization, it shall mean the specification or test method (including Provisional AASHTO and Tentative ASTM) which is current on the date of advertisement for bids.

**106-03 PLANT INSPECTED MATERIALS.**

The manufacture, production and/or fabrication of some materials and products may require acceptance of the plant, including, but not limited to: mill, plant, shop or other location; on a recurring basis prior to the production and inspection of materials produced.

Materials inspected at manufacturing or fabrication plants shall be marked with the contract number and the contract pay item number prior to shipment to the contract site. Any material which has been plant inspected and accepted by this Department for any Department contract, shall not be shipped to other work unless authorized by the Department.

Where plant inspection is not maintained, the method and procedure for sampling, inspecting and reporting shall be in accordance with the procedural directives of the Department, issued by the Materials Bureau.

**A. Covered Locations.** The Department maintains plant inspection capabilities throughout the contiguous 48 states of the United States and the provinces of Canada. The Contractor shall notify the Department 60 calendar days in advance of beginning of the work in any mill, plant, shop or other manufacturing location that is not currently accepted, to allow time for a qualification inspection and arrangements for inspection, sampling and/or testing during the work.

**B. Non Covered Locations.** When inspection, sampling, and/or testing of materials and products manufactured, produced and/or fabricated in a non covered location, and deemed by the Department to require inspection, sampling and/or testing at the site of manufacture, production and/or fabrication, the plant, and manufacturer and/or fabricator shall be qualified by the Department prior to the required inspection, sampling and/or testing. The Contractor shall notify the Department 60 calendar days in advance of beginning of the work in any mill, plant, shop or other manufacturing location to allow time for a qualification inspection and arrangements for inspection, sampling and/or testing during the work.

The expense of all required inspection, sampling, testing and qualification of plants and manufacturers or fabricators in non-covered locations shall be paid for by the Contractor. These expenses shall include the costs of wages and benefits, travel, meals, lodging, communication and all other direct costs of inspection, sampling and testing paid by the Department to perform these services using Department employees or designated representatives under contract to the Department. Reimbursement to the Department shall be made in the form of a deduction from payments due the Contractor. The costs of tests performed in a Department Laboratory will not be charged to the Contractor.

The location of inspection, sampling and/or testing materials and products will, at the option of the Department, be performed at the site of manufacture, production and/or fabrication or at a covered location designated by the Contractor and approved by the Department.

**C. Stock Lot Testing.** When the Department determines that conformance with the contract requirements of plant inspected materials from non-covered locations may be determined by visual inspection and/or testing, specimens may be presented at a covered location in specifically defined lot quantities as directed by the Department. Such materials or products shall be offered for inspection...
not less than 30 days prior to their intended shipment to the contract. All expenses attendant to making such materials or products available for inspection, sampling and/or testing shall be paid by the Contractor.

D. Sample Shipment. The shipment of samples to the Department Laboratory from locations outside of the 48 contiguous states of the United States and the provinces of Canada shall be a direct cost borne by the Contractor or its agent and all such shipments shall be made under provisions established by the Department to ensure identity and security of the sample.

106-04 MATERIAL CERTIFICATION AND APPROVED LIST.
Whenever any specification provides for “Manufacturer’s Certification” or “Approved List” as a Basis of Acceptance, the Department reserves the right to sample and/or test material in any shipment prior to incorporation in the work.

Manufacturers’ Certifications and documents prepared for general use, such as catalog cuts and manufacturer’s directions, may use S.I. or U.S. customary measurement units, or units from both systems. In drawings and documents containing dual units, the S.I. units will be the primary units, and the S.I. units will be the units reviewed. The Contractor shall be responsible for all annotations on the source documents, conversions between the measurement systems and all errors resulting therefrom.

Some standard specifications reference a Manufacturer’s Certification as evidence of acceptability of specific materials or products. A Manufacturer’s Certification can only be properly executed by the manufacturer or producer of the material or product. When manufactured products are subsequently provided by a Material Supplier other than the manufacturer, a Material Supplier’s Certification shall be provided in addition to the Manufacturer’s Certification.

A. Material Certification. When shipments are made directly to a contract by the manufacturer or producer a Manufacturer’s Certification shall include the essential components outlined below. When shipments are made to a contract by a Material Supplier, a Material Supplier’s Certification shall accompany the Manufacturer’s Certification and shall include the essential components outlined below.

1. Identification of Manufacturer or Producer. Name of the company and address of its manufacturing or producing facility.

2. Identification of Material or Product. Generic name of the material or product and the Department Section 700 materials designation number.

3. Identification of Shipment. Sufficient detail to describe the quantity contained in the shipment, the contract number and a date of shipment. A Material Supplier’s Certification shall clearly indicate that the shipment is all or a portion of the quantity detailed on the accompanying Manufacturer’s Certification.

4. Statement of Conformance. The certification shall definitively state that the material contained in the shipment meets the requirements of a specific Department specification or a specific specification or standard of another agency (i.e., ASTM, AASHTO, AWWA, etc.). If the material in the shipment contains steel and/or iron, the certification shall definitively state that the material is or is not of domestic origin. An acceptable statement is: “Conforms (or Does not conform) to the requirements of NYSDOT Standard Specification §106-11, Buy America.”

If the product supplied has been altered subsequent to the certification by the manufacturer, the Material Supplier’s Certification shall definitively state that the material or product contained in the shipment meets the requirements of a specific Department specification or a specific specification or standard of another agency.

5. Certification Execution. The certification shall be signed by a person authorized to legally bind the company, as indicated by statement or title/position. Notarization of the signature is not required.
§106

B. Improper Certification. If the Material Certification does not properly identify conformance to the specification, the product shall be rejected. If the Manufacturer and/or Material Supplier requests to leave the product in place and provide a revised certification only, the revised certification shall be accompanied by a letter of explanation indicating the basis for use of the revised certification. The letter shall also include corrective action to ensure future certifications will be representative of the material or product supplied. The letter shall be signed by a person authorized to legally bind the company, as indicated by statement or title/position.

106-05 RECYCLED MATERIALS.

The Contractor is encouraged to provide reused or recycled materials to the maximum extent possible. Recycled materials currently approved by the Department include glass, recycled asphalt pavement (RAP), recycled portland cement concrete aggregate (RCA), blast furnace slag, fly ash, microsilica, waste stream plastics and tires.

In order to be considered for use by the Department, recycled or waste material must exhibit the desired engineering characteristics, consistently satisfy specification requirements, provide an acceptable level of performance, be economically competitive with available materials, and not be harmful to the environment. If waste materials are proposed to be used, the Contractor may need to obtain a beneficial use determination (BUD) from the NYS Department of Environmental Conservation prior to its use as specified in 6 NYCRR 360-1.15. The beneficial use determination, testing, evaluation and approval of unapproved waste materials can be a very long term process over multiple years, and should not be expected to be completed for any given contract.

106-06 STORAGE AND HANDLING OF MATERIALS.

Materials shall be so stored as to ensure the preservation of their quality and fitness for the work. Stored materials, even though accepted before storage, shall be inspected prior to their use in the work and shall meet the contract requirements at the time of their use. Railroad cars, barges and other containers used for the transportation of materials shall be clean when any materials are deposited therein.

106-07 BASIS FOR MEASUREMENT.

Weight shall be used in all cases for percentage determination unless otherwise specified.

106-08 REJECTED MATERIALS.

Any material which is rejected because of failure to meet the required tests or that has been damaged so as to cause rejection, shall be immediately removed from the site of the work by the Contractor at no additional cost to the State unless otherwise directed by the Engineer. Material which has been rejected on the results of Department tests will not be resampled or retested unless otherwise directed by the Department. No rejected materials, the defects of which have been subsequently corrected, shall be used until written notification of the acceptance of the material has been received by the Engineer.

106-09 EQUIVALENTS.

The requirements for apparatus, articles, or materials shall be specified, if feasible, in generic terms which afford competition for equivalent products or items. When no generic specification can be found or devised, a minimum of at least three, if available, known acceptable trade names or proprietary products shall be provided for the Contractor’s benefit and to afford the desired competition. The Department will determine whether a product proposed by a Contractor meets the requirements of the specifications.

106-10 INDEPENDENT ASSURANCE SAMPLING AND TESTING.

Independent Assurance Sampling and Testing (IAST) is a Federally mandated program that assures that when acceptance testing is performed on Department contracts, proper procedures are followed and all equipment used is in proper working order and calibration. IAST is separate and independent from acceptance testing. Testing performed for IAST will in no way affect any acceptance or payment decision. The results of IAST testing will be used to determine the qualifications of inspectors performing acceptance testing and the condition of equipment used in acceptance testing on Department projects.

The IAST program will evaluate the personnel and equipment responsible for performing quality control sampling and testing that is used to make acceptance decisions. The Contractor and all personnel, organizations, who are responsible for performing acceptance sampling and testing on behalf of the

NEW YORK STATE DEPARTMENT OF TRANSPORTATION
STANDARD SPECIFICATIONS of May 4, 2006

101
§106

Contractor shall cooperate with and accommodate this program by performing, and allowing State representatives to perform sampling and testing at the times and locations requested by the Regional IAST personnel. The required sampling and testing procedures are listed in the Department’s Independent Assurance Sampling and Testing Manual. IAST personnel will observe the tester obtaining samples and performing the tests. IAST personnel will also take split samples to the Regional Laboratory for testing.

106-11 BUY AMERICA.

In accordance 41 U.S.C. §10a et. seq., 23 CFR 635.410 and Section 146 of the State Finance Law, as amended, permanently incorporated steel and/or iron materials shall be domestically produced regardless of the percentage they comprise in a manufactured product or form they take. Award of the contract will be made in accordance with §103-01, Contract Award.

For a contract awarded based on being allowed to permanently incorporate foreign steel and/or iron materials in the work, the Contractor may supply either domestic or foreign steel and/or iron materials and will be paid the foreign bid prices. For a contract awarded based on domestic steel and/or iron materials, the Contractor may permanently incorporate in the construction of this contract a minimal amount of foreign steel and/or iron materials if the combined cost of such materials does not exceed one-tenth of one percent (0.1 %) of the total contract cost or $2,500, whichever is greater. The combined cost of foreign steel and/or iron materials will be the value of the materials as they are delivered to the contract, documented by invoice or bill of sale to the Contractor.

To qualify as domestic, all manufacturing processes, including manufacture, fabrication, grinding, drilling, welding, finishing, coating and assembly of any product containing steel and/or iron materials, must have been performed in the United States. To further define the coverage, a domestic product is a manufactured steel and/or iron materials construction material that was produced in one of the 50 States, the District of Columbia, Puerto Rico, or in the territories and possessions of the United States. Raw materials used in the steel and/or iron materials may be imported. Raw materials are materials such as iron ore, limestone, waste products, etc., which are used in the manufacturing process to produce the steel and/or iron materials products. Waste products include scrap; i.e., steel no longer useful in its present form from old automobiles, machinery, pipe, railroad rail, steel trimmings from mills or product manufacturing, and the like. Extracting, crushing, and handling the raw materials which is customary to prepare them for transporting are exempt from Buy America. The use of foreign source steel or iron billets is not acceptable under Buy America.

A. Control of Materials. All items, regardless of origin, shall comply with their individual specification requirements and with the requirements stated elsewhere in this subsection. In the event the contract is awarded based on using only domestic steel and/or iron materials, the Contractor shall supply only domestic steel and/or iron materials and will be paid the domestic bid prices. The Contractor will be responsible for ensuring the domestic steel and/or iron materials are supplied in conformance with the above referenced laws. Such responsibility extends to informing all affected Subcontractors and material suppliers of these specific requirements and ascertaining that steel and/or iron materials being supplied is in conformance with the standard specifications.

B. Waivers. In addition to the award of a bid based on foreign steel and/or iron materials, waivers to the Buy America requirement may be requested by the State to the Division Federal Highway Administration if it can be demonstrated that the use of domestic steel and/or iron materials would be inconsistent with the public interest, such materials and products are not produced in the United States in sufficient and reasonably available quantities and of satisfactory quality.

Provided one or more of the above requirements are met, the Contractor may submit a request for a waiver to the Engineer. The request shall include copies of all documentation verifying the unavailability of the material or product, and/or justification of the application for a waiver.

For Federally Aided contracts, final approval of the Buy America Waiver request will be made by the Division Federal Highway Administration and concurred with by the Director, Construction Division. For non-Federally Aided contracts, upon final approval of the affected Department program areas, notification and approval of the Buy America Waiver request will be made by the Director, Construction Division.

The following is a list of materials or products which are exempt from the Buy America provisions, and do not require submission of a waiver request:

NEW YORK STATE DEPARTMENT OF TRANSPORTATION
STANDARD SPECIFICATIONS of May 4, 2006
SECTION 107 - LEGAL RELATIONS AND RESPONSIBILITY TO PUBLIC

107-01 LAWS, RULES, REGULATIONS AND PERMITS.

The Contractor shall conduct its operations in compliance with all the laws and regulations of the United States, State of New York and Public Authorities and the applicable ordinances of any county, city, town, or village and the lawful direction of the officers, agents or representatives of the United States, the State of New York, Public Authorities or of said county, city, town, or village. The Contractor shall procure all licenses and permits necessitated by the Contractor’s operations. All costs due to compliance with the above described laws, regulations, and ordinances shall be included in the contract bid prices unless otherwise provided for in the contract.

A. Invasive Species. Federal and State Agencies have promulgated regulations regarding invasive plant species, agricultural insects and diseases. The Contractor shall thoroughly clean all construction equipment and vehicles operating in infested areas prior to moving to non-infested areas in accordance with Federal and State Department of Agriculture regulations for plant pest control.

B. Independent Contractor. The relationship of the Contractor to the State is that of an independent Contractor, and said Contractor, in accordance with its status as such Contractor, covenants and agrees that it will conduct itself consistent with such status, that it will neither hold itself out as nor claim to be an officer or employee of the State by reason hereof, and that it will not, by reason hereof, make any claim, demand or application to or for any right or privilege applicable to an officer or employee of the State, including, but not limited to workers’ compensation coverage, unemployment insurance benefits, social security coverage, or retirement membership or credit.

C. Cooperation With Investigations. The Contractor hereby agrees to the provisions of §139-a and §139-b of the State Finance Law which require that upon the refusal of a person, when called before a grand jury, head of a State department, temporary State commission or other State agency, or the organized crime task force in the NYS Department of Law, which is empowered to compel the attendance of witnesses and examine them under oath, to testify in an investigation, concerning any transaction or contract had with the State, any political subdivision thereof, a public authority or with any public department, agency or official of the State or of any political subdivision thereof or of a public authority, to sign a waiver of immunity against subsequent criminal prosecution or to answer any relevant question concerning such transaction or contract;

1. Such person, and any firm, partnership or corporation of which he is a member, partner, director or officer shall be disqualified from thereafter selling to or submitting bids to or receiving awards from or entering into any contracts with the State of any public department, agency or official thereof, for goods, work or services, for a period of five years after such refusal, and;
2. Any and all contracts made with the State or any public department, agency or official thereof, since the effective date of this law, by such person, and by any firm, partnership or corporation of which he is a member, partner, director or officer may be canceled or terminated by the State without incurring any penalty or damages on account of such cancellation or termination, but any moneys owing by the State for goods delivered or work done prior to the cancellation or termination shall be paid.

107-02 PATENTED DEVICES, MATERIALS AND PROCESSES.

It is mutually understood and agreed that the contract prices are to include all royalties and costs arising from patents, trademarks, and copyrights in any way involved in the work. Whenever the Contractor is required or desires to use any design, device, material or process covered by letters, patent or copyright, the Contractor shall indemnify and save harmless the State from any and all claims for infringement by reason of the use of any such patented design, device, material or process, to be performed under the contract, and shall indemnify the said State for any costs, expenses and damages which it may be obliged to pay, by reason of any such infringement, at any time during the prosecution or after the completion of the work.
107-03 FEDERAL AID PARTICIPATION.

All contracts in which the Federal Government participates financially are designated as Federal-Aid contracts. For all Federal-Aid contracts, the Contractor shall conform in all respects in accordance with the true intent and meaning of each and all of the requirements contained in the FHWA-1273 Required Contract Provisions Federal-Aid Construction Contracts, a copy of which will be found incorporated in each Federal-Aid contract proposal. When any of such Federal Provisions may be in conflict with any other provisions of the contract the Federal Provisions shall prevail and take precedence and be of force over and against any said conflicting provisions of said contract.

107-04 SANITARY CODE.

The Contractor shall comply with the provisions of the State Sanitary Code relating to camps and obtain from the local health officers permits for the construction, maintenance and operation of labor camps, if used.

107-05 SAFETY AND HEALTH REQUIREMENTS.

The Contractor shall perform all work in the contract with due regard to the safety and health of the employees and of the public. The Contractor shall comply with 29 CFR 1926, Safety and Health Regulations for Construction, administered by the Federal Occupational Safety and Health Administration (OSHA) regarding the safety and protection of persons employed in construction and demolition work.

No Contractor employee may use, distribute, dispense, possess or manufacture any alcoholic beverages, illegal drugs or any other intoxicating substance on a contract site. Contractor’s written policy shall require that employees not report to work under the influence of drugs or alcohol, nor be impaired or unable to function at the workplace as a result of consuming alcohol or other intoxicants. While prescription drugs are not prohibited, they should not render an employee unfit for duty. Contractor employees that are suspected of using drugs or alcohol, or who are suspected to be under the influence of such substances, shall be reported to the Engineer. Contractor employees who are under the influence of drugs or alcohol may deemed incompetent, and are subject to dismissal in accordance with §105-02 Character of Workers.

The Contractor shall notify the Engineer of any inspections scheduled or conducted on the contract by OSHA, NYS Department of Labor (NYSDOL), or other safety and health agencies, of any resulting closing conference, and provide the Engineer with the opportunity to be present at such inspections and closing conference. The Contractor shall notify the Department in writing of the results of any safety and health inspections conducted by representatives of OSHA, NYSDOL, or other safety and health agencies, within one work day of the completion of the closing conference resulting from such inspections. If any citations are issued for alleged violations of OSHA Regulations, a copy shall be provided to the Engineer within one work day of their receipt by the Contractor, and a copy of the final disposition of such citations shall be provided to the Engineer within one work day of receipt by the Contractor.

A. High Visibility Apparel. All Contractors’ employees shall wear at all times protective helmets and construction apparel or other appropriate high-visibility apparel when working within a highway right of way or contract limits. All high-visibility apparel shall be closed front and rear; in good condition to maintain the color, visibility, reflectivity, and conspicuity. Contractors’ employees will be considered to include everyone on the Contractor’s payroll, Subcontractors, material suppliers, and other personnel under the direction of the Contractor. Protective helmets and high-visibility apparel are not required for employees when they are within a completely enclosed cab constructed of steel frame and glass, or inside a motor vehicle.

1. Protective Helmets. Protective helmets shall meet current OSHA standards for impact, electrical shock, and burn protection. Protective helmets used during nighttime operations shall be equipped with a minimum of 7500 mm² of reflective tape on all four sides (i.e., 25 mm by 75mm strip - 1875 mm² per side). Protective helmets for flaggers shall be orange.
2. **Construction Apparel.** Construction Apparel shall consist of a vest, shirt, or jacket; orange, fluorescent orange, yellow, fluorescent yellow, yellow-green, fluorescent yellow-green or combination of these colors meeting the requirements of the MUTCD.

3. **Nighttime Apparel.** Nighttime Apparel shall consist of a vest, shirt, or jacket; orange, fluorescent orange, yellow, fluorescent yellow, yellow-green, fluorescent yellow-green or combination of these colors meeting the requirements of ANSI 107 Class 2.

4. **Traffic Control Apparel.** Traffic Control Apparel shall consist of a vest, shirt, or jacket; fluorescent orange with fluorescent yellow-green striping bands or fluorescent yellow-green with fluorescent orange striping bands, placed both horizontal and vertical, meeting the requirements of ANSI 107 Class 2. The striping bands shall be approximately 120 mm wide with retroreflective strips.

   Retroreflective strips shall consist of two 25 mm wide retroreflective strips being 50 mm apart in the center of the fluorescent striping band material or a single 50 mm wide in the center of the fluorescent striping band material.

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**B. Project Safety and Health Plan.** It shall be the responsibility of the Contractor to perform all necessary planning, supervision, and training activities to ensure that all of the requirements of 29 CFR 1926 are fully met for all workers employed in the construction of the contract. The Contractor shall provide to the Department prior to the start of work satisfactory evidence that all current requirements of 29 CFR 1926 will be adequately addressed. As a minimum, the Contractor shall provide a written Project Safety and Health Plan which documents the Contractor's company policy relative to safety, and which identifies and addresses specific safety and health concerns to be encountered on the project. Before the work begins and periodically throughout the contract duration, the Contractor's project supervision staff shall meet with the Engineer to review and discuss the status of safety issues on the project. An appropriate notice shall be posted on the contract site that the Project Safety and Health Plan is available for examination by any worker. As a minimum this plan shall include the following items:

- Identification of project and company safety officers.
- Hazardous Materials Communications Plan.
- Employee Safety Training Program.
- Company safety policy.
- Procedures to address project safety and health concerns.
- Procedures for compelling worker compliance with safety and health requirements.

Certain of these items may be submitted in the format of a Company Safety and Health Program, with the Project Safety and Health Plan limited to project-specific issues.

The Contractor shall be responsible to ensure that each Subcontractor employed on the project complies with this requirement. The Contractor shall provide a Project Safety and Health Plan(s) to the Department covering all work to be done by Subcontractor(s) prior to starting work. As an alternative, the Contractor may provide a certification that all activities performed by and workers employed by the Subcontractor will be subject to the Contractor's Project Safety and Health Plan.

Submission of the required Project Safety and Health Plan(s) by the Contractor and its acceptance by the Department shall not be construed to imply approval of any particular method or sequence for addressing safety and health concerns, or to relieve the Contractor of its responsibility to adequately protect the safety and health of workers as well as any members of the public who may be affected.

**C. Emergency Contact Person.** The Contractor shall designate someone to be available to respond to emergency calls. The name of the person and the telephone number at which he/she can be reached at any time shall be given to the Engineer and all police agencies in the area. Such person shall have full authority and capability to mobilize forces promptly as required to respond to an emergency and protect the public.

**D. Accident Reporting.** The Contractor shall immediately notify the Department verbally of any accident or incident that results in the death of a worker, motorist or pedestrian. The Contractor shall
§107

notify the Department in writing within 24 hours, with the details relative to any accident or incident occurring within the contract limits or is directly related to construction activity or involving any worker employed on the contract or delivering materials, equipment or supplies to the contract, provided:

- The accident or incident results in the death of a worker,
- The accident or incident involved a utility (overhead or underground),
- The accident or incident involved a motorist or pedestrian,
- The incident was a near miss,
- The accident otherwise meets the notification requirements of OSHA.

The Engineer will provide the Contractor with a copy of the Department accident report for any accident occurring within the contract limits or involving the Contractor’s personnel, equipment or operations.

**E. Imminent Danger and Emergency Actions.** Any action by the Contractor that presents a potentially imminent danger of injury to the public, a worker, or the inspection staff will be halted immediately by the Engineer, and operations stopped in accordance with §105-01 Engineer’s Authority. The Contractor’s personnel shall have local emergency numbers readily available. These numbers shall include local utility, police/fire and medical assistance. In the event of an emergency, the Contractor shall evacuate all employees and endangered persons from the immediate vicinity to the best of the Contractor’s ability.

**F. Restricted Areas.** The Contractor shall identify, guard and protect restricted areas such as open and unattended excavations, areas subject to falling debris and other potentially hazardous locations in and adjacent to areas lawfully frequented by any person. Such protection shall consist of one, or a combination of, the following:

- A substantial fence or barricade, not less than 1.2m in height and mounted on satisfactory supports spaced at intervals of not more than 3m. Warning signs reading “DANGER-KEEP OUT” shall be mounted on the fence or barricade at no more than 30m intervals. The signs shall be a minimum of 600mm wide by 400mm high. The lower portion of the sign shall be white and shall bear the words “KEEP OUT” in 125mm black letters. The upper portion shall be predominantly red with 125mm white lettering spelling out the word “DANGER.” The lettering shall be enclosed by an approximately elliptical, white ring and the entire sign bordered in black. All barricades and warning signs shall be furnished, erected, relocated, maintained, and removed as required.
- A 1.2m (minimum) extension of the trench sheeting above the ground surface adjacent to an excavation.
- A substantial covering over an excavation. Where it is possible that vehicles will move over such covering, the covering shall be of sufficient strength to withstand the loading.

**G. Work Site Access.** The Contractor shall provide safe access to the work site by workers and inspection staff such that no active traffic lanes are routinely crossed by pedestrian workers or inspection staff reporting to and leaving the work site. Vehicles and equipment used to transport personnel to the work site shall safely enter and depart the work site.

The Contractor shall designate a safe parking area(s) for workers to park private vehicles near the project site acceptable to the Engineer. Contractor personnel shall park in non-designated parking areas within the right of way only with the prior approval of the Engineer.

**H. Fall Protection.** The Contractor shall provide fall protection for all workers in compliance with 29 CFR 1926. The Contractor shall include procedures to provide fall protection in the Project Safety and Health Plan. The minimum fall protection requirements include the following:

1. Fall protection shall be provided for all workers at or above 1.8 m or the height thresholds listed in 29 CFR 1926, Subpart L and Subpart M, whichever is lower, and for all locations where there is a risk of a fall onto dangerous equipment or an impalement hazard, regardless of height. All fall protection systems shall meet the requirements of 29 CFR 1926, Subpart M. For
situations where lifelines are interrupted, double lanyards shall be utilized to ensure that workers are continuously protected. One lanyard shall remain connected at all times.

2. Attachments or other temporary appurtenances on all beams and other structural elements shall be in place prior to erection or removal to provide fall protection until other means of protection such as deck forms are in place. Fall protection shall consist of personal fall arrest systems, safety nets or other means. During placement or removal of structural members when the member is supported by a lifting device, workers exposed to moving members shall be required to tie off only if they are not exposed to a greater risk from the moving member. Fall protection systems utilized shall enhance safety rather than create a secondary hazard.

3. The Contractor shall establish procedures to minimize occurrences of unprotected exposure to fall hazards. When a worker must rig a fall protection system, and rigging cannot be accomplished from an aerial lift or by tying-off to the existing structure, momentary exposure to a fall hazard may be unavoidable.

4. Ladders or stairways meeting the requirements of 29 CFR 1926, Subpart X shall be provided at all points of personnel access where there is a change in elevation of 480 mm (19 in) or more, and no ramp, runway, sloped embankment or personnel hoist is provided. Climbing on forms, falsework, or the structure to gain access to work areas is expressly prohibited.

5. Scaffolds necessary to provide temporary access to work areas shall be in compliance with 29 CFR 1926, Subpart L and shall include a top rail, mid rail, and toe board on all open sides and ends. Scaffolds shall be erected, moved, altered and/or dismantled only under the supervision and direction of a competent person.

6. Suspended scaffolds may be used only if personnel lifts, scaffolds, or other means are not practical, and shall meet the requirements of 29 CFR 1926, Subpart L. Specifically, the scaffold shall be secured to the suspension cables at all times. All personnel working on a suspended scaffold shall be provided fall protection using an independent anchorage.

7. Workers in personnel aerial lifts shall use a personal fall arrest system attached to the boom or basket. Aerial lifts shall be operated in accordance with 29 CFR 1926, Subpart L.

I. Working Over Water. Any worker who is exposed to the risk of drowning shall wear a U.S. Coast Guard approved personal flotation device (PFD) at all times. A risk of drowning shall be considered to exist where water depths exceed 1.5m, or water is subject to sudden fluctuations to a depth exceeding 1.5m. A risk of drowning may also exist where water depths as little as 0.6m are combined with swift currents, or a fall into the water may result in a person being rendered unconscious or otherwise disabled. Working on top of ice shall be considered as working over water. Where practical, workers should not work alone in situations where a risk of drowning exists.

When continuous fall protection is used, without exception, the drowning hazard has effectively been removed, and wear of a PFD is not required. When safety nets are used as fall protection the drowning hazard has not been removed, and wear of a PFD is required. When aerial lifts are used over or near water the drowning hazard has not been removed, and wear of a PFD is required by occupants of the lift, regardless of whether a personal fall arrest system is used.

When working over or adjacent to water, ring buoys with a minimum of 30m of line attached, shall be placed at a maximum interval of 60m along the work site shoreline or along the work limits and a boat/skiff for emergency response shall be in place prior to that exposure. The boat/skiff shall be unlocked and available for immediate use at all times, and able to retrieve a worker from the water in no more than 4 minutes from the time they entered the water. If additional hazards (very cold water, rapids, etc.) exist the boat/skiff shall be able to retrieve the worker before being overcome by that hazard.

A boat/skiff for emergency rescue operations shall be equipped with a motor, paddles or oars, a ring buoy, and a reach extension device. The boat/skiff shall be equipped and operated in accordance with NYS Navigation Law.

J. Electrical Safety. Electrical safety policy and procedures are based on the New York State High Voltage Proximity Act and 29 CFR 1926. They apply to all operations that could cause employees or the vehicles or equipment they are operating to come into contact with (“direct contact”) or enter into dangerous proximity to (“indirect contact”) energized electrical systems. Electrical systems shall be assumed to be energized high voltage until verified otherwise by the
NEW YORK STATE DEPARTMENT OF TRANSPORTATION
STANDARD SPECIFICATIONS of May 4, 2006

§107

Utility. The Contractor shall identify and reference all potential electrical hazards and document such actions to the Engineer as part of the Project Safety and Health Plan.

Pursuant to the High Voltage Proximity Act, for all electrical systems carrying 600 volts or more, the Contractor shall:

- Notify the Utility at least 5 working days before any work begins which requires the Utility to identify voltages and clearances, or de-energize, insulate or relocate lines.
- Ensure employees are not placed in dangerous proximity to high voltage. Dangerous proximity is defined as within 3.05 m (10ft) for voltages up to 50 kilovolts, and an additional 0.1m for every 10 kilovolts over 50 kilovolts. Dangerous proximity applies to the individual and any conductive object.
- Inform employees of the hazards and corresponding precautions when working near high voltage.
- Post warning decals on equipment regarding 3.05 m (10ft) minimum clearance.
- Ensure that when any equipment operator is unable to assess clearances, a "spotter" observes for clearance and directs the operator.

Prior to the start of work where contact with energized electrical systems is possible, the Contractor shall identify existing facilities and reference their location to prominent physical features. In advance of work, the Utility shall be called upon to identify energized facilities, and to determine the need to de-energize, insulate, or otherwise protect the facilities against accidental contact. The actual work of protecting facilities will be carried out by the Utility. Facility relocation or protection provided at the request of the Department will be as described in the contract documents. Protection provided for the benefit, or at the request, of the Contractor shall be the financial responsibility of the Contractor.

Energized electrical lines or equipment shall be conspicuously marked and workers shall be reminded of their locations and the safeguards and precautions to be taken prior to beginning any nearby work that may cause the workers to approach electrical lines. New employees shall be informed of electrical hazards and proper precautions and procedures.

1. **Paving Operations.** Prior to the start of each workday high visibility markers or other devices approved by the Engineer shall be placed to mark the location of all overhead wires, including, but not limited to electrical, telephone and cable television. As an alternative, the pavement beneath overhead lines may be marked with spray paint or by other means approved by the Engineer. This requirement shall also apply to off-site areas used for contract purposes. The Contractor shall periodically patrol the worksite to ensure that the markings are in place and shall replace any that are missing and shall maintain all markings in good condition.

2. **Aerial Lifts, Lifting Equipment, Boom Devices.** Where there is potential for proximity or contact with energized lines or equipment, work shall not begin until a safety meeting is conducted and appropriate steps are taken to identify, mark, and warn against accidental contact.

3. **Tree Work.** Branches touching wires shall be removed by the Utility before work begins. Limbs and branches shall not be dropped onto overhead wires. If limbs or branches fall across electrical wires, work shall stop immediately and the Utility shall be notified. Workers shall be equipped with appropriate personal protective gear for working near electricity.

4. **Building Electrical Work.** Employees working on electrical systems for buildings shall be knowledgeable about and shall employ, when appropriate, OSHA Lock-Out/Tag-Out procedures to prevent exposure to unguarded electrical systems.

K. **Open Excavations and Trenches.** In accordance with 29 CFR 1926.650, a trench is a narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 4.6 m. If forms or other structures are installed or constructed in an excavation so as to reduce the dimension measured from the forms or structure to the side of the excavation to 4.6 m or less, the excavation is also considered to be a trench. The Contractor shall provide protection from collapse and cave-in for any employee who enters a trench or other excavation in accordance with the
requirements of 29 CFR 1926 Subpart P, unless the excavation is less than 1.5 m in depth and examination of the ground by the Contractor’s competent person provides no indication of a potential cave-in. The Contractor shall include procedures to meet the excavation safety requirements in the Project Safety and Health Plan.

Trenching and excavation work shall be carried out under the supervision of the Contractor’s competent person. The Contractor shall provide ladders or ramps for access and egress within 7.5m of an employee work area if a trench is 1.2m or more deep. The Contractor shall keep traffic, equipment and materials at least 0.6m away from the edge of any trench or excavation, or use retaining devices. When mobile equipment is operated near an excavation or must approach the edge of an excavation, either the operator must have a clear and direct view of the edge of the excavation; or a warning system of barricades, hand signals or mechanical signals shall be used. Workers shall not be permitted under loads that are being handled by lifting or digging equipment.

For the purposes of open excavations and trenches, the term “competent person” shall be defined as one who has had specific training in, and is knowledgeable about, soil analysis, the use of protective systems and the requirements of 29 CFR 1926 Subpart P.


1. Asbestos. Asbestos abatement contractors and workers, including both removal and air monitoring contractors, shall be appropriately licensed and certified by the NYS Department of Labor (NYSDOL). The asbestos abatement contractor will perform all removal and disposal of asbestos-containing material. The Contractor shall verify that a disposal site for the asbestos-containing material is available before starting work. Prior to removal and disposal work, the Contractor shall supply the Engineer with proof that:
   - The firm performing the work has a valid asbestos-handling license.
   - The firm’s insurance coverage consists of an asbestos specific-occurrence type policy with no deductible or sunset clause.
   - Its abatement supervisor is a NYSDOL certified asbestos project supervisor.
   - All employees engaged in the work are properly certified and have current physical examinations and respirator fit tests.
   - Proper notification of work beginning on the asbestos project has been given to NYSDOL and the United States Environmental Protection Agency (USEPA).

   After work is completed, the Contractor shall provide the Engineer with two (2) copies of Daily Logs, Visitor’s Logs, OSHA Air Monitoring Records, and NYSDOL compliance air monitoring records.

2. Lead Safety and Health. The Contractor shall provide worker lead protection in accordance with 29 CFR 1926.62. The Contractor shall provide to the Engineer a written Lead Compliance program addressing as a minimum the specific issues listed in 29 CFR 1926.62 (e)(2), a written Hazard Communication program and Worker Lead Training program as components of the Project Safety and Health Plan. The Contractor shall provide detailed information describing the training and experience of the competent person who will supervise the compliance program on site, provide a description of procedures to monitor worker exposures to lead and provide the proposed medical monitoring program. If respirators are to be used to protect workers from lead exposure, a written respirator program shall be provided.

   Specific operations that would likely result in worker exposure to lead include, but are not limited to:
   - Removal of lead based paint coatings by abrasive blasting or other procedures.
   - Cleanup and removal of paint debris.
   - Cleanup, relocation, and dismantling of paint removal containment structures.
   - Flame cutting, heating, or welding of steel coated with lead-based paint.
   - Removal of bolts or rivets coated with lead-based paint.
Any other operations that may dislodge existing coatings of lead-based paint, or subject them to abrasion or elevated temperatures.

The Contractor shall identify and implement engineering and work practice controls to reduce worker exposure to lead to a level at or below the Permissible Exposure Level (PEL). The use of respirators and protective clothing shall be used to supplement engineering and work practice controls, if necessary, to protect workers from exposures above the PEL. Reliance on respirators or protective clothing to protect workers from exposures above the PEL, without first implementing feasible engineering and work practice controls, shall not be permitted except for initial assessment of exposure levels as described in 29 CFR 1926.62 (d). The removal of lead-based paint from structural steel shall be required prior to heating, welding, or flame cutting to reduce worker exposure below the PEL. In cases where the Contractor can clearly demonstrate through exposure monitoring that other work practices and engineering controls, under the oversight of a certified industrial hygienist, can effectively maintain actual worker exposure below the permissible exposure level, exceptions to this requirement may be granted by the Engineer.

The Contractor shall provide to the Engineer copies of documentation, as they are completed, to demonstrate full compliance with 29 CFR 1926.62. These records shall include, as applicable, the completed worker lead training, completed respirator programs, air monitoring results, exposure monitoring results, worker medical monitoring results, and other such records as are necessary to document compliance with the standard.

3. Equipment Involving Radioactive Materials. The use of equipment involving radioactive materials, including but not limited to nuclear density gauges, shall adhere to all applicable regulations, including U.S. Nuclear Regulatory Commission regulations, related USDOT regulations concerning transportation of radioactive materials, and 12 NYCRR 38. Fourteen (14) days prior to the start of any work involving such equipment, the Contractor shall submit to the Engineer a written Radiation Safety Plan. The plan shall address in detail transportation and storage of the equipment and operating and emergency procedures. It shall provide the name and address of the Contractor's Radiation Safety Officer. A copy of the owner’s license to possess the radiation source, issued by the NYSDOL, shall also be provided. All operators of the equipment shall be certified by a gauge manufacturer as to having completed training on the safe use of the equipment. A copy of the certification shall be provided to the Engineer for each operator prior to their work on the project.

4. Silica. The Contractor shall provide protection to all workers from exposure to hazardous levels of silica in accordance with 29 CFR 1926.55. In accordance with §107-05B. Project Safety and Health Plan, the Contractor shall identify and address silica health and safety in the written Project Safety and Health Plan. The Contractor shall identify and implement worker training, engineering controls, and workplace practice controls to reduce worker exposure to silica prior to instituting a program based on respirators or protective clothing to protect workers from exposures. Engineering controls shall include, but shall not be limited to; dust suppression through the application of water or other methods, use of general or local ventilation, and containment/isolation. Workplace practice controls shall include proper use and implementation of supervision, task procedures, employee training, signing, protective clothing, housekeeping, and personal hygiene. If engineering controls and work practice controls cannot reduce exposures below the personal exposure limit, the Contractor shall institute a respirator program. Each of these safety components is covered individually by 29 CFR 1926.

Many materials disturbed by the Contractor’s operations may contain hazardous levels of silica. Silica may be in soil, concrete or asphalt pavement, superstructure or substructure materials. Specific operations that may result in worker exposures to silica, include, but are not limited to:

- Saw cutting, grinding, milling, hammering, drilling, or chipping of rock, cement concrete, or asphalt concrete.
- Concrete pavement rubblizing.
- Demolition of brick, cement concrete, or masonry structures.
• Abrasive blasting, if the abrasive contains silica, or of cement concrete, rock, or asphalt concrete.
• Dry sweeping or pressurized air blowing of cement concrete, rock, sand, or asphalt concrete dust.

M. Demolition/Removal of Buildings and Structures. Demolition or removal work shall not be performed by the use of explosives unless approved by the Regional Director.

N. Drilling and Blasting. Blasting shall be performed in accordance with the Department publication entitled Procedures for Blasting. This publication is available upon request from the Regional Director or the Director, Geotechnical Engineering Bureau.

The Contractor shall submit a written Blast Plan in accordance with Procedures for Blasting for approval by the Department a minimum of 10 work days prior to start of blasting operations. A preblast meeting relative to the method, manner and procedure of blasting operations shall be held with the Engineer, the Contractor, the Blaster, a Departmental Engineering Geologist and representatives of all interested agencies prior to the commencement of drilling and blasting operations.

Whenever explosives are used, they shall be of such character and strength and in such amounts as permitted by state and local laws and ordinances and all agencies having jurisdiction over them. The Department reserves the right to specify the maximum size of the charges. Blasting shall be done only when the Engineer and those agencies shall approve and under such restrictions as they may impose.

If a blast causes injury, damage to property, adverse affects upon traffic, or causes gases to migrate and/or accumulate in a potentially harmful manner, all blasting operations shall cease pending review of the procedures. The review will be conducted by the Engineer in conjunction with an Engineering Geologist to ensure that proper procedures and practices were used to determine if the approved procedures need to be revised. Should the findings of the review indicate the injury, damage, traffic delay, or migration/accumulation of gases was attributed to improper blasting operations, the blaster of record may be removed at the Department’s option.

The Contractor shall meet all the requirements of 12 NYCRR 23 and 12 NYCRR 39, which include but are not limited to the licensing for ownership, possession, transportation, or use of explosives, certifications for blasters, and provisions for storage, construction and maintenance of magazines.

O. Equipment Safety Procedures. The following provisions shall apply to all work on the project, including but not limited to, the activities of all Subcontractors, Manufacturers, Fabricators, Material Suppliers, independent truckers and owner-operators. The Contractor shall include the proposed equipment safety procedures in the Project Safety and Health Plan.

• A spotter shall guide the backing of any vehicle or equipment with restricted visibility to the rear. This rule applies in any location where workers on foot, pedestrians, private vehicles or similar hazards may be present.
• If the operator loses visual contact, the vehicle shall immediately be brought to a full stop until visual contact with the spotter is reestablished.
• Dump truck boxes may be raised only under the control of a spotter, unless the vehicle is in an area clearly marked to be free of overhead wires and safe for dumping.
• Dump truck boxes shall be lowered prior to moving, except when dumping into a paver or similar operations, under the control of a spotter.
• All excavating, lifting and similar equipment shall comply with electrical safety requirements, and shall operate under the control of a spotter whenever working within 5m of an overhead line. The distance shall be measured as a slope distance perpendicular from the conductor to the nearest point on the vehicle.
• Any operator found in violation of the above rules by the Engineer or his/her representative will be removed from the project immediately, and will not be allowed to work on any Department project for a minimum of one (1) year.
§107

P. Lifting. The following shall apply for all lifting operations when utilizing lift equipment. Lift equipment for this lifting paragraph shall be defined as equipment capable of lifting an item more than five meters high, has the ability to swing or rotate a boom, and has a maximum rated lifting capacity exceeding one metric ton. All lift provisions of the Steel Construction Manual and the Prestressed Concrete Construction Manual remain in effect. This paragraph does not pertain to lifting operations covered under Section 585, Structural Lifting Operations, nor ordinary excavation operations. This paragraph does apply however to cranes with either fixed or swinging leads that are dedicated to pile driving operations.

1. Competent Person. The Contractor shall designate, to the Engineer, one person, who is competent in lifting operations, to be completely in charge of each lifting operation. In general, Competent Person shall mean one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them. The Competent Person shall have the authority to take an unsafe piece of equipment out of service until the hazard is eliminated. The Competent Person shall be knowledgeable about lifting equipment and equipment operations, Manufacturer’s specifications and recommendations, and have a thorough knowledge of the requirements, regulations and standards governing his/her duties. The Competent Person shall, as a minimum, have the ability to interpret load charts, calculate lift loads, recognize overhead wire hazards and know all aspects of the rigging.

The Competent Person shall inspect all lift equipment prior to and during usage to make sure the equipment is in a safe operating condition.

2. Lift Equipment. Lift equipment shall have durable, legible load charts which shall have been prepared by either the equipment manufacturer or a Professional Engineer. If manufacturer’s load charts are unavailable, charts may be prepared by a Professional Engineer. The Professional Engineer shall utilize the same factors of safety against overturning as the equipment manufacturer. The charts shall be attached to the equipment in a location accessible to the operator while at the controls. The charts shall contain a full range of load ratings at all stated operating radii. The charts shall also note conditions such as outriggers, counter weights, and work area, i.e., over side, over front, or over rear of equipment.

Equipment may lift loads up to those indicated on the manufacturer’s or Professional Engineer’s load chart if the equipment has the following safety devices and the safety devices are operating:

a. Load and radius measuring device pre-programmed to continuously relate the measured data to the load radius chart as a direct reading of load or percentage of the rated load, and connected to a warning light and an acoustical signal located at the operator’s position or in the cab to indicate overload.

b. A device that continuously indicates the levelness of the machine and is visible from the operator’s controls.

Lift equipment with non-operational safety devices or no safety devices shall be operated at levels not to exceed 78 percent of the Manufacturer’s or Professional Engineer’s load charts. This equipment shall have a separate load chart labeled “78% Load Chart” and it shall be attached to the equipment.

Lift Equipment with operational safety devices that is operating from a barge shall utilize a manufacturer’s or Professional Engineer’s load chart that is established specifically for operating from a barge. Lift Equipment on barges with non-operational safety devices or no safety devices shall operate at 78 percent of the Manufacturer’s or Professional Engineer’s load chart for working on barges. This equipment shall have a separate load chart labeled “78% Load Chart for Equipment on Barges.”

Equipment used for lifting over a railroad shall be restricted such that the operational capacity shall be limited to 66 2/3% of its tipping load as specified in §105-09, Work Affecting Railroads or be limited to the load limits indicated in the previous three paragraphs, whichever is lower.
3. Lift Plan. A Lift Plan is necessary only when required by a contract pay item specification, the Steel Construction Manual, or Prestressed Concrete Construction Manual. The Contractor shall submit erection drawings, demolition plans or other information as required, which detail the lifting procedure or lift plan. This information shall be submitted to the Engineer 30 days prior to the commencement of erection or demolition work, for review and approval by the Department and, when applicable, any railroad affected by the proposed procedure.

Structural elements shown on shop drawings and erection drawings may have units expressed in both metric and English units, however metric measurements or dimensions shall control.

As a minimum, the information in the submittal for a lift plan shall include the following:

a. Plan of the work area showing support structures, roads, railroad tracks, canals, streams and utilities.
b. Lift radii and pin locations.
c. Length of boom.
d. Counterweight size and location.
e. Lift configuration(s).
f. Location of trucks for delivery or removal of materials.
g. Restrictions on swing radii.
h. Sectional views of all lifts where electrical facilities are within a 5 meter radius of any part of the lifting equipment or object being lifted.
i. Wind restrictions if they are a requirement of the Manufacturer’s lifting notes.
j. Catalog cuts for all lifting devices shown on the drawing.
k. All pertinent rigging with dimensions.
l. Equipment such as rigging, beam clamps, jibs, swing-away, super-lifts, additional blocks, cheek plates, headache balls, and additional cables at the time of the lift shall be included as part of the load and shall be indicated as such.
m. Position of outriggers and outrigger supports.
n. Outside dimension of tracks for track mounted lifting equipment.
o. Parts of line for hook block.
p. A comparison of total lift weight vs. lifting equipment capacity for the pick radius.
q. Maintenance and protection of traffic provisions specifically required for the lift.

When the lifting operation imparts loads on a structure, false work or utility, when there is a two machine lift, or when a slider beam is used, the Contractor shall submit calculations which show that the proposed operation is safe and/or that the operation will not cause an overstress condition. The calculations and any supporting drawings or other information shall be stamped and signed by a Professional Engineer. Any and all alterations or modifications to a lift plan shall be signed and stamped by a Professional Engineer if the originally approved lift plan was prepared and signed by a Professional Engineer. The Engineer shall be notified of any alterations or modifications.

4. Pre-Lift Meeting. A pre-lift meeting will be required for projects that require a lift plan. The Competent Person, and other appropriate contractor staff, shall attend the pre-lift meeting with the Engineer, as well as representatives from the utilities and railroads if deemed applicable, five work days before lifting operations are to be performed. The meeting shall include but not be limited to: the review of site conditions, erection or demolition plans, lift loads vs. lift equipment capacity, obstructions, utilities, traffic concerns, and the roles of Department and Contractor personnel.

5. Lift Operations. The Competent Person shall be present for all lifting operations. If a crane is utilized in a lifting operation, or a crane with either fixed or swinging leads is utilized in a pile driving operation, the operator shall present to the Engineer a valid New York State Certificate of Competence to operate a crane, except an individual operating a crane within a city having a population of one million or more. Individuals operating a crane within a city having a population of one million or more shall present the Engineer with a valid license or certification to operate a crane issued by such city. If there are any other local crane license requirements,
they too shall be presented to the Engineer. In addition, a copy of the annual inspection report of the crane shall be readily available and provided upon the Engineer’s request.

Any discrepancies between the Lift Plan and the actual lift conditions shall be reported immediately to the Competent Person in charge of the lift operations and to the Engineer. The operation shall not proceed until all issues are resolved to the satisfaction of the Engineer.

**Q. Histoplasmosis.** Histoplasmosis is a fungal infection caused by a soil organism found in large masses of bird or bat droppings, and is a potential health hazard in areas where birds or bats have nested for long periods. Such conditions are often found on bridge structures, in barns, farm buildings and cold storage facilities, areas with small amounts of dried droppings pose minimal hazard. Airborne material may enter the body by inhalation or ingestion.

Prior to work in any area where birds or bats nest, the Contractor shall conduct a thorough inspection to determine if, and to what extent there is a build-up of droppings. Workers conducting an inspection shall be equipped with personal protective equipment, which include gloves, rubber boots, rain suit components, goggles and a dust/nuisance respirator. Questions regarding proper equipment for this activity shall be directed to the Engineer.

If substantial material is found, the Contract shall clean the work area using a high powered water hose or by scraping. If the material is to be scraped away, it shall be kept wet during the entire process. Workers engaged in cleaning activity shall wear personal protective equipment specified above. Application of a cleaning agent (bleach, for example), before removal may help dissolve the material, and a disinfectant shall be applied to cleaned surfaces. Compressed air shall not be used to remove pigeon droppings because it produces airborne particles.

When cleaning has been successfully completed, the personal protective equipment specified above is no longer required. Employees engaged in cleaning, or any other activity which involves exposure to pigeon droppings, shall observe a high degree of personal hygiene, even if the exposure is casual. Special care shall be taken to wash hands thoroughly before eating or smoking.

**R. Confined Spaces.** Confined spaces are defined as any space having limited means of egress, which is subject to the accumulation of toxic or flammable contaminants or has an oxygen deficient atmosphere. Confined spaces include, but are not limited to: sanitary sewers, sanitary manholes and structures, drainage lines and drainage structures, underground utility vaults, enclosed bridge beams and heated enclosures. All personnel required to enter confined spaces shall be instructed as to the nature of the hazards, the necessary precautions and in the use of protective and emergency equipment required.

Fuel-fired heated enclosures are frequently constructed to provide the requirements for winter concrete placement or similar operations. The Contractor shall provide adequate ventilation to maintain acceptable air quality or conduct air quality monitoring when heaters are or have been operating prior to personnel entry. If acceptable air quality cannot be verified, then appropriate respirators shall be worn. No worker shall enter a confined, heated space unless that space can be ventilated or the worker removed from outside the enclosure if the worker is overcome by fumes. Particularly during off-shift hours, no worker shall enter an unventilated, heated enclosure unless another worker is present immediately outside the enclosure. All unnecessary combustibles and debris shall be removed from the enclosure and escape exits shall be provided so workers can escape safely if a fire starts, prior to heating.

**S. Fire and Explosion Prevention.** The Contractor shall ensure that combustibles do not accumulate. Flammable materials shall be handled and stored as required by OSHA regulations. “No Smoking” signs shall be posted and enforced wherever flammable materials are stored or used. Fire extinguishers shall be provided and maintained throughout the site, in accordance with the requirements of 29 CFR 1926, Subpart F. Fires will be considered, as a minimum, a near-miss accident, and therefore shall be reported in accordance with existing reporting requirements.

During refueling, all possible sources of ignition, including, but not limited to sparks, open flames and electrical equipment shall be eliminated. Fuel containers shall be grounded to the tank to prevent static electrical sparks. A "No Smoking or Open Flame" sign shall be posted conspicuously in the vicinity of refueling operations.
Cutting and welding equipment shall be stored according to recognized safety standards. Any defective tanks or equipment shall be removed to a safe storage area immediately until repairs are made. When cutting or burning is underway, steps shall be taken to ensure that sparks do not ignite combustibles.

**T. Pavement Striping.** The Contractor's striping safety procedures shall be spelled out, as appropriate, in the Project Safety and Health Plan. For polyester striping operations, specific procedures for the safe handling and storage of MEKP (organic peroxides) shall be addressed in the Contractor's project safety and health plan. The equipment shall be carefully inspected by a person knowledgeable about striping operations and trained on safe operating and emergency procedures prior to the start of work to ensure safety features are in place. All appropriate Material Safety Data Sheets and safety operations manuals shall be present in the cab of the striper at all times. All required placards and warnings shall be in place and clearly legible at all times.

### 107-06 INSURANCE.

The Contractor shall procure and maintain, at its own expense and without expense to the State, insurance for liability for damages imposed by law, for the work covered by the contract, of the types and in the amounts hereinafter provided, covering all operations under the contract whether performed by it or its Subcontractors. Insurance shall be procured from insurance companies authorized to do such business in the State and shall be maintained until contract final acceptance by the State. Before commencing work, the Contractor shall furnish to the Commissioner a certificate or certificates of insurance, in form satisfactory to the Commissioner, showing that it has complied with this subsection, which certificate or certificates shall provide that the policies shall not be changed or canceled until thirty (30) days written notice has been given to the Commissioner. All policies supplied under the provisions of this Section shall be endorsed to provide for the above 30 day written notice of cancellation or change provisions.

The types of insurance are as follows:

#### A. Workers’ Compensation Insurance.

A policy covering the obligations of the Contractor in accordance with the provisions of the Workers’ Compensation Law and the Disability Benefits Law, covering all operations under the contract, whether performed by it or its Subcontractor(s). The contract shall be void and of no effect unless the person or corporation making or executing same shall secure compensation and disability benefits coverage for the benefit of, and keep insured during the life of said contract, such employees in compliance with the provisions of the Workers’ Compensation Law (State Finance Law Section 142).

#### B. Liability and Property Damage Insurance.

Policies shall follow the current 1986 Insurance Services Office (ISO) format. Unless otherwise specifically required by special provision, policies shall not be amended or contain deductible clauses or coverage exclusions of any nature and shall have limits not less than:

<table>
<thead>
<tr>
<th>Bodily Injury and Property Damage Liability Combined Single Limit</th>
<th>Each Occurrence</th>
<th>Aggregate</th>
</tr>
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<td>$1,000,000</td>
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For all damages arising during the policy period, insurance shall be furnished in the types (1.) through (6.) as described below. An umbrella type policy, dedicated to the contract, may be used to meet these limits.

1. **a. Contractor’s Liability Insurance.** A policy issued to and covering the liability for damages imposed by law upon the CONTRACTOR with respect to all work performed by it under the contract agreement;

   b. **Contractor’s Liability Insurance.** A policy issued to and covering the liability for damages imposed by law upon EACH SUBCONTRACTOR with respect to all work performed by said Subcontractor under the contract agreement;
§107

2. **Owners Protective Liability Insurance.** A policy issued to and covering the liability for damages imposed by law upon The People of the State of New York, the State of New York, the Commissioner of Transportation, all employees of the Department of Transportation both officially and personally, any municipality in which the work is being performed, any public benefit corporation, railroad, public utility whose property or facilities are affected by the work, any consultant inspecting engineer or inspector working for or on the contract, and their agents or employees, with respect to all operations under the contract agreement by the Contractor or its Subcontractors, including omissions and supervisory acts of the State, municipality, public benefit corporation or consultant. Specifically, this includes, but is not necessarily limited to the parties listed in the Special Note entitled Additional Insured Parties. Failure to list a firm, organization or municipality, etc. does not eliminate the requirement to provide such coverage.

If the Contractor elects to use the same policy for more than one contract, it shall provide, with the insurance certificate, the Aggregate Limits of Insurance Endorsement (per contract) indicating the specific contract site and contract number;

3. **Contractor’s Protective Liability Insurance.** A policy issued to and covering the liability for damages imposed by law upon the Contractor with respect to all work under the contract agreement performed for the Contractor by Subcontractors;

4. **Completed Operations Liability Insurance.** A policy issued to and covering the liability for damages imposed by law upon the Contractor and each Subcontractor arising out of that part of the work performed by each between the date of final cessation of the work and the date of final acceptance thereof;

5. **Commercial General Liability Insurance.** A policy issued to and covering the liability for damages imposed by law upon The People of the State of New York, the State of New York and the Commissioner of Transportation and all employees of the Department of Transportation both officially and personally, any municipality in which the work is being performed, any public benefit corporation, railroad, or public utility whose property or facilities are affected by the work, or any consultant inspecting engineer or inspector working for or on the project, and their agents or employees, with respect to temporarily opening any portion of the State construction project under this contract agreement, until the construction or reconstruction pursuant to the contract agreement has been accepted by the State. Specifically, this includes, but is not necessarily limited to the parties listed in the Special Note entitled Additional Insured Parties. Failure to list a firm, organization or municipality, etc. does not eliminate the requirement to provide such coverage. This coverage will not be required for contracts involving only turf establishment, landscaping, or traffic signals, which do not involve work on the roadway.

6. **Automobile Liability and Automobile Property Damage Insurance.** A policy covering all owned, non-owned and hired vehicles used in connection with the work covered by the contract documents, bearing, or required by NYS Motor Vehicle Law to bear, license plates under the circumstances for which they are being used.

107-07 PROTECTION OF UNDERGROUND FACILITIES.  
The Contractor shall use the necessary precautions to prevent damage to pipes, conduits, and other underground facilities. All costs associated with verification of the location of underground facilities pursuant to 16 NYCRR 753 Protection of Underground Facilities, as amended, shall be included in the prices bid for the respective contract items involved unless separate payment is otherwise provided for in the contract. The Contractor shall provide access to Public Service Commission personnel to examine and inspect excavation and demolition methods used within 4.5m (15 feet) in any direction of any underground facility.

A. **One-Call.** Pursuant to 16 NYCRR 753 Protection of Underground Facilities, prior to non-emergency excavation, subsurface exploration of any kind, or installation below existing grade, including, but not limited to; digging, auguring, backfilling, boring, drilling, excavation, grading, jack hammering, pipe jacking, pavement milling, pile driving, plowing in, pulling in, sawcutting, tree root
removal, trenching, tunneling and the installation of guiderail posts, sign posts, fence posts or underground conduit, the One-Call notification system shall be notified of the date and location of the proposed work. The Contractor shall contact the One-Call notification system serving the area a minimum of 2 days and a maximum of 10 days, not including the date of the call, prior to work. The Contractor shall mark proposed locations of excavation, or other activity listed above, with white paint, white stakes or other indications as agreed to by the Utilities to facilitate the work of underground utility designation. Utilities that do not belong to the One-Call notification system shall be contacted separately. The Town, City or County may be contacted to obtain a list of Utilities. If additional work is required, and staking, marking or other designation has been lost, the Contractor shall contact the One-Call notification system for subsequent designation. If an underground facility has been designated, but the Contractor cannot physically locate the facility, the Utility shall be notified, so that the designation can be verified. If an unmarked or unknown facility is discovered during the course of the Contractor's operations, the Utility or suspected Utility shall be notified. If the owner cannot be determined, the One-Call notification system shall be notified. The Contractor shall support and protect from damage all exposed underground facilities. The Contractor shall notify the Engineer of any accidental contact with or potential damage to any underground facility, regardless of whether the damage is visible or not.

The Contractor shall provide to the Engineer, in writing, the information provided to the One-Call notification system, or the Utility if it is not a One-Call notification system member, and the control number issued for each call placed to request designation of underground facilities. The Contractor shall protect and preserve designations until no longer required for safe work near the underground facility.

The Contractor shall identify and provide to all forepersons and equipment operators, a list of emergency phone numbers for each Utility having facilities within the contract limits. Supervisors shall periodically review the location of underground facilities with all workers who are subject to exposure, including new employees. If the Contractor fails to notify the One-Call notification system or a non-member Utility prior to excavation or activity listed above, a Stop Work Order will be issued in accordance with the provisions of §105-01 Engineer’s Authority. Prior to lifting the Stop Work Order, the Department will consider convening a show cause meeting, at its convenience, to consider possible worker dismissal in accordance with §105-02 Character of Workers or contract termination in accordance with Article 11 Right to Suspend Work and Cancel Contract of the contract agreement.

B. Verification. Pursuant to 16 NYCRR 753 Protection of Underground Facilities, the Contractor shall verify precise location, size, depth and direction of run of an underground facility or its encasement, by hand shovel or vacuum excavation, prior to the use of powered equipment or the installation of any proposed work, including the projected line of a trenchless installation such as boring or drilling, within the tolerance zone. Powered equipment may be used to remove pavement or masonry within the tolerance zone, but only to the depth of such pavement or masonry. Powered equipment shall not be used within 100 mm of the verified location of an underground facility.

C. Contact or Damage. Pursuant to 16 NYCRR 753 Protection of Underground Facilities, the Contractor shall, in the event of contact or damage to an underground facility, immediately notify the Utility and the Engineer, suspend excavation or demolition in the immediate vicinity of the contacted or damaged facility and take such emergency actions as are warranted to protect all endangered persons to the best of its ability.

D. Pressure Pipes. Pressure pipes shall not be pressurized without being adequately restrained against movement, and no personnel shall be allowed in a trench or area containing a pressure pipe during initial pressurization until the pipe has been fully pressurized. Particular attention shall be paid to fittings and bends that create a thrust, which, if improperly restrained, may cause the pipe joints to separate and injure nearby personnel.

E. Quality Level Designations. The quality of information gathered about underground utilities is shown on contract plans using a Quality Level Designation. The Quality Level Designation may be different within the same area for different underground utilities, depending on the accuracy and availability of information. Below are the Quality Level Designation definitions:
§107

1. **Quality Level A.** Quality Level A is the highest degree of accuracy. The information shown on the plans has been obtained by the actual exposure (or verification of previously exposed and surveyed utility facilities) of subsurface utilities, using (typically) minimally intrusive excavation equipment to determine their precise horizontal and vertical positions, as well as their other utility facility attributes. Shown on contract plans as QLA.

2. **Quality Level B.** Quality Level B is the second highest degree of accuracy. The information shown on the plans has been obtained through the application of appropriate surface geophysical methods (i.e., underground cameras, radar, sonar, tone outs, etc.) to identify the existence and appropriate horizontal position of subsurface utility facilities. Quality Level B data are reproducible by surface geophysics at any point of their depiction. The information was surveyed to applicable tolerances and reduced onto the plans. No excavations were performed. Shown on contract plans as QLB.

3. **Quality Level C.** Quality Level C is the third highest degree of accuracy. The information shown on the plans has been obtained by surveying and plotting visible above-ground utility features and by using professional judgment in correlating this information to Quality Level D information. Shown on contract plans as QLC.

4. **Quality Level D.** Quality Level D is the lowest degree of accuracy. The information shown on the plans was derived solely from existing NYSDOT and/or utility company records or recollections. Shown on contract plans as QLD.

107-08 PROTECTION AND RESTORATION OF PROPERTY AND LANDSCAPE.

The Contractor shall protect and preserve all public and private property, including all existing vegetation, existing landscape features, and monuments within, along, and adjacent to the highway right of way. The Contractor shall use every precaution necessary to prevent damage, injury, pollution or destruction; shall protect all trees and other woody plants which are to remain; and shall take special care to protect the natural vegetation and surroundings including all natural drainageways, waterways, wetlands, woods and fields. The Contractor shall store materials in such a manner as to prevent leaching which would be injurious to water, soils, and plants.

A. **Within the Right of Way.** Before beginning the use of any area within the right of way, but not within the limits of disturbance shown in the contract documents, the Contractor shall obtain the written approval of the Engineer. Before beginning the use of any area within the right of way, but outside the contract limits, the Contractor shall obtain the written approval of the Department through modification of the contract limits by order-on-contract or the issuance of a highway work permit. Approval will not be given if the area is not suitable for acceptable restoration or if serious or permanent environmental damage is foreseeable. This applies to areas such as, but not limited to: borrow areas, spoil areas, equipment and/or material storage areas, haul roads, batching areas, water points, shop areas and all similar areas.

Where a contract pay item for turf establishment is not included in the contract, disturbed earth areas within the work limits shall be graded and seeded as specified for the standard turf establishment item. The cost of this work shall be included in the prices bid for the various items in the contract and no separate payment will be made therefore.

B. **Outside the Right of Way.** The Contractor shall notify the Engineer of the use of any specific area outside the right of way before work in any such area is begun, except areas which have been or are being used by the Contractor as its established and permanent headquarters, equipment storage sites or to commercial borrow sources, commercial gravel pits, commercial quarries, and all similar areas. The Contractor shall provide the Engineer with a copy of any permit application or notice of intent, without attachments.

In accordance with the SPDES General Permit for Stormwater Discharges from Construction Activity, any construction activity that results in a soil disturbance of more than 0.4 Ha (1 acre) on a single property will require SPDES permit coverage from the NYS Department of Environmental
Conservation (NYSDEC). When SPDES permit coverage is required, the property owner, as the “Operator” must develop and implement a NYSDEC approved stormwater pollution prevention plan (SWPPP) and conduct required periodic inspections until the permit coverage is terminated.

In accordance with the Mined Land Reclamation Law, (Environmental Conservation Law Article 23, Title 27), all borrow pits and aggregate sources outside of the State right of way, where more than 910 metric tons or 570 cubic meters (1,000 tons or 750 cubic yards), whichever is less, of minerals are removed from the earth within any twelve successive calendar months, require mining permits obtained from NYSDEC. When a mining permit is required, the Contractor, in addition to complying with restoration requirements for all areas as stated below, may be required by the Engineer to meet pertinent standards contained in the law and/or 6 NYCRR Part 420 et. seq.

Where borrow pits result in the formation of ponds or low areas intermittently filled with water, the Contractor shall furnish the Engineer with a copy of its agreement with the landowner permitting the use of such areas. If such an area is within sight of any highway, the Regional Director’s written approval shall be obtained prior to the removal of borrow from such a location. If such approval is not granted, material for use on the contract or for any other State contract may not be removed from the area. If the Contractor removes material from such an area without the written approval of the Regional Director, payment will not be made for any item of work in which the material has been used. Grading plans may be required for such areas and due consideration given to the appearance of the areas if they are visible from any highway.

C. Restoration. All areas disturbed by the Contractor shall be restored to a pleasing and acceptable condition, particularly those areas within sight of the finished highway or any other highway. All such areas shall present a pleasing appearance to travelers on any highway. Where deemed necessary by the Engineer, the Contractor shall submit a grading plan. Grading plans shall include the sequence of operations, the erosion and sediment controls, final slopes and surface restoration details.

Because the extent of such areas and the use and treatment during construction is within the discretion of the Contractor, within the limitations and requirements outlined, no direct payment will be made for any labor, material or equipment necessary for the restoration of these areas. The cost of the work shall be included in the amount bid for other items of work. Work shall be done in general accordance with the Department’s specifications for similar items of work.

The Contractor shall repair all injuries to woody plants which are to remain by approved horticultural methods; and shall scarify the compacted soil and regrade so as to restore the property to a natural condition. Where the soil over the root area of trees to be preserved has been compacted, it shall be restored by proper cultivation to a condition to permit the entrance of water and the proper aeration of roots.

In general, the restoration of disturbed areas shall include:
1. The removal of all equipment and parts, junk, rubbish, excess materials and debris of all kind;
2. Clean up as required, grading as shown on a grading plan if required; or graded so as to blend into the surrounding ground forms;
3. Scarification of yards, batch sites, haul roads, etc., to the depth necessary to support vegetation;
4. The removal of pavement or granular surfacing from, and regrading of, temporary roads or areas;
5. The repair/removal of damaged trees;
6. The fertilizing, seeding and mulching of disturbed areas;
7. Grading the slopes of excavated areas to a stable condition, but in no case shall earth cut faces be left steeper than one (1) vertical on one and one-half (1.5) horizontal. All rock cut slopes shall be scaled to remove any loose or unstable rock.

The restoration of disturbed areas shall be accomplished prior to contract final acceptance. The work of restoring Contractor’s work areas (storage, batching, equipment, shop areas, etc.) may be done after contract final acceptance, but shall be completed prior to execution of the final agreement.

107-09 DAMAGE.

All damage, direct or indirect, of whatever nature resulting from the performance of the work or resulting to the work during its progress from whatever cause, including omissions and supervisory acts
of the State, shall be borne and sustained by the Contractor, and all work shall be solely at its risk until it has been finally inspected and accepted by the State except that:

**A. Damage by Public Traffic.** Payment shall be made to the Contractor for repair or replacement of any permanent element of the highway which is completed to the stage of serving its intended function and is subsequently damaged by accident by public traffic. The Contractor must supply satisfactory evidence that such damage was caused by a public traffic accident and not by vandalism or by the Contractor’s equipment. Satisfactory evidence shall generally be limited to: accident reports filed with the NYS Department of Motor Vehicles, police agencies or insurance companies; statements by reliable, unbiased eye witnesses; or identification of the vehicle involved in the accident. Physical evidence that the damage was caused by a motor vehicle (such as tire marks or broken headlight glass) will not be sufficient unless it can be shown that the damage was not caused by the Contractor’s vehicles or by vandalism.

Work for which there is a bid item will be paid for at the unit price for that item. Work for which there is no bid item will be paid for at an agreed price or by means of force account. Payment will not be made for repair or replacement in any way connected with untimely failure of any portion of the highway under public traffic, and the determination regarding this matter shall be made by the Regional Director, taking into consideration the normal life and the amount of normal wear of the element involved. This provision does not relieve the Contractor of the responsibility of maintenance and protection of traffic for the contract or the responsibility of having wholly complete and acceptable work at the time of final inspection and contract acceptance. Payment for such damage shall be made only after the Contractor has demonstrated to the satisfaction of the Regional Director that it had made every reasonable effort to collect the costs from the person or persons responsible for damage.

The Contractor shall not be responsible for damages resulting from faulty designs as shown in the contract documents nor damages resulting from willful acts of Department officials or employees and nothing in this paragraph or contract shall create or give to third parties any claim or right of action against the Contractor or State beyond such as may legally exist irrespective of this paragraph or contract.

**B. Damage by Occurrence.** In the event that damage to the work in progress is caused by an Occurrence, as hereinafter defined, and to the extent that such damage has been determined by the Department to be beyond that which may be anticipated from heavy storms, and also to the extent that such damage is not reimbursable by insurance carried by the Contractor, the Contractor may apply to the State to pay or participate in the cost of repairing the damage to the work, unless such damage is caused by the Contractor’s action or inaction or the Contractor’s means and methods of construction. At the sole discretion of the Department, terminate the contract may be terminated and the Contractor relieved of further obligation to perform the work, subject to the following:

1. **Occurrence.** Occurrence shall include only those floods, droughts, tidal waves, fires, hurricanes, earthquakes, windstorms or other storms, landslides or other catastrophes when such occurrences or conditions and effects have been proclaimed a disaster or state of emergency by the President of the United States, or the Governor of New York State, or the Federal Highway Administrator, or the chief executive of a county or city.

2. **Application by Contractor.** The Contractor’s written request for the State to pay or participate in the cost of rebuilding, repairing, restoring or otherwise remedying damage to the work caused by an occurrence shall be submitted to and approved by the Commissioner before performing any work other than emergency work, including emergency work necessary to provide for passage of public traffic.

**C. Obligation to Indemnify by the Contractor.** The Contractor shall indemnify and save harmless the State, except as prohibited by law, any municipality in which the work is being performed, and/or any public benefit corporation, railroad, or public utility whose property or facilities are affected by the work, from suits, claims, actions, damages and costs, of every name and description resulting from the work under its contract during its prosecution and until the acceptance
§107

107-10 MANAGING SURPLUS MATERIAL AND WASTE.

The Contractor shall manage all surplus materials and waste generated in the performance of the contract in accordance with applicable federal, state, and local laws and regulations. Nothing herein is intended to prevent the Contractor from removing surplus materials or waste to appropriate off-site locations for beneficial reuse, recovery, or recycling purposes. The Contractor is encouraged to reuse, salvage or recycle materials to the maximum extent possible. Surplus or used materials generated from Department contracts that are easily recognizable, maintain their physical properties, are easily separated and transported, and have value as commodities are often recycled. These include metals (steel, iron, etc.), recycled asphalt pavement (RAP) in the form of chunks or millings, and recycled portland cement concrete aggregate (RCA). Surplus and used materials, unless identified otherwise, become the property of the Contractor. In accordance with 6 NYCRR 371.1(e)(1)(xiii) excluded scrap metal is not solid waste when being recycled.

Waste Management shall mean the collection, transportation, transfer, processing, recovery, storage, reclamation, treatment, handling and disposal of waste whether performed directly by the Contractor or thereof. The Contractor and any assigns, heirs, or successors in interest shall also indemnify and save harmless, except as prohibited by law, the consultant inspecting engineer or inspector working for the State relative to the project from suits, claims, actions, damages and costs involving personal injury and property damage resulting from the Contractor’s work under the contract during its prosecution and until the acceptance thereof. The State may retain such monies from the amount due the Contractor as may be necessary to satisfy any claim for damages recovered against the State, any municipality in which the work is being performed, and/or any public benefit corporation, railroad or public utility whose property or facilities are affected by the work or consultant inspecting engineers or inspectors working for the State relative to the project. The Contractor’s obligation under this paragraph shall not be deemed waived by the failure of the State to retain the whole or any part of such monies due the contractor, nor where such suit, action, damages and/or costs have not been resolved or determined prior to release of any monies to the Contractor under the contract, nor shall such obligation be deemed limited or discharged by the enumeration or procurement of any insurance for liability for damages imposed by law upon the Contractor, Subcontractor or the State, any municipality in which the work is being performed, and/or any public benefit corporation, railroad or public utility whose property or facilities are affected by the work, or any consultants or contract engineers working for the State relative to the project.

The Contractor has the obligation, at its own expense, for the defense of any action or proceeding which may be brought against the parties specified in this Section. This obligation shall include the cost of attorney fees, disbursements, costs and other expenses incurred in connection with such action or proceeding.

Such obligation does not extend to those suits, actions, damages and costs of every name which arise out of the sole negligence of the State, any municipality in which the work is being performed, and/or any public benefit corporation, railroad or public utility whose property or facilities are affected by the contract work, or any consultants or contract engineers working for the State relative to the project, their agents or employees, relative to the construction, alteration, or repair or maintenance of a building, highway or structure and appurtenances and appliances thereof including moving, demolition and excavating connected therewith.

D. Prompt Response to Claims by the Public. The Contractor’s responsibility for the contract site applies to the full limits of the contract regardless of the extent or nature of contract work at a particular location. This obligation begins when the contract is awarded and continues until final acceptance of the work. The Contractor shall promptly address all written damage claims of the public and, if not addressed directly, claims shall be promptly turned over to the Contractor’s insurance carrier without prejudicing the validity of the claim. There should be an interval of no more than ten (10) working days between receipt of a written claim by the Contractor and receipt by the carrier. The Contractor and/or the Insurance Carrier are expected to investigate, determine and adjust such claims promptly and fairly with notice to the Engineer. The Engineer will monitor claims by the public. If the Contractor fails to provide satisfactory resolution through a timely claims adjustment process or denies the claim without proper cause and justification, the Department may invoke Article 8 of the contract or utilize other remedies.
others. Unless otherwise noted in the contract documents, all materials or substances that are spent, useless, worthless, or in excess to the Department, including materials generated on-site by the Department’s contract supervision and inspection activities, are covered by this subsection.

Unless specifically noted in the contract documents, it is not guaranteed that placement of surplus materials or spoil will be allowed within the right of way. Payment for managing surplus material and solid waste shall be included in the various contract pay items. The absence or unavailability of disposal areas on the contract site or the refusal of a permitted solid waste management facility to accept waste will not be the basis for a dispute for additional compensation for the disposal of wastes.

**A. Excess Soil and Rock.** Excess soil and rock may be generated by construction activities associated with Department contracts. Excess soil and rock may be presumed uncontaminated absent records, existing data, or knowledge/observation to the contrary. These materials may be excess because the quantity available exceeds the quantity required, or they do not have the engineering properties required for use, or they may not be of economic value in the current location, such as when the cost to transport the material approaches or exceeds its sale value. Provided these materials are uncontaminated, in accordance with 6 NYCRR 360-1.15(b)(7) they are not considered waste when used as fill material. These materials may be sold (“placed in commerce”) to a consumer and the consumer is responsible for its use/placement.

**B. Spoil.** Spoil may include excess soil and rock, and contains recognizable, uncontaminated concrete (including incidental pavement markings), asphalt pavement (including incidental pavement markings), brick, glass or soil materials generated by the cleaning of drainage ditches, culverts, storm sewers, catch basins or related appurtenances. Reinforcing steel embedded in concrete is considered an incidental metal and is included within the definition of concrete. Spoil may be presumed uncontaminated absent records, existing data, or knowledge/observation to the contrary. Spoil shall not be pulverized, shredded, or otherwise processed such that the individual waste components are rendered unrecognizable. Provided spoil is uncontaminated, in accordance with 6 NYCRR 360-1.15(b)(11) these materials are not considered waste when placed in commerce for service as a substitute for conventional aggregate.

Spoil areas for the disposal of excess soil and rock and spoil shall be established and restored in accordance with §107-08 Protection and Restoration of Property and Landscape. Excess soil and rock and spoil may be disposed of within the right of way whenever possible to flatten embankment side slopes, or may be disposed of in other locations within the right of way approved by the Engineer, but is not subject to the provisions governing lift placement and compaction. The Department makes no assurance that appropriate spoil areas within the right of way will be available for any individual contract. If no spoil area is available within the right of way, the Contractor shall dispose of these materials elsewhere, subject to appropriate environmental and land use regulations. Excess soil and rock and spoil may be disposed of at a location outside the right of way that takes no compensation, fee or other form of consideration, exempt from permit requirements, in accordance with 6 NYCRR 360-7(b)(1), between the hours of sunrise and sunset.

**C. Construction and Demolition Debris.** In accordance with 6 NYCRR 360-1.2(b)(38), Construction and demolition (C&D) debris is uncontaminated solid waste resulting from land clearing and from the construction, remodeling, repair and demolition of utilities, structures, and roads. C&D debris may include excess soil and rock or spoil, and includes but is not limited to: wood (including painted, treated and coated wood and wood products), land clearing debris, plumbing fixtures, electrical wiring, electrical components containing no hazardous liquids, nonfriable asbestos, wall coverings, plaster, drywall, roofing shingles and other roof coverings and pipes or metal attached to or embedded in these waste materials. C&D debris shall not be pulverized, shredded, or otherwise processed such that the individual waste components are rendered unrecognizable. C&D debris shall be disposed of in an permitted C&D waste management or processing facility. Nonfriable asbestos shall be disposed of at permitted C&D waste management facility. If a C&D waste facility is not available, C&D debris may be disposed of at a solid waste facility.

Unadulterated wood chips and mulch used for mulch, landscaping, or erosion control purposes are not solid waste. Trees, stumps, wood chips and yard waste generated from activities within the right of way may be disposed of in spoil areas within the right of way only, but are not subject to the
provisions governing lift placement and compaction. Spoil areas shall be established and restored in accordance with §107-08 Protection and Restoration of Property and Landscape. These materials may also be disposed of at a permitted C&D or solid waste management facility.

In Nassau and Suffolk Counties all C&D debris shall be disposed of only in a C&D landfill or processing facility permitted by the NYS Department of Environmental Conservation (NYSDEC). In addition to the requirements of these specifications, no on-site disposal shall take place in these counties without appropriate notice to the Regional Office of the NYSDEC.

Within the Adirondack Park, construction and demolition debris shall only be deposited in accordance with additional requirements of the Adirondack Park Agency.

D. Non-Hazardous Solid Waste. Non-hazardous solid waste includes, but is not limited to: tires, office trash, garbage, roadside litter and street sweepings. The Contractor may collect and store non-hazardous solid waste on the contract site in transfer containers or other appropriate containers pending transportation to a legally permitted solid waste management facility. The Contractor shall meet the following conditions:

- Waste management activities shall be controlled to prevent odors and other nuisance conditions.
- Putrescible solid waste shall be removed when transfer containers are full, or weekly, whichever comes first.
- Non-putrescible solid waste may be collected and stored on the site in a transfer or other appropriate container not longer than 45 days.

E. Non-Hazardous Industrial Waste. Non-hazardous industrial waste includes, but is not limited to: asbestos, pavement marking waste, contaminated soil, empty drums and empty fuel tanks. These wastes require disposal at permitted solid waste management facilities or may be used in applications that have received generic or case-specific beneficial use determinations from NYSDEC. A waste transporter permitted by NYSDEC is required for transport of over 225 kg (500 pounds) of waste in a single load to a disposal facility.

1. Asbestos. Friable and nonfriable asbestos containing materials (ACM) shall only be handled or packaged for transport by a NYS Department of Labor licensed contractor using certified personnel. Friable asbestos waste shall only be transported by a permitted waste transporter under a waste shipment record and disposed of at a permitted waste management facility approved to accept friable asbestos. Non-friable asbestos shall be transported and disposed of as C&D debris.

2. Pavement Marking Wastes. Pavement marking wastes, including millings from the localized removal of only pavement markings and not surface milling, including the pavement material and debris containing the removed markings generated by cleaning and removal operations shall be disposed of as non-hazardous industrial solid waste, at a permitted solid waste management facility, typically a municipal landfill. Pavement marking waste should be collected by typical construction methods such as sweeping and/or vacuuming.

   Solid waste management facilities may question whether pavement marking wastes are regulated hazardous wastes because yellow pavement marking products may contain lead and chromium in the pigments. Testing by the Department (toxicity characteristic leaching potential (TCLP)) of yellow pavement marking waste as well as the dried pure paint samples indicated that although it contained lead and chromium, it did not meet the regulatory limit for classification as a hazardous waste and was therefore considered a non-hazardous industrial waste.

3. Contaminated Soil. Soil contaminated with petroleum or other non-hazardous materials shall be disposed of as non-hazardous industrial waste at a permitted solid waste management facility or used in applications that have received generic or case-specific beneficial use determinations from the NYSDEC.

4. Empty Drums or Containers that Previously Held a Known Hazardous Material. In accordance with 6 NYCRR Part 371.1(h), drums and containers that have had the contents removed by common practices, have less than 25 mm of product residue on the bottom, and less than 3% of the original product are considered “empty” and non-hazardous, even if the material
they previously contained would otherwise have been classified as a hazardous waste. This does not apply to drums or containers that held acutely hazardous wastes. Empty drums and containers shall be recycled or disposed of at a permitted waste management facility. Empty containers may be returned to the manufacturer, sent to a reconditioner or handled as scrap metal, cardboard, etc. and are exempt from waste transporter requirements when destined for such reuse.

**F. Hazardous Waste.** Hazardous wastes are those wastes that are specifically “listed wastes” per 6 NYCRR 371 and/or those that display hazardous wastes characteristics for ignitability, corrosivity, reactivity and/or toxicity.

1. **Generator Status.** Unless specifically noted otherwise in the contract documents, for all contacts that generate more than 100 kg of hazardous waste per month, the Contractor shall comply with the regulations governing a Large Quantity Generator.

   a. **Conditionally Exempt Small Quantity Generator (CESQG).** Federal and State hazardous waste regulations classify a CESQG as one that generates less than 100 kg of hazardous waste per month and stores less than 1,000 kg of hazardous waste.

   b. **Small Quantity Generator (SQG).** Federal and State hazardous waste regulations classify an SQG as one that generates between 100 and 1,000 kg of hazardous waste per month or stores between 1,000 kg and 6,000 kg of hazardous waste.

   c. **Large Quantity Generator (LQG).** Federal and State hazardous waste regulations classify an LQG as one that generates more than 1000 kg of hazardous waste per month.

2. **Hazardous Waste Handling Requirements.** The Contractor shall meet the following hazardous waste requirements:
   a. Waste shall be properly packaged, with a written description and labeled as hazardous.
   b. Waste shall be inspected at least weekly while stored on site.
   c. Waste shall be shipped by a permitted waste transporter with a hazardous waste manifest and required documentation.
   d. Waste shall be disposed of at a permitted hazardous waste treatment storage and disposal facility (TSDF).
   e. Waste shall be removed within 90 days after generation, unless a specific contract pay item requires removal sooner.
   f. Hazardous waste shall be stored on the site of generation until manifested and shipped for disposal. The only exceptions for this are for CESQG wastes which may be temporarily relocated to non-permitted facilities.
   g. Preparedness and prevention features and contingency planning and emergency procedures shall be developed as per 6 NYCRR 373-3.3 and 373-3.4, respectively.
   h. Personnel must be trained in hazardous waste management procedures relevant to the positions in which they are employed.
   i. Appropriate security shall be provided for hazardous wastes while stored on site.

**107-11 AIR QUALITY PROTECTION.**

The Contractor shall schedule and conduct activities to minimize impacts to air quality and to prevent hazardous or objectionable air quality conditions within the contract limits and in areas adjacent to or affected by the work. The Engineer will suspend the performance of any construction activity that creates hazardous or objectionable air quality conditions until the unsatisfactory condition has been corrected.

**A. Dust.** The Contractor shall apply pro-active measures to prevent discharge of dust into the atmosphere that unreasonably interferes with the comfortable enjoyment of life and property or is harmful to plants or animals.

**B. Burning.** Any material generated by any activity for the development, modification and construction of any transportation facility shall not be burned on the contract site. This shall include but not be limited to products of land clearing and demolition.
§107

C. Prevention. The Contractor shall employ appropriate protection techniques and/or systems to prevent hazardous or objectionable air quality conditions, particularly when conducting drilling, cutting, grinding, abrasive blasting or similar operations that impact air quality.

107-12 WATER QUALITY PROTECTION.

Water quality protection is a joint responsibility of the Department, as the owner and the holder of environmental permits, and the Contractor, acting as an agent for the Department. The Contractor shall protect all water resources within the contract limits and on lands adjacent to or affected by the work, and take measures to maintain water quality of receiving water bodies.

The Contractor shall schedule and conduct its work to minimize soil erosion, not cause or contribute to a violation of water quality standards and prevent sedimentation on lands adjacent to or affected by the work. Construction of temporary soil erosion and sedimentation control measures, temporary and permanent soil stabilization, construction of drainage facilities and performance of other contract work which will contribute to the control of erosion and sedimentation shall be carried out in conjunction with related construction operations. The area of disturbance at any one time by construction operations shall be kept to a minimum and shall not exceed the limits established in the contract documents or applicable permits.

Prior to the start of related construction, the Contractor shall review the erosion and sediment control plan included in the contract documents, and if necessitated by the Contractor’s operations, modify the plan for compatibility with the Contractor’s intended sequence of construction operations, to include, but not limited to: construction phases; contract milestones, installation of control measures, clearing and grubbing operations, earthwork, etc. The Contractor’s modified erosion and sediment control plan shall be submitted to the Engineer for approval, along with a progress schedule for accomplishment of temporary and permanent erosion and sediment control work in accordance with §108-01 Progress Schedule.

Prior to the start of related construction, the Contractor shall submit for approval a proposed plan of erosion and sediment control and water pollution control on material storage areas, haul roads and borrow pits and a plan for disposal of surplus excavated materials within the right of way. The Contractor shall submit for approval the names of individuals who will be inspecting control measures, and a description of their qualifications. The Contractor’s erosion and sediment control plan shall be prepared in accordance with Department specifications and the guidance contained in the New York Guidelines for Urban Erosion and Sediment Control, latest edition, printed by the Empire State Chapter, Soil and Water Conservation Society, c/o Cayuga County SWCD, 7413 County House Road, Auburn, New York 13021.

No related work shall be started until the erosion and sediment control plans and progress schedules have been approved by the Engineer. As conditions change during construction or work is not progressed in accordance with the schedule, the Contractor shall regularly submit a progress schedule update in accordance with §108-01 Progress Schedule and an updated erosion and sedimentation control plan, as necessary, for approval by the Engineer.

The Contractor’s operations shall be carried out in accordance with the approved erosion and sediment control plans, progress schedule, contract documents and permits. The Contractor shall be guided by, but not limited to, the following:

A. Permits. All applicable statutes, regulations, permits and approvals of the NYSDEC, other water quality management agencies and fish and wildlife agencies shall be complied with in the performance of the contract. Care shall be taken so as not to cause turbidity that will result in a visible contrast to the natural conditions of a waterway or impoundment, cause sedimentation or impair the waters for their best uses.

B. Borrow or Spoil Areas. Erosion and sediment control of borrow areas, spoil areas and construction roads shall be conducted both during and after completion of the work, to minimize soil erosion and not cause or contribute to a violation of water quality standards and prevent sedimentation on lands adjacent to or affected by the work.

C. Fording. Fording of waterways may require a permit from NYSDEC, and will not normally be allowed, therefore, temporary bridges or other structures shall be used where a waterway crossing is

NEW YORK STATE DEPARTMENT OF TRANSPORTATION
STANDARD SPECIFICATIONS of May 4, 2006
necessary. Unless otherwise approved in writing by the Engineer, the Contractor shall not ford or operate mechanized equipment in waterways.

**D. Work Areas Adjacent to Waterways.** When work areas, borrow areas, spoil areas or gravel pits are located in or adjacent to waterways or impoundments, such areas shall be separated from the rest of the waterway or impoundment by a dike or other barrier to prevent sediment from entering a flowing waterway or impoundment. Care shall be taken during the construction and removal of such barriers so as not to cause turbidity or sedimentation.

**E. Removal of Temporary Obstructions.** All waterways shall be cleared as soon as practicable of false work, piling, debris or other obstructions placed during construction operations and which are not a part of the finished work.

**F. Maintenance.** Ditches which are filled, or are partly or wholly inoperative, shall be cleaned and made operative before the Contractor stops work for each day, and shall be maintained in a satisfactory condition for the duration of the contract. All erosion and sedimentation control measures which have been displaced, or are partly or wholly inoperative, shall be repaired within 72 hours after required inspection, unless repairs are required sooner by the contract documents.

**G. Water Discharges.** Water containing sediment from aggregate washing, pump discharges or other operations shall be treated by filtration, settling basin or other means sufficient to prevent turbidity or sedimentation of receiving waterways. Turbid wash water or pump discharges shall not be allowed to enter waterways or impoundments.

**H. Pollutants.** Pollutants such as fuels, lubricants, bitumens, raw sewage and other harmful materials shall not be discharged into or near waterways and impoundments or into natural or manmade channels leading thereto.

The Contractor shall ensure that all controls are functioning in an effective manner and address all failures or other problems in a pro-active manner, immediately. If a situation comes to the Engineer’s attention, the Engineer will inform the Contractor of unsatisfactory construction procedures and operations insofar as water quality management are concerned. The Engineer will also review the Contractor’s compliance with state and federal permit conditions as they relate to water quality. If the unsatisfactory construction procedures and operations are not corrected in a timely manner, the Engineer will suspend the performance of any or all operations in accordance with §105-01, Engineer’s Authority until the unsatisfactory condition has been corrected.

**SECTION 108 - PROSECUTION AND PROGRESS**

**108-01 PROGRESS SCHEDULE.**

All costs to create and update the progress schedule shall be solely the Contractor's obligation and will be at no additional cost to the State unless specifically provided for in other contract provisions.

**A. Initial Progress Schedule.** Within five days after date of commencement of work, or within such time as determined by the Regional Director, the Contractor shall prepare and submit to the Engineer for approval, a progress schedule showing the order in which the Contractor proposes to carry on the work, the date on which it will start the major items of work (including but not limited to excavation, drainage, paving, structures, mobilization, soil erosion and sediment control, etc.) and the critical features (including procurement of materials, plant and equipment) and the contemplated dates for completing the same. The purpose of the progress schedule is to ensure adequate planning and execution of the work and to evaluate the progress of the work. Any graphical representations shall be shown at a suitable scale to be legible and readable. Progress schedules shall, at a minimum, include the following items, as applicable: (a) major work items and activities to be performed; (b) seasonal weather limitations; and (c) phase duration or milestone events.

Such schedule may be utilized to facilitate the State's inspection and coordination of construction activities. Approval of the progress schedule shall not be construed to imply approval of any...
§108

NEW YORK STATE DEPARTMENT OF TRANSPORTATION
STANDARD SPECIFICATIONS of May 4, 2006

particular method or sequence of construction or to relieve the Contractor of providing sufficient materials, equipment and labor to guarantee completion of the contract in accordance with the contract documents. Approval shall not be construed to modify or amend the contract agreement or the date of completion therein.

B. Progress Schedule Updates. On a monthly basis, or at such intervals as directed by the Engineer, the Contractor shall adjust the schedule to reflect any major changes in the contract work, completion time, or both, and submit the adjusted schedule to the Engineer.

When requested by the Regional Director, the Contractor shall furnish weekly progress schedule updates indicating number of personnel, equipment type, and location and nature of the work to be performed.

If the work falls behind the progress schedule, the Contractor shall take such actions as necessary to improve its progress. If the Contractor is behind schedule any month, the Contractor shall indicate what measures it will take in the next thirty (30) days to put the work back on schedule so as to meet the contract completion date specified in the contract. In preparing the revised schedule, the Contractor shall consider increasing its work force, construction plant and equipment, the number of work shifts, etc. If the Engineer finds the proposed schedule not acceptable, he/she may require the Contractor to submit a new schedule. The Department may request that meetings be held by the Contractor at least on a monthly basis and be attended by the Engineer who shall monitor the Contractor's progress and performance.

C. Failure to Submit Progress Schedule. If the Contractor fails to submit a progress schedule within the time period described or any revision or update when required, the Engineer may withhold approval of contract payments pursuant to Article 8 No Payment on Contractor's Non-compliance of the contract agreement until such time as the Contractor submits the required progress schedule.

108-02 COMPLETION DATE.

The Contractor shall employ and supply a sufficient force of workers, materials and equipment and shall progress the work with such diligence so as to ensure completion of the work prior to the contract completion date.

In accordance with Article 4 Date of Completion of the contract agreement, the Contractor shall complete all work to be performed under the contract within the time stated in the contract agreement or within such extended time for completion as may be granted by the Commissioner. If the Contractor desires an extension of time, an Application For Extension of Completion Date shall be submitted to the Engineer sufficiently early for the Engineer to make a recommendation and forward the application so that it may be filed with the Regional Director at least 15 days prior to the contract completion date.

108-03 FAILURE TO COMPLETE WORK ON TIME.

For each calendar day, or any portion thereof, that any work remains uncompleted after the contract completion date specified in the contract agreement, Liquidated Damages and/or Engineering Charges from the contract completion date to the final date of completion of the work will be assessed against the Contractor. When specified in the contract documents, Liquidated Damages may also be assessed for each calendar day, or any portion thereof, for failure to complete certain portions of work or for failure to comply with requirements shown in the contract documents. Liquidated Damages will be assessed not as a penalty, but as liquidated damages; provided however that due account shall be taken of any adjustment of the contract time for completion of the work as provided for elsewhere in the specifications.

A. Engineering Charges. Engineering Charges include all appropriate engineering and inspection expenses incurred by the State, its consultants and inspection agencies, and by railroad companies.

Engineering Charges will be assessed in cases where the work has been unduly delayed by the Contractor because of unwarranted reasons, inefficient operation, or for any other reason for which the Department determines the Contractor to be responsible. Reasonable time necessary for reviews of shop drawings by the State or its agents, for changes or additions to the work to meet field conditions which do not significantly affect the scheduled completion of the contract, delays incurred by seasonal and weather limitations, localized labor actions and shortages of supplies or materials,
§108

and other situations which should be anticipated are neither compensatory nor eligible for extensions of time without the assessment of Engineering Charges, except as provided for under §108-04 Delay Provisions.

Before assessing Engineering Charges, the Department will give due consideration to factors attributing to such delay due to extenuating circumstances beyond the control of the Contractor limited to the following:

1. The work or the presence on the contract site of any third party, including but not limited to that of other contractors or personnel employed by the State, by other public bodies, by railroad, transportation or utility companies or corporations, or by private enterprises, or any delay in progressing such work by any third party except as indicated or disclosed in the contract documents or ordinarily encountered or generally recognized as inherent in the work.
2. The existence of any facility or appurtenance owned, operated, or maintained by any third party, except as indicated or disclosed in the contract documents or ordinarily encountered or generally recognized as inherent in the work.
3. The act, or failure to act, of any public or governmental body, railroad, transportation or utility companies or corporations, including, but not limited to, approvals, permits, restrictions, regulations or ordinances not attributable to a Contractor's submission, action or inaction or Contractor's means and methods of construction.
4. Restraining orders, injunctions, or judgments issued by a court not caused by a Contractor's submission, action or inaction or Contractor's means and methods of construction.
5. Any industry-wide labor boycotts, strikes, picketing or similar situations, as differentiated from jurisdictional disputes or labor actions affecting a single or small group of contractors or suppliers.
6. Any industry-wide shortages of supplies or materials required by the contract work, as differentiated from delays in delivery by a specific or small group of suppliers.
7. Unusually severe storms of extended duration or impact, other than heavy storms or climatic conditions which could generally be anticipated by the bidders, as well as floods, droughts, tidal waves, fires, hurricanes, earthquakes, landslides, or other catastrophes.
8. Decisions by the Department to open certain sections of the contract to traffic before the entire work is completed.
9. Significant changes in contract quantities, major extra contract work, delays in the review or issuance of orders-on-contract or field change sheets, or delays beyond the established time periods for review and approval for shop drawings, which significantly affect the overall completion of the contract.
10. Failure of the State to provide individual rights-of-way parcels for an extended period of time beyond that indicated by the contract if such unavailability, as determined by the Commissioner, significantly affects the scheduled completion of the contract.
11. Any situation which was beyond the contemplation of the parties at the time of entering into the contract.
12. Award of the contract by the State more than forty-five (45) days beyond the letting date.
13. Situations covered by §104-03 Differing Site Conditions, §104-04 Significant Changes in the Character of Work and §104-05 Suspensions of Work Directed by the Engineer.

B. Liquidated Damages. Liquidated damages will be in the amount per calendar day specified in Table 108-1 Schedule of Liquidated Damages, in addition to Engineering Charges as provided for in §108-03A. Engineering Charges. Liquidated Damages for special or very large contracts may be specified in the contract proposal. Liquidated Damages will not apply to contracts containing no work within the roadway limits. The Commissioner may waive such portions of the liquidated damages as may accrue if the work is deemed to be in such condition as to be safe and convenient for use by the traveling public.

Permitting the Contractor to continue and finish the work or any part of it after the time fixed for its completion or after the date to which the time for completion may have been extended, will in no way constitute a waiver on the part of the State of any of its rights under the contract.

The Contractor is responsible and liable for said liquidated damages even in the event that the Contractor abandons the performance of the contract or the Contractor's employment is terminated pursuant to the provisions of this contract.
TABLE 108-1 SCHEDULE OF LIQUIDATED DAMAGES

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108-04 DELAY PROVISIONS.

A. Compensable Delays. The Department may provide monetary compensation for delays and interference in certain defined instances. The Contractor will only be eligible for extra compensation caused by delay or interference affecting the performance or the scheduling of contract work for those instances arising out of:

1. §104-03 Differing Site Conditions;
2. §104-04 Significant Changes in the Character of the Work; and
3. §104-05 Suspensions of Work Directed by the Engineer;
4. Situations not referenced in this paragraph and which are not within the contemplation of the parties at the time of entering into the contract.

These aforementioned provisions may also form the basis for extra work compensation pursuant to §105-14 Disputed Work and Dispute Resolution and §109-05 Extra Work and Time Related Compensation. Failure of the Contractor to adequately progress completion of the work will be considered in determining whether the aforementioned instances are the primary causes of delay. In all such instances, for any requests made under this subsection, the Contractor shall keep detailed written records of the costs in accordance with §104-06 Notice and Recordkeeping. Any dispute shall be promptly submitted to the Engineer in writing, pursuant to §105-14 Disputed Work and Dispute Resolution.

B. Non-Compensable Delays. The Contractor agrees to make no monetary request for, and has included in its bid prices for the various items of the contract, any extra/additional costs attributable to any delays, inefficiencies or interferences in the performance of the contract caused by or attributable to the items set forth below. The Contractor shall be compensated solely by an extension of time, with or without engineering charges as appropriate, to complete the performance of the work in accordance with the provisions of §108-02 Completion Date.

1. The work, or the presence on the contract site, of any third party, including but not limited to personnel or other contractors employed by the State, by other public bodies, by railroad, transportation or utility companies or corporations, or by private enterprises.
2. Any delay in progressing work by any third party as indicated or disclosed in the contract documents or ordinarily encountered or generally recognized as inherent in the work.
3. The existence of any facility or appurtenance owned, operated, or maintained by any third party, as indicated or disclosed in the contract documents or ordinarily encountered or generally recognized as inherent in the work.
4. The act, or failure to act, of any other public or governmental body, railroad, transportation or utility companies or corporations, including, but not limited to, approvals, permits, restrictions, regulations or ordinances attributable to a Contractor's submission, action or inaction or Contractor's means and method of construction.
5. Restraining orders, injunctions, or judgments issued by a court which were caused by a Contractor's submission, action or inaction or Contractor's means and method of construction.
§108

6. Any labor boycott, strike, picketing or similar situation.
7. Any shortages of supplies of materials required by the contract work.
8. Climatic conditions, storms, floods, droughts, tidal waves, fires, hurricanes, earthquakes, landslides, or other catastrophes. However, payment may be made for repairing damage to the work caused by an “occurrence” as provided in §107-09 Damage.
9. Extra work which does not significantly affect the overall completion of the contract, delays in the review or issuance of orders-on-contract, or field change sheets or delays within the established time periods for review and approval for shop drawings.
10. Any situation which was within the contemplation of the parties at the time of entering into the contract.
11. Award of the contract by the State more than forty-five (45) days beyond the letting date.

108-05 SUBLETTING OR ASSIGNING THE CONTRACT.
The Contractor shall perform with its own organization contract work amounting to not less than 50 percent of the original total contract bid price, except that any items designated by the State as “Specialty Items” may be performed by subcontract and the amount of any such “Specialty Items” so performed may be deducted from the original total contract bid price before computing the amount of work required to be performed by the Contractor with its own organization. The contract amount upon which the 50 percent requirement is computed includes the cost of materials and manufactured products which are to be purchased or produced by the Contractor under the contract provisions.

- “Its own organization” shall be construed to include only workers employed and paid directly by the Contractor and equipment owned or rented by it, with or without operators.
- “Specialty Items” shall be construed to be limited to work that requires specialized knowledge, skill or equipment not ordinarily available in contracting organizations qualified to bid on the contract as a whole and in general are to be limited to minor components of the overall contract.

The Contractor shall be responsible for all work performed by Subcontractors, Manufacturers, Fabricators, Material Suppliers and any other parties in the performance of the contract. Contract work shall be performed under a subcontract only after approval by the Regional Director. Work shall be performed only by the Subcontractor specifically approved by the Regional Director. Work shall not be assigned by the Subcontractor to a lower tier subcontractor. Violations of the aforementioned will result in no payment by the State for the completed work.

A. Subcontractor Approval.
Approval of Subcontractors is required for:

- The on-site completion of items of work as defined in the contract documents.
- The on-site maintenance of previously furnished and installed products.
- The delivery of materials to the contract site and incorporation directly into the work by the supplier's work force in such a manner that no further handling or manipulation of the material is necessary in order to conform with the construction details of the appropriate specification item.

- Approval of subcontractors excludes:
- Manufacturers, Fabricators and Material Suppliers who do not incorporate supplies or materials directly into the contract work.
- The on-site completion of a portion of the work that does not constitute a complete contract item, and that occurs over less than an aggregate of 5 days on the contract site.
- Specialized work which is not accounted through labor, equipment and materials, such as professional fees, testing fees, dumping fees, utility charges
- Owner/Operator Trucking, both on-site and off-site.

B. Approval Procedure. Subcontractors will not be approved by the Department until such time as the Contract Management Bureau has received a completed Form CCA-1, New York State Uniform Contracting Questionnaire from the Subcontractor. For each Subcontractor, the Contractor shall submit an Approval to Subcontract, a labor affidavit on Form AC 2948 Subcontractor’s Certification, a Designation of Affirmative Action Representatives, and a Contractor/Subcontractor SPDES Permit Certification to the Regional Construction Group for approval by the Regional Director. Contractors
that own Department approved civil rights reporting software shall submit subcontractor approval forms generated with that software. The Contractor shall not subsequently alter software generated forms.

C. Trucking and Other Equipment Owner/Operators. Equipment owner/operators are recognized by the Department and by Labor Law as unique business situations. Owner/Operators, by definition are individual businesses, do not have employees, and therefore are not subject to prevailing wage rates.

D. Disadvantaged/Minority/Women's Business Enterprises (D/M/WBE) Policy. In the solicitation of Subcontractors to perform work under this contract, prior to bidding or entering into any commitments for subcontracting or for purchase of supplies, materials or leasing of equipment, the Contractor shall solicit participation of D/M/WBEs in accordance with the utilization goals published in the contract documents, and in accordance with the provisions of §102–12 D/M/WBE Utilization.

E. Subcontract Provisions. All Subcontracts shall be in writing and shall contain all pertinent provisions of the contract in regard to Federal and State Laws and Regulations. All Subcontractors shall maintain insurance coverages as required by §107-06 Insurance.

All subcontracts, supply or equipment contracts in excess of $10,000 shall incorporate the provisions of §102–11 Equal Employment Opportunity Requirements.

All subcontracts, supply or equipment contracts shall incorporate the provisions of §105-14 Disputed Work and Dispute Resolution. If such subcontracts or supply or equipment contracts do not have similar provisions, then the State payments to the Contractor for such subcontract or supply or equipment work shall be limited to only that which are provided by the provisions of this subsection as if it were in effect for such subcontract or supply or equipment contract.

For all Federal-Aid contracts, all subcontracts, supply or equipment contracts shall incorporate all of the provisions of Form FHWA-1273, Required Contract Provisions Federal-Aid Construction Contracts. The provisions of Form FHWA-1273 shall be directly incorporated into each subcontract, and may not be incorporated by reference.

All Subcontractors working within the contract limits or at a facility dedicated to the contract shall have a written Project Safety and Health Plan in accordance with §107-05 Safety and Health Requirements or shall have a copy of the Contractor's written Project Safety and Health Plan and shall confirm by written agreement with the Contractor that all Subcontractor operations are adequately addressed. The Contractor shall have a copy of each Subcontractor's written Safety and Health Plan, and shall ensure that the Subcontractor's plans are not in conflict with the Contractor's written Safety and Health Plan.

108-06 COMMENCEMENT OF ACTIONS ON STATE PUBLIC WORKS CONTRACTS.

In accordance with State Finance Law §138-a, the time within which an action on this contract, against the Contractor, must be commenced shall be computed from the date of completion of the physical work. The Contractor may notify the Department in writing that such physical work has been completed by specifying a completion date, which date shall be no more than 30 days previous to the date of such notice, in which case the completion date set forth in such notice shall be deemed to be the date of completion of the physical work unless the Department, within 30 days of receipt of such notice, notifies the Contractor in writing of its disagreement.

In the event the Contractor fails to send a notice provided for herein, or the State disagrees, then the date of completion of the physical work shall be determined in any other manner provided by law. If the Contractor elects to send such a notice, it shall be sent by certified mail to:

New York State Department of Transportation
Office of Legal Affairs
50 Wolf Road
Albany, New York 12232
§108

The Department hereby disagrees with any date selected by the Contractor pursuant to §138-a of the State Finance Law which is earlier than the date of contract final acceptance as determined by the Commissioner or his/her designee. The provisions of §138-a shall in no way modify the duties and obligations of the Department to comply with Article eleven-A of the State Finance Law (prompt payment legislation).

108-07 SEASONAL SHUT-DOWN.

If it should become necessary to stop the work due to the lateness of the season, the Contractor shall open proper draining ditches, erect temporary structures where necessary, prepare the contract site so that there will be a minimum interference with traffic, set up and maintain a competent organization to maintain traffic through the contract site, and take precautions to prevent damage or unreasonable deterioration of the work during the time it is closed.

SECTION 109 - MEASUREMENT AND PAYMENT

109-01 MEASURING QUANTITIES.

All contract payments, including the final, will be made for quantities of work performed and materials placed in accordance with the contract documents as determined by the measurements of the Engineer, and the resulting quantities shall be accepted as final, conclusive and binding upon the Contractor. Various methods of quantity computation may be used by the Engineer, including but not limited to: manual arithmetic calculations, manual measuring tools such as a planimeter, and computer tools/software. The Engineer will choose the computation method, and the method may vary by contract and by contract pay item as appropriate. The Engineer will choose the method by which the work will be measured, such as: measure from documents/data (contract plans, cross sections, CADD files, etc.) or measure from field survey of completed work, with the goal of obtaining reasonably accurate quantities of work for payment using a commensurate amount of effort and resources.

109-02 COMPENSATION FOR ALTERED QUANTITIES.

The Department reserves the right to order changes in quantities of contract pay items as is necessary to complete the work, in accordance with the intent of the contract documents.

A. **Major Items.** For Major Items (as defined in §101-02 Definitions of Terms), payment will be made for all extra work at the contract unit bid price for work up to 125% of the original contract quantity. For Major Item quantities less than 75% or more than 125% of the original contract quantity, consideration of contract adjustment will be in accordance with §104-04B. Major Items. Total payments made for all work on a Major Item that decreases to below 75% of the original contract item quantity, will not exceed the total payments which would have been made if the original contract quantity had been completed at the original unit price bid.

B. **Minor Items.** For Minor Items (as defined in §101-02 Definitions of Terms), payment will be made for extra work at the contract unit bid price, except for any extra work that is both: (1) more than 200% of the original contract quantity and (2) results in an increase of more than $1,000 from the original contract amount, will be considered a Significant Change in accordance with §104-04C Minor Items.

For Minor Items where the contract bid price does not exceed 125% of either the statewide or regional weighted average bid price, the contract bid price may be extended up to a increase of $5,000 from the original contract amount.

109-03 SCOPE OF PAYMENT.

The Contractor is directed to the provisions of Sections 70, 71 and 79-a of the Lien Law that apply to funds being received by a Contractor for a public improvement. The funds received by the Contractor shall constitute trust funds in the hands of the Contractor and shall be applied first to the payment of certain claims.

No certificate approving or authorizing the first partial payment, or in the event there shall be no first partial payment, then no certificate approving or authorizing any final payment will be made to a foreign Contractor unless such Contractor shall have furnished satisfactory proof that all taxes due by such
Contractor under the provisions of Articles 9, 9A, 16 and 16A of the Tax Law have been paid. The certificate of the State Tax Commission to the effect that all such taxes have been paid shall be conclusive proof of the payment of such taxes. The term foreign Contractor means: in the case of an individual, a person who is not a resident of this State; in the case of a partnership, one having one or more partners who is not a resident of this State; and in the case of a corporation, one not organized under the laws of this State.

Section 179 of the State Finance Law requires the Department to make payment on highway construction contracts within certain time frames. If the Department unjustifiably fails to pay within the prescribed time, it may be required to pay interest for each day in excess of the prescribed time.

109-04 PARTIAL PAYMENTS.

Upon application by the Contractor, and approval by the Regional Director, payments for the actual cost of certain materials may be made to the Contractor prior to incorporation of such material in the permanent work.

A. Eligibility. To be eligible for partial payment, materials must meet all of the following conditions:
1. Inclusion on the listing later in this section;
2. Have a minimum material cost of $5,000. Individual components of an item or related items may be combined to meet the minimum (i.e. combination of all guiderail components);
3. Be materials which will be incorporated into permanent work;
4. Steel and iron materials shall be in a condition which is ready for fabrication or installation. Other materials shall be in a condition which is ready for on-site installation without further fabrication or processing;
5. Be delivered and stored at the work site or at a site and in a manner approved by the Regional Director; and
6. Be materials which will be stored, or already have been stored, for a minimum of 60 days.

B. Application for Partial Payment. With application for partial payments, the Contractor shall provide documentation as follows:
1. Bill(s) of sale or vouchers indicating the actual dollar value of the materials as stored;
2. Certification of Title showing that title to the materials, without encumbrances, is in the name of the Contractor and that title is warranted to the NYS Department of Transportation;
3. Documented evidence of acceptability of the materials; and
4. If the materials are stored on private property, a release and waiver covering such materials, and providing access to the storage site, which release and waiver shall be executed by the property owner in favor of the NYS Department of Transportation or its agents.

When applying for partial payment of products which are claimed to be in short supply or unique to an individual contract, the Contractor shall include documentation supporting that claim, to the satisfaction of the Regional Director.

The amount of partial payments will not exceed the total invoice amount for stored materials, nor will the partial payment for materials relating to any contract work item exceed eighty five percent (85%) of the unit price for that item. The quantity of material for which payments are made will not exceed the estimated contract quantity for that item.

The making of partial payments shall not be deemed to be a final acceptance of materials, nor will it relieve the Contractor of responsibility for such materials. The Contractor shall be responsible for ensuring that only those materials which comply with the specifications are incorporated into the work.

All costs associated with handling, transportation and storage of materials; including any storage site rental, security, and weather protection; shall be borne by the Contractor and included in the prices bid for contract work. Any materials, other than those which are determined by the Regional Director to be unique to the contract, not incorporated into the work shall remain the property of the Contractor. Partial payments made for such unused materials will be withdrawn with no further obligation by the State.
LIST OF MATERIALS
Iron, Steel and Aluminum products (including bridge bearings and all metal components of railings and bridge superstructures);
Precast and Prestressed Concrete products;
Pipe and Underdrain products;
Concrete and Stone curb or masonry products;
Concrete, Steel and Timber piles and appurtenances;
Timber products;
Traffic Signal, Traffic Control, Signing and Lighting components;
Intelligent Transportation System (ITS) components (cameras, telecommunications components, computers, etc.)
Cable, Wire and Conduit;
Impact Attenuator components;
Materials in short supply; or
Materials meeting specific, unique requirements (determined by the Regional Director)

109-05 EXTRA WORK AND TIME RELATED COMPENSATION.
The Contractor will be compensated for extra work under existing unit prices in accordance with §109-02 Compensation for Altered Quantities, by agreed price in accordance with §109-05A. Agreed Price Work, or by force account in accordance with §109-05B. Force Account Work.

A. Agreed Price Work. Agreed prices for new items of work or materials in accordance with one of the methods outlined below may be accepted by the Engineer and incorporated into an order-on-contract as the Department may deem them to be just and fair and beneficial to the State. An order-on-contract containing an agreed price not supported by one of the following may be subsequently rejected by the Department or the Office of the State Comptroller.

1. Original Contract Bid Price. The original contract bid price, adjusted for documented increase or decrease in material cost, equipment rate, mobilization, and/or site conditions.

2. Weighted Average Bid Price. Reference to the statewide or regional weighted average bid price for a minimum of 3 contracts for similar type, quantity, and/or location of work from the Weighted Average Item Price Report or other recent contracts, adjusted for documented increase or decrease in labor, materials, equipment, mobilization, and/or site conditions.

3. Average of 3 Bidders. For work in unusual circumstances or unusual site conditions, the average bid price for the 3 lowest responsible bidders presented in the Tabulation of Bids for that contract. If less than 3 responsible bids were received, this option shall not be used.

4. Price Analysis. A price analysis shall be based on an estimated breakdown of charges listed in §109-05B Force Account Work below, using the equipment and other rates in effect when the agreed price is developed by the Contractor. The analysis shall be based on crew composition, material prices, equipment production and overall production rates that are reasonable in comparison with contract bid price work.

   Equipment rates shall be used with no rate adjustment factor and no regional adjustment factor. An appropriate type and size of equipment similar to that available on the contract site, if present, shall be used.

   Labor rates may be determined using 15% of wages and supplemental (fringe) benefits for FICA, Medicare, paid holidays, Federal unemployment tax, and State unemployment insurance in lieu of a detailed accounting. Overhead and profit will not be allowed on the labor markup.

   Due to the cost and effort associated with development, a price analysis should generally be reserved for extra work under an individual contract pay item or a single price analysis, of more than $1,000.

   The Contractor shall provide a price analysis within 10 work days of request by the Engineer. The Department will accept or reject the Contractor’s proposed agreed price within 10 work days of receipt of a complete price analysis.
B. Force Account Work. Where there are no applicable unit prices for extra work and agreed prices cannot be readily established or substantiated, the Contractor will be paid by Force Account for the actual, reasonable and verifiable cost of the items listed below. The Contractor shall maintain and submit force account records in accordance with §109-05C. Force Account Report.

1. Contractor Charges. At the preconstruction meeting, the Contractor should provide the Engineer documentation supporting its Commercial General Liability Insurance rates for the current period, and provide updates within 30 days after the renewal date, to assist in timely preparation and review of force account reports.

   a. Labor. Necessary labor costs include wages, supplemental (fringe) benefits, payroll taxes, state unemployment insurance, workers compensation insurance and other such reasonable charges that are paid by the Contractor pursuant to existing written agreements with its employees and/or labor organizations. Each class of labor shall be billed separately at actual payroll rates, average rates based on different classes of labor will not be accepted. The wage rate for an individual worker may be up to 110% of the prevailing wage, provided the Contractor documents through certified payrolls that the worker has and continues to be paid more than the prevailing wage for contract work. No reimbursement will be made for travel, lodging, signing bonuses, or other similar payments made to workers.

      At the Contractor’s option, a labor markup of 15% of all wages, not including supplemental (fringe benefits), for FICA, Medicare, paid holidays, Federal unemployment tax, and State unemployment insurance in lieu of a detailed accounting. Overhead and profit will not be paid on the labor markup.

      Workers compensation insurance rate will be the base rate and the territorial differential only established by the NYS Workers Compensation Insurance Rating Board, subject to the Construction Employment Limitation Program limits. No other additional charges or modifiers will be included.

      Insurance and other costs incurred or limited on a weekly basis will be reimbursed based on the percentage of the employees weekly gross wages paid under force account.

   b. Materials. Materials are necessary products incorporated in the temporary or permanent work, including transportation to the site. Transportation may be accounted for under materials as either a unit price for transportation or equipment/operator charges. Equipment charges for transportation of materials shall be accounted for as equipment in accordance with §109-05B.1.c. Equipment with no allowance for overhead and profit. Materials will be measured as quantities incorporated, with no reduction for required overlap, and appropriate waste due to construction and/or installation.

      Oxygen, acetylene, propane, welding rods, grinding wheels, saw blades, hammer and drill bits, drill steel, and tooth-bits consumed in progressing the work are considered to be materials for which reimbursement will be made. Other materials which are consumed in progressing the work are considered to be included in overhead and no separate reimbursement will be made. Material acquired by direct purchase shall be documented by bills or acceptable invoices. All prices on used material incorporated in either temporary or permanent work shall be billed at a fair value, less than the original cost when new. A reasonable salvage credit will be determined by the Engineer in coordination with the Contractor for substantial salvageable material recovered.

   c. Equipment. Equipment, other than small tools, used by the Contractor shall be of suitable size and suitable capacity required for the work to be performed. If the Contractor elects to use equipment of a higher rate than the equipment suitable for the work, payment will be made at the rate applicable to the suitable equipment. The equipment actually used and the suitable equipment upon which the rate is based will be recorded as a part of the force account report. Usage will be recorded in hours to the nearest whole hour. The Engineer will determine the suitability of the equipment. If there is a differential in the rate of pay of the
§109

operator of oversize or higher rate equipment, the rate paid for the operator will likewise be related to the suitable equipment.

(1) Contractor Owned Equipment. The Contractor will be reimbursed for its ownership costs and for its operating costs for self owned equipment at the rates listed in the “Rental Rate Blue Book for Construction Equipment” published by Primedia Information, Inc. (hereafter referred to as the Blue Book) in effect at the time the work is performed.

a) Ownership Costs. The rates for ownership costs will reimburse the Contractor for all non-operating costs of owning equipment, including depreciation on the original purchase, major overhaul repairs, cost of facilities capital, normal risk insurance, property taxes, storage, licenses, record keeping costs, overhead, and profit.

In the event that the Contractor does not have a needed type or piece of equipment on the contract site, the Contractor will be paid for the reasonable cost of moving the equipment onto and away from the contract site.

The hourly rate for the first 8 hour shift will be the Blue Book monthly rate divided by 176 multiplied by the rate adjustment factor and then multiplied by the regional adjustment factor. The hourly rate for subsequent shifts during the same day will be 75% of the first shift hourly rate. Equipment required to be present, but idle, will be paid at 50% of the first shift hourly rate. Reimbursement will be made for for the product of the hours of actual use or hours it is required to be present, and not available for mobilization elsewhere, multiplied by the hourly rate.

b) Operating Costs. The rate for operating costs includes preventative and field maintenance, fuel, lubricants, and other operating expendables. Operating cost does not include the operator’s wages. Reimbursement will be made for the product of the number of hours of actual use multiplied by the operating rate. The hourly rate will be paid for all hours of operation, including those during subsequent shifts on the same day.

c) No Established Rate. In the event that rates are not established in the Blue Book for a particular piece of equipment, the Contractor shall contact the Blue Book publisher to establish rates. If the publisher will not establish rates, the Department will establish rates for ownership costs and operating costs for that piece of equipment consistent with its cost and expected life.

(2) Rented Equipment. In the event that the Contractor does not own a specific type of equipment and must obtain it by rental, the Contractor will be paid for the time that the equipment is used to accomplish the work or is required to be present, plus the reasonable cost of moving the equipment onto and away from the contract site.

a) Rental Costs. The Contractor will be paid the invoiced rental rate for the equipment, not to exceed the Blue Book ownership rate.

b) Operating Costs. The Contractor will be paid for the operating cost of the equipment in accordance with §109-05B.1.c.(1)b) unless reflected in the rental price.

c) Rates Including Operator. In the event that the Contractor rents equipment with an operator or fully fueled and/or maintained equipment such as cranes, concrete pumpers, trucks, etc. payment will be made on the basis of an invoice for the rental of the equipment and the costs of moving to and from the site, provided the total rate is substantiated by area practice. The rate including operator will not exceed the total of the ownership rate and the operating rate from the Blue Book, and the prevailing wage rate of an appropriate operator, if an operator is supplied.
(3) Maximum Ownership/Rental Costs. The maximum amount paid for the ownership costs of Contractor owned or the rental costs of rented equipment, is limited to the original purchase price as listed in the “Green Guide for Construction Equipment” published by Primedia Information, Inc. If the ownership or rental reimbursement is limited by the original purchase price, the Contractor will be reimbursed for the operating cost per hour for each hour of actual use.

d. Sales Taxes. Sales taxes, if any, required to be paid on rented equipment or materials not permanently incorporated into the work.

e. Overhead. Overhead will be computed at ten percent (10%) of items §109-05B.1.a. Labor (but not including the premium portion of overtime) and §109-05B.1.b. Materials, and will be defined to include the following:

(1) Additional premium on bond, additional premium for insurance required by the State other than Workers Compensation Insurance and Commercial General Liability Insurance;
(2) All salary and expenses of executive officers, supervising officers/employees, superintendents, and clerical or administrative employees, including payroll taxes, unemployment insurance, workers compensation insurance, and charges that are paid by the Contractor to or on behalf of those employees pursuant to written agreement with its employee(s) and/or labor organizations;
(3) Minor equipment such as small tools, including shovels, picks, axes, saws, bars, sledges, lanterns, jacks, etc., and other miscellaneous supplies and services;
(4) Contractor’s field office rental, utility charges, potable water, sanitation, cleaning, computers, CADD equipment, drafting equipment reproduction costs, etc.

f. Profit. Profit will be computed at ten percent (10%) of items §109-05B.1.a. Labor (but not including the premium portion of overtime) and §109-05B.1.b. Materials.

g. Commercial General Liability (CGL) Insurance. Commercial General Liability (CGL) insurance will be reimbursed at the rate paid by the Contractor in accordance with the method procured from its insurer.

(1) Contractors that pay commercial general liability on the basis of a percentage of payroll will be paid that percentage of item §109-05B.1.a. Labor.
(2) Contractors that pay commercial general liability on the basis of a percentage of gross sales will be paid that percentage of items §109-05B.1.a. through f.

2. Subcontractor Charges. When the work is performed by a Subcontractor, the Contractor will be paid the actual and reasonable cost of such subcontracted work as outlined above in §109-05B.1.a through §109-05B.1.g, plus an additional overhead of five percent (5%) of the cost of items §109-05B.1.a. Labor and §109-05B.1.b. Materials.

3. Service Charges. When work is performed by, and a fee is paid to, a service provider, the Contractor will be paid the actual cost of the service fee plus five percent (5%) for contract supervision, overhead and profit. This 5% will be applied once to the service fee regardless of the firm making direct payments to the service provider.

C. Force Account Report. Payment for force account work will be made on the basis of the following reports. Reports shall be submitted in a format acceptable to the Department. Appropriate forms are available from the Department.

If the Engineer disagrees with the accuracy, applicability, or reasonableness of any portion of a Contractor's submission, he/she shall promptly notify the Contractor. The Engineer will make any notations, remarks or comments on the records that may assist in final payments and then sign and date to indicate receipt, but not necessarily concurrence.
1. **Daily Summary.** The Contractor shall deliver a daily summary of force account work to the Engineer not later than close of business on the work day following that for which the work is reported. This summary shall be dated and signed by the Contractor’s authorized representative. The summary shall contain:
   a. The contract number, other contract information, and the Contractor name/information.
   b. A brief description of the work performed and the work location for that day.
   c. A list of personnel by name, including the hours worked, and labor classification.
   d. A list of materials used indicating the quantity and nature. The cost shall be documented later by proper receipts.
   e. A list of equipment used indicating the number of hours used and the type, manufacturer, model, model year, size of equipment, and any required attachments.

2. **Weekly Labor Summary.** Within 5 calendar days after the end of each pay period, the Contractor should deliver to the Engineer a Force Account Summary of Labor used on the work, which shall include the name, labor classification, hours worked, hourly rate of pay, supplemental (fringe) benefits, and/or other items as shown on the certified payroll. If the Contractor does not provide the Engineer with Weekly Labor Summaries, no progress payments on that force account will be made.

3. **Force Account Report Submission.** On completion of the specific force account work, the Contractor shall deliver to the Engineer a Force Account Report, wherein all labor, materials, equipment, and other charges are shown and totaled. The Force Account Report shall be dated and signed by the Contractor's authorized representative. When the Contractor and the Engineer agree on the Force Account Report, the Engineer will prepare and submit an order-on-contract containing the Force Account Report to the Regional Construction Engineer for approval.

4. **Force Account Review.** The Department will review the Force Account Report and make any notations, remarks or comments on this form that may assist in final payments. The emphasis of this review will be on labor rates, payroll taxes, material costs, equipment rates, insurance rates, conformance with payment provisions of technical specifications, and overall documentation. The Regional Construction Engineer will forward the order-on-contract to the Director, Construction Division. The Department, after review and approval, will forward the order-on-contract to the Office of the State Comptroller (OSC) for review and approval. Payment cannot be made prior to approval by the OSC.

5. **Late Submissions.** In the event the Contractor fails to deliver the required force account documentation to the Engineer in a timely manner, and as a result the order-on-contract for the force account work is not fully approved at the date of final acceptance, the required final payment date will be extended by the number of calendar days between final acceptance and the issuance of this force account order-on-contract, attributable to the Contractor's late force account submissions.

D. **Time Related Dispute Compensation.** The Contractor will only be eligible for extra compensation for expenses or costs which are identified as compensable under §108-04A. *Compensable Delays.* In the event any legal action is instituted against the State by the Contractor due to any such dispute for additional compensation, whether due to time related dispute, delay, acceleration, breach of contract, or otherwise, the State's liability will be limited to those items which are specifically identified as compensable under §109-05D.1. *Recoverable Contractor Costs.* Nothing in this subsection is intended to create any liability of the State not existing at common law or pursuant to the terms of this contract or to prevent the Contractor from filing a claim in the New York State Court of Claims. The remedies contained herein are exclusive.

1. **Recoverable Contractor Costs.** Only the following elements, will be recoverable by the Contractor as “time related dispute compensation” provided that they are actual and reasonable. Any such adjustment will be made via order-on-contract. Escalated costs will include
unanticipated higher or lower costs attributable, with appropriate credits, to the performance of work or portions of work in an extended time period due to extenuating circumstances beyond the control of the Contractor.

Extra work required due to a time related dispute shall be accounted for and reimbursed in accordance with §109-05B., less any appropriate credit.

a. Labor. Documented escalated labor costs determined in accordance with §109-05B.1.a. Labor;

b. Materials. Documented escalated material costs determined in accordance with §109-05B.1.b. Materials;

c. Equipment. Documented escalated equipment costs less appropriate credits, determined in accordance with §109-05B.1.c. Equipment. The ownership cost for idle equipment will be 50% of the rate set forth in §109-05B.1.c. Equipment. Idle time shall not exceed 8 hours per day, 40 hours per week, or the annual usage hours established in the “Blue Book”. No operating costs will be paid for idle equipment;

d. Extended Field Office Costs. Fees paid to service provider(s) for required Contractor’s field office rental, utility charges, potable water, sanitation, cleaning, etc. The Contractor will be paid the actual cost of the service fee plus five percent (5%) for contract supervision, overhead and profit. This 5% will be applied once to the service fee regardless of the firm making direct payments to the service provider;

e. Extended Contract Site Overhead. Documented additional or escalated contract site overhead costs during the extended period, including superintendent, office engineer and clerical staff, but not including working forepersons;

f. Home Office Overhead. Home office overhead equal to 10% of the total of items §109-05D.1.a Labor and §109-05D.1.b. Materials;

2. Recoverable Subcontractor Costs. When the work is performed by a Subcontractor, the Contractor will be paid the actual and reasonable costs of such subcontracted work as outlined above in §109-05D.1.a through §109-05D.1.d. except when §104-03 Differing Site Conditions, §104-04 Significant Changes in Character of the Work or §104-05 Suspensions of Work Ordered by the Engineer apply, no profit or anticipated profits will be allowed;

3. Non-Recoverable Costs. The parties agree that, in any dispute for time related compensation, the Department will have no liability for the following items and the Contractor further agrees it shall make no claim for the following items:

a. Home office overhead in excess of that provided in §109-05D.1.e. Home Office Overhead;

b. Profit, in excess of that provided in §109-05D.1.f. Profit;

c. Loss of anticipated or unanticipated profit;

d. Labor inefficiencies and loss of productivity;

e. Consequential damages, including but not limited to interest on monies in dispute, including interest which is paid on such monies, loss of bonding capacity, bidding opportunities, or interest on investment, or any resultant insolvency;

f. Indirect costs or expenses of any nature;
§109

g. Direct or indirect costs attributable to performance of work where the Contractor, because of situations or conditions within its control, has not progressed the work in a satisfactory manner.

h. Attorneys fees and dispute or claims preparation expenses.

### 109-06 CONTRACT PAYMENTS.

Payments will be made to the Contractor for work satisfactorily performed monthly in accordance with Article 7 *Contract Payments* of the contract agreement. No contract payment will be rendered unless the value of the work done equals 5% of the Contract Amount or $1000, whichever is the lesser. At the Contractor's request, semimonthly contract payments may be rendered provided the value of the work performed in a two-week interval is in excess of $50,000 or if, in the opinion of the Department, it is to the best interests of the State to do so.

### 109-07 PROMPT PAYMENTS BY THE CONTRACTOR.

Section 139-f(2) of the State Finance Law requires the Contractor to pay each Subcontractor and materialman for the value of work performed pursuant to contract no later than fifteen (15) calendar days from the receipt of each payment the Contractor receives from the State. Payment by the Contractor to Subcontractors or materialmen shall represent the value of work performed and/or materials furnished and reflect the percentage of work completed or materials furnished by the Subcontractor or materialmen and be based upon the actual value of the subcontract or purchase order. The Contractor shall not hold any retainage, but may deduct an amount necessary to satisfy any claims, liens or judgments against a Subcontractor or materialman which have not been fully discharged.

The Contractor shall maintain an accounting system acceptable to the Department to track payments made by the State to the Contractor and payments made by the Contractor to each Subcontractor, Manufacturer, Fabricator or Material Supplier by item and by date, for the purpose of enabling the Department to audit the payment provisions of this subsection. The system shall be able to provide data necessary for the completion of Contractor Report of Contract Payments. Reports shall include a certification that Subcontractors, Manufacturers, Fabricators and Material Suppliers have been paid with any exceptions noted and explained.

### 109-08 ELIMINATED MATERIALS.

Materials required by the contract documents and not incorporated into the work due to changes caused by field conditions or revisions to the design by the State after the material was ordered or purchased may be eligible for reimbursement. Materials will be eligible for reimbursement if they are determined by the Regional Director to be unique to the contract, and meet one or more of the following conditions:

- The material order cannot be canceled or changed to reflect the revised quantity required.
- The material cannot be restocked or the cost of restocking is excessive.
- The Contractor or Subcontractor does not maintain a supply of the material.
- The cost of the material exceeds $1000. or five percent (5%) of the item, whichever is greater.

The Contractor will be reimbursed its material cost minus salvage value, or the material cost plus necessary delivery costs to a site identified by the Engineer, if the Department opts to take the material. Overhead and profit will be paid once, at a maximum of five percent (5%) for all materials not incorporated into the work, regardless of whether the Contractor or the Subcontractor pays for the material and/or delivery costs.

### 109-09 FINAL ACCEPTANCE AND FINAL PAYMENT.

The provisions of Article 9 *Final Acceptance of Work* and Article 10 *Final Payment* of the contract agreement shall apply.

#### A. Final Additions or Deductions

Upon the completion of the required work as shown in the contract documents, should the final quantities show either an increase or decrease from the original estimate of quantities, then such increases or decreases will be computed at the unit bid prices, unless the unit bid prices have been adjusted and the final value will be computed by adding or deducting this amount from the gross sum bid as modified by any orders-on-contract.
B. Final Acceptance. Prior to the final acceptance of the work by the Commissioner or his/her designee, the contract work may be inspected, accepted and approved by other agencies and/or municipalities who will have jurisdiction of the work after final acceptance. Upon final acceptance, seventy percent (70%) of the withheld retainage may be released in accordance with Article 9 Final Acceptance of Work. Within 7 days of Final Acceptance, the Contractor shall provide a completed FHWA Record of Materials, Supplies and Labor (Form FHWA-47M).

C. Final Agreement. The final agreement will not be drawn and finalized until all work required under the contract has been satisfactorily completed, all disputes presented and all accounts for extra work and materials have been rendered, considered, and if agreed to, incorporated by order on contract or made a part of such final agreement. Work remaining to be accomplished under an Uncompleted Work Agreement shall be considered as completed work for the purpose of the final agreement, provided the Uncompleted Work Agreement has been executed in accordance with §109-10 Uncompleted Work Agreement. Work accomplished under a warranty agreement shall be considered as completed work for the purpose of the final agreement, provided the warranty agreement has been executed and any required bond deposited by the Contractor.

The Commissioner, or his/her designee, will approve a final agreement as prepared and approved by the Regional Director, less any and all deductions authorized to be made by the Commissioner under the contract. Payment pursuant to such final agreement less any deductions authorized to be made by the Comptroller shall constitute the final payment to the Contractor.

In order to enable the Department to process the final agreement properly and expeditiously, the Contractor shall submit the following documents, as may be appropriate, to enable the processing of the final payment as described above.

Certified Payrolls
Final Labor Affidavits (AC 2947, Contractor's Certification & AC 2948, Subcontractor's Certification)
Final Civil Rights Reports (In accordance with §105-21 Civil Rights Reporting)
Final Agreement
Release from any Outstanding Disputes
Final Survey Notes/Computations
Approved Reproducible Drawings
Approved Field Change Sheets (From VECP or other Contractor Proposals)
Material Certifications
Tax Clearance for “Foreign” (out of State) Contractors, Corporations or Entities

The above list is general in nature, every item may not be applicable to the contract and other documents and submissions not shown above may be required to enable the processing of the final payment. Any time taken beyond the date of final acceptance to satisfy or furnish the above information shall extend the required payment date by an equal period of time.

D. Final Payment. Section 179 of the State Finance Law requires the Department to make final payment on highway construction contracts within seventy-five (75) calendar days after final acceptance by the Commissioner. If the Department unjustifiably fails to pay the final payment within the prescribed 75 calendar days, it may be required to pay interest for each day in excess of the 75 calendar days. The Department, in accordance with Section 179 of the State Finance Law, has determined that a thirty (30) calendar day inspection period after contract final acceptance is required for final payments, after which time the 75 day interest-free processing period will commence.

E. Acceptance of Final Payment. The acceptance by the Contractor, or by anyone claiming by or through it, of the final payment shall constitute and operate as a release to the State from any and all claims of any liability to the Contractor for anything theretofore done or furnished for or relating to or arising out of the work done thereunder, and for any prior act, neglect, or default on the part of the State or any of its officers, agents, or employees unless the Contractor serves a detailed and verified statement of claim upon the NYS Department of Transportation not later than 40 days after the mailing of such final payment. Such statement shall specify the items and details upon which the
claim will be based and any such claim shall be limited to such items. Should the Contractor refuse to accept the final payment as tendered by the Comptroller, it shall constitute a waiver of any right to interest thereon.

109-10 UNCOMPLETED WORK AGREEMENTS.
Whenever a contract shall, in the judgment of the Department, be substantially completed, and keeping the contract open and maintaining the contract bonding, would be an injustice to the Contractor, the Department may enter into an Uncompleted Work Agreement with the Contractor. Prior to entering into an Uncompleted Work Agreement, the essential items in the contract shall have been completed by the Contractor in accordance with the terms of the contract and the provisions of §109-09C. Final Agreement, and certified by the Regional Director. The essential items in the contract shall include, but will not be limited to the completion of or the safe working order of all pavement, shoulders, guide rail, drainage, signs, and signals, so that the highway is safe for use by the traveling public without the use of any temporary or emergency devices.

The final contract account will include such uncompleted items and pay therefore at the item prices in the contract, upon execution of the Uncompleted Work Agreement. The Uncompleted Work Agreement will be based on an estimate of work remaining to be completed. If actual quantities are later found to vary from the estimate, no adjustment of quantities can be made under an Uncompleted Work Agreement.

The Contractor shall execute an Uncompleted Work Agreement upon depositing with the Department a certified check drawn upon a legally incorporated bank or trust company, or securities as are listed in State Finance Law §139(3). The deposit shall be an amount equal to at least double the value of such uncompleted work, including those pay items that are uncompleted and such work that is required but not included as a contract pay item. When the cost to perform the work is not reflected by the unit prices bid, the Engineer will estimate the value of uncompleted work. The deposit will be held by the Department until the Engineer certifies that all previously uncompleted work has been satisfactorily completed. When the Contractor satisfactorily completes the uncompleted portions of work, the deposit will be returned. No partial releases of funds from an Uncompleted Work Agreement will be made. If portions of uncompleted work will be completed at varying times, the Department may consider the use of multiple Uncompleted Work Agreements.
Section 200
EARTHWORK

SECTION 201 - CLEARING AND GRUBBING

201-1 DESCRIPTION

201-1.01 General. This work shall consist of clearing, grubbing, removing and disposing of all trees, brush, stumps, fences, debris, and miscellaneous structures not covered under other contract items within the construction area and such other areas as specified or directed. The Contractor shall clear such additional areas within the limits of the right-of-way and easement lines as specified or directed.

201-1.02 No Burning Requirement. Materials generated by the work, including construction and demolition debris, shall not be disposed of by burning on or off the site. Off site burning in a permitted solid waste incinerator or in another lawful manner as refuse derived fuel will be permitted.

201-2 MATERIALS (Not specified)

201-3 CONSTRUCTION DETAILS

201-3.01 Limits of Work Areas. The Engineer will establish the limits of areas to be cleared and grubbed, to be cleared but not grubbed, or areas, objects or features that are designated to remain undisturbed. In general, the work areas shall include the road section, stream channels, ditches, temporary approaches to bridges, detours and other areas as shown in the contract documents or directed by the Engineer. The Engineer will designate fences, structures, debris, trees and brush to be cleared where grubbing is not required. Clearing beyond the areas of construction shall be done only where specified or directed.

201-3.02 Clearing and Grubbing. During the life of the contract the Engineer may order the clearing of any trees within the R.O.W. that the Engineer determines to be hazardous or dead and unsightly.

The Contractor shall carefully prune all branches of trees less than five (5) meters above any part of the roadway and all branches which have been broken or injured during construction. The work shall be done as specified under §614-3.01A Equipment and B. Pruning.

Whenever trees are felled or trimmed on/or adjacent to highways, all wood shall be immediately removed from the roadway or any area that would present a hazard to traffic. Grubbed stumps shall be moved immediately at least ten (10) meters from the edge of pavement. No trees, tree trunks, stumps or other debris shall be felled, sidecast or placed outside the limits of the road section. No grubbing will be required beneath the embankment where the finished grade will be two (2) meters or more above the original ground surface unless otherwise specified in the contract documents. Where trees or existing stumps are cleared and grubbing is not required, the tree trunk or existing stump shall be cut off not more than 150 mm above the original ground surface unless otherwise approved. Exposed stumps not required to be removed but which are within ten (10) meters of the edge of the pavement or are in a built-up area shall be chipped out to a depth of not less than 150 mm below the finished grade and the holes backfilled if directed by the Engineer. This work shall be completed within one week after start of work on the tree.

201-3.03 Disposal

A. General. All wood including grubbed stumps shall be removed from the contract site or otherwise disposed of.
B. Methods of Disposal of Wood and Brush.

1. Disposal (No Burning). All wood and brush shall be disposed of within fifteen (15) days after cutting or felling unless otherwise approved. No burning of land clearing materials that result from the clearing and grubbing operations, except in a permitted solid waste incinerator or as refuse derived fuel, will be permitted. The Contractor will have the following options or combination of options for disposal of this material:

a. The Contractor shall make every effort to salvage marketable timber as specified in paragraph B4 of this subsection.

b. When permitted by a note in the contract documents, disposable material may be placed at locations approved by the Engineer within the right-of-way but outside of the embankment area.

When permitted by a note in the contract documents, disposable material may be placed in the embankment side slope area. The contract documents will define the embankment side slope area and the procedures for the concurrent construction of the embankment and disposal section.

This type of disposal will require certain preparatory work. Preparation for direct burial of woody materials shall consist of cutting main trunks and limbs and chipping smaller limbs, branches, foliage and brush. Under conditions when disposal space and earth cover are limited in size and quantity, stumps will have to be ranked in size and placed in layers so as to make best use of the space available and the quantity of materials to be buried.

c. The Contractor may bury disposable material off the right-of-way at locations obtained by the Contractor at no expense to the State. Such locations are to be approved in writing by the Engineer. The disposal work will require the same preparatory work as stated in option b. above except that the Engineer may waive such requirements for miscellaneous work which may be accommodated in a satisfactory manner by other methods. The disposal area is to be covered with earth as hereinafter specified.

d. The Contractor may reduce all woody materials to chips and dispose of the chips as specified in paragraph B2 of this subsection.

e. The material may be sent to a refuse derived fuel processing facility or to other processing facility for eventual beneficial re-use as fuel or for other lawful re-use.

Under no circumstances is disposal to be made in swamp or wet lands. When the disposal area is within the embankment section or is formed by flattening the embankment slopes, the elevation of the normal embankment construction shall always equal or exceed that of the disposal area. There is to be absolutely no end dumping of disposable material over the sides of the embankment. All disposal areas are to be finally covered with a minimum of 600 mm of earth and graded to drain properly.

2. Chipping. Wood may be reduced to chips by the use of an approved chipping machine or stump grinder. Chips shall be 15 mm maximum thickness or of other approved thicknesses. Chips resulting therefrom may be disposed of by being stockpiled and used as mulch for planting, by distribution on the ground surface in wooded areas within the right-of-way as approved by the Engineer, or by disposal at a location off the contract site satisfactory to the Engineer.

3. Burying. No tree trunks, stumps or other debris shall be buried inside the right-of-way limits without the written approval of the Engineer. Disposal areas outside the right-of-way limits shall be approved in writing by the Engineer and shall be acquired by the Contractor at no expense to the State.

4. Salvage of Marketable Timber. In the interest of conservation, the Contractor shall make every effort possible to salvage marketable timber produced as a result of clearing operations, provided the amount of timber is great enough to make the hauling practical. In general, marketable timber is construed to mean logs 2.5 to 5 m in length, plus appropriate trimming allowance, having a diameter inside the bark, at the small end, of approximately 250 mm. In the event that the Contractor is not successful in salvaging marketable timber, the Contractor shall advise the Engineer, in writing, of the efforts to salvage and indicate the reason why the timber could not be salvaged.
Any wood that is cut up in firewood lengths or other marketable lengths may be neatly piled adjacent to the right-of-way in an area provided by the Contractor for periods in excess of one week but shall be removed prior to completion of the contract.

### 201-4 METHOD OF MEASUREMENT

**201-4.01 Per Hectare.** Payment for Clearing and Grubbing will be made at the unit price bid per hectare computed to the nearest one hundredth hectare.

**201-4.02 Per Lump Sum.** Payment for Clearing and Grubbing will be made on a lump sum basis for work satisfactorily completed. Monthly payments will be made in proportion to the amount of work done as determined by the Engineer.

**201-4.03 Borrow Areas.** Borrow pits or other pit areas from which material is secured shall not be included for measurement of clearing and grubbing.

### 201-5 BASIS OF PAYMENT

**201-5.01 Clearing and Grubbing.** Payment will be made at the contract price to furnish all materials, labor and equipment necessary to satisfactorily complete the work as specified. No separate payment will be made for any excavation, backfill or earth cover necessary to complete the work of disposal outside the embankment area nor for the work in handling, storing, rehandling and hauling of disposable material within or outside the right-of-way.

*Payment will be made under:*

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<th>Item No.</th>
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<td>201.06</td>
<td>Clearing and Grubbing</td>
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<td>201.07</td>
<td>Clearing and Grubbing</td>
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### SECTION 202 - REMOVAL OF STRUCTURES AND OBSTRUCTIONS

**202-1 DESCRIPTION.** This work shall consist of the removal and disposal, wholly or in part, of all buildings, structures, pavements, obsolete utility lines and tanks which are released to the Contractor in accordance with the provisions of these specifications. The work includes the demolition of existing superstructures, substructures, supporting bents and columns, surrounding material, and the removal of old bituminous concrete overlay and bituminous patches, within the right-of-way, listed in the itemized proposal, or directed by the Engineer. It also includes salvaging and storing designated materials, relocating designated buildings and backfilling resulting trenches, holes, pits, and cellars.

**202-2 MATERIALS** *(Not specified)*

**202-3 CONSTRUCTION DETAILS

**202-3.01 General and Safety Requirements.** The Contractor shall conduct all demolition operations in a safe, legal, and responsible manner and shall ensure that any equipment, material, or method used shall be safe for the workers and the public. All laws, rules, regulations, and local building codes shall be followed. Local building code shall mean, outside of New York City, a code enacted or adopted by competent local officials or bodies at least as stringent in its requirements as the “New York State Fire Prevention and Building Code” and its associated reference standards. In New York City, Local Building Code shall mean the New York City Building Code.

Prior to demolition operations, an engineering survey shall be made by a competent person of the building, bridge, or other structure to determine its condition and the possibility of collapse of any portion, as outlined in 29 CFR 1926, Subpart T. As defined in 29 CFR 1926, Subpart C “Competent Person” means someone who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are or will be unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them. For purposes
§202

of this contract a competent person for bridge structures longer than twenty feet shall mean a registered professional engineer experienced in the design, construction or demolition of such structures unless waived in the contract documents. For buildings, other than ordinary wood frame construction, shall mean a registered professional architect or registered professional engineer experienced in building design, construction, or demolition.

Adjacent buildings or structures, within 30 meters of the building or structure, shall also be included in the survey if directed by the Engineer. The findings and recommendations of this survey shall constitute a “removal plan.” Removal plans that are required to be prepared by a registered professional engineer or architect shall be submitted to the Engineer thirty (30) days prior to the commencement of demolition. Other removal plans shall be submitted fifteen (15) days prior to demolition. The removal plan shall include a description of the type, size, weight, and location of all equipment to be used and a sequence of removal activities. The removal plan shall be filed with the Project Safety and Health Plan.

The Contractor shall protect power, water, or other utility lines during demolition. If such lines cannot be protected in place they shall be temporarily relocated, as necessary, and protected prior to demolition. Other severed sewer lines or drains emanating from the building or structure shall be capped or otherwise tightly sealed to prevent the entry of foreign materials into the main sewer or drain. All asbestos materials or other hazardous material shall be removed from or otherwise remediated on the work will be performed by, and at the expense of, its respective owners upon adequate notice.

The findings and recommendations of these monitoring assessments shall be made part of the removal plan prepared for the work and shall be provided to the Engineer promptly.

Before any structure or building served with or having utilities thereon is demolished or relocated all telephone, cable, electric, gas, water, steam, or any other service shall be shut off at the street and capped, or otherwise made safe and controlled, outside the building or off the structure before the general demolition work is started. Remediation work of asbestos or other hazardous material however may proceed before services are cut, except that all electric circuitry in any work area that is humid, wet, or will become wet or humid during the work shall be shut down and locked out. If power is required in such places, temporary power and light circuits may be brought into the work area provided such circuits have ground fault interrupters at their sources. In each case, the utility companies involved shall be notified, in writing, at least five (5) working days, or longer if indicated elsewhere in the contract documents, in advance of the work. The Contractor will be held fully responsible for any claim arising from failure to do so.

During the periods that personnel are required to work on, in, or around a building or structure to be demolished or relocated which is in a damaged or deteriorated condition by fire, flood, explosion, weather, or other cause, its elements shall be adequately braced to prevent collapse. Details of the bracing shall be provided in the removal plan previously mentioned in connection with the engineering survey and shall be included with the Project Safety and Health Plan for the project.

All asbestos materials or other hazardous materials shall be removed from or otherwise remediated on each structure or building before the general demolition work on that building or structure begins. The requirements and payment for this work will be as indicated elsewhere in the contract documents and as
outlined in the asbestos or hazardous material remediation plan prepared by the State or others for the project.

Where a falling hazard exists to personnel, the openings shall be protected to a height of approximately one meter. All floor or deck openings not used as material drops shall be covered over with materials substantial enough to support the weight of any loads which may be imposed upon them. Such materials shall be properly secured to prevent accidental movement.

When excavation is required, the Contractor shall provide excavation protection for workers and the public in accordance with §107-05K. Open Excavations and Trenches.

The Contractor shall repair or replace in kind, at no cost to the State and in a manner as approved by the Engineer, sidewalks, curbs, roadway and other materials designated to remain in place which are damaged by or as a result of the work.

202-3.02 Disposal Of Buildings. Any building designated for disposal and released to the Contractor thirty (30) days or earlier before the contract completion date, shall become the property of the Contractor and shall be promptly demolished at its site. Any proposal to allow such building or any portion thereof to remain standing at the site, or to be relocated to another site, shall be referred to the Director of the Real Estate Division for approval and shall be accomplished under terms and conditions established by the State. An appropriate extension of time may be allowed for work resulting from demolition of buildings released to the Contractor after the date indicated above. All abandoned equipment, material other than those of a hazardous nature, and fixtures of any kind remaining on the property after it is released to the Contractor shall become the Contractor's property and shall be removed as part of the building disposal. Materials of a hazardous nature shall be removed or remediated as indicated below. All the requirements of §202-3.01 General and Safety Requirements shall apply together with the following:

A. Unauthorized Entry. The Contractor shall immediately inspect all buildings released for demolition and shall prevent unauthorized entry to these buildings by boarding up or otherwise blocking potential entrances. If material blocking entrances is removed, the Contractor shall, after determining the building to be vacant, replace the removed material in such a manner as to keep the buildings from being re-entered.

B. Hazardous Material. Asbestos, hazardous chemicals, gases, explosives, flammable materials, or similarly dangerous materials in the building or on the property shall be removed and disposed of or otherwise remediated in accordance with all applicable rules, regulations and laws concerning the handling and disposal of Hazardous Materials or Hazardous Wastes. Payment and requirements for such disposals and/or remediations shall be as indicated elsewhere in the contract documents. Petroleum products in storage tanks shall be removed in accordance with and paid for under the pay item for Disposal of Petroleum Storage Tanks.

C. Rodent, Insect, and Wildlife Control. The Contractor shall exterminate rodents and insects in each building so infested, as determined by the Engineer, City, County or District Office of the State Department of Health. The Contractor or Subcontractor performing the exterminating work shall, upon request, show at least five (5) years experience at extermination of the kind required. If the building or structure to be demolished is inhabited by wildlife, the Regional Office of the Department of Environmental Conservation or the local animal control officer shall be contacted and given the opportunity to remove such wildlife before extermination or demolition operations are commenced. If inhabited by domesticated animals, the local animal control officer shall be given the opportunity to arrange for their removal. The work of extermination shall be performed in accordance with the requirements of the City, County or District Office of the State Department of Health.

Bait shall be placed at least thirteen (13) calendar days but not more than thirty (30) calendar days before actual demolition is started, or at such other times as required by the City or County Health Department. Insects shall be controlled by spraying or fumigating. If it is necessary to seal the building for the treatment to be effective or to prevent migration of insect, pest, or vermin, the Contractor shall seal the building.
§202

If extermination is being conducted because it was ordered by the City, the County, or the State Department of Health, then the Contractor shall notify that office that the extermination has been completed and shall obtain their written concurrence that the extermination work was satisfactorily completed. Demolition work shall not proceed until the Engineer receives a copy of the written concurrence of the City, County or District Office of the State Health Department stating the extermination has been satisfactorily performed.

D. Glass. Glass that will create a hazard if fragmented shall be removed.

E. Demolition of Party Wall Structures. In the event that the demolition of one or more units of a group of party wall structures leaves a wall or walls exposed, the Contractor shall comply with the following requirements:

1. Furring, plaster, chimneys which are directed to be removed, projecting parts, and the like shall be removed.
2. The walls shall be made self-supporting, safe and weatherproof with construction similar to or consistent with the remaining building. The supports and bracing details necessary to accomplish this shall be included as a recommendation contained in the removal plan.
   The walls shall be left in a presentable and sound weatherproof condition compatible in appearance with the remaining building and in conformance with local building codes, as determined by the Engineer.
3. The roof shall be properly flashed, repaired, or otherwise treated to prevent leaks.
4. The Contractor shall provide and place on solid foundation any shoring necessary to prevent damage to adjacent property. Necessary details of the foundation and shoring shall be included in the Removal Plan. The Contractor shall be held responsible for any claim arising out of failure to prevent damage to adjacent properties.
5. All work shall be in conformance with local building codes.

F. Demolition of Buildings. Unless mechanically demolished, the demolition of multi-story buildings herein defined as consisting of more than 2 ½ stories shall be accomplished story by story without accumulating rubble on the floors of the partially demolished structure.
   If mechanical demolition is used, during actual operations no worker shall be permitted at any location onto which debris may fall or which may become unstable or collapse as a result of the demolition operations. Only the minimum number of workers actually necessary for the performance of the work shall be permitted in those locations at other times until such time as the operations are complete and the debris has been removed.
   If debris is dropped through holes in the floor without the use of chutes, the area onto which the material is dropped shall be completely enclosed with substantial barricades nominally one meter high, or higher if directed, and placed not less than two (2) meters back from the projected edge of the opening above. If the hole is to be used by machines as a material drop, substantial timber or other curbing shall be securely anchored around the hole. The barricades, but not the curbing, may be moved aside temporarily during periods that the machines are actually using the hole. Barricades shall be promptly restored to their proper locations when the machines have ceased actually using the hole.
   Signs warning of the hazard and of falling materials shall be posted at each level.
   Demolition and removal activities shall not be permitted in lower areas until debris handling ceases above.
   The locations and details of any signs, barricades, curbings, and decking used to cover over holes in the flooring shall be indicated in the removal plan prepared for the building.

G. Partial Demolition of Buildings. If the work involved consists of demolishing only a portion of a building, the Contractor shall cooperate with the owner(s) of the remaining portion so that annoyance and inconvenience is minimized.
   The competent person shall survey the site of the partial demolition and shall recommend any measures necessary to prevent the work from affecting adjacent property. Any measures recommended shall be included in the Removal Plan.
The Contractor shall close the open ends of the buildings being partially demolished with construction similar to the remainder of the building and shall furnish and install supporting members, framing, and foundations to support the remaining structure. All construction necessary to close the openings shall be of a strength and type to meet the local building codes. Structural supports shall be of the same materials as the existing supporting members to which they frame or with which they share load or shall be compatible with them. The Contractor may use salvaged lumber for sheathing provided that such lumber is sound and suitable, as determined by the Engineer. New kiln dried timber and lumber shall be used for all other purposes. The supporting members, framing and foundation etc, necessary to accomplish this shall be submitted as a recommendation of the previously mentioned engineering survey and included with the Removal Plan for the building.

**H. Demolition of Foundation.** Unless indicated otherwise or their removal would endanger adjacent improvements, the Contractor shall remove the foundation walls to the depth of the lowest cellar floor and shall break up any cellar floor, backfill the hole and grade the site to the satisfaction of the Engineer immediately after demolition of the structure.

**I. Dust Control.** Provisions shall be made at every demolition site to control the quantity of dust resulting from demolition operations by wetting the debris and the immediate work area with water or other appropriate spraying agents or by means acceptable to the Engineer. Dust control measures shall be included in the Removal Plan.

**J. Maintenance and Protection of Traffic, Including Pedestrians.** The Contractor shall, for the duration of the contract, maintain and keep safely passable and free from debris, snow and ice, all public walkways adjacent to the properties on which buildings to be demolished are located. Active entrances to two or more story buildings being demolished shall be completely protected by sidewalk sheds, canopies or other means detailed in the Removal Plan and approved by the Engineer. Protection shall be provided a minimum distance of 2.5 meters from the face of the building. All such protection shall extend a minimum of 0.3 meters beyond each side of the building entrances or openings and shall be capable of sustaining a load of 7.2 kilopascals. All sidewalks or other walkways subject to falling objects as determined by the Engineer or within 2.5 meters of a two story or taller building, or greater distance if indicated in the contract documents, upon which traffic is to be maintained shall be protected by sidewalk shed or canopy designed by a professional engineer registered to practice in the State of New York to withstand the loading as required above. For single story buildings, these requirements may be waived if in the opinion of the Engineer the work may be satisfactorily and safely completed without these protective devices. No canopy or shed shall contain design features that will deflect falling material into an area where they could cause harm or injury to person or property.

**K. Disposal of Materials.** Disposal of all materials shall be in accordance with all federal, state, and local laws, rules, and regulations, any provision found elsewhere in the contract documents, and most specifically in §107-16 A “Construction and Demolition Debris”, if included in the contract, and shall be subject to the approval of the Engineer.

**L. Removal of Salvaged Materials.** All salvaged materials shall be removed from the site of the work prior to the final acceptance of the project. The Contractor shall not hold any sales, public or private, of salvaged equipment, material, or articles on State owned land. The State does not guarantee the number of fixtures, quantity or quality of equipment or any other material of value existing in the building to be present after its release to the Contractor. The Contractor waives all claims against the State because the salvage value of any building has decreased at the time of disposal.

**M. Use of Non-State Owned Land.** If any material is to be placed upon non-state owned lands, written permission from the owner thereof shall be furnished to the Engineer prior to the use of such lands.
§202  

N. Removal of Buildings by Others. The State reserves the right to clear the Right of Way of any building by permitting the owner thereof to remove it from the site. Should any building be removed or demolished by its owner, the Contractor shall demolish the foundation and grade the site as indicated in §202-3.02H Demolition of Foundation.

O. Deletion of Buildings from Contract. The State reserves the right to delete any building demolition work from the Contract. There will be no compensation for claims of lost profits.

P. Explosives. Unless specifically authorized in the contract documents, demolition shall be accomplished without the use of explosives.

Q. Domestic Sewage Facilities. Septic tanks, leaching basins, cesspools and other similar facilities associated with buildings being demolished or those that will be abandoned shall be pumped free of septage or sewage, removed, and the resulting hole shall be backfilled in lifts of compacted suitable material. If permitted by the Engineer, the facilities may be collapsed in place after pumping instead of removal. Septage recovered from the pumping operation shall be handled, transported, and disposed of in accordance with 6 NYCRR Part 364.

202-3.03 Relocating Buildings. The Contractor shall, if directed by the Engineer, relocate specified buildings to sites designated by the owner and approved by the Department. The Contractor shall do all work in accordance with applicable State and local requirements and shall obtain necessary permits.

All the applicable requirements of §202-3.01 General and Safety Requirements, §202-3.02 Disposal of Buildings and the following shall apply:

A. Preparation of Site. The Contractor shall construct all necessary foundations and cellar floors for the relocated building to meet applicable local building codes but not less than equivalent in construction to the existing features. The Contractor shall also grade the new site, and construct necessary driveways and sidewalks, topsoil and/or seed the area and perform other incidentally required items of work to prepare the site as indicated in the contract documents or by the Engineer.

B. Moving Buildings. The Contractor shall move the building safely and in a manner so as to cause the least possible damage to the building and the least possible interference with or inconvenience to its occupant(s). The Contractor shall also arrange for any temporary rerouting of overhead lines or relocating guide wires and for the clearance of other obstructions. The Contractor shall be responsible for the repair of any damage that may occur to the building, pavement and other features within and around the area of the move as a result of the move.

C. Service Connections. At the building's final location, the Contractor shall reconnect or arrange for the reconnection of necessary plumbing, gas, heating, electrical, sanitary, water supply and other services at least equivalent in construction to those existing. The work shall be accomplished in such a manner as to cause the least possible disruption to the properties affected. All work shall be in conformance with the requirements of the various utilities and local building codes. Payment and requirements for such work shall be as indicated elsewhere in the contract documents.

D. Restoration Work. The Contractor shall restore all portions of the building, including steps, porches, railings, lean-tos, and other appurtenances, to as good and serviceable condition, in accordance with local building codes, as existed prior to its relocation as determined by the Engineer. Any property damaged or destroyed during the execution of the work shall be repaired or replaced, as determined by the Engineer at the Contractor's expense to the satisfaction of the Engineer.

E. Demolition of Old Foundations. The Contractor shall remove old foundation walls in compliance with the provisions of §202-3.02H Demolition of Foundation.

F. Expenses and Liabilities. The Contractor shall save the State and the owner harmless as to all costs, expenses, and liabilities in connection with carrying out the work, and shall not hold the State
liable for any claim on account of any delay or interferences with any part of the work due to relocating buildings.

**G. Furnishing Sites.** Sites to which the buildings are to be moved will be furnished without cost to the Contractor.

**H. Removal of Building by Others.** The State reserves the right to clear the Right of Way of any building by permitting the owner thereof to remove it from the site. Should the building be removed or demolished by its owner, the Contractor shall demolish the foundation and grade the site as indicated in §202-3.02H Demolition of Foundation.

**202-3.04 Disposal of Petroleum Storage Tanks.** Subsection 202-3.01 General and Safety Requirements and the following shall apply to this work.

All tanks containing petroleum liquids shall be removed in accordance with the requirements of the local fire and police officials, and those of the New York State Department of Environmental Conservation in general and 6 NYCRR Part 613 in particular. In addition, the following requirements shall apply:

**A. Explosion Meter.** The Contractor shall supply an explosion meter to monitor the tank atmosphere.

**B. Emptying Tanks Before Removal.** Before the removal of any tank is commenced, it shall first be pumped completely dry. All water obtained from this operation shall be transported and disposed of in accordance with applicable laws. All product obtained shall be either disposed of according to applicable laws or used or recycled at the Contractor's option. During the emptying operation the following restrictions shall apply:

1. Smoking shall be banned in the area.
2. All open-flame and spark producing equipment within the area shall be shut down.
3. All electrical and internal combustion equipment, unless it is designed to be “explosive proof”, shall be removed from the area.
4. Only “non-sparking” tools shall be used.
5. Static electricity shall be controlled.
6. The work area shall be secured.

**C. Additional Safety Precautions.** After the excavation work of underground tanks has been completed, but before removal of the tank, the Contractor shall distribute a minimum of one kg of crushed dry ice for 500 liters capacity (approximately one pound crushed dry ice for 60 gallons capacity) in the tank. Removal work shall not start until the readings from the explosion meter indicate that a safe and non-explosive tank atmosphere has been achieved as evidenced by readings less than ten percent (10%) of the lower explosive or flammable level at all elevations within the tank. Removal work shall be progressed diligently and expeditiously without interruption until its completion. The explosion meter shall be used to take subsequent readings periodically or continuously as directed by the Engineer as work is progressing. If any reading indicates a dangerous level is approaching, work shall cease, the workers shall exit the tank, and additional carbon dioxide shall be introduced into the tank until safe conditions are restored to all levels within the tank.

The Contractor shall permit only trained and properly equipped personnel to enter the tank. Tanks shall not be entered unless personnel have and use proper self contained breathing apparatus and standby personnel similarly equipped are present at the site to safeguard and protect those working in the tank. Workers in the tank shall also have and use appropriate harnesses and lifelines connected to personnel retrieval equipment fully rigged, and ready for use.

**D. Removal of Contaminated Soil.** Contaminated soil shall be removed and paid for in accordance with provisions found elsewhere in the contract documents.
E. Backfilling. The Contractor shall backfill any resulting holes and trenches with suitable material placed and compacted as indicated in §202-3.02H Demolition of Foundation and regrade the area to drain as directed by the Engineer.

F. Removal of Supporting Structures. Tank supports shall be removed and disposed of in a manner approved by the Engineer.

G. Cleaning of Tanks. All tanks shall be cleaned prior to disposal, either on-site or off, of all residue and product clinging to their surfaces. All product, cleaning solvents, and water generated by the operation, shall be transported by a transporter permitted under 6 NYCRR 364 and, if disposed of in New York State, disposed of at a site regulated by the New York State Department of Environmental Conservation.

H. Transportation of Tanks. Unless cleaned, tanks shall be transported only by transporters permitted under 6 NYCRR 364. Prior to transporting an uncleaned tank, all holes shall be plugged and the tank shall be placarded. The tank shall be vented by means of a three millimeter hole in one of the plugs. The tank shall be securely fastened to the transporting vehicle oriented so that the plug with the hole in it is uppermost on the tank. Cleaned tanks need not be transported by permitted transporters nor is it necessary to placard a cleaned tank.

I. Disposal of Tanks. All tanks shall be cleaned prior to disposal. All non-metal tanks shall be disposed of (or recycled) at facilities permitted by the New York State Department of Environmental Conservation. Metal tanks shall be disposed of only by recycling.

202-3.05 Demolition of Structures. General. §202-3.01 General and Safety Requirements shall apply to this work and in addition the following also apply:

Except as noted below, any structure designated for demolition and released to the Contractor shall be demolished at its site. Any proposal to allow such structure or any portion thereof to remain standing on the site or to be relocated to another site, shall be referred to the Deputy Chief Engineer, Structures for approval and accomplished under terms and conditions established by the State.

Colored tapes, barricades, marking paint, and signs shall be used to mark all areas that could become subject to collapse or that could become unstable as a result of demolition activity. Such areas are to be designated as non-access areas, and are to be identified by the previously mentioned Engineering Survey. Personnel and equipment with operators on board shall remain outside these designated non-access areas at all times during demolition operations or at any time the area is subject to collapse.

During the course of demolition work, the Contractor shall cause the structure to continue to be monitored by a competent person, as defined in §202-3.01, and the designated non-access areas or any additional non-access areas identified during the course of the work shall be appropriately marked and signed.

In accordance with state policy, steel and other metals other than those embedded in concrete or otherwise inseparable from articles being discarded shall be disposed of in a manner that ensures their salvage or beneficial re-use.

For steel structures coated with lead-based paint, the contractor shall comply with the provisions of 29 CFR 1926.62 and all other applicable worker Health and Safety Regulations. In addition, the contractor shall comply with all applicable regulations controlling the release of lead-based paint into the environment. Prior to the beginning of any steel removal operations, the paint shall be removed for a minimum distance of four inches on each side of the centerline of cut, bolt row, or weld as applicable. The paint removal work shall be done in accordance with the requirements of Section 741. In cases where the contractor can clearly demonstrate through exposure monitoring that other work practices and engineering controls, under the oversight of a certified industrial hygienist, can effectively maintain actual worker exposure below the permissible exposure level, exception to this requirement may be granted by the Engineer.

202-3.06 Dismantling and Storing of Existing Superstructures. In accordance with §202-3.01 General and Safety Requirements, §202-3.05 Demolition of Structures-General and the following, all concrete and paving material and other materials as directed shall be carefully removed from the structure
in a manner so as to not damage materials to be stored. If not incorporated into the work the removed materials shall be disposed of by the Contractor in a manner approved by the Engineer and as outlined in §202-3.02K Disposal of Waste Materials. The parts of superstructure designated to be stored shall be dismantled, protected, and stored on site or at the locations designated without damage. All stored steel members and other stored members as directed shall be adequately match-marked in order to permit reassembly.

Any parts of the structure designated for storage which are damaged during the course of the operation or during storage shall be repaired or replaced at the direction of the Engineer at the Contractor’s expense.

202-3.07 Removing Existing Superstructures. In accordance with §202-3.01 General and Safety Requirements, §202-3.05 Demolition of Structures-General and the following, all concrete and paving material shall be removed from the structure and if not incorporated into the work shall be disposed of by the Contractor in a manner in accordance with laws, rules or regulations and as approved by the Engineer and as outlined in §202-3.02K Disposal of Waste Materials.

The rest of the material removed under this work will become the property of the Contractor and, except for materials incorporated into the work, shall be removed from the site of the work and disposed of in a manner approved by the Engineer.

202-3.08 Removing Old Bituminous Concrete Overlay. The Contractor shall remove the old bituminous concrete overlay and bituminous patches indicated in the Contract Documents in a manner approved by the Engineer. If the Contract Documents indicate that the overlay or patch to be removed contains asbestos, but not more than one percent by volume, the material shall be softened by radiant heat and removed while still hot, or in a thoroughly wet condition by means other than cold milling, or in accordance with the blanket variance for the removal of bituminous pavement containing asbestos.

Should the percentage asbestos be greater than one percent (1%) by volume, the material is defined as Asbestos Containing Material by Industrial Code Rule 56 and shall be removed and paid for as indicated elsewhere in the Contract Documents.

202-3.09 Removal of Substructures. The appropriate construction details specified for Section 203, Excavation and Embankment, as stated in §203-3.01 General through and including §203-3.08 Disposal of Surplus Excavated Material shall apply. The excavation shall be dewatered and kept free from water, snow and ice when necessary.

Sheeting or piling shown on the Contract Plans which is integral with the substructure and is designated to remain in place shall be cut off at the elevations shown on the plans. If indicated in the Contract Documents, existing sheeting or piling shall be extracted.

The Contractor may, with the permission of the Engineer, extract sheeting or piling not shown to be extracted or designated to remain in place rather than cutting it off at the elevations shown on the plans at no additional cost to the State.

If excavation protection is required solely to ensure the safety of workers and the public, the Contractor shall provide excavation protection. If excavation protection is necessary also to protect structures or other improvements, or if the alternatives of laying back slopes or benching are not available, the support system shall be as indicated in the contract documents.

If directed, the resulting hole shall be backfilled with suitable material placed in lifts and compacted as indicated in §202-3.02H Demolition of Foundation to the satisfaction of the Engineer and the area shall then be regraded as directed, topsoiled, and/or seeded.

202-4 METHOD OF MEASUREMENT

202-4.01 Relocating or Disposal of Buildings. The work will be measured on a lump sum basis for the relocation or disposal of the given building in accordance with the provisions of these specifications. Monthly estimates of the percentage completion will be made in proportion to the amount of work satisfactorily completed.

If a property owner, upon agreement with the Department, removes the building, the Contractor shall demolish the existing foundation, cellar floors, walks and other facilities to properly complete the work, and will be paid 20% of the bid price.
202-4.02 Disposal of Buildings (Credit Item). The bidder may provide a credit bid price for this work in the event that the estimated salvage value of the building materials exceeds the cost of demolition. When a credit bid price is intended for this work, it shall be identified by the bidder as follows:

A. Where the unit bid price is written in words in the proposal the words “a credit to New York State of” shall be written by the bidder preceding the bid price in words.
B. The bidder shall insert the word “credit” where the unit bid price and amount bid are written in numbers.

202-4.03 Disposal of Petroleum Storage Tanks. This work will be measured as the number of tanks within the indicated size range removed and disposed of in accordance with the provisions of these specifications.

However, if the tank owner, upon agreement with the Department, removes the tank or tanks, the Contractor shall remove any supporting structures and backfill the resulting hole and/or trenches with suitable material, placed and compacted in accordance with §202-3.02H Demolition of Foundation, and will be paid 20% of the bid price in compensation for backfilling any resulting hole or for removing and disposing of the tank supporting structure.

202-4.04 Dismantling and Storing Existing Superstructures. The work will be measured on a lump sum basis for “Dismantling and Storing Existing Superstructures.” Monthly estimates of the percentage completion will be made for this work in proportion to the amount of work satisfactorily completed.

202-4.05 Removing Existing Superstructures. The Contractor will be paid the lump sum price bid for “Removing Existing Superstructures.” Monthly estimates of the percentage completion shall be made for this work in proportion to the amount of work satisfactorily completed.

202-4.06 Removing Old Bituminous Concrete Overlay. The quantity to be measured will be the number of square meters of bituminous concrete overlay removed in accordance with the plans or as approved by the Engineer.

202-4.07 Removal of Substructures. The quantity of material removed and disposed of shall be the number of cubic meters of material computed from the payment lines shown on the Contract Plans irrespective of the excavation protection method chosen by the Contractor under 202-3.09.

202-5 BASIS OF PAYMENT

202-5.01 Disposal of Buildings. Except as indicated in the following the lump sum bid for Disposal of Buildings shall include the cost of all labor, materials and equipment necessary to satisfactorily complete the work. Unless indicated otherwise, asbestos and hazardous waste removal or remediation work shall be paid for under separate pay items. Suitable or select material obtained from other than the demolition site used to fill cellars will be paid for separately. Water used for dust control or compaction shall also be paid for separately if a pay item for water is included in the contract.

The cost of extermination work shall be included in the price bid if the contract documents indicate that extermination work is required for the given building; otherwise the work of extermination will be paid for as extra work.

202-5.02 Disposal of Buildings (Credit Item). When a credit price is bid for this work, the total or gross sum bid for the contract shall be the sum of all the bid amounts for the various items, not including those credit bids, reduced by the total bid amount involving credit bid prices.

202-5.03 Relocating Buildings. Except as indicated in the following the lump sum price bid shall include the cost of all labor, materials, and equipment necessary to satisfactorily complete the work including the cost of any excavation necessary at the old or the new building site, and any incidentals.
Suitable or select material obtained off-site to backfill the original cellar hole will be paid for separately. Water used for dust control or for compaction shall be paid for separately only if an item for water exists in the contract. Sidewalks, driveways, topsoil, and turf reestablishment will also be separately paid. The cost of extermination work shall be included in the price bid if the contract documents indicate that extermination work is required for the given building; otherwise the work of extermination will be paid for as extra work.

Unless indicated otherwise, the work of reconnecting and providing services for the relocated building at its new site shall be performed and paid for under separate pay items.

202-5.04 Disposal of Petroleum Storage Tanks. The unit bid price for the removal and disposal of Tanks within the indicated size range shall include the cost of all labor, materials, and equipment necessary to satisfactorily perform the work except that suitable or select material obtained from other than the tank site used to fill the resulting hole will be paid separately. Removing and disposing of contaminated soil, except that contaminated during the tank removal operations, will be separately paid.

202-5.05 Dismantling and Storing Existing Superstructures and Removing Existing Superstructures. The lump sum bid shall include the cost of all labor, materials, and equipment necessary to complete the work. The lump sum bid shall also include the cost of repair or replacement of any element designated to be stored that is damaged during the operation and any protective system(s) required to ensure the safety of the workers or the public unless indicated on the plans. Support or protection systems when indicated on the plans, the extraction of existing sheeting designated to be extracted, topsoiling, and seeding will be paid for separately under their respective items. Water used for compaction or to control dust will also be paid for separately if a pay item for water is included in the Contract. Backfilling with select material or with suitable materials that must be obtained off-site will be separately paid.

202-5.06 Removal of Substructures. Except as indicated below, the unit price bid per cubic meter for this work shall include the cost of furnishing all labor, materials, and equipment necessary to complete the work, including the cost of cutting existing sheeting or piling the protective system(s) required to ensure the safety of the workers and the public, unless indicated on the plans, and keeping the site dewatered and free of water, ice and snow when necessary. Support or protection systems when indicated on the plans, Topsoiling, and/or Seeding will be paid for separately under their respective items. Backfilling with select materials or with suitable materials which must be obtained off-site will be separately paid. Water will be paid for separately only if the pay item for Applying Water is in the contract. If the Contract Plans indicate that the sheeting or piling is to be extracted, payment for the extraction shall be made separately.

202-5.07 Removing Old Bituminous Concrete Overlay. The unit price bid per square meter shall include the cost of furnishing all labor, materials and equipment necessary to complete the work, except the cost of removing Asbestos Containing Material shall be paid for separately.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
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</thead>
<tbody>
<tr>
<td>202.01mnn</td>
<td>Disposal of Buildings</td>
<td>Lump Sum</td>
</tr>
<tr>
<td>202.02mnn</td>
<td>Disposal of Buildings (Credit Item)</td>
<td>Lump Sum</td>
</tr>
<tr>
<td>202.03mnn</td>
<td>Relocating Buildings</td>
<td>Lump Sum</td>
</tr>
<tr>
<td>202.05xx</td>
<td>Disposal of Petroleum Storage Tanks (various size ranges)</td>
<td>Each</td>
</tr>
<tr>
<td>202.11mnn</td>
<td>Dismantling and Storing Existing Superstructures</td>
<td>Lump Sum</td>
</tr>
<tr>
<td>202.12mnn</td>
<td>Removing Existing Superstructures</td>
<td>Lump Sum</td>
</tr>
<tr>
<td>202.19</td>
<td>Removal of Substructures</td>
<td>Cubic Meter</td>
</tr>
<tr>
<td>202.20</td>
<td>Removing Old Bituminous Concrete Overlay</td>
<td>Square Meter</td>
</tr>
</tbody>
</table>

NOTE: mnnn denotes serialized pay item for each building or structure; see §101-02 Definitions of Terms under “Specifications”.
xx -see Catalog of Standard Pay Items or Proposal for complete description.
SECTION 203 - EXCAVATION AND EMBANKMENT

203-1 DESCRIPTION. This work shall consist of excavation, disposal, placement and compaction of all materials that are not provided for under another section of these Specifications, and shall be executed in conformance with payment lines, grades, thicknesses and typical sections specified in the contract documents.

203-1.01 Unclassified Excavation. Unclassified excavation shall consist of the excavation and disposal of all materials, of any description, encountered in the course of construction, unless otherwise specified in the contract. Estimated limits and descriptions of subsurface deposits and formations which may be shown in the contract documents are supplied as a part of Base Line Data.

203-1.02 Embankment. The embankment is the portion of a fill section situated between the embankment foundation and the subgrade surface, excluding any material placed under another section of these specifications.

203-1.03 Embankment Foundation. The embankment foundation is the surface upon which an embankment is constructed after all work required under §203-3.09 has been completed.

203-1.04 Subgrade Surface. The subgrade surface is the surface of the road section upon which the select materials and/or subbase are placed.

203-1.05 Subgrade Area. The subgrade area is that portion of an embankment situated above either of the following, but excluding any material placed under another section of these specifications.

A. A line located 0.6 m below the subgrade surface and extended to the intersection with the embankment side slopes, or
B. The embankment foundation, whichever is higher.

The material and compaction requirements for the subgrade area in embankments are found in §203-2.02 and §203-3.12, respectively.

In cut sections, the subgrade area is not defined except where undercut and backfill with a select material item is specified or ordered: in such cases, the payment lines for undercut work shall define the subgrade area.

203-1.06 Embankment Side Slope Area. The embankment side slope areas are those cross-sectional areas of an embankment situated outside of lines projected downward and outward on a one on one slope from the edges of the subgrade surface to their intersection with the embankment foundation, but excluding any portion lying within a subgrade area.

203-1.07 Topsoil. See Section 613, Topsoil.

203-1.08 Suitable Material. A material whose composition is satisfactory for use in embankment construction is a suitable material. The moisture content of the material has no bearing upon such designation. In general, any mineral (inorganic) soil, blasted or broken rock and similar materials of natural or man made (i.e. recycled) origin, including mixtures thereof, are considered suitable materials. Determinations of whether a specific natural material is a suitable material shall be made by the Engineer on the above basis.

Recycled materials that the Department has evaluated and approved for general use shall be considered to be suitable material for embankment construction subject to the conditions for use as determined by the Department. The Regional Geotechnical Engineer and Geotechnical Engineering Bureau are available to provide guidance on the use of such materials. In general, the use of recycled materials must be also sanctioned by the Department of Environmental Conservation, usually in the form of a Beneficial Use Determination (BUD).

Glass from recycling facilities shall be considered suitable material for embankment construction.
Reclaimed Asphalt Pavement (RAP), and Recycled Portland Cement Concrete Aggregate (RCA) shall be considered suitable materials for embankment construction, subject to the following conditions for use:

RAP - The Contractor shall provide and place RAP conforming to the requirements of Section 304.
RCA - The Contractor shall provide and place RCA conforming to the requirements of Section 304.

Pieces of broken up concrete pavement from on-site pavement removal or in-place recycling (i.e. rubblizing, crack and seat, break and seat, etc.) may be used in embankment construction. Refer to §203-3.09 and §203-3.10.

203-1.09 Unsuitable Materials. Any material containing vegetable or organic matter, such as muck, peat, organic silt, topsoil or sod, that is not satisfactory for use in embankment construction under §203-1.08 is designated as an unsuitable material. Certain man made deposits of industrial waste, toxic or contaminated materials, sludge, landfill or other material may also be determined to be unsuitable materials, based on an evaluation by the Department’s Geotechnical Engineering Bureau and Environmental Analysis Bureau, and the Department of Environmental Conservation.

203-1.10 Borrow. Borrow is material required for earthwork construction in excess of the quantity of suitable material available from the required grading, cuts and excavations. Borrow may be necessary even though not shown on the plans.

203-1.11 Embankment Construction Control Devices. This work shall consist of furnishing, installing and maintaining devices such as settlement gages, settlement rods, piezometers and other equipment used specifically for controlling earthwork construction.

203-1.12 Proof Rolling. Proof rolling consists of applying test loads over the subgrade surface by means of a heavy pneumatic-tired roller of specified design, to locate and permit timely correction of deficiencies likely to adversely affect performance of the pavement structure.

203-1.13 Graded Surfaces. The Contractor shall form and trim all graded surfaces to the lines and grades shown on the plans or as modified by the Engineer.

203-1.14 Select Granular Fill - Slope Protection. This work shall consist of excavating for, furnishing, and installing granular fill slope protection in accordance with these specifications, the standard sheets, conforming to the lines and grades shown on the plans, or where directed by the Engineer.

203-1.15 Applying Water. Under this work, the Contractor shall furnish and apply water for dust control, for compaction purposes and for such other purposes (not provided for in other Sections) as called for on the plans, in the itemized proposal or as directed by the Engineer. Water shall not be applied in inclement weather or when the temperature is below 0°C.

203-1.16 Modifying Cut Slopes and Other Means of Obtaining Borrow. The Regional Director may approve the modification of cut slopes and other means of obtaining material, which is not part of the contract, so long as provisions are made to prevent unsafe conditions, damage, and nuisances to property, wildlife areas, and haul routes within and outside the contract limits. Such approval may be granted only after review of a written proposal by the Contractor showing the final deposition of the material, the haul route, hauling hours, and provisions necessary to comply with the above. Should unanticipated conditions arise resulting in any unsatisfactory situation, the Engineer shall immediately rescind the approval pending satisfactory correction.

The following procedure shall apply to areas within the R.O.W. limits which are not designated as available sources of borrow by a Special Note in the contract proposal where the Contractor requests and is granted permission to modify slopes to obtain material for use on State contract work only. The Contractor will be required to reimburse the State with a rebate for the material obtained in these areas. Permission will not be granted to excavate material beyond the design slopes if it is to be used on other than State contract work.
The rebate to be obtained from the Contractor for this material is comprised of 1) A royalty based on the actual value of the excavated material, and 2) A credit for the difference in the contractor's handling costs if these handling costs have been reduced. The royalty which is to be obtained for the excavated material shall be appropriate for the item for which it is to be utilized and shall be comparable to the current price being paid to purchase similar material in the area.

If the Contractor's handling costs associated with obtaining material from within the R.O.W. limits are greater than those for obtaining material from other acceptable sources, these additional handling costs must be borne by the Contractor. The royalty shall not be reduced to offset any increased handling costs incurred by the Contractor.

If the Contractor's handling costs associated with obtaining materials from within the R.O.W. limits are less than those for obtaining material from other acceptable sources, the differences shall be reimbursed to the State as a credit in addition to the royalty.

The difference in the Contractor's handling cost shall be determined by an analysis based on a comparison of haul lengths, hauling equipment, hauling operation, use of haul roads or public highways, preparation and restoration of the borrow areas, and any other variables involved.

Prior to modifying rock cut slopes, the Geotechnical Engineering Bureau must be consulted. If rock cut slopes are flattened sufficiently to eliminate the need for presplitting, an additional rebate will be necessary.

All special requirements to be fulfilled by the Contractor, at the Contractor's own expense, shall be clearly stated in the agreement. The foregoing requirement of receiving a rebate from the Contractor for material obtained by modification of slopes shall apply only to locations not designated in the Contract Documents.

203-1.17 Cleaning Culverts, Closed Drainage Systems, Drainage Structures and Manholes. This work shall consist of cleaning and keeping clean, existing culverts, closed drainage systems and drainage structures indicated in the contract documents or where directed by the Engineer, for the duration of the contract.

203-2 MATERIALS

203-2.01 Tests and Control Methods. Materials tests and control methods pertaining to the item requirements and work of this Section will be performed in conformance with the procedures contained in the appropriate Departmental publication in effect on the date of the advertisement for bids. These publications are available upon request to the Regional Director or the Director, Geotechnical Engineering Bureau.

203-2.02 Select Materials and Subgrade Area Material Requirements. The requirements for select materials and subgrade area materials are described below. All processing operations including washing, removal of oversize material, blending, or crushing shall be completed at the source of the material. The procedure for acceptance or rejection of these materials shall be as described in the appropriate Geotechnical Control Procedure (GCP) manual.

A. Subgrade Area Material. Subgrade area material shall consist of any suitable material having no particles greater than 150 mm in maximum dimension, unless Select Granular Subgrade with the well graded rock option is used. In that case, refer to 203-2.02 E. 1. A.

If concrete is used, any exposed mesh or rebar shall not exceed 25 mm in length.

B. Select Borrow and Select Fill

1. Gradation. Material furnished for these items shall be suitable material having no particles greater than 1 m in maximum dimension. Of the portion passing the 100 mm square sieve, the material shall have the following gradation:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing by Weight</th>
<th>Sieve Size</th>
<th>Percent Passing by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>425 µm</td>
<td>0 to 70</td>
<td>75 µm</td>
<td>0 to 15</td>
</tr>
</tbody>
</table>
2. **Soundness.** The material shall be sound and durable. A material with a Magnesium Sulfate Soundness Loss exceeding 35 percent will be rejected.

3. **Composition.** RAP shall not be used.

C. **Select Granular Fill and Select Structural Fill.** Materials furnished under these items shall be suitable, well graded, and conform to the following requirements:

1. **Gradation.** Except when used as backfill material for aluminum pipe with Type IR corrugations (Spiral Rib Pipe), the material shall have the following gradation:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 mm</td>
<td>100</td>
</tr>
<tr>
<td>425 µm</td>
<td>0 to 70</td>
</tr>
<tr>
<td>75 µm</td>
<td>0 to 15</td>
</tr>
</tbody>
</table>

   When used as backfill for Corrugated Aluminum Pipe, Type 1R (Spiral Rib Pipe) 100% of the material shall also pass the 50 mm sieve.

2. **Soundness.** The materials shall be substantially free of shale and soft, poor durability particles. A material with Magnesium Sulfate Soundness Loss exceeding 30% will be rejected.

3. **Composition.** RAP shall not be used.

   When used as backfill for aluminum pipe, the material shall be free of Portland cement or Portland cement concrete.

4. **pH.** Where the State elects to test for this requirement, a material with pH of less than 5 or more than 10 shall be rejected.

D. **Select Granular Fill Slope Protection.** Material furnished for use under this item shall consist of rock, stone, slag, cobbles, or gravel, substantially free of shale or other soft, poor durability particles.

1. **Gradation**
   
a. Broken or blasted unweathered rock used for this item shall be well graded, having no particles greater than 600 mm in maximum dimension, and substantially free from particles greater than 300 mm in maximum dimension, containing little or no material passing the 2 mm mesh sieve.
   
b. All materials, other than broken or blasted unweathered rock, shall meet the following gradation requirements:

<table>
<thead>
<tr>
<th>Material Size</th>
<th>Percent Passing by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>600 mm maximum dimension</td>
<td>100</td>
</tr>
<tr>
<td>150 mm maximum dimension</td>
<td>90 to 100</td>
</tr>
<tr>
<td>50 mm square sieve</td>
<td>0 to 30</td>
</tr>
<tr>
<td>6.3 mm sieve</td>
<td>0 to 10</td>
</tr>
</tbody>
</table>

2. **Soundness.** Where the State elects to test for this requirement, a material with a Magnesium Sulfate Soundness Loss exceeding 35 percent will be rejected.
§203

E. **Select Granular Subgrade.**

1. **Gradation**

   a. Well graded rock may be used for this item. Particles shall not exceed 300mm in greatest dimension nor 2/3 of the loose lift thickness, whichever is less.

   b. All materials, other than well graded rock, furnished under this item shall have no particles greater than 150 mm in maximum dimension. Of the portion passing the 100 mm square sieve, the material shall have the following gradation:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.3 mm</td>
<td>30 to 100</td>
</tr>
<tr>
<td>425 µm</td>
<td>0 to 50</td>
</tr>
<tr>
<td>75 µm</td>
<td>0 to 10</td>
</tr>
</tbody>
</table>

2. **Soundness.** A material with a Magnesium Sulfate Soundness Loss exceeding 35 percent will be rejected.

3. **Composition.** RAP shall not be used.

F. **Glass**

1. **Gradation.** Glass shall be crushed to a maximum particle size of 10 mm.

2. **Characteristics.** Glass may contain up to a maximum of 5 percent by volume of china, ceramics, plate glass products, paper, plastics or other deleterious materials. The material shall be subject to visual inspection by the Regional Geotechnical Engineer and may be rejected based on this inspection. In case of rejection, the inspection must be documented in writing to the Engineer-In-Charge indicating the basis of rejection.

G. **RAP**

1. **Gradation.** RAP shall have a maximum top size of 50 mm at the time of placement.

2. **Characteristics.** RAP shall meet the requirements stated in Section 304.

H. **RCA**

1. **Gradation.** RCA shall meet the gradation requirements for the appropriate item of use.

2. **Characteristics.** RCA shall meet the requirements stated in Section 304, and the applicable parts of Section 203 herein.

I. **Sand Backfill.** Materials furnished under these items shall be suitable and conform to the following requirements:

   1. **Gradation.** The material shall have the following gradation:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.5 mm</td>
<td>100</td>
</tr>
<tr>
<td>6.3 mm</td>
<td>90 to 100</td>
</tr>
<tr>
<td>75 µm</td>
<td>0 to 5</td>
</tr>
</tbody>
</table>

   2. **Soundness.** The materials shall be substantially free of shale and soft, poor durability particles.
3. **pH.** Where the State elects to test for this requirement, a material with pH of less than 5 or more than 10 shall be rejected.”

J. Necessary fill material for cleaning, grading and shaping the existing roadside section shall conform to the requirements of Subsection 203-2.02A, Subgrade Area Material.

### 203-2.03 Water.
Water used for dust control or compaction purposes may be obtained from any source. When used for watering seeded or sodded areas, or surfaces to be seeded or sodded, water shall meet the requirements of §712-01.

### 203-2.04 Embankment Construction Control Devices.
The materials details for embankment control devices shall be as specified in the current publication issued by the Department covering construction, installation, maintenance and abandonment of these devices.

### 203-3 CONSTRUCTION DETAILS

#### 203-3.01 General.
The Contractor shall remove all soil, rock, and other material, and utilize or dispose of these materials as required by the plans and specifications. All excavation and embankment work shall be executed to payment lines shown in the contract documents.

All graded earth surfaces outside the roadway limits shall be smoothed and trimmed in reasonably close conformity (plus or minus 150 mm) of true grade. After trimming, the area shall be left in a compact and satisfactory condition, free of large stones or other objectionable materials, as determined by the Engineer.

Earthwork construction operations requiring compaction shall not be performed from November 1 thru April 1 except with written permission of, and under such special conditions and restrictions as may be imposed by the Regional Director, after discussion with the Regional Geotechnical Engineer or the Director, Geotechnical Engineering Bureau. Under no conditions will the contractor be permitted to place material that is frozen, or place fill material on frozen ground.

#### 203-3.02 Archaeological Salvage.
Whenever, during the course of construction, historical or prehistoric objects or human remains are encountered, such objects shall not be destroyed or moved. Work shall be stopped and rescheduled to avoid disturbing such areas and the Engineer-in-Charge of the project shall be notified immediately.

The Engineer will, through proper channels, notify the Director of the Construction Division who will notify the DOT Environmental Analysis Bureau and the Regional Cultural Resources Coordinator who will arrange to have an immediate inspection of the site.

In the event that the objects are to be removed or salvaged, agreements between the Commissioner and the Contractor will be made to cover the cost of any extra work. Such work will be limited to that performed within the right-of-way, and at any location under direct control of the Contractor used as a source of approved borrow material.

#### 203-3.03 Scheduling of Work to Minimize Soil Erosion and Water Pollution.
The Contractor shall ensure effective and continuous soil erosion and sediment control throughout the construction period. The Contractor shall prepare and submit for approval, plans and schedules for all excavation, stripping, embankment, fill and grading operations. Such plans and schedules shall include but are not limited to temporary and permanent erosion control measures specified in Section 209, Soil Erosion and Sediment Control, Section 610, Turf and Wildflower Establishment and Section 612, Sodding.

#### 203-3.04 Drainage and Grading.
The Contractor shall provide and maintain slopes, crowns and ditches on all excavation and embankments to ensure satisfactory surface drainage at all times. Ditches and other drainage facilities necessary to remove ponded water shall be constructed as soon as practical to have the work area dry during the progression of work. All existing culverts and drainage systems shall be maintained in satisfactory operating condition throughout the course of the work. If it is necessary to interrupt existing surface drainage, sewers or under-drainage, then temporary drainage facilities shall be provided until the permanent drainage work is complete. Top-of-slope interceptor ditches, where shown
§203

on the plans, shall be completed before adjacent excavation operations are begun. In earth cuts, the Contractor shall progress excavation operations in such a manner that the portion of the cut immediately adjacent to the design slope is at least 1.5 m lower than the general level of the cut at all times until the lower payment line is reached.

The construction of these temporary drainage facilities shall be considered as incidental to the construction of the project and no additional payment will be allowed.

Any portion of an embankment or subgrade which has, in the opinion of the Engineer, been damaged by the Contractor's equipment during the course of construction, shall be repaired and recompacted by the Contractor to the satisfaction of the Engineer, and no extra payment will be made therefore.

Where seepage causes instability of slopes, excavation and backfill or other corrective measures shall be performed as ordered by the Engineer and paid for under the appropriate item. Excavation for the installation of slope protection may be necessary at any time and location throughout the duration of the contract and may not necessarily coincide with the Contractor's performance of the general excavation work.

203-3.05 Rock Excavation. Presplitting is required where the design rock slope is one vertical on one horizontal or steeper and the vertical height of the exposed rock slope exceeds 1.5 m. Ripping will not be allowed within 3 m of a slope that requires presplitting. Test sections will be required at the outset of presplit drilling and blasting operations for the evaluation of the presplit rock slopes by a Departmental Engineering Geologist. The Contractor will be required to completely expose the presplit rock face in the test section for evaluation prior to any further presplit drilling.

All rock slopes shall be thoroughly scaled and cleaned to the satisfaction of the Engineer. For rock excavations involving multiple lifts, scaling of upper lifts shall be completed prior to drilling and fragmenting of lower lifts. Scaled rock slopes shall be stable and free from possible hazards of falling rocks or rock slides that endanger public safety. If, after scaling, such conditions still exist, a determination of the cause will be made by a Departmental Engineering Geologist and if it is determined that the conditions are the result of poor quality work or improper methods employed by the Contractor, the Contractor shall provide approved remedial treatment, at no expense to the State. Such treatment may include, but is not necessarily limited to, laying back the slope, rock bolting, or shotcreting. In no case shall the subgrade be trimmed prior to the completion of the scaling operation at any location.

A. Presplitting. Prior to drilling presplitting holes, the overburden shall be completely removed to expose the rock surface along the presplitting line. The methods of collaring the holes to achieve required inclination and alignment shall be approved by the Engineer.

The presplitting holes shall be a maximum of 100 mm in diameter, spaced not more than 1 m center to center along the slope, and drilled at the designed slope inclination for a maximum slope distance of 20 m. When excavation operations are conducted in multiple lifts, the presplitting holes for successive lifts may be offset a distance of not more than 1 m for a design slope of one vertical on one horizontal and not more than 0.3 m for slopes of steeper design; however, a presplitting hole shall not be started inside the payment line. If presplitting is conducted in lifts, each lift shall be of approximately equal depth. All presplitting holes shall be checked and cleared of obstructions immediately prior to loading any holes in a round. All presplitting holes shall be loaded with a continuous column charge manufactured especially for presplitting which contains not more than 0.5 kg of explosive per meter. The top of the charge shall be located not more than 1 m below the top of rock. A bottom charge of not more than 1.5 kg of packaged explosive may be used; however, no portion of any bottom charge shall be placed against a proposed finished slope. Each presplitting hole shall be filled with No. 1A crushed stone stemming meeting the gradation requirements of §703-02, Coarse Aggregates. The presplitting charges shall be fired with detonating cord extending the full depth of each hole and attached to a trunk line at the surface. Detonation of the trunk line shall be with blasting cap(s) and shall precede the detonation of fragmentation charges within the section by a minimum of 25 milliseconds. Presplitting shall extend for a minimum distance equal to the burden plus 1m beyond the limits of fragmentation blasting within the section.

B. Fragmentation Blasting. Fragmentation holes, or portions thereof, shall not be drilled closer than 1.2 m to the proposed finished slope. Where presplitting is required, fragmentation holes adjacent to the presplitting holes shall be drilled parallel to the presplitting holes for the full depth of
the production lift at a spacing not exceeding the spacing of the production pattern. Only packaged explosives shall be used 3 m or less from a design slope which requires presplitting regardless of the construction sequence. Fragmentation charges shall be detonated by properly sequenced millisecond delay blasting caps.

### C. Explosive Loading Limits.

In the absence of more stringent requirements, the maximum quantity of explosives allowed per delay period shall be based on a maximum particle velocity of 50 mm/s at the nearest structure to be protected. In the absence of seismic monitoring equipment, the following explosive loading limits shall apply:

**DISTANCE EQUAL TO OR LESS THAN 65 m FROM THE NEAREST STRUCTURE**

1. When the distance from the proposed blasting area to the nearest structure to be protected is 2 m or less, no blasting shall be allowed.

2. When the distance between the blasting area and the nearest structure to be protected is greater than 2 m and equal to or less than 4.5 m, a maximum of 0.1 kg of explosives per delay period (minimum of twenty-five (25) milliseconds) blasting cap shall be allowed.

3. When the distance between the blasting area and the nearest structure to be protected is greater than 4.5 m and equal to or less than 65 m, a Scaled Distance of 9 m shall be utilized to determine the maximum amount of explosive allowed per delay period (minimum of twenty-five (25) milliseconds) blasting cap. The Scaled Distance Formula is as described below:

\[
SD = \frac{D}{1.5 \sqrt{E_{\text{max}}}}
\]

where:
- SD = Scaled Distance
- D = Distance from blasting area to nearest structure to be protected in meters
- \( E_{\text{max}} \) = Maximum kilograms of explosive per delay period (minimum of twenty-five milliseconds) blasting cap

AND

\[
E_{\text{max}} = \frac{D^2}{(SD)^2} \times (.45)
\]

**DISTANCE GREATER THAN 65 m FROM THE NEAREST STRUCTURE**

1. When the blaster elects to utilize more than 25 kg of explosive per delay period (minimum of twenty-five (25) milliseconds) blasting cap, a seismograph shall be employed to monitor the blasting vibrations generated. The initial loading shall be computed using a Scaled Distance of 9 m. The resulting particle velocity measured by the seismograph shall be evaluated by a Department Engineering Geologist. The Geologist's evaluation shall be the basis for adjusting the Scaled Distance.

No separate payment shall be made for this work. The cost shall be included in the appropriate excavation item. The above requirements shall in no way relieve the Contractor of liability for any damage incurred as a result of the blasting operations.

### 203-3.06 Suitable Materials.

Moisture content has no bearing on the suitability of material to be used for embankment construction, however, the moisture content of a material may be such that its use will require manipulation. It is the Contractor's responsibility to determine the economics of using, or disposing and replacing, such materials. Material determined by the Contractor to be un-economical for use may be disposed of as specified under §203-3.08 and replaced with other material at no additional cost to the State.

When a contract includes the item “Unclassified Excavation and Disposal”, all excavated suitable materials, including the excavation performed under “Structure Excavation” and “Trench and Culvert Excavation,” shall become the Contractor's property for disposal or use under another item of these specifications.
203-3.07 Unsuitable Materials. All excavated unsuitable materials shall be the Contractor's property for disposal as surplus materials under the provisions of §203-3.08.

203-3.08 Disposal of Surplus Excavated Materials. Only unsuitable materials, or that portion of suitable material excavated in excess of the quantity required to construct all embankments on the project, shall be considered as surplus. Where disposal of surplus materials cannot be accommodated within the right of way, the excess shall become the Contractor's property for disposal. Surplus material disposed of within the right-of-way shall be placed in accordance with §107-10 Managing Surplus Material And Waste.

203-3.09 Embankment Foundation. After completion of the work required under Section 201, Clearing and Grubbing, and Section 202, Removal of Structures and Obstructions, the embankment foundation shall be prepared. Sod and topsoil shall be removed where the final pavement grade is 2 m or less above the existing ground surface and in other areas designated in the plans or by the Engineer. Prior to embankment construction and subbase course placement, the surface on which the embankment and/or subbase is to be placed shall be thoroughly compacted to the satisfaction of the Engineer. Unsuitable materials other than sod and topsoil shall be removed to the depths shown in the plans or as directed by the Engineer. Underwater areas shall be filled with “Select Borrow or Select Fill,” §203-2.02B, to 0.6 m above the water surface at the time of placement, and paid for under its appropriate item.

   Where embankments are to be constructed over ground that will not adequately support embankment construction equipment, an initial layer of fill may be allowed to form a working platform. The need, manner of construction, and thickness of such a layer shall be subject to approval of the Engineer, and the layer will be permitted only where the lack of support is, as determined by the Engineer, not due to deficient ditching, grading or drainage practices or where the embankment could be constructed in the approved manner by the use of different equipment or procedures. Thicknesses of up to 1 m may be permitted for such a layer. Concrete slabs may be used at the bottom of such a layer, provided they are placed horizontally.

   In locations where embankments are to be constructed on hillsides or against existing embankments with slopes steeper than 1 (vertical) on 3 (horizontal), the slopes shall be benched. Required benches shall be constructed as shown on the Standard Sheet, “Earthwork Transition and Benching Details.”

   Where old pavement is encountered within 0.6 m of the top of the subbase course, it shall be broken up or scarified.

203-3.10 Embankments. The embankment shall be constructed of suitable material as defined by §203-1.08, Suitable Material. Embankment material shall not be placed on frozen earth, nor shall frozen soils be placed in any embankments. Embankment material shall be placed and spread in lifts (layers) of uniform thickness, then uniformly compacted as specified under applicable portions of §203-3.12, Compaction. During embankment construction operations, earth moving equipment shall be routed so as to prevent damage to any compacted lift. Damage to any compacted lift at any time during the course of construction, such as rutting under the loads imposed by earth moving equipment, shall be fully repaired by the Contractor at his/her own expense prior to placement of any overlying materials. At the close of each day's work, the working surface shall be crowned, shaped and rolled with smooth steel wheel or pneumatic tired rollers, for positive drainage.

   Particles with a dimension in excess of two-thirds of the loose lift thickness are designated as oversized particles. Oversized particles shall be removed prior to compaction of the lift and may be placed in the Embankment Side Slope Area, Subsection203-1.06.

   Pieces of concrete may be used provided that the voids between the pieces are completely filled, and the greatest dimension of any piece does not exceed 2/3 the loose lift thickness. Exposed mesh or rebar shall not exceed 25 mm in length.

   Embankments constructed using rock products or pieces of concrete shall be spread by bladed equipment on each lift to minimize the formation of large voids as the work progresses. The top lift of a rock or concrete fill shall be chinked.

   When permitted by a note in the plans or proposal, stumps, logs, and other materials may be placed in the Embankment Side Slope Area, §203-1.06, provided that: 1) such matter is deposited and compacted
concurrent with the adjacent embankment, and; 2) any stumps or woody material are covered by not less than 0.6 m of soil beneath the exposed side slope surface.

Glass shall not be placed in contact with synthetic liners, geogrids, geotextiles or other geosynthetics. Glass incorporated into embankments shall be thoroughly mixed with other suitable material so that Glass constitutes no more than 30 percent by volume anywhere in the embankment as visually determined by the Engineer-In-Charge.

203-3.11 Subgrade Area. Where a subgrade area is defined in an embankment by §203-1.05, Subgrade Area, the material placed shall conform to §203-2.02A, Subgrade Area Material, placed and compacted in conformance with §203-3.10 and §203-3.12. Where longitudinal and transverse changes from cut to fill are encountered in the work, a subgrade transition section shall be provided in conformance with Standard Sheet “Earthwork Transition and Benching Details.” Where a subgrade area becomes defined by §203-1.05 in a cut section, the materials placed and other details shall be as specified under §203-3.14C, unless otherwise required by the contract documents. Prior to subbase course placement, the surface on which the subbase is to be placed shall be thoroughly compacted to the satisfaction of the Engineer.

203-3.12 Compaction

A. General Requirements. It shall be the Contractor's responsibility to properly place and compact all materials in the road section and other locations specified in the contract documents, and to correct any deficiencies resulting from insufficient or improper compaction of such materials throughout the contract period. The Contractor shall determine the type, size and weight of compactor best suited to the work at hand, select and control the lift (layer) thickness, exert control over the moisture content of the material, and other details necessary to obtain satisfactory results. During the progression of the work, the Department will inspect the Contractor's operations and will permit the work to continue where:

1. Lift thickness is controlled and does not exceed the maximum allowed according to the equipment classifications in subparagraph B of this subsection, and the equipment meets all specified class criteria. Thinner lifts and lighter equipment than the maximum allowed may be necessary for satisfactory results on some materials.
2. The compactive effort (number of passes and travel speed) is uniformly applied and not less than that specified for the given equipment class and lift thickness. Higher efforts than the minimum allowed may be necessary for satisfactory results on some materials.
3. The Engineer concludes from a visual observation that adequate compaction has been attained, with the exception of backfill at structures, culverts, pipes, conduits, and direct burial cables. However, the State reserves the right to perform density tests at any time. When tests are performed, the results shall indicate that not less than 90 percent of Standard Proctor Maximum Density is attained in any portion of an embankment, or 95 percent in a subgrade area, or as specified for other items with a percent maximum density requirement.
4. Significant rutting under the action of the compactor is not observed on the final passes on a lift.

Whenever the Contractor's operations do not conform to the above criteria, or requirements contained in other subparagraphs of this subsection, the Engineer will prohibit placement of an overlying lift until the Contractor takes effective corrective action.

When the Engineer determines that density tests are necessary, the Contractor shall provide any assistance requested to facilitate such tests. Such assistance shall include but will not be limited to excavation and backfill of test pits and holes. This work shall be considered to be incidental construction.

Damage to any compacted lift at any time during the course of construction such as rutting under the loads imposed by earth moving equipment, shall be fully repaired by the Contractor at his/her own expense prior to placement of any overlying materials.

B. Compaction Equipment. The selection of compaction equipment is the Contractor's responsibility, but shall be subject to meeting the requirements of this subparagraph and approval by
the Engineer with respect to its provisions. All compaction equipment shall be marked by a
permanently attached manufacturer's identification plate designating the name of the manufacturer,
model number and serial number of the machine as minimum identification. This plate shall be
installed in a readily visible location. Compaction equipment lacking such an original manufacturer's
identification plate, or with altered or illegible plates, will not be recognized as acceptable
compaction equipment. Any equipment not principally manufactured for compaction purposes and
equipment which is not in proper working order in all respects shall not be approved or used. The
Engineer will also withhold approval of any compactor for which the Contractor cannot furnish
manufacturer's specifications covering data not obvious from a visual inspection of the equipment and
necessary to determine its classification.

The term, “pass,” for any type of compactor, shall denote one direct vertical application of
compactor effort over all elemental areas of a lift surface. Terms in common parlance, such as
“coverage,” “trips,” etc., have no significance, equivalence, or application under these specifications.

**FIGURE 203-1 PNEUMATIC-TIRED COMPACTOR CLASSIFICATIONS**

<table>
<thead>
<tr>
<th>PNEUMATIC COMPACTOR CLASS</th>
<th>TIRE SIZE</th>
<th>NO. PLYS</th>
<th>INFL. PRESS. (kPa)</th>
<th>RANGE OF BALLASTED WHEEL LOADS (Kilonewtons per Wheel)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>7.50 x 15</td>
<td>4</td>
<td>240</td>
<td>9 - 14</td>
</tr>
<tr>
<td>B</td>
<td>7.50 x 15</td>
<td>6</td>
<td>415*</td>
<td>9 - 18</td>
</tr>
<tr>
<td>C</td>
<td>7.50 x 15</td>
<td>14</td>
<td>900*</td>
<td>9 - 18</td>
</tr>
<tr>
<td>D</td>
<td>9.00 x 20</td>
<td>10</td>
<td>520*</td>
<td>18 - 27</td>
</tr>
<tr>
<td>E</td>
<td>11.00 x 20</td>
<td>12</td>
<td>620*</td>
<td>27 - 36</td>
</tr>
<tr>
<td>F</td>
<td>13.00 x 24</td>
<td>18</td>
<td>690*</td>
<td>36 - 45</td>
</tr>
</tbody>
</table>

* Inflation pressure for not less than the last two passes on each lift. May be reduced during earlier passes and gradually increased to this level.

1. **Pneumatic-Tired Compactors.** This type of compactor shall be classified for use
according to the requirements of Figure 203-1. For the lift thickness selected by the Contractor,
the minimum class and wheel load which will be allowed on that lift thickness, shall be as shown
in Figure 203-2.

The minimum effort for all pneumatic compactors shall be 6 passes, at speeds up to 3.6 m/s
on no more than the first 2 passes, and all subsequent passes at speeds of 1.8 m/s or less.

2. **Smooth Drum Vibratory Compactors.** This type of compactor is defined as a machine
which primarily develops its compactive effort from the vibrations created and is classified for
use according to the developed compactive force rating (CFR) per linear meter of drum width.

The CFR is defined as follows:

$$
CFR = \frac{\text{Unsprung Drum Weight (kN)} + \text{Dynamic Force (kN)}}{\text{Drum Width (m)}}
$$

The unsprung drum weight is the static weight of the drum and appurtenances without any
reaction transmitted to the drum from the main chassis of the compactor. The dynamic force
produced is dependent on the frequency of vibration, and therefore, CFR ratings shall be
determined for the actual operating frequency of the compactor. Approval for vibratory
compactors shall be confined, however, to equipment operating at not less than 18 Hz, nor more
than 25 Hz, and those where the actual dynamic force at the actual operating frequency is at least
2.5 times the unsprung drum weight.
Conversion of manufacturer’s published ratings, at a given frequency, shall be made with the following equation:

\[
F_2 = \frac{F_1(V_2)^2}{(V_1)^2}
\]

where:  
- \(F_1\) = Dynamic Force at Rated Frequency  
- \(F_2\) = Dynamic Force at Operating Frequency  
- \(V_1\) = Rated Frequency  
- \(V_2\) = Operating Frequency

For the lift thickness selected by the Contractor, the minimum CFR rating and minimum effort on such a lift, shall be as shown in Figures 203-3B&C, respectively. Non-Centrifugal (Vertical force only) types of vibratory compactors shall be approved as above, less 30 kN/m before using Figures 203-3 B&C as a minimum number of passes at a single specified speed. An equivalent effort, relating varying numbers of passes to other speeds is given by the equation:

\[
\text{Speed } X = \frac{(\text{Specified Speed})(\text{Min. Passes at Speed } X)}{(\text{Specified Min. Passes})}
\]
The Contractor may choose to alter the specified minimum pass requirement, provided that speed is adjusted to the value given by this equation and does not exceed 1.8 m/s.

FIGURE 203-3 VIBRATORY COMPACTORS

Where vibratory compactors are used on a project, the Contractor shall furnish for the exclusive use of the Engineer, one vibrating reed tachometer per project, plus one additional tachometer for each group of two vibratory compactors in excess of two per project. Tachometers shall have a frequency range adequate to cover operating frequencies of all vibratory compactors used on the project and shall have scale divisions of 1 Hz or less. Tachometers may be placed on the ground surface near the compactor when making readings, or with suitable damping materials interposed, placed directly on the compactor drum frame.

The dispensations permitted under this specification for vibratory compactors are contingent upon proper operation of the equipment at all times during compaction operations. In any instance where the Engineer encounters any problems with operators rolling without vibration, for any reason, and immediate and effective corrective action is not taken by the Contractor, the Engineer will halt the work until the problem is resolved. If continuing problems of this nature occur, the Engineer may suspend all provisions of this subparagraph and consider the vibratory compactors as smooth steel wheel rollers classified according to their gross weight.

3. **Sheepsfoot Rollers.** This type of compactor shall be defined as a machine which is primarily designed to compact a lift from the bottom to the top.

The maximum loose layer thickness of the material to be compacted shall be equal to the length of the feet plus fifteen (15) percent. The end area size and configuration of the feet shall be selected by the Contractor to suit the characteristics of soil being compacted.

Where sheepsfoot rollers are used, with or without vibration, the number of passes required for job control shall be determined by a jobsite test in which the feet penetrate into the loose lifts
and, with further passes, eventually and substantially “walk out” of the layer. This job control shall then be established for that machine, lift thickness and material, provided that adequate moisture control is continuously maintained per §203-3.12C. Sheepfoot rollers shall be operated at speeds not exceeding 2 m/s, when towed and 5 m/s when self-propelled.

4. Smooth Steel Wheel Rollers. Smooth steel wheel rollers shall be considered as primary compactors on layers whose maximum thickness, after compaction, is 200 mm. When so used, the roller shall have a nominal gross weight of not less than nine metric tons, exert a minimum force of not less than 50 kN/m of width on the compression roll faces, and a minimum of 8 passes shall be applied over each lift with the roller operating at a speed not exceeding 2 m/s.

When the Contractor employs smooth steel wheel rollers exclusively for surface compaction, leveling or finishing operations on lifts previously compacted by other types of primary compactors, the above restrictions shall not apply.

This section applies to non-vibratory rollers or vibratory rollers operated in the static mode only.

5. Other Type of Compactors. Compactor types other than those classified above, may be employed by the Contractor, subject to approval by the Engineer of the proposed minimum applied effort (minimum number of passes and travel speed) and maximum lift thickness. Such approval by the Engineer will be based upon the results of appropriate on-site field tests.

6. Compaction Equipment for Confined Areas. In areas inaccessible to conventional compactors, or where maneuvering space is limited, impactor rammers, plate or small drum vibrators, or pneumatic buttonhead compaction equipment may be used with layer thickness not exceeding 150 mm before compaction. However, materials placed for subbase course construction shall have a maximum compacted thickness of 150 mm. Hand tampers shall not be permitted. The Engineer may approve or reject any of the above described mechanical devices based upon the results of appropriate on-site field tests.

C. Moisture Control. All fill or backfill material to be compacted, shall be at a moisture content for adequate compaction of that material using the compactor selected by the Contractor to perform the work. The Contractor shall be responsible for determining the appropriate moisture content, and for controlling it within the proper limits as the work is progressed. When water must be added to a material, it may be added on the lift or in the excavation or borrow pit. Water added on the lift, however, shall be applied by use of an approved pressure distributor. Distributors must be approved and documented by the Engineer. Documentation by the Engineer shall be adequate evidence of approval. Water added shall be thoroughly incorporated into the soil, and manipulation shall be provided whenever necessary to attain uniformity of moisture distribution in the soil. When the moisture content of a lift about to be compacted exceeds the required amount, compaction shall be deferred until the layer has dried back to the required amount. Natural drying may be accelerated by blending in a dry material or manipulation alone, to increase the rate of evaporation. Increased loose lift thickness caused by blending in a dry material, however, may necessitate a change in compaction equipment to meet the minimum provisions of subparagraph B of this subsection.

203-3.13 Proof Rolling in Embankment Sections. Immediately prior to final trimming of the subgrade surface and placement of subbase materials in embankment sections, all areas of the subgrade surface within roadway limits shall be proof rolled according to the requirements of this subsection. This work, and any delays due to this work, shall be considered incidental to the embankment item.

A. (Vacant).

B. Equipment. The proof roller shall consist of a chariot type rigid steel frame with a box body suitable for ballast loading up to forty-five metric tons gross weight, and mounted on four (4) pneumatic tired wheels acting in a single line across the width of the roller on its transverse load center line. The wheels shall be equipped with 18.00 x 24 or 18.00 x 25, 24 ply tires, and shall be
suspended on articulated axles such that all wheels carry approximately equal loads when operating over uneven surfaces.

C. Determination of Roller Stress. Initially, the gross ballasted weight and tire inflation pressure of the proof roller shall be adjusted to the highest stress level shown in Figure 203-4 based on:

1. The Engineer's general description of the subgrade soils.

2. The Engineer's estimation of the relative subgrade support within the subgrade soil description range. The initial roller stress for embankments constructed of rock shall be the maximum level listed in Figure 203-4 (Gross Metric Tons 45, Tire kPa 910).

The roller shall be operated briefly to establish the acceptability of the initial stress level. Proof rolling of the embankment shall be performed at the next lower stress level whenever operation of the roller at a higher stress level is accompanied by consistent lateral displacement of soil out of the wheel paths.

D. Procedure. After an acceptable stress level is established, two complete passes of the roller shall be applied over all elements of the area to be proof rolled. Any deficiencies disclosed during the proof rolling operation shall be corrected. Subsidence depressions shall be filled with material similar to the subgrade soil and then compacted in a normal manner. After compaction, these areas shall be proof rolled again. Corrective work shall be judged complete and accepted by the Engineer when all elements of the subgrade surface over a given embankment show a satisfactory uniform response to the proof roller.
E. Exceptions. Proof rolling of the subgrade surface in embankment sections will not be required in any area where:

1. Due to restrictions in available access and/or maneuvering space, use of the proof roller may damage adjacent work;
2. The proof roller will approach a culvert, pipe or other conduit closer than 1.5 m in any direction.

203-3.14 Proof Rolling in Cut Sections. Immediately prior to final trimming of the subgrade surface and placement of subbase materials in cut sections, all areas of the subgrade surface within roadway limits shall be proof rolled according to the requirements of this subsection. This work, and any delays due to this work, shall be considered incidental to the excavation item.

A. Purpose. In cut sections, the purpose of proof rolling is to determine the location and extent of areas below the subgrade surface that require corrective undercutting and are not so specified in the contract plans.

B. Equipment. The proof roller used in embankment sections, as specified in §203-3.13B, shall be employed for proof rolling in cut sections except that the roller shall be loaded to achieve a single stress level in operation, using a gross ballasted weight of twenty-seven metric tons and all tires inflated to 275 kPa.

C. Procedure. Two complete passes shall be applied over all elements of the area to be proof rolled. Where any portion of the cut subgrade surface other than that which has been damaged by the Contractor's operations fails to provide a satisfactory support for the proof rolling operation, the Engineer may order corrective undercut and backfill work performed. Backfill of undercuts shown on the plans or ordered by the Engineer shall meet the requirements of Select Granular Subgrade, §203-2.202E, placed and compacted as approved by the Engineer. Where natural soil below this course will not support the weight of the construction equipment, and when ordered by the Engineer, the course shall be placed in one lift. No additional proof rolling shall follow corrective work.

D. Exceptions. Proof rolling of the subgrade surface in cut sections will not be required in any area where the subgrade surface is in a rock cut, or where undercut and backfill has been previously performed. The Engineer may order undercutting and backfill without proof rolling of any cut where the need for corrective work, as determined by the Engineer, is obvious without actual proof rolling. The Engineer may also delete proof rolling in any cut section where, based upon a written evaluation by a Departmental Geotechnical Engineer, proof rolling would be detrimental to the work.

203-3.15 Fill and Backfill at Structures, Culverts, Pipes, Conduits and Direct Burial Cables. The type of material to be used in bedding, filling and backfill at structures, culverts, pipes, conduit and direct burial cable and payment lines therefore shall be in conformance with the details shown on the appropriate Standard Sheet or as noted on the plans or as ordered by the Engineer. Do not use RAP. Do not use slabs or pieces of either concrete or asphalt.

Fill or backfill material at structures, culverts and pipes shall be deposited in horizontal layers not exceeding 150 mm in thickness prior to compaction. Compaction of each layer shall be as specified under §203-3.12, Compaction. A minimum of 95 percent of Standard Proctor Maximum Density will be required. When placing fill or backfill around culverts and pipes, layers shall be deposited to progressively bury the pipe or culvert to equal depths on both sides. When filling behind abutments and similar structures, all material shall be placed and compacted in front of the walls prior to placing fill behind the walls to a higher elevation. The limits to which this subsection will apply shall be in accordance with the Standard Sheets or as modified on the plans.

Fill or backfill for conduit or cable placed in a trench shall be carefully placed in a horizontal layer to a depth of 150 mm over the top of the conduit or cable. This layer of material shall not be compacted, however, the remaining portion of the trench shall be backfilled in accordance with the preceding paragraph. Where cables or conduits are placed and backfilled by a machine in one operation, the above requirements for backfilling do not apply.
Where sheeting has been used for the excavation, and incremental removal of sheeting is not specified in the plans or proposal, sheeting shall be pulled when the trench has been backfilled to the maximum unsupported trench depth allowed by 29 CFR 1926.

203-3.16 **Borrow.** The management of a borrow source and the acceptability of all borrow material shall be subject to the approval of the Engineer at all times. The Contractor shall notify the Engineer at least ten (10) work days in advance of opening any borrow area, and request approval of the source under the pay item involved. Test pits required by the Engineer to evaluate the acceptability and limits of the source, shall be provided by the Contractor at the Contractor’s own expense. Concurrent removal of material for more than one pay item from a single source or pit shall be prohibited except with the written permission of, and under such conditions and restrictions as may be imposed by the Engineer. All borrow pits shall be stripped of sod, topsoil and vegetable matter well in advance of any working face. The minimum distance by which stripping shall lead excavation for a given source shall be established by the Engineer to suit local conditions. Where a borrow source is not under direct control of the Contractor or where special conditions exist, the Engineer may waive any of the above requirements and establish alternative provisions for the control and acceptability of borrow.

Ordinary borrow will be accepted for use where the material qualifies under the definition of Suitable Material, §203-1.08. The borrow of select granular materials enumerated in §203-2.02 shall be accepted subject to meeting the additional provisions contained, therein. All borrow, whether ordinary borrow or select borrow placed within the limits of Embankment or the Subgrade Area shall be placed in conformance with §203-3.10 or §203-3.11 respectively, as appropriate, or where used for fill or backfill at structures, culverts and pipes, in conformance with §203-3.15.

203-3.17 **Select Granular Fill, Slope Protection.** The Contractor shall perform the excavation in accordance with the requirements for “Unclassified Excavation and Disposal” as described elsewhere in these specifications. The Contractor shall then spread material conforming to the requirements given in §203-2.02D, in one layer to its full thickness by a method approved by the Engineer. The work shall be performed where shown on the plans or where directed by the Engineer in accordance with the standard sheets, and details shown on the plans. Compaction of the slope protection is not required. Slope Protection shall be either of two types, as described below:

A. **Select Granular Fill, Slope Protection - Type A.** Under this type, the Contractor shall furnish and install the slope protection where shown on the plans in accordance with the details shown on the Standard Sheets.

B. **Select Granular Fill, Slope Protection - Type B.** Under this type, the Contractor shall furnish and install the slope protection where directed by the Engineer in accordance with the details shown on the Standard Sheets.

203-3.18 **Embankment Construction Control Devices**

A. **Settlement Gages and Settlement Rods.** Settlement gages and rods shall be constructed, installed, and maintained where shown on the plans and in accordance with the details contained in the current publication issued by the Department covering construction, installation, maintenance, and abandonment of these devices.

Where settlement gages are called for, it will be the Contractor’s option to install pipe gages or manometer gages, unless a definite type is specified on the plans or in the proposal. Settlement gages and settlement rods will be accepted for conformance with the specification requirements on the basis of an inspection of the installation by the Departmental Geotechnical Engineer.

B. **Piezometers.** Piezometers shall be constructed, installed, and maintained at the locations shown on the plans and in accordance with the detailed drawings and specifications included in the proposal.

203-3.19 **Cleaning Culverts and Closed Drainage Systems.** Culverts, closed drainage systems, drainage structures and manholes shall be thoroughly cleaned and maintained clean as determined by the
Engineer for the duration of the contract. Materials removed shall be disposed of in accordance with §203-3.08 “Disposal of Surplus Excavated Materials.”

**203-3.20 Subgrade Surface Tolerance.** After compaction, the subgrade surface shall not be above design elevation at any location.

**203-3.21 Clean, Grade and Shape Existing Roadside Section.** The Contractor shall remove earth, turf, brush and debris, or provide necessary fill material to restore adequate roadside drainage. Ditches shall be shaped as shown on the plans. Material removed shall be disposed of in conformance with the provisions of Subsection 203-3.08, Disposal of Surplus Excavated Materials.

The Contractor shall protect all fences, markers, culverts, underground structures, utilities and other appurtenances adjacent to the work area. Any damaged facilities and/or disturbed areas shall be replaced in kind at no additional cost to the state.

**203-4 METHOD OF MEASUREMENT**

**203-4.01 General.** Quantities for all items of work with payment units in cubic meters encompassed by this Section, shall be computed from payment lines shown on the plans or standard sheets except where revised payment lines are established by the Engineer prior to performing the work. Work performed beyond any designated payment line, including any offset required for the construction of presplit rock slopes in lifts, shall not be included in the computation of quantities for the item involved.

For any item paid for in its final position, no additional quantity shall be measured for payment to make up losses due to foundation settlement, compaction, erosion or any other cause.

Cross sectioning, for the exclusive purpose of determining quantities for payment, shall be employed only where payment lines are not shown on the Plans or Standard Sheets, and cannot be reasonably established by the Engineer.

Quantities for benching shall be computed for payment from the details and instructions shown on the Standard Sheet, “Earthwork Transition and Benching Details.”

The excavation of unsuitable materials designated as topsoil under Section 613, shall be included in the quantity measured for the appropriate unclassified excavation item, without distinction. Separate payment for placing topsoil, however, is made under Section 613.

**203-4.02 (Vacant).**

**203-4.03 Unclassified Excavation and Disposal.** Quantities shall be in cubic meters, computed in the original position for all excavation within right-of-way limits. No deduction shall be made for any pipes, culverts, structures, or other obstructions, unless these are measured for payment under another contract item. Excavation for borrow of suitable materials for embankment construction, shall not be included in the computation for this work.

**203-4.04 Embankment in Place.** Quantities shall be in cubic meters, computed in the final compacted position. Any additional quantity of material required to compensate for embankment settlement shall not be included in the measurement of this item. The quantities of embankment shall exclude the total volume of pipes, culverts, other roadway items, and granular backfill within the payment lines for such granular backfill.

**203-4.05 Ordinary Borrow.** Where the item, “Embankment in Place,” is designated for the project by the proposal, all borrow of ordinary suitable materials shall be incidental to the work of that item.

**203-4.06 Select Borrow.** Quantities shall be in cubic meters, computed in the original position.

**203-4.07 Select Fill and Select Granular Subgrade.** Quantities for each of these items shall be in cubic meters, computed in the final compacted position.

**203-4.08 Select Granular Fill, Select Structure Fill, and Sand Backfill.** Quantities for this work shall be computed in cubic meters in the final compacted position. A deduction shall be made for
pipes (based on nominal diameters) and other payment items when the combined cross-sectional area exceeds 0.1 m² unless otherwise shown on plans. No deduction will be made for the cross-sectional area of an existing facility.

203-4.09 Select Granular Fill, Slope Protection. Quantities shall be in cubic meters, computed in the final position.

203-4.10 (Vacant).

203-4.11 Embankment Construction Control Devices. Quantities shall be per each device satisfactorily installed and maintained under their respective items “Surface Settlement Gages,” “Subsurface Settlement Gages,” “Settlement Rods,” or “Piezometers.”

203-4.12 Cleaning Culverts and Closed Drainage Systems. This work will be measured by the number of meters of culvert and or pipe of the size range indicated in the Contract Documents.

Measurement will be the total length end to end along the invert of culvert or closed drainage system cleaned. Multiple barrel culverts will be measured along each individual barrel. The length of closed drainage systems will be determined by measuring from the inside wall surface to the inside wall surface of the adjacent manhole or other drainage structure. The spans of culverts will be determined as the greatest internal horizontal width of the culvert measured perpendicular to the axis of the structure.

203-4.13 Cleaning Drainage Structures and Manholes. This work will be measured as the number of drainage structures or manholes cleaned and maintained within the inside walls of the structure, excluding existing structures being altered under Section 604.

203-4.14 Applying Water. The unit of measurement shall be one operating pressure distributor per calendar day, denoted hereafter as one p.d.d. Where the Contractor works in more than one separate and distinct shift per calendar day, each shift shall be considered as one p.d.d. A single shift plus overtime work, however, shall be considered as one p.d.d. The quantity thus determined shall be applied directly as the quantity to be paid for where the distributors used have a capacity of 11,000 L or less.

Provided that the Engineer determines that the total operating distributor capacity (number and sizes of all distributors) employed is reasonably commensurate with the needs for water application, additional payment will be allowed for distributors exceeding 11,000 L in capacity as follows:

Where the distributor capacity exceeds 11,000 L but is less than 19,000 L the p.d.d.’s shall be multiplied by 1.5 and where the capacity is 19,000 L or more, multiplied by 2.0 to determine the quantity for payment.

203-4.15 Clean, Grade and Shape Existing Roadside Section. This work will be measured as the number of meters along the edge of the adjacent roadway.

203-5 BASIS OF PAYMENT

203-5.01 General-All Items. The unit price bid for all pay items of work encompassed by this Section, shall include the costs of furnishing all equipment, labor and materials as necessary to complete the work of the item, except where specific costs are designated or included in another pay item of work.

All incidental costs, such as acquisition of borrow pits or material outside of the right-of-way, rock drilling and blasting, compaction and special test requirements, stockpiling and rehandling of materials, precautionary measures to protect private property and utilities, to form and trim graded surfaces, proof rolling, re-proof rolling, corrective work disclosed by proof rolling and any delays caused by this corrective work, shall all be included in the unit price of the pay item where such costs are incurred.

Except that, corrective work ordered in cut sections based on an evaluation of proof rolling will be paid for under the appropriate excavation and backfill items. When there is no pay item for Applying Water in the itemized proposal, the work shall be performed in accordance with the specifications for the appropriate items but the costs thereof shall be included in those pay items that require the application of water. When there is no pay item for Clearing and Grubbing in the itemized proposal, this work shall be
performed in accordance with the specifications for the appropriate item but the cost thereof shall be included in those pay items that require clearing and grubbing.

Cleaning culverts, removing and resetting guiderail and establishing turf and sodding will be paid under their respective specification items.

Items with additional provisions to these are listed in subsections sequentially numbered following this subsection. Items with no additional provisions to these above are:

- Embankment In Place
- Select Borrow
- Select Fill
- Select Granular Fill
- Select Granular Fill, Slope Protection (Type A & B)
- Select Granular Subgrade
- Select Structure Fill
- Applying Water
- Sand Backfill

203-5.02 (Vacant).

203-5.03 Unclassified Excavation and Disposal. The unit price bid shall cover all costs of required excavation within the right of way limits, and all costs of disposal if the excavated materials are not used under another pay item.

203-5.04 (Vacant).

203-5.05 Embankment Construction Control Devices. The unit price bid shall cover all costs of providing, installing and maintaining each device, including excavation, trenching and backfill during the course of the work. No payment will be made under any other item of the contract for any work associated with these items.

A. Settlement Gages and Settlement Rods. When each installation is completed, 75 percent of the item unit price will be paid. The remaining 25 percent will be paid when each device has been properly maintained and is abandoned according to the procedures of §203-3.18A. Unless otherwise specified in the proposal, the unit price shall also include the costs of removal.

B. Piezometer. When each installation is completed and the device placed in satisfactory operation, 75 percent of the unit price will be paid. The remaining 25 percent will be paid when all earthmoving and slope work is completed in the vicinity of each installation. Any installation rendered inoperative due to damage by construction equipment after partial or full payment, shall be immediately repaired or the full amount of such payment shall be deducted from other monies due the Contractor under the contract.

203-5.06 Cleaning Culverts and Closed Drainage Systems. The unit price bid per linear meter shall include the cost of all labor, materials, and equipment necessary to satisfactorily perform the work.

Payment, for cleaning culverts and/or closed drainage systems will be made only for those facilities designated on the plans or by the Engineer. Only one payment for each facility will be made regardless of the number of times it is cleaned. The cleaning of drainage structures and manholes shall be paid for under their respective item.

203-5.07 Cleaning Drainage Structures and Manholes. The unit price bid for each shall include the cost of all labor, materials and equipment necessary to satisfactorily perform the work. Payment for cleaning drainage structures and manholes will be made only for those facilities designated on the plans or by the Engineer. Only one payment for each facility will be made regardless of the number of times it is cleaned.
Payment will be made under:

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<th>Item No.</th>
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<tr>
<td>203.02</td>
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<td>Piezometers</td>
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<td>P.D.D.</td>
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<td>Cleaning Culverts with Span of 1300 Millimeters or Less</td>
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<td>Cleaning Culverts with Span of More Than 1300 Millimeters</td>
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<td>Cleaning Closed Drainage Systems</td>
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<td>Select Structure Fill</td>
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<td>203.51</td>
<td>Clean, Grade and Shape Existing Roadside Section</td>
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SECTION 204 - CONTROLLED LOW STRENGTH MATERIAL (CLSM)

204-1 DESCRIPTION. The work consists of mixing and placing Controlled Low Strength Material (CLSM) or Controlled Low Strength Material (CLSM, No Fly Ash) at the locations shown on the plans or where ordered by the Engineer.

204-2 MATERIALS

204-2.01 Tests and Control Methods. Provide CLSM containing cement and water. At the Contractor’s option, it may also contain fly ash (unless the No Fly Ash item is specified), aggregate, or chemical admixtures in any proportions such that the final product meets the strength and flow consistency requirements included in this specification.

Provide materials meeting the requirements of the following subsections:

Portland Cement, Type 1 or Type 2: § 701-01
Water: § 712-01

If used, provide materials meeting the following requirements:

Aggregates: Gradation: 100% passing the 2.0 mm sieve and a maximum of 20% passing the 75 µm sieve.
Fly Ash: Provide fly ash that complies with the requirements of § 711-10. Waive the loss on ignition requirement.
Chemical Admixtures: Provide admixtures that comply with § 711-08. The mix may include high air generators manufactured for CLSM.

Certify that the CLSM will have a 28 day compressive strength between 275 kPa and 1030 kPa, and provide this certification to the Engineer.

Design the CLSM mix so that it sets within the time stated in the contract documents. If no set time is required by the Department, design the set time to conform with the Maintenance and Protection of Traffic scheme and requirements of the project.
Prior to placement, the CLSM will have a minimum diameter spread of 200 mm as determined from the following procedure performed by the Engineer:

- Fill a hollow plastic or metal cylinder 150 mm in length and 75 mm inside diameter with the CLSM and strike off the surface.
- Raise the flow cylinder 150 mm in a continuous motion without rotation.
- Immediately measure the spread of the CLSM along two diameters which are perpendicular to each other.

Cast three (3) specimens (cylinders) for each batch in accordance with Materials Method 9.2. and deliver them to the Geotechnical Engineering Bureau within seven days of the pour date for evaluation.

### 204-3 CONSTRUCTION DETAILS

#### 204-3.01 General.

Provide all equipment for this work subject to approval of the Engineer.

Mix the materials at a stationary mixing plant which is either a continuous or a batch type plant, designed to accurately proportion either by volume or by weight, so that when the materials are incorporated in the mix, a thorough and uniform mix will result.

The mix may be transported in open haul units provided the material is placed within 30 minutes of the end of mixing. Use a rotating drum unit capable of 2 - 6 rpm to transport material which cannot be placed within 30 minutes after the end of mixing.

In work involving quantities of CLSM less than 2 cubic meters, the Engineer may permit the Contractor to use a small construction mixer. Provide a mixer capable of mixing CLSM that has the specified compressive strength and flow consistency. Mix all components so as to produce a uniform product.

Narrower trench widths can be employed when using CLSM due to the self-compacting properties of the material. Construction personnel and equipment are not required to be in the trench for compaction operations. Refer to the current Standard Sheet for Controlled Low Strength Material (CLSM) Installation Details for Circular and Elliptical Metal Pipes, Structural Plate Pipes and Pipe Arches, and Reinforced Concrete and Other Rigid Pipes. For installations that require that construction personnel temporarily occupy the trench follow all OSHA requirements.

#### 204-3.02 Fill and Backfill at Structures, Culverts, Pipes, Conduits and Direct Burial Cables.

Place the CLSM using a method approved by the Engineer, in accordance with the appropriate Standard Sheet for additional guidance on the use of CLSM as backfill material.

When placing CLSM for pipe backfill, discharge the material onto the top of the pipe at the center. Do not place CLSM in contact with aluminum pipe, including connections, fixtures, etc., unless the aluminum has been coated with an approved primer.

Do not place CLSM containing fly ash in contact with cast iron or ductile iron pipes, fittings or appurtenances.

CLSM should be kept encapsulated with soil, as it is highly erodible and disintegrates when left exposed to the environment.

In situations where CLSM is used as backfill around lightweight pipe, take precautions to counteract the pipe’s buoyancy.

### 204-4 METHOD OF MEASUREMENT

#### 204-4.01 General.

Payment for CLSM will be made for the number of cubic meters of satisfactorily placed CLSM computed between the payment lines shown on the contract documents or from payment lines established in writing by the Engineer.

A deduction shall be made for pipes (based on nominal diameters) and other payment items when the combined cross-sectional area exceeds 0.1 m² unless otherwise shown. No deduction will be made for the cross-sectional area of an existing facility.

No additional quantity shall be measured for payment to make up losses due to foundation settlement, compaction, erosion or any other cause.
Cross sectioning, for the purpose of determining quantities for payment, shall be employed only where payment lines are not shown on the contract documents or Standard Sheets, and cannot be reasonably established by the Engineer.

204-5 BASIS OF PAYMENT

204-5.01 General. The unit price bid shall include the costs of furnishing all equipment, labor and materials necessary to complete the work, except where specific costs are designated or included in another pay item of work.

Payment will be made under:

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<th>Item No.</th>
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SECTION 205 (VACANT)

SECTION 206 - TRENCH, CULVERT AND STRUCTURE EXCAVATION

206-1 DESCRIPTION

206-1.01 General. This work shall consist of the excavation of all materials and backfill or disposal of excavated material required for trenches, culverts, structures, conduit and direct burial cable not otherwise provided for in other sections of these specifications. All such excavation shall be unclassified excavation as defined in §203-1.01. The work shall also consist of all required protection necessary to ensure the safety of the workers and the public.

206-1.02 Trench and Culvert Excavation and Trench and Culvert Excavation - Original Grade (O.G.) The work specified under these items shall include the excavation for and backfill of all culverts, pipe lines, and other minor structures including but not limited to leaching basins, catch basins, field inlets, manholes and drop inlets.

206-1.03 Structure Excavation. The work specified under this item shall include the excavation for all bridge foundations, walls and other major structures and backfill of suitable excavated material if another item is not specified.

206-1.04 Conduit Excavation and Backfill including Surface Restoration. The work specified under this item shall include the excavation, necessary backfill and surface restoration required for conduits and direct burial cables.

206-1.05 Test Pits. The work specified under this item shall include the excavation and backfill of test pits at locations shown in the contract documents, or as directed by the Engineer. Excavation and backfill methods, limits and equipment used shall be approved by the Engineer. This work will not relieve the contractor of the responsibility to locate underground facilities as required under 16 NYCRR 753.

206-2 MATERIALS. (Not Specified).

206-3 CONSTRUCTION DETAILS

206-3.01 General. The appropriate construction details specified for “Excavation and Embankment” in §203-3.01 through and including §203-3.12, and §203-3.15 shall apply to the work specified in this section.

The excavation shall be dewatered and kept free from water, snow and ice when necessary.

Special care shall be taken not to disturb the bottom of the excavation, and not to remove the material at final grade until just before the structure is placed.
The Contractor shall carry out all excavation operations in a safe and prudent manner so that the workers, the public, and adjacent public and private property will be protected from unreasonable hazard in accordance with §107-05K. *Open Excavations and Trenches.*

If no support or protective system is shown in the plans or proposal, the Contractor may open the excavation with the sides sloped to a stable slope not steeper than that allowed by 29 CFR 1926 Subpart P. Taking this option, however, does not relieve the Contractor of responsibilities as stated in this subsection. When the Contractor chooses this option, the materials used and method of construction outside the payment lines shall be in accordance with the requirements of this Section.

When excavation is required for the installation of conduit or direct burial cable, the Contractor shall notify the Engineer upon completion of the excavation. No conduit or cable shall be placed in the excavation until the Engineer has approved the depth and cross-section.

**206-3.02 Replacement of Pavement Structure Courses.** When the Contractor, in placing conduits, direct burial cable or utilities, excavates into the pavement, subgrade, subbase, or shoulder courses, such courses must be replaced in kind, character and condition, to maintain a uniform road section.

**206-3.03 Disposal of Excavated Material.** The provisions of §203-3.06 and/or §203-3.07 shall apply to all material excavated under this section which is not used as backfill.

**206-3.04 Test Pits.** The Contractor shall excavate and backfill test pits in order to determine existing underground utility type, size and/or condition where new utility connections to existing facilities are proposed. The Contractor shall excavate and backfill test pits in a manner approved by the Engineer that prevents damage to wrappings, coatings or other protective coverings, such as by hand digging, vacuum excavation or similar non-destructive locating equipment. The limits of the excavation shall be those sufficient to determine existing utility type, size and/or condition.

**206-4 METHOD OF MEASUREMENT**

**206-4.01 General.** The quantity of excavation shall be the number of cubic meters of material computed from payment lines shown on the plans or the appropriate standard sheets, except where revised payment lines are established by the Engineer prior to performing the work. Work performed beyond any designated payment line will not be included in the computation of quantities for the item involved.

**206-4.02 Trench and Culvert Excavation.** Unless otherwise shown or indicated on the contract plans, payment lines for excavation of pipe and culvert lines, and minor structures will be determined as follows:

**A. Bottom Payment Line.** The elevation of the bottom payment line shall be the invert elevation of the pipe, conduit, or culvert. For pipes, conduits, or culverts of nominal horizontal dimensions of 300 to 3700 mm, the width of the excavations at the bottom payment line shall be the nominal inside horizontal dimension of the pipe, conduit, or culvert plus 1.2 m, or three (3) times the nominal inside horizontal dimension, whichever is less; for pipes with a nominal horizontal dimension greater than 3700 mm the width will be as shown on the appropriate standard sheets or in the contract documents. For concrete and smooth interior corrugated polyethylene pipe, twice the minimum wall thickness shall be added to the preceding. For concrete pipe, the bottom payment line is the Bedding Control Line shown on the applicable standard sheet.

**B. Top Payment Line.** Except when otherwise provided in the contract, the payment line in a cut section shall be the surface at the centerline of the pipe, culvert or conduit after completion of the general excavation and prior to excavation to place material paid for under another item of the contract; except that, when an undercut is made for unstable conditions, the payment line will be at the top of the undercut backfill. The payment line in a fill section shall be the ground surface prior to commencing work on the contract.
C. Side Payment Lines. The side payment lines of the excavation shall be vertical to the bottom of payment line, regardless of whether sheeting is or is not required or used.

For utility lines, exclusive of conduit and cable lines, of less than 300 mm diameter, the excavation width shall be the actual bottom width necessary, as determined by the Engineer, to properly perform the installation work required, or 1 m, whichever is less.

D. Payment Lines for Minor Structures. Payment lines for minor structures shall be vertical from the bottom of the footing and shall extend out 0.6 m from the perimeter of the structure footing. The top payment line shall be the same as for (B) above.

206-4.03 Conduit Excavation and Backfill including Surface Restoration. The quantity of conduit and/or cable excavation and backfill including surface restoration for payment shall be the number of linear meters measured along the center of the conduit and/or cable placed, in accordance with the methods stated below.

Wherever a pair or group of conduits and/or cables are physically connected together, they shall be considered as a single conduit and/or cable.

A. Wherever conduit and/or cable in the same trench are physically separated laterally by 150 mm or more between centerlines, as shown on the plans or as directed by the Engineer, the linear meter measurement shall be made along the center of each conduit and/or cable.

B. Wherever a pair or group of conduits and/or cable in the same trench are physically separated laterally by less than 150 mm between centerlines of adjacent conduit and/or cable, as shown on the plans or as directed by the Engineer, the linear meter measurement for those conduits and/or cable shall be made along the center of that pair or group of conduit and/or cables.

206-4.04 Trench and Culvert Excavation - O.G. The provisions of §206-4.02 Trench and Culvert Excavation shall apply, except the top payment line shall be the existing ground surface at the centerline of the pipe, culvert or conduit prior to commencing work on the contract.

206-4.05 Test Pits. The quantity to be measured for payment will be the number of test holes excavated and backfilled in accordance with the contract documents.

206-5 BASIS OF PAYMENT

206-5.01 Trench, Culvert and Structure Excavation. The unit price bid for this work shall include the cost of labor, materials and equipment required to satisfactorily complete the work, including the costs of excavation, backfill (except select backfill paid for separately), disposal of excavated material, presplitting rock excavations where required, and keeping the site dewatered and free from earth, water, ice and snow when necessary.

The cost for necessary guarding and protection required to protect the public from open trenches and, that required for the protection to ensure the safety of the workers shall be included in the bid price for Trench, Culvert and Structure Excavation. Progress payments will be made after the excavation has been completed, and prior to the completion of other work included under this item, including but not limited to pumping, fencing and backfilling. Payment will be made, at the unit price bid, for 75% of the quantity excavated within the prescribed payment lines. The balance of the quantity excavated will be paid for upon proper completion of backfill placement.

If the Contractor chooses the slope layback option to satisfy OSHA, no extra payment will be made for the cost of any labor, equipment or material necessary to restore the area outside the payment lines shown on the plans.

206-5.02 Sheeting, Cofferdams or Temporary Water Diversion Structures. Payment for Sheeting, Cofferdams or Temporary Water Diversion Structures required by the plans, specifications, or ordered by the Engineer in writing will be made in accordance with the appropriate item.

Where cofferdams are specified for structure excavation, the work required to keep the site free from earth, water, ice and snow shall be included in the item for cofferdams when necessary.
§206  

206-5.03 Replacement of Pavement Structure Courses. With exception of the Conduit Excavation and Backfill including Surface Restoration item, the work of replacing pavement, subcourses and shoulder courses shall be paid for and performed under the provisions of their respective items and subsections.

206-5.04 Conduit Excavation and Backfill including Surface Restoration. The unit price bid per linear meter for this work shall include the cost of furnishing all labor, materials and equipment necessary to excavate and backfill the trench and to replace any pavement, shoulder, and sidewalk courses, subcourses, curbs, drives, lawns and other top surfaces as required to complete the work.

206-5.05 Test Pits. The unit price bid for this work shall include the cost of furnishing all labor, materials and equipment necessary to excavate and backfill the test pit and replace any pavement, shoulder and sidewalk courses, subcourses, curbs, drives, lawns and other top surfaces required to complete the work.

Payment will be made under:

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<td>206.05</td>
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SECTION 207 - GEOTEXTILES AND PREFABRICATED COMPOSITE DRAINS FOR STRUCTURES

207-1 DESCRIPTION

207-1.01 Geotextiles. The work shall consist of furnishing and installing approved Geotextile of the Class and Type indicated, at the locations, and in the manner shown on the plans or as directed by the Engineer, in writing, prior to performing the work.

207-1.02 Prefabricated Composite Drains for Structures. The work shall consist of furnishing and installing an approved Prefabricated Composite Structural Drain (PCSD) or Prefabricated Composite Integral Abutment Drain (PCIAD) as specified at the location(s) shown on the contract documents or as directed by the Engineer, in writing, prior to performing the work.

Prior to installation, the Contractor shall furnish the Engineer with copies of the manufacturer’s literature with details and installation requirements for the PCSD or PCIAD. If not included in the manufacturer’s literature, a letter identifying the geotextile wrap shall also be provided to the Engineer.

207-2 MATERIALS

207-2.01 General. The Geotextile and Prefabricated Composite Drain for Structures shall be the type appropriate for the intended use as shown on the plans and be listed in the Appropriate Approved List issued by Department's Materials Bureau. Evaluation of a Geotextile or Prefabricated Composite Drain for Structures not on the Approved List will be made in accordance with procedural directives of the Geotechnical Engineering Bureau. Evaluation will require a minimum of four months.

The Contractor shall provide PCSD or PCIAD that is a flexible product consisting of a geotextile bonded to an internal supporting core.

The Contractor shall provide PCSD or PCIAD that is resistant to deterioration from salts, road oils, fuels and other deleterious substances encountered in this type of application.

Only approved structural drains with an impermeable core will be permitted for use in installations where fresh concrete is to be placed against the drain.
§207 - 207-2.02 Basis of Acceptance

A. Geotextiles. The Geotextiles which are on the Approved List issued by the Department's Materials Bureau will be accepted on the basis of the brand name labeled on the Geotextile or the Geotextile container and verification of the Geotextile by a Departmental Geotechnical Engineer.

B. Prefabricated Composite Drains for Structures. The Prefabricated Composite Drain for Structures which are on the Approved List issued by the Department’s Materials Bureau will be accepted on the basis of the brand name labeled on the drain’s packaging and verification by the Engineer of the geotextile wrap being on the approved list for a drainage application.

207-2.03 Quality Assurance

A. Geotextiles. When the State elects to sample, one ten square meter sample will be obtained for quality assurance testing. The results of this testing will only affect a product’s standing on the Approved List. Payment for this sample will be made at the unit bid price.

B. Prefabricated Composite Drains for Structures. When the State elects to sample, a 1 meter long by roll width sample will be obtained for quality assurance testing. The results of this testing will only affect a product’s standing on the Approved List. No payment will be made for this sample.

207-3 CONSTRUCTION DETAILS

207-3.01 Geotextiles

A. General. The Geotextiles shall be protected from exposure to sunlight during transport and storage. After placement, the Geotextile shall not be left uncovered for more than two (2) weeks.

Traffic or construction equipment will not be permitted directly on the Geotextile. Geotextiles may be joined by either sewing or overlapping. Sewn seams shall be lapped a minimum of 100 mm and double sewn. The thread used to sew the seam shall be nylon or polypropylene. Overlapped seams shall have a minimum overlap of 500 mm except when placed under water where the overlap shall be a minimum of 1 m. All seams shall be subject to the approval of the Engineer. Geotextile which becomes torn or damaged due to the Contractor’s operations shall be replaced or patched at no cost to the State. The patch shall extend 1 m beyond the perimeter of the tear or damage.

B. Bedding and Slope Protection. The Geotextile shall be placed and anchored on a prepared surface approved by the Engineer. The Geotextile shall be laid loosely but in intimate contact with the soil so that placement of the overlying materials will not stretch or tear the Geotextile. Where Geotextile is placed above water, the backfill placement shall begin at the toe and proceed up the slope.

Where Geotextile is placed under water, the long dimension shall be placed parallel to the direction of flow. Successive Geotextile sheets shall be overlapped so that the upstream sheet is placed over the downstream sheet. As the Geotextile is placed under water, the backfill material shall be placed on it to the required thickness. The Geotextile placement shall not progress more than 15 m ahead of the backfill placement.

Rip-rap, stone filling (Heavy) or stone filling (Medium) shall not be dropped onto the Geotextile from a height greater than 0.3 m. Slope protection and smaller sizes of stone filling shall not be dropped onto the Geotextile from a height exceeding 1 m.

C. Separation and Stabilization. The Geotextile shall be placed as directed by the Engineer. The Geotextile shall be laid loosely but in intimate contact with the soil so that placement of the overlying material will not stretch or tear the Geotextile.

D. Drainage. The Geotextile shall be placed to conform loosely to the shape of the trench.
After placing the filter material, the Geotextile shall be folded over the top of the filter material to produce a minimum overlap of 300 mm. The Geotextile shall then be covered with the subsequent course.

207-3.02 Prefabricated Composite Drains for Structures. The Contractor shall install the drain in conformance with the manufacturer’s installation procedures. The drain shall be installed so that the backfill, when placed, will be in contact with the geotextile and forms a continuous drainage layer without interruption within the drain’s plane. At all locations, a positive outlet for the water in the drain shall be provided. This may involve making a hole in the core at the weep hole locations for approved drains with an impermeable core. Do not puncture the geotextile. Any damaged geotextile shall be repaired.

Adhesive shall be applied to the wall surface, and not directly to the drain.

During all periods of shipment and storage, the drain shall be wrapped and protected from direct exposure to sunlight, mud, dirt and debris.

Care shall be exercised while backfilling to prevent damage to the drain. Repairs or replacements of drain damaged by construction operations shall be performed, as directed by the Engineer, at no cost to the State.

207-4 METHOD OF MEASUREMENT

207-4.01 Geotextiles

A. General. The quantity of Geotextile will be the number of square meters computed from the payment lines shown on the plans or from payment lines established in writing by the Engineer. Measurement will not be made for Geotextile used for repairs, seams, or overlaps. If taken, the amount of quality assurance samples will be added to this quantity.

B. Drainage. The number of square meters shall be computed by multiplying the length of the trench where Geotextile is used by the theoretical perimeter (determined from the typical section).

207-4.02 Prefabricated Composite Drains for Structures. The quantity of PCSD or PCIAD is the number of square meters satisfactorily installed computed from the payment lines indicated in the contract documents or from payment lines established, in writing, by the Engineer.

207-5 BASIS OF PAYMENT

207-5.01 Geotextiles. The unit price bid per square meter for these items shall include the cost of furnishing all labor, equipment, and materials necessary to complete the work, including the cost of preparing the surface upon which the Geotextile is placed. No payment will be made for replacement or repairs.

207-5.02 Prefabricated Composite Drains for Structures. The unit price per square meter for this item includes the cost of furnishing all labor, equipment, and material necessary to complete the work. No payment will be made for repairs or replacement.

Payment will be made under:

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<td>Geotextile Separation</td>
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SECTION 208 (VACANT)
SECTION 209 - SOIL EROSION AND SEDIMENT CONTROL

209-1 DESCRIPTION. This work shall consist of furnishing, installing, inspecting, maintaining, and removing soil erosion and sediment control measures as shown on the contract documents or as ordered by the Engineer during the life of the contract to provide soil erosion and sediment control. This work shall be coordinated with the soil erosion and sediment control features specified elsewhere in the contract documents to the extent practical to assure effective and continuous soil erosion and sediment control throughout the construction and post construction period.

209-1.01 Erosion Control. See §101-02 Definitions of Terms, Erosion Control, for the definition of Erosion Control. The following items of work are provided in this section to address soil erosion control - mulch, straw/wood fiber mulch, seed and mulch, seed and straw/wood fiber mulch, all classes and types of rolled erosion control products, and soil stabilizers. Other items may be provided in the contract documents to provide soil erosion control (e.g., turf establishment, bank and channel protection, etc.).

209-1.02 Sediment Control. Sediment control is any action taken or item used as part of a project or as a separate action to minimize suspended solid material transport by water. The following items of work are provided in this section to address sediment control - haybale/strawbale, strawbale, sediment trap, turbidity curtain, silt fence.

209-2 MATERIALS. Unless otherwise stated elsewhere in the contract documents, materials shall be as stated herein.

209-2.01 Mulch. Mulch shall be §713-18 Hay, §713-19 Straw, or §713-11 Wood Fiber Mulch. Straw/Wood Fiber Mulch shall be §713-19 Straw or §713-11 Wood Fiber Mulch.

209-2.02 Seed. Seed shall be ryegrasses (annual or perennial) or cereal grasses suitable to the area and as a temporary cover which will not compete with the grasses sown later for permanent cover.

209-2.03 Stone Filling. Stone filling shall meet the requirements of §620-2.02 Stone Filling, light.

209-2.04 Haybale/Strawbale. Haybale/Strawbale shall meet the requirements of §713-18 Hay or §713-19 Straw. Strawbale shall be §713-19 Straw.

All bales shall be tightly bound; loose or broken bales will not be accepted. Hardwood stakes shall be at least 32 mm x 32 mm and a minimum of 0.6 m long.

209-2.05 Geotextile. Geotextiles shall meet the requirements of §207-2 Materials. UV sensitive geotextiles shall be protected from exposure to sunlight during transport and storage.

209-2.06 Prefabricated Check Dams and Drainage Structure Inlet Protection. The materials used for prefabricated check dams and drainage structure inlet protection shall be triangular-shaped in cross section, and have a height of at least 200 mm - 250 mm in the center with two equal sides and a 450 mm - 600 mm base. The triangular-shaped inner material shall be urethane foam. The outer cover shall be a woven bedding type geotextile placed around the inner triangle and extend 600 mm - 920 mm beyond each side of the triangle base.

Other materials may be proposed by the Contractor who shall be solely responsible for their performance.

209-2.07 Vacant.

209-2.08 Silt Fence. Silt fence shall be listed in the Approved List. A silt fence assembly shall consist of silt fence geotextile, posts, and fasteners and may include mesh support consistent with the Approved List.

A. Posts. Posts shall meet the following requirements:
1. Either wood, metal, or synthetic posts may be used. Softwood post shall be 38 mm x 89 mm, hardwood post shall be at least 32 mm x 32 mm, steel post shall be "T" or "L" shaped in cross section, with a minimum weight of 2 kg/m.

2. Posts shall be a minimum of 1.2 m long and shall be spaced consistent with the material selected and as indicated in the Approved List.

B. Mesh Support. For those silt fence assemblies on the Approved List that require a mesh support, the support shall consist of 14 gauge (min) welded wire mesh with a maximum 150 mm x 150 mm opening or polymeric mesh. All mesh support shall be a minimum of 750 mm in height.

C. Fasteners. Fasteners shall be heavy duty staples, hog rings, tie wires, or any other fastener compatible with the post material.

209-2.09 Gravel Bag. Bags shall be fabricated from reinforced woven geotextile and shall include ties. No burlap bags shall be allowed. Coarse aggregate shall meet the gradation requirements of size designation #1 or #2 of Table 703-4 and shall be used as the fill material. Each gravel bag shall be individually tied and double bagged. The bag with fill material shall be inversely inserted into the second bag in order to prevent leakage.

209-2.10 Sand Bag. Sand bags shall meet the requirements of §209-2.09 Gravel Bag except that sand meeting the gradation requirements of §703-06 Cushion Sand shall be used as the fill material.

209-2.11 Pipe Slope Drain. Pipe slope drain materials may consist of new or used material in satisfactory condition and suitable for the intended use. The Engineer will reject used materials determined to be unsatisfactory. Pipe couplings shall be appropriate for the pipe and as recommended by the Manufacturer. End sections may be steel, aluminum, or polyethylene.

209-2.12 Rolled Erosion Control Products and Soil Stabilizers. These materials shall meet the requirements of §713-07 Jute Mesh Or Other Approved Erosion Control Materials and shall be of the Type and Class specified in the contract documents.

209-2.13 Stabilized Construction Entrance. Construction entrances shall consist of a geotextile, crushed stone or gravel and, if necessary, a drainage pipe to maintain ditch flow.

A. Geotextile. Geotextile shall meet the requirements of §207-2 Materials, Geotextile Stabilization, Strength Class 1.

B. Crushed Stone or Gravel. Crushed stone or gravel shall be 150 mm of coarse aggregate material meeting the gradation requirements of size designation #3 on Table 703-4.

C. Drainage Pipe. The Contractor shall provide a drainage pipe sized with sufficient capacity to carry ditch flow. The pipe dimension shall be consistent with the modified soil erosion and sediment control plan approved by the Engineer. The drainage pipe may consist of new or used material in satisfactory condition and suitable for the intended use. The Engineer will reject any materials determined to be unsatisfactory.

209-2.14 Temporary Pipe Inlet/Outlet Protection. The materials used shall be as indicated on the standard sheets.

209-2.15 Temporary Sediment Trap. The materials used shall be as indicated on the standard sheets.

A. Impervious Embankment In Place.

1. The impervious embankment material shall have the following gradation:
209-3 CONSTRUCTION DETAILS.

209-3.01 General. In the event of conflict between these specification requirements and pollution control laws, rules, regulations or permit conditions by other federal or state or local government agencies, the more restrictive laws, rules or regulations shall apply.

All work done under this section shall be performed consistent with §107-12 Water Quality Protection and included as part of the construction schedule submitted by the Contractor under §108-01 Start and Progress of Work. The Contractor’s schedules and methods shall be consistent with the soil erosion and sediment control plan included in the contract documents or the modified plan approved by the Engineer. The Contractor shall begin earthwork only after receiving written approval from the Engineer for the scheduling of earthwork and work covered under this section.

The Contractor shall designate to the Engineer an erosion and sediment control supervisor with adequate training, experience, and authority to implement and maintain all erosion and sediment control measures.

Perimeter sediment controls shall be installed prior to performing grubbing, excavation, and borrow or fill operations. The Contractor shall limit the area of clearing and grubbing, excavation, borrow and embankment operations in progress, commensurate with their capability and progress in keeping the finish grading, mulching, seeding and other temporary and/or permanent control measures current in accordance with the approved schedule. Under no condition shall earth material exposed by grubbing, excavation, borrow or fill or other work be left without application of temporary or permanent erosion controls for a period of greater than 7 days. The Engineer may determine that a potential for erosion or sediment transport exists and order the Contractor to install temporary erosion controls earlier. When permanent soil erosion and sediment control measures can not be installed due to seasonal or other limitations, temporary soil erosion and sediment control measures shall be installed. Prior to removing or disturbing any erosion or sediment control measure that may be required to be reestablished due to continual grading operations, the Contractor shall verify the proposed progression of operations and the reestablishment of control measures with the Engineer to ensure the continuity of erosion and sediment control.

Sediment control measures shall not be removed without the Engineer’s approval.

209-3.02 Inspection and Maintenance. Soil erosion and sediment control measures shall be inspected and maintained by the Contractor during the life of the project, including winter shutdown, etc. Such inspection and maintenance shall continue until after the permanent stabilization measures are in place and the temporary control measures are ordered to be removed by the Engineer. The remaining disturbed area shall be permanently stabilized as indicated in the contract documents.

All temporary controls shall be inspected by the Contractor every seven calendar days, after each rainfall of 12 mm or more within a 12 hour period, or daily during prolonged rainfall to determine if the measure is functioning as intended. All inspections shall be completed within one calendar day.

Within 3 calendar days from completion of the inspection, the Contractor shall:

• Repair or rebuild the control measure to function as originally intended.
• Remove sediment deposition which reaches one half the height of the control measure. All sediment deposits shall be considered unsuitable material and disposed of in accordance with §203-3.08, Disposal of Surplus Excavated Materials. Material shall be disposed of away from wetlands, water courses or other bodies of water.

Torn or punctured silt fence fabric may be repaired by the placement of a patch, on the upstream side, consisting of an additional layer of fabric over the damaged area, or replacement of the damaged section.
Where erosion control materials have been used on final grade that have been permanently seeded, the Contractor shall care for the areas until acceptance of the Contract or acceptance of the turf, whichever is later. Where necessary, such care may include, but is not limited to providing warning signs or barricades for protection against traffic. Any surfaces that have settled, become gullied, or otherwise damaged due to the Contractor’s operations shall be repaired at no additional expense to the state to re-establish the grade and soil conditions that existed prior to placing erosion control materials.

209-3.03 Temporary Mulch. The Contractor shall have the capability to mulch any disturbed areas on any given day (e.g., those areas where earthwork operations are ongoing, etc.). The Contractor shall apply mulch on disturbed areas consistent with the approved project schedule.

Mulch shall be spread uniformly in a continuous blanket at an approximate rate of 4 t/ha. Mulch may be spread by hand, mechanical spreaders, or blowers.

209-3.04 Temporary Seed and Mulch. The Contractor shall apply seed and mulch on disturbed areas consistent with the approved project schedule.

Prior to the application of seed, all areas where compaction has occurred shall be scarified. The seed bed shall be loose and friable for positive seed retention.

Ryegrasses shall be spread at a rate of 3.5 g/m2 to uniformly cover the ground. Cereal grasses shall be spread at a rate of 11.2 g/m2 to uniformly cover the ground. Seeds shall be evenly distributed by any method of sowing that does not injure the seeds in the process of spreading.

Mulch shall be spread immediately following application of seed. Mulch shall be spread uniformly in a continuous blanket at an approximate rate of 4 t/ha. Mulch may be spread by hand, mechanical spreaders, or blowers. Mulch and seed shall not be placed simultaneously, except in the case of hydroseeding.

209-3.05 Temporary Check Dam. Check dams shall be constructed where shown in the contract documents and in accordance with the standard sheets. A bedding type geotextile or stone scour protection shall be placed as indicated in the contract documents.

A. Prefabricated Check Dam. The length of each prefabricated check dam shall be as indicated in the contract documents. The dam shall be attached to the ground with wire staples. The staples shall be No. 11 gauge wire and be 150 mm - 210 mm long. Staples shall be placed as indicated in the contract documents.

The geotextile filter material shall be attached to the triangular frame by using wire ties or staples. The ties shall be placed evenly 0.3 m on center.

209-3.06 Temporary Haybale/Strawbale. Bales shall be placed with the cut ends vertical as shown in the contract documents. Each bale shall be embedded into the soil a minimum of 100 mm, and be securely anchored. Hardwood stakes shall be installed a minimum of 300 mm into the ground below the bale. The first stake in each bale shall be driven at an angle toward the previously laid bale to force the bales together.

209-3.07 Temporary Silt Fence. Unless otherwise detailed in the contract documents, silt fence shall be installed as follows:

1. Posts shall be driven into the ground.
2. Geotextile and any mesh support (if applicable) shall be placed on the upstream side of the posts.
3. The geotextile shall be fastened to each post in no less than 4 locations with approved fasteners.
4. The mesh support shall be fastened to each post at the top, bottom, and two additional evenly spaced locations, or by a continuous corded attachment along the top of the assembly.
5. Any geotextile or mesh splices necessary for fence erection shall be continuous between two post sections.
6. Geotextile at the bottom of the fence shall be buried in a trench to a depth of 150 mm. The trench shall be back filled with the excavated soil and the soil compacted by tamping.
§209

209-3.08 Temporary Sediment Trap. Sediment traps shall be constructed where shown in the contract documents and in accordance with the standard sheets.

A. Sand Bag Berm and Earth Berm.

1. The area under which the sand bag berm or earth berm will be constructed shall be cleared, grubbed and stripped of any vegetation and root mat. The pool area shall be cleared. All work shall be performed consistent with the requirements of §201-3 Construction Details.

2. The earth berm embankment shall be constructed consistent with the requirements of §203-Excavation & Embankment, except as herein modified. Immediately prior to placement of the impervious embankment material, the entire earth surface on or against which fill is to be placed, shall be thoroughly scarified to a depth of 150 mm and compacted to not less than 95 percent of Standard Proctor Maximum Density. Impervious embankment material shall then be deposited in horizontal layers not exceeding 200 mm in thickness prior to compaction. Each layer shall be compacted to not less than 95 percent of Standard Proctor Maximum Density. The moisture content of all impervious embankment material shall not be greater than 2 percent above Optimum Moisture Content as determined by A.A.S.H.T.O Designation: T-99, Method C at the time of compaction.

   Sand bag and ditch dam sediment traps shall be constructed as shown on the Standard Sheets.

3. All fill slopes shall be 2:1 or flatter. Cut slopes shall be 1:1 or flatter.

4. Temporary mulch and rolled erosion control product shall be applied to earth berm side slopes.

5. Excavate and install light stone at emergency spillway.

B. Riser and Outlet Pipe. The section of the riser above the embedment shall be perforated with 25 mm diameter holes or slits spaced 150 mm vertically and horizontally and placed in the concave portion of the riser pipe. No holes shall be made within 150 mm of the outlet pipe.

   The riser shall be wrapped with 6 mm to 12 mm hardware cloth wire then wrapped with Class A Geotextile Drainage Fabric. The geotextile shall extend 150 mm above the highest hole and 150 mm below the lowest hole. Where ends of geotextile come together, they shall be overlapped, folded and stapled to prevent bypass.

   Straps or connecting bands shall be used to hold the geotextile and wire fabric in place. They shall be placed at the top and bottom of the cloth.

   The riser shall be anchored with a steel plate base to prevent floatation. A 7 mm minimum thickness steel plate shall be attached and sealed to the riser by a continuous weld around the bottom to form a watertight connection. 600 mm of suitable material shall be placed on the plate and tamped.

   Fill material around the outlet pipe shall be hand compacted in four 100 mm layers. A minimum of 600 mm of hand compacted backfill shall be placed over the outlet pipe before crossing it with construction equipment.

   All outlet pipe connections shall be watertight.

C. Sediment Removal. Sediment shall be removed and trap restored to its original dimensions when the sediment has accumulated to ½ the design depth of the trap.

209-3.09 Vacant.

209-3.10 Temporary Pipe Slope Drain. Pipe slope drain shall be placed where shown in the contract documents and constructed in accordance with the standard sheets.

209-3.11 Drainage Structure Inlet Protection. Drainage structure inlet protection shall be placed where shown in the contract documents and constructed in accordance with the standard sheets.

209-3.12 Rolled Erosion Control Products and Soil Stabilizers. The time and method of placement shall be as specified in the contract documents and/or according to Manufacturer’s recommendations.

   For areas at final grade, all loose stones, clods, sticks, or other undesirable material shall be removed in accordance with the manufacturer’s recommendations or as specified elsewhere in the contract.
documents. In addition, those areas at final grade shall be scarified to a minimum depth of 25 mm immediately prior to installation, unless topsoil is being placed and the erosion control material will be installed within 2 workdays of topsoil placement.

A. Rolled Erosion Control Products.

1. Class II, Type A, Jute Mesh. Jute mesh shall be placed without stretching on the freshly prepared surface so that it lays loosely on the soil and in contact with the soil at all points; and then it shall be rolled or tamped firmly into the soil surface. The upper end of each roll shall be turned down and buried to a depth of 150 mm with the soil firmly tamped against it. Unless otherwise specified in the contract documents, check slots shall be constructed at 15 m intervals down the slope. The construction procedure shall consist of placing a fold of material 150 mm vertically into the ground and tamping soil firmly against it. Jute mesh shall be placed so that all edges shall have a minimum overlap of 150 mm. The ends of rolls shall be placed with the upgrade section on top. Jute mesh shall be held tightly to the soil by anchors driven firmly into the ground. Anchors shall be spaced not more than 1 m apart on the sides and along the centerline of all drainage ways. Jute mesh ends and check slots shall have anchors spaced at 300 mm intervals.

2. Class I, Other Class II, and Class III Rolled Erosion Control Products. These products shall be placed and firmly anchored as stated in the manufacturer’s instructions.

B. Class IV Soil Stabilizers. These materials shall be applied as recommended by the Manufacturer. Type A & B are intended to be applied with hydroseeding equipment. Type B may also be placed through dry spreading. When dry spreading method is used, the Contractor shall apply the material uniformly. Where applied, Type A shall be minimum of 6 mm thick. When Type A is used in conjunction with turf establishment, seeds must be sown separately and prior to the application of the soil stabilizer.

209-3.13 Construction Entrances. Construction entrances shall be placed where shown in the contract documents and constructed in accordance with the standard sheets.

The Contractor shall grade, including excavating or placing fill, to prepare the original ground surface for the placement of a stabilized pad of 150 mm of coarse aggregate material, underlain by a geotextile. If necessary, a drainage pipe shall be installed to maintain the capacity of the ditch. The pipe dimension shall be consistent with the modified soil erosion and sediment control plan approved by the Engineer. All areas cut or filled and not stabilized by the construction entrance material shall be covered with an erosion control treatment (temporary mulch, temporary seed and mulch, etc.) and shall be included in this pay item.

When washing is performed, the washing area within the construction entrance shall be located in an area which will drain into an approved sediment control measure(s).

The construction entrance shall be maintained in a condition which will prevent tracking or flowing of sediment onto the right-of-way. All sediment spilled, dropped, washed or tracked onto the right-of-way shall be removed immediately. In the event the entrance is no longer performing properly (i.e. the entrance aggregate becomes clogged with sediment), the Contractor shall top-dress the entrance with additional coarse aggregate material.

209-3.14 Temporary Pipe Inlet/Outlet Protection, Silt Fence. Temporary pipe inlet/outlet protection, silt fence, shall be placed where shown in the contract documents and constructed in accordance with the standard sheets.

209-4 METHOD OF MEASUREMENT. Measurement will be made for installation or reinstallation of temporary soil erosion and sediment controls shown in the contract documents.

209-4.01 Temporary Mulch. Measurement will only be made for work directed or approved by the Engineer. This work will be measured as the number of square meters of mulch to the nearest square meter.
§209

209-4.02 Temporary Seed and Mulch. Measurement will only be made for work directed or approved by the Engineer. This work will be measured as the number of square meters to the nearest square meter.

209-4.03 Temporary Check Dams. Stone, gravel, and sand bag check dams will be measured by the number of check dams. All other check dams will be measured by the number of meters to the nearest meter.

209-4.04 Temporary Haybale/Strawbale. Bales will be measured by the number of meters to the nearest meter.

209-4.05 Temporary Silt Fence. Silt fence will be measured by the number of meters of silt fence to the nearest meter. No measurement will be made for seams or overlaps.

209-4.06 Temporary Sediment Trap. Sediment traps will be measured by the number of traps.

209-4.07 Vacant.

209-4.08 Temporary Pipe Slope Drain. Pipe slope drain will be measured by the number of drains.

209-4.09 Drainage Structure Inlet Protection. Silt fence geotextile, and prefabricated drainage structure inlet protection measures will be measured by the number of meters to the nearest meter. Gravel bag measures will be measured by the number of cubic meters to the nearest cubic meter.

209-4.10 Rolled Erosion Control Products and Soil Stabilizers. Rolled erosion control products and soil stabilizers will be measured as the number of square meters to the nearest square meter.

209-4.11 Construction Entrances. Construction entrances shown in the contract documents will be measured by the number of square meters to the nearest square meter. Measurement will not be made for construction entrances associated with the contractor’s operations (e.g., staging areas, storage yards, borrow sites, etc.).

209-4.12 Temporary Pipe Inlet/Outlet Protection, Silt Fence. Temporary pipe inlet/outlet protection, silt fence, will be measured by the number of meters to the nearest meter.

209-5 BASIS OF PAYMENT.

209-5.01 General. The unit price bid for all work items shall include the cost of furnishing all labor, equipment, and materials necessary to satisfactorily complete the work as shown in the contract documents, including the cost of excavation associated with the removal of accumulated sediment and the installation of erosion and sediment control measures covered by this Section.

Progress payments will be made for check dams, turbidity curtain, silt fence, pipe slope drain, and sediment traps. Fifty percent of the price bid will be paid after installation. The remaining percentage will be paid when the temporary control measure is removed and the remaining area is permanently stabilized.

Payment will not be made for work which is attributed to the Contractor's negligence, carelessness or failure to install temporary or permanent controls in accordance with the contract documents.

209-5.02 Mulch. Mulching will only be paid for when directed or approved by the Engineer.

209-5.03 Seed and Mulch. Seed and mulch will only be paid for when directed or approved by the Engineer. In addition to the provisions of §209-5.01, the unit price bid for this item shall include water.

209-5.04 Sediment Trap - Temporary. In addition to the provisions of §209-5.01, the unit price bid for this item shall include bags, excavation, impervious embankment material, outlet pipe, riser assembly,
light stone filling, and geotextile. Temporary mulch and rolled erosion control product will be paid for under their respective items.

209-5.05 Pipe Slope Drain - Temporary. In addition to the provisions of §209-5.01, the unit price bid for this item shall include bales, pipe, pipe end sections, stone, and geotextile.

209-5.06 Construction Entrances. In addition to the provisions of §209-5.01, the unit price bid for this item shall include any erosion control treatments (temporary mulch, temporary seed and mulch, etc.) required to stabilize an erodible surface produced by the installation of the construction entrance, periodic top-dressing with additional coarse aggregate material, and washing station provisions.

Additional sediment control measures (silt fence, haybale/strawbale, sediment trap, etc.) required to control a washing area will be paid for under their respective item(s).

Payment will be made under:

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<th>Item No.</th>
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<th>Pay Unit</th>
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<td>Seed and Mulch - Temporary</td>
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SECTION 210 - REMOVAL AND DISPOSAL OF ASBESTOS CONTAINING
MATERIAL (BUILDINGS, BRIDGES AND HIGHWAYS)

210-1 DESCRIPTION. Under this specification, the Contractor shall remove and dispose of asbestos containing material from all locations of building(s), bridge(s) and/or highway(s) designated in the Contract Documents and/or where directed by the Engineer in accordance with: 12 NYCRR 56 or, if indicated, an approved variance thereof promulgated by the New York State Department of Labor (NYSDOL); the National Emission Standards for Hazardous Air Pollutants (NESHAP), promulgated by the United States Environmental Protection Agency (USEPA); and the Occupational Safety and Health Administration (OSHA).

Additional project specific requirements may be found on the plans or in the proposal in a note entitled "Asbestos Remediation Supplemental Requirements".

210-2 MATERIALS. All materials used in the performance of the work shall comply with all applicable regulatory standards. Respirators and filters shall comply with NIOSH and MSHA standards. HEPA filtration systems shall comply with ANSI Z9.2-79.

210-3 CONSTRUCTION DETAILS. Prior to beginning any work under this item, the Contractor shall supply the Engineer with proof that the firm performing the work has a valid asbestos handling license; that its insurance coverage whether provided by the Contractor or the Asbestos Subcontractor, is consistent with §107-06 Insurance and includes an asbestos specific occurrence type policy with no deductible or sunset clause; that its project supervisor is a NYSDOL certified asbestos project supervisor; that all employees engaged in the work are properly certified and have current physical examinations and respirator fit tests; and that the proper notification of work beginning on the asbestos project has been given to NYSDOL and USEPA. Also, after the work is completed, the Contractor shall provide the Engineer with a written certification ("Waste Shipment Record") that the material was disposed of in an approved waste disposal site. The certification shall include the name and address of the waste disposal site or sites used.

Unless indicated otherwise, the Contractor shall arrange and pay for all air quality monitoring required for regulatory compliance. The firm and persons engaged shall be: properly licensed and certified; independent of the Contractor or the Asbestos Contractor performing the asbestos work; properly insured; and approved in accordance with §108-05 Subletting or Assigning the Contract.

Asbestos containing material shall be disposed of in accordance with 40 CFR Part 61 and all other requirements and laws, rules, and regulations of Federal, State, or local agencies. Disposal sites which accept asbestos containing materials for disposal shall be permitted by the New York State Department of Environmental Conservation (NYSDEC) to accept such material for disposal. If disposed of out-of-state, the rules, regulations, and laws of that state shall apply.

In the event of a conflict between these specification requirements and laws, rules and regulations of Federal, State, or local agencies, the more restrictive of the specification or the laws, rules or regulations shall apply.

Two copies of Daily logs, Visitor Logs, OSHA Air Monitoring record, and New York State Department of Labor compliance air monitoring records shall be provided to the Engineer.
210-4 METHOD OF MEASUREMENT. The quantity of asbestos containing material to be measured for payment will be determined by one of the following methods, as indicated:

210-4.01 Square Meter. The quantity to be measured will be the area, measured to the nearest one tenth square meter, of asbestos containing material removed and disposed of in accordance with the contract documents and 12 NYCRR 56, or with the contract documents and an approved variance thereof.

210-4.02 Meter. The quantity to be measured will be the length, measured to the nearest one tenth meter, of asbestos containing material removed and disposed of in accordance with the contract documents and 12 NYCRR 56, or with the contract documents and an approved variance thereof.

210-4.03 Lump Sum. The quantity will be measured for payment on a lump sum basis. No actual measurements will be taken.

210-4.04 Fixed Price Lump Sum. The lump sum of money shown in the itemized proposal for this work will be considered the price bid even though payment will be made only for the work performed. Payments on contract will be based on one or both of the following:

A. Agreed Price. The Agreed Price will be based on a cost analysis submitted by the Contractor and agreed to by the State prior to performing the work. The submittal shall include a detailed estimate from the licensed asbestos removal contractor for the estimated cost of the removal and disposal.

B. Force Account. A separate Force Account will be maintained of the total asbestos removal work performed on each building, structure or highway to be worked on.

210-5 BASIS OF PAYMENT. Payment for the work, under this specification, shall include the cost of air quality monitoring, unless indicated elsewhere in the Contract Documents. Payment shall include all labor, materials, equipment, and asbestos related fees and insurances necessary to complete the asbestos removal and disposal work in accordance with the plans, specifications, and applicable Federal, State, and Local laws, rules, and regulations.

Payment shall not include “Jersey Barriers”, “Shadow Vehicles” and other Maintenance and Protection of Traffic devices outside the regulated asbestos work area required by specific Applicable Variances (AV) and/or Blanket Variances (BV) shall be paid under their respective Item(s), as specified in the Contract Documents.

210-5.01 Square Meter, Meter, or Lump Sum Bid Items. Payment for 75% of the completed quantity will be made upon the Project Monitor's written concurrence with the Contractor's certification as to the following: that the building, structure and/or highway is visually free of asbestos; that the removal of the asbestos containing material was performed as required; that the final clearance air monitoring results meet the acceptable level specified in 12 NYCRR 56; and, that the building(s), bridge(s) and/or highway(s) are certified by the Asbestos contractor to be available for normal demolition. If there is no Project Monitor on the project, the Engineer's concurrence with the Certification will be necessary before any payments can be made.

The remainder of the payment for completed work will be made upon receipt by the Engineer of a certified statement from the disposal facility, signed by an official thereof, that the asbestos containing material has been accepted and disposed of in accordance with all applicable laws, codes, rules, and regulations.

210-5.02 Fixed Price Lump Sum. The fixed price lump sum published in the proposal is an amount estimated by the State to be adequate to complete the work. The Contractor will not be obligated to complete the work within the amount published nor will the State by publishing the price be obligated to pay over to the Contractor the whole or any of the amount published. Payments under this work will be made by Force Account or by Agreed Price, or by a combination thereof, as agreed to by the State and the Contractor in writing prior to undertaking the work. Payments may total less than the lump sum amount.
§210

published in the proposal or, with an order-on-contract, may total more than the fixed price lump sum amount published in the proposal.

Payment for 75% of the Agreed Price or Force Account charges will be made upon the Project Monitor's written concurrence with the Contractor's certification as to the following: that the building, structure and/or highway is visually free of asbestos; the removal of the asbestos containing material was performed as required; that the final clearance air monitoring results meet the acceptable level specified in 12 NYCRR 56; and, that the building(s), bridge(s) and/or highway(s) are certified by the Asbestos contractor to be available for subsequent demolition and/or construction. If there is no Project Monitor on the project, the Engineer's concurrence with the Certification will be necessary before any payments can be released.

The remainder of the payment for completed work will be made upon receipt by the Engineer of a certified statement from the disposal facility, signed by an official thereof, that the asbestos containing material has been accepted and disposed of in accordance with all applicable laws, codes, rules, and regulations.

Asbestos specific insurance premiums will be reimbursed as the actual and identifiable cost of the portion of the premium attributable to the work performed under the Fixed Price Lump Sum Item. No overhead or profit will be allowed on asbestos specific insurance premiums.

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<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
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<tr>
<td>210.0102</td>
<td>Removal and Disposal of Asbestos-Containing Roofing Material</td>
<td>Square Meters</td>
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<td>210.0103</td>
<td>Removal and Disposal of Asbestos-Containing Roofing Material</td>
<td>Lump Sum</td>
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</tr>
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<td>210.0112</td>
<td>Removal and Disposal of Asbestos-Containing Roofing Material (BV 11)</td>
<td>Square Meters</td>
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</tr>
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<td>210.0122</td>
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Siding (Buildings)

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</table>
§210

NEW YORK STATE DEPARTMENT OF TRANSPORTATION
STANDARD SPECIFICATIONS of May 4, 2006

210.0222  Removal and Disposal of Asbestos-Containing Siding Material (AV 89)  Square Meters
210.0223  Removal and Disposal of Asbestos-Containing Siding Material (AV 89)  Lump Sum
210.0224  Removal and Disposal of Asbestos-Containing Siding Material (AV 89)  Fixed Price Lump Sum

Window Caulking and/or Glazing (Buildings)

210.0301  Removal and Disposal of Asbestos-Containing Window Caulking and/or Glazing  Meter
210.0303  Removal and Disposal of Asbestos-Containing Window Caulking and/or Glazing  Lump Sum
210.0304  Removal and Disposal of Asbestos-Containing Window Caulking and/or Glazing  Fixed Price Lump Sum
210.0311  Removal and Disposal of Asbestos-Containing Window Caulking and/or Glazing (BV 11)  Meter
210.0313  Removal and Disposal of Asbestos-Containing Window Caulking and/or Glazing (BV 11)  Lump Sum
210.0314  Removal and Disposal of Asbestos-Containing Window Caulking and/or Glazing (BV 11)  Fixed Price Lump Sum

Flooring (Buildings)

210.0402  Removal and Disposal of Asbestos-Containing Flooring and/or Mastic  Square Meter
210.0403  Removal and Disposal of Asbestos-Containing Flooring and/or Mastic  Lump Sum
210.0404  Removal and Disposal of Asbestos-Containing Flooring and/or Mastic  Fixed Price Lump Sum
210.0412  Removal and Disposal of Asbestos-Containing Flooring and/or Mastic (AV 120)  Square Meter
210.0413  Removal and Disposal of Asbestos-Containing Flooring and/or Mastic (AV 120)  Lump Sum
210.0414  Removal and Disposal of Asbestos-Containing Flooring and/or Mastic (AV 120)  Fixed Price Lump Sum

Ceilings (Buildings)

210.0502  Removal and Disposal of Asbestos-Containing Ceilings  Square Meters
210.0503  Removal and Disposal of Asbestos-Containing Ceilings  Lump Sum
210.0504  Removal and Disposal of Asbestos-Containing Ceilings  Fixed Price Lump Sum
210.0512  Removal and Disposal of Asbestos-Containing Ceilings (AV 86)  Square Meters
210.0513  Removal and Disposal of Asbestos-Containing Ceilings (AV 86)  Lump Sum
210.0514  Removal and Disposal of Asbestos-Containing Ceilings (AV 86)  Fixed Price Lump Sum

Thermal System Insulation (Buildings)

210.0601  Removal and Disposal of Asbestos-Containing Thermal System Insulation  Meters
§210

Removal and Disposal of Asbestos-Containing Thermal System Insulation

210.0602 Square Meters
210.0603 Lump Sum
210.0604 Fixed Price Lump Sum
210.0611 Meters
210.0613 Lump Sum
210.0614 Fixed Price Lump Sum
210.0621 Meters
210.0623 Lump Sum
210.0624 Fixed Price Lump Sum

Miscellaneous (Buildings)

210.4901 Meters
210.4902 Square Meters
210.4903 Lump Sum
210.4904 Fixed Price Lump Sum
210.4911 Meters
210.4912 Square Meters
210.4913 Lump Sum
210.4914 Fixed Price Lump Sum
210.4923 Lump Sum
210.4924 Fixed Price Lump Sum

Concrete Encased Pipe (Bridges & Highways)

210.5001 Meter
210.5003 Lump Sum
210.5004 Fixed Price Lump Sum
210.5011 Meter
210.5013 Lump Sum
210.5014 Fixed Price Lump Sum
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**Underground Pipe (Bridges & Highways)**

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<td>210.5133</td>
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</tr>
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</tr>
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**Suspended Pipe (Bridges & Highways)**

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<td>210.5201</td>
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<td>Removal and Disposal of Suspended Asbestos-Containing Pipe</td>
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<td>210.5204</td>
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<td>210.5211</td>
<td>Removal and Disposal of Suspended Asbestos-Containing Pipe (BV 3R1)</td>
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<td>210.5221</td>
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### §210

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#### Bond Breakers and/or Joint Fillers (Bridges & Highways)

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#### Caulking (Bridges & Highways)

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**Asphalt (Bridges & Highways)**

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</tr>
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<td>210.5512</td>
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**Miscellaneous (Bridges & Highways)**

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**Item Number Codes**

- **xx** Category
  - 01-49 Buildings, 49 Miscellaneous (Buildings)
  - 50-99 Bridges and Highways, 99 Miscellaneous (Bridges and Highways)
- **y** BV or AV
  - 1-9 In order of listing within the category, 0 No BV or AV
- **z** Payment Method
  - 1 Meters, 2 Square Meters, 3 Lump Sum, 4 Fixed Price Lump Sum
Section 300
BASES AND SUBBASES

SECTION 301 (VACANT)

SECTION 302 - BITUMINOUS STABILIZED COURSE

302-1 DESCRIPTION. This work shall consist of furnishing and placing a course of bituminous stabilized granular material and stabilized reclaimed asphalt pavement shoulder in conformance with this specification, the payment lines, and typical sections shown on the plans or as specified by the Engineer.

302-2 MATERIALS

302-2.01 General. The Contractor has the following options in furnishing a bituminous stabilized course:

Option A. Furnish a granular material conforming to the requirements of Option A under §302-2.03, mixed with an asphalt emulsion conforming to §702-3201. Requests to use any asphalt emulsion other than that specified must be approved by the Director, Geotechnical Engineering Bureau. The written request must state the type of asphalt emulsion for the proposed use and be accompanied by a sample (one liter minimum) of such. The Geotechnical Engineering Bureau will require at least fourteen (14) days to act upon the request, after receipt of the request and the sample.

Option B. Furnish a 19, 25 or 37.5 mm hot mix asphalt (HMA), mixed and placed in conformance with the Materials and Construction Details specified in Section 402, Hot Mix Asphalt (HMA) Pavements, except as modified herein.

Option C. Furnish a granular material conforming to the requirements of Option C under §302-2.03, mixed with the appropriate P.G. Binder specified in the contract and placed in accordance with the requirements of Section 402 except as modified herein. The amount of P.G. Binder for this option will be as ordered by the Engineer, but shall range between 6 and 8 percent by weight. Unless otherwise indicated by a Special Note in the Proposal, this option will be permitted only in Nassau and Suffolk Counties.

Before any Bituminous Stabilized Course is prepared, the Contractor shall take one of the following two actions:

- Notify the Engineer in writing as to which option is selected to furnish material under. Only this option will then apply for the entire project unless written approval is received from the Engineer.
- Submit to the Engineer for approval, a plan of the project delineating the areas where each option will apply. Exceptions to the approved plan during the course of the work shall be subject to advance written approval by the Engineer.

302-2.02 Tests and Control Methods. Materials tests and quality control methods pertaining to the work of this Section will be performed in conformance with the procedures contained in the appropriate Department publications which are current on the date of advertisement for bids. These publications are available upon request to the Regional Director or the Director, Geotechnical Engineering Bureau.

302-2.03 Granular Material Requirements for Options A and C. All borrow sources of granular materials for Options A and C shall be managed in accordance with the applicable provisions of §203-3.16, Borrow.

A. Gradation Requirements. The material for Options A and C shall conform to Table 302-1.


§302

B. Soundness. Granular materials will be accepted on the basis of a Magnesium Sulfate Soundness Loss after 4 cycles of 20 percent or less, unless other values are specified by a Special Note in the Proposal.

| Table 302-1 Gradation of Options A and C, Percent Passing by Weight |
|-------------------------|-----------------|-----------------|-----------------|--------------------|-----------------|-----------------|
| Sieve Option | 50 mm | 25 mm | 12.5 mm | 6.3 mm | 2.0 mm | 425 µm | 150 µm | 75 µm |
| A | 100 | 30-65 | 5-40 | 0-10
| C | 100 | 85-100 | 65-85 | 55-75 | 20-40 | 5-18 | 4-12

C. Plasticity Index. The plasticity index shall not exceed 5.0 for the granular material unless otherwise stated in the Proposal by a Special Note.

302-3 CONSTRUCTION DETAILS

302-3.01 Weather Limitations for Option A. This work will not be permitted on a subbase or subgrade containing frost, nor when the temperature of the surface on which the mixture is to be placed is below 7°C. All material placed under this section during any calendar year shall be mixed after March 1 of that year. No material shall be placed from the last Saturday of September to May 15, except with written permission of and under such special limitations and conditions as may be imposed by the Deputy Chief Engineer (Technical Services).

302-3.02 Equipment for Mixing Option A. All equipment for this work shall be subject to approval of the Engineer at all times. No work under this section will be permitted until all equipment and the processing facilities are established, inspected and approved.

Mixing shall be done with a rotating paddle shaft pugmill, providing suitable pressure-kneading action in mixing. Mixing by blading, shoveling and/or scooping will not be permitted.

The materials shall be mixed either at a central twin shaft pugmill mixing plant by the plant mix method, or on the roadbed (or some other area approved by the Engineer) by a traveling twin shaft pugmill, whichever equipment the Contractor elects to use.

The mixer shall be either a continuous or a batch type pugmill, designed to accurately proportion either by volume or by weight, so that when the granular material and bituminous material are incorporated in the mix, a thorough and uniform coating of the granular material will result. The pugmill mixer shall be provided with weighing, volumetric or other gauging equipment which shall be capable of providing accurate control at all times of the amount of granular material entering the mixer per time interval. The mixer shall be equipped to mechanically interlock the bituminous feed with the granular material feed, such that uniformity of the mixture is assured at all times. A water pump with meter shall be available to add water to the granular material, just prior to the addition of the bituminous material.

The mixer shall be equipped with a positive displacement meter for totalizing the quantity of bituminous material applied to the mixing chamber. A by-pass valve shall be placed on the bituminous line between the positive displacement meter and the spray bar in the pugmill to permit determination of the accuracy of the positive displacement meter. The Contractor shall furnish a clean 208 L drum having one end completely open, and a length of flexible hose to permit filling from the by-pass valve on the bituminous line.

Traveling pugmill mixing equipment shall not be operated at speeds greater than those recommended by the manufacturer for the depth of treatment and quantity of material used.

Where the materials are mixed at a central twin shaft pugmill mixing plant, the pugmill mixing chamber shall extend at least 1.2 m beyond the last point where the granular material, binder, and water are fed into the mixer, so that all materials will be completely and thoroughly mixed in the pugmill for a distance of at least 1.2 m. The pugmill paddles shall be of a type adjustable for angular position on the shaft, and shall be reversible to allow retardation of the flow of the mixer, in order to control the mixing time. A dam or baffle, if approved in writing by the Director, Geotechnical Engineering Bureau may be used for the purpose of retarding flow. A mechanically operated discharge hopper of at least 0.75 m³
capacity shall be provided. Sufficient clearance for a ten wheel dump truck shall be provided beneath the discharge hopper to permit calibration.

**302-3.03 Stockpiling and Sampling for Option A.** Before mixing with the bituminous material, the granular material shall be stockpiled, sampled and tested for approval as stipulated in §302-2.02.

**302-3.04 Mixing for Option A.** The proportion of bituminous material that shall be mixed with the granular material will range between 80 L/m³ and 95 L/m³ loose (uncompacted) measure. The actual proportion within this range, however, shall not be less than that determined by the Geotechnical Engineering Bureau and specified by the Engineer after the stockpiled granular material is sampled and tested. In computing the rate of application, the loose measure volume shall be determined by level filling a truck, having a minimum capacity of 6 m³, with granular material. No mixing will be allowed until the temperature of the granular material is 7°C or higher.

The moisture content of the granular material, based on the material passing 19.0 mm sieve, just prior to the addition of the bituminous material, shall be in the range of 4 to 8 percent. The acceptable moisture content within this range shall be determined by the Engineer.

All granular material removed from stockpiles for introduction into continuous twin shaft or traveling twin shaft pugmill mixers shall be by side excavation for the full height of the stockpile unless otherwise approved in writing by the Director, Geotechnical Engineering Bureau.

If mixed in a traveling plant, the method of transporting and introducing granular material from approved stockpiles into the mixer shall be as approved by the Engineer.

The application temperature of the bituminous material shall be designated by the Engineer and within the range specified in §702 for the bituminous material used.

After the granular material and bituminous material have been introduced into the pugmill, the mixing shall continue for a length of time necessary to uniformly coat the particles and to obtain a homogeneous mixture.

The discharge gates in a central plant shall not remain open during production of the stabilized mixture and shall only be opened in order to empty the hopper after the hopper becomes full. The discharged mixture may be immediately transported directly to the grade or stockpiles for later use.

The material shall be transported to the stockpile by dump truck haul. If the Contractor wishes to utilize a method other than dump truck haul to construct stockpiles, a request shall be submitted to the Director, Geotechnical Engineering Bureau. The request shall include the proposed method and type of equipment to be used.

Approval, if granted, will be based on the opinion of the Director, Geotechnical Engineering Bureau as to the capabilities of the proposal to provide a stockpile of uniformly mixed, uncontaminated material. If granted, such a waiver will remain in force only so long as all conditions for which the waiver is granted remain unchanged and a satisfactory material results.

**302-3.05 Transporting, Spreading, Compacting and Finishing of Option A.** If a central mixing plant is used, the mixture shall be transported from the mixing plant or stockpiles to the point of use in pneumatic tired vehicles, having tight bodies previously cleaned of all other materials. Approved mechanical spreading equipment shall be used for placing.

The mixture shall be spread in a thickness sufficient to produce the final compacted thickness shown on the plans. The maximum compacted thickness of any layer shall not exceed 100 mm.

After spreading, the mixture shall not be compacted until properly cured. Adequate curing shall be the responsibility of the Contractor, who shall take into account all factors, including weather and time of the year. Material that cannot be properly and adequately compacted to a stable condition shall be removed and replaced at no expense to the State. Compaction of the course shall be in accordance with the applicable provisions of §402-3.07, Compaction.

Successive layers shall not be placed until the underlying layer has been satisfactorily compacted and approved by the Engineer.

**302-3.06 Traffic.** The movement of highway traffic and construction equipment over this course may be permitted at locations designated by and in a manner under such restrictions as are ordered by the Engineer. Any damage occurring to the course as a result of traffic shall be repaired at no expense to the State as ordered by the Engineer.
302-3.07 Care of Adjoining Pavement. Where this course constitutes a base course for a shoulder, the Contractor shall organize the work and conduct the various operations so as to keep the surface of the adjacent pavement clean at all times, or shall bear the full expense of cleaning the pavement as ordered by the Engineer.

302-3.08 Tolerance. Where used as a base course supporting other pavement courses, the final surface elevation of this course shall not vary more than 6 mm above or below the design grade elevation at any location.

Where used as a shoulder base course, the surface elevation of this course shall not vary more than 6 mm above or below, true grade at any location.

302-3.09 Maintenance. The Contractor shall be required to maintain the bituminous stabilized course in good condition and in a manner satisfactory to the Engineer from the time work is begun until all work has been completed and accepted. Maintenance by the Contractor shall include immediate repairs of any defects, regardless of cause, that may occur.

302-3.10 Repairs. Repairs to the bituminous stabilized course shall be made in a manner that will assure restoration of a uniform surface and durability of the part repaired. A stabilized course that is either faulty, damaged or with low areas shall be repaired by replacing the stabilized course material to the full depth of treatment. When the extent of damage is essentially at the surface of the course and where the areas are low, the Contractor may elect to repair the course with a surface application of an approved, suitable, top course bituminous concrete mix, in lieu of a full depth material replacement.

302-4 METHOD OF MEASUREMENT. The quantity of Bituminous Stabilized Course to be measured for payment, will be the number of cubic meters of compacted material computed from the payment lines shown on the plans, the specifications, or as ordered by the Engineer.

302-5 BASIS OF PAYMENT. The unit price bid per cubic meter shall include the cost of furnishing all labor, materials and equipment, including bituminous material and water necessary to complete the work.

Any work by the Contractor required for the maintenance or repair of bituminous stabilized course prior to acceptance of the contract, shall be done at the Contractor’s expense.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>302.01</td>
<td>Bituminous Stabilized Course</td>
<td>Cubic Meter</td>
</tr>
</tbody>
</table>

SECTION 303 - OPTIONAL FLEXIBLE SHOULDER

303-1 DESCRIPTION. The work shall consist of furnishing and placing flexible shoulders where shown on the plans or where directed by the Engineer. The Contractor shall have the option of selecting from five (5) alternative flexible shoulder systems.

303-2 MATERIALS. Materials which shall be used and individual component course thickness are specified in the table below for the five (5) options:

<table>
<thead>
<tr>
<th>Table 303-1 Thickness of Courses (Millimeters)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option 1</td>
</tr>
<tr>
<td>Asphalt Concrete Type 6, (Type 7 if Indicated on Plans) §403-2</td>
</tr>
<tr>
<td>Bituminous Stabilized Course §302-2 (opt A or C)</td>
</tr>
<tr>
<td>Asphalt Concrete Type 3, Binder Course, §403-2</td>
</tr>
<tr>
<td>Asphalt Concrete Type 1, Base Course, §403-2</td>
</tr>
<tr>
<td>Subbase Course §304-2</td>
</tr>
</tbody>
</table>
Where the adjacent pavement is asphalt concrete and the new overlay surface course is 40 mm thick, then the thickness of the surface course of the shoulder may be increased to 40 mm and the course of Bituminous Stabilized Course (option 1), Type 1 Base Course (option 2), or Type 3 Binder Course (option 3) may be decreased by 15 mm.

Material requirements and quality control methods pertaining to this work shall be as required under Sections 302, 304, and 403 in conformance with the procedures contained in appropriate Department publications in effect on the date of advertisement for bids.

303-3 CONSTRUCTION DETAILS. The construction details shall be the same as those in Subsections 302-3, 304-3 and 403-3. Under options 3, 4 & 5, the Subbase Course material shall be placed at the same time as the underlying Subbase Course. For option 5, vibratory compaction equipment appearing on the current “Approved List - Bituminous Concrete Vibratory Compaction Equipment” shall be required if the entire 75 mm lift of asphalt concrete Type 3 is to be placed as a single lift. For option 4, the asphalt concrete shall be placed in two lifts.

303-4 METHOD OF MEASUREMENT. The quantity of Optional Flexible Shoulder shall be the number of square meters of satisfactorily completed shoulder computed from the payment lines on the plan or from revised payment lines established in writing by the Engineer.

303-5 BASIS OF PAYMENT. The unit price bid for this work shall include the cost of furnishing all labor, material and equipment necessary to complete the work.

When an asphalt concrete material is placed in one operation in both the shoulder and pavement area, a deduction from the weight delivered shall be made for the asphalt concrete placed in the shoulder. The quantity to be deducted will be determined by multiplying the computed volume of such material placed in the shoulder within the payment lines times a factor of 2.25 metric tons/cubic meter.

Payment will not be made for losses of material resulting from compaction, foundation settlement, erosion, or any other causes. The cost of such losses shall be included in the price bid for this item.

If the Contractor elects to use options 3, 4 or 5, the cost of the additional 25 mm of subbase course material necessary to bring the section to grade shall be included in the price bid for this item.

If there is an asphalt price adjustment provision in the contract, the adjustment to be made shall be computed assuming a conversion factor of one hundredth (0.01) of a metric ton of asphalt per square meter of Optional Flexible Shoulder.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item Description</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>303.01</td>
<td>Optional Flexible Shoulder</td>
<td>Square Meter</td>
</tr>
</tbody>
</table>

SECTION 304 - SUBBASE COURSE

304-1 DESCRIPTION

304-1.01 General. The work consists of furnishing, placing and compacting a subbase course in conformity with the lines, grades, thicknesses and typical sections shown on the plans, or as determined by field conditions and ordered in writing by the Engineer.

304-1.02 Optional Type. Unless otherwise stated in the plans or in the proposal, select any of the four (4) options as follows:

**Option A.** Subbase construction consisting of two (2) separate layers of Type 4 and Type 3 Subbase Course.

**Option B.** Subbase construction consisting of a single layer of Type 1 Subbase Course.

**Option C.** Subbase construction consisting of a single layer of Type 2 Subbase Course.

**Option D.** Subbase construction consisting of a single layer of Type 4 Subbase Course.
§304

304-1.03 Definitions. Deleterious: Any material that does not consist of concrete, asphalt, glass, brick, stone, sand, gravel or blast furnace slag, when these materials are used in subbase in conformance with the specification requirements, OR any material which, in the opinion of the Director, Geotechnical Engineering Bureau, may adversely affect the performance of the product either during handling, during construction, or in its final application.

304-2 MATERIALS

304-2.01 Test and Control Methods. The Department will perform materials tests and quality control methods pertaining to the work of this section in conformance with the procedures contained in the appropriate Departmental publications which are current on the date of advertisement for bids. These publications are available upon request to the Regional Director or the Director, Geotechnical Engineering Bureau.

304-2.02 Material Requirements. Provide suitable material conforming to the requirements of Section 203 and to the requirements contained herein.

Provide a subbase material which meets the specification material requirements and is within the Contractor’s capabilities to place and fine grade to the required tolerances. Should the subbase course become unstable at any time prior to the placement of the overlying course, correct the unstable condition to the satisfaction of the Engineer at no additional cost to the State. Perform any required modification prior to placing the material on the grade.

If used, glass shall conform to the applicable paragraph of Section 203.

If Recycled Portland Cement Concrete Aggregate (RCA) is used and it comes from other than a Department of Transportation project, provide documentation showing that the material obtained is from a NYSDEC registered or permitted construction and demolition (C&D) debris processing facility as specified in Section 360-16.1 of 6NYCRR Part 360, “Solid Waste Management Facilities”.

If Blast Furnace Slag is to be used, provide documentation showing that it has undergone a NYSDEC beneficial use determination (BUD) prior to its use as specified in 6NYCRR Part 360-1.15, “Solid Waste Management Facilities”.

For Types 1, 3 and 4 furnish materials consisting of approved Blast Furnace Slag, Stone, Sand, and Gravel, or blends of these materials with not more than 30 percent by weight of glass. Alternately, the following materials are also acceptable under these types as a replacement for the materials mentioned above:

Alternate A. At least 95 percent, by weight, of Recycled Portland Cement Concrete Aggregate (RCA), and free from organic and other deleterious material. This material may contain up to 5% by weight asphalt and/or brick.

Alternate B. A mixture of Recycled Portland Cement Concrete Aggregate (RCA) conforming to Alternate A above mixed with stone, sand, gravel or blast furnace slag. This material may contain up to 5% by weight asphalt and/or brick.

Alternate C. Bituminous material that is reclaimed from bituminous pavement and/or shoulders (Reclaimed Asphalt Pavement, or RAP) on a project constructed by the Department of Transportation and is well-graded from coarse to fine and free from organic or other deleterious material, including tar. This material is at least 95 percent, by weight, reclaimed bituminous material and has a maximum top size, at time of placement, of 50 mm. The gradation requirements for the different Types listed below do not apply when the material consists of RAP. No soundness or Plasticity Index testing will be required for this Alternate.

If, in the opinion of the Regional Geotechnical Engineer, this material becomes unstable during construction, it may be necessary to add a mixture of natural suitable material to the RAP. Acceptance of the final product shall be based on an evaluation by the Regional Geotechnical Engineer. Provide written documentation that the reclaimed bituminous material originated on a Department of Transportation project. Include an identifier, such as State Highway, Construction Contract or Departmental Project Identification Number (PIN).
For Type 2, furnish materials consisting of approved Blast Furnace Slag or of Stone which is the product of crushing or blasting ledge rock, or a blend of Blast Furnace Slag and of Stone.

A. Gradation. Gradation shall conform to Table 304-1.

<table>
<thead>
<tr>
<th>Sieve Size Designation</th>
<th>Type 1</th>
<th>Type 2</th>
<th>Type 3</th>
<th>Type 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 mm</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td>-</td>
</tr>
<tr>
<td>75 mm</td>
<td>100</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>50 mm</td>
<td>90 - 100</td>
<td>100</td>
<td>-</td>
<td>100</td>
</tr>
<tr>
<td>6.3 mm</td>
<td>30 - 65</td>
<td>25 - 60</td>
<td>30 - 75</td>
<td>30 - 65</td>
</tr>
<tr>
<td>425 µm</td>
<td>5 - 40</td>
<td>5 - 40</td>
<td>5 - 40</td>
<td>5 - 40</td>
</tr>
<tr>
<td>75 µm</td>
<td>0 - 10</td>
<td>0 - 10</td>
<td>0 - 10</td>
<td>0 - 10</td>
</tr>
</tbody>
</table>

B. Soundness. Material for Types 1, 2 and 4 will be accepted on the basis of Magnesium Sulfate Soundness Loss after four (4) cycles of 20 percent or less, unless material meeting the requirements of Alternate C (304-2.02) is used. Material for Type 3 will be accepted on the basis of a Magnesium Sulfate Soundness Loss after four (4) cycles of 30 percent or less.

C. Plasticity Index. The required Plasticity Index of the material passing the 425 µm mesh sieve is 5.0 or less.

D. Elongated Particles. A flat or elongated particle is defined herein as one which has its greatest dimension more than three (3) times its least dimension. Provide material consisting of particles where not more than 30 percent, by weight, of the particles retained on a 12.5 mm sieve are flat or elongated. When the State elects to test for this requirement, material with a percentage greater than 30 will be rejected. Acceptance for this requirement will normally be based on a visual inspection by the Engineer.

304-2.03 Stockpiling. Stockpile all material except as noted herein.

A. Material furnished under Type 3 will not be required to be stockpiled unless it contains RCA or glass.
B. Stockpiling of the reclaimed bituminous material for Alternate C is not required.

Stockpile construction requirements, sampling, testing and acceptance/rejection procedures are stipulated in the appropriate Departmental publication.

304-2.04 Material for Temporary Work. Material used as a subbase for the construction of temporary work may be approved by a Departmental Geotechnical Engineer by visual inspection in accordance with the procedure in the current Departmental publication. Do not incorporate material so approved into the final project without following the appropriate acceptance procedure for the item of intended use.

304-3 CONSTRUCTION DETAILS

304-3.01 General. Notify the Engineer in writing of which placement option, material option (if applicable) and/or material type is proposed for use, at least 14 calendar days prior to performing the work. If it is proposed that more than one option or type is to be used, submit a plan to the Engineer describing where each option or type is proposed for use. This plan must be approved by the Engineer prior to incorporating it into the project. The State reserves the right to disapprove the use of more than one option on a project. Use uniform subbase types and materials between the roadbed limits.
§304-3.02 Placement

- Place the upper course material on the grade in a manner to minimize segregation, using equipment and procedures approved by the Engineer. Do not perform uncontrolled spreading from piles dumped on the grade.
- The maximum compacted layer thickness is 380 mm, or as shown on the plans. In confined areas as defined by the Engineer the maximum compacted layer thickness is 150 mm. The minimum loose lift thickness is 1.5 times the maximum particle size.
- Place Type 1 with a minimum compacted layer thickness of 150 mm.
- Do not place Type 3 material within 100 mm of the bottom of a pavement course.
- Do not place materials blended with glass in contact with synthetic liners, geogrids, geotextiles or other geosynthetics. Ensure that glass incorporated into subbase is thoroughly mixed so that glass constitutes no more than 30 percent by weight anywhere in the subbase.
- When placing material under Option A, place and compact each material in a separate lift.

304-3.03 Compaction. When the moisture content is within the limits for proper compaction, compact the material in accordance with the requirements of §203-3.12, Compaction. Density tests are not required for the acceptance of these courses.

If a subbase course is disturbed by frost action prior to paving, re-compact the subbase where directed by the Engineer.

304-3.04 Traffic and Contamination. The movement of highway traffic over the final surface of the subbase may be permitted at locations designated by, and under such restrictions as ordered by the Engineer, provided such movements take place prior to the final finishing of this course to the specified tolerance. Do not allow highway traffic to move over subbase containing glass. The movement of construction equipment on this course may be permitted at locations designated by and under such restrictions as ordered by the Engineer. At locations where permission is granted for such movement, place and maintain the temporary surface of the course, upon which the construction traffic is running, at least 50 mm above the final surface of the course. Just prior to paving and after all construction traffic not required for the removal has ceased, remove the 50 mm protective layer, and prepare and compact the exposed surface of the course to the specified tolerance.

No payment will be made for furnishing, placing, maintaining, removing and disposing of the 50 mm thick protective layer. Include the cost thereof in the price bid for Subbase Course.

If, in the opinion of the Engineer, the subbase is damaged or mixed with the subgrade or any other material due to the Contractor’s operation, remove such material and replace it with the appropriate subbase material at no additional cost to the State.

304-3.05 Tolerance. Place Types 1, 2 or 4 so that after compaction the top surface of the course does not extend more than six (6) mm above nor more than six (6) mm below true grade for the course at any location. Place Type 3 course so that the finished surface does not extend above the true grade and surface for this course at any location.

304-4 METHOD OF MEASUREMENT

304-4.01 Subbase Course. The quantity is the number of cubic meters of material, computed from payment lines shown on the plans or, where changes have been ordered, from payment lines established by the Engineer.

304-5 BASIS OF PAYMENT

304-5.01 Subbase Course. The unit price bid for this work includes the cost of furnishing all labor, material and equipment necessary to complete the work. Include the cost of adding water in the price bid unless the items for furnishing and applying water are included in the contract. No direct payment will be made for losses of material resulting from compaction, foundation settlement, erosion, or any other cause. Include the cost of such losses in the price bid for this item. No deductions will be made for the volumes occupied by manholes, catch basins and other such objects.

No additional payment will be made for the protective layer, as stated in 304-3.04.
Progress payments will be made after the subbase course has been properly placed and compacted. Payment will be made at the unit price bid for seventy-five (75) percent of the quantity. The balance of the quantity will be paid for after the final finishing to the required tolerance and just prior to the placing of the next course.

**Payment will be made under:**

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>304.11</td>
<td>Subbase Course, Type 1</td>
<td>Cubic Meter</td>
</tr>
<tr>
<td>304.12</td>
<td>Subbase Course, Type 2</td>
<td>Cubic Meter</td>
</tr>
<tr>
<td>304.13</td>
<td>Subbase Course, Type 3</td>
<td>Cubic Meter</td>
</tr>
<tr>
<td>304.14</td>
<td>Subbase Course, Type 4</td>
<td>Cubic Meter</td>
</tr>
<tr>
<td>304.15</td>
<td>Subbase Course, Optional Type</td>
<td>Cubic Meter</td>
</tr>
</tbody>
</table>

**SECTIONS 305 AND 306 (VACANT)**

**SECTION 307 - HYDRATED LIME STABILIZED SUBGRADE**

**307-1 DESCRIPTION.** Hydrated lime stabilized subgrade shall consist of the in-place subgrade soil mixed uniformly with hydrated lime and moistened, compacted and cured in accordance with these specifications, the plans and as specified by the Engineer.

**307-2 MATERIALS**

**307-2.01 Lime Stabilization.** Materials for lime stabilization shall meet the requirements of the following:

- Water 712-01
- Hydrated Lime 712-04

Hydrated lime which has slaked prior to mixing, for any reason, shall not be incorporated in the work.

**307-2.02 Surface Treatment.** When a surface treatment is required to protect the completed lime stabilized course as specified in §307-3.11, the materials for surface treatment shall meet the following requirements:

- Asphalt Emulsion - (RS-2) 702-3101
- Coarse Aggregate - 1A size 703-02

**307-3 CONSTRUCTION DETAILS**

**307-3.01 Equipment.** No work will be permitted until all necessary equipment is on hand, inspected and approved by the Engineer.

**A. Scarifiers.** A grader-scarifier, heavy disc harrow, heavy plow or rotary pulverizing mixer shall be used for the initial scarification of the soil. The equipment shall be capable of scarifying the soil to the full depth of stabilized treatment.

**B. Mixers.** A rotary pulverizing mixer or heavy plow shall be used for all mixing of the hydrated lime with the subgrade soil. The use of a heavy plow will be permitted only if the rotary pulverizing mixer is not capable of adequately mixing the lime-soil mixture to the full depth of treatment. Rotary mixers shall be equivalent to the Seaman Duo-Stabilizer Model DS730 or the Brothers Master Mixer Model LSPRM84A.

**C. Lime Spreaders.** Spreading equipment shall be capable of uniformly distributing the lime without excess loss and at a specified rate.
§307

D. **Compactors.** Compaction equipment shall be selected as specified in §203-3.12, Compaction.

E. **Shaping.** Shaping of the stabilized course shall be accomplished with a motor-grader or equivalent equipment capable of shaping the surface to the required tolerances specified.

F. **Finish Rolling.** A smooth steel wheel tandem roller weighing between 7 to 9 metric tons shall be used for the finish rolling.

G. **Water Equipment.** Water shall be added to the soil with a pressure distributor or other suitable equipment capable of uniformly distributing the required amount.

307-3.02 **Weather Limitations.** Lime stabilization of the subgrade shall not be done when the subgrade temperature is below 5°C, nor in the period from October 15 to May 15, except by written permission of and under such special limitations as set forth by the Deputy Chief Engineer (Technical Services). The hydrated lime shall not be mixed with frozen subgrade soil or when the subgrade contains frost. Lime shall not be applied when wind conditions, as determined by the Engineer, are such that blowing lime becomes objectionable or hazardous to traffic, workers, and adjacent property owners.

307-3.03 **Protection and Safety.** Before lime is spread, the Contractor shall take necessary precautions and provide necessary equipment to protect all personnel and adjacent properties from lime dust created by the lime application and mixing operations. Safety goggles and lightweight filter masks shall be provided by the Contractor to all working personnel and shall be worn at all times during these operations.

307-3.04 **Preparation of Foundation.** Prior to the addition of any lime to the subgrade, the area to be stabilized shall be graded and shaped in close conformity to the typical sections, lines and grades as shown on the plans or as specified by the Engineer. Where the depth of lime stabilization exceeds 150 mm, the subgrade soil in excess of the 150 mm depth shall be removed, placed in windrows and processed as an additional lift.

307-3.05 **Scarifying.** The subgrade soil shall be scarified 150 mm deep to the width required for stabilization. The scarified material shall be partially pulverized by making one pass through the area with a pulverizing rotary mixer. The pulverizing portion of the scarifying operation may be deleted in some areas, where, as determined by the Engineer, the subgrade soils are excessively wet and sticky so that pulverizing with a rotary mixer is impractical.

307-3.06 **Application of Lime.** The hydrated lime shall be applied to the scarified material by an approved method and at the rate stipulated in the plans or as specified by the Engineer. A lime slurry, applied by an approved method and suitable equipment, will be permitted. Spreading equipment shall uniformly distribute the lime without excess loss. No equipment except that used for spreading and mixing shall be permitted to pass over the spread lime until it is mixed. The Engineer may require the spread lime to be sprinkled with water to reduce dusting.

307-3.07 **Primary Mixing.** After the required amount of lime has been uniformly spread, it shall be mixed into the subgrade to the full depth of treatment using a traveling rotary mixing machine or heavy plow. A minimum of three passes will be required to assure uniform incorporation of the hydrated lime. Water shall be added at the rate of up to 2000 L/metric ton of lime as required for the proper consistency.

The primary mixing operation shall be completed within four hours after application of the lime. At this time, all of the lime shall be thoroughly and uniformly incorporated into the subgrade to the full depth of treatment in such a manner that the result is a homogeneous, friable mixture of subgrade soil and lime, free from clods or lumps exceeding 50 mm in size. Where the required depth of stabilization exceeds 150 mm, the windrowed material in excess of the 150 mm depth shall be spread to the required lift thickness and processed, by the addition of lime and primary mixing, as specified for the first layer. Each additional layer, where required, shall be processed similarly.
Immediately after the primary mixing operations are completed for the full depth of treatment, the surface of the subgrade shall be shaped and lightly sealed with a pneumatic tired or smooth steel wheel roller. The surface shall be crowned so as to properly shed water if rain occurs.

307-3.08 Curing. Following primary mixing operations, the stabilized course shall be allowed to cure for at least 24 hours plus any additional time required for the lime to properly react with the subgrade soil. Curing periods in excess of 24 hours shall be as determined and specified by the Engineer. During the curing period, the surface of the material shall be kept moist to prevent drying and cracking, and maintained in a properly sealed and crowned condition as specified by the Engineer.

307-3.09 Secondary Mixing. Immediately after the completion of the curing period, the stabilized course shall again be completely mixed and pulverized to the full depth of stabilization by a rotary pulverizing mixer. Secondary mixing shall continue for at least three passes or until, as determined by the Engineer, the material is properly mixed and blended. Adjustments in water content shall be made during the secondary mixing operation to obtain the proper moisture content required for compaction.

307-3.10 Compaction, Shaping and Finishing. Compaction of the mixture shall begin immediately after completion of the secondary mixing operations and after the proper moisture content for compaction has been obtained. Compaction shall be in accordance with the requirements of §203-3.12, Compaction. After compaction and shaping, the surface of the course shall be finished-rolled by a smooth steel wheel tandem roller weighing between seven and nine metric tons. The secondary mixing, compaction, shaping and finishing operations shall be completed within eight hours after the start of the secondary mixing.

The surface of the finished stabilized subgrade course shall not extend above design grade at any location.

The thickness of the complete hydrated lime stabilized subgrade will be determined from measurements made in test holes located at random intervals not to exceed 150 m. The measured thickness shall not deviate from that shown on the plans or specified by the Engineer, by more than plus 40 mm or minus 25 mm. Areas of hydrated lime stabilized subgrade not meeting the specified thickness requirements shall be reconstructed.

The subbase course material shall be placed and compacted within two days after the lime stabilized subgrade course has been compacted, shaped and finished at that location. The surface of the treated subgrade shall be kept continuously moist up to the time of subbase material placement.

307-3.11 Surface Treatment Option. The Contractor may elect to defer placement of the subbase materials up to two weeks by placing a bituminous membrane, cationic asphalt emulsion, over the treated subgrade. The bituminous membrane must be placed within two days after the stabilized subgrade has been compacted and finished. The stabilized subgrade must be kept continuously moist prior to application of the bituminous membrane. The bituminous material shall be applied at a uniform rate 0.9 L/m$^2$ of treated subgrade. Where traffic is to operate on the treated subgrade, the bituminous membrane shall be chipped with a uniform coating of Size 1A aggregate applied at a rate of 8 kg/m$^2$ of treated subgrade.

307-4 METHOD OF MEASUREMENT

307-4.01 Hydrated Lime Stabilized Subgrade. The quantity of hydrated lime stabilized subgrade to be paid for will be the number of cubic meters of lime stabilized computed within the payment lines shown on the plans or otherwise specified in writing by the Engineer.

307-4.02 Furnishing and Applying Hydrated Lime. The quantity of hydrated lime to be paid for will be the number of metric tons of hydrated lime furnished and applied. Lime that has slaked prior to application and additional lime applied because of reduced lime content resulting from excessive thickness of the lime stabilized layer will not be measured for payment.
307-5 BASIS OF PAYMENT

307-5.01 Hydrated Lime Stabilized Subgrade. The unit price bid per cubic meter shall include the cost of furnishing all labor, equipment and materials necessary to complete the work, except that furnishing and applying water and hydrated lime will be paid for separately. No payment will be made for the asphalt emulsion or 1A stone chips, nor for any maintenance, repairs or reconstruction of the stabilized subgrade made before acceptance, nor for any losses of material which may result from compaction, erosion or any other causes.

307-5.02 Furnishing and Applying Hydrated Lime. The unit price bid for hydrated lime shall include the cost of all material, labor and equipment necessary to furnish, store, handle and apply hydrated lime in accordance with these specifications.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>307.01</td>
<td>Hydrated Lime Stabilized Subgrade</td>
<td>Cubic Meter</td>
</tr>
<tr>
<td>307.02</td>
<td>Furnishing and Applying Hydrated Lime</td>
<td>Metric Ton</td>
</tr>
</tbody>
</table>

SECTION 308 - SOIL CEMENT COURSE

308-1 DESCRIPTION. This work shall consist of furnishing and placing a course of Portland cement stabilized soil in accordance with these specifications and in reasonably close conformance to the lines, grades, and typical sections shown on the plans or as ordered by the Engineer.

308-2 MATERIALS. Materials used for this item shall conform to the following Sections of these Specifications:

- Portland Cement, Type 2 701-01
- Asphalt Emulsion (RS-2) 702-3101
- Coarse Aggregate - 1A size 703-02
- Water 712-01
- Calcium Chloride 712-02

Soil shall be graded from coarse to fine, free of topsoil, organic matter, and substances deleterious to the normal hardening of the soil cement mixture, and shall be subject to the approval of the Engineer at all times. The soil will be sampled by the Engineer prior to use and submitted to the Geotechnical Engineering Bureau to determine both its suitability and the cement content to be used. Frozen soil or soil containing frost shall not be used.

The soil material shall be stockpiled, sampled and tested before mixing in conformance with material tests and quality control methods contained in the appropriate Department publications which are current on the date of advertisement for bids. These publications are available upon request to the Regional Director or the Director, Geotechnical Engineering Bureau.

308-3 CONSTRUCTION DETAILS

308-3.01 Equipment. No work under this item will be permitted until all equipment and facilities involved are established, inspected and approved by the Engineer.

The materials shall be mixed in a central twin-shaft pugmill mixing plant or mixed on the roadbed by a traveling pugmill, whichever equipment the Contractor elects to use. Traveling pugmill mixing equipment shall not be operated at speeds greater than those recommended by the manufacturer for the depth of treatment and quantity of materials to be mixed.

Where the materials are mixed in a central twin-shaft pugmill mixing plant, the mixing area of the pugmill shall extend at least 1.2 m beyond the last point where the soil, cement, or water are fed into the mixer, so that all materials will be completely and thoroughly mixed in the pugmill for a distance of at least 1.2 m. The paddles of the pugmill shall be adjustable for angular position on the shaft, and shall be reversible to retard the flow of mixture in order to control the mixing time. Where the materials are mixed
at a central twin-shaft mixing plant, a hydraulically or mechanically operated discharge hopper of at least 0.75 m³ capacity shall be provided. Sufficient clearance for a ten-wheel dump truck shall be provided underneath the hopper.

The central mixer shall be either a continuous or batch type pugmill, and shall be designed to accurately proportion the mix either by volume or by weight. The pugmill mixer shall be provided with weighing, volumetric or other gauging equipment, which shall be capable of providing accurate control at all times of the amounts of soil and cement entering the mixer per time interval. The mixer shall be equipped with a method of mechanically interlocking the cement feed with the soil feed so that uniformity of the mixture will be assured at all times. A water pump and meter arrangement shall be available for addition of water to the soil and cement. The water supply line shall have a 90° T connection with a valve immediately downstream of the flow meter for calibration purposes. The meter shall be calibrated at least once a year under the direction of Department personnel.

A smooth steel wheel roller and a self-propelled pneumatic tired or self-propelled vibratory compactor shall be used for compaction. The minimum number of passes shall be determined by the Engineer, after field tests, and shall be such as to produce the specified minimum density for the full depth of the course. Cleated or tracked equipment will not be permitted on the soil cement course. In areas inaccessible to pneumatic tired compactors, or where maneuvering space is limited, impact rammers and/or vibratory equipment may be used provided the required density is obtained.

Equipment suitable for storing, handling, weighing, measuring, proportioning, controlling and applying or spreading the cement shall be used.

Equipment suitable for accurately metering, controlling and applying the water shall be used. If a pugmill mixer is used, all necessary water for mixing shall be added in the pugmill. If a rotary mixer is permitted and used, water for mixing shall be added through a spray bar in the mixing chamber.

308-3.02 Weather Limitations. Soil Cement Course shall not be placed between October 15 and May 15 nor when the air temperature in the shade is 5°C or lower. Soil cement course shall not be placed upon a frozen surface.

308-3.03 Preparation of Foundation. Before soil cement operations are begun, the area upon which the soil cement course is to be placed shall be graded, shaped, and compacted as required in conformance with the grades, lines, thicknesses and typical sections shown on the plans or as ordered by the Engineer.

The subgrade and any preceding course shall be compact and suitable to support the construction and compaction equipment without settlement or displacement. Soft or yielding subgrade shall be corrected and made stable before the soil cement course is placed.

308-3.04 Application of Calcium Chloride and Cement. Where required by a Special Note in the Proposal, the specified quantity of calcium chloride ordered by the Engineer in flake form shall be uniformly added to the soil before adding the cement.

Portland cement, in the amount ordered by the Engineer, shall be added uniformly to the soil material. The amount of cement ordered by the Engineer will range generally between 8 percent and 10 percent by weight.

The percentage of moisture in the soil, at the time of cement application, shall not exceed the quantity that will permit a uniform mixture of soil and cement during mixing operations and shall not exceed the optimum moisture content for the soil cement mixture, as determined by the Engineer.

Where a traveling pugmill mixer is used, cement that has been displaced or removed from the windrow regardless of cause, shall be replaced before mixing is started, at the Contractor's expense.

308-3.05 Mixing and Spreading. Immediately prior to mixing, the soil shall have a minimum temperature of 5°C. After the cement has been applied to the soil, it shall be immediately mixed with the soil. Mixing shall continue until the cement has been thoroughly blended with the soil to prevent the formation of cement balls when the water is applied. Immediately after the soil and cement have been thoroughly mixed, the full amount of water shall be applied uniformly and mixing shall be continued until an intimate and homogeneous blend of soil, cement and water has been obtained.

When water application and mixing have been completed, the percentage of moisture in the mixture based on oven-dry weights, shall not be below, nor more than two percent above, the specified optimum moisture content determined by the Engineer.
In order to minimize segregation of the mix, the discharge gates shall be kept closed until the hopper is filled to at least one-half of its capacity. After the hopper is emptied, the gates shall be closed until the hopper is refilled. The material shall then be discharged into clean trucks and transported directly to the grade.

The soil cement shall be spread on an accepted subgrade or preceding course immediately after mixing. If mixed in a central plant, approved mechanical spreading equipment shall be used and not more than 30 minutes shall elapse between the time of mixing the cement and the start of the compaction operation.

In case of rain between the time of adding cement and final finishing, the Engineer shall be the sole judge of what areas involved are satisfactory and what areas are not acceptable. Areas not acceptable to the Engineer shall be removed to the full depth of the soil cement course and properly replaced at the Contractor's expense for all labor, materials and equipment involved.

308-3.06 Compaction. Prior to the beginning of compaction, the mixture shall be in a loose condition for its full depth on the subbase course. As an immediate continuation of mixing operations, and after an initial breakdown pass with a smooth steel wheel roller, the loose mixture then shall be uniformly compacted, by a self-propelled pneumatic tired or self-propelled vibratory compactor, to the specified density. All areas and portions of this course shall be thoroughly and uniformly compacted for the full thickness of the course to a minimum dry density of 95 percent of the maximum density. During compaction, water shall be applied to the surface as determined and ordered by the Engineer, to maintain the optimum moisture content.

308-3.07 Finishing. During the compaction operations, shaping will be required to obtain the required surface and cross-section. During shaping operations it may be necessary to lightly scarify and broom-drag the surface in order to remove ridges or depressions in excess of the permitted tolerance. The resulting surface shall then be rolled with a smooth steel wheel roller, weighing not less than nine metric tons, or pneumatic tire rollers, or both. The final rolling shall be done by a smooth steel wheel roller.

Several applications of water may be required to keep the surface at the proper moisture content, as ordered by the Engineer, during the finishing operation. Water shall be applied by the pressure spray bar method. Compaction and finishing shall be done in such a manner as to produce, in not longer than two and one-half hours after completion of mixing, a smooth, dense surface, free of surface compaction planes, cracks, ridges or loose material. Immediately after rolling, the surface of the course shall be tested for trueness, transversely and longitudinally. The finished surface of the course shall not extend above, nor be greater than 15 mm below, true grade and surface at any location. Surface finishing shall be completed in daylight hours.

Any portion of this course which has a density less than that specified shall be corrected or removed and replaced to its full depth to meet these specifications, at the Contractor's expense.

308-3.08 Construction Joints. At the end of each day's construction, a straight transverse and/or longitudinal construction joint shall be formed by cutting back into the completed work to form a true vertical face, which shall be properly maintained until the abutting section is completed.

308-3.09 Curing and Surface Treatment. After the soil cement course has been finished as specified herein, it shall be continually protected against drying by the application of water, until the bituminous seal is applied. At least 48 hours shall elapse between the completion of the finishing operations and the application of the bituminous seal.

At the time the bituminous seal is applied, the soil cement surface shall be dense, free of all loose and extraneous material, and shall contain sufficient moisture to prevent penetration of the bituminous material. Water shall be applied in sufficient quantity to fill the surface voids of the soil cement immediately before the bituminous seal is applied. The bituminous seal shall be uniformly applied to the surface of the completed soil cement at the rate of approximately 0.7 L/m² to 1.4 L/m² with approved heating and distributing equipment. The exact rate and temperature of application to give complete coverage without excessive run-off will be as determined and ordered by the Engineer. No traffic, nor placement of an overlying course, will be permitted over the soil cement course within five days from the application of the bituminous seal. Where this course is utilized for maintaining traffic, the application of the bituminous material shall be immediately followed by the application of approved cover aggregate of
1A size at the rate of 10 kg/m² to 16 kg/m². The aggregate will be broomed and rolled as ordered by the Engineer.

When the air temperature may be expected to reach the freezing point, sufficient protection from freezing shall be given the soil cement for seven days after its construction and until it has hardened to the satisfaction of the Engineer.

**308-3.10 Traffic.** No traffic or hauling equipment other than that necessary for sealing, chipping or for placing the next course will be permitted over this course, unless specifically permitted by a Special Note in the Proposal.

**308-3.11 Maintenance.** The Contractor shall be required, within the limits of the contract, to maintain the soil cement in good condition and in a manner satisfactory to the Engineer from the time he first starts work until all work has been completed and accepted. Maintenance by the Contractor shall include immediate repairs of any defects, regardless of cause, that may occur. This work shall be done by the Contractor at its own expense, and repeated as often as may be necessary to keep the course continuously intact. Repairs are to be made in a manner to insure restoration of a uniform surface and durability of the part repaired. Faulty and damaged work, regardless of cause, shall be replaced for the full depth of the course by the Contractor at its own expense. Any low areas, regardless of cause, shall be remedied by replacing the material for the full depth of the course and not by adding a thin layer of soil cement to the completed work.

**308-4 METHOD OF MEASUREMENT.** The quantity to be paid for under this item will be the number of cubic meters of material computed within the payment lines shown on the plans or otherwise ordered in writing by the Engineer, and completed in accordance with the plans and specifications. The thickness of the surface treatment will not be included in the volume measured for payment.

**308-5 BASIS OF PAYMENT.** The unit bid price per cubic meter for this item will include the cost of furnishing all labor, equipment and materials necessary to complete the work, except that furnishing Portland cement, calcium chloride (where required), bituminous material, water equipment and applying water, will be paid for separately under their respective items.

No direct payment will be made for any maintenance, repairs and replacements made before acceptance, nor for any losses of material which may result from shrinkage, compaction, foundation settlement, waste, overflow, erosion, leakage or any other causes: the cost of such will be included in the price bid for this item.

*Payment will be made under:*

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>308.01</td>
<td>Soil Cement Course</td>
<td>Cubic Meter</td>
</tr>
</tbody>
</table>
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Section 400
HOT MIX ASPHALT

SECTION 401 - PLANT PRODUCTION

401-1 DESCRIPTION. The contractor is responsible for Quality Control (QC). QC is defined as all activities required to produce HMA that meets all specification requirements. The contractor will incorporate a Quality Control system for all plant production of hot mix asphalt (HMA) and assume responsibilities for all QC activities at the production facilities.

The contractor shall produce the HMA according to the specifications herein and provide production documentation. Quality Adjustment Factors (QAFs) will be used to assess HMA production quality and these factors will be applied to calculate a quality payment adjustment.

The State is responsible for Quality Assurance (QA). QA is defined as all activities performed by the State to assure that HMA production meets the specification requirements. The State will determine quality payment adjustments for each day’s production using a daily QAF obtained from the calculations of the average absolute values for volumetric and non-volumetric mixes in accordance with Materials Procedure (MP) 96-02, Quality Control and Quality Assurance Procedures for Quality Control Hot Mix Asphalt Production. The daily QAFs measure production variation from the mean of the specification limits.

401-2 MATERIALS. The provisions of §402-2, Materials, apply and are as modified herein. Produce HMA in accordance with the requirements outlined in this specification, including all applicable Test Methods and Materials Procedures. HMA mixture designs must be acceptable to the State prior to any HMA production.

The State reserves the right to suspend any mixture design when the mixture demonstrates unacceptable paving quality or exhibits properties that will affect the anticipated pavement performance.

401-2.01 Hot Mix Asphalt Designs. Produce HMA in accordance with the procedures outlined in NYSDOT’s Materials Method (MM) 5.16, Superpave Hot Mix Asphalt Mixture Design and Mixture Verification Procedures.

Formulate and submit a HMA design to the Regional Materials Engineer (RME) that satisfies all design criteria outlined in MM 5.16. When the submitted HMA design is assigned verification status, the design must be verified during production as outlined in MM 5.16. Notify the RME at least 24 hours prior to the start of verification status production. When producing under Verification Status, make necessary adjustments to control the process. Apply daily QAFs to both verification and production status mix designs. Mixtures produced under Verification Status, as outlined in MM 5.16, are allowed for use on State projects.

For any HMA permeable base and shim mixtures required by the contract documents, formulate and submit to the RME a job mix formula that satisfies the General Limits imposed by Table 401-1, Composition of Hot Mix Asphalt Mixtures.

401-2.02 Aggregates. Aggregate must be from a source approved by the State. Use fine aggregate that consists of materials conforming to the requirements of §703-01, Fine Aggregate. In addition, fine aggregate may consist of screenings, free from deleterious materials and manufactured from sources of stone, gravel, or slag meeting the requirements of §703-02, Coarse Aggregate.

Use coarse aggregate that consists either of crushed stone, crushed gravel, or crushed slag conforming to the requirements of §703-02, Coarse Aggregate and the requirements outlined in MM 5.16.

Use slag aggregate on State projects only when an alternate pay item which takes the mix yield differential into account is included on the plans or in the itemized proposal.

When coarse aggregates for the mixture are from more than one source or of more than one type of material, proportion and blend them to provide a uniform mixture.
### Table 401-1 Composition of Hot Mix Asphalt Mixtures

<table>
<thead>
<tr>
<th>Screen Sizes</th>
<th>Permeable Base Mixture Requirements</th>
<th>Type 1</th>
<th>Type 2</th>
<th>Shim Type 5</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>General Limits</td>
<td>Job Mix Tolerance</td>
<td>General Limits</td>
<td>Job Mix Tolerance</td>
</tr>
<tr>
<td></td>
<td>% Passing</td>
<td>%</td>
<td>% Passing</td>
<td>%</td>
</tr>
<tr>
<td>50.0 mm</td>
<td>100 -</td>
<td>-</td>
<td>100 -</td>
<td>-</td>
</tr>
<tr>
<td>37.5 mm</td>
<td>95-100 -</td>
<td>-</td>
<td>75-100 ±7</td>
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</tr>
<tr>
<td>25.0 mm</td>
<td>80-95 ±6</td>
<td>55-80 ±8</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>12.5 mm</td>
<td>30-60 ±6</td>
<td>23-42 ±7</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>6.3 mm</td>
<td>10-25 ±6</td>
<td>5-20 ±6</td>
<td>100 -</td>
<td>-</td>
</tr>
<tr>
<td>3.2 mm</td>
<td>3-15 ±6</td>
<td>2-15 ±4</td>
<td>80-100 ±6</td>
<td>-</td>
</tr>
<tr>
<td>850 µm</td>
<td>- -</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>425 µm</td>
<td>- -</td>
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<td>-</td>
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<tr>
<td>180 µm</td>
<td>- -</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>75 µm</td>
<td>0-4 ±2</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Asphalt Content, %</td>
<td>2.0-4.0</td>
<td>NA</td>
<td>2.5-4.5</td>
<td>NA</td>
</tr>
<tr>
<td>Mixing and Placing Temperature Range °C</td>
<td>110-150</td>
<td>110-150</td>
<td>120-165</td>
<td></td>
</tr>
</tbody>
</table>

**NOTES:**
1. All aggregate percentages are based on the total weight of the aggregate.
2. The asphalt content is based on the total weight of the mix. When using slag aggregates in the mix, the asphalt content shall be increased accordingly, a minimum of 25 percent for an all slag mix.
3. Use a PG binder appropriate for the project location as specified in Table 6-4 of the Comprehensive Pavement Design Manual.

### A. Coarse Aggregate Type F1 Conditions

1. Limestone, dolomite or a blend of the two having an acid-insoluble residue content of not less than 20.0%.
2. Sandstone, granite, chert, traprock, ore tailings, slag or other similar noncarbonate materials.
3. Gravel, or a natural or manufactured blend of the following types of materials: limestone, dolomite, gravel, sandstone, granite, chert, traprock, ore tailings, slag or other similar materials, meeting the following requirements:
   a. 12.5 mm Nominal Maximum Size Aggregate Mixes. Noncarbonate plus 3.2 mm particles must comprise a minimum of 30.0% of the total aggregate (by weight with adjustments to equivalent volumes for materials of different specific gravities). Additionally, a minimum of 95.0% of plus 9.5 mm particles must be non-carbonate.
   b. 9.5 mm Nominal Maximum Size Aggregate Mixes. Noncarbonate plus 3.2 mm particles must comprise a minimum of 30.0% of the total aggregate (by weight with adjustments to equivalent volumes for materials of different specific gravities). Additionally, a minimum of 95.0% of plus 4.75 mm particles must be non-carbonate.

### B. Coarse Aggregate Type F2 Conditions

1. Limestone, dolomite, or a blend of the two having an acid-insoluble residue content of not less than 20.0%.
2. Sandstone, granite, chert, traprock, ore tailings, slag or other similar noncarbonate materials.
3. Gravel, or a natural or manufactured blend of the following types of materials: limestone, dolomite, gravel, sandstone, granite, chert, traprock, ore tailings, slag or other similar materials, meeting the following requirements:

a. 12.5 mm Nominal Maximum Size Aggregate Mixes. Noncarbonate plus 3.2 mm particles must comprise a minimum of 10.0% of the total aggregate (by weight with adjustments to equivalent volumes for materials of different specific gravities). Additionally, a minimum of 20.0% of plus 9.5 mm particles must be noncarbonate.

b. 9.5 mm Nominal Maximum Size Aggregate Mixes. Noncarbonate plus 3.2 mm particles must comprise a minimum of 10.0% of the total aggregate (by weight with adjustments to equivalent volumes for materials of different specific gravities). Additionally, a minimum of 20.0% of plus 4.75 mm particles must be noncarbonate.

C. Coarse Aggregate Type F3 Conditions

1. Limestone or a blend of limestone and dolomite having an acid-insoluble residue content of not less than 20.0%.
2. Dolomite.
3. Sandstone, granite, chert, traprock, ore tailings, slag or other similar noncarbonate materials.
4. Gravel, or a natural or manufactured blend of the following types of materials: limestone, dolomite, gravel, sandstone, granite, chert, traprock, ore tailings, slag or other similar materials, meeting the following requirements:

a. 12.5 mm Nominal Maximum Size Aggregate Mixes. Noncarbonate plus 3.2 mm particles must comprise a minimum of 10.0% of the total aggregate (by weight with adjustments to equivalent volumes for materials of different specific gravities). Additionally, a minimum of 20.0% of plus 9.5 mm particles must be noncarbonate.

b. 9.5 mm Nominal Maximum Size Aggregate Mixes. Noncarbonate plus 3.2 mm particles must comprise a minimum of 10.0% of the total aggregate (by weight with adjustments to equivalent volumes for materials of different specific gravities). Additionally, a minimum of 20.0% of plus 4.75 mm particles must be noncarbonate.

D. Coarse Aggregate Type F9 Conditions. Use coarse aggregate meeting the requirements of §703-02, Coarse Aggregate.

401-2.03 Mineral Filler. Mineral filler will conform to the requirements of §703-08, Mineral Filler.

401-2.04 Performance-Graded Binder. Use the Performance-Graded Binder (PG Binder) in the production of these mixtures that meets the AASHTO MP1 - Standard Specification for Performance-Graded Asphalt Binder.

Initial acceptance of the PG Binder is based on the primary source appearing on the State’s Approved List for Bituminous Material Primary Sources, A. Performance-Graded Binders for Paving. Acceptance of the PG Binder is contingent upon satisfactory test results from samples taken, as required by the State’s procedural directives, at the location where the material is incorporated into the work. A primary source is defined as a firm that samples, tests, and certifies by Production Lot that the PG Binder is in conformance with the specifications. The procedural directives for sampling, testing, and certifying the PG Binder, and for achieving and maintaining approved list status, are available from the Materials Bureau.

The temperature of PG Binder delivered to the HMA Production Facility will not exceed 175°C, unless the PG Binder supplier recommends it.

401-2.05 Reclaimed Asphalt Pavement. Reclaimed Asphalt Pavement (RAP) will meet the requirements as written in MM 5.16.

401-3 CONSTRUCTION DETAILS.
§401-3.01 Quality Control. Perform all sampling and testing in accordance with procedures supplied by or approved by the State. Document all QC test results and records in a legible manner and provide them to the State at the end of each production season or when requested by the RME. HMA produced without the required sampling, testing and documentation may be rejected.

A. Control Plan. Provide a control plan for each HMA mixing plant. Only one control plan is needed when more than one plant is located at the same site. Identify all plants at the site in the control plan.

List the personnel associated with HMA production, including the names and their functions necessary to implement the QC program. Include in the list, the control plan administrator, designated assistant, QC personnel, and phone numbers. Assume the responsibility of administration of the control plan.

Submit the control plan to the RME for initial approval at least 15 working days prior to HMA production for the State from the facility. After the control plan has been assigned initial approval, submit a statement outlining the control plan status to the RME each subsequent year at least 15 working days prior to any HMA production. Also, submit amendments to the control plan, or personnel changes for approval annually prior to production and as changes occur during the construction season. The State reserves the right to suspend production in the event the control plan is not followed. Control plan guidelines are available from the RME.

B. Quality Control Organization

1. Plan Administrator. The plan administrator is a representative of the HMA manufacturer and will have full authority to institute all operations of the control plan. The plan administrator is responsible to ensure all requirements are in conformance with the specification. The plan administrator's signature will be legally binding. One plan administrator is allowed to be responsible for multiple production locations. An assistant plan administrator may be designated in the absence of the plan administrator. The plan administrator or assistant must be available to communicate with the State personnel at all times. The State reserves the right to stop production when the plan administrator or designee is not available. In addition, the plan administrator is responsible for the following:

a. Location and control of friction aggregate stockpiles.
b. Outlining testing frequencies, testing procedures, and documentation procedures.
c. Periodic verification during production that the proper friction aggregate and the correct amount of friction aggregate is being included into the State mixes as outlined in NYSDOT’s Materials Method (MM) 28, Friction Aggregate Control and Test Procedures.
d. Documentation of all friction related activities (e.g. corrections to problems, modifications to friction aggregate mix controls and routine friction aggregate inspections during production) on NYSDOT form BR 303 Quality Control Daily Diary.

2. Quality Control Technician (QCT). The QCT must possess a current New York Construction Materials Association Certification or its equivalent, as determined by the Director, Materials Bureau. The production facility must have a sufficient number of QCTs to perform QC sampling and testing, but at least one certified QCT at each production facility site. Non-certified technicians may be utilized to augment the certified QCT. HMA production is not acceptable unless the certified QCT is present during production. A certified QCT is not required to be present for HMA production of 150 metric tons or less, if approved by the RME. Technicians associated with private testing organizations must meet the requirements specified above.

The State reserves the right to stop plant production in the event unacceptable technician performance is noted. The RME or representative will immediately inform the plan administrator regarding the reasons for stopping production operations.

The State may require the HMA manufacturer to replace unacceptable technicians before HMA production is allowed to continue.
**401-3.02 Production Facility Laboratory.** Maintain an approved production facility site laboratory to perform all required HMA sampling and testing. All sampling and testing equipment must meet the requirements pertaining to test procedures detailed in this specification. Unless otherwise outlined in the MM 5.16, calibrate all testing equipment requiring calibration annually and certify that all testing equipment meets the required operational tolerances. The State will perform verification of the production facility site laboratory and testing equipment annually. Additional verification will be performed when deemed necessary. Make laboratory sampling and testing equipment available to the State’s QA personnel. The requirements specified in §401-3.08 A.13. Inspection Facilities, apply.

**401-3.03 Plant Lots and Sublots.** Determine plant lots and sublots on a daily basis in accordance with MP 96-02.

A plant lot is defined as the quantity in metric tons of HMA produced per plant for each mix design in one day. When different mix designs are produced on the same day, then each mix design represents a separate plant lot. For each mix design produced, number the plant lots consecutively (1-200) throughout the production season starting with the number one at the beginning of each calendar year’s production and increase the lot number by one for each day’s production.

Plant lots are subdivided into sublots and are based on anticipated daily production. A sublot is defined as a portion of a plant lot not to exceed 1250 metric tons. When production exceeds 1250 metric tons and the excess is not greater than 150 metric tons, incorporate the excess into the previous sublot. Sublots are assigned a consecutive letter (A-E) and begins with “A” each production day.

QC testing is allowed on any portion of a plant lot, including any production less than 150 tons, as documented in the Control Plans, when an option of testing quantities less than 150 metric tons is selected.

QC testing is not required on the first or last 150 metric ton portion of a lot. This testing exclusion does not apply for lots greater than 150 but less than 300 metric tons, retest samples, or any sample obtained when production is terminated before the anticipated production for that plant lot. When a lot is greater than 150 but less than 300 metric tons, obtain a sample from the portion greater than 150 metric tons.

When production stops before a sublot sample is obtained, incorporate the untested sublot quantity into the previous sublot of the same day. If there is no previous sublot to incorporate it into, the untested sublot quantity is considered a plant lot and the QAF for that amount will be 1.00. Do not incorporate untested sublot quantities into any subsequent or previous day’s plant lot production. When production stops after a sublot sample is obtained and the quantity is less than 1250 metric tons, it is still considered a sublot.

A retest may be performed on any portion of a plant sublot providing the retest sample is obtained after the required random sample. The retest sample does not have to be obtained randomly. When a sublot is retested, average the absolute difference test value from the retest sample with the required random sample’s absolute difference test value. This average represents the sublot’s test value in the calculation of the daily QAF. When a retest is performed, document all actions on NYSDOT form BR 303, Quality Control Plant Diary.

When the daily plant lot quantity is between 150 metric tons and 500 metric tons, report the daily QAF as 1.00 providing the required QC sample yields a QAF between 0.90 and 1.00. If the required test result yields a QAF greater than 1.00, report the actual QAF. If the required test result yields a QAF less than 0.90, the State will evaluate the subject production in accordance with procedures outlined in §401-4, Method of Measurement.

**A. Certified Lot Production.** HMA production without the required QC testing is allowed to be certified for plant lot quantities of 150 metric tons or less. Certified plant lots have a QAF of 1.00. All certified production must meet the requirements outlined in this specification. Obtain friction aggregate samples as outlined in MM 28 for all certified production placed in pavement courses requiring friction aggregate. Transmit BR-307, Quality Control HMA Certification, to the Project Engineer on a daily basis for the quantity of certified production.

**B. Volumetric Mixture Storage.** When volumetric mixtures are stored prior to delivery, incorporate the stored quantity into the plant lot associated with the date of delivery. If there is no production to incorporate into, consider the stored quantity a new plant lot.
C. Non-Volumetric Mixture Storage. When non-volumetric mixtures are stored prior to delivery, incorporate the stored quantity into the plant lot associated with the date of production. The lot number and daily QAF determined during production will be associated with the stored quantity.

D. Night Production. During night production, associate the plant lots as specified in this subsection. If continuously producing for a calendar day or more, the plant lot will be defined when the plant’s employee shift change occurs. Notify the RME which option will be used at least one day prior to any production of this type.

E. Highway Permit Production. HMA production supplied to highway permit projects will meet all requirements outlined in this specification. Quality payment adjustments are not applicable. However, all HMA production placed is subject to rejection as outlined in §401-2 Materials.

401-3.04 Quality Control Sampling and Testing. Obtain QC samples as outlined in MP 96-02. The QCT will perform QC sampling and testing meeting the requirements outlined in §401-3.01 B. 2, Quality Control Technician. The State will determine Daily QAFs using the QCT’s test results as outlined in §401-3.03 and §401-3.04.

QC test procedures are verified by the Quality Assurance Technician (QAT), a State’s representative, on a random basis by split sample testing. The QC sample is split into two representative samples and individually tested by the QCT and the QAT. The QAT’s test results are compared to the QCT’s test results.

The QCT/QAT test results must be within the allowable tolerances outlined in Table 401-2, Allowable Split Sample Testing Tolerances.

<table>
<thead>
<tr>
<th>Test Property</th>
<th>Tolerance</th>
<th>Within Lab</th>
<th>Lab to Lab</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gradation ≥ 425 µm Sieve</td>
<td>5.0 %</td>
<td>7.0 %</td>
<td></td>
</tr>
<tr>
<td>Gradation &lt; 425 µm Sieve</td>
<td>2.0 %</td>
<td>3.0 %</td>
<td></td>
</tr>
<tr>
<td>Bulk Specific Gravity</td>
<td>0.020</td>
<td>0.028</td>
<td></td>
</tr>
<tr>
<td>Maximum Specific Gravity</td>
<td>0.011</td>
<td>0.019</td>
<td></td>
</tr>
</tbody>
</table>

When the test results exceed the allowable tolerance, perform a split sample retest on the test property that exceeded the allowable tolerance. The retest must be performed on the day the material is produced or delivered. When the retest exceeds the allowable tolerance, the State will terminate the production and all QC test results up to this point will be used to determine the daily QAF. Production is not allowed until the RME is satisfied that the cause for the excessive deviation in the split sample verification is resolved.

Obtain all required HMA samples, including the maximum specific gravity and a composite aggregate (hot bin) split sample. Obtain a minimum of one aggregate split sample per day for each mix type produced. Prepare the HMA specimens and reduce the aggregate split sample to testing size in accordance with MM 5.16. Dry the composite aggregate samples and air dry the compacted specimens and the maximum specific gravity samples prior to packaging. Package hot bin aggregate samples separately by hot bins and retain all samples together. Identify and retain all the samples at the production site for a minimum of ten (10) business days. The identification of the retained samples will include the facility number, production date, plant lot, sublot, and mix description.

Unless directed by the RME, discard all retained specimens and samples at the end of the specified time period. The State reserves the right to witness any or all QC sampling and testing, and test any or all retained samples.

Perform all sampling and testing using test procedures and frequencies outlined in Table 401-3, Quality Control Sampling and Testing.

A. Random Sampling. Obtain QC samples for aggregate and HMA randomly using the procedures outlined in MP 96-02. Random sample numbers may be re-selected to accommodate
changes in anticipated production quantity. Obtain other required QC samples as outlined in B. Quality Control Testing, and Table 401-3, Quality Control Sampling and Testing.

**B. Quality Control Testing**

1. **Aggregate Gradation.** Perform the aggregate gradation analysis using the procedures outlined in AASHTO T-27, Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregate. An ignition furnace can be used to prepare samples for an aggregate gradations analysis using the procedures outlined in Test Method NY 400-13C.

   a. **Volumetric Design Mixes.** Perform an aggregate gradation analysis on every other sublot produced. Perform a minimum of one gradation analysis per day for each HMA mix design used for production. Determine aggregate consensus properties and specific gravities at the beginning of each production season and subsequently at the midpoint of the production season using test methods outlined in MM 5.16. Coarse aggregate specific gravity may be determined on a composite aggregate blend in-lieu of testing each aggregate size designation (i.e., 1A’s, 1’s, and 2’s).

   b. **Non-Volumetric Design Mixes.** Perform an aggregate gradation analysis on every sublot for each HMA mix design used for production.

<table>
<thead>
<tr>
<th>TABLE 401-3 QUALITY CONTROL SAMPLING AND TESTING</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Plant Test</strong></td>
</tr>
<tr>
<td>Aggregate Gradation</td>
</tr>
<tr>
<td>Aggregate Moisture</td>
</tr>
<tr>
<td>Air Voids</td>
</tr>
<tr>
<td>Mix Moisture</td>
</tr>
<tr>
<td>Mix Temperature</td>
</tr>
<tr>
<td>Asphalt Binder Content</td>
</tr>
<tr>
<td>RAP Binder Content</td>
</tr>
<tr>
<td>RAP Gradation</td>
</tr>
<tr>
<td>RAP Moisture</td>
</tr>
<tr>
<td>Asphalt Binder Sampling</td>
</tr>
<tr>
<td>Friction Aggregate</td>
</tr>
</tbody>
</table>

**NOTES:**

1. Volumetric design mixes - one test every other sublot, minimum one per day.
   Non-Volumetric design mixes - one test every sublot.
2. Required for drum mix plants, or as requested by the RME for batch plants.
3. Required for volumetric design mixes.
4. Required for batch and drum mix plants when producing recycled mixes.
5. The State is responsible for sample submission.
6. Required for drum mix plants only.

b. **Non-Volumetric Design Mixes.** Perform an aggregate gradation analysis on every sublot for each HMA mix design used for production.
**2. Air Void Analysis - Volumetric Design Mixes.** Perform an air void analysis for each sublot of volumetric HMA mix design used for production. Use HMA samples obtained from the delivery vehicle. When holding bins are used for storage, perform the air void analysis on HMA samples taken after storage. Perform the air void analysis using procedures outlined in MM 5.16.

When performing the air void analysis, use Table 401-4, Allowable Specimen Tolerance Range, to determine if sample specimens are valid for analysis. The Allowable Specimen Tolerance Range listed in Table 401-4 is applicable to all QC and retest samples. The difference between the specimen test results should not exceed the tolerance range values in Table 401-4. If the results exceed the allowable tolerance range, the specimens are not valid and the test results will not be used in the calculation of the daily QAF.

<table>
<thead>
<tr>
<th>TABLE 401-4 ALLOWABLE SPECIMEN TOLERANCE RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mix Types</td>
</tr>
<tr>
<td>All Mix Types except the 37.5 mm Maximum Sp.Gr</td>
</tr>
<tr>
<td>Number of Specimens</td>
</tr>
<tr>
<td>2 .020 .011 .019</td>
</tr>
<tr>
<td>3 .023 ------ ------</td>
</tr>
<tr>
<td>4 .025 ------ ------</td>
</tr>
</tbody>
</table>

When a plant lot consists of one sublot and the test specimen value exceeds the allowable tolerance, perform a retest. If production is terminated before a retest sample can be obtained, the QAF for that plant lot will be reported as 1.00. When a plant lot consists of multiple sublots and the test specimen value for a sublot exceeds the allowable tolerance, perform a retest on the material within that sublot. If a retest is not or cannot be performed, use an absolute difference value of 0.92 for that sublot to calculate the plant lot daily QAF in accordance with MP 96-02.

**3. Determination of Asphalt Binder Content.** Determine the asphalt binder content using the procedures outlined in Materials Method (MM) 5, Plant Inspector’s Manual for Bituminous Concrete Production. Calculate the asphalt binder content during initial production and then routinely throughout production for a minimum of four times per day per HMA mix design used for production.

**4. Mixture Temperature.** Determine the mix temperature for each mix type at the beginning of each production day starting with the first or second delivery vehicle and then routinely throughout the production day. Determine a minimum of four temperatures per day independent of HMA mix design used for production. Record the temperature on the delivery ticket and transmit to the project paving site with the delivery vehicle. When holding bins are loaded for storage, determine the mix temperature routinely throughout the loading time.

**5. Aggregate and Mix Moisture Content.** Determine moisture content of the aggregate, the recycled mixtures, and the HMA mixture in accordance with procedures outlined in MM 5.0. Aggregate moisture testing of individual components is allowed. Determine the aggregate moisture content daily in accordance with the frequency detailed in Table 401-3. Perform one test during the initial production and at least one test per day on a composite aggregate sample. The frequency for determining the moisture content in the HMA and HMA with RAP mixtures is a minimum once per day. If excessive mix moisture results are obtained, the testing frequency may be increased as directed by the RME. The moisture content of the mixtures upon discharge from the mixing unit will not exceed 0.5 percent.

**6. Asphalt Binder Sampling.** Obtain asphalt binder samples in accordance with procedures outlined in Materials Method (MM) 8.1, Quality Assurance Procedure for Paving Asphalt Cement. Obtain a minimum of one sample for each production day. The frequency may be increased at the discretion of the RME. Asphalt binder samples are not required when production is 150 metric tons or less. Identify all samples as determined by the RME and store them at the
facility site. The State will supply sample containers, document and submit these samples for testing.

7. Friction Aggregate. The friction aggregate will meet the requirements outlined in §401-2.02, Aggregates. Perform sampling and testing of friction aggregate at the production facility using procedures outlined in MM 28.

8. Recycled Mixes. Perform sampling and testing of HMA containing reclaimed asphalt pavement (RAP) using procedures outlined in MM 5.0. The frequency of sampling and testing is outlined in §401-3.04, Quality Control Sampling and Testing, except perform the following tests at frequencies outlined in MM 5.0 and Table 401-3.

   a. RAP Moisture Test
   b. RAP Binder Content
   c. Recycled Mix Moisture Test

C. Air void and Gradation Reporting. Report the air void test values to the nearest 0.01 of a percent and aggregate gradation test values to the nearest 0.1 of a percent. When determining test result acceptability, the air void test value is referenced to the mix design median of 4.00 percent and the gradation test value is referenced to the Job Mix Formula (JMF) target value.

D. Significant Decimals. For reporting the results, use the following rules for rounding off for all calculations:

1. When the digit to be dropped (1 digit beyond the significant digit) is less than 5, the preceding digit will not change.
2. When the digit to be dropped (1 digit beyond the significant digit) is 5 or greater, the preceding digit will be increased by 1.

E. Volumetric Plant Production Tolerances. Determine the volumetric properties outlined in Table 401-5, Volumetric Plant Production Tolerance, for every sublot of HMA volumetric design produced. When any mix design test property consistently falls outside any tolerance value, the design may be rescinded as outlined in MM 5.16.

<table>
<thead>
<tr>
<th>TABLE 401-5 VOLUMETRIC PLANT PRODUCTION TOLERANCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Property</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>Voids in the Mineral Aggregate, VMA</td>
</tr>
<tr>
<td>Voids Filled with Binder, VFB</td>
</tr>
</tbody>
</table>

NOTES:
1. Compact all gyratory specimens to N_{design}
2. Tolerances are referenced to the specification value.

F. Sampling and Testing Disputes. The State will perform referee sampling and testing to settle all disputes. Referee samples will be obtained randomly and independently from the QC samples and tested at the Regional or Central Office laboratory. If production is terminated, the State will test the samples retained at the production facility. The State's independent referee test results are final, and will be used to determine the daily QAF for the disputed quantity and the acceptance of the in-place production material.

401-3.05 Production Control. Make necessary process control adjustments during production as long as the target values do not exceed the specification general limits. However, strive for the mix design target values when making necessary process control adjustments. Only the aggregate gradation production tolerance is allowed to exceed the general limits. Also, when adjustments are made to any volumetric mixture design during production, all specified properties must remain within the specified production limits. Record all adjustments, including new target values, on BR-303 QC Daily Diary.
any test value consistently falls outside the allowable production tolerance, take corrective actions. In
addition, notify the RME prior to production of any subsequent adjusted sublot.

Production may be terminated at any time, in which case, notify the RME immediately. When
production is terminated, the HMA quantity produced up to that point is considered a plant lot and the
daily QAF is determined using all required and all additional QC test values. HMA in storage from any
terminated plant lot having a QAF less than 0.90, or any required testing not in conformance with the
specification requirements, will be considered unacceptable.

When the daily QAF is less than 0.90 for two consecutive production days, terminate production.
When production is terminated due to unacceptable production quality, demonstrate by trial production
that the production process yields a QAF of 0.90 or greater before resuming production for the State.
Also, notify the RME when any sublot yields a QAF of less than 0.90.

The State may rescind a “Production Status” of a mix design if the design consistently produces a
mixture that yields a daily QAF less than 1.00 and/or has volumetric properties outside the plant
production tolerances.

During production of any HMA design assigned “Verification Status” as outlined in MM 5.16 or the
first production day of the construction season for any HMA design assigned “Production Status”, the
State will report a daily QAF of 1.00 provided the required test results yield a daily QAF between and
including 0.90 and 1.00. When the required test results yield a daily QAF greater than 1.00, the State will
report the actual daily QAF. When the required test results yield a daily QAF less than 0.90, the State will
evaluate the subject production in accordance with procedures outlined in §401-4, Method of
Measurement.

A. Mixing Plant Control. All mix production must be in the automatic mode. If any material is
produced and shipped to State projects in a non-automatic mode, notify the RME immediately. Do
not ship any material produced in the automatic mode that exceeds twice the production tolerance.
Material produced in the automatic mode that is between the single and double production tolerance
may be shipped. However, the RME will determine if the material is acceptable to the State.

B. Friction Aggregate Control. Use the following friction aggregate criteria:

1. If the friction aggregate test results are greater than the JMF requirements, continue friction
aggregate controls.
2. If the friction aggregate test results are greater than the State’s minimum specifications, but less
than the JMF requirements, perform aggregate adjustments and retest.
3. If the friction aggregate test results are less than the State’s minimum specifications, stop
production, notify the RME, correct the problem and retest before resuming production.

401-3.06 Production Quantities. Whenever production is made for the State, notify the Regional
Materials office by 3:00 p.m. the day before the day of production.

Maintain a record of each day’s production quantity for each mix design supplied to the project site
daily. Retain these records at the production facility. These records must be available to the State’s
representative for review. Ship all production quantities to the project site as outlined in §401-4 Method
of Measurement.

401-3.07 Documentation. Record all QC test data for each plant on the appropriate forms provided by
the State. Update the QC test data within 24 hours following each plant lot production and retain these
records at the plant site laboratory. Also, keep a copy of the plant automation printout at the plant facility
for each mix type produced and make them available for review at all times. Transmit a summary of all
test data weekly to the RME.

401-3.08 HMA Mixing Plant. HMA mixing plants must be of sufficient design and capacity to
produce HMA as specified. HMA mixing plants that differ from conventional designs will be considered
for use by the Director, Materials Bureau. All HMA mixing plants must be approved for metric
A. Requirements for All Plants

1. Acceptance. Each HMA mixing plant requires initial and annual approval by the Director, Materials Bureau. The RME may disapprove use of a previously approved mixing plant at any time for non-conformance with specifications. Once disapproved, production for State projects will not be allowed until corrective measures have been implemented satisfactory to the RME.

2. Friction Aggregate Management. Provide training to plant process control personnel regarding friction aggregate stockpiling, blending and batching procedures and/or verification testing at the plant facility. If necessary, provide additional training midway through the production season. Also, list the names of each individual and the training received and maintain this record at the plant facility for review by State’s representative. As a minimum the following personnel must be thoroughly familiar with all friction aggregate control procedures.

   a. Plant Superintendent
   b. Quality Control Technician
   c. HMA Plant Operator
   d. Loader Operator/Truck Driver feeding HMA plant

3. Failure of Equipment

   a. Printer Breakdown. When the automated proportioning system or delivery weigh system printer is not properly working, the producer must notify the QAT at the plant site. However, when a QAT is not present, the producer must notify the RME immediately. Production is allowed during the breakdown period providing the tons produced are properly documented as outlined by the RME. The breakdown period shall not exceed 48 hours.

   b. Gyratory Compactor Breakdown. When a breakdown of gyratory compactor occurs, the RME will be notified immediately. The RME may allow production to continue for an initial limited time period (not to exceed 48 hours). Mix type, placement location, test results and/or any problems occurring with the mixture at the plant or project will be primary considerations for determining if, and how long, production will be allowed to continue. When permitted during the breakdown period, the following shall apply:

      1. HMA samples (enough for at least 2 specimens) will be taken at the normal specified required frequency, retained until the gyratory compactor is repaired, then tested for informational purposes.
      2. Aggregate gradations will be performed and recorded for each sublot produced during the breakdown period.
      3. The final QAF shall be 1.00 for all mix accepted by the Project Engineer during the breakdown period.

4. Scales, Continuous Weigh Systems and Meters. Perform tests on scales, continuous weigh systems, and meters for accuracy, at no cost to the State. These tests must be performed by a qualified technician using procedures outlined in Materials Method (MM) 27, Plant Equipment Inspection Manual. Perform the test as follows:

   a. Annually, prior to use for State work.
   b. At intervals of not more than 90 calendar days.
   c. Whenever the plant changes location.
   d. At any time directed by the RME.

   Provide standard test weight and a platform, cradle or hanger approved by the RME or the authorized representative for testing each scale. Provide at least 10 standard 25 kg test weights for testing the springless dial or load cell type scales. Provide a sufficient number of test weights to test belt scales within production range.
§401

5. Equipment for PG Binder Material. Tanks for the storage of PG Binder must be capable of heating and maintaining the required binder temperature. Where meters are used, the binder temperature at the meter must be within 15°C of the temperature for which the meter is calibrated. Provide separate tanks and pipe lines when asphalt binder and other liquid asphaltic materials are mixed in the same mixer.

Equip all mixing plants with a sampling valve designed to be non-clogging, safe and completely divorced from any solvent clean-out operations. For plants having multiple tanks, locate the sample valve in the line between the tanks and the mixing plant or in the return line. When plants have only one tank, locate the sample valve directly on the tank. Clearly label “Sample Valve”. The type and location of the valve requires the RME’s approval.

6. Aggregate Cold Feed Bins. Use separate cold feed bins for each aggregate size for the production of HMA mixes. The RME may permit methods of blending. The cold feed bins must be of sufficient size to maintain a continuous and uniform flow of material during HMA production.

7. PG Binder Control Unit. Provide a satisfactory means to add the proper amount of PG Binder to the mixture. Maintain the required temperatures of the PG Binder in the pipelines, meters, weigh buckets, spray bars, and other containers or flow lines. When a meter system is used, provide a by-pass so that the binder quantity and flow rate can be checked in accordance with MM 27.

8. Thermometric Equipment. All plants must have provisions to determine the asphalt binder temperature prior to entry into the mixing unit. Batch plants must have provisions to determine the aggregate temperature during discharge from the dryer. Drum mix plants must have provisions to determine the HMA mixture temperature during discharge from the mixing unit. All temperature measuring devices must be accurate within 3°C.

9. Dust Collector. Equip all plants with adequate dust collectors constructed to remove or return uniformly all or portions of the collected dust to the system.

10. Truck Scales. Truck scales used, or required to be used at a plant site, must be a platform type scale conforming to the requirements of National Institute of Standards and Technology Handbook 44. Test the truck scales as outlined in §401-3.08 A.4. Scales, Continuous Weigh Systems and Meters. All truck scales must have sufficient capacity and size to weigh the largest loaded vehicle in one weighing.

Equip truck scales used for determining delivered quantity at the mixing plant site with a recording device approved by the Director, Materials Bureau. The recording device must produce a ticket with a time-date print and any two of the following weights:

a. Gross weight
b. Net weight
c. Tare weight

Print tare weights by weighing each truck empty for each delivery. Do not manually manipulate truck scales during the printing process. In addition, the truck scale weigh system must be interlocked to allow printing only when the scale has come to a complete rest.

11. Safety Requirements. All mixing plants must be in compliance with all applicable state and federal safety requirements. Provide a platform(s) or other suitable device for accessibility to the top of truck bodies to obtain HMA samples and mix temperatures.

12. RAP Delivery System. Feed RAP into the plant using equipment specifically designed for recycling. All RAP equipment requires approval of the Director, Materials Bureau. Install
scalping screens, grizzlies or similar devices on RAP feed bins. These devices must be capable of removing foreign material in excess of 100 mm.

13. Inspection Facilities. At each HMA mixing plant site, provide a weatherproof building or trailer type unit for use as a QC/QA inspection facility consisting of a testing laboratory and office. The inspection facility must meet all applicable uniform fire prevention and building code requirements. Partition the QA office area from the testing laboratory. The inspection facility will have a minimum gross area of 22 square meters with a layout providing a minimum internal width of 2.1 meters and a ceiling height of not less than 2.3 meters. The laboratory must have tables, work benches, shelving, and other necessary equipment required for testing HMA. Should the HMA manufacturer elect or be required to provide additional testing equipment, increase the internal area proportionally to house and operate the additional testing equipment.

When multiple plants are located at one site, the inspection facility will be proportionally larger. The laboratory and office space must be of a sufficient size to accomplish an acceptable performance of QC/QA duties during all HMA production. The inspection facility’s use will be exclusively for its intended purpose and have protection from a noise level greater than an 8 hour time weighted average of 85 dBA. The State will have priority use when more than one inspection authority is using the inspection facility.

The inspection facility and the location requires the approval of the RME. The inspection facility must have the following well-maintained items: (Note: The Gyratory Compactor, Specimen Mold Assembly, and Specimen Extractor are not required to be onsite at the facility during the inspection; however, they must be onsite during production.)

a. Office Equipment. A standard size office desk having a minimum surface size of 750 mm by 1500 mm with drawers and a chair. A fireproof file cabinet with at least two lockable drawers and two keys with access only to State personnel.

b. First Aid Kit. An adequately stocked first aid kit will be available at the plant site. The laboratory area will have an emergency eye wash station.

c. Toilet. A flush type toilet and necessary supplies. The toilet must be enclosed in a separate room properly vented and complying with applicable sanitary codes. Provide a lavatory with running water. When a plant is set up on a temporary basis for a specific project, a portable toilet is acceptable in lieu of the above.

d. Lighting. Electric lights, non-glare type to provide a minimum illumination level of 1100 lux at the desk and work bench level.

e. Laboratory Sink. Sink and faucet having an adequate supply of clean running water.

f. Heating and Cooling. Adequate heating and cooling equipment to maintain an ambient temperature of 20° C ± 3°.

g. Ventilation. Adequate ventilation system to remove dust and fumes from the laboratory. A 6 m³/min. (minimum) exhaust hood vented to the atmosphere will be located over the extractor, sample drying area and aggregate sieve shakers when located inside.

h. Telephone. A telephone for the exclusive and private use of State personnel located in the laboratory office. A fax machine must be available for State use.

i. Potable Water. A water cooler or other source of potable water will be available at the inspection facility or plant site.

j. Maintenance. Maintain the inspection facility, office, and testing equipment such that they are in good operating condition. Also, keep the facility clean.
k. **Fire Extinguisher.** Furnish and locate a properly maintained 4.5 kg capacity multi-class ABC fire extinguisher in the laboratory area.

l. **Extractor.** For plants producing recycled mixtures, equip the laboratory facility with a chemical extractor or an ignition oven to determine the binder content.

m. **Coarse and Fine Aggregate Sieve Shaker.** Sieve shakers must meet the requirements of AASHTO T27. When a shaker is located outside the inspection facility, fully enclose and weatherproof it.

n. **Sample Splitter.** The sample splitter meeting the requirements of AASHTO T248.

o. **Balances.** Balances meeting the requirements of AASHTO M231, Class G2.

p. **Sample Drying Appliance.** Oven, stove or hot plate of sufficient size for rapidly drying aggregate samples.

q. **Miscellaneous Equipment.** Miscellaneous items including but not limited to, sample containers, scoops, and other equipment deemed necessary by the RME. Sieves of proper size for all mix types produced.

r. **Gyratory Compactor.** Gyratory compactor meeting the requirements of AASHTO TP4 calibrated at a frequency outlined in MM 5.16. When a compactor is used at a remote location during a breakdown period, outline the details in the Control Plan.

s. **Specimen Mold Assembly.** Mold assembly will meet the requirements of AASHTO TP4. Provide a minimum of four mold assemblies and an adequate supply of paper discs.

t. **Specimen Extractor.** The extractor will meet the requirements of AASHTO TP4.

u. **Oven.** Supply a thermostatically controlled convection type oven having a minimum capacity of 0.15 cubic meter to preheat the specimen mold assemblies and asphalt mix samples. The oven must have a controlled temperature range up to 200°C with ±3°C accuracy throughout the range.

v. **Maximum Specific Gravity Equipment.** Equipment meeting the requirements of AASHTO T209.

w. **Bulk Specific Gravity Equipment.** Equipment meeting the requirements of AASHTO T166.

B. **Requirements for Batching Plants**

1. **Drier.** Equip the plant with a drier or driers which continuously agitate the aggregate during the heating and drying process. The drier equipment must be capable of supplying uniformly heated and dried material in sufficient quantities equivalent to the operating capacity of the plant.

2. ** Screens.** Provide plant screens with nominal capacities in excess of the full capacity of the mixer. The screens must be capable of screening all aggregates to the specified sizes.

3. **Hot Bins.** The plant storage bins must be of sufficient storage capacity to supply the mixer when it is operating at full capacity. The plant must have at least four storage bins so arranged as to assure separate and adequate storage of the appropriate fractions of the aggregates required to give proper proportioning to the mix. Each bin must include an overflow chute of such size and at such location as to prevent backing up of material into other compartments or bins. Each compartment must have an individual outlet gate so that there is no leakage when closed. The
gates must quickly and completely cut off the flow of material. Equip bins with devices in the bins at the lower quarter points to indicate when the aggregates fall below this point. Provide a separate dry storage for mineral filler or baghouse fines when they are added to the mixture as a separate material.

4. Hot Bin Sampling Devices. Provide adequate facilities to obtain representative aggregate samples from the full width and depth of the discharge area from each aggregate hot storage bin while the plant is in operation. The device must consist of a sampling tray of adequate capacity which is structurally supported during the sampling operation. Alternative sampling device may be provided subject to approval of the RME. Access to sampling facilities must meet the requirements of §401-3.08 A.11. Safety Requirements.

5. Weigh Hopper. The equipment must include some means for accurately weighing each size of aggregate in a weigh hopper suspended on scales and of ample size to hold a full batch. When the weigh hopper gate is closed, material must not leak into the mixer while weighing a batch.

6. Aggregate and Asphalt Binder Scales. Scales must conform to the requirements of the National Institute of Standards and Technology Handbook 44, except that the number of scale divisions must not be less than 500 or greater than 2000. Scales installed on or after January 2, 1987 must be either the springless dial or load cell type and must indicate the load at all stages of the weighing operation from zero to full capacity. Scales installed after January 2, 2003 shall be only load cell type scales which indicate the load at all stages of the weighing operation from zero to full capacity. The minimum resolution of repeating dials or digital displays must be equivalent to or less than the minimum graduations on the primary scale. Repeating dials or digital displays must match the primary scale within one graduation. Locate the scales, repeating dials, or digital displays so they are easily readable from the operator's work station by direct sight. Prevent any manipulation of scale weight.

7. Asphalt Binder Bucket. The asphalt binder bucket must be large enough to handle a batch in a single weighing. Configure the filling system and bucket so that the asphalt binder will not overflow, splash, or spill outside the bucket during filling and weighing. The bucket must be steam or oil jacketed or equipped with electric heating units. The equipment shall deliver the asphalt binder in a thin uniform sheet or in multiple sprays over the full length of the mixer.

8. Proportioning Control. All batch plants must proportion materials by an automatic proportioning system approved by the Director, Materials Bureau. Install the system in a dust and weather protected area of at least 4.0 square meters with no internal dimension less than 2.0 meters. The system must accurately proportion various mixture components by mass or volume, and control the cycle sequence and timing during the mixing operation. All systems must operate in metric units on or before January 2, 2003, unless otherwise indicated in the contract documents. The entire batching and mixing cycle shall be continuous without any manual operations. There must be an interlock system that will interrupt and stop the automatic batching operations whenever a component proportion exceeds the allowable batching tolerance.

The automatic proportioning system must be capable of consistently delivering individual design components within the full range of batch sizes with the following batching tolerances:

<table>
<thead>
<tr>
<th>Component</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Each Aggregate Component</td>
<td>1.5%</td>
</tr>
<tr>
<td>Mineral Filler</td>
<td>0.5%</td>
</tr>
<tr>
<td>Asphalt Binder</td>
<td>0.1%</td>
</tr>
<tr>
<td>Zero Return (Aggregate)</td>
<td>0.5%</td>
</tr>
<tr>
<td>Zero Return (Asphalt Binder)</td>
<td>0.1%</td>
</tr>
</tbody>
</table>

The preceding percentages are based on the total batch weight of the HMA mixture, except that the zero return tolerance is based on the minimum batch size.

If mineral filler is used, the allowable tolerance for the aggregate component weighed prior to the filler in a cumulative weighing system is 0.5 percent. If a separate tolerance control is not provided for mineral filler, then reduce all aggregate tolerances to 0.5 percent.
9. Recording of Batching. Equip all plants with automatic digital recording devices approved by the Director, Materials Bureau, and locate these devices such that the operator can access and read them from the work station. The recording device must be able to record the quantities of aggregate, mineral filler, asphalt binder, and the total weight of each batch of HMA mixture produced. All recording of batches must show the day, month, year and time to the nearest minute for each batch. The printout must permanently identify each batch. Provide the State with a clear and legible copy of the recording for each batch.

Record asphalt binder quantities separate from aggregate and filler and record as weight. If measured in volume (liters), convert the volume to weight in kilograms at 15°C.

Record the weights as indicated on the batching scale or display within an accuracy of 1 scale graduation or increment. The minimum resolution of digital recorders shall be equivalent to or less than the minimum graduation or increment on the scale or display.

Automation systems installed on or after January 2, 1987 shall clearly identify on the recordation when a batch is initiated without satisfying all conditions of fully automated production under these specifications. The recordation shall also identify when the system is taken out of the fully automated mode during the batching sequence. The recordation must provide a clear identification when an out of tolerance condition is accepted during batching, when a system produces a “demonstration” or “simulated” batch, and when a system reprints a batch ticket.

In addition to the above information, if the automation is capable of making batches other than standard sizes (full, ½ or ¼ Mg increments), the recordation must show for each aggregate (mineral filler and RAP, if used) and asphalt material, the target weight and the calculated over and under weights, OR, the calculated over and under weights and the theoretical batch total. The State requires this heading to be printed once for each load, regardless of the number of batches per load. If loading storage silos, consider each full ticket as a load.

10. Mixer Unit. The plant must include a batch mixer of an approved pugmill type capable of producing a uniform mixture within the permissible job mix tolerances. The mixer must have a capacity of not less than one metric ton. The blades of the mixer shall have a clearance not in excess of 20 mm from all fixed and moving parts. Replace paddle blades which are worn in excess of 25 percent in face area from their new condition. If not enclosed, the mixer must be equipped with a dust hood to prevent loss of dust. The mixer must be constructed to prevent leakage of the contents and must not cause significant segregation during the mixture discharge.

11. Control of Mixing Time. The mixer must be equipped with an accurate time lock properly coordinated with the automation of batching equipment to control the operations of a complete mixing cycle. It must lock the aggregate weigh hopper after charging of the mixer until the closing of the mixer gate at the completion of the cycle. It must lock the asphalt binder delivery system throughout the dry mixing period and lock the mixer gate throughout the complete mixing period. The following are terms related to the timing of the mixing cycle:

- Cycle Time - the interval of time between successive openings of the mixer discharge gate for succeeding batches.
- Mixing Time - the interval of time between the opening of the aggregate weigh box gate and the opening of the mixer discharge gate.
- Dry Mixing Time - the interval of time between the opening of the aggregate weigh box gate and the beginning of application of asphalt binder.
- Wet Mixing Time - the interval of time between the beginning of application of asphalt binder and the opening of the mixer discharge gate.
- Finish Mixing Time - the interval of time between the termination of application of asphalt binder and the opening of the mixer discharge gate.

The control of the timing must be flexible and capable of being set at intervals of five seconds or less throughout the total cycle time. Once the cycle times are set, manipulation of the set times is not allowed.
C. Requirements for Drum Mix Plants

1. Aggregate Feed Bins. Aggregate feed bins shall have adequate separation to keep aggregates from overflowing from one bin to another. Configure the feed bins so that material in excess of 100 mm cannot be placed into the bin. Clearly label all feed bins to identify the aggregate size used.

Each feed bin shall proportion aggregate accurately and uniformly. The section of the bin that controls the feed rate flow must be adjustable and have a method to identify the opening. Interlock each feed bin so that HMA production is interrupted within five seconds if any feed bin becomes empty or the flow is obstructed.

2. Mineral Filler System. Mineral filler shall be delivered to the mixing plant independently from the aggregates. The filler system shall proportion the mineral filler at adjustable rates accurately and uniformly. The filler system must be accurate to 0.25 percent based on the total weight of the HMA mixture. Interlock the filler system so that HMA production is interrupted within five seconds if the system becomes empty or the flow is obstructed.

3. Aggregate Weigh System. The plant shall weigh the aggregates continuously with a system meeting the requirements of National Institute of Standards and Technology Handbook 44. The weigh system will be tested as outlined in §401-3.08 A.4. Scales, Continuous Weigh Systems and Meters. Provide means for diverting the aggregate after passing over the weigh system and prior to entry into the drum. The weigh system must be readable to the nearest 0.01 metric ton during testing.

The Director, Materials Bureau will consider other weighing systems different from conventional designs. The following tolerances apply to all continuous weigh systems:

a. Acceptance tolerance. Acceptance tolerance is 0.5% of the test load and applies to initial installation of the weigh system, to the annual approval prior to production, and whenever the equipment is tested because it fails to meet the maintenance tolerance during production.

b. Maintenance tolerance. Maintenance tolerance is 1.0% of the test load and applies during all times other than those where acceptance tolerance apply.

4. PG Binder System. The plant shall continuously proportion PG Binder at adjustable rates accurately and uniformly. The binder system must be accurate to 0.1 percent based on the total weight of the HMA mixture. The binder system will be tested as outlined in §401-3.08A.4. Scales, Continuous Weigh Systems and Meters. The binder system must be interlocked so that production is interrupted within five seconds if the PG Binder flow to the mixer unit ceases. Install a temperature compensating device in conjunction with the meter to correct the quantity of asphalt binder at 15°C.

5. Proportioning Control. All drum mix plants shall proportion materials by an automatic proportioning system that will increase and decrease the production rate using a single input. Install the system in a dust and weather protected area of at least 4.0 sq. meters with no internal dimensions less than 2.0 meters. The system shall accurately proportion various mixture components by mass or volume. All systems must operate in metric units on or before January 2, 2003, unless otherwise indicated in the contract documents.

a. Aggregate Feed Rate Control. The plant must have an adjustable feed rate control for each aggregate bin feeder and mineral filler feeder. The controls must maintain an aggregate flow accuracy such that the total variation of all materials being drawn per interval of time must not exceed an amount equal to 1.5 percent of total weight of HMA mixture per interval of time. Add mineral filler with a maximum variation of 0.5 percent of the total weight of HMA mixture per interval of time.
The flow rates of aggregate and mineral filler must be continuously displayed in the control room in metric tons per hour. The maximum resolution will be 1 metric ton per hour for dry aggregate and 0.1 metric ton per hour for mineral filler.

b. Aggregate Weight Indicators. Weight indicators in the control room must display the weights of dry aggregate and mineral filler in metric tons. They must continuously accumulate weights of material during the production period. The maximum resolution will be 0.1 metric tons for dry aggregate and 0.01 metric tons for mineral filler if added separately. The indicators must be resettable to zero and have provisions to prevent manipulation.

c. Aggregate Moisture Compensator. A moisture compensation device must be capable of electronically converting the wet weight of aggregate to dry aggregate weight. The moisture compensation may be input based on composite or individual aggregate bin moisture. The maximum graduations on the compensator shall be 0.1 percent.

d. PG Binder Control. The PG Binder control must be capable of inputting the binder content as a percentage based on total weight of mixture. The maximum graduation on the binder input control is 0.1 percent. The asphalt binder delivery system must be linked with the aggregate delivery system to automatically maintain the required proportions as the aggregate flow varies. The delivery tolerance for asphalt binder is 0.1 percent based on the total HMA mixture weight. The flow rate of asphalt binder must be continuously displayed in the control room in metric tons per hour and have a maximum resolution of 0.1 metric ton per hour.

e. PG Binder Quantity Indicator. The PG Binder quantity indicator in the control room must display the quantity of the binder in metric tons and must continuously accumulate the quantity of binder during the production period in the day. The maximum resolution will be 0.01 metric tons. The indicator must be resettable to zero and have provisions to prevent manipulation.

6. Recodarion of Proportions. The mixing plant must be equipped with an automatic digital recording device approved by the Director, Materials Bureau, which simultaneously records the accumulated weights of dry aggregate, mineral filler and PG Binder at five minute intervals during production and on demand. The recordation must include the actual PG Binder content as a percentage of the total HMA mixture weight. The maximum resolution will be 0.1 metric tons for dry aggregate, 0.01 metric tons for mineral filler, if added separately, 0.01 metric tons for PG Binder, and 0.1% for PG Binder content. All recordation must show the day, month, year, and time to the nearest minute for each print. Provide a clear and legible copy of the recordation to the State.

Automation systems installed on or after January 2, 1992 must clearly identify on the recordation when a batch is initiated without satisfying all conditions of fully automated production under these specifications. The recordation should also identify when the system is taken out of the fully automated mode during the batching sequence.

7. Automatic Aggregate Sampling Device. Provide an automatic aggregate sampling device which will divert a representative combined aggregate sample into a hopper or container for the purpose of gradation testing. The device shall effectively sample the full width and depth of the aggregate flow without losing any portion of the sample. The sampling point must be after the aggregate is proportioned and prior to its mixing with asphalt binder.

8. Mixer Unit. The plant shall include a continuous mixer of a type approved by the Director, Materials Bureau, having an automatic burner control and being capable of producing a uniform mixture within the job-mix tolerances. Repair or replace flights within the drum which are missing, loose, broken, bent, scalloped or worn excessively from their new condition to the
satisfaction of the RME. Discharge the HMA mixture into a HMA holding bin meeting the requirements of §401-3.09, Hot Mix Asphalt Holding Bins.

9. Truck Scales. Each drum mix plant site shall have a platform scale conforming to the requirements outlined in §401-3.08A.10. Truck Scales.

401-3.09 Hot Mix Asphalt Holding Bins. HMA mixtures may be held in holding bins which are especially designed for that purpose. The holding bins require initial approval by the Director, Materials Bureau.

A. Holding Times. Holding time is defined as the time interval beginning with the introduction of HMA mixture into the bin to the time of completion of discharge from the bin. Standard holding times are 12, 24, and 48 hours. Standard surge time is six hours.

B. Acceptance Criteria. The HMA mixture, after storage, must meet the criteria outlined in Table 401-6, HMA Holding Bin Acceptance Criteria.

C. Quantity Documentation. The quantity of the mixture drawn from holding bins and delivered to State projects shall be measured and recorded by one of the following:

1. A truck scale conforming to the requirements of §401-3.08A.10. Truck Scales.
2. A weight box or hopper suspended beneath the holding bin. The Director, Materials Bureau must approve all scale systems or other weighing devices prior to State use. Scales installed after January 2, 2003 must be load cell type scales which indicate the load at all stages of the weighing operation from zero to full capacity. The scale shall measure the actual weight to within an accuracy of 0.1 percent of full scale or one graduation, whichever is less. The minimum graduation will have a value not exceeding 10 kg or 0.01 metric tons. The minimum resolution of repeating dials or digital displays will be equivalent to or less than the minimum graduations on the primary. There must be an interlock cutoff circuit to prevent the commencement operation if the scale is outside of the zero return tolerance. The zero return tolerance will be from 0 to a maximum of plus 70 kilograms or 0.07 metric tons whichever is applicable.

Each installation shall be equipped with a recording device approved by the Director, Materials Bureau. The recorder shall produce a ticket with a time-date print and the total amount of mixture discharged into the truck. The minimum resolution of the recorder must be equivalent to or less than the minimum graduations on the scale or digital display. Manual manipulation of the scales during weighing and printing process is not allowed. In addition, interlock the system to allow printing only when the scale has come to a complete rest.

D. Holding Bin Evaluation and Approval. Prior to use on State projects, the Director, Materials Bureau must evaluate and approve each holding bin. The scope of the evaluation conducted will depend upon the standard holding times request. The evaluation is based on sampling and testing of HMA mixtures held in the bin.

If the HMA mixture from a holding bin shows signs of aggregate segregation, PG Binder migration, PG Binder hardening, or improper temperature control, delivery from the holding bin shall
be discontinued until satisfactory results can be achieved to the satisfaction of the RME. The State reserves the right to evaluate any approved bin any time.

401-3.10 Preparation of PG Binder. Heat the PG Binder to the temperature recommended by the PG Binder supplier in a manner that will avoid overheating and provide a continuous supply to the mixer at a uniform temperature.

401-3.11 Preparation of Aggregates.

A. Requirements for All Plants. Keep all State approved aggregates from different sources separate from each other unless approved by the RME. Separate all State approved aggregates from non-approved aggregates.

B. Requirements for Batch Plants. Stockpile all aggregates, including RAP, on free draining and clean bases such that the aggregates are not contaminated with foreign materials. When a batch plant is located at an approved aggregate processing facility, aggregate is permitted to be transferred from the facilities discharge point to the plant’s cold feed bin. However, if the RME determines that non-uniform aggregate gradation or moisture content results, this transfer of aggregate will no longer be permitted.

Dry the aggregates for the mixture and heat to the required temperature. Aggregates are considered dry when the moisture content just prior to batching does not exceed 0.5 percent of oven dried weight. Drying and heating must not damage or contaminate the aggregate. After heating and drying, screen the aggregates into fractions and place into separate compartments.

RAP will be last in the aggregate weigh sequence and the RAP design batch weight must be increased to compensate for moisture content. All requirements pertaining to aggregates apply to RAP, including the equipment requirements for automated proportioning and recordation stipulated for aggregates in §401-3.08, HMA Mixing Plant.

C. Requirements for Drum Mix Plants. Stockpile all aggregates, including RAP, on free draining and clean bases such that the aggregates are not contaminated with foreign materials. Direct transfer of aggregates from the processing facility’s discharge point to the plant’s cold feed bin is not permitted.

The aggregates for the mixture must be from supplies having a uniform gradation and moisture content. The aggregates must have stable moisture contents as determined by the QCT.

Determine the final acceptance for aggregate gradation from samples of the composite aggregate taken by the automatic sampling device described in §401-3.08 C.7. Automatic Aggregate Sampling Device.

Introduce RAP into the drum so that it will not come in direct contact with the burner flame. Mixing RAP with other aggregates must occur before the asphalt binder introduction point. All requirements pertaining to aggregates apply to RAP including the equipment requirements for automated proportioning and recordation outlined in §401-3.08, HMA Mixing Plant. In addition, add RAP with a maximum variation of 0.5 percent of the total weight of HMA per interval of time. RAP shall be accumulatively recorded as dry material separately from other aggregates.

401-3.12 Mixing. The mixer must be capable of producing a well-coated and homogeneous mixture at the specified temperature. The finished mixture must contain a minimum percentage of fully coated particles of 85 percent for base course and 95 percent for binder and surface course. The procedure for determining particle coating is available from the RME.

A. Requirements for Batch Plants. The volume of aggregates and PG Binder in the mixer shall not extend above the tips of the mixing blades and shall not exceed the manufacturer's rated capacity of the mixer. In addition, the total quantity of material mixed shall not be less than 50 percent of the manufacturer's rated capacity of the mixer.

The standard dry and wet mixing times for batch plants are 15 and 45 seconds, respectively. Any deviation from standard mixing times must meet the requirements outlined below and be approved by the RME.
1. Base Course Mixes. Dry mix the base course mixes for at least the period of time necessary to discharge all aggregates into the mixer. The wet mixing period must then commence and continue until at least 85 percent of the coarse aggregate particles are fully coated or the finish mixing time exceeds ten seconds, whichever is longer.

2. Top and Binder Course Mixes. Dry mix the top and binder course mixes for at least the period of time necessary to discharge all aggregates into the mixer or 10 seconds, whichever is longer. The wet mixing period must then commence and continue until at least 95 percent of the coarse aggregate particles are fully coated or the finish mixing time exceeds 10 seconds, whichever is longer.

B. Requirements for Drum Mix Plants and for recycle mixes in Batch Plants. The moisture content of the mixture upon discharge into the haul unit will not exceed 0.5 percent when tested in accordance with procedures outlined in MM 5.0.

401-4 METHOD OF MEASUREMENT. Determine the quantities daily for each plant. The quantity is the number of actual metric tons determined from the automated proportioning system, the delivery vehicle weigh system, or the HMA holding bin weigh system. Measure or calculate the quantity based on the measured amount and report to the nearest 0.01 of a metric ton.

A delivery ticket indicating the total quantity in metric tons being delivered must accompany each delivery vehicle supplying HMA. The method of determining the delivered quantity is subject to the approval of the RME. Make one legible copy of the delivery ticket available to the State’s paving inspector prior to the placement of the mixture. The delivery ticket shall show the following minimum information and the HMA coded as outlined in Table 401-7, Delivery Ticket Mix Coding.

- Ticket number
- Plant identification
- Contract number
- Mix Codes
- Quantity of material in vehicle
- Date and Time

The QAT will determine a daily QAF for each day’s production from either Table 401-8, Air Voids in Plant Mixture (Volumetric Designs) or Table 401-9, Percent Passing (Non-Volumetric Designs) using the calculations of the average absolute difference values in accordance with MP 96-02. The Engineer will use the daily QAF to calculate quality payment adjustment for each day’s production.

A. Volumetric Designs - Quality payment adjustment for volumetric design mixtures is based on plant mixture air voids. The Engineer will obtain the daily QAF for volumetric design mixtures from Table 401-8, Air Voids in Plant Mixture. When hot mix asphalt holding bins are used for volumetric design mixtures, the Engineer will determine the daily QAF for the stored mixture on the day of delivery.

<table>
<thead>
<tr>
<th>Mix Type</th>
<th>Code</th>
<th>Code</th>
<th>Design ESAL</th>
<th>Code</th>
<th>Consensus Properties</th>
<th>Code</th>
<th>PG Binder Type</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.5 mm</td>
<td>09</td>
<td>F1</td>
<td>&lt;0.3 million</td>
<td>1</td>
<td>&lt;100 mm</td>
<td>Y</td>
<td>PG 58-34</td>
<td>A</td>
</tr>
<tr>
<td>12.5 mm</td>
<td>12</td>
<td>F2</td>
<td>&lt;3.0 million</td>
<td>2</td>
<td>&gt;100 mm</td>
<td>N</td>
<td>PG 64-22</td>
<td>B</td>
</tr>
<tr>
<td>19.0 mm</td>
<td>19</td>
<td>F3</td>
<td>&lt;10 million</td>
<td>3</td>
<td>100 mm</td>
<td>C</td>
<td>PG 64-26</td>
<td>C</td>
</tr>
<tr>
<td>25.0 mm</td>
<td>25</td>
<td>F9</td>
<td>&lt;30 million</td>
<td>4</td>
<td>200 mm</td>
<td>D</td>
<td>PG 70-22</td>
<td>D</td>
</tr>
<tr>
<td>37.5 mm</td>
<td>37</td>
<td>-----</td>
<td>&gt;30 million</td>
<td>5</td>
<td>300 mm</td>
<td>E</td>
<td>PG 76-22</td>
<td>E</td>
</tr>
<tr>
<td>OTHER</td>
<td>G</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>OTHER</td>
<td>G</td>
</tr>
</tbody>
</table>

NOTES:
1. Friction Aggregate Classification Codes
2. When at least 75% of a layer is deeper than 100 mm below the pavement surface, the >100 mm aggregate consensus properties apply for that layer.
3. Delivery Ticket Mix Coding Example: 12.5 mm, <30 million design, <100 mm from surface, PG 64-28 Mix Coding on Delivery Ticket: 12F24YC.
TABLE 401-8 AIR VOIDS IN PLANT MIXTURE (Volumetric Designs)

<table>
<thead>
<tr>
<th>Average Absolute Value (Test Value - 4.0)</th>
<th>Quality Adjust. Factor (QAF)</th>
<th>Average Absolute Value (Test Value - 4.0)</th>
<th>Quality Adjust. Factor (QAF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00 - 0.17</td>
<td>1.05</td>
<td>1.31 - 1.40</td>
<td>0.96</td>
</tr>
<tr>
<td>0.18 - 0.33</td>
<td>1.04</td>
<td>1.41 - 1.50</td>
<td>0.95</td>
</tr>
<tr>
<td>0.34 - 0.50</td>
<td>1.03</td>
<td>1.51 - 1.60</td>
<td>0.94</td>
</tr>
<tr>
<td>0.51 - 0.67</td>
<td>1.02</td>
<td>1.61 - 1.70</td>
<td>0.93</td>
</tr>
<tr>
<td>0.68 - 0.83</td>
<td>1.01</td>
<td>1.71 - 1.80</td>
<td>0.92</td>
</tr>
<tr>
<td>0.84 - 1.00</td>
<td>1.00</td>
<td>1.81 - 1.90</td>
<td>0.91</td>
</tr>
<tr>
<td>1.01 - 1.10</td>
<td>0.99</td>
<td>1.91 - 2.00</td>
<td>0.90</td>
</tr>
<tr>
<td>1.11 - 1.20</td>
<td>0.98</td>
<td>over 2.00</td>
<td>0.85</td>
</tr>
<tr>
<td>1.21 - 1.30</td>
<td>0.97</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

B. Non-Volumetric Designs - Quality payment adjustment for non-volumetric design mixtures is based on plant mixture aggregate gradation. The daily QAF will be calculated for non-volumetric design mixtures for all Job Mix Formula sieves having design target values less than 90 percent passing. The daily QAF for non-volumetric design mixtures will be the lowest factor obtained from Table 401-9, Percent Passing. If each individual QAF is equal to or greater than 1.00, the highest calculated QAF will be used.

When any material with plant air voids of less than 2% or greater than 6% which results in daily QAF of 0.85, the Engineer will evaluate the subject material to determine if it will be left in-place. The considerations for determining whether the material in question is left in place are, but not limited to:

- Type of material produced
- The layer in which the material was placed
- The location of the project

If the subject material is left in-place, the Engineer will use a daily QAF of 0.85 to calculate the quality payment adjustment. If the subject material is not left in-place, remove and replace the material at no cost to the State. The daily QAF for the replaced material shall be determined as outlined in this subsection. The daily QAF applies to all production quantity deemed acceptable by the Engineer.

TABLE 401-9 PERCENT PASSING (Non-Volumetric Designs)

<table>
<thead>
<tr>
<th>Average Absolute Value (Test Value - JMF Target Value)</th>
<th>Quality Adjustment Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sieve Size 425µm and Larger</td>
<td></td>
</tr>
<tr>
<td>0.0 - 0.8</td>
<td>1.05</td>
</tr>
<tr>
<td>0.9 - 1.5</td>
<td>1.04</td>
</tr>
<tr>
<td>1.6 - 2.3</td>
<td>1.03</td>
</tr>
<tr>
<td>2.4 - 3.0</td>
<td>1.02</td>
</tr>
<tr>
<td>3.1 - 4.5</td>
<td>1.01</td>
</tr>
<tr>
<td>4.6 - 6.0</td>
<td>1.00</td>
</tr>
<tr>
<td>6.1 - 6.3</td>
<td>0.99</td>
</tr>
<tr>
<td>6.4 - 6.6</td>
<td>0.98</td>
</tr>
<tr>
<td>6.9 - 7.2</td>
<td>0.97</td>
</tr>
<tr>
<td>7.5 - 7.8</td>
<td>0.94</td>
</tr>
<tr>
<td>7.9 - 8.1</td>
<td>0.93</td>
</tr>
<tr>
<td>8.2 - 8.4</td>
<td>0.92</td>
</tr>
<tr>
<td>8.5 - 8.7</td>
<td>0.91</td>
</tr>
<tr>
<td>8.8 - 9.0</td>
<td>0.90</td>
</tr>
<tr>
<td>over 9.0</td>
<td>0.85</td>
</tr>
<tr>
<td>Sieve Size 180µm</td>
<td></td>
</tr>
<tr>
<td>0.0 - 0.5</td>
<td></td>
</tr>
<tr>
<td>0.6 - 1.0</td>
<td></td>
</tr>
<tr>
<td>1.1 - 1.5</td>
<td></td>
</tr>
<tr>
<td>1.6 - 2.0</td>
<td></td>
</tr>
<tr>
<td>2.1 - 3.0</td>
<td></td>
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<td>3.1 - 4.0</td>
<td></td>
</tr>
<tr>
<td>4.1 - 4.2</td>
<td></td>
</tr>
<tr>
<td>4.3 - 4.4</td>
<td></td>
</tr>
<tr>
<td>4.5 - 4.6</td>
<td></td>
</tr>
<tr>
<td>4.7 - 4.8</td>
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<tr>
<td>4.9 - 5.0</td>
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</tr>
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</tr>
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<td>5.3 - 5.4</td>
<td></td>
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<tr>
<td>5.5 - 5.6</td>
<td></td>
</tr>
<tr>
<td>5.7 - 5.8</td>
<td></td>
</tr>
<tr>
<td>5.9 - 6.0</td>
<td></td>
</tr>
<tr>
<td>over 6.0</td>
<td></td>
</tr>
</tbody>
</table>

| Sieve Size 75µm                                        |                           |
| 0.0 - 0.3                                              |                           |
| 0.4 - 0.5                                              |                           |
| 0.6 - 0.8                                              |                           |
| 0.9 - 1.0                                              |                           |
| 1.1 - 1.5                                              |                           |
| 1.6 - 2.0                                              |                           |
| 2.1 - 3.0                                              |                           |
| 3.1 - 4.0                                              |                           |
| 4.1 - 4.2                                              |                           |
| 4.3 - 4.4                                              |                           |
| 4.5 - 4.6                                              |                           |
| 4.7 - 4.8                                              |                           |
| 4.9 - 5.0                                              |                           |
| 5.1 - 5.2                                              |                           |
| 5.3 - 5.4                                              |                           |
| 5.5 - 5.6                                              |                           |
| 5.7 - 5.8                                              |                           |
| 5.9 - 6.0                                              |                           |
| over 6.0                                               |                           |

NEW YORK STATE DEPARTMENT OF TRANSPORTATION
STANDARD SPECIFICATIONS of May 4, 2006
SECTION 402 - HOT MIX ASPHALT (HMA) PAVEMENTS

402-1 DESCRIPTION. These specifications apply to all plant mixed Hot Mix Asphalt (HMA) produced at an approved production facility under Section 401, Plant Production, irrespective of aggregate gradation, type, and amount of HMA material or use.

This work will consist of one or more courses of HMA pavement constructed on the prepared foundation in accordance with these specifications, the specific requirements of the item under contract, and as shown in the contract documents or as directed by the Engineer.

Prior to routine paving, the Engineer will conduct a pre-paving meeting with all parties working under this specification.

402-2 MATERIALS

402-2.01 General. Obtain State approval of materials before any material is mixed at any HMA plants. Obtain approval of aggregate sources for coarse and fine mineral aggregates from the Regional Materials Engineer. Performance-Graded Binder (PG Binder), mineral filler or any other materials that are used in the mix will be accepted according to the State’s written instructions. The PG Binder and the Design Estimated Traffic in 80 kN ESALs will be specified by a special note in the contract documents.

402-2.02 Composition of Mixtures. Formulate and submit, to the Regional Materials Engineer, a Superpave Mix Design that satisfies the requirements of §401-2 and the mixture design procedure as written in Materials Method (MM) 5.16, Superpave Hot Mix Asphalt Mixture Design and Mixture Verification Procedures.

Table 402-1, General Description, lists the specification types of compaction methods and their use.

<table>
<thead>
<tr>
<th>Specification Types</th>
<th>50 Series</th>
<th>60 Series</th>
<th>70 Series</th>
<th>80 Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coarse Agg. Type F1</td>
<td>Mainline paving for controlled access highways, i.e., interstate, parkways.</td>
<td>Mainline paving other than 50 or 70 Series.</td>
<td>Compaction monitoring using PTZ based on average of 4 cores.</td>
<td>Mainline paving on low volume roadways.</td>
</tr>
<tr>
<td>Coarse Agg. Type F2</td>
<td>Compaction monitoring using 4 cores every day.</td>
<td>Compaction monitoring using PTZ based on average of 4 cores.</td>
<td>Compaction monitoring using a density gauge.</td>
<td>Compaction based on number of passes.</td>
</tr>
<tr>
<td>Coarse Agg. Type F3</td>
<td>Mainline paving for controlled access highways, i.e., interstate, parkways.</td>
<td>Mainline paving other than 70 Series.</td>
<td>Compaction monitoring using PTZ based on average of 4 cores.</td>
<td>Miscellaneous repairs, bridge approaches, trenches, etc.</td>
</tr>
<tr>
<td>Coarse Agg. Type F9</td>
<td>Compaction monitoring using 4 cores every day.</td>
<td>Mainline paving other than 50 or 70 Series.</td>
<td>Compaction monitoring using PTZ based on average of 4 cores.</td>
<td>Miscellaneous repairs, bridge approaches, trenches, etc.</td>
</tr>
</tbody>
</table>

NOTES: 402.XXYZQR
For 50, 60, and 70 series compaction methods, notify the Engineer of a desired mix temperature to be delivered to the project. For the 80 series compaction method, the Engineer will specify the desired mix temperature. The mixtures will be produced, delivered to the work site, and incorporated into the work within 10°C of the specified temperature. The specified temperature must be within the mixing and compaction range of 120°C and 165°C, or as recommended by the PG Binder manufacturer.

### 402-3 CONSTRUCTION DETAILS

#### 402-3.01 Weather and Seasonal Limitations

Do not place HMA plant mix on any wet surface or when the surface temperature is less than specified in Table 402-2, Temperature and Seasonal Requirements, or when weather conditions will prevent proper handling or finishing of the HMA mixtures.

Discontinue paving as soon as the surface temperature falls below the requirements which are shown in Table 402-2 and applies for all pavement and shoulder courses.

<table>
<thead>
<tr>
<th>Nominal Compacted Lift Thickness</th>
<th>Surface Temperature Minimum (Note 1)</th>
<th>Seasonal Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 mm</td>
<td>5°C</td>
<td>None</td>
</tr>
<tr>
<td>50 mm but &lt;100 mm</td>
<td>8°C</td>
<td>(Notes 2 &amp; 3)</td>
</tr>
<tr>
<td>&lt;50 mm</td>
<td>10°C</td>
<td>(Notes 2 &amp; 3)</td>
</tr>
</tbody>
</table>

**NOTES:**
1. Measure all temperatures on the surface where the mixture is to be placed and the controlling temperature will be the average of three temperature readings taken at locations 8 meters apart.
2. Place Top Course only during the period of April 1st up to and including the third Saturday of November in the counties of Dutchess, Orange, Rockland, Putnam, Westchester, Nassau, Suffolk, and the City of New York.
3. Place Top Course only during the period of May 1st up to and including the third Saturday of October in all counties except as noted in Note 2.

HMA pavement for temporary detours, which are not and will not become part of the permanent pavement, will not be subject to the above requirements in regard to temperature and seasonal limitations, but must be placed as approved by the Engineer.

Place HMA paving mixtures for curbs, driveways, sidewalks, gutters, and other incidental construction on surfaces having a minimum temperature of 10°C. The Engineer may allow the placement of these mixtures below the minimum temperature to expedite the completion of the project.

Schedule the paving operations such that all paving necessary to provide safe and adequate maintenance and protection of traffic or for protection of previously laid courses is completed within the weather and seasonal limitations. Such scheduling will include expediting construction operations to permit paving within the seasonal limitations or by limiting the length of work to that which can be completed before the seasonal shut-down. The cost of scheduling and sequencing of work to conform with the seasonal limitations will be reflected in the unit bid prices for the related contract items. Should paving operations not be completed within weather and seasonal limitations, provide all temporary materials and work necessary, such as the shimming of castings and protrusions, drainage of the roadway, providing acceptable rideability, and other work needed for the adequate maintenance and protection of traffic until paving operations can be completed the following paving season, and will not be reimbursable by the State.

Repair any damage to the base and binder course which has been placed and which will be permanently incorporated into the work and left open to traffic over the winter, at no additional expense to the State. In addition, clean this pavement course in accordance with Section 633, Conditioning.
Existing Pavement, at no additional expense to the State, immediately prior to applying a tack coat and overlaying. Apply tack coat in accordance with Section 407, Tack Coat, immediately prior to overlaying.

The contractor may propose to place surface course HMA pavement outside seasonal and/or weather limitations by providing a limited warranty against defects in such work. Warranty information can be provided by the Engineer.

**402-3.02 HMA Pavers.** Provide a self-powered HMA paver with an activated screed or strike-off assembly. The machine shall be capable of spreading and finishing courses of HMA plant mix material in lane widths applicable to the specified typical section and thicknesses shown on the plans. When screed extensions are necessary for placement of mainline pavement, such extensions shall be of the same design as the main screed. Auger and tunnel extensions are required to be mounted on the paver when the screed is extended more than 0.3 meter for fixed paving widths wider than 3.6 meters. Pavers used for shoulders and similar construction shall be capable of spreading and finishing courses of HMA plant material in widths shown on the plans. The paver shall have a receiving hopper with sufficient capacity for uniform spreading operation and with automatic flow controls to place the mixture uniformly in front of the screed. Heat the screed or strike-off assembly as necessary to produce a finished surface of the required smoothness and texture without tearing, shoving or gouging the mixture. When laying mixtures, the paver shall be capable of operating at forward speeds consistent with satisfactory placement of the mixtures.

HMA pavers used for placing the initial paving layer, base, binder, and surface courses shall be equipped with approved automatic transverse slope and longitudinal grade screed controls. The controls shall automatically adjust the screed and increase or decrease the mat thickness to compensate for irregularities that are in the surface being paved. The controls shall be capable of maintaining the proper transverse slope and be readily adjustable so transitions and super-elevated curves can be satisfactorily paved. The controls shall operate from suitable fixed or moving references as prescribed in §402-3.06, Spreading and Finishing. When paving width is in excess of 5.2 meters, a paver must have approved automatic transverse slope and longitudinal grade screed controls that operate from both sides of the paver.

The transverse slope and longitudinal grade screed controls of the HMA paver may be manually adjusted according to the requirements of §402-3.06, Spreading and Finishing. The HMA pavers must be at the project site prior to the start of paving operations to allow examination and approval by the Engineer. Repair or replace immediately any paver found to be worn or defective either before or during its use.

**402-3.03 Hauling Equipment.** Transport HMA mixtures to the work site in vehicles having clean, smooth and tight metal beds. Cover the HMA mixture with waterproof covers during transportation. If a flexible cover is used, it must overlap the vehicle’s sideboards and back by a minimum of 150 mm and be securely fastened. The inside surface of the vehicle body may be lightly coated with a release agent. Release agents must meet all applicable State and Federal environmental requirements. Petroleum products or solvents having an adverse effect upon the HMA pavement will not be permitted for use as release agents. All hauling equipment is subject to the approval of the Engineer.

**402-3.04 Rollers.** All rollers shall be an approved vibratory, static steel wheel type, or pneumatic tire type used according to the requirements of §402-3.07, Compaction. All rollers shall be in good mechanical condition, free from excessive backlash, and capable of operating at speeds slow enough to avoid displacement of the mixture. The number and weight of rollers must be sufficient to satisfactorily compact the mixture while it is still in a workable condition. The use of equipment which results in excessive crushing of aggregate will not be permitted.

**A. Vibratory rollers** shall be of a type that are specifically designed for the compaction of HMA mixture. Vibratory roller models satisfying the specification requirements contained herein will be evaluated by the Materials Bureau to determine compaction capabilities. If acceptable, the roller model will be placed on the State’s current Approved List for Hot Mix Asphalt Vibratory Compaction Equipment. For all State projects, use only the vibratory roller models appearing on this list. Alternate types of rollers may be approved by the Director, Materials Bureau, for 50, 60, 70, and 80
§402
series compaction methods, if, upon reviewing the specification of the rollers and demonstration that satisfactory results can be achieved.

Vibratory rollers shall meet the following requirements:

 Nominal Amplitude      1.25 mm maximum.
 Vibration Frequency     1500 vpm minimum.
 Drum Width (dual vibrating drums) 1.3 m, minimum
 (single vibrating drum)     2.1 m, minimum

When the rollers have pneumatic drive wheels, apply release agents to the tires to prevent material pickup.

All vibratory rollers shall be equipped with a speedometer that accurately indicates roller speed in either 1 km/hr or 15 m/min increments (maximum) throughout the specified operating range. Vibratory rollers must also be equipped with a speed control device that can be set to prevent the roller from traveling in excess of 4 km/hr or 67 m/min when the roller is in vibratory mode. The type of speed control device will be subject to the approval of the Director, Materials Bureau.

B. Static steel-wheel rollers shall be self-propelled and be either 9 to 11 metric ton tandem three axle type or 7 to 9 metric ton tandem two axle type.

C. Pneumatic rubber-tired rollers shall be self-propelled and consist of two axles on which multiple pneumatic-tired wheels are mounted in such a manner that the rear wheels shall not follow in the tracks of the forward wheels and will be spaced to give essentially uniform coverage with each pass. The axles will be mounted in a rigid frame provided with means for adding ballast. The wheels shall be mounted so as to oscillate individually or in pairs. The tires must be smooth and show no tread pattern, be of equal size and diameter, and be uniformly inflated. Pneumatic rollers shall meet the following requirements unless otherwise approved:

 Maximum Wheel Load          2,600 kg
 Tire Compression on Pavement 550 ± 35 kPa
 Maximum Axle Load           10,160 kg

402-3.05 Conditioning of Existing Surface. When specified in the contract, clean the surface of the existing pavement, fill joints and cracks, and level the surface to a uniform grade and cross slope prior to the application of a new HMA concrete course. Clean the surface and fill the joints and cracks under the provisions of Section 633, Conditioning Existing Pavement. Clean any foreign material resulting from construction operations from the pavement at no additional cost to the State. Leveling of the pavement surface prior to new HMA placement will be in conformance with the requirements stated below:

a. Apply a thin, uniform tack coat as specified in Section 407, Tack Coat, to all contact surfaces of existing HMA and Portland Cement Concrete layers including such areas as adjacent pavement edges, curbing, gutters, manholes, and other structures, immediately prior to placing the HMA mixture against them.

b. Fill depressions and wheel path ruts prior to the paving of the truing and leveling course, as directed by the Engineer. For wheel path ruts with a depth of 7 mm, but less than 20 mm, use Shim Course. For ruts greater than 20 mm, use a 9.5 mm mixture.

c. If a truing and leveling course is specified on the plans or in the itemized proposal, place the course(s) of a minimum variable thickness of proper plant mix necessary to bring the surface of the existing pavement to the same transverse slope and longitudinal grade required for the finished pavement surface. Test the surface of this course in the same manner prescribed in §402-3.10, Surface Tolerance, except that the allowable variation from the true surface after compaction must not exceed 10 mm. Unless a mixture type is specified in the plans, use Table 402-3, Mixture Selection for T&L Course, to select the appropriate mix type such that dragging of stones is minimized during placement of the mixture.
TABLE 402-3  MIXTURE SELECTION FOR T&L COURSE

<table>
<thead>
<tr>
<th>Compacted Thickness Range (mm)</th>
<th>Mixture Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 40</td>
<td>9.5 mm or 12.5 mm</td>
</tr>
<tr>
<td>&gt;40</td>
<td>19.0 mm or 25.0 mm</td>
</tr>
</tbody>
</table>

NOTE: 37.5mm mixture may be used when the compactive thickness is greater than or equal to 75mm.

When constructing wedges for super-elevation, select a mixture such that dragging of stones at the thin edge is minimized. If dragging is excessive in any T&L course, as determined by the Engineer, the selected mixture will be disallowed for use for the application. Pay special attention to the proper compaction of thin sections.

402-3.06 Spreading and Finishing. Apply tack coat on the contact surfaces between all HMA pavement lifts in accordance with Section 407, Tack Coat, prior to placing HMA mixture regardless of time period between lifts. The only exception to this is the surface of permeable base courses. Paving over a tack coat should not commence until the emulsion has broken (goes from brown to black) or is tacky when touched.

Lay the mixture upon an approved clean, tack coated surface. Spread and strike off to the established grade and elevation. Use HMA paver(s) to distribute the mixture either over the entire width or over such partial width as may be practicable. Upon arrival at the site, the trucks will dump the mixture into the paver. Immediately spread and strike off to the required width and appropriate loose depth to obtain the required compacted thickness at completion of the work.

When the initial pavement course is laid with automatic HMA pavers, guide the paver by a taut reference line positioned at or near the pavement centerline or edge. Erect and maintain the reference line to the satisfaction of the Engineer. Support the reference line at approximately 8 meter intervals on tangent sections and at closer intervals on curves. Tension the line sufficiently to remove any sags. The Engineer may permit a moving reference of at least 9 meters in length in lieu of a reference line. The moving reference may be a floating beam, ski, or other suitable type such that the resulting pavement layer surface is sufficiently even. A short ski or shoe may also be used for the initial course with the approval of the Engineer if a satisfactory fixed reference such as a curb, gutter, or other fixed reference is adjacent to the pavement. When the proposed floating beam or the short ski does not produce the results similar to those obtained using a taut reference line, the Engineer shall disapprove the use of these devices.

Place subsequent pavement courses over the initial course using one of the above methods. In addition, any course in an adjacent lane may be used as the reference for the use of a short ski. The Engineer has final approval of the method chosen by the Contractor.

The automatic screed controls will not be required where existing grades at roadway intersection or drainage structure must be met, for shoulders, temporary detours, behind curbs, or in other areas where its use is impractical.

If there are less than 1250 square meters in the contract, or the areas to be paved are small and scattered, the HMA mixture may be spread by hand methods. For these areas, dump and spread the mixture such that the compacted thickness meets the specified thickness in the plans.

Prior to the beginning of rolling, check the loose mat, adjust any irregularities, and remove and replace all unsatisfactory material.

When placing the Shim Course to fill wheel ruts in an existing pavement, each wheel path rut must be paved separately. The placement equipment will be a drag box configuration or approved equal having side forms. Use the equipment to spread and strike off the shim course material to a uniform width of approximately 1.2 meters. The intent of the operation is to fill the low area only and not to place the material for the pavement's full lane width. The placement equipment wheels and/or other appurtenances must not interfere with the distribution and placement of the shim course material. Deliver the placement equipment to the project site prior to the placing operation to allow sufficient time for examination and approval by the Engineer.

402-3.07 Compaction. Compact the HMA mixture using the appropriate compaction method specified in Table 402-4, Compaction Methods, associated to specific items being placed.
TABLE 402-4 COMPACTION METHODS

<table>
<thead>
<tr>
<th>Compaction Methods</th>
<th>Item Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>A=50 series</td>
<td>402.XX5ZQR</td>
</tr>
<tr>
<td>B=60 series</td>
<td>402.XX6ZQR</td>
</tr>
<tr>
<td>C=70 series</td>
<td>402.XX7ZQR</td>
</tr>
<tr>
<td>D=80 series &amp; other</td>
<td>402.XX8ZQR &amp; other</td>
</tr>
</tbody>
</table>

NOTES: XX = 37, 25, 19, 12, 09, 05, 01
Z = Friction requirement (1, 2, 3, 9)
Q = Quality item number
R = Revision number

Immediately after the HMA mixture has been spread, struck off, and surface irregularities adjusted to uniformity, compact it using rollers meeting the requirements of §402-3.04, Rollers. Roll the surface when the mixture is in the proper condition and when the rolling does not cause displacement, cracking, or shoving. Initially roll all courses with the roller traveling parallel to the centerline of the pavement, beginning at each edge and working toward the center. Roll banked curves starting at the low-side edge and working toward the superelevated edge.

Correct at once any displacement occurring as a result of reversing the direction of the roller, or from other causes, by the use of rakes and addition of fresh HMA mixture as required. Exercise care in rolling so as not to displace the line and grade of the edges of the HMA mixture. To prevent adhesion of the mixture to the rollers, keep the wheels properly moistened with water, water mixed with small quantities of detergent or other approved material. Petroleum products or solvents having an adverse effect upon the HMA pavement will not be permitted.

When the rolling operation is complete, defects, such as shallow ruts, ridges, roller marks, cracking, tearing, segregation, or any other irregularities, as determined by the Engineer, shall not be visible in the pavement. If these defects are present, correct these defects to the satisfaction of the Engineer or replace the pavement at no additional cost to the State.

Along forms, curbs, headers, walls, and other areas not accessible to rollers, thoroughly compact the mixture with mechanical tampers. On depressed areas, use a trench roller or a small vibratory roller with the approval by the Engineer. Cleated compression strips also may be used under the roller to transmit compression to the depressed area.

Remove and replace any mixture that becomes loose and broken, mixed with dirt, or is in any way defective, with fresh HMA mixture. Compact the mixture to conform with the surrounding area. Correct any area showing an excess or deficiency of HMA material.

When Shim Course is used for filling wheel ruts, compact with a minimum of three passes of a pneumatic rubber tire roller. When Shim Course is used as a skim coat, use pneumatic rubber tire rollers unless other rollers are approved by the Engineer.

Vibratory compaction is not permitted when compacting HMA mixtures on structural bridge decks, or other structures with less than 0.6 meters of cover. When using vibratory compaction, repair all damages which may occur to the highway components and adjacent property, including buried utility and service facilities, at no cost to the State.

When placing HMA mixture using either 50, 60, or 70 series compaction methods, control the operation of the rollers including the speed, the amplitude settings, the vibration frequency, and the weight of the rollers.

For 60 and 70 series compaction methods, use at least one of the density gauges specified in §402-3.07 E of this section.

Use the following compaction methods based on the item numbers for HMA placements on all Department contracts.

A. 50 Series Compaction Method. On the first day of mainline paving, select one of the following options:

1. Option 1: Test Section. Prior to routine paving of this item, construct a test section on the project site at a location approved by the Engineer. The test section will be a maximum of 500
lane meters on the mainline. Construct the full width of the pavement if necessary. The test section will be the same depth specified for the construction of the course which it represents. Use the first 100 linear meters of the test section to stabilize the paving operation. There is no maximum length if the test section is not on the mainline. The first 200 metric tons of quantity placed on a test section will be paid at a factor of 1.5 times the bid price. The remaining quantity will be paid at the bid price. A maximum of two test sections per item will be paid at the 1.5 adjustment. Pavement density Quality Adjustment Factors (QAFs) will not apply to the first two test sections. If more than two test sections are required, the pavement density QAF will apply when the additional test sections are located on the mainline. Only one test section per item per day will be placed. Subsequent test sections after the initial passing test section will be subject to approval by the Engineer. Once the test section is completed, the Engineer will select core locations and have cores taken in accordance with §402-3.08, Pavement Density Samples. When the average density of the cores is less than 88% of the maximum theoretical density, the Engineer will evaluate the test section to determine its acceptability. If found acceptable, payment will be adjusted by a factor of 0.60. If found unacceptable remove and replace at no additional cost to the State and the 1.5 factor will not apply.

Routine paving operations for this item will not be permitted until the results of the cores from the test section has a minimum pavement density QAF of 1.00. If the pavement density QAF is less than 1.00, construct another test section in accordance with Option 1.

2. Option 2: Routine Paving. Begin paving operations. Test Section Adjustment of 1.5 for the first 200 metric tons will not apply. All material placed will be subject to a pavement density QAF. If the pavement density QAF on the first day of paving is less than 1.00, construct a test section in accordance with Option 1.

During the placement of HMA mixture under this method, including the test section, take cores and loose mix samples in accordance with §402-3.08, Pavement Density Samples.

A paving lot is defined as a day’s production which must be a minimum of 200 metric tons. Each paving lot will be equally divided into four sublots in accordance with Materials Procedure (MP) 96-04, Asphalt Concrete Statistical Pavement Density Determination. When paving is continuous within a 24-hour period, a new lot will result when a change occurs in the paving crew. When a single plant is supplying to multiple paving operations or multiple plants are supplying to multiple paving operations, each paving operation will be evaluated separately. Multiple plants will not be allowed to supply HMA mixture to a single paver. If less than 200 metric tons are placed on any day, pavement cores will not be required and the density QAF will be reported as 1.00 for that day, provided that the Engineer is satisfied that the procedures used in these areas obtain pavement densities similar to previously placed pavement sections.

Compact the pavement sufficiently to achieve densities, as a percentage of the mixture’s average daily maximum theoretical density (%MADMTD), in a range of 92% to 97%. Pavement cores and loose mix samples will be tested and analyzed by the Department in accordance with MP 96-04 to determine the pavement density QAF.

When consecutive lots are found to have a density QAF equal to or less than 0.85, stop paving operations and immediately construct a new test section in accordance with Option 1, described previously in this section.

The density QAF will not be applied to material placed on ramps with a uniform full-width section of less than 400 m in length, shoulders, maintenance widenings and crossovers, and bridges. Payment for these areas will be based on satisfactory placement and compaction. Placement and compaction procedures will be satisfactory when the procedures used in these areas obtain pavement density similar to that obtained on the mainline pavement sections. If the shoulder shows signs of distress at this level of compaction, decrease the compaction effort until no further damage occurs to the shoulder or subbase. If a density gauge(s) is used to monitor mainline paving, use the same gauge(s) to monitor density of the above referenced areas.

B. 60 Series Compaction Method. On the first day of paving, select one of the options specified below:
1. **Option 1 - Test Section Only.** The test section is constructed to determine a Project Target Density (PTD) for this item and correlation of a density gauge. Prior to routine paving operations for this item, construct a test section at a location approved by the Engineer. Construction of the test section will not be allowed unless both a density gauge and the operator are present. The test section will be a maximum of 500 lane meters on the mainline. The Contractor will construct the full width of the pavement if necessary. The test section will be the same depth specified for the construction of the course which it represents. Use the first 100 linear meters of the test section to stabilize the paving operation. The remainder of the length will be used to determine the PTD.

During construction of the test section, take samples in accordance with §402-3.08, Pavement Density Samples. These samples should represent the material placed on the test section. At the conclusion of the test section, the Engineer will randomly select four 150 mm core locations on the test section (excluding the initial 100 linear meters) in accordance with §402-3.08, Pavement Density Samples. Take density readings with a density gauge(s) at each core location prior to drilling the cores. A density gauge reading is the average of multiple density gauge measurements taken in accordance with the appropriate Materials Procedure. Deliver the samples and the four density gauge readings with the gauge type, model, and serial number for each gauge to be correlated to the Regional Laboratory in accordance with §402-3.08, Pavement Density Samples. The Regional Materials Engineer will use the test section cores and density gauge readings to establish a PTD for each density gauge within one business day of the delivery of the samples and density gauge readings. When the average of the cores is less than 88% of the maximum theoretical density, the Engineer will evaluate the test section to determine its acceptability. If found acceptable, payment will be adjusted by a factor of 0.60. If found unacceptable remove and replace at no additional cost to the State and the 1.5 factor will not apply.

The first 200 metric tons of quantity placed on a test section will be paid at a factor of 1.5 times the bid price. The remaining quantity will be paid at bid price. A maximum of two test sections per item will be paid at the 1.5 adjustment. Place only one test section per item per day. Subsequent test sections after the initial test section will be subject to approval by the Engineer.

Routine paving will only begin after a PTD has been established by the Regional Materials Engineer based on testing of the pavement cores.

2. **Option 2 - Test Section immediately followed by Routine Paving.** Inform the Engineer when this option is selected. Construct a test section as described in Option 1 and continue paving. Take additional loose-mix samples in accordance with §402-3.08. Store these samples at the plant. The 1.5 adjustment for the test section does not apply when this option is selected. Determine an Interim PTD to monitor pavement density as described in the appropriate Materials Procedure. If nuclear density readings over two consecutive locations fall below 96% or above 103% of the PTD or if the moving average of the last 10 nuclear density readings falls below 98% of the PTD, stop routine paving operations and immediately construct a new test section in accordance with requirements of Option 1 - Test Section Only.

At the end of the first day’s paving, submit a copy of the appropriate BR form, as described in MP 96-01 or MP 03-001, to the Engineer. The Engineer will determine whether the density readings taken using the Interim PTD are acceptable based on the Actual PTD in accordance with MP 96-01 or MP 03-001. If not, the Engineer will select core locations randomly over the entire first day’s production excluding the test section. Prior to drilling these cores, take density readings at each core location. Deliver the core samples, density gauge readings, and the loose mix samples to the Regional Laboratory in accordance with §402-3.08, Pavement Density Samples.

If the average density of the pavement cores is not between 92% and 97% of the mixture’s maximum theoretical density, the Engineer will make a payment adjustment in accordance with Table 402-9, Density Quality Adjustment Factors, to the material placed on that day excluding the material placed on the test section.

Use only the gauge(s) correlated during the construction of the test section for monitoring pavement density during routine paving operations.
Compact the pavement sufficiently to achieve the PTD value. The minimum acceptable density reading is 96% and no greater than 103% of the PTD at a single test location and 98% of the PTD calculated as a moving average of the last 10 test locations as determined by a density gauge. Take density gauge readings at each location, randomly selected by the Engineer in accordance with the appropriate Materials Procedure, every 60 meters along the length of the pavement for each pass of the paver. Record these density values on the appropriate BR form.

If density gauge readings over two consecutive locations fall below 96% or above 103% of the PTD or if the moving average of the last 10 density gauge readings falls below 98% of the PTD, stop routine paving operations and immediately construct a new test section in accordance with requirements of Option 1 - Test Section Only.

Placement and compaction on shoulders, ramps, maintenance widenings and crossovers, and bridges will be deemed satisfactory by the Engineer when the procedures used in these areas obtain pavement density similar to that obtained on the mainline pavement sections. Monitor and record the density of the above-referenced areas with the same density gauge to insure the PTD is achieved. If the shoulder subbase is structurally insufficient to sustain the level of compaction such that the shoulder shows signs of distress, decrease the compaction effort until no damage occurs to the shoulder or subbase.

Additional pavement core samples may be required for daily density verification from the previously placed HMA. The requirement of these samples shall be based on the following situations:

- Insufficient number of density readings recorded, either at a specific location or at the required frequency.
- Paving without a density gauge on site.
- Paving completed after the only calibrated density gauge on site breaks down.
- Gauge readings do not seem to accurately represent the HMA density.

When pavement samples are required, take cores and density gauge readings at each core location in accordance with §402-3.08, Pavement Density Samples, and deliver them to the Regional Laboratory. The Regional Materials Engineer may establish a new PTD based on these cores. The material placed under the above situations will be subject to a payment adjustment.

Pavement samples may be required to verify PTD used on the contract for the following situations:

- When the contract includes multiple paving locations.
- Changes in existing pavement condition being overlaid.
- Excessive plant mix variations.
- Using a Job Mix Formula different from the mix produced for the Test Section or producing the mix in a plant different from the plant used during the Test Section.

When pavement samples are required, take cores, density gauge readings at each core location, and loose-mix samples in accordance with §402-3.08, Pavement Density Samples, and deliver them to the Regional Laboratory. The material placed under these situations will not be subject to payment adjustment. The Regional Materials Engineer will establish a new PTD if different from the original PTD.

C. 70 Series Compaction Method. On the first day of paving, construct a test section on the project site at a location approved by the Engineer, using the same equipment and procedures to be used in the construction of the remainder of the course being laid. The test section is constructed to determine the Project Target Density (PTD). Routine paving operations may begin immediately following the construction of the test section once a PTD has been established based on the evaluation of density readings. Paving operations will not be allowed unless both a density gauge and an operator are present.

Test Section. Construct a test section maximum of 500 linear meters on the mainline which has the same depth specified for the construction of the course it represents. Use the first 100 meters of the test section to stabilize the paving operation. The remainder of the length will be
used to determine the Project Target Density (PTD). Once a sufficient amount of material has
been placed in the remaining test section, compact the pavement initially with a breakdown roller
making four vibratory passes or as recommended by the Engineer. The Engineer will select three
random locations in accordance with the appropriate Materials Procedure, and mark these sites
so that subsequent density testing can be performed at the same locations. Take density readings
at the three selected sites. A density gauge reading is defined as the average of multiple density
gauge measurements taken in accordance with the appropriate Materials Procedure. Make
additional machine passes using either the intermediate or the finish roller and take additional
density readings at the three previously selected sites after each pass until the increase in density
is less than 32.0 kg/m³, or until the Engineer stops further compaction because the pavement
shows signs of distress.

The Engineer will calculate the average of the highest density reading from each of the
random locations. The resulting average will be set as the PTD.

Compact the pavement sufficiently to achieve the PTD value. The minimum acceptable density
reading will be 96% or maximum of 103% of the PTD in a single test location and 98% of the PTD
calculated as a moving average of the last 10 test locations as determined by a density gauge. Take
density gauge readings at each location, randomly selected by the Engineer in accordance with the
appropriate Materials Procedure, approximately every 60 meters along the length of the pavement for
each pass of the paver. Record these values on the appropriate BR form.

If density gauge readings over two consecutive locations fall below 96% or above 103% of the
PTD or if the moving average of the last 10 density gauge readings falls below 98% of the PTD, stop
routine paving operations and immediately construct a new test section in accordance with
requirements of the Test Section.

Placement and compaction on shoulders, ramps, maintenance widenings and crossovers, and
bridges will be satisfactory when the procedures used in these areas obtain pavement density similar
to that obtained on the mainline pavement sections. Monitor the density of areas with the same
density gauge to insure the PTD is achieved. If the shoulder subbase is structurally insufficient to
sustain the level of compaction such that they show signs of distress, decrease the compaction effort
until no damage occurs to the shoulder or subbase.

D. 80 Series Compaction Method. For this compaction method, use either of the compaction
options listed below:

1. Option 1 - Static Compaction. Use this option only when the compacted thickness of the
finished mat is 100 mm or less. The roller speeds shall not exceed 5 km/hr and will move at a
slow and uniform speed. The roller drive wheel or drum will be nearest to the paver. When
paving multiple lanes simultaneously, increase the required number of rollers proportionately for
each additional full lane width unless otherwise approved by the Engineer. Under this option,
initially roll all HMA mixtures with an approved steel-wheel roller operating in a static mode.
Overlap the previous roller pass by one-half the width of the roller.

Immediately following the initial rolling, roll the mat with an approved pneumatic rubber-
tired roller. A minimum of 3 passes of the rubber-tired roller will be required. One pass is defined
as one movement of the roller over any point of the pavement in either direction.

Immediately following the pneumatic rubber-tired rolling, finish rolling the mat with a steel-
wheel roller to remove all shallow ruts, ridges, roller marks, and other irregularities from the
surface.

To prevent adhesion of the mixture to the drum(s) and pneumatic tires, keep the drum(s) and
the pneumatic tires properly moistened with water, or water mixed with small quantities of
detergent or other approved materials.

When the compaction procedure fails to produce acceptable results, adjust the procedure to
obtain the desired results.

2. Option 2 - Vibratory Compaction. Under this option, furnish a vibrating-reed tachometer
for the exclusive use of the Engineer. The vibrating-reed tachometer must have a frequency range
of 17 Hz to 67 Hz with a minimum reed interval of 1 Hz between 17 Hz and 33 Hz and a minimum reed interval of 2 Hz between 33 Hz and 67 Hz.

Operate vibratory rollers at a uniform speed not exceeding 4 km/hr (67 m/min.) on all pavement courses. Complete all turning of the compaction equipment on material which has had a minimum of one roller pass.

The number of passes listed in Table 402-5, Number of Passes, are recommended and may be increased or decreased to obtain adequate density. Complete all breakdown roller passes before the mat temperature falls below 120º C. One vibratory pass is defined as one movement of one drum of the roller over the pavement in either direction. One static pass is defined as one movement of the roller over the pavement in either direction. Remove all ruts, ridges, roller marks, or other irregularities from the surface using static rolling. The Engineer may approve alternate compaction procedures for areas where the specified procedures are not practical.

If satisfactory compaction is not obtained, or damage to highway components and/or adjacent property occurs using vibratory compaction equipment, immediately cease using this equipment and proceed with the work in accordance with the conventional compaction procedures stipulated under Option A at no additional cost to the State.

**TABLE 402-5 NUMBER OF PASSES**

<table>
<thead>
<tr>
<th>Pavement Courses</th>
<th>Option 1 Three Roller Train (Static)</th>
<th>Option 2 Vibratory Rollers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Steel Wheel Rollers</td>
<td>Pneumatic Roller</td>
</tr>
<tr>
<td>37.5 mm Base (Each Lift)</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>25.0 mm Binder</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>19.0 mm Binder</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>12.5 mm Top</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>9.5 mm Top</td>
<td>4</td>
<td>3</td>
</tr>
</tbody>
</table>

For the permeable base course, compact the mixture between the temperatures of 60º C and 110º C by applying two static roller passes. Up to 2 additional passes may be required to obtain adequate density.

**E. Density Gauges**

1. **Nuclear Density Gauge.** Use a nuclear density gauge to monitor the pavement density in accordance with this subsection and Materials Procedure (MP) 96-01, Nuclear Gauge Density Data Collection for Hot Mix Asphalt. A nuclear density gauge shall consist of a radioactive source, scaler, and other basic components housed in a single backscatter unit. The gauge must be operated by personnel trained in the principles of nuclear testing and safety practices.

2. **Nonnuclear Density Gauge.** Use a nonnuclear density gauge to monitor the pavement density in accordance with this subsection and Materials Procedure (MP) 03-001, Nonnuclear Density Gauge Data Collection for Hot Mix Asphalt. The nonnuclear density gauge shall function in the temperature and moisture levels experienced during HMA paving. The nonnuclear density gauge shall contain the internal circuitry to determine the density of HMA pavements by measuring changes in the electromagnetic field resulting from the HMA compaction process.

**402-3.08 Pavement Density Samples**

**A. Pavement Cores.** The Engineer will select one pavement core location for each sublot in accordance with MP 96-04, to represent each paving sublot. The Engineer will define a total of four 150 mm diameter coring locations. The pavement core samples must come from within the 150 mm diameter circles outlined. Under no circumstances will the Engineer designate the coring locations before the rolling operation is completed. The rolling operation is completed when all compaction
equipment has moved off the sublot designated for coring. Obtain the 150 mm diameter pavement core samples no later than a day following placement of the lot. If necessary, cool the pavement so that the core samples are not damaged during coring. Do not intentionally separate the pavement core from the underlying material if it does not debond during coring. The State will separate the pavement core required for testing from the underlying material by sawing, if necessary. Backfill the core holes with a similar HMA material before opening the lane to traffic.

**B. Loose Mix Samples.** On each paving day, take four loose mix samples in accordance with AASHTO T168, Standard Test Method for Sampling Bituminous Paving Mixtures. Take these samples periodically throughout the day so as to represent the entire day’s production. When a low production day is anticipated, it is recommended that a minimum of three loose mix samples be obtained before production is terminated. When operational conditions cause production to be terminated before the specified number of samples have been taken, the following procedures will be used:

1. If only three samples are taken, the loose mix maximum theoretical density (MTD) will be based on the average of the three samples taken.
2. If only one or two samples are taken, the day’s production will be added to the next day’s production and sublots determined based on the total quantity placed during the two days. Therefore a maximum of six loose mix samples will be used to determine the loose mix MTD.

Deliver the loose mix samples to the Regional Laboratory no later than the end of the following day’s placement. If, for any reason, a delay occurs in the delivery of the lot samples for three consecutive lots, paving operations for the item will not be permitted to continue until the samples are delivered and tested.

**C. Security Procedure.** After procuring the pavement cores, secure them in accordance with MP 96-04. Cores arriving at the Regional Laboratory for testing with a damaged or missing security seal will not be tested, and new cores will be taken within 0.3 m from the original core location at the same offset.

**D. Sample Delivery.** Deliver the pavement core samples to the State Regional Laboratory no later than the end of the following day’s placement. If, for any reason, a delay occurs in the delivery of the lot samples for three consecutive lots, paving operations for the item will not be permitted to continue until the samples are delivered and tested.

**E. Core Testing.** The option of testing pavement samples taken under §402.3-08, Pavement Density Samples, for 50 and 60 series compaction methods may be selected with the approval of the Regional Materials Engineer. Under this provision, perform all sample testing as outlined in accordance with the requirements of Materials Procedure (MP) 98-01, Procedure for Testing Cores Taken from All Hot Mix Asphalt (HMA) Performance-Related Specifications. In addition, when this option is selected, the Engineer will define one additional core from two of the sublots within 0.3 m from the original core location at the same offset.

**402.3.09 Joints.** The finished pavement at all joints must comply with the surface smoothness requirements and exhibit the same uniformity of texture and compaction as other sections of the course. Do not pass rollers over the unprotected edges of a freshly laid mixture unless permitted by the Engineer.

In the formation of all joints, excluding the tapered wedge joint, the exposed edge of the newly placed layer that will become part of the joint shall be the full thickness of the layer and straight. If the edge of the newly placed layer is unacceptable, correct the edge by using a power driven saw or other approved tools to cut a neat line. Apply a light coat of HMA material meeting the requirements of Section 702 to the existing pavement edges in order to provide bonding with the newly laid pavement.

The pavement of successive courses will be such that all joints are offset no more than 150 mm from the joint of the lower pavement course, unless otherwise approved by the Engineer.
A. Transverse. Place the courses as continuously as possible to limit the number of transverse joints. Stagger the transverse joints in adjacent lanes a minimum of 3 meters. Form the transverse joint by cutting back on the previous run to expose the full depth of the course.

Set up the paver such that material is laid to overlap the previously placed edge by 50 mm to 75 mm. The thickness of the overlap material will be approximately 1/4 the compacted thickness of the course, so as to result in a smooth and well compacted joint after rolling. Broom the overlapped material back onto the hot mat so that the roller operator can crowd the small excess into the hot side of the joint. If the overlap is excessive, trim off the excess material so that the material along the joint is uniform. Remove and discard the coarse particles of aggregate in the overlap material if deemed necessary by the Engineer.

Compact the transverse joint in static mode with the roller parallel to the joint and perpendicular to traffic. Place boards of proper thickness at the edge of the pavement for the off pavement movement of the roller. Make the first pass with the roller operating on the previously laid material with 150 to 200 mm of its drum(s) projecting onto the non-compacted mix. Then make successive passes with the roller drum(s) moving approximately 300 mm per pass onto the hot material until half the width of the roller is on the hot mat.

If a vibratory roller with pneumatic drive wheels is used, align the first pass with one of the pneumatic wheels directly on the joint and the drum operating in static mode. Then make successive passes with the roller drum moving approximately 300 mm per pass onto the hot mat until half the width of the roller is on the hot mat.

B. Longitudinal. Carefully plan the placement of the surface course to ensure that the longitudinal joints in the surface course will correspond with the edges of the proposed traffic lanes. Other joint arrangements will require approval of the Engineer. When traffic is maintained on the roadway during paving operations, place the mixture such that no more than 30 meters of the longitudinal pavement joint will be exposed at the end of the working day unless a greater length is permitted in the contract documents. An exposed joint in excess of 30 meters must be a tapered wedge joint. If an exposed joint in excess of 30 meters is allowed overnight, place warning signs at a maximum spacing of 300 meters to alert drivers of the uneven edge. Approval to leave an exposed edge must be requested in writing in advance of paving operations. If approval is granted to leave a longitudinal pavement joint exposed to traffic, plan the paving operation so that the edge is only exposed to traffic for one night and is not exposed over weekends or holidays.

If permission is granted to expose a longitudinal pavement joint overnight and the joint becomes damaged or provides an unsafe condition for motorists, the Engineer will rescind the approval to expose the longitudinal pavement joint overnight. Then, no more than 30 meters of the longitudinal pavement joint may be exposed at the end of the work day.

Use the following options when paving adjoining lanes:

1. Option A - Butt Joint. Under this option lay the asphalt concrete such that it uniformly overlaps the adjacent cold mat 50 to 75 mm. The thickness of the overlap material will be approximately one-fourth the compacted thickness of the course, so as to result in a smooth and well compacted joint after rolling. Broom or rake back the overlapped material onto the adjacent hot lane so that the roller operator can crowd the small excess into the hot side of the joint. Broadcasting of the overlap material onto the lane is not allowed. If the overlap is excessive, trim off the excess material so that the material along the joint is uniform. Remove and discard the coarse particles of aggregate in the overlap material if deemed necessary by the Engineer.

2. Option B - Tapered Wedge Joint. Under this option, place the HMA mixture for the first mat with an attachment to the paver to provide a sloping wedge with a vertical stepdown at the longitudinal pavement joint. Extend a wedge of material from the bottom of the stepdown to the existing surface at a slope of 1 on 8 or flatter. Compact the first mat such that the roller compacts up to but does not extend past the stepdown. The vertical stepdown will be 12.5 mm minimum after compaction of the mat. Place the second mat such that it uniformly overlaps the adjacent cold mat 25 to 40 mm. The thickness of the overlap material will be approximately 1/4 the compacted thickness of the HMA layer, so it result in a smooth and well compacted joint after rolling. Broom or rake back the overlapped material onto the adjacent hot lane so that the roller
operator can crowd the small excess into the hot side of the joint. Broadcasting of the overlap material onto the lane is not allowed. If the overlap is excessive, trim off the excess material so that the material along the joint is uniform. Remove and discard the coarse particles of aggregate in the overlap material if deemed necessary by the Engineer.

If a dual-drum vibratory roller is used during construction of a longitudinal joint using either Option A or B, operate the roller in vibratory mode and as close to the paver as practicable. Make the first pass with the roller traveling toward the paver and operating on the hot mat with 150 to 200 mm of the roller drum protruding onto the cold mat. The roller will apply a second pass to the joint as it travels back away from the paver. If a single-drum vibratory roller with pneumatic drive wheels is used, operate the roller in vibratory mode and follow the same procedure except that the roller will be aligned on the joint so that the pneumatic drive wheels travel on the joint. All turning movements of the roller will be done on previously compacted material. After applying two roller passes on the longitudinal joint, proceed with the roller to the low side of the lane and compact as described in §402-3.07, Compaction.

402-3.10 Surface Tolerance. Construct the pavement surface to a 6 mm tolerance. If the pavement surface is not being constructed or has not been constructed to this tolerance based upon visual observation or upon riding quality, the Engineer may test the surface with a 5 meter straight edge or string line placed parallel to the centerline of the pavement and with a 3 meter straight edge or string line placed transversely to the centerline of the pavement on any portion of the pavement. Variations exceeding 6 mm will be satisfactorily corrected or the pavement relaid at no additional cost to the State.

402-3.11 Thickness Tolerance. The thickness indicated for each of the various courses of HMA pavement is the nominal thickness. Construct the pavement so that the final compacted thickness is as near to the nominal thickness as is practical, and within the tolerances specified below.

The Engineer may request cores to determine the thickness of the completed pavement layer for final acceptance and payment. Provide traffic control for safety purposes at no additional cost to the State when the pavement is cored. Fill all core holes with HMA mixture and compact the mixture in a manner satisfactory to the Engineer. The Engineer may use another acceptance method such as yield calculations to determine the final thickness for acceptance and payment.

HMA mixture, placed as a truing or leveling course as described in §402-3.05, Conditioning of Existing Surface, will not be considered in pavement thickness determinations.

A tolerance not to exceed 6 mm from the nominal thickness required for the course specified under one pay item will be acceptable where the required nominal thickness is 100 mm or less. A tolerance not to exceed 13 mm from the nominal thickness required for the course or courses specified under one pay item will be acceptable where the required nominal thickness is over 100 mm. The total thickness of all HMA mixture courses will not vary from the total of the nominal thickness indicated on the plans by more than 6 mm where the total nominal thickness is 100 mm or less; or more than 13 mm where the total nominal thickness is over 100 mm but not more than 200 mm; and by not more than 16 mm where the total nominal thickness is more than 200 mm.

When the HMA mixture is placed on newly constructed subbase material, an additional tolerance of plus 6 mm will be allowed both in the nominal thickness of the course placed directly on the subbase and the total pavement thickness.
No payment will be made for any material placed in excess of the permissible tolerance except as provided herein. Tolerances indicated for the thicknesses of individual layers of multilayer pavements (including composite pavements) are guides which should be met as closely as practical. Tolerance for the total thickness of such pavement is also a guide. In order to attain a smooth riding pavement true to line and grade, pavements which substantially conform to the plans and specifications, even though the thickness tolerance may not be exactly met, may be accepted and paid for under the following conditions:

Where the total thickness of such pavements is less than the specified thickness including tolerances, the Regional Director, may with approval of the Director, Construction Division, approve, accept and pay for such pavements; where the total thickness of such pavements is greater than the specified thickness, the Regional Director may accept and pay for such pavements when the excess thickness was necessary to attain a smooth riding pavement surface. Payment for excess thickness necessary to achieve a smooth riding surface will be considered only in cases where an existing pavement surface has been resurfaced.

402-3.12 Paver and Equipment Cleaning. Cleaning tools and equipment used for HMA placement is not allowed on the pavement surface. Also, do not conduct cleaning near streams, ponds, drainage structures or other areas that are tributaries to waterways. Use an area designated by the Engineer for cleaning all paving equipment and tools. If possible, remove solid pieces of asphalt by scraping or other mechanical means prior to application of a cleaning agent. If a petroleum product is used for cleaning, contain all liquid products during cleaning operations using tarpaulins, sand pads, pails, or other collection methods to prevent spillage or accidental release. Use hand sprayers or other similar devices to minimize the amount of petroleum product applied. Properly dispose of sand and collected petroleum products as petroleum contaminated soil. Dispose solid, dry asphalt fragments as exempt construction and demolition waste. Report any petroleum product spillage to the ground to the NYS Department of Environmental Conservation.

402-4 METHOD OF MEASUREMENT. Provisions of §401-4 Method of Measurement apply, including the following:

The HMA will be measured by the number of metric tons of compacted mixture in the accepted work. In addition, quality payment adjustments are applicable for all hot mix asphalt in accordance with these specifications herewith and the provisions outlined in the contract documents. All quality payment adjustments are measured in Quality Units. Quality Units will be determined for each day’s production and placement by using the daily Quality Adjustment Factor (QAF) for plant production, pavement density, longitudinal joint density and pavement smoothness and the appropriate tons accepted by the Engineer.

\[
\text{Quality Units} = (\text{Quality Adjustment Factor} - 1.00) \times \text{Appropriate Accepted HMA Tons}
\]

When the pavement density QAF applies, use one of the following methods of measurements in Table 402-6, Methods of Measurements, corresponding to the item used on the project:

<table>
<thead>
<tr>
<th>Method Type</th>
<th>Pay Item Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A=50 series</td>
<td>402.XX5FZR</td>
<td>QAF based on calculated PWL using four cores.</td>
</tr>
<tr>
<td>B=60 series</td>
<td>402.XX6FZR</td>
<td>QAF based on average of four core densities.</td>
</tr>
</tbody>
</table>

**A. 50 Series Method.** The Engineer will determine the paving lot’s Percent Within Limits (PWL) in accordance with MP 96-4. This PWL will be used to determine the density QAF as shown in Table 402-7, Quality Schedule. The quantity of the HMA mixture subject to possible adjustment will be determined from actual quantity placed on the mainline and ramps of uniform width longer than 400 meters. When shoulders and mainline are placed together, the mainline quantity may be determined using typical sections shown in the contract documents.

The pavement density QAF from Table 402-7, Quality Schedule, will apply to the paving lot to determine the payment adjustment. The pavement density QAF will not apply to material placed on ramps with a uniform full width section of less than 400 meters in length, shoulders, maintenance
widening and crossovers, and bridges. Payment in these areas will be a QAF of 1.00 based on satisfactory placement and compaction as determined by the Engineer.

**B. 60 Series Method.** The State will test all pavement density samples for this item when Option 2 on the initial paving day is selected or if the Engineer requests additional cores on any day after the first day as outlined in the specifications. Full payment will be made when the average density of the four cores is between 92% and 97% of the mixture's average daily maximum theoretical density. If the average density fails to meet this limit, a payment adjustment will be made based on bid price and in accordance with Table 402-9, Density Quality Adjustment Factors, to all the material placed on the mainline for the day the cores represent, excluding the material placed on the test section.

<table>
<thead>
<tr>
<th>Percent Within Limits (PWL)</th>
<th>Quality Adjustment Factor (QAF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PWL_{92-97} &gt; 93</td>
<td>1.05</td>
</tr>
<tr>
<td>PWL_{92-97} ≤ 93</td>
<td>( \sum (\text{PWL}<em>{\text{Segment}} \times \text{PayFactor}</em>{\text{Segment}})^{1.2} )</td>
</tr>
</tbody>
</table>

**NOTES:**
1. Where PWL\_Density\_Range will be calculated for each of the nine density ranges in Table 402-8, Density Segment Pay Factors, using the standard deviation and average density for the lot.
2. If the QAF is determined to be 0.60 or less, then the lot will be evaluated by the Engineer to determine if it may remain in-place. The type of material produced (i.e., binder, top), the layer in which it was used, and the location of use (i.e., mainline or a non-critical area) will be primary considerations in the determination of whether the HMA can be left in-place. If the HMA cannot be left in-place, it will be removed at no cost to the State. However, if the State determines that the HMA can be left in-place, the QAF will be 0.60.

<table>
<thead>
<tr>
<th>Density Segment</th>
<th>Segment Pay Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>88 - 89</td>
<td>0.60</td>
</tr>
<tr>
<td>89 - 90</td>
<td>0.70</td>
</tr>
<tr>
<td>90 - 91</td>
<td>0.80</td>
</tr>
<tr>
<td>91 - 92</td>
<td>0.90</td>
</tr>
<tr>
<td>92 - 93</td>
<td>1.00</td>
</tr>
<tr>
<td>93 - 96</td>
<td>1.05</td>
</tr>
<tr>
<td>96 - 97</td>
<td>1.00</td>
</tr>
<tr>
<td>97 - 98</td>
<td>0.90</td>
</tr>
<tr>
<td>98 - 99</td>
<td>0.80</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Average Core Density</th>
<th>Quality Adjustment Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>91.0, Density &lt; 92.0 or 97.0 &lt; Density, 98.0</td>
<td>0.95</td>
</tr>
<tr>
<td>90.0, Density &lt; 91.0</td>
<td>0.90</td>
</tr>
<tr>
<td>88.0, Density &lt; 90.0</td>
<td>0.85</td>
</tr>
<tr>
<td>Density &lt; 88.0 or Density &gt; 98.0</td>
<td>0.60*</td>
</tr>
</tbody>
</table>

*The lot will be evaluated by the State to determine if it may remain in-place. The type of material produced (i.e., binder, top), the layer in which it is used, and the location of use (i.e., mainline or a non-critical area) will be primary considerations in the determination of whether the HMA can be left in-place. If the HMA cannot be left in-place, it will be removed at no cost to the State. However, if the State determines that the HMA can be left in-place, the Quality Payment Adjustment will be calculated using a QAF of 0.60.

The quantity of the HMA mixture subject to possible adjustment will be determined from actual quantity placed in the accepted work on the mainline and ramps of uniform width longer than 400 meters. When shoulders and mainline are placed together, the mainline quantity may be determined using typical sections shown in the plans. The payment adjustments will be applied to material placed on mainline but not shoulders, ramps, maintenance widenings and crossovers, and bridges.
402-5 BASIS OF PAYMENT. The unit price bid per ton for all pavement courses shall include the cost of all material, labor and equipment necessary to complete the work, including any cleaning pursuant to §402-3.01; cleaning of foreign material from the pavement as a result of construction operations; all necessary repairs to highway components and/or adjacent property caused by construction operations; any necessary work to correct surface tolerances per §402-3.10; the scheduling and sequencing of work to conform with weather and seasonal limitations, and all temporary materials and work and/or repairs associated with paving operations outside the specified weather and seasonal requirements; and any removal and replacement of HMA pursuant to §401-4 and §402-4 Method of Measurement. The unit bid price also includes the cost of all necessary traffic control, equipment, labor and materials required in obtaining the pavement cores, filling all core holes with HMA, and compacting these core holes to the satisfaction of the Engineer. In addition, Quality Units may apply to the hot mix asphalt items as calculated in §402-4. Payment of Quality Units will be made based on the Index Price listed in the contract documents. The index price shown in the itemized proposal for each Quality Unit is considered the price bid. The unit (index) price is NOT to be altered in any manner by the bidder. Should the bidder alter the amount shown, the altered figure will be disregarded and the original price will be used to determine the total amount bid for the Contract.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>402.010901</td>
<td>Type 1 F9, Asphalt-Treated Permeable Base Course</td>
<td>Metric Ton</td>
</tr>
<tr>
<td>402.010911</td>
<td>Plant Production Quality Adjustment to 402.010901 M</td>
<td>Quality Unit</td>
</tr>
<tr>
<td>402.011901</td>
<td>Type 2 F9, Asphalt-Treated Permeable Base Course</td>
<td>Metric Ton</td>
</tr>
<tr>
<td>402.011911</td>
<td>Plant Production Quality Adjustment to 402.011901 M</td>
<td>Quality Unit</td>
</tr>
<tr>
<td>402.017901</td>
<td>True &amp; Leveling F9, Superpave HMA, 70 Series Compaction</td>
<td>Metric Ton</td>
</tr>
<tr>
<td>402.017911</td>
<td>Plant Production Quality Adjustment to 402.017901 M</td>
<td>Quality Unit</td>
</tr>
<tr>
<td>402.018901</td>
<td>True &amp; Leveling F9, Superpave HMA, 80 Series Compaction</td>
<td>Metric Ton</td>
</tr>
<tr>
<td>402.018911</td>
<td>Plant Production Quality Adjustment to 402.018901 M</td>
<td>Quality Unit</td>
</tr>
<tr>
<td>402.058901</td>
<td>Shim Course F9, Hot Mix Asphalt</td>
<td>Metric Ton</td>
</tr>
<tr>
<td>402.058911</td>
<td>Plant Production Quality Adjustment to 402.058901 M</td>
<td>Quality Unit</td>
</tr>
<tr>
<td>402.095101</td>
<td>9.5 mm F1 Superpave HMA, 50 Series Compaction</td>
<td>Metric Ton</td>
</tr>
<tr>
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<td>Quality Unit</td>
</tr>
<tr>
<td>402.095121</td>
<td>Pavement Density Quality Adjustment to 402.095101 M</td>
<td>Quality Unit</td>
</tr>
<tr>
<td>402.095201</td>
<td>9.5 mm F2 Superpave HMA, 50 Series Compaction</td>
<td>Metric Ton</td>
</tr>
<tr>
<td>402.095211</td>
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<td>Quality Unit</td>
</tr>
<tr>
<td>402.095221</td>
<td>Pavement Density Quality Adjustment to 402.095201 M</td>
<td>Quality Unit</td>
</tr>
<tr>
<td>402.096101</td>
<td>9.5 mm F1 Superpave HMA, 60 Series Compaction</td>
<td>Metric Ton</td>
</tr>
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<td>Plant Production Quality Adjustment to 402.096101 M</td>
<td>Quality Unit</td>
</tr>
<tr>
<td>402.096201</td>
<td>9.5 mm F2 Superpave HMA, 60 Series Compaction</td>
<td>Metric Ton</td>
</tr>
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<td>Quality Unit</td>
</tr>
<tr>
<td>402.096301</td>
<td>9.5 mm F3 Superpave HMA, 60 Series Compaction</td>
<td>Metric Ton</td>
</tr>
<tr>
<td>402.096311</td>
<td>Plant Production Quality Adjustment to 402.096301 M</td>
<td>Quality Unit</td>
</tr>
<tr>
<td>402.097101</td>
<td>9.5 mm F1 Superpave HMA, 70 Series Compaction</td>
<td>Metric Ton</td>
</tr>
<tr>
<td>402.097111</td>
<td>Plant Production Quality Adjustment to 402.097101 M</td>
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<tr>
<td>402.097201</td>
<td>9.5 mm F2 Superpave HMA, 70 Series Compaction</td>
<td>Metric Ton</td>
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<td>Quality Unit</td>
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<tr>
<td>402.098101</td>
<td>9.5 mm F1 Superpave HMA, 80 Series Compaction</td>
<td>Metric Ton</td>
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<td>Quality Unit</td>
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<td>402.098201</td>
<td>9.5 mm F2 Superpave HMA, 80 Series Compaction</td>
<td>Metric Ton</td>
</tr>
<tr>
<td>402.098211</td>
<td>Plant Production Quality Adjustment to 402.098201 M</td>
<td>Quality Unit</td>
</tr>
<tr>
<td>402.098301</td>
<td>9.5 mm F3 Superpave HMA, 80 Series Compaction</td>
<td>Metric Ton</td>
</tr>
<tr>
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<td>Plant Production Quality Adjustment to 402.098301 M</td>
<td>Quality Unit</td>
</tr>
<tr>
<td>402.098901</td>
<td>9.5 mm F9 Superpave HMA,Shoulder Course,80 Series Compaction</td>
<td>Metric Ton</td>
</tr>
<tr>
<td>402.098911</td>
<td>Plant Production Quality Adjustment to 402.098901 M</td>
<td>Quality Unit</td>
</tr>
</tbody>
</table>
SECTION 403 - HOT MIX ASPHALT (HMA) PAVEMENTS FOR MUNICIPALITIES

403-1 DESCRIPTION. These general specifications apply to plant mixed Hot Mix Asphalt (HMA) for use by municipalities such as Towns, Counties, etc. Modifications of these general requirements will be
indicated in the specific requirements for each item. These mixes are suitable for low to moderate traffic volumes.

This work will consist of one or more courses of HMA constructed on the prepared foundation in accordance with these specifications and the specific requirements of the item under contract, and in reasonably close conformance with the lines, grades, thickness and typical sections shown on the plans or established by the Engineer.

Appropriate mix types with corresponding friction aggregates and Performance Graded Binder (PG Binder) grades must be specified and used based on the traffic levels and the project location. When the traffic levels exceed an AADT of 8,000 for two lanes or 13,000 for three or more lanes, then Items in Section 402 must be specified.

403-2 MATERIALS

403-2.01 General. Use all materials for HMA production such as aggregates, PG Binder, Reclaimed Asphalt Pavement (RAP), mineral filler or any other materials meeting the State’s requirements.

403-2.02 Composition of Mixtures. The HMA plant mix will generally be composed of a mixture of aggregate, Reclaimed Asphalt Pavement (RAP), filler if required, and PG Binder. For any HMA required by the plans or itemized proposal, formulate, a job mix formula that satisfies the General Limits imposed by Table 403-1, Composition of Hot Mix Asphalt Mixtures. In addition, the formula will state the mineral aggregate sources, and the PG Binder used in the mixture. For Type 6F2, 6F3, 7F2, and 7F3 mixtures, determine the optimum asphalt content for the proposed gradation using the Marshall Mix Design Method (50 blows).

The resultant mixture shall meet the following Marshall Mix Properties:

<table>
<thead>
<tr>
<th>Mix Property</th>
<th>Type 6F2, 6F3</th>
<th>Type 7F2, 7F3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Voids, %</td>
<td>3.0 - 5.0</td>
<td>3.0 - 5.0</td>
</tr>
<tr>
<td>Voids in Mineral Agg. (VMA), %, min.</td>
<td>14</td>
<td>16</td>
</tr>
<tr>
<td>Voids Filled with Binder (VFB), %</td>
<td>65 - 78</td>
<td>65 - 78</td>
</tr>
</tbody>
</table>

Produce, deliver to the work site, and incorporate the mixture into the work within 10°C of the temperature specified by the Engineer but within the mixing and placing temperature range imposed by Table 403-1, Composition of Marshall Designed Plant Mixtures.

The aggregates will be those noted in the job mix formulas. The PG Binder will be accepted on the basis of PG Binder supplier’s certification.

Perform quality control tests during HMA production to ensure specification compliance. The plant mixed material will be accepted after blending and mixing at the plant. The pavement courses will be accepted after all paving operations are completed.

403-2.03 Aggregates. Fine aggregate will consist of materials conforming to the requirements of §703-01, Fine Aggregate. In addition, fine aggregate may consist of screenings, free from deleterious materials and manufactured from sources of stone, gravel, or slag meeting the requirements §703-02, Coarse Aggregate. Coarse aggregate will consist of crushed stone, crushed gravel, or crushed slag conforming to the requirements of §703-02, except for gradation.

When aggregates from approved natural fine sand sources are combined with coarse aggregates in the mixture, aggregate particles will meet additional requirements as follows:

- Particles in the No. 1A and No. 1 primary sizes will meet the quality requirements of §703-02 and will have a minimum of 85 percent, by weight, of the particles with at least two fractured faces.
- Particles in the No. 2, No. 3 and No. 3A primary sizes will meet the quality requirements of §703-02 and will have a minimum of 75 percent, by weight, of the particles with at least one fractured face.

Slag aggregate may be used only when an alternate pay item which takes the mix yield differential into account is included on the plans or in the itemized proposal.

Aggregates for all mixtures specified in Table 403-1, including Type 6 or 7 (F9), shall meet the requirements of §703-02, Coarse Aggregate. In addition, the aggregate requirements for Type 6F2, 6F3, 7F2, and 7F3 mixtures shall meet one of the following requirements based on the mix type specified in the contract documents:
A. Coarse Aggregate Type F2 Conditions

1. Limestone, dolomite, or a blend of the two having an acid-insoluble residue content of not less than 20.0%.
2. Sandstone, granite, chert, traprock, ore tailings, slag or other similar noncarbonate materials.
3. Gravel, or a natural or manufactured blend of the following types of materials: limestone, dolomite, gravel, sandstone, granite, chert, traprock, ore tailings, slag or other similar materials, meeting the following requirements:
   
a. Type 6F2 Mixes. Noncarbonate plus 3.2 mm particles must comprise a minimum of 10.0% of the total aggregate (by weight with adjustments to equivalent volumes for materials of different specific gravities). Additionally, a minimum of 20.0% of plus 6.3 mm particles must be noncarbonate.
   
b. Type 7F2 Mixes. Noncarbonate plus 3.2 mm particles must comprise a minimum of 10.0% of the total aggregate (by weight with adjustments to equivalent volumes for materials of different specific gravities). Additionally, a minimum of 20.0% of plus 3.2 mm particles must be noncarbonate.

### TABLE 403-1 COMPOSITION OF HOT MIX ASPHALT MIXTURES

<table>
<thead>
<tr>
<th>Mixture Requirements¹</th>
<th>Base</th>
<th>Binder</th>
<th>Shim</th>
<th>Top²,⁴</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Type 1</td>
<td>Type 2</td>
<td>Type 3</td>
<td>Type 5</td>
</tr>
<tr>
<td>50.0 mm</td>
<td>100 - 100</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>37.5 mm</td>
<td>90 -100</td>
<td>100</td>
<td>75 - 100</td>
<td>7</td>
</tr>
<tr>
<td>25.0 mm</td>
<td>78 - 95</td>
<td>5</td>
<td>55 - 80</td>
<td>8</td>
</tr>
<tr>
<td>12.5 mm</td>
<td>57 - 84</td>
<td>6</td>
<td>23 - 42</td>
<td>7</td>
</tr>
<tr>
<td>6.3 mm</td>
<td>40 - 72</td>
<td>7</td>
<td>5 - 20</td>
<td>6</td>
</tr>
<tr>
<td>3.2 mm</td>
<td>26 - 57</td>
<td>7</td>
<td>2 - 15</td>
<td>4</td>
</tr>
<tr>
<td>850 µm</td>
<td>12 - 36</td>
<td>7</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>425 µm</td>
<td>8 - 25</td>
<td>7</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>180 µm</td>
<td>4 -16</td>
<td>4</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>75 µm</td>
<td>2 - 8</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PGB Content, %²</td>
<td>4.0 - 6.0</td>
<td>0.4</td>
<td>2.5 - 4.5</td>
<td>0.4</td>
</tr>
<tr>
<td>Mixing and Placing</td>
<td>120-165</td>
<td>110-150</td>
<td>120-165</td>
<td>120-165</td>
</tr>
<tr>
<td>Temp. Range, °C</td>
<td>Description and Typical Uses</td>
<td>Dense Base: For general use</td>
<td>Open Base: For permeable base layer</td>
<td>Dense Binder: Intermediate layer for general use</td>
</tr>
</tbody>
</table>

### NOTES:
1. All aggregate percentages are based on the total weight of the aggregate.
2. The asphalt content is based on the total weight of the mix. When using slag aggregates in the mix, increase the PGB content accordingly, a minimum of 25 percent for an all slag mix.
3. 6F2, 6F3, 7F2, 7F3 mix types require friction coarse aggregates, and are required for mainline driving surface courses.

4. For Type 6 and Type 7 (F9) aggregate requirements, Marshall design will not be required. These mix types are suitable where the State’s requirements for F9 aggregate apply.

5. Introduce the PG Binder into the pugmill between 110°C and 175°C, or as recommended by the PG Binder supplier.

B. Coarse Aggregate Type F3 Conditions

1. Limestone or a blend of limestone and dolomite having an acid-insoluble residue content of not less than 20.0%.
2. Dolomite
3. Sandstone, granite, chert, traprock, ore tailings, slag or other similar noncarbonate materials.
4. Gravel, or a natural or manufactured blend of the following types of materials: limestone, dolomite, gravel, sandstone, granite, chert, traprock, ore tailings, slag or other similar materials, meeting the following requirements:
   a. Type 6F3 Mixes. Noncarbonate plus 3.2 mm particles must comprise a minimum of 10.0% of the total aggregate (by weight with adjustments to equivalent volumes for materials of different specific gravities). Additionally, a minimum of 20.0% of plus 6.3 mm particles must be noncarbonate.
   b. Type 7F3 Mixes. Noncarbonate plus 3.2 mm particles must comprise a minimum of 10.0% of the total aggregate (by weight with adjustments to equivalent volumes for materials of different specific gravities). Additionally, a minimum of 20.0% of plus 3.2 mm particles must be noncarbonate.

When coarse aggregates for these mixes are from more than one source or of more than one type of material, proportion and blend them to provide a uniform mixture.

403-2.04 Mineral Filler. Mineral filler, if required in the mix to meet gradation requirements, will conform to the requirements of §703-08, Mineral Filler.

403-2.05 Performance-Graded Binder. The PG Binder will meet the requirements of §401-2.04, Performance Graded Binder. Unless the type of PG Binder is specified in the contract documents, use PG 64-22, or a PG Binder specified in Table 6-4, Performance Graded Binder Selection, of Chapter 6 of the Comprehensive Pavement Design Manual, or other suitable PG Grade as approved by the Engineer.

403-2.06 Reclaimed Asphalt Pavement. Reclaimed Asphalt Pavement (RAP) will meet the requirements as written in Materials Method (MM) 5.16, Superpave Hot Mix Asphalt Mixture Design and Mixture Verification Procedures.

403-3 CONSTRUCTION DETAILS. The contractor is responsible for Quality Control (QC). QC is defined as all activities required to produce HMA that meets all specification requirements. The Contractor will produce HMA in accordance with the State approved Control Plan and assume responsibilities for all QC activities at the production facilities. If specified in the contract documents, the Quality Control provisions of Section 401 shall apply.

 Unless modified in the contract document, the details of §401-3, Construction Details, will apply except for the gyratory compactor, specimen mold assembly, and the extractor of §401-3.08 HMA Mixing Plant are not required. "In addition, the oven's capacity will be a minimum of 0.04 cubic meter."
Errata 5/8/03 The HMA mixing plant inspection facilities shall include mixture design equipment for Marshall method as detailed below.

 The details of §402-3 Construction Details will apply except for §402-3.05 Conditioning of Existing Surface and §402-3.07 Compaction, and §402-3.08 Pavement Density Samples. The requirements for conditioning of the existing surface and compaction are detailed below.

403-3.01 Equipment for Marshall Design Method

A. Marshall Compactor. A compactor will meet the requirements of AASHTO T245. Mount the compactor on a solid base. The compactor will be automatically driven, have a stroke counter, and be capable of automatically stopping after applying the desired number of strokes. The compaction hammer shall weigh 4.536 kilograms (0.009 kg).
**B. Marshall Specimen Mold Assembly.** The specimen mold assembly will meet the requirements of AASHTO T245. The assembly shall consist of a compaction mold, base plate, and collar. Provide a minimum of three specimen mold assemblies and an adequate supply of 100 mm paper discs.

**C. Marshall Specimen Extractor.** Supply an extractor, meeting the requirements of AASHTO T245, to extract the 100 mm Marshall specimens from the compaction molds.

**D. Hot Plate.** Supply a hot plate suitable for heating the Marshall compaction hammer. A hot plate meeting the requirements of §401-3.08, 13. p. Sample Drying Appliance, will be acceptable.

403-3.02 Conditioning of Existing Surface. Clean the surface of the existing pavement prior to placing any HMA. When specified in the contract documents:

- Clean and fill the joints and cracks under the provisions of Section 633, Conditioning Existing Pavement.
- Apply a thin, uniform tack coat under the provisions of Section 407, Tack Coat, to all contact surfaces of existing HMA and Portland Cement Concrete layers including such areas as adjacent pavement edges, curbing, gutters, manholes and other structures, immediately prior to placing the HMA mixture against them.
- If the pavement surface is rutted, fill all depressions and wheel path ruts prior to the paving of the truing and leveling course, as directed by the Engineer. For wheel path ruts 7 mm or greater, but 20 mm or less, use Shim Course. Otherwise, for ruts greater than 20 mm, use a Type 7 mixture or other appropriate mixture.
- Place a truing and leveling course of a minimum variable thickness of proper plant mix necessary to bring the surface of the existing pavement to the same transverse slope and longitudinal grade required for the finished pavement surface. For compacted thickness up to 50 mm, use a Type 6 or Type 7 mixture. For compacted thickness in excess of 50 mm, use a Type 3 mixture. Pay special attention to the proper compaction of thin sections.

403-3.03 Compaction Immediately after the HMA mixture has been spread, struck off and surface irregularities adjusted, thoroughly and uniformly compact it by rolling. Roll the surface when the mixture is in the proper condition and when the rolling does not cause undue displacement, cracking or shoving. Initially roll all courses with the roller traveling parallel to the centerline of the pavement beginning at each edge and working toward the center. Roll the banked curves starting at the low side edge and working toward the super-elevated edge.

Correct at once any displacement occurring as a result of reversing the direction of the roller, or from other causes, by the use of rakes and addition of fresh mixture as required. Exercise care in rolling so as not to displace the line and grade of the edges of the HMA mixture. To prevent adhesion of the mixture to the drum(s) and pneumatic tires, keep the drum(s) and the pneumatic tires properly moistened with water or water mixed with small quantities of detergent or other approved material. Any petroleum products or solvents having an adverse effect upon the HMA pavement will not be permitted for use.

There shall be no visible defects, such as shallow ruts, ridges, roller marks, cracking, tearing, segregation, or any other irregularities as determined by the Engineer, in the pavement when the rolling operation is complete. If these defects are present, correct these defects to the satisfaction of the Engineer or relay the pavement at no additional cost.

Along forms, curbs, headers, walls and other areas not accessible to the rollers, thoroughly compact the mixture with mechanical tampers as directed by the Engineer. On depressed areas, use a trench roller or a small vibratory roller with the approval by the Engineer. Cleated compression strips also may be used under the roller to transmit compression to the depressed area.

Remove and replace any mixture that becomes loose and broken, mixed with dirt, or is in any way defective with fresh HMA mixture which shall be compacted to conform with the surrounding area. Correct any area showing an excess or deficiency of HMA material to the satisfaction of the Engineer.

When using vibratory compaction, assume full responsibility for the cost of repairing all damages which may occur to the highway components and adjacent property including buried utility and service facilities.
Use either of the two compaction options listed below except that the shim course must be compacted with a minimum of three passes of a pneumatic rubber tired roller unless otherwise approved by the Engineer for variance. Option B - Vibratory Compaction is not permitted when compacting HMA concrete courses on structural bridge decks, or other structures with less than 0.60 meters of cover.

**A. Option A. Three Roller Compaction Train.** Under this option, initially roll all HMA mixtures with an approved steel-wheel roller operating in a static mode. Overlap the previous roller pass by one-half the width of the roller.

Immediately following the initial rolling, roll the mat with an approved pneumatic rubber-tired roller. A minimum of 3 passes of the rubber-tired roller will be required. One pass is defined as one movement of the roller over any point of the pavement in either direction.

Immediately following the intermediate rolling, finish roll the mat with a steel-wheel roller to remove all shallow ruts, ridges, roller marks, and other irregularities from the surface.

Use this option only when the compacted thickness of the finished mat is 100 mm or less. Unless approved by the Engineer, the roller speeds shall not exceed 5 kilometers per hour. When paving multiple lanes simultaneously, increase the required number of rollers proportionately for each additional full lane width unless otherwise permitted by the Engineer.

**B. Option B - Vibratory Compaction.** Under this option, use vibratory rollers appearing on the current Approved List - HMA Concrete Vibratory Compaction Equipment. For each project where a vibratory roller is used, furnish a vibrating reed tachometer for the exclusive use of the Engineer. The vibrating reed tachometer must have a frequency range of 17 Hz to 67 Hz with a minimum reed interval of 1 Hz between 17 Hz and 33 Hz and a minimum reed interval of 2 Hz between 33 Hz and 67 Hz.

Operate vibratory rollers at a uniform speed not exceeding 4 kilometers per hour (67 meters per minute) on all pavement courses. Complete all turning of the compaction equipment on material which has had a minimum of one roller pass.

The required number of passes listed in Table 403-2, Number of Passes, is recommended and may be increased or decreased if, in the opinion of the Engineer, adequate density can be achieved. Complete all breakdown roller passes before the mat temperature falls below 120° C. One vibratory pass is defined as one movement of one drum of the roller over any point of the pavement in either direction. One static pass is defined as one movement of the roller over any point of the pavement in either direction. Remove all ruts, ridges, roller marks or other irregularities from the surface using static rolling. The Engineer may alter the compaction procedures for small areas where the specified procedures are not practical.

If the Engineer determines that unsatisfactory compaction is being obtained or damage to highway components and/or adjacent property is occurring using vibratory compaction equipment, then immediately cease using this equipment and proceed with the work in accordance with the conventional compaction procedures stipulated under Option A at no additional cost.

<table>
<thead>
<tr>
<th>TABLE 403-2 NUMBER OF PASSES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pavement Courses</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Base (Open Graded Each Lift)</td>
</tr>
<tr>
<td>Base (Dense-Graded)</td>
</tr>
<tr>
<td>Binder (Dense-Graded)</td>
</tr>
<tr>
<td>Top (Dense-Graded All Types)</td>
</tr>
</tbody>
</table>

When the compaction procedure being used fails to produce results acceptable to the Engineer, adjust the procedure to obtain the desired results. Rollers will move at a slow and uniform speed. The roller drive roll or wheel will be nearest the paver.

**403-4 METHOD OF MEASUREMENT.** The Engineer shall measure the quantity of the HMA placed and compacted in the accepted work. The quantity shall be measured in metric tons to the nearest 0.01 and determined from the delivery ticket.
Each delivery vehicle supplying HMA mixture shall be accompanied with a delivery ticket indicating the total quantity in metric tons being delivered. The quantity on the delivery ticket shall be determined from the automated proportioning system or the delivery vehicle weigh system. The delivery ticket shall contain the following minimum information:

- Ticket Number
- Plant Identification
- Contract Number
- Material Description, (including the PG-Binder Grade)
- Quantity of Material in Vehicle
- Date and Time

Make one legible copy of the delivery ticket available to the project inspector prior to the placement of the mixture.

**403-5 BASIS OF PAYMENT.** The unit bid price per ton for all pavement courses shall include the cost of all material, labor and equipment necessary to complete the work, including any cleaning pursuant to §403-3.02; cleaning of foreign material from the pavement as a result of construction operations; all necessary repairs to highway components and/or adjacent property caused by construction operations; any necessary work to correct surface tolerances per §402-3.10; and the scheduling and sequencing of work to conform with weather and seasonal limitations, and all temporary materials and work and/or repairs associated with paving operations outside the specified weather and seasonal requirements. Cleaning, sealing, and filling the cracks will be paid under Section 633. Tack coat will be paid under Section 407, Tack Coat.

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>403.118902</td>
<td>Hot Mix Asphalt, Type 1 Base Course</td>
<td>Metric Ton</td>
</tr>
<tr>
<td>403.128902</td>
<td>Hot Mix Asphalt, Type 2 Base Course</td>
<td>Metric Ton</td>
</tr>
<tr>
<td>403.138902</td>
<td>Hot Mix Asphalt, Type 3 Binder Course</td>
<td>Metric Ton</td>
</tr>
<tr>
<td>403.158902</td>
<td>Hot Mix Asphalt, Type 5 Shim Course</td>
<td>Metric Ton</td>
</tr>
<tr>
<td>403.178202</td>
<td>Hot Mix Asphalt, Type 6 F2 Top Course</td>
<td>Metric Ton</td>
</tr>
<tr>
<td>403.178302</td>
<td>Hot Mix Asphalt, Type 6 F3 Top Course</td>
<td>Metric Ton</td>
</tr>
<tr>
<td>403.178902</td>
<td>Hot Mix Asphalt Type 6 Top Course</td>
<td>Metric Ton</td>
</tr>
<tr>
<td>403.198202</td>
<td>Hot Mix Asphalt, Type 7 F2 Top Course</td>
<td>Metric Ton</td>
</tr>
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<td>403.198302</td>
<td>Hot Mix Asphalt, Type 7 F3 Top Course</td>
<td>Metric Ton</td>
</tr>
<tr>
<td>403.198902</td>
<td>Hot Mix Asphalt Type 7 Top Course</td>
<td>Metric Ton</td>
</tr>
<tr>
<td>403.218902</td>
<td>Hot Mix Asphalt, True and Leveling Course</td>
<td>Metric Ton</td>
</tr>
</tbody>
</table>

**SECTION 404 (VACANT)**

**SECTION 405 - COLD MIX BITUMINOUS PAVEMENT (OPEN GRADED)**

**405-1 DESCRIPTION.** This work shall consist of constructing one or more courses of cold mix bituminous pavement on a prepared base in accordance with these specifications and in substantial conformance with the lines, grades, thicknesses, and typical cross-sections shown on the plans or established by the Engineer.

**405-2 MATERIALS**

**405-2.01 Bituminous Material.** The bituminous materials required for mixing and for sealing shall meet the requirements of section 702, Bituminous Materials. The type and grade of bituminous material shall be that indicated on the plans or in the proposal.

**405-2.02 Aggregates.** The aggregates shall be Department approved aggregates meeting the requirements of § 703-02, Coarse Aggregates, for the sizes specified. Screened gravel shall not be permitted unless specified on the plans or in the proposal.
405-2.03 Composition of Mixtures. The bituminous cold mix shall be composed of a mixture of aggregate and bituminous material as ordered and approved by the Engineer. The mix shall be proportioned as specified in Table 405-1, Composition of Cold Bituminous Mixtures.

<p>| TABLE 405-1 COMPOSITION OF COLD BITUMINOUS MIXTURES |
|---------------------------------|-----------------|-----------------|-----------------|</p>
<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Mixes</th>
<th>Type 1 General Limits % passing</th>
<th>Type 2 General Limits % passing</th>
<th>Type 3 General Limits % passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 mm</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>100</td>
</tr>
<tr>
<td>37.5 mm</td>
<td>-</td>
<td>100</td>
<td>75-100</td>
<td>50-80</td>
</tr>
<tr>
<td>25 mm</td>
<td>100</td>
<td>90-100</td>
<td>50-80</td>
<td>0-15</td>
</tr>
<tr>
<td>12.5 mm</td>
<td>90-100</td>
<td>15-45</td>
<td>0-10</td>
<td>-</td>
</tr>
<tr>
<td>6.3 mm</td>
<td>15-45</td>
<td>0-10</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3.2 mm</td>
<td>0-10</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>75 µm</td>
<td>0-1.0</td>
<td>0-1.0</td>
<td>0-1.0</td>
<td>-</td>
</tr>
<tr>
<td>Bituminous Material</td>
<td>4.7-7.0</td>
<td>4.0-6.0</td>
<td>3.5-5.5</td>
<td></td>
</tr>
<tr>
<td>Description</td>
<td>Open, Coarse Texture</td>
<td>Open, Coarse Texture</td>
<td>Open, Coarse Texture</td>
<td></td>
</tr>
<tr>
<td>Typical Uses</td>
<td>Surface Course</td>
<td>Intermediate</td>
<td>Base Course</td>
<td></td>
</tr>
</tbody>
</table>

1 Percentage based on total aggregate weight.
2 Total Emulsion Percentage based on total mix weight.
3 When crushed air-cooled blast furnace slag aggregate is selected, the above bituminous material content shall be increased approximately 25%.

405-3 CONSTRUCTION REQUIREMENTS

405-3.01 Weather Limitations. Bituminous material or mixture shall not be applied on any soft surfaces, when the surface is wet, when the temperature of the surface on which the mixture is to be placed is below 7°C, or when other weather conditions would prevent proper construction of the pavement.

405-3.02 Equipment. The following equipment shall be required:
- Either central pugmill mixer and bituminous paver or Travel plant mixer
- Bituminous material distributor
- Steel wheeled roller, 7-11 Metric Ton or Approved vibratory roller
- Chip spreader
- Power broom
- Motor grader, if required
- Miscellaneous equipment to perform the work

All equipment and the condition of the equipment for this work shall be subject to approval of the Engineer at all times.

Mixing shall be done with a rotating twin paddle shaft pugmill providing suitable pressure-kneading action in mixing. Mixing by blading, shoveling and/or scooping will not be permitted.

The materials shall be mixed either by the travel mix plant method or in a central pugmill mixer.

The mixer shall be either a continuous traveling type, central continuous or batch type pugmill designed to accurately proportion whether by volume or by weight, so that when the aggregate and bituminous materials are incorporated in the mix, a thorough and uniform coating will result. The mixer shall be equipped to mechanically or electrically interlock the bituminous feed with the aggregate feed such that uniformity of the mixture is assured at all times. The pugmill mixer, either traveling or central type, shall be provided with weighing, volumetric or other gauging equipment which shall be capable of providing accurate control at all times of the amount of aggregate entering the mixer per time interval.

On the central continuous type pugmill a mechanically operated discharge hopper of at least 0.76 cubic
meters capacity shall be provided. The mixer shall be equipped with a positive displacement metering system capable of totalizing the quantity of bituminous material applied to the mixing chamber.

405-3.03 Preparation of the Base. The roadway surface to be covered shall be free from holes, depressions, bumps, waves and corrugations. Any unsuitable surface areas shall be repaired by replacement of the unstable materials or by patching with a material to produce a tight surface having the same elevation as the surrounding surface. The roadway surface shall be broomed when ordered by the Engineer to remove loose material.

405-3.04 Mixing and Spreading. The aggregate and asphalt shall be thoroughly mixed so that the bituminous material is uniformly distributed throughout and all aggregate particles are uniformly coated. The mixture shall be deposited on the prepared base either in a windrow at the back of the travel mixer or mechanically spread in a uniform layer so as to produce the specified thickness after compaction. If deposited in a windrow, it shall be spread over the entire roadway surface by motor grader or other approved spreader to produce the specified thickness after compaction. The maximum allowable compacted thickness shall be 50 mm for the Type 1 mix (Table 405-1) and 100 mm for the Type 2 and Type 3 mixes (Table 405-1).

405-3.05 Compaction. After spreading, the mixture shall be thoroughly and uniformly compacted with a self-propelled steel-wheeled roller or an approved vibratory roller to obtain a thoroughly compacted pavement. The number of roller passes to achieve the desired compaction shall be approved by the Engineer.

405-3.06 Surface Testing. The finished surface of the pavement shall be tested with a 5 meter straight edge laid parallel with the center line of the pavement. Any area exceeding a 6 mm variation from the surrounding area shall be satisfactorily corrected or removed and replaced.

405-3.07 Pavement Sealing. Either prior to initial compaction or immediately after compacting the mix, No. 1A size key stone meeting the requirements of § 703-02, Coarse Aggregates, shall be uniformly spread upon the surface at the rate of 5-8 kg/m² and the course rolled. No. 1 size key stone meeting the requirements of § 703-02, Coarse Aggregates, at the rate of 5-10 kg/m², may be used for key stone on the base course mixes. After placement of the No. 1A size key stone, the pavement shall be opened to traffic for a minimum of 3 days before placing the seal coat. Prior to the application of the seal coat, the pavement surface shall be thoroughly swept and cleaned of all excess material. The seal coat shall be bituminous material asphalt emulsion meeting the requirements of § 702-3101 or § 702-4101 applied at the rate of 1.4 to 2.3 L/m² (Type 1 mix, Table 405-1) or 2.3 to 2.9 L/m² (Type 2 mix, Table 405-1). This shall be immediately followed by an application of No. 1A cover aggregate at the rate of 8-10 kg/m² which shall then be rolled. In the case where multiple lifts of Cold Mix Bituminous Pavements are used, only the surface of the top course shall require a seal coat. In multiple lift construction, each lift requires an application of key stone to fill voids in the mat.

405-4 METHOD OF MEASUREMENT. The bituminous cold mix pavement shall be measured by the number of metric tons compacted aggregate, including key and cover stone, placed in accordance with the specifications. The liquid bituminous material shall be measured by the liter.

405-5 BASIS OF PAYMENT. The unit price bid per metric ton shall include the preparation of base, the cost of furnishing all the aggregate, the mixing, placing, compaction and all labor and equipment necessary to complete the work. The bituminous material will be paid for under its appropriate item.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>405.01</td>
<td>Cold Mix Bituminous Pavement (Open Graded)</td>
<td>Metric Ton</td>
</tr>
</tbody>
</table>

SECTION 406 (VACANT)

SECTION 407 - TACK COAT
407-1 DESCRIPTION. This work shall consist of preparing and treating an existing bituminous or portland cement concrete surface with bituminous tack coat in accordance with these specifications and in reasonably close conformity with the limits shown on the plans or established by the Engineer.

407-2 MATERIALS. The bituminous tack coat shall meet the requirements of the following designation:

Asphalt Emulsion for Tack Coat 702-90

The bituminous tack coat will be sampled and tested in accordance with the Department's written instruction.

407-3 CONSTRUCTION DETAILS

407-3.01 Equipment. The Contractor shall provide a distributor for applying tack coat. The distributor shall be designed, equipped, maintained and operated so that the tack coat can be heated and applied uniformly on variable widths of surface up to 4.5 meters at readily determined and controlled rates from 0.14 to 9.10 L/m$^2$, with uniform pressure, and with an allowable variation from any specified rate not to exceed 0.10 L/m$^2$. Distributor equipment shall include a tachometer, accurate metering device or a calibrated tank, and a thermometer for measuring temperatures of tank contents. Distributors shall be equipped with a power unit for the pump, and full circulation spray bars adjustable laterally and vertically.

The distributor may be equipped with an attached bristle broom designed such that it drags on the pavement behind the spray bars. If the broom is used, it shall be adjustable laterally and vertically so that the full width of the applied tack coat is broomed uniformly into the pavement surface.

Distributors shall be equipped with an approved bituminous material sampling valve. The valve shall be installed as described in Department written instructions. When samples are taken through such valves, they shall be considered representative of all material in the tank.

Smaller power spray units of hand spray equipment will be permitted only in areas where the Engineer determines the use of a distributor is impractical.

407-3.02 Application of Bituminous Material. The tack coat shall be uniformly applied by a pressure distributor to a prepared clean pavement. The tack coat shall be applied as approved by the Engineer to offer the least inconvenience to traffic and to permit the one-way traffic, where practical, to prevent pickup or tracking of the bituminous material.

The tack coat shall not be applied on a wet pavement surface or when the pavement surface temperature is below the temperature requirements outlined in Table 402-2 Temperature and Seasonal Requirements of Subsection 402-3.01 HMA Pavements, Weather and Seasonal Limitations. The temperature and areas to be treated shall be approved by the Engineer prior to application. The application rate shall be 0.14 to 0.32 L/m$^2$ as approved by the Engineer. Table 407-1 contains recommended application rates for tack coat on various surfaces:

<table>
<thead>
<tr>
<th>Surface Type</th>
<th>Application Rate (liters/m$^2$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Hot Mix Asphalt</td>
<td>0.14 - 0.18</td>
</tr>
<tr>
<td>Milled Surfaces</td>
<td>0.21 - 0.25</td>
</tr>
<tr>
<td>Existing Hot Mix Asphalt</td>
<td>0.21 - 0.25</td>
</tr>
<tr>
<td>Portland Cement Concrete</td>
<td>0.17 - 0.30</td>
</tr>
<tr>
<td>Vertical Surfaces (curbs, concrete drainage structures and appurtenances)</td>
<td>0.27 - 0.32</td>
</tr>
</tbody>
</table>
§407

407-4 METHOD OF MEASUREMENT. The quantity to be paid for will be the number of liters of asphalt emulsion for tack coat measured at 15°C incorporated into the work.

407-5 BASIS OF PAVEMENT. The unit price bid per liter for tack coat shall include the cost of furnishing materials and all equipment and labor necessary to complete the work.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>407.01</td>
<td>Tack Coat</td>
<td>Liter</td>
</tr>
</tbody>
</table>

SECTIONS 408 AND 409 (VACANT)

SECTION 410 - BITUMINOUS SURFACE TREATMENT - SINGLE COURSE

410-1 DESCRIPTION. The work shall consist of the construction of a single bituminous surface treatment for both pavements and shoulders in accordance with these specifications in substantial conformance with the limits shown on the plans or established by the Engineer.

410-2 MATERIALS

410-2.01 Bituminous Materials. All the provisions of Section 618 shall apply with the following additions:

A. Bituminous Material Approval. The bituminous material shall be obtained from a storage facility that has been approved by the Director, Materials Bureau within the current calendar year, before the start of work.

B. Bituminous Material Selection. The selected bituminous material shall be compatible with the aggregate to be used. It's the contractors responsibility to ensure compatibility between the bituminous material and aggregate. The selection of bituminous material shall also be subject to the approval of the Engineer. Under the work the Contractor shall select, furnish and apply one of the following bituminous materials to a prepared surface.

1. Bituminous Surface Treatment - Pavement

<table>
<thead>
<tr>
<th>Materials Designation</th>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>702-3101</td>
<td>RS-2</td>
<td>Rapid Setting Asphalt Emulsion</td>
</tr>
<tr>
<td>702-3102</td>
<td>HFRS-2</td>
<td>High Float Rapid Setting Asphalt Emulsion</td>
</tr>
<tr>
<td>702-4101</td>
<td>CRS-2</td>
<td>Cationic Rapid Setting Asphalt Emulsion</td>
</tr>
</tbody>
</table>

When the two-way AADT is greater than 500, the selected bituminous material shall be polymer modified to increase the desired aggregate retention. When the two-way AADT is less than 500, the Contractor may or may not choose to blend the emulsion with a polymer modifier.

2. Bituminous Surface Treatment - Shoulders

<table>
<thead>
<tr>
<th>Materials Designation</th>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>702-3101</td>
<td>RS-2</td>
<td>Rapid Setting Asphalt Emulsion</td>
</tr>
<tr>
<td>702-3102</td>
<td>HFRS-2</td>
<td>High Float Rapid Setting Asphalt Emulsion</td>
</tr>
<tr>
<td>702-3301</td>
<td>HFMS-2</td>
<td>High Float Medium Setting Asphalt Emulsion</td>
</tr>
<tr>
<td>702-4101</td>
<td>CRS-2</td>
<td>Cationic Rapid Setting Asphalt Emulsion</td>
</tr>
</tbody>
</table>

410-2.02 Aggregates. The aggregates for bituminous surface treatments shall conform to the requirements of Subsection 703-02, “Coarse Aggregate” and be from an approved source. Where
aggregates for pavement surface treatment are from more than one source or of more than one type of
material, they shall be proportioned and blended to provide a uniform mixture. The procedure used for
proportioning shall be approved by the Regional Director or the authorized representative.

A. **Bituminous Surface Treatment - Pavement.** The aggregate size shall be No. 1ST and meet
one of the following:

1. Limestone having an acid insoluble content of not less than 20%, excluding particles of chert and
similar siliceous rocks. Blends of siliceous and non-siliceous and non-siliceous limestone will not be
permitted.
2. Dolomite
3. Sandstone, granite, chert, trap rock, ore tailings or other similar non-carbonate materials.
4. Gravel, or a natural or manufactured blend of two or more of the following types of material;
limestone, dolomite, gravel, sandstone, granite, chert, trap rock, ore tailings, slag or other similar
materials meeting the following requirements:
   - Non-carbonate plus 3.2 mm particles must comprise a minimum of 10.0% of the total aggregate
     (by weight with adjustments to equivalent volumes for materials of different specific gravities).
   - A minimum of 20.0% of plus 4.75 mm particles must be non-carbonate.

B. **Bituminous Surface Treatment - Shoulders.** The required aggregate size shall meet the
following gradation requirements:

<table>
<thead>
<tr>
<th>Screen Sizes</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.5 mm</td>
<td>100</td>
</tr>
<tr>
<td>6.3 mm</td>
<td>85-100</td>
</tr>
<tr>
<td>3.2 mm</td>
<td>0-15</td>
</tr>
</tbody>
</table>

410-2.03 Polymer Modifier. The minimum amount and type of polymer modifier shall be based on
the bitumen content and shall be determined by the laboratory performing the mix design. The minimum
polymer modifier content shall be 3% polymer solids, based on bitumen weight. The polymer materials
shall be milled or blended into the asphalt or blended into the emulsifier solution prior to the
emulsification process.

410-3 CONSTRUCTION DETAILS

410-3.01 Bituminous Surface Treatment - Pavements

A. **Weather and Seasonal Limitations.** Bituminous material shall not be applied to a pavement
surface when the:

1. Surface is wet
2. Ambient temperature is less than 10°C in the shade
3. Ambient temperature is greater than 35°C
4. Weather conditions would prevent proper construction of the surface treatment

The surface on which the bituminous material is applied shall have a temperature of 20°C or
higher.

Surface treatments shall be placed during the period of May 1st up to the last Saturday in August
(inclusive).

B. Equipment. The following equipment shall be required:

1. **Self-propelled Rotary Power Broom.** A self-propelled rotary power broom shall so be
designed, equipped, maintained and operated so that the pavement surface can be swept clean.
The broom shall have an adjustment to control the downward pressure. The power broom shall
meet the approval of the Engineer.
2. **Bituminous Material Distributor.** The liquid bituminous material distributor shall have been calibrated within the previous 12 months for transverse and longitudinal application rates according to ASTM D2995, Practice for Determining Application Rate of Bituminous Distributors. The bituminous material distributor shall be equipped, maintained, and operated so that the bituminous material can be applied at controlled temperature rates from 0.16 to 6.36 L/m². The distributor shall be capable of applying bituminous material on variable widths up to 4.6 meters. The distributor shall uniformly apply the bituminous material to the specified rate with a maximum allowed variation of 0.064 L/m². Distributor equipment shall include tachometer, accurate volume measuring devices or a calibrated tank, and a thermometer for measuring temperatures of tank contents. Distributors shall be equipped with a separate power unit for the pump, and full circulation spray bars adjustable laterally and vertically.

The distributor and/or transport shall be equipped with a sampling valve so designed and installed as to be non-clogging and safe. The type of valve and its general location shall be according to Department written instructions. When samples are taken through such valves in accordance with Department instructions, they shall be considered representative of all material in the tank.

3. **Self-propelled aggregate spreader.** The aggregate spreader shall be a self-propelled unit capable of uniformly spreading the aggregate at the required rate on a minimum width of 150 mm wider than the width of the lane to be treated. The spreader shall meet the approval of the Engineer and be calibrated similar to the test method used in ASTM D2995, within the previous 12 months, for transverse and longitudinal application using a portable scale and several sheets of canvas, 0.3 m x 1 m in size.

4. **Pneumatic tire roller.** A minimum of two pneumatic tire rollers will be required for each project. The Engineer will require a sufficient number of pneumatic tire rollers to permit initial rolling of the aggregate to occur within 5 minutes of the application of the bituminous material and the final of the three coverages to be completed within 30 minutes of the application of the bituminous material. The pneumatic tire rollers shall be self-propelled and have oscillating wheels with smooth tread tires and will have a minimum ballasted weight of 9 metric tons. The tire pressure for all wheels shall be uniform within ±0.035 MPa. The rollers shall be operated at a maximum speed of 8 kilometers per hour. To prevent pick-up of the aggregate to the tires, the tires shall be kept properly moistened with water mixed with small quantities of detergent or other material approved by the Engineer. In no case shall a solvent having affect upon the surface treatment be used.

C. **Determination of the Quantities of Materials to be Applied.** The Contractor shall place a minimum of three test patches at locations determined by the Engineer. The site or sites selected to apply the test patches should be representative of the various road surfaces on which the surface treatment is to be applied. The detailed instructions for test patch installations are as follows:

1. **Test Patch Section.** The test patch section shall consist of a minimum of three test patches at varying application rates. Recommended variation of 2.3 L/m² both sides of the selected target as suggested in 2.a. (below). Each test patch shall be a minimum of 1 x 3 meters or big enough to cover sufficient lane width so traffic will drive over it.

2. **Suggested Application for Emulsion and Aggregates**

   a. **Emulsion**

      i. **High Volume Traffic, Tight Surfaces.** Emulsion application shall be 1.6 liters/meter²

      ii. **Low Volume, Porous Surfaces.** Emulsion application shall be 2.0 liters/meter²
b. Aggregate - 1ST(11-13 kg/m²). The actual amount of aggregate should be determined by weighing the amount of aggregate required to completely cover a one square meter area one aggregate layer thick.

3. Determination of Application Quantities

a. Emulsion Quantity. Kilograms of Emulsion Per Patch = Application Rate (L/m²) X Size of Test Patch (square meters) X Unit Weight of Emulsion (1.0 kilogram per liter).

b. Aggregate Quantity. Kilograms of Aggregate Per Patch = Application Rate (kg/m²) X Size of Patch (square meters).

4. Layout Procedure

a. Clean patch area.
b. Mark out patch with chalk and straight edge.
c. In a pre-tarred container weigh out determined amount of aggregate for patch.
d. In a pre-tarred container, weigh out determined amount of emulsion for patch. The emulsion should be at the application temperature and work should proceed rapidly to maintain temperature.
e. Immediately pour the emulsion on the marked patch area, spread with a squeegee until emulsion is evenly spread at uniform thickness throughout the patch area. Squeegeeing should be kept to a minimum to minimize breaking of the emulsion. This whole operation should be done quickly to insure the emulsion doesn't set before cover aggregate is applied.
f. Spread preweighed cover aggregate, by hand, over patch area.
g. With pneumatic tire roller, roll the patch area a minimum of three complete passes.

5. Evaluation of Test Patches. After a minimum of 14 days of traffic over the test patches, the Engineer will evaluate the test patches for aggregate retention, flushing or bleeding, aggregate embedment and bonding to the existing pavement.

The selected patch should retain a minimum of 95% of the cover aggregate, show no signs of flushing or bleeding, have 70% embedment of aggregate into the emulsion residue and be securely bonded to the existing pavement.

D. Preparation of Surface. A self-propelled power broom shall be used to clear any loose material from the pavement surface immediately prior to the application of bituminous material. Potholes shall be patched with an appropriate asphalt concrete truing and leveling course approved by the Engineer. These patched areas shall be fog sealed with the same bituminous material selected for the project at a rate of 1.40 liters/square meter.

Manhole covers, drop inlets, catch basins, curb any other structure within the roadway area shall be protected against the application of surface treatment material.

E. Application of Bituminous Material. Bituminous material shall be applied by means of a pressure distributor in a uniform, continuous spread over the section to be treated and within the temperature range specified. The quantity of bituminous material to be used shall be that established by the test patch unless modified by the Engineer. The allowable variation from this quantity shall not exceed 0.10 L/m². A strip of building paper, at least 1 meter in width and with a length equal to that of the spray bar of the distributor plus 300 millimeters, shall be used at the beginning of each spread. If the cut-off is not positive, the use of paper may be required at the end of each spread. The paper shall be removed and disposed of in a satisfactory manner. The distributor shall be moving forward at the proper application speed at the time the spray bar is opened. If any skipped areas or deficiencies occur, the operation shall be immediately stopped. Junctions of spreads shall be carefully made to assure a smooth riding surface and the deficient areas corrected in a manner approved by the Engineer.

The bituminous material shall not be applied more than 60 meters in advance of the self-propelled stone spreader.
Under no circumstances shall operations proceed in such a manner that bituminous material will be allowed to chill, set up, dry, or otherwise impair retention of the cover aggregate. Traffic will not be allowed to run on uncovered bituminous material.

The distributor, when not spreading, shall be parked so that the spray bar or mechanism will not drip bituminous material on the surface of the traveled way.

**F. Application of the Cover Aggregate.** Immediately following the application of bituminous material, cover aggregate shall be spread at the rate established for the test patch unless modified by the Engineer. The allowable variation from this rate shall not exceed two kg/m². All aggregate used for bituminous surface treatment shall be clean as determined by the Engineer at the time of placement.

Spreading shall be accomplished in such a manner that the tires of the aggregate spreader at no time contact the uncovered and newly applied bituminous material.

Immediately after the cover aggregate is spread, any deficient areas shall be covered by additional material. Pneumatic tire rolling shall begin immediately. The initial pass shall be completed within 5 minutes of the application of the bituminous material and shall be continued until three complete coverages are obtained within 30 minutes of the application of the bituminous material. Pneumatic tire rollers shall come to a complete stop prior to reversing direction.

Any free bituminous material on the surface caused by a deficient amount of cover aggregate shall be covered by broadcasting additional aggregate over the deficient area. Any excess aggregate material shall be swept from the surface in a manner acceptable to the Engineer.

**G. Opening to Traffic.** “Loose Stone” signs meeting requirements of NYSMUTCD shall be posted at 1.6 kilometer intervals throughout the length of the project. These signs shall be erected before surface treatment starts and removed after contract is accepted.

Unless otherwise specified, the highway shall be kept open to traffic at all times. Traffic shall be discontinued on the lane being surface treated; and as soon as the final layer is applied and rolled, controlled traffic may be permitted thereon. Traffic shall be maintained at a speed not to exceed 24 km/h for a period of four hours after placement of the surface treatment by the use of two-way radio equipped patrol vehicles in accordance with the maintenance and protection of traffic details shown on the plans. All patrol vehicles shall be equipped with signs meeting the requirements of Section 254.5 of the Manual of Uniform Traffic Control Devices. The required number of two-way radio-equipped patrol vehicles shall be as follows:

<table>
<thead>
<tr>
<th>Lane Kilometers</th>
<th>Number of Patrol Vehicles</th>
</tr>
</thead>
<tbody>
<tr>
<td>for past 4 hours</td>
<td></td>
</tr>
<tr>
<td>1.6</td>
<td>1</td>
</tr>
<tr>
<td>3.2</td>
<td>3</td>
</tr>
<tr>
<td>4.8 or more</td>
<td>4</td>
</tr>
</tbody>
</table>

Immediately after completion of surface treatment, the section shall be posted for speed limit of 48 km/h for a period of three days. The signs should be posted at 800 meter intervals and signs showing other speed limitations should be covered for this period. All construction signs shall meet the requirements of the NYSMUTCD.

**410-3.02 Bituminous Surface Treatment - Shoulders.** The requirements of §410-3.01 shall apply except that the sections labeled “A. Weather and Seasonal Limitations,” “C. Determinations of the Quantities of Material to be Applied” and “G. Opening to Traffic” do not apply. The following modifications to A. Weather and Seasonal Limitations and C. Determination of the Quantities of Materials to be applied do apply in their place.

**A. Weather and Seasonal Limitations.** Bituminous material shall not be applied on a wet surface, when the ambient temperature is less than 10°C and rising, or when weather conditions would prevent proper construction of the surface treatment. The surface on which the bituminous material is applied shall be placed only during the period of May 1st up to and including the last Saturday of September.
C. Determination of the Quantities of Materials to be Applied. The quantity of bituminous material to be used shall be in the range of 1.6-2.3 liters/square meter unless otherwise directed by the Engineer. The cover aggregate shall be spread in a single stone thickness in the range of 8 to 14 kilograms/square meter for the indicated aggregate unless otherwise directed by the Engineer. The actual quantity of bituminous material shall be such that a minimum of 70% of the aggregate particle is embedded in the bituminous material. The actual quantities used will be determined visually by the Engineer at the time of placement.

410-4 Method of Measurement. Bituminous surface treatments for pavement and shoulders will be measured by the number of square meters of compacted material in place making no deductions for minor untreated areas such as catch basins and manholes.

The bituminous material will be measured by the number liters used.

410-5 Basis of Payment

410-5.01 Bituminous Surface Treatment - Pavement and Shoulders. The unit price bid per square meter shall include the cost of all labor, materials, and equipment necessary to perform the work except:

- Bituminous material used for treatment will be paid under separate item.
- Patching material will be paid for under the item for Truing and Leveling.
- Construction signs will be paid for under appropriate items.

The cost of installing test patches and furnishing patrol vehicles when surface treating pavements shall be included in the unit bid price for the surface treatment.

410-5.02 Bituminous Material - Pavement and Shoulders. The unit price bid per liter shall include all the cost of labor, materials, and equipment necessary to perform the work.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>410.04</td>
<td>Bituminous Surface Treatment (Pavement)</td>
<td>Square Meter</td>
</tr>
<tr>
<td>410.05</td>
<td>Bituminous Surface Treatment (Shoulders)</td>
<td>Square Meter</td>
</tr>
<tr>
<td>410.07</td>
<td>Bituminous Material (Pavement and Shoulders)</td>
<td>Liter</td>
</tr>
</tbody>
</table>

SECTION 411 - STABILIZED GRAVEL SURFACE COURSE

411-1 Description. The work shall consist of placing a stabilized gravel surface course with additive, if specified, on a prepared base in accordance with these specifications and in conformance with the lines and grades shown on the plans or as directed by the Engineer.

411-2 Materials

411-2.01 Gravel. The gravel shall conform to the following gradation requirements:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 mm</td>
<td>100</td>
</tr>
<tr>
<td>6.3 mm</td>
<td>30 - 65</td>
</tr>
<tr>
<td>75 µm</td>
<td>10 - 20</td>
</tr>
</tbody>
</table>

Particles passing the 425 µm sieve size shall have a maximum liquid limit of 30 and a plasticity index ranging from 3 to 8. The maximum loss in 4 cycles of the Magnesium Sulfate Soundness Test shall be 30. If the gravel as obtained from the bank is deficient in any of the requirements specified, such deficiency shall be corrected by screening, processing and/or blending with other acceptable materials before stockpiling. The requirements of §304-2.03, Stockpiling shall apply to all gravel furnished for this work.
411-2.02 **Chemical Additives.** Chemical additives, if required, shall meet the applicable requirements of the following subsections:

- Calcium Chloride 712-02
- Sodium Chloride 712-03

411-3 **CONSTRUCTION DETAILS**

411-3.01 **Placement.** After the base has been brought to grade and cross section, as shown on the plans, thoroughly compacted, and approved by the Engineer, the Contractor shall place the stabilized gravel surface course.

When calcium or sodium chloride additives are specified, they shall be added by an approved mechanical distributor after the gravel has been spread and prior to the addition of water. Calcium chloride shall be added in the amount of 10 grams per square meter per millimeter of compacted thickness of the course. Sodium chloride shall be added at a rate of 40 grams per square meter per millimeter of compacted thickness of the course which is equivalent to approximately 2% of sodium chloride based on dry weight of aggregate. Water shall then be added to the material in amounts as directed by the Engineer.

If the Contractor so elects, only the calcium chloride may be added to the gravel material as a water solution. In such cases the Contractor shall submit to the Engineer a detailed description in writing of the proposed procedure of operations. Construction shall not be started until the Engineer’s approval is obtained in writing.

411-3.02 **Mixing**

- **A. Gravel Without Additive.** Water shall be thoroughly dispersed by any appropriate methods which will insure a uniform consistency and moisture content within the limits for proper compaction.

- **B. Gravel With Additive.** The water and the chemical additive shall be thoroughly and uniformly incorporated with the gravel for the full depth of the course, by mixing with an approved power-driven rotary type mixing machine. Mixing shall continue until the material is of uniform composition. The Contractor may elect to mix the materials in an approved plant of the pugmill type. Mixing by blading, shoveling and/or scooping will not be permitted.

411-3.03 **Compaction.** When the in-place material is of uniform consistency and has a moisture content within the limits for proper compaction, as determined by the Engineer, it shall be thoroughly compacted by the use of self-propelled pneumatic tired or vibratory compactor in accordance with the requirements of §203-3.12. During the compaction operation, light grading shall be done as required to maintain the surface of the course true to grade and cross-section. In confined areas, inaccessible to rollers, mechanical rammers shall be used to obtain the compaction required in §203-3.12. The finished surface of the stabilized gravel course shall be rolled in a float of free water with a smooth steel wheeled roller weighing not less than nine metric tons. In all cases, the material must be so thoroughly compacted that it will not displace under the roller.

This course shall not be placed in excess of 150 linear meters without being shaped, compacted and finish rolled.

When posts for guide railing are to be installed adjacent to a stabilized gravel surface course, extreme care shall be taken during installation of the posts so that the stabilized gravel surface course is not disturbed.

411-3.04 **Surface Preparation for Treatment**

- **A. Calcium Chloride Stabilized Gravel Surface Course.** After the calcium chloride stabilized gravel surface course has been completed, water shall be applied to the surface in amounts as directed by the Engineer. Immediately following the application of water, calcium chloride shall be applied on the surface with an approved mechanical spreader at the rate of one-quarter kilogram per square meter.
B. Sodium Chloride Stabilized Gravel Surface Course. After the sodium chloride stabilized gravel surface course has been brought to final grade and cross section and rolling has been completed, the course shall be permitted to cure for a minimum of 10 days at a minimum temperature of 15°C before any additional pavement courses are applied. The cured completed surface course shall be broomed to remove dust, before application of the overlying course.


411-4 METHOD OF MEASUREMENT. The quantity for payment, in cubic meters of material, shall be computed within the payment lines shown on the plans or otherwise ordered in writing by the Engineer, and in accordance with the plans and specifications.

411-5 BASIS OF PAYMENT. The unit bid price per cubic meter shall include the cost of furnishing all labor, materials and equipment necessary to complete the work, except that the water, the calcium chloride, and the sodium chloride shall be paid for under their appropriate items. No direct payment will be made for any losses of material which may result from shrinkage, compaction, foundation settlement, waste, overflow, erosion, leakage, or any other causes; the cost of such losses shall be included in the price bid for this work.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>411.01</td>
<td>Stabilized Gravel Surface Course</td>
<td>Cubic Meter</td>
</tr>
<tr>
<td>411.02</td>
<td>Calcium Chloride Stabilized Gravel Surface Course</td>
<td>Cubic Meter</td>
</tr>
<tr>
<td>411.03</td>
<td>Sodium Chloride Stabilized Gravel Surface Course</td>
<td>Cubic Meter</td>
</tr>
</tbody>
</table>

SECTION 490 - COLD MILLING

490-1 DESCRIPTION. This work shall consist of the milling, shaping and removal of portions of existing surfaces by a cold milling process, and subsequent cleaning, utilizing equipment and procedures meeting the requirements in this specification.

The work shall consist of Miscellaneous Cold Milling or Production Cold Milling of bituminous or portland cement concrete as indicated in the contract documents and as shown on the plans.

490-2 MATERIALS

490-2.01 Equipment. Milling machines shall be power operated, self-propelled machines capable of removing the desired thickness of existing surfaces. The machines shall have sufficient power, traction and stability to accurately maintain depth of cut and slope. They shall be capable of producing a finished profile and cross slope to within 6 mm of that required and shall produce a uniform surface texture free from gouges and ridges greater than 10 mm in depth.

The machines shall be equipped with a means to control dust and other particulate matter created by the cutting action.

The machines shall have an integral loading system or sufficient equipment shall be provided to accomplish complete removal of milled material at a rate equivalent to the milling rate.

Vacuum trucks, street sweepers or power brooms shall be used to clean the milled surfaces. The Engineer may disallow the use of power brooms in urban, residential or other sensitive areas if the dust raised by the broom is deemed by the Engineer to be objectionable.

490-2.02 Disposal of Material. Material removed during the milling process, including foreign debris within or on the pavement, shall become the property of the Contractor and shall be disposed of at a site obtained by the Contractor.

490-3 CONSTRUCTION DETAILS
§490

490-3.01 General. Milling shall be performed at the locations and in accordance with the details indicated on the plans.

When indicated on the plans, profile and cross slope shall be controlled by a taut reference string line. The reference elevation and string line shall be established by the Contractor and subject to the approval of the Engineer.

Areas not accessible to the milling machine, such as around and/or adjacent to inlets, manholes, curbs and transverse joints on structures, may be removed by a small milling machine, handwork or other methods approved by the Engineer.

All milled material, including that removed by other means, shall be immediately removed from the milled surfaces and adjacent surfaces. Surfaces shall be cleaned of all fines and dust prior to opening to traffic. The Contractor shall conduct operations in such a manner that dust is controlled and is not objectionable. Milled and adjacent surfaces shall be cleaned again, as directed by the Engineer, prior to the placement of tack coats, or pavement courses if traffic has been allowed on the milled surface and/or if more than 48 hours have elapsed since the initial cleaning.

The Contractor shall maintain drainage at catch basins, according to the details shown on the plans, or in a manner approved by the Engineer.

When working adjacent to traffic, the Contractor shall immediately remove material that is spilled on the traveled way.

Milled surfaces to be overlaid with asphalt concrete shall be covered with at least a single course of asphalt concrete before the end of the paving season. Portland cement concrete overlays shall be completed over milled surfaces before the end of the paving season. Damage to milled surfaces resulting from traffic or other causes such as, but not limited to, raveling, fuel spillage or any contaminants which would inhibit bond, shall be repaired or remilled by the Contractor in a manner approved by the Engineer.

490-3.02 Production Cold Milling. Production cold milling of bituminous or portland cement surfaces shall be performed in accordance with the details and at the locations indicated on the plans.

490-3.03 Miscellaneous Cold Milling. Miscellaneous cold milling of bituminous or portland cement surfaces shall be performed in accordance with the details and at the locations indicated on the plans.

490-3.04 Production Cold-Mill Surface Planing. Production cold-mill surface planing of bituminous concrete surfaces shall be performed in accordance with the details and at the locations indicated on the plans. When specified, the milling machine shall control the profile and cross slope with a moving reference at least 9 meters in length. The moving reference may be a floating beam, ski, or other suitable type such that the resulting milled surface is sufficiently even.

In areas accessible to the milling machine, construct a milled surface to a maximum12 mm tolerance. If the pavement surface is not being constructed or has not been constructed to this tolerance based upon visual observation or upon riding quality, the Engineer may test the surface with a 5-meter straight edge or string line placed parallel to the centerline of the pavement and with a 3-meter straight edge or string line placed transversely to the centerline of the pavement on any portion of the pavement. Variations exceeding 12 mm will be satisfactorily corrected at no additional cost to the State.

490-4 METHOD OF MEASUREMENT. The quantity shall be measured as the number of square meters of pavement surface milled in accordance with the plans and this specification.

In no case will a deduction in area be made for minor unmilled areas due to catch basins, manholes, transverse joints, or minor low areas in pavements from the measured surface area that has been milled. Minor unmilled or low areas are those areas of 10 square meters or less.

490-5 BASIS OF PAYMENT. The unit price bid per square meter shall include the cost of furnishing all labor and equipment necessary to complete the milling, including the removal of pavement by other means, the removal and disposal of milled material, the removal and hauling of milled material to a designated storage area when indicated in the contract documents and cleaning the resultant surface after milling. No payment will be made for additional cleaning that may be necessary just prior to placement of any overlaying pavement courses or tack coats. The cost of maintaining drainage shall be included in the price bid for maintenance and protection of traffic. The cost of providing temporary pavement wedges...
of asphalt concrete around drainage structures, manholes, valve boxes, bridge abutments and beginning and ends of milled pavement shall be paid for as outlined in §619-5.12 of the Standard Specifications.

Tack coats and overlay courses shall be paid for under their respective items.

**Payment will be made under:**

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>490.10</td>
<td>Production Cold Milling of Bituminous Concrete</td>
<td>Square Meter</td>
</tr>
<tr>
<td>490.15</td>
<td>Production Cold-Mill Surface Planing of Bituminous Concrete</td>
<td>Square Meter</td>
</tr>
<tr>
<td>490.20</td>
<td>Production Cold Milling of Portland Cement Concrete</td>
<td>Square Meter</td>
</tr>
<tr>
<td>490.30</td>
<td>Miscellaneous Cold Milling of Bituminous Concrete</td>
<td>Square Meter</td>
</tr>
<tr>
<td>490.40</td>
<td>Miscellaneous Cold Milling of Portland Cement Concrete</td>
<td>Square Meter</td>
</tr>
</tbody>
</table>

**SECTIONS 491 THRU 499 (VACANT)**
SECTION 501 - PORTLAND CEMENT CONCRETE - GENERAL

501-1 DESCRIPTION. These general requirements apply to concrete furnished for pavement, structures and incidental construction. Additional requirements may be specified in the contract item. All testing will be done in accordance with Department procedures.

501-2 MATERIALS

501-2.01 Composition of Mixtures. The Contractor shall inform the Regional Director, in writing, of the materials sources prior to mixing concrete. Proportion and mix portland cement, fine aggregate, coarse aggregate, water, admixtures, pozzolan and/or microsilica to create a homogeneous portland cement concrete mixture.

Produce the class of concrete indicated in the contract documents. However, substitutions may be made according to Table 501-1, Concrete Class Options.

<table>
<thead>
<tr>
<th>TABLE 501-1 CONCRETE CLASS OPTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete Class</td>
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<tr>
<td>----------------</td>
</tr>
<tr>
<td>A</td>
</tr>
<tr>
<td>C</td>
</tr>
<tr>
<td>D</td>
</tr>
<tr>
<td>DP</td>
</tr>
<tr>
<td>E</td>
</tr>
<tr>
<td>H</td>
</tr>
<tr>
<td>F, G, GG, or HP</td>
</tr>
<tr>
<td>I</td>
</tr>
<tr>
<td>J</td>
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</tbody>
</table>

NOTES:
1. Regional Director approval required for pavement applications, including approach slabs. DCES approval required for structural or deck applications. May not be used in mass placements, or as a substitute for class A in Sign Structure, Signal Pole, and Luminary Foundations.
2. The requirements of §502-2.01 and §502-2.02 apply

501-2.02 Material Requirements

<table>
<thead>
<tr>
<th>Portland Cement</th>
<th>701-01</th>
<th>Fly Ash</th>
<th>711-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blended Portland Cement</td>
<td>701-03</td>
<td>Microsilica</td>
<td>711-11</td>
</tr>
<tr>
<td>Admixtures</td>
<td>711-08</td>
<td>GGBFS *</td>
<td>711-12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Water</td>
<td>712-01</td>
</tr>
</tbody>
</table>

* Ground Granulated Blast Furnace Slag

A. Cementitious Materials. Use only cementitious materials meeting §701-01 whose brand name and type appears on the Department’s Approved List. Cementitious materials stored over the winter at concrete producing facilities will be retested for specification compliance. All contaminated, or hardened cementitious material will be rejected and not used in Department work.
The Department will consider requests to evaluate alternate cements, pozzolan or microsilica. The use of alternatives is subject to approval by the Director, Materials Bureau.

1. **Portland Cement.** Use Type I, Type II or Type I/II cement, except as indicated below or in the contract documents.

   Type I cement is restricted to fresh water and low sulfate soil areas. Use Type II or Type I/II cement in high sulfate, and salt water areas. Salt water areas are defined as; The Hudson River south of the Newburg-Beacon Bridge, and all other tidal/sea water spray areas of New York State. Type I/II cement is defined as a cement that meets the requirements of both Type I and Type II cements. High alkali cement is defined as any portland cement having an alkali content in excess of 0.70% as denoted on the Approved List. High alkali cement use is restricted, unless otherwise approved by the Regional Director, to mixtures that do not contain reactive aggregates (as denoted in the Department’s List of Approved Sources of Aggregates).

2. **Blended Portland Cement.** Blended cements meeting the requirements of 701-03, may be used as follows:

   a. **Type IP or SM.** Blended Portland Cement (Type IP or Type SM), may be used in all classes of concrete listed in Table 501-03, Concrete Mixtures, except Class F. Type IP or SM blended cement replaces the portland cement/pozzolan portion of the designed mix in Class DP, G, GG, or HP concrete. When using Type IP or SM blended cement in Class DP and HP concrete, an addition of Microsilica §711-11 is required.

   b. **Type SF.** Blended Portland Cement (Type SF), may be used in Class DP or HP concrete. Type SF blended cement replaces the portland cement/microsilica portion of the designed mix in Class DP or HP concrete. When using Type SF blended cement in Class DP or HP concrete, an addition of Fly Ash, §711-10, or Ground Granulated Blast Furnace Slag (GGBFS), §711-12, is required.

   c. **Ternary Blend.** Blended Portland Cement (Ternary Blend), may be used in Class DP or HP concrete. Ternary blend cement in Class DP or HP concrete replaces the entire portland cement/pozzolan/microsilica portion of the designed mix. No subsequent addition of cementitious material is required or allowed.

3. **Pozzolan.** Pozzolan is defined as Fly Ash, §711-10, or Ground Granulated Blast-Furnace Slag (GGBFS), §711-12. All classes of concrete, except Class F, allow or require a pozzolan as a partial replacement for portland cement. Classes DP, G, GG, and HP concrete require the use of a pozzolan.

4. **Microsilica.** Class DP and HP concrete require Microsilica, §711-11, as a partial replacement for portland cement. Microsilica, a pozzolanic material, is not included in the definition of a pozzolan in these specifications.

**B. Aggregates.** Use aggregate from a source on the Approved List of Sources of Fine and Coarse Aggregates that also meets the following requirements for gradation and friction.

1. **Gradation.** Samples will be taken from stockpiles, barges, conveyor belts, or bins and tested for gradation at the plant site in accordance with NYSDOT Materials Method 9.1. Rejected aggregates may be reprocessed or reworked to meet the gradation requirements.

   a. **Concrete Sand.** Use only sand meeting the requirements of §703-07, Concrete Sand.

   b. **Coarse Aggregate.** Use only crushed stone, crushed gravel, or crushed slag meeting the requirements of §703-02, Coarse Aggregates in either one or a combination of size designations specified in Table 703-4, Sizes of Stone, Gravel, and Slag and graded according to Table 501-2, Coarse Aggregate Gradations.
Aggregates that are uniform in size, but do not meet the requirements in Table 703-4, may be approved by the Regional Director. When these sizes are combined to meet the mixture gradation requirements of Table 501-2, the gradation requirements of §703-02 shall not apply. Blending of aggregates during the batching process may be approved by the Regional Director. When blending aggregates prior to batching, the blending method requires approval by the Regional Director.

<table>
<thead>
<tr>
<th>TABLE 501-2 COARSE AGGREGATE GRADATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sieve Sizes</td>
</tr>
<tr>
<td>37.5 mm</td>
</tr>
<tr>
<td>25.0 mm</td>
</tr>
<tr>
<td>12.5 mm</td>
</tr>
<tr>
<td>6.3 mm</td>
</tr>
</tbody>
</table>

**NOTES:**
ASTM C33 Size Number 7 is an acceptable equivalent to the Type CA 1 gradation.
ASTM C33 Size Number 57 is an acceptable equivalent to the Type CA 2 gradation.
Material passing the 75 µm sieve (wet) is limited to a maximum 1.0 % by mass for ASTM sizes 7 and 57.

2. **Friction.** Sample and test aggregate for friction characteristics according to the procedures of Materials Method 28 “Friction Aggregate Control and Test Procedures.” The Engineer will identify pavement areas, if any, represented by failing samples according to the procedures of Materials Method 28 “Friction Aggregate Control and Test Procedures.”

   a. **Concrete Sand.** For use in concrete pavements, bridge decks, precast pavers, or any other item used in concrete highway wearing surfaces, sand (natural or manufactured) must contain at least 25.0% acid-insoluble residue in the plus 600 µm size fraction and in the minus 600 µm size fraction. Sands may be blended to meet this requirement.

   b. **Type 1 Coarse Aggregate.** Use coarse aggregate meeting one of the of the following requirements:
      - Limestone, dolomite, or a blend of the two, having an acid-insoluble residue content not less than 20.0%.
      - Sandstone, granite, chert, traprock, ore tailings, slag, or other similar noncarbonate materials.
      - For concrete mixtures containing CA1 coarse aggregate: gravel or a blend of rock types containing no less than 95.0% noncarbonate particles (by weight with adjustments to equivalent volumes for materials of different specific gravities) in the minus 25.0 mm, plus 6.3 mm primary size fraction.
      - For concrete mixtures containing CA2 coarse aggregate: gravel or a blend of rock types containing no less than 95.0% noncarbonate particles (by weight with adjustments to equivalent volumes for materials of different specific gravities) in the minus 37.5 mm, plus 12.5 mm and the minus 12.5, plus 6.3 mm primary size fractions.

   c. **Type 2 Coarse Aggregate.** Use coarse aggregate meeting one of the following requirements:
      - Limestone, dolomite, or a blend of the two, having an acid-insoluble residue content not less than 20.0%.
      - Sandstone, granite, chert, traprock, ore tailings, slag, or other similar noncarbonate materials.
      - For concrete mixtures containing CA1 coarse aggregate: gravel or a blend of rock types containing no less than 20.0% noncarbonate particles (by weight with adjustments to equivalent volumes for materials of different specific gravities) in the minus 25.0 mm, plus 6.3 mm primary size fraction.
§501

- For concrete mixtures containing CA2 coarse aggregate: gravel or a blend of rock types containing no less than 20.0% noncarbonate particles (by weight with adjustments to equivalent volumes for materials of different specific gravities) in the minus 37.5 mm, plus 12.5 mm and the minus 12.5, plus 6.3 mm primary size fractions.

  d. Type 3 Coarse Aggregate. Use coarse aggregate meeting one of the following requirements:
  - Limestone or a blend of limestone and dolomite having an acid-insoluble residue content not less than 20.0%.
  - Dolomite.
  - Sandstone, granite, chert, traprock, ore tailings, slag or other similar noncarbonate materials.
  - For concrete mixtures containing CA1 coarse aggregate: gravel or a blend of rock types containing no less than 20.0% noncarbonate particles (by weight with adjustments to equivalent volumes for materials of different specific gravities) in the minus 25.0 mm, plus 6.3 mm primary size fraction.
  - For concrete mixtures containing CA2 coarse aggregate: gravel or a blend of rock types containing no less than 20.0% noncarbonate particles (by weight with adjustments to equivalent volumes for materials of different specific gravities) in the minus 37.5 mm, plus 12.5 mm and the minus 12.5, plus 6.3 mm primary size fractions.

  e. Type 9 Coarse Aggregate. Use coarse aggregate meeting the requirements of §501-2.02 B.1.b. Coarse Aggregate.

C. Admixtures. Use only admixtures meeting §711-08 that appear on the Department’s Approved List. Admixtures not conforming to §711-08 are subject to approval by the Director, Materials Bureau.

501-2.03 Concrete Batching Facility Requirements. Batching facilities must be of sufficient design and capacity to produce the quantity of concrete specified. Batching facilities that differ from conventional designs will be considered for use by the Director, Materials Bureau.

A. Acceptance. Each facility requires initial and annual approval by the Director, Materials Bureau. The Regional Director may disapprove use of a previously approved facility at any time for non-conformance with the specifications. Once disapproved, production for Department work will not be allowed until corrective measures are implemented under the approval of the Regional Director.

B. Bins. Each facility requires:
- Sufficient size and number of storage bins to produce the quantity of concrete specified.
- Positive separations between fine aggregate and various sizes of coarse aggregates.
- Separate cement, pozzolan, and microsilica bins, except Type I and Type II cement may be combined in common storage unless the cement is intended for use in high sulfate or salt water areas as described in §501-2.02 A. Cementitious Materials.
- Cement, pozzolan, and microsilica bins with protection from rain and moisture.
- A means of safely obtaining uncontaminated samples from all microsilica bins.
- A means of safely obtaining uncontaminated samples from any cement or pozzolan bin that has been determined by the Regional Materials Engineer as either unsafe to sample, or difficult to verify the acceptability of its contents.

  Sampling will be conducted, or witnessed by the Regional Materials Engineer’s representative.

C. Weigh Hoppers and Discharge Chutes. Each facility requires:
- Separate weigh hoppers for aggregate and cementitious materials.
- Enclosed cement weigh hopper to protect against moisture and reduce escaping dust.
• Chutes arranged so that materials will not lodge or be lost on discharge.
• No chutes suspended from any part of the weighing system.
• Vibrators arranged so that no significant vibrations are transmitted to the scales or other plant control equipment during the weighing process.

D. Scales. Each facility requires:
• Load cell type scales which indicate the load at all stages of the weighing operation, from zero to full capacity, when installed for weighing materials after January 2, 2003.
• Scales that meet the requirements of the National Institute of Standards and Technology, Handbook 44, with no less than 500 nor more than 2000 scale divisions.
• Digital displays that match the primary scale within 1 division.
• Minimum resolution of digital displays equivalent to the minimum resolution on the primary scale.
• Digital displays located in direct sight of the operator’s normal work station.
• Face of digital displays protected from manipulation.

Test all plant scales for accuracy, at no additional cost, by a qualified technician as follows:
• Annually, prior to use for Department work.
• At intervals of not more than 90 calendar days.
• Whenever a plant changes location.
• At any time ordered by the Regional Director.

Provide a cradle or test platform, approved by the Regional Director, for each scale, and at least 20 standard 25 kg (or metric equivalent) test weights. The use of a set of test weights for two or more facilities will be permitted when they can be available within 1 hour. If directed by the Regional Director, make provisions for locking scales against tampering.

E. Proportioning Control Equipment. Proportion the materials by automatic proportioning devices approved by the Director, Materials Bureau. All systems must be approved to operate in metric units on or before January 2, 2003, unless otherwise indicated in the contract documents.

The Regional Director may require the locking or sealing of proportioning equipment that is subject to manipulation. Install automatic proportioning equipment in a dust and weather protected area of at least 4.0 square meters, with no internal dimension less than 2.0 meters.

Include equipment to:
• Produce all batches in fully automatic mode using preprogrammed metric mix designs. The only manual operation allowed is a switch or button to start the batching sequence and/or discharge the completed batch.
• Accurately proportion the various components of the mixture by mass, or by volume for admixtures and water, in the proper order so that aggregates and cementitious materials are displayed cumulatively (when appropriate).
• Deliver each constituent within the tolerances indicated in Table 501-4, Batching Tolerances.
• Control the cycle sequence.
• Interrupt and stop the automatic batching operations via auxiliary interlock cutoff circuits, whenever an error exceeding the acceptable tolerance occurs in proportioning, for all materials except water.
• Time the mixing operations for central mix plants, and provide a clear indication on the recordation whenever the mix time has been interrupted.

Interlock the system so that during the batching of cementitious materials, aggregates and admixtures:
• No inlet gate can open while the weigh hopper discharge gate is open.
• No inlet gate can open while another material is being weighed in a shared weigh hopper.
• No weigh hopper discharge gate can open while the hopper is being filled nor until the full batch mass is within delivery tolerance.
• No new batch can be weighed until the hopper is entirely empty of the previous batch and the scale has returned to within the allowable zero tolerance.

**F. Admixture Dispensing Systems.** Equip plants with calibrated systems that meet the following:

• A sufficient number of dispensing systems to supply the concrete mixture specified.
• The ability to dispense each admixture through its own measuring system.
• Accurate measurement within the tolerance limits specified in Table 501-4, Batching Tolerances.
• A bypass valve to obtain a calibrated sample of admixture from each measuring device.
• Uniform distribution of admixture throughout the mix within the specified mixing period.
• When multiple admixtures are added, no direct contact with each other prior to mixing.
• An approved automatic admixture dispensing system in plants equipped with automated proportioning systems.
• Volumetric measuring devices interlocked with the automated proportioning equipment that insure the preset quantity has been actually measured and completely discharged.
• A readable indication at the operator’s normal work station of the actual quantity batched.

Interlock the admixture system with the automated proportioning system so that aggregate and/or cement weigh hopper discharge gates cannot be opened until the preset quantity of admixture has been batched or discharged.

Recordation of the presence of admixture is dependent on completion of admixture discharge.

**G. Recordation Equipment.** Equip all plants with digital recording instruments approved by the Director, Materials Bureau, that meet the following requirements:

• Is readily accessible and readable at the operator’s normal work station.
• Provides separate quantity recordation of each aggregate component, cement, pozzolan, microsilica, admixture, fine aggregate moisture content, and water (at central mix plants) for each batch of concrete. Water at central mix plants may be recorded by mass or volume.
• Records the batch number, concrete class, date (day, month, year), and time of day to the nearest minute on each batch record.
• Provides cumulative recordation (when batching cumulatively) of mass and/or volume as indicated on the batching scale or meter within an accuracy of 1 scale or meter graduation.
• Has a minimum recorder resolution equivalent to or less than the minimum graduation on the scale or meter, unless otherwise approved by the Director, Materials Bureau.
• Provides a clear and legible copy of all batch records, containing permanent identification of the time and all quantities in each batch, to the Department.
• Automatically stamps the date and time of batch completion on each batch and/or delivery ticket.
• Provides clear identification on batch recordation when:

  ♦ Initiating a batch without all conditions satisfied for full automated production.
  ♦ An out of tolerance condition is accepted during batching.
  ♦ A system is taken out of the full automated mode during the batching sequence.
  ♦ A system produces a “demonstration” or “simulated” batch.
  ♦ A system reprints a batch ticket.
  ♦ The timing of a central mixer has been interrupted.

When the automation system can produce other than standard size batches (full, half or quarter cubic meter increments), recordation will be subject to approval of the Director, Materials Bureau.

**H. Inspection Facility.** Provide a weatherproof building or trailer, for use as an inspector’s testing laboratory and office that meets the following criteria:

• Meets all applicable uniform fire prevention and building code requirements.
• Office area partitioned from the testing laboratory.
• Minimum gross area of 15 square meters, a minimum internal width of 2.1 meters and a ceiling height of not less than 2.3 meters.
• Protected from a noise level greater than an 8 hour, time weighted average of 85 dBA.
• Laboratory area with tables, work benches, shelving, and other equipment for testing portland cement concrete mixes.
• Increase the area proportionally to house and operate any additional testing equipment, and when there are multiple plants at one site, size the increase of the laboratory and office space to be adequate for performing inspection duties during all production circumstances.

Use the inspection facility only for its intended purpose, and when the inspection facility is used by more than one inspection authority, the Department will have priority. The facility and its location are subject to approval by the Regional Materials Engineer. Maintain the inspection facility, office, and testing equipment in good operating and clean condition. The Producer will be responsible for routine cleaning.

Equip the inspection facility with the following:

1. **Office Equipment.** A Standard size (approx. surface dimensions: 75 cm x 150 cm) office desk with drawers and a chair, and a fireproof file cabinet with at least two locking drawers and two keys.

2. **First Aid Equipment.** An adequately stocked first aid kit at the plant site including:
   • An emergency eye wash station in the laboratory area.
   • Safety equipment including gloves, dust mask, etc..

3. **Sanitary Facilities.** A flush type toilet at the plant site, enclosed in a properly vented, separate room and complying with applicable sanitary codes. A portable toilet may be substituted when a facility is set up on a temporary basis for a specific project.

4. **Lighting.** Electric, non glare, providing a minimum illumination level of 1000 lux at desk and work bench level.

5. **Laboratory Sink / Potable Water.** A Sink and faucet with an adequate supply of clean water for testing, and if necessary, a water cooler for potable drinking water.

6. **Heating and Cooling.** Adequate heating and air conditioning equipment to maintain an ambient temperature of 20±3°C.

7. **Ventilation.** Minimum 0.1 m³/sec exhaust hood, vented to the atmosphere, located over the sample drying area.

8. **Communication Equipment.** A telephone with a dedicated line in the laboratory office and a fax machine at the inspection facility or plant site for the inspector’s use.

9. **Fire Extinguisher.** A 4.5 kilogram capacity multi-class ABC fire extinguisher, maintained and located in the laboratory area.

10. **Coarse Aggregate Sieve Shaker.** Power driven, with a minimum clear sieve area of 0.21 square meters.
    • Anchored to a firm base.
    • Imparts a vertical, or lateral and vertical motion.
    • Equipped with an automatic timing shut-off device and dust cover.
    • Fully enclosed and weatherproof when located outside the inspection facility.

11. **Fine Aggregate Sieve Shaker.**
    • Power driven, independent of the coarse aggregate shaker.
§501

- For 200 mm minimum diameter sieves.
- Imparts a vertical, or lateral and vertical motion.
- Equipped with an automatic timing shut-off device.

12. Sample Splitter. Able to split samples with a particle size of 13 to 50 millimeters.

13. Large Scale. Minimum capacity of 14 kg, with a maximum gradation of 0.005 kg meeting AASHTO M-231 Class G20. Scales provided as new or replacement after September 1, 2004, must be digital.”

14. Small Scale. Minimum capacity of 1500 g, with a maximum gradation of 0.1 g meeting AASHTO M-231 Class G2. Scales provided as new or replacement after September 1, 2004, must be digital.

15. Sample Drying Appliance. Stove or hot plates sized to rapidly dry aggregate samples with a minimum total of four burners.

16. Miscellaneous Testing Equipment. Miscellaneous equipment as per Department written directives or as requested by the Regional Director.

17. pH Test Kit. pH test kit meeting the requirements of Materials Procedure NY 90-1 for all plants supplying concrete containing microsilica (711-11).

501-2.04 Concrete Mixer and Delivery Unit Requirements. Each mixer requires a Manufacturer's plate, which contains the mixing capacity of the mixer, in a convenient visible location. Repair or replace blades inside the drum that have become heavily encrusted with mortar, or are loose, broken, bent, scalloped or worn 20% in any dimension or otherwise damaged.

A. Central Mixers. Central mixers meeting the following may be used unless otherwise specified:
- Equipped with an acceptable timing device that prohibits a batch of concrete from being discharged before the specified mixing time has elapsed (as per §501-3.03 C) without a clear indication on the recordation equipment.
- Able to discharge the entire batch in an unrestricted manner into a hopper or delivery unit.

B. Delivery Units. Delivery units are subject to inspection as per NYSDOT Materials Method 9.1 and approval by the Regional Director. If found unfit, it will be disapproved until properly repaired. Completely clean and empty the agitating and non-agitating units of concrete and wash water before loading again.

1. Truck Mixer Requirements. Use an inclined axis rotating drum type with a water tank system able to measure water (liters) going into the drum within a 2% accuracy, and equipped with a hatch in the drum periphery to permit access to inspect the inside.

   Each truck mixer unit will be inspected and approved annually by the Regional Materials Engineer for use in Department work, and additional inspections will be made during use to determine its operating condition. Truck mixers will not be permitted to mix batches greater than the maximum capacity indicated on the Manufacturer's rating plate.

   a. Transit Mixed Concrete. Equip each truck mixer used for transit mixed concrete with an electrical revolution-counting device, appearing on the Approved List, mounted in a clearly visible position as follows:
   - Separate counters showing; The number of drum revolutions at speeds within the mixing range and the total number of drum revolutions.
   - Both counters legible to one revolution and designed to accept a non-standard electric plug for resetting each counter to read zero when loading at the batch plant.
   - Tamper-proof such that if tampering occurs, the counters will become inoperative or the device will otherwise indicate tampering, including the interruption of electric power.
Installed to count the number of revolutions of the drum only in the direction of mixing.
Adjusted so that it counts the number of revolutions specified for the mixing and agitating drum speed within the tolerances indicated on the Manufacturer’s rating plate, but not to exceed the following Department's requirements for truck mixers:
- Mixing - 6 RPM minimum to 18 RPM maximum
- Agitating - 2 RPM minimum to 6 RPM maximum
- The mixing and agitating revolution limits may be adjusted for individual mixing units upon approval of the Director, Materials Bureau.

b. Central Mixed or Truck Mixed Concrete. Equip each truck mixer used for central or truck mixed concrete, either as described in §501-2.04 B.1.a., for Transit Mixed Concrete, or as follows:
- Mixing speed capability- 6 RPM minimum to 18 RPM maximum.
- Agitating speed capability - 2 RPM minimum to 6 RPM maximum.
- Approved counter- located in a position readily visible to the Engineer that accurately counts the number of revolutions in the direction of mixing.

2. Non- Agitating/Open Haul Units for Central Mixed Concrete. Each truck shall be:
- Sound and watertight enough to prevent loss of material during delivery.
- Free of contamination.
- Covered to protect the concrete from adverse drying or precipitation, when ordered by the Engineer.

C. Mobile Concrete Mixing Units. A mobile concrete mixing unit, with the Engineer’s approval, may be used for miscellaneous work such as curb, gutter, headwalls, catch basins, manholes, drop inlets, field inlets, sign foundations, lighting structure foundations, anchor units, pullboxes, leveling footings and similar placements.

Equip the mobile mixing unit with proportioning devices that deliver the materials within the following tolerances by mass:

<table>
<thead>
<tr>
<th>Material</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cement</td>
<td>0 to +4%</td>
</tr>
<tr>
<td>Fine Aggregate</td>
<td>±2%</td>
</tr>
<tr>
<td>Coarse Aggregate</td>
<td>±2%</td>
</tr>
<tr>
<td>Admixtures</td>
<td>±1%</td>
</tr>
<tr>
<td>Water</td>
<td>±3%</td>
</tr>
</tbody>
</table>

Use a self contained, continuous mixing type, that meets the following:
- Carries unmixed dry bulk cementitious materials, fine and coarse aggregate, water and admixtures sufficient for at least 4.5 cubic meters per batch, unless otherwise approved by the Regional Materials Engineer.
- Measures the amount of cement being introduced into the mix by a clearly visible meter which is kept clean at all times.
- Records the quantity of cement by a ticket printer that, as a minimum, records the number of revolution counts of the cement feeder.

1. Water system

a. Provides positive control of the water flow into the mixing chamber.
b. Water flow indicated by a readily adjustable flow-meter to provide for minor variations in aggregate moisture.
c. Equipped with a bypass valve or hose suitable to determine batching accuracy.

2. Admixture System

a. Equipped with at least one admixture delivery system.
b. Provides positive control of the admixture flow into the unit's mix water system.
c. Flow-meters to control the amount of admixture added to the mix.
d. Dispenses admixtures in a manner that provides uniform distribution throughout the concrete.
e. Adds admixture in the amount necessary to achieve the required air content.
f. Equipped with a bypass valve to obtain a calibrated sample to determine batching accuracy.

3. Mobile Mixing Unit:

a. Capable of combining aggregates, cement, water and admixture into a thoroughly mixed and uniform mass, and discharging the mixture without segregation.
b. Set the mixing time to achieve proper and uniform mix, as determined by the Engineer.
c. Stockpile all mix materials at the project site, unless otherwise approved by the Engineer.
d. Provide the necessary scales, containers and personnel, approved by the Engineer, to calibrate the unit.
e. Calibrate the unit and provide a record of the calibration to the Engineer for the mix design to be used. The Regional Materials Engineer will furnish the mix design information and the calibration procedure. The Department reserves the right to witness calibration of the unit.
f. Prior to actual use, demonstrate to the Engineer that the concrete meets the specification requirements for slump, air content and proportioning. Proportioning may be verified in accordance with NYSDOT Materials Method 9.4.

Correct any improper mixer conditions as approved by the Engineer. Improper conditions include, but are not limited to, blades that have become heavily encrusted with mortar, or are loose, broken, bent, scalloped, or worn 20% in any dimension or otherwise damaged. The Engineer will discontinue use of a unit that performs unsatisfactorily.

D. Small Mixing Units. The Engineer may allow a small construction mixer to mix small quantities of concrete. Mix for at least 90 seconds after all materials are in the mixer, and the Engineer will test the concrete for the specified slump and air content.

501-3 CONSTRUCTION DETAILS

501-3.01 Proportioning. Proportion all ingredients, except for admixtures, according to Table 501-3, Concrete Mixtures and as determined by the Department unless otherwise indicated in the contract documents. Any concrete mix design not meeting the requirements of Table 501-3 will be subject to approval by the Director, Materials Bureau.

A. Aggregates and Cementitious Materials. Aggregate and cementitious material proportions are indicated in Table 501-3, Concrete Mixtures, for standard classes of concrete. Mixes containing aggregate other than those permitted by §501-2.02B, Aggregates, are subject to approval by the Director, Materials Bureau.

Certain aggregates appear in the Approved List of Sources of Fine & Coarse Aggregates that have use limitations if combined with a high-alkali portland cement. The Regional Materials Engineer may allow the use of these aggregates in combination with high-alkali cements provided that pozzolans are substituted for cement in the following way:

<table>
<thead>
<tr>
<th>TABLE 501-3A POZZOLAN SUBSTITUTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete Class Specified</td>
</tr>
<tr>
<td>A, C, E, H</td>
</tr>
<tr>
<td>I, J</td>
</tr>
<tr>
<td>D</td>
</tr>
<tr>
<td>G2 and GG2</td>
</tr>
<tr>
<td>F</td>
</tr>
</tbody>
</table>

NOTES:
1. Class HP and DP concrete may be substituted to mitigate ASR as listed above. Classes HP and DP require the replacement of portland cement with 20% pozzolan and 6% microsilica. The pozzolan may be either Class C or F Fly Ash (§711-10) or Ground Granulated Blast Furnace Slag (§711-12).
2. Classes G and GG require the replacement of portland cement with 20% pozzolan. The mitigation of ASR in Classes G and GG must be accomplished using Class F Fly Ash (§711-10).
Notify the Regional Materials Engineer prior to using pozzolan substitutions to mitigate ASR when using reactive aggregates in combination with a high alkali cement. Approval may be withdrawn when unsatisfactory results occur.

**B. Admixtures.** Admixtures are used to achieve the desired set retardation, water reduction, slump, and/or the required air content, and are not considered part of the solid volume. The admixture manufacturer’s recommended maximum dosage rate should not be exceeded to obtain the desired results as specified in Table 501-3.

1. **Air Entrainment.** Air entraining agent is required for all mixes to produce concrete with an air content in the range specified in Table 501-3, Concrete Mixtures unless otherwise indicated in the contract documents. The Engineer will test the concrete for plastic air content, and reject concrete with air contents outside the specified limits.

2. **Retardation.** The setting time of concrete may be retarded when necessary for proper placement. A water-reducing and retarding admixture (§711-08, ASTM Type D), is required in Class DP for Structural Slab Overlays (Section 584), Class HP for Superstructure Slabs and Structural Approach Slabs (Section 557), Class G and Class GG concrete. It may be used with, or in place of, a water-reducing admixture (§711-08, ASTM Type A) in other applications that allow Class DP or Class HP. Limit the use of the water-reducing and retarding admixture to the minimum amount required to achieve retardation during placing conditions. Unless otherwise specified, the use of water-reducing and retarding admixtures are subject to approval of the Regional Director.

3. **Water Reduction.** Unless otherwise specified, a water-reducing admixture (§711-08, ASTM Type A), is required in Classes DP, HP, I and J concrete. For all other classes, except G and GG, a water-reducing admixture may be used, subject to advance notification and approval of the Regional Materials Engineer. High Range Water-Reducing Admixtures (§711-08, ASTM Type F), may not be used unless allowed by specification, plans, or the Director, Materials Bureau.

**C. Water.** Add water to obtain the slump desired by the Engineer, within the Design Mix Guidelines of Table 501-3, Concrete Mixtures. The Engineer will test the concrete for slump, and reject concrete with a slump greater than the guidelines for use in Department work.

Concrete with insufficient slump may be adjusted to within the guidelines of §501-3.03 by adding water and remixing, when permitted by the specifications or the Engineer.

**D. Pozzolan.** Up to 20% of the cement content for Classes A, C, D, E, H, I, and J may be substituted with a pozzolan (Fly Ash or GGBFS), except where prohibited by the Regional Director. No additional pozzolan is permitted in Classes DP, G, GG, or HP. No pozzolan is permitted in Class F.

**E. Microsilica.** Microsilica meeting the requirements of §711-11 may be added as part of a Blended Cement (§701-03, Type SF or Ternary Blend) or batched independently as a powder, or a slurry.
### TABLE 501-3 CONCRETE MIXTURES

#### Design Mix Guidelines (where sand fineness modulus = 2.80)¹

<table>
<thead>
<tr>
<th>Concrete Class</th>
<th>T.C.M. Content (kg/m³)</th>
<th>Sand % Total Agg. (solid volume)</th>
<th>Water/cementitious mat'ls (by mass)</th>
<th>Air Content % desired (Range)</th>
<th>Slump Range (mm)</th>
<th>Type of Coarse Aggregate Gradation</th>
<th>Primary Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>360</td>
<td>36.2</td>
<td>0.46</td>
<td>6.5 (5.0 - 8.0)</td>
<td>65 - 90</td>
<td>CA 2</td>
<td>general purpose structural</td>
</tr>
<tr>
<td>C6</td>
<td>359</td>
<td>35.8</td>
<td>0.44</td>
<td>6.5 (5.0 - 8.0)</td>
<td>25 - 75</td>
<td>CA 2 Pavement: slipform paving, form paving thin structural applications</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>430</td>
<td>45.8</td>
<td>0.44</td>
<td>7.5 (6.0 - 9.0)</td>
<td>65 - 90</td>
<td>CA 1 thin structural applications overlays structural slabs and structural approach slabs high early strength for pavement or structural applications</td>
<td></td>
</tr>
<tr>
<td>DP ²</td>
<td>430</td>
<td>45.8</td>
<td>0.40</td>
<td>7.5 (6.0 - 9.0)</td>
<td>75-125</td>
<td>CA 1 thin structural applications, overlays structural slabs and structural approach slabs high early strength for pavement or structural applications</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>384</td>
<td>35.8</td>
<td>0.44</td>
<td>6.5 (5.0 - 8.0)</td>
<td>75 - 100</td>
<td>CA 2 Pamment: slipform paving, form paving thin structural applications</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>425</td>
<td>34.6</td>
<td>0.38</td>
<td>6.5 (5.0 - 8.0)</td>
<td>50 - 75</td>
<td>CA 2 Pamment: slipform paving, form paving thin structural applications</td>
<td></td>
</tr>
<tr>
<td>G ³</td>
<td>431</td>
<td>45.0</td>
<td>0.45</td>
<td>6.0 (4.0 - 8.0)</td>
<td>150-180</td>
<td>CA 2 structural slabs and structural approach slabs underwater</td>
<td></td>
</tr>
<tr>
<td>GG ³</td>
<td>475</td>
<td>45.0</td>
<td>0.45</td>
<td>6.0 (4.0 - 8.0)</td>
<td>150-180</td>
<td>CA 1 underwater (special) pumping applications</td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>400</td>
<td>40.0</td>
<td>0.44</td>
<td>6.5 (5.0 - 8.0)</td>
<td>75 - 100</td>
<td>CA 2 pumping applications pumping, structural slabs, approach slabs, substructures exposed to chlorides slip forming highway median barriers</td>
<td></td>
</tr>
<tr>
<td>HP ²</td>
<td>405</td>
<td>40.0</td>
<td>0.40</td>
<td>6.5 (5.0 - 8.0)</td>
<td>75-125</td>
<td>CA 2 pumping applications pumping, structural slabs, approach slabs, substructures exposed to chlorides slip forming highway median barriers slip forming structural median barriers, parapet walls and curbs</td>
<td></td>
</tr>
<tr>
<td>I ⁴</td>
<td>380</td>
<td>41.0</td>
<td>0.44</td>
<td>6.0 (4.0 - 8.0)</td>
<td>15 - 40</td>
<td>CA 2 slip forming highway median barriers, parapet walls and curbs</td>
<td></td>
</tr>
<tr>
<td>J ⁴</td>
<td>403</td>
<td>45.8</td>
<td>0.44</td>
<td>6.0 (4.0 - 8.0)</td>
<td>15 - 40</td>
<td>CA 1 slip forming highway median barriers, parapet walls and curbs</td>
<td></td>
</tr>
</tbody>
</table>

#### NOTES:

1. Mixture proportions will be computed by the Regional Materials Engineer using the fineness modulus and bulk specific gravities (saturated surface dry) of the aggregates proposed for use.
2. Class DP and HP require the replacement of portland cement with 20% pozzolan and 6% microsilica and the addition of a water reducing admixture and / or water- reducing and retarding admixture. Refer to §501-3.01 B, Admixtures.
3. Class G and GG require the replacement of portland cement with 20% pozzolan, and the addition of a water- reducing and retarding admixture. Refer to §501-3.01 B, Admixtures.
4. These mixes require the use of a water reducing admixture. Refer to §501-3.01 B, Admixtures.
5. T.C.M. = Total Cementitious Material.
6. Slump range for slipform paving is 25 – 65mm and for fixed form paving is 40 – 75 mm.

#### 501-3.02 Handling, Measuring and Batching Materials

Arrange the batching facility and equipment to assure a continuous supply of material to the work.

When written approval is granted by the Regional Director, bagged cement, pozzolan or microsilica may be incorporated into the mix. Adjust the batch size to use whole bags of cementitious materials and batch the aggregates at the plant site according to these specifications.
**A. Stockpiles.** Build good draining bases for stockpiles, at the batching facility, on prepared aggregate, concrete, metal or wood surfaces, or barge floors, subject to approval by the Regional Director. Build the stockpiles by methods which do not cause particle segregation. Stockpile all aggregates separately, by source and size so that no cross contamination occurs. Label all Department approved stockpiles by source number.

Handle aggregates throughout the batching process such as to maintain uniform grading of the material. In case the aggregates contain a high or non-uniform moisture content, stockpile the aggregates for a sufficient length of time to stabilize the moisture content.

Equip each plant with a moisture sensing device that indicates, on a readily visible scale or chart, the fine aggregate moisture content as it is batched. Indicate the free moisture content on the batch recordation during batching. The free moisture content during batching is limited to a maximum of 8% of the fine aggregate’s saturated-surface dry mass.

The Regional Materials Engineer will determine the acceptability and accuracy of the moisture sensing device. If the device is considered accurate, the free moisture content of the fine aggregate may be allowed to be adjusted between batches based on the most recent moisture reading. No adjustment for free moisture will be allowed for an individual batch after batching starts.

**B. Heating Materials for Cold Weather Concreting.** Use equipment that uniformly heats the materials. To obtain the specified temperature of the plastic concrete when the air temperature is below 0°C, heat the aggregates by steam or dry heat and heat the mix water. When the air temperature is 0°C or more, and the aggregates are free of ice, the specified temperature may be obtained by heating only the mix water. The equipment and operations for heating the materials must be approved by the Regional Director prior to use on Department projects.

<table>
<thead>
<tr>
<th>Specified Temperature Range</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mix Water</td>
<td>20°C</td>
<td>80°C</td>
</tr>
<tr>
<td>Aggregate</td>
<td>4°C</td>
<td>40°C</td>
</tr>
<tr>
<td>Plastic Concrete in place</td>
<td>10°C</td>
<td>20°C</td>
</tr>
</tbody>
</table>

To avoid the possibility of flash set when water is heated over 40°C, combine the water and aggregate in the mixer so that the water temperature is reduced before cement is added.

**C. Batching.**

1. **Aggregates.** When sizes are weighed cumulatively, allow a ±2% tolerance for each draw mass, based on the combined aggregate batch mass. If sizes are weighed separately, apply the tolerance to each scale mass.

2. **Cement and Pozzolan**

   a. *Batching without microsilica powder added independently on a common scale.* Weigh the cement, blended cement, or pozzolan cumulatively with a ±1% tolerance for each draw mass, based upon the combined mass of cementitious materials. Weigh the pozzolan last in the weighing sequence.

   b. *Batching with microsilica powder added independently on a common scale.* Weigh the cement, Type IP or SM blended cement, or pozzolan cumulatively with a ±0.5% tolerance for each draw mass, based upon the combined mass of cementitious materials. Double the minimum allowable batch mass. Weigh the microsilica last in the weighing sequence.

3. **Microsilica**

   a. *Batching with cement, Type IP or SM blended cement, or pozzolan on a common scale.* Weigh the microsilica powder cumulatively with a ±0.5% tolerance for each draw mass, based upon the combined mass of cementitious materials. Double the minimum allowable batch mass. Weigh the microsilica last in the weighing sequence.
b. **Batching microsilica powder on a separate scale.** Allow a ±1.0% tolerance for the total draw mass of microsilica.

c. **Batching microsilica slurry.** Either add the microsilica slurry using the permanently installed automation system or using a two stop, off-line, automated batching system, approved by the Regional Materials Engineer as meeting the following requirements:

- System interlocks: To interrupt and stop the batching whenever an out of tolerance condition occurs.
- Meter accuracy: ±1.0% by volume of slurry
- Batching Tolerance: ±2.0% by volume of slurry
- Program quantity: liters, nearest tenth
- System recordation:
  - Correct date and time
  - Truck number (or other method relating slurry to batch ticket)
  - Delivered quantity (liters, nearest tenth)

Locate the control box/printer for the off-line batching system at the plant operator’s work station unless otherwise approved by the Regional Materials Engineer. Calibrate the system according to procedures approved by the Regional Materials Engineer. Re-calibrate the system if any part, or all, of the system is moved. Electrical circuits used to check delivery tolerances may be set at any span within the full allowable tolerance for any approved batch size. For plants not equipped to automatically adjust tolerances, set the tolerance span for the minimum approved batch size when producing varying batch sizes.

Agitate the slurry as necessary to prevent separation. Remove and replace slurry that reaches a temperature less than 0°C, at no additional cost to the Department.

### D. Delivery Tickets

Each delivery ticket must contain the following:

- Delivery Ticket Number
- Plant Identification, with plant name and location and/or facility number
- Contract Number
- Concrete Class or Item Number
- Quantity (Nominal Batch Size)
- Truck Number
- Batch Number
- An Automatically Applied Time-Date Stamp (immediately upon completion of batching) which may consist of one of the following:
  - Time - Date stamp by separate printing device on a regular ticket
  - Time - Date printed by a batch weight recorder on a printed ticket.
  - Time - Date printed by a batch weight recorder on a printed tape. Affix a copy of the tape to the regular delivery ticket.

### E. Failure of Automatic Batching, Admixture Dispensing and Recording Equipment

If automatic proportioning, admixture dispensing or recording instruments fail, the plant may be allowed, subject to approval of the Regional Director or his representative, to continue producing concrete for the Department for up to 48 hours from the time of breakdown. Written permission of the Regional Director will be required to operate without these instruments for periods longer than 48 hours.

During this period, batch all materials within the automatic proportioning system tolerances.
TABLE 501-4  BATCHING TOLERANCES

<table>
<thead>
<tr>
<th>Material</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cement, Pozzolan, or Blended</td>
<td>± 1% (by mass) of total cementitious materials, if no microsilica is weighed cumulatively on common scale.</td>
</tr>
<tr>
<td>Cement</td>
<td>± 0.5% (by mass) of total cementitious materials, if microsilica powder is weighed cumulatively on a common scale.</td>
</tr>
<tr>
<td></td>
<td>± 0.5% (by mass) of total cementitious materials, if weighed cumulatively with cement, Type IP or SM blend, or pozzolan.</td>
</tr>
<tr>
<td>Microsilica Powder</td>
<td>± 1% (by mass) if weighed on a separate scale.</td>
</tr>
<tr>
<td>Microsilica Slurry</td>
<td>± 2% (by volume)</td>
</tr>
<tr>
<td>Aggregate</td>
<td>±2% (by mass)</td>
</tr>
<tr>
<td>Water (See Note 1)</td>
<td>± 1% (by mass or volume)</td>
</tr>
<tr>
<td>Admixtures 711-08</td>
<td>± 3% (by mass or volume) or ± 1 meter pulse (see Note 3), whichever is greater.</td>
</tr>
<tr>
<td>Admixture (other)</td>
<td>contact Director, Materials Bureau</td>
</tr>
<tr>
<td>Zero - Aggregate (See Note 2)</td>
<td>± 2%</td>
</tr>
<tr>
<td>Zero - Cementitious Mat’ls. (See Note 2)</td>
<td>± 1%</td>
</tr>
<tr>
<td>Zero - Water (See Note 1, 2)</td>
<td>± 1%</td>
</tr>
</tbody>
</table>

NOTES: 1: Tolerance applies to water added at central mix plants only.
2: Zero Tolerance is based on the minimum allowable batch size.
3: Based on the preprogrammed target quantity.

501-3.03 Concrete Mixing, Transporting and Discharging.

A. General. Mix the concrete at a central mix plant, in truck mixers in transit or at the site. When mixed at a central mix plant, transport the concrete in vehicles acceptable to the Regional Director. Place the fresh concrete directly into the forms or into conveyance equipment approved by the Regional Director before evidence of initial set. No water addition will be permitted after the mix has reached the mid-point of the slump range, as indicated in Table 501-3, Concrete Mixtures, for the class used. Concrete with a discharge temperature exceeding 32°C will be subject to rejection.

Notify the Regional Materials Engineer’s office by 3:00 PM on the day before any production for the Department. Supply fresh concrete at a rate consistent with placement operations as determined by the Engineer. The Regional Director may disapprove the use of any type of concrete mixing or transporting units when unsatisfactory results occur.

Load the mixer, regardless of type, in a manner approved by the Regional Director and mix batches of concrete no larger than the rated capacity shown on the Manufacturer's plate.

A summary of time limitations for various types of concrete mixing equipment, from the beginning of batching to the completion of discharge, is given in Table 501-7, Summary of Concrete Batching, Mixing, Hauling and Discharging.

B. Concrete Uniformity. Use a mixer that combines aggregates, cementitious materials, water and admixtures into a uniform mass within the specified time. The mixer is required to discharge the mixture without segregation, and meet the uniformity requirements in Table 501-5, Concrete Uniformity. The Department will perform tests when required by the specifications or requested by the Regional Director.

It will only be necessary to verify that mixing equipment meets uniformity requirements if evidence of non-uniform concrete is found or a reduced mixing time for central mixers is requested. A reduction in the batch size below the rated mixer capacity or reduced mixing speed tolerance limits may be required to obtain uniformity.
### TABLE 501-5 CONCRETE UNIFORMITY

<table>
<thead>
<tr>
<th>Test</th>
<th>Permissible Variation (Concrete samples taken at two locations in the batch)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass per cubic meter calculated to an air-free basis</td>
<td>32.0 kg per m³</td>
</tr>
<tr>
<td>Air Content, % by volume of concrete</td>
<td>1.0%</td>
</tr>
<tr>
<td>Slump:</td>
<td></td>
</tr>
<tr>
<td>Average slump 100 mm or less</td>
<td>25 mm</td>
</tr>
<tr>
<td>Average slump greater than 100 mm</td>
<td>40 mm</td>
</tr>
<tr>
<td>Coarse aggregate content, portion by mass of each sample retained on a 4.75 mm sieve</td>
<td>6.0%</td>
</tr>
<tr>
<td>Unit mass of air-free mortars based on average for all comparative samples tested</td>
<td>1.6 %</td>
</tr>
</tbody>
</table>

**NOTE:** The Department will take samples at the mixer discharge point and test in accordance with Materials Method 9.2.

### C. Central Mixed Concrete.
Central mixed concrete is concrete mixed in a stationary mixer and transported in approved agitating or non-agitating delivery units to the deposition point. If microsilica slurry is batched, consult the slurry supplier so that microsilica balling does not occur. Use a minimum 90 second mixing time after all materials are in the drum, unless tests show that the requirements of Table 501-5, Concrete Uniformity, can be consistently obtained at a lesser time as approved by the Director, Materials Bureau.

Use delivery units that transport thoroughly mixed concrete without loss of uniformity meeting the requirements of §501-2.04B.1.b. or §501-2.04B.2., pertaining to Central Mixed Concrete.

Travel on a haul road free from holes, washboarding or other features that cause segregation in plastic concrete.

Do not exceed the time limit between completion of mixing at a central mix plant and completion of discharge as noted in Table 501-6, Time Limits for Delivery of Central Mixed Concrete.

When transporting central mixed concrete in units approved for truck mixing, add a minimum of 90% of the design water to the mix with the batch plant water system.

Two additions of water will be allowed at the discharge point to obtain initial slump. After each addition, mix the concrete at least 30 mixing-speed revolutions before discharging. The initial loads may, with prior written approval by the Regional Materials Engineer, also be adjusted by using a water-reducing admixture (711-08, ASTM Type A). This adjustment will be limited to the first trucks arriving for a particular placement before any adjustments have been made at the batching facility. Observe the maximum number of mixing revolution or water addition requirements. Make all subsequent admixture additions or adjustments during production at the batching facility. No additions or adjustments are allowed when non-agitating / open haul units are used.

### TABLE 501-6 TIME LIMITS FOR DELIVERY AND DISCHARGE OF CENTRAL MIXED CONCRETE

<table>
<thead>
<tr>
<th>Delivery Unit</th>
<th>Maximum Time (Minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Agitating / Open haul</td>
<td>30</td>
</tr>
<tr>
<td>Agitating - rotating drum</td>
<td>90 *</td>
</tr>
</tbody>
</table>

* The Engineer will reject the concrete if there is evidence of initial set, and may reduce the time limit in hot weather or under unusual conditions if unsatisfactory results occur. For concrete that does not contain a water-reducing and retarding admixture, the time to initial strike-off or placement of subsequent lifts is included in the delivery and discharge time limit.

### D. Transit Mixed Concrete.
Transit mixed concrete is concrete batched at the production facility and mixed completely in a truck mixer at the following locations or combinations thereof: the plant, while in transit, or the discharge point. Transit mix may be used for all concrete items unless otherwise specified. Use a truck mixer meeting the requirements of §501-2.04B.1.a., pertaining to Transit Mixed Concrete.

Load the mixer as follows:
1. Totally drain the drum of wash water before loading.
2. Revolve the drum while loading the mix ingredients, except when adding microsilica slurry, and add approximately 90% of the design water.
3. Begin mixing within 5 minutes of cement to aggregate contact.

### TABLE 501-7 SUMMARY OF CONCRETE BATCHING, MIXING, HAULING AND DISCHARGING

<table>
<thead>
<tr>
<th>Central Mixed Concrete</th>
<th>Transit Mixed Concrete</th>
<th>Truck Mixed Concrete</th>
</tr>
</thead>
<tbody>
<tr>
<td>Begin Batching</td>
<td>Hatch Batching</td>
<td>Begin Batching</td>
</tr>
<tr>
<td>Load mixer</td>
<td>Hatch load, or ribbon load materials through barrel hopper.</td>
<td>Load aggregates.</td>
</tr>
<tr>
<td>End of Batching and</td>
<td>Add approx. 90% of design water</td>
<td>Drum may be</td>
</tr>
<tr>
<td>Begin Mixing</td>
<td></td>
<td>rocked or revolved</td>
</tr>
<tr>
<td>90 Second minimum after all materials are in the mixer.</td>
<td></td>
<td>Drum may be</td>
</tr>
<tr>
<td>End of Mixing</td>
<td></td>
<td>Cement In Contact</td>
</tr>
<tr>
<td>Open Haul</td>
<td>Rotating Units</td>
<td>Load Cement</td>
</tr>
<tr>
<td>Drum</td>
<td>30 Minutes maximum</td>
<td>(See Note 3)</td>
</tr>
<tr>
<td></td>
<td>90 Minutes maximum</td>
<td>Cement In Contact</td>
</tr>
<tr>
<td></td>
<td>(See Note 2)</td>
<td>Aggregates</td>
</tr>
<tr>
<td>Completion of Discharge</td>
<td>90 Minutes maximum</td>
<td>Class HP or Class DP</td>
</tr>
<tr>
<td>(When concrete is transported in units approved for mixing, see Note 1)</td>
<td></td>
<td>100 rev. minimum</td>
</tr>
<tr>
<td></td>
<td>(Note 2)</td>
<td>200 rev. maximum</td>
</tr>
<tr>
<td>Mix: 6-18 rpm</td>
<td></td>
<td>End of Batching</td>
</tr>
<tr>
<td>End of Mixing</td>
<td></td>
<td>All Other Classes</td>
</tr>
<tr>
<td>Agitate 2-6 rpm</td>
<td>100 rev. minimum</td>
<td>100 rev. minimum</td>
</tr>
<tr>
<td>Mix: 6-18 rpm</td>
<td>160 rev. maximum</td>
<td>160 rev. maximum</td>
</tr>
<tr>
<td>End of Mixing</td>
<td>15 Minutes maximum</td>
<td>End of Mixing</td>
</tr>
<tr>
<td>Begin Discharge</td>
<td></td>
<td>Agitate 2-6 rpm</td>
</tr>
<tr>
<td>50 Minutes maximum</td>
<td></td>
<td>End of Discharge</td>
</tr>
<tr>
<td>Completion of Discharge</td>
<td></td>
<td>Completion of Discharge</td>
</tr>
</tbody>
</table>

**NOTES:**
1. The remainder of the design water may be added at the work site to attain initial slump. When approved by the Regional Materials Engineer, only the first trucks may be adjusted to obtain initial slump using a water-reducing admixture (§711-08, ASTM Type A). Exceeding the maximum mixing revolutions or water addition requirements will not be permitted.
2. For mixtures that do not contain a water-reducing and retarding admixture (§711-08, ASTM Type D), the 90 minute maximum time includes the time to initial strike-off, or placement of subsequent lifts.
3. Add cement through hatch. Do not move drum while cement is being added.

If microsilica slurry is batched, consult the slurry supplier so that microsilica balling does not occur.

Mix for a minimum of 100 mixing-speed revolutions and then check for consistency. If the truck is en route to the project, change the speed from mixing to agitating after 100 mixing revolutions. Unless restricted by local traffic laws, do not stop the rotation of the drum during transit.

Two additions of water will be allowed to obtain initial slump at the discharge location. After each addition, mix at least 30 mixing speed revolutions. For Class DP or HP concrete, mix a total of 100 to 200 mixing speed revolutions. For all other classes of concrete, mix a total of 100 to 160 mixing speed revolutions.

The initial loads may, with prior written approval by the Regional Materials Engineer, also be adjusted by using a water-reducing admixture (§711-08, ASTM Type A). This adjustment will be
§501

limited to the first trucks arriving for a particular placement before any adjustments have been made at the batching facility. Observe the maximum number of mixing revolution or water addition requirements. Make all subsequent admixture additions or adjustments during production at the batching facility.

After mixing, either discharge the load immediately or revolve the drum at agitating speed. Once begun, discharge the entire load within 50 minutes.

For mixes containing a water-reducing and retarding admixture, the total time interval from the moment the cement makes contact with the aggregates to the completion of discharge shall not exceed 90 minutes.

For mixes that do not contain a water-reducing and retarding admixture, the total time interval from the moment the cement makes contact with the aggregates to the completion of initial strike off or placement of subsequent lifts shall not exceed 90 minutes.

The Regional Director may reduce the total time limit in hot weather or under unusual conditions, if unsatisfactory results are obtained.

E. Truck Mixed Concrete. Truck mixed concrete is concrete completely mixed in a truck mixer meeting the requirements of §501-2.04B.1.b. Truck Mixers, after adding water at the discharge location. Apply §501-3.03D. Transit Mixed Concrete, except as follows:

1. Loading of Mixer:

   a. Regular Truck Mix (cement in contact with moist aggregates). The drum may be rocked or revolved while loading coarse and/or fine aggregates with admixtures. Load the cement last, while keeping the drum stationary. Begin mixing within 30 minutes of cement to aggregate contact.

   b. Layered Truck Mix (cement in contact with Saturated Surface Dry(SSD) or drier coarse aggregate). Batch the fine aggregate with admixtures, coarse aggregate and cement all separately. Load these materials through a hatch in the side of the drum in the following sequence: fine aggregate with admixtures, coarse aggregate, and cement last. The drum may be rocked after adding each aggregate size, but kept stationary while loading the cement. Begin mixing within 90 minutes of cement to coarse aggregate contact.

2. Mixing: Begin mixing at the discharge location. Add water to the drum either from the head section or by dual injection from both the head and discharge end. Mix for a minimum 100 revolutions or until uniform concrete of the specified consistency is produced, whichever is longer. Do not exceed a 15 minute mixing period.

3. Discharge: Discharge the entire load within 30 minutes after mixing.

501-4 METHOD OF MEASUREMENT. The Engineer will compute the volume of concrete as the number of cubic meters within the payment lines indicated on the plans or as specified by the Engineer. No deductions will be made for the volume of embedded reinforcement, structural shapes or joint materials. Also, no deductions will be made in concrete pavement for catch basins, manholes, etc. unless otherwise indicated in the contract documents.

501-5 BASIS OF PAYMENT. Include the cost of furnishing all materials, equipment and labor necessary to complete the work in the unit price bid for the appropriate items.

SECTION 502 - PORTLAND CEMENT CONCRETE PAVEMENT

502-1 DESCRIPTION. Construct a portland cement concrete (PCC) pavement and shoulders, if required, as detailed in the contract documents.
Portland Cement Concrete 501
Anchoring Materials - Chemically Curing 701-07
Highway Joint Sealants (ASTM D 6690, Type IV) 705-02
Silicone Joint Sealants 705-05
Premoulded Resilient Joint Filler 705-07
Preformed Elastic Longitudinal Joint Seal 705-10
Preformed Elastic Transverse Contraction and Expansion Joint Seal 705-12
Lubricant for Preformed Elastic Joint Sealer 705-13
Longitudinal Joint Ties 705-14
Transverse Joint Supports 705-15
Wire Fabric for Concrete Reinforcement 709-02
Epoxy Coated Bar Reinforcement, Grade 420 709-04
Quilted Covers (for curing) 711-02
Plastic Coated Fiber Blankets (for curing) 711-03
Polyethylene Curing Covers (white opaque) 711-04
Membrane Curing Compound 711-05
Form Insulating Materials for Winter Concreting 711-07
Water 712-01
Backer Rods ASTM D 5249

In addition to meeting the requirements of ASTM D 5249 (Type 1 or 3), backer rods must be closed cell polyethylene foam with a diameter at least 25% wider than the second-stage saw cut.

In addition to meeting the requirements of §701-07, Anchoring Materials - Chemically Curing, the material used to anchor longitudinal joint ties, dowels, or other miscellaneous items into hardened concrete must be a pourable, two-component, 100% solids structural epoxy dispensed:

- From side-by-side cartridges by manual or pneumatically powered injection guns.
- Through a static mixing nozzle that homogeneously mixes the material without any hand mixing.
- The Department may perform supplementary sampling and testing of the silicone and highway joint sealants. Deliver sealant in the manufacturer’s original sealed container legibly marked with the:
  - Manufacturer’s name.
  - Trade name of the sealant.
  - Manufacturer’s lot or batch number.
  - Pouring temperature (Highway Joint Sealant only).
  - Safe heating temperature (Highway Joint Sealant only).

502-2.01 Concrete. Use Class C concrete furnished in accordance with Section 501, Portland Cement Concrete – General, when specified. High-Early-Strength (HES) concrete, meeting the requirements of §502-2.02, may be substituted for closure or short placements, subject to the Engineer’s approval.

502-2.02 High-Early-Strength (HES) Concrete. Use HES concrete where required in the contract documents or where the Contractor’s request to use HES concrete is approved by the Department.

Whether required or requested, design the HES mix to satisfy the opening to traffic time requirements of the project and Table 502-1, High-Early-Strength Concrete Mix Requirements. Submit the HES concrete mix design to the Engineer. Include admixture brands and dosages as well as mixing, transporting, placing, paving, curing, and anticipated strength gain details.

Produce and place a 3.0 m³ (minimum) trial batch at an off-contract location selected by the Contractor and agreed upon by the Engineer. Produce the trial batch using the same materials and processes as those to be used to produce concrete for the contract. Provide the Engineer a 7-day minimum advance notification of trial batch production. Produce and place the trial batch in the presence of the Engineer, the Regional Materials Engineer, and Materials Bureau personnel.

Provide an American Concrete Institute (ACI) Certified Concrete Field Testing Technician, Grade I, or higher, to:

- Measure slump, air content, and unit weight of the trial batch.
§502

- Cast cylinders from the trial batch for compressive strength and freeze-thaw resistance testing.

Determine the compressive strength of the trial batch concrete at the desired time as discussed in §502-3.18C, Project Strength Determination.

The Materials Bureau will render a decision on mix acceptability, curing, and opening to traffic requirements within 45 calendar days of trial batch production. Changes other than minor fluctuations in admixture dosage rates require a new mix design and trial batch. The Engineer will reject the concrete if the specified slump or plastic air content are not achieved. The Engineer may halt paving and order additional trial batches whenever the specified compressive strength requirements are not achieved.

**TABLE 502-1 HIGH-EARLY-STRENGTH CONCRETE MIX REQUIREMENTS**

<table>
<thead>
<tr>
<th>Property</th>
<th>Minimum</th>
<th>Desired</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>28 Day Compressive Strength</td>
<td>28.0 MPa</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Opening Compressive Strength</td>
<td>17.0 MPa</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Freeze-Thaw Loss (Test 502-3P, 3% NaCl)</td>
<td>-</td>
<td>0.0 %</td>
<td>3.0 %</td>
</tr>
<tr>
<td>Plastic Air Content</td>
<td>5.0 %</td>
<td>6.5 %</td>
<td>8.0 %</td>
</tr>
<tr>
<td>Hardened Air Content</td>
<td>5.0 %</td>
<td>6.5 %</td>
<td>8.0 %</td>
</tr>
<tr>
<td>Water – Cement Ratio (w/c)</td>
<td>-</td>
<td>-</td>
<td>0.44</td>
</tr>
<tr>
<td>Slump²</td>
<td>25 mm</td>
<td>-</td>
<td>150 mm</td>
</tr>
</tbody>
</table>

**NOTES:**
1. See §502-3.18, Opening to Traffic.
2. Minimum slump provided the mix consolidates and finishes properly. Maximum slump provided the mix is nonsegregating.

502-2.03 Portland Cement Treated Permeable Base (PCTPB). Use (1) coarse aggregate meeting §501-2.02B2, Coarse Aggregate, with Type CA2 gradation, (2) portland cement, Type I, II, or I/II meeting §701-01, Portland Cement, and (3) water in the following proportions:

- Cement 143 kg/m³
- Aggregate 1600 kg/m³
- W/C 0.37 max

Aggregate weight is based on a bulk density of 1600 kg/m³ and a saturated, surface-dry condition determined in accordance with AASHTO T 19M, Bulk Density (“Unit Weight”) and Voids in Aggregate. Adjust the aggregate weight accordingly if the contract aggregate has a different bulk density.

Use saturated, surface-dry coarse aggregate if PCTPB is brought to the site in open haul units. Coarse aggregate for PCTPB do not have to meet friction requirements.

502-2.04 Equipment. Provide the Engineer with an equipment list and specifications a minimum of 14 days prior to the planned start of PCC paving. Bring all equipment needed to place, consolidate, finish, texture, cure, saw cut, seal, and test the PCC pavement and permeable base to the job site a minimum of 1 full work day before its use to allow examination by the Engineer. Repair or replace any equipment found to be defective before or during its use. Discontinue any operation if unsatisfactory results are being obtained. Use of equipment other than described below is subject to the approval of the Director, Materials Bureau.

**A. Slipform Paving.** Use a self-propelled slipform paver equipped with:
- Rigid side forms that laterally support the concrete and minimize edge slumping.
- A full-width finishing pan.
- Attached internal vibrators capable of consolidating the entire concrete placement.

Slipform paving consists of a single paver, or a placer/spreader followed by a separate paver, capable of placing, spreading, consolidating, screeding, and finishing the concrete such that hand
finishing is kept to a minimum. Use equipment guided by a reference system that ensures the pavement is placed to the specified line, grade, and cross section.

### B. Fixed Form Paving

1. **Forms.** Use straight forms without horizontal joints meeting Table 502-2, Form Requirements, and equipped with:
   - At least 3 stake pockets spaced 1.0 m apart (maximum), each having a positive, nondetachable wedge.
   - Positive, interlocking devices capable of holding abutting sections together to form neat, tight joints.

   Flexible, curved, or wooden forms may be used in irregular areas or curved sections having horizontal radii of 30 m or less.

2. **Paving Equipment.** Use a self-propelled paver equipped with a full-width finishing pan and attached internal vibrators capable of consolidating the entire concrete placement. Three (3) full-width transverse finishing screeds may be used in lieu of the full-width finishing pan. When 2 pavers are used to employ 3 transverse screeds, vibrate with the first paver only.

   Finishing machines with double cylinders and augers capable of rotating in opposite directions, attached internal vibrators, and at least 1 pan float may also be used. However, if the pavement is specified as nonprofilographed, §502-3.16, Profilograph, and §502-3.17, Diamond Grinding, will apply. §502-3.15, Hardened Surface Test, will not apply.

   Fixed form paving consists of 1 or 2 pavers, or a placer/spreader followed by the paver(s), capable of placing, spreading, consolidating, screeding, and finishing the concrete to the specified line, grade, and cross section such that hand finishing is kept to a minimum.

   
   **TABLE 502-2 FORM REQUIREMENTS**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material</td>
<td>Steel, 6 mm thick, minimum.</td>
</tr>
<tr>
<td>Length</td>
<td>3.0 m, minimum.</td>
</tr>
<tr>
<td>Depth</td>
<td>Equal to the sum of the edge thicknesses of all pavement layers placed within the form.</td>
</tr>
<tr>
<td>Base Width</td>
<td>Equal to the depth, minimum.</td>
</tr>
<tr>
<td>Horizontal Top Face</td>
<td>50 mm wide, minimum, and lying in a plane with a maximum variation of 3 mm in 3.0 m.</td>
</tr>
<tr>
<td>Vertical Face</td>
<td>Maximum variation of 6 mm in 3.0 m and rounded on the upper corner with a 20 mm radius, maximum.</td>
</tr>
<tr>
<td>Flange Bracing</td>
<td>Extends outward on the base b of the form depth, minimum.</td>
</tr>
</tbody>
</table>

3. **Paving Irregular Areas.** Pave with the following equipment, in order of preference, if slipform or fixed form paving equipment cannot be used in an irregular area:
   a. Triple tube roller pavers.
   b. Concrete finishing machines equipped with internal vibrators and double cylinders and augers capable of rotating in opposite directions and at least 1 pan float.
   c. Roller pavers.
   d. Manual, vibrator equipped power screeds appearing on the Department’s Approved List.
   e. By hand.

C. **Vibrators.** Use paver-mounted internal vibrators capable of consolidating the entire concrete placement that are:
   - Capable of being shut off without shutting off the paver.
   - Equipped with frequency controls readily accessible to the paver operator.
   - Capable of simultaneously operating at the same frequency as the other paver-mounted vibrators.
• Capable of operating through a frequency range of 6,000 - 10,000 vibrations per minute.

Check vibrator operating frequencies daily when paving begins. Check frequencies under load with the Engineer present. If the paver is not equipped with direct-read frequency gauges for each vibrator, supply the Engineer with a calibrated, hand-held tachometer, including instructions, to monitor vibrator frequencies. The tachometer will remain the Contractor’s property after paving is complete.

Use hand-held vibrators capable of operating through a frequency range of 6,000 - 10,000 vibrations per minute in irregular areas or at any location that is not consolidated by internal vibrators attached to the paving equipment.

D. Permeable Base Paving Equipment. Use pavers meeting §502-2.04A, Slipform Paving, with vibrators disengaged or §402-3.02, HMA Pavers, with an attached vibrating screed. Permeable base may be placed by hand and compacted with plate or small drum vibrators in fixed form operations with permeable base placed within the forms or in areas not accessible to pavers.

E. Saw Cutting Equipment. Use diamond blade saws capable of making straight cuts to the dimensions depicted in the Standard Sheets that are equipped with cutting guides, blade guards, water cooling systems, dust controls, and cut depth control. Where beveled saw cuts are required, use a cutting or grinding device attached to the saw blade, or a separate device following the saw.

Maintain equipment and supplies to ensure uninterrupted saw cutting. Early entry saws require approval from the Director, Materials Bureau. Submit requests to use early entry saws at least 7 calendar days before paving.

F. Curing Compound Applicators. Use atomizing mechanical sprayers capable of exerting consistent pressure without hand pumping that are equipped with tank agitators to continuously mix the curing compound. Use nozzles with spray shields to prevent drift. Flush nozzles daily before use.

Maintain equipment and supplies, including extra nozzles, to ensure uninterrupted curing compound application. In a slipform paving operation, use self-propelled applicators guided by the same reference system as the slipform paver. In a fixed form operation, applicators need not be self-propelled.

G. Profilograph. For projects with profilograph smoothness requirements, use an automated California-type profilograph capable of producing and analyzing a profile trace in accordance with Materials Method 24, Portland Cement Concrete Pavements Profilograph Operations. Use automation capable of reporting profile indices in mm/km using a 5 mm blanking band and in mm/km using a zero blanking band.

H. Diamond Grinding. Use equipment having gang-mounted diamond saw blades on a multiblade arbor specifically designed for pavement bump cutting or production grinding. When production grinding, use equipment capable of producing a 1.2 m (minimum) grinding pass width that is equipped with a vacuum system capable of removing slurry from the pavement surface. Use blade spacers having a minimum thickness of 2.67 mm. Inform the Engineer of the spacer thickness selected.

I. Drills. Use gang drills with a minimum of 2 independently powered and driven drills. Use tungsten carbide drill bits. Rest and reference the drill rig frame on and to the pavement surface such that the drilled holes are cylindrical, perpendicular to the surface being drilled, and repeatable in terms of position and alignment. Hand-held drills, or gang drills resting on the permeable base or subbase, are permitted for drilling holes in longitudinal joints if there is not enough room to use gang drills resting on the pavement surface. This typically occurs when traffic is being maintained on a previous placement.

J. Joint Sealing - Silicone Joint Sealant. Use equipment that pumps the silicone directly from plastic pails or drums by compressed air powered extrusion pumps designed for moisture curing.
silicone sealants. Use teflon seals and packing and teflon lined hoses to prevent moisture permeation. Use nozzles that apply the silicone within the joint confines for the full width of the joint, and to the level below the pavement surface depicted in the Standard Sheets.

K. Joint Sealing - Highway Joint Sealant. Heat the sealant in a melter constructed either:
- As a double boiler with the space between inner and outer shells filled with oil or other heat-transfer medium.
- With internal tubes or coils carrying the sealant through a heated oil bath and into a heated double-wall hopper.

Do not use direct heating. Use a melter capable of maintaining the sealant's pouring temperature and providing homogeneous sealant equipped with:
- Positive temperature control.
- Continuous full sweep mechanical agitation.
- Separate thermometers indicating the temperatures of the heat transfer medium and the sealant in the hopper. Do not place any sealant if the thermometers are defective or missing.

Provide 2 thermometers having stems 450 mm long and temperature ranges sufficient to meet the requirements of this specification. Use a discharge hose equipped with a controlled heating apparatus or sufficiently insulated to maintain the proper sealant pouring temperature. Use nozzles that apply the joint sealant within the joint confines for the full width of the joint, 5 mm - 10 mm below the pavement surface.

L. Air Blasting Equipment. Use equipment with traps or other installed devices that prevent moisture and oil from contaminating the concrete surface. Use a compressor that delivers air at a minimum of 3.4 m$^3$ per minute and develops a minimum nozzle pressure of 0.62 MPa. Check the compressed air stream purity daily with a clean white cloth.

502-3 CONSTRUCTION DETAILS. Convene a prepaving meeting 7 to 14 days before the planned start of PCTPB paving with the Engineer and any PCC paving and saw cutting subcontractors to coordinate all aspects of paving and inspection, including equipment review, construction methods, and time and personnel requirements.

Construct a smooth, well consolidated, properly finished, textured, and cured pavement to the line and grade depicted in the contract documents, 6 mm vertically at any location.

502-3.01 Weather Limitations

A. Rain. Do not pave in the rain. Supply sufficient quilted covers, plastic coated fiber blankets, or polyethylene curing covers near the paving operation when rain may be expected. Securely cover any concrete exposed to rain that has not reached initial set or will be visibly affected by the rain.

B. Cold Weather. Place concrete when the air temperature is 4°C and rising, or warmer, and when the surface temperature of the area to be paved is 4°C, or warmer. Stop paving when the air temperature falls below 4°C. Measure temperatures in the shade to an accuracy of 1°C. Refer to §502-3.11C, Cold Weather Curing.

502-3.02 Subbase Course. Furnish in accordance with Section 304, Subbase Course, before placing any PCTPB or PCC. If the subsequent PCC placement is a profilographed traveled way and the area is available, widen the prepared subbase course at the same line, grade, and cross slope such that it is at least:
- m beyond the longitudinal edges of a slipform pavement.
- 300 mm beyond the outside longitudinal edges of the fixed forms.

Additional subbase course that is not included in the finished work will be paid for under Section 304 items included in the contract.
§502

502-3.03 Portland Cement Treated Permeable Base. Apply §502-3.01, Weather Limitations. Place and consolidate permeable base within 2 hours of water addition to the mix. Allow to air cure for a minimum period of time such that concrete placement results in no damage to the permeable base.

Place permeable base on a prepared subbase course to the dimensions depicted in the contract documents such that the final surface elevation does not vary more than 6 mm above or 25 mm below the design grade elevation at any location. In a slipform paving operation, test the surface both perpendicular to the pavement centerline and diagonally across the pavement using a stringline placed across the referencing system. Test the surface (1) at the beginning of each day’s placement, (2) every 15 m thereafter, (3) at the end of each day’s placement, and (4) wherever required to ensure reasonably close conformance to the contract documents. In a fixed form paving operation, use a scratch board placed transversely across the forms to continuously test the surface elevation and verify the appropriate concrete thickness will be placed. Trim excess permeable base from high areas exceeding 6 mm in 3 m before it hardens. Build up low areas deeper than 25 mm in 3 m with CA 1 or CA 2 coarse aggregate.

In a slipform paving operation, place the permeable base slightly wider than the pavement width being placed. Remove and replace permeable base placed wider than the pavement if it is damaged or contaminated.

In a fixed form paving operation, place permeable base either within the forms or beneath the forms. When placing within forms, place a bead of commercial masonry caulk along the top surface of the permeable base at the form interface before placing concrete to prevent paste infiltration down the vertical face of the form. The masonry caulk bead is not required at placement edges outside of the underdrains.

Construction traffic may be maintained on permeable base in areas of limited access. Remove and replace damaged or contaminated permeable base before placing PCC.

502-3.04 Slipform Paving. Establish a reference system to achieve the specified smoothness level. If string lines are used, set them by survey and use dual lines for the initial placement if it is a profilographed traveled way and the area is available.

Maintain uniform concrete quality and head in front of the paver. Coordinate concrete delivery to maintain continuous forward movement of the paver and avoid excessive delivery truck queues. Keep paver tracks clear of concrete and debris before and during paving.

If concrete is placed directly on subbase, i.e., there is no permeable base, wet the entire subbase surface without forming puddles or mud immediately before placing concrete.

Whenever possible, unload concrete into a mechanical spreader that deposits it near the final position before paving. If a spreader is not used, uniformly distribute the concrete in front of the paver by maneuvering the delivery truck chute.

Consolidate the entire concrete placement using internal vibrators attached to the machine. Combine paver forward speed, vibrator frequency, and vibrator depth to consolidate the concrete without segregation, vibrator trails, or contacting the joint assemblies. Discontinue vibration and tamping if the paver stops.

Determine edge slump by extending a 600 mm (minimum) long straightedge over the longitudinal pavement edges. Immediately correct edge slumps greater than 6 mm that are between concrete placements and greater than 10 mm at free edges and HMA shoulders.

502-3.05 Fixed Form Paving.

A. Setting Forms. Compact the supporting layer at the form line such that the forms are supported for their full length. Set forms to string lines placed at the pavement elevation, line, and grade and to achieve the specified smoothness. If a form sits above the string line, remove the form and trim the form line to the proper grade. If a form sits below string line, remove the form and fill and compact the low area with granular material at least 150 mm on both sides of the form. Frequently check form grade and alignment while paving. Reset forms as necessary.

Set forms to accommodate a full days paving before placing concrete. Extend forms beyond construction bulkheads to provide a working platform at the end of a placement. Secure each form with a minimum of 3 pins each of sufficient length to hold the forms in place without movement during any operation. Lock the forms together such that the form ends are aligned and the joints are
Align keyway strips in a smooth, horizontal plane, parallel to the top of the form. Match keyway strips on abutting forms such that a nearly seamless keyway results.

**B. Paving.** Apply oil to forms before placing concrete. Immediately before placing concrete, wet the entire subbase or permeable base surface without forming puddles or mud. Whenever possible, unload concrete into a mechanical spreader that deposits it near the final position before paving. If a spreader is not used, uniformly distribute the concrete in front of the paver by maneuvering the delivery truck chute.

Maintain uniform concrete quality and head in front of the paving machine and without running over the screeds. Coordinate concrete delivery to maintain continuous forward movement of the paver and avoid excessive delivery truck queues. Keep form tops clean before and during paving. Consolidate the entire concrete placement using internal vibrators attached to the paver. Combine paver forward speed, vibrator frequency, and vibrator depth to consolidate the concrete without segregation, vibrator trails, or contacting the joint assemblies. Discontinue vibration and tamping if the paver stops.

Mark the midpoint (10 mm) of each transverse contraction joint with a shim placed into the plastic concrete immediately adjacent to each form. Use shims equal in width and depth to the contraction joint first-stage saw cuts depicted in the Standard Sheets. Set the shims perpendicular to the forms and the pavement surface. Make first-stage saw cuts from shim to shim as discussed in §502-3.06A1, Transverse Contraction Joints. Use shims of sufficient lengths to allow complete first-stage saw cutting to each shim without striking the form.

**C. Paving Irregular Areas.** Uniformly spread concrete. If concrete is spread by hand, use come-alongs or shovels. Do not use rakes or hand-held vibrators to spread concrete. Use hand-held vibrators ahead of the paving equipment to consolidate all concrete not vibrated by equipment-mounted internal vibrators. Keep hand-held vibrators perpendicular to the pavement surface. Vibrate between 2 and 4 seconds in each location, overlapping adjacent locations. Do not drag hand-held vibrators through the concrete. Do not walk through consolidated concrete.

**D. Form Removal.** Remove forms after the concrete has developed sufficient strength to allow removal without damaging the pavement. Repair pavement damaged during form removal. Remove forms before making second-stage saw cuts.

### §502-3.06 Joint Construction.
Provide the Engineer approved Materials Details for longitudinal joint ties and transverse joint supports before placing any joint hardware. Construct joints in accordance with the Standard Sheets and approved Materials Details. Do not stand on joint hardware. Base final joint layout on construction staging and the actual location of utilities, drainage structures, intersections, tapers, and other irregular areas. Submit a proposed joint layout to the Engineer at least 10 calendar days prior to PCC paving. Obtain the Engineer’s joint layout approval before paving. Make second-stage saw cuts and bevels, clean, and seal joints in accordance with §502-3.12, Sealing Joints.

**A. Transverse Joints.** Transverse joints include contraction, expansion, hinge, and construction joints. Secure joint supports to the permeable base or subbase as depicted in the Materials Details. Maintain joint supports in their proper position and alignment during paving.

Construct transverse joints perpendicular to both the pavement surface and longitudinal joints in the area being paved. Use a 4.8 m typical transverse joint spacing for pavements having standard slab widths of 3.66 m and 4.27 m. For pavements having other slab widths, determine typical maximum and minimum transverse joint spacings in accordance with the following:

\[
\begin{align*}
L_{\text{max}} & = \text{maximum transverse joint spacing (slab length), } m = W_{\text{min}} \times 1.33 \\
L_{\text{min}} & = \text{minimum transverse joint spacing (slab length), } m = W_{\text{max}} \div 1.33 \\
W_{\text{max}} & = \text{maximum slab width across the pavement (load carrying slabs only), } m \leq 4.8 \text{ m} \\
W_{\text{min}} & = \text{minimum slab width across the pavement (load carrying slabs only), } m
\end{align*}
\]
The range of slab lengths may be extended to 3.0 m - 5.0 m (from \( L_{\text{min}} \) m - \( L_{\text{max}} \) m above) in accordance with the contract documents to accommodate utilities, drainage structures, and irregular areas.

1. **Transverse Contraction Joints.** All transverse joints are contraction joints unless otherwise shown in the contract documents. Typically, contraction joints are constructed in a straight line across the full width of the PCC pavement and shoulders. Contraction joints may be slightly angled (rather than straight across a pavement) at tied longitudinal joints between lanes placed separately if the placements do not have the same centerline, e.g., where a ramp centerline diverges from parallel to the pavement centerline. Contraction joints may terminate at, or be misaligned at, untied longitudinal joints as discussed in §502-3.06B3, Untied Longitudinal Joints with Keyway.

Store transverse contraction joint support assemblies in inverted stacks at the project site. Handle joint supports such that no twisting or bending occurs during storage and positioning. Supports with bent, twisted, or deformed wires will be rejected.

Before placing concrete, position transverse joint supports such that the:

- Entire longitudinal axis of each dowel is located at the middepth of the pavement slab (6mm).
- Longitudinal axes of the dowels are aligned parallel with the pavement centerline and pavement surface such that the maximum misalignment of one dowel end relative to the other is 4 mm.
- Midpoint of the longitudinal axis of each dowel is at the center of the joint (25 mm).
- Longitudinal axes of the two end dowels are 100 mm - 200 mm from the longitudinal joints.
- Longitudinal axes of the dowels are spaced 100 mm - 300 mm apart.

Mark the location of each contraction joint before placing concrete. In a slipform paving operation, mark the joint support midpoint on the subbase or permeable base immediately adjacent to the pavement. In a fixed form paving operation, mark the joint support midpoint with shims as discussed in §502-3.05B, Paving. Immediately before concrete placement, cut the tie wires (parallel to the dowels) holding the 2 upper transverse support members in position.

Make first-stage saw cuts as soon as the concrete has hardened sufficiently to permit sawing without causing raveling wider than 3 mm. Replace blades if raveling persists. Center first-stage saw cuts within 25 mm of the longitudinal midpoints of the dowels.

Complete first-stage saw cuts before any uncontrolled cracking occurs. Be prepared to make first-stage saw cuts 24 hours a day to prevent uncontrolled cracking. Provide lighting required to make first-stage saw cuts at night at no additional cost to the State.

Sweep or wash first-stage saw cut debris from the pavement before profilographing, before it rains, or before opening the pavement to any traffic, such that debris does not enter the joint.

2. **Transverse Expansion Joints.** Construct transverse expansion joints as part of the utility and drainage structure isolation systems depicted in the Standard Sheets or where indicated in the contract documents. Handle and position expansion joint supports in accordance with §502-3.06A1, Transverse Contraction Joints.

Construct expansion joints using 10 mm – 15 mm thick premoulded resilient joint filler placed in 1 piece between longitudinal joints. Tightly place and support abutting sections of joint filler such that no concrete infiltrates the joint. Place expansion caps on the dowels as depicted in the Materials Details. Do not tap or hammer the caps onto the dowels.

No saw cuts are required in expansion joint construction. Remove the finishing cap, if supplied, after the concrete has developed sufficient strength to prevent damage.

3. **Transverse Construction Joints.** Construct transverse construction joints wherever there is an interruption of more than 30 minutes in concrete paving operations. Construct these joints as wide as the concrete placement, typically 1 or 2 lanes, but not necessarily the full pavement width. Align construction joints with transverse contraction or construction joints in adjacent lanes.
At unplanned stops, remove plastic concrete to the midpoint of the preceding transverse joint support. Place an Engineer-approved bulkhead over the exposed support assembly such that half of the dowel lengths are embedded within newly placed concrete. Immediately remove all plastic concrete in front of the bulkhead and from the exposed joint support.

At planned stops, use either the bulkhead system described above or transverse joint supports fabricated with hollow plastic cylinders, closed on one or both ends, instead of dowels. Use hollow cylinders with an inner diameter 0 mm – 1 mm greater than the required dowel diameter and an outer diameter 7 mm, maximum, larger than the required dowel diameter. Position cylinders as required in §502-3.06A1, Transverse Contraction Joints, with closed ends on the side of the support opposite to the paving direction.

Pave beyond the joint support containing the hollow cylinders. After the concrete has gained sufficient strength to prevent damage, saw cut the newly placed concrete full depth through the midpoint of the longitudinal axis of each cylinder (25 mm). Do not saw cut into previously placed PCC. Instead, stop saw cutting at the longitudinal joint between placements and chip out any uncut concrete such that a vertical joint face results.

Remove concrete and the joint assembly ahead of the saw cut. Repair damaged permeable base and/or subbase with coarse aggregate having a CA 1 or CA 2 gradation. Insert dowels into the exposed hollow cylinder to the required alignment in §502-3.06A1, Transverse Contraction Joints, and resume paving.

First-stage saw cuts are not required at construction joints.

4. Transverse Hinge Joints. Do not place hinge joints without the Engineer’s approval. Construct transverse hinge joints when a slab length exceeds the geometric requirements of §502-3.06, Transverse Joints. (This situation typically occurs near structures that are skewed from perpendicular to the pavement centerline.)

Locate hinge joints such that they are equally spaced between other types of transverse joints. Construct hinge joints in accordance with 502-3.06A1, Transverse Contraction Joints, except the positioning requirements do not apply. Instead, position transverse hinge joint supports such that the:

- Entire longitudinal axis of each deformed bar is located at the middepth of the pavement slab (6 mm).
- Longitudinal axes of the bars are aligned parallel with the pavement centerline and pavement surface such that the maximum misalignment of one bar end relative to the other is 25 mm.
- Midpoint of the longitudinal axis of each bar is at the center of the joint (25 mm).
- Longitudinal axes of the two end bars are 100 mm - 250 mm from the longitudinal joints.
- Longitudinal axes of adjacent bars are spaced 100 mm - 450 mm apart.

B. Longitudinal Joints. Select tie type, size, spacing, and positioning in accordance with the contract documents. Provide a minimum clearance of 75 mm between the end ties in a slab and any part of the transverse joint support. Keep ties free of materials that inhibit bonding to concrete or anchoring material. Maintain ties in their proper position during paving.

Eliminating a longitudinal joint (and subsequent sawing and sealing) between a shoulder and adjacent lane is optional provided (1) the lane and shoulder are paved simultaneously and (2) the resulting slabs meet the geometric requirements detailed in §502-3.06A, Transverse Joints.

It is highly desirable to align longitudinal joints with the permanent pavement markings. Tied longitudinal joints located in the wheelpaths of the completed pavement will require additional ties.

1. Longitudinal Joints Between Lanes Paved Simultaneously. Use one-piece ties fabricated into assemblies capable of securely holding 2 or more ties. Secure the assemblies to the permeable base or subbase prior to paving in accordance with the Materials Details.

Make first-stage saw cuts parallel to the pavement centerline and perpendicular to the pavement surface within 24 hours of concrete placement and after first-stage transverse saw cuts are complete. Replace saw blades if raveling wider than 3 mm occurs. Center first-stage saw cuts within 25 mm of the longitudinal midpoint of the ties.

Sweep or wash first-stage saw cut debris from the pavement before profilographing, before it rains, or before opening the pavement to any traffic, such that debris does not enter the joint.
2. Tied Longitudinal Joints Between Lanes Paved Separately. In a slipform operation, construct a butt joint and drill and anchor one-piece ties into the hardened concrete. Do not drill holes until the concrete has developed sufficient strength to withstand drilling without damage. Damage from drilling will be treated in accordance with §502-3.14, Damaged or Defective Concrete.

Use #19 ties, 700 mm long between travel lanes and 450 mm long between a travel lane and a PCC shoulder. Anchor ties between travel lanes 300 mm into the previously placed concrete, leaving 400 mm projecting from the joint face. Anchor ties between a travel lane and a PCC shoulder 200 mm into the previously placed concrete, leaving 250 mm projecting from the joint face.

Place end ties in a slab 300 mm - 350 mm from the transverse joint. Typically, space ties between the end ties 600 mm apart, maximum. Pavements having 4 or more tied lanes, or 3 lane pavements 300 mm (or more) thick, may require a decreased spacing in accordance with the contract documents.

Drill such that the hole diameters are in accordance with the anchoring material manufacturer’s written recommendations. Give those recommendations to the Engineer before drilling any holes. Replace worn bits when necessary to ensure the proper hole diameter is drilled.

Follow the anchoring material manufacturer’s written recommendations for cleaning the holes. Give those recommendations to the Engineer. As a minimum, air blast the drilled holes. Insert the air blasting equipment nozzle to the back of the hole to force out all dust and debris.

When using new cartridges of anchoring material, ensure the initial material exiting the nozzle appears uniformly mixed. If it is not uniformly mixed, waste the material until uniformly mixed material extrudes.

Place the anchoring material in the back of the hole using a nozzle or wand of sufficient length. Push the tie into the hole while twisting such that the air pocket within the hole is heard to burst and the anchoring material is evenly distributed around the bar. Use sufficient amounts of anchoring material such that it slightly extrudes out the hole as the bar is inserted.

In a fixed form operation, construct either a butt or a keyed joint. If a butt joint is constructed, drill and anchor longitudinal joint ties as described above. If a keyed joint is constructed, use multiple-piece ties. Apply a corrosion inhibiting coating to the threads of all components before assembly. Bolt the female portion of the tie to the form prior to paving as depicted in the Standard Sheets. Insert and tighten the male ends before paving the adjacent lane. Ensure all threaded connections are tight.

First-stage saw cuts are not required between lanes paved separately.

3. Untied Longitudinal Joints with Keyway. Construct untied longitudinal joints with keyways at utilities and/or drainage structures, at intersections, between adjacent lanes having non-parallel center lines (such as ramps), or where indicated in the contract documents. Form as depicted in the Standard Sheets. Transverse joint type, location, and alignment may be changed when a transverse joint intersects an untied longitudinal joint.

Patch honeycombing along the untied longitudinal joint face to achieve a smooth surface prior to applying the bond breaker and placing the adjacent concrete.

First-stage saw cuts are not required.

C. Utility and Drainage Structure Isolation Joint Systems and Telescoping Manholes. Isolate utilities and drainage structures from the pavement using the isolation joint systems or telescoping manhole castings depicted in the Standard Sheets. Remove temporary support bolts from the telescoping manhole casting as soon as the concrete hardens. If telescoping manhole castings are not used, form the required isolation joint system.

Construct transverse portions of the isolation joint systems in accordance with §502-3.06A2, Transverse Expansion Joints, or §502-3.06A3, Transverse Construction Joints, in accordance with the contract documents. Construct other isolation joints in accordance with the contract documents.
502-3.07 Paving Adjacent To Existing Concrete. Wherever paving equipment operates on existing PCC pavement that is to remain, install bolt-on track covers or rubber tired, flangeless wheels. Remove all debris on the existing PCC pavement in the equipment track. Immediately remove any concrete that spills onto the existing concrete.

When paving from (or to) a transverse construction joint or intersecting pavement, use hand-held vibrators to thoroughly consolidate any concrete inaccessible to the paving equipment vibrators. Hand finish these areas with the minimum effort required to produce an acceptable surface. Do not dump the grout box head into the pavement concrete when approaching a construction joint.

502-3.08 Plastic Thickness Determination. In a slipform paving operation, anchor flat, thin (1 mm - 3 mm), 150 mm x 150 mm rigid steel or plastic plates to the permeable base (or subbase) surface 600 mm from both placement edges at 50 m intervals. Clearly mark the plate locations on the subbase, permeable base, or previously placed concrete immediately adjacent to the placement. Provide the Engineer with a round, rigid, nonaluminum probe, having a 3 mm - 4 mm diameter. The Engineer will determine the plastic concrete thickness by inserting the probe to the plate and measuring the insertion depth. The plate thickness will be added to the insertion depth to determine concrete thickness.

In a slipform paving operation, the minimum measured plastic thickness must be within 10 mm of the thickness required in the contract documents. Areas not meeting minimum thickness will be treated in accordance with §502-3.14, Damaged or Defective Concrete. If 2 consecutive measurements do not meet minimum thickness, stop paving and reestablish the paving operation to achieve acceptable thickness.

502-3.09 Finishing. Mechanically finish the pavement after consolidation and strike off. Use machine mounted finishers such as full-width finishing pans, transverse oscillating screeds, longitudinal floats, pan floats or separate pieces of equipment such as tube floats or Lewis floats.

After mechanical finishing, hand finish the pavement to correct and seal minor imperfections. Provide an ACI certified concrete flatwork finisher to supervise all hand finishing. Provide proof of ACI flatwork certification to the Engineer. Keep hand finishing to a minimum. Do not use excess mortar or discarded concrete to fill low areas. Use work bridges to hand finish concrete inaccessible from the pavement edge. Do not add water to the concrete surface to close imperfections. Stop paving or reformulate the concrete mix if surface imperfections that require additional water to close routinely occur.

502-3.10 Texturing. Immediately after finishing and prior to applying the curing compound, texture the concrete surface using one of the following procedures in accordance with the contract documents. Apply longitudinal tining if no texturing method is designated in the contract documents. Additional requirements, such as Mean Texture Depth measured by a sand patch test or a profilometer may be included in the contract documents. If the contract has a closed drainage system, provide a 200 mm – 300 mm blank in the texture along the pavement edges to enhance drainage to catch basins.

A. Longitudinal Tining. Texture the concrete parallel to the pavement centerline with a set of evenly spaced spring steel tines. Use rectangular tines 3 mm wide, 0.7 mm thick, and approximately 125 mm long at a center-to-center spacing of 19 mm.

Operate the tine head manually or mechanically. In either case, hold the tines as near an angle of 45° to the concrete surface as possible to minimize mortar dragging. Produce tine texture 2 mm - 4 mm deep with minimal dislodging of aggregate. Do not make multiple tine passes in the same area. Keep tines 50 mm - 100 mm from the placement edges. Keep the tines free of hardened concrete.

B. Artificial Turf Drag. Use a seamless strip of artificial turf drag appearing on the Department's Approved List entitled “Turf Drag” under “Equipment, Concrete Related.” Produce a consistent texture, free of ridges or gouges, parallel to the pavement centerline either by hand or by attaching a weighted strip to the paver, texture/cure machine, or work bridge. Periodically replace or clean the drag to remove hardened concrete paste that compromises texture.

C. Transverse Tining. Texture the concrete perpendicular to the pavement centerline with a set of variably spaced spring steel tines. Use rectangular tines 3 mm wide, 0.7 mm thick, and approximately 125 mm long at the following center-to-center spacing in millimeters:
Operate the tine head manually or mechanically. In either case, hold the tines as near an angle of 45° to the concrete surface as possible to minimize mortar dragging. Produce tine texture 2 mm - 4 mm deep with minimal dislodging of aggregate. Do not make multiple tine passes in the same area. Keep the tines free of hardened concrete. If the tine texture is placed manually, or if the mechanical equipment does not operate from the same referencing system as the paver, provide a 75 mm - 100 mm blank at each transverse joint saw cut location.

502-3.11 Curing. Keep the curing operation close to the texturing operation such that concrete is cured immediately after it is textured. The Engineer may stop paving if curing lags. Cure Class C concrete placed between June 1 and September 15 for 4 days, minimum. Cure Class C concrete placed between September 16 and May 31 for 6 days, minimum. Cure HES concrete in accordance with Materials Bureau requirements based on the Contractor-submitted mix design and the trial batch evaluation.

A. White Pigmented Membrane Curing Compound. Typically, cure concrete with white pigmented membrane curing compound. Mix the curing compound before each use and continuously agitate during use. Thoroughly and uniformly coat all exposed surfaces (including slipformed edges and formed edges immediately after form removal) at a minimum rate of 3.5 m²/L. Check the application rate after every paving day, including exposed vertical slab faces in the calculations. Apply the curing compound in 2 opposite direction passes with no longer than 15 minutes between passes.

Immediately reapply curing compound to any damaged coating areas during the curing period. During curing equipment breakdown, cure the pavement in accordance with §502-3.11B, Curing Covers. Do not apply curing compound in the rain. If rain damages the curing compound before it sets, reapply curing compound after the pavement surface dries.

B. Curing Covers. Use of curing covers is subject to the approval of the Engineer. Use quilted covers, plastic coated fiber blankets, or polyethylene curing covers. Do not use covers with tears or holes. Cover all exposed surfaces and extend the covers a minimum of 300 mm beyond the pavement edges or beyond the forms, when used. Overlap successive covers 300 mm, minimum. Secure the covers to keep them in contact with the entire surface and maintain the overlap. Wet the entire surface of quilted covers and maintain them in a wetted condition throughout the curing period.

C. Cold Weather Curing. Supply form insulating materials for winter concreting when the air temperature is expected to fall below 4°C at any time during the curing period. Use material capable of maintaining a surface temperature of 13°C and being easily removed and replaced to accommodate first-stage saw cuts. Apply the insulating material to prevent newly placed concrete from being exposed to air temperatures below 2°C for the curing period. Secure the insulation tight to the concrete surface to prevent air intrusion beneath the insulation. Extend the insulation 300 mm beyond the newly placed concrete. Insulate the pavement vertical edge and/or forms as well.

Place recording surface thermometers between the pavement surface and insulating material 300 mm from one of the placement edges wherever insulation is used. Use 4 equally spaced thermometers for each day’s paving. Do not subject the concrete to a temperature drop in excess of 10°C during the first 24 hours after removing the insulation.


First-stage sawcuts may be temporarily left unfilled if a placement is only subjected to occasional construction traffic, such as pickup trucks or cars. In this case, sweep the pavement to ensure debris does not enter the joints.

Temporarily fill unsealed first-stage cuts with jute or backer rod if a placement is:
- Subjected to consistent construction traffic.
- Used as a haul road for subsequent concrete placements.
Temporarily opened to general traffic while final sealing has been delayed for convenience, such as to maximize sealing production.

Before cleaning, remove any temporary fillers and repair damaged joints in accordance with §502-3.14, Defective or Damaged Concrete, including chipped joints resulting from debris accumulation in an unfilled or unsealed joint. Do not reuse backer rod used as temporary fillers in the final joint sealing.

A. Sealing Transverse Contraction Joints - Highway Joint Sealant. Widen joints to 6 mm – 9 mm for a depth of 25 mm if the first-stage saw cuts are less than 6 mm wide to allow full-depth sealing. Immediately wash the widening cut slurry from the pavement such that it does not reenter the joint. Do not seal transverse construction joints or longitudinal joints when highway joint sealants are specified for transverse contraction joints.

Joint cleaning and sealing may be delayed for convenience. Clean the joints by abrasive blasting immediately before sealing. Keep the nozzle within 50 mm of the joint surfaces. The Engineer may allow pressure washing in lieu of abrasive blast cleaning if it is not allowed in the contract. When pressure washing, use (1) a 6.0 MPa minimum pressure and (2) a maximum pressure such that no damage occurs to the concrete. Manually dislodge debris remaining in the joint after cleaning, and reclean the joint. Immediately after pressure washing, air blast the joint to remove any debris from the cut and dry the exposed faces.

Do not allow any traffic on the pavement between cleaning and sealing. Reclean the joint if it rains between cleaning and sealing or if any traffic is on the placement between cleaning and sealing. Provide the Engineer a copy of the sealant Manufacturer's written recommendations for heating and application at least 1 work day before sealing. Follow those recommendations. Unless stated otherwise, the recommended pouring temperature is 5°C below the manufacturer's designated safe heating temperature, with an allowable variation of 5°C.

Prior to sealing, discharge sealant from the applicator wand into a vessel and measure the sealant temperature. The temperature must be equal to or above the Manufacturer’s recommended minimum pouring temperature and equal to or below the Manufacturer’s recommended safe heating temperature.

Do not use sealant heated above the safe heating temperature. Sealant may be reheated or heated in excess of 6 hours if allowed by the Manufacturer’s heating and application recommendations. In these cases, recharge the melter with fresh sealant amounting to at least 20% of the sealant volume remaining in the melter.

Seal joints immediately after cleaning. Seal the joint from the bottom of the cut to within 5 mm - 10 mm of the pavement surface. Seal when the:

- Air and surface temperatures are 5°C or warmer.
- Air temperature is above the dew point.
- Pavement surface and all joint surfaces are dry.

Open to traffic after the sealant has cured to prevent tracking. Do not blot with fine aggregate.

B. Sealing Joints - Silicone Sealant. Make second-stage saw cuts and/or bevels in accordance with the Standard Sheets and (1) no sooner than 72 hours after concrete placement and (2) after the curing period has ended if curing covers are used. Wash the resulting slurry from the pavement and joint immediately after making second-stage saw cuts and/or bevels.

Second-stage saw cuts may be delayed for convenience, but do not leave second-stage saw cuts unsealed or unfilled while open to any traffic. Temporarily fill second-stage saw cuts with jute or backer rod if (1) they are exposed to any traffic before cleaning and sealing or (2) weather conditions are not favorable for timely (within 2 calendar days) cleaning and sealing, whether or not they are exposed to any traffic. Do not reuse backer rod used as temporary filler in the final joint sealing.

Install the sealant in accordance with the Manufacturer’s written instructions. Give those instructions to the Engineer before any second-stage saw cutting begins. Consult the Manufacturer for primer requirements associated with the coarse aggregate used in the concrete.

Abrasive blast both vertical joint faces immediately before sealing. Tilt the nozzle to abrasive blast one vertical face at a time at each joint until uniformly abraded surfaces result. Air blast after
abrasive blasting to remove all abrasives. Reclean the joint if it rains between cleaning and sealing. Do not allow any traffic on the pavement between cleaning and sealing. Immediately after blasting, install backer rod to the required depth without ripping, tearing, or puncturing the rod. Roll the insertion wheel over the backer rod twice, once in each direction.

Seal when the:

- Air and surface temperatures are 5°C or warmer.
- Air temperature is above the dew point.
- Pavement and all joint surfaces are dry.

Where possible, first widen and seal the longitudinal joints (if required), then widen and seal the transverse joints such that the entire transverse joint contains a continuous sealant bead. If this is not possible, install the silicone in full placement widths.

Traffic may traverse silicone sealed joints after the sealant has skinned over, provided traffic opening and sealer manufacturer requirements have been met.

C. Sealing Joints - Preformed Joint Sealers. Make second-stage saw cuts and/or bevels in accordance with the Standard Sheets and (1) no sooner than 72 hours after concrete placement and (2) after the curing period has ended if curing covers are used. Extend the second-stage saw cut vertically down the free concrete edges. Wash the resulting slurry from the pavement and joint immediately after making second-stage saw cuts and/or bevels.

Second-stage saw cuts may be delayed for convenience, but do not leave second-stage saw cuts unsealed or unfilled while open to any traffic. Temporarily fill second-stage saw cuts with jute or backer rod if (1) they are exposed to any traffic before cleaning and sealing or (2) weather conditions are not favorable for timely (within 2 calendar days) cleaning and sealing, whether or not they are exposed to any traffic.

Clean the joints by pressure washing before sealing. Use (1) a 6.0 MPa minimum pressure and (2) a maximum pressure such that no damage occurs to the concrete. Manually dislodge debris remaining in the joint after cleaning, and reclean the joint. Within 24 hours of pressure washing, air blast the joint to remove any debris from the cut and dry the exposed faces. Reclean the joint if it rains between cleaning and sealing. Do not allow any traffic on the pavement between cleaning and sealing.

Install the sealant in accordance with the Manufacturer’s written instructions. Give those instructions to the Engineer before any second-stage saw cutting begins. Lubricate the concrete, the sealer, or both before installation such that the lubricant fully covers the sealer/concrete interface, but not the top of the sealer.

Install one piece of transverse joint sealer in a compressed condition across the full pavement width, including concrete shoulders, and down the vertical saw cut at the free edge. Cut the longitudinal sealer where it crosses a transverse joint. Do not splice the longitudinal sealer between transverse joints. Seal the intersection between longitudinal and transverse sealers with lubricant.

Install the sealer such that it is not stretched more than 5%, nor compressed more than 2%, of the minimum theoretical length. Check the installation for stretch and compression by installing sealers in 5 transverse joints and removing the sealer immediately after installation and checking the length. An alternate method for checking stretch and compression, where applicable, may be performed by premarking or precutting the sealer to length prior to installation. If the measurement of any of these 5 sealers exhibits stretching in excess of 5% or compression in excess of 2%, modify the installation method to meet the requirements or discontinue installation.

Once sealing operations begin, remove 1 joint per 100 in the presence of the Engineer to check stretch and compression. If the sealer is found to be stretched in excess of 5% or compressed in excess of 2%, remove the sealer material from successive joints in both directions until sealers are found that meet the stretch and compression requirements. Replace all joints sealers found with excess stretch or compression. Replace joint sealers removed and found to meet the stretch and compression requirements.
TABLE 502-3 JOINT SEALING ALTERNATIVES

<table>
<thead>
<tr>
<th>Joint Type</th>
<th>Sealing Alternative</th>
<th>First-Stage Saw Cut Required</th>
<th>Second-Stage Saw Cut and Bevel Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transverse Contraction</td>
<td>Silicone or Preformed</td>
<td>Yes</td>
<td>Both</td>
</tr>
<tr>
<td></td>
<td>Highway Joint Sealant</td>
<td>Yes</td>
<td>Neither</td>
</tr>
<tr>
<td>Transverse Expansion and Isolation</td>
<td>Silicone or Preformed</td>
<td>No</td>
<td>Bevel Only</td>
</tr>
<tr>
<td>Transverse Construction</td>
<td>Silicone or Preformed</td>
<td>No</td>
<td>Both</td>
</tr>
<tr>
<td>Longitudinal - Between Lanes Placed</td>
<td>Do Nothing1</td>
<td>Yes</td>
<td>Second-Stage Only</td>
</tr>
<tr>
<td>Simultaneously</td>
<td>Silicone or Preformed</td>
<td>No</td>
<td>Neither</td>
</tr>
<tr>
<td>Longitudinal - Between Lanes Placed</td>
<td>Silicone or Preformed</td>
<td>No</td>
<td>Second-Stage Only</td>
</tr>
<tr>
<td>Separately and Untied Joints With Keyway</td>
<td>Do Nothing1</td>
<td>No</td>
<td>Neither</td>
</tr>
</tbody>
</table>

NOTE:
1. Do nothing if highway joint sealants are specified for transverse contraction joints.

502-3.13 Pavement Protection. Protect the pavement and appurtenances from traffic and construction operations. Protect the work and provide for traffic as indicated in the contract documents.

502-3.14 Damaged or Defective Concrete. Repair or replace all damaged or defective concrete which occurs prior to final acceptance. Perform these repairs as described in the contract documents at no cost to the State. Damage and defects include, but are not limited to, cracking, spalling, honeycombing, or imperfections caused by inadequate pavement protection, traffic, and/or construction practices. Slipformed concrete with inadequate plastic thickness as described in §502-3.08, Plastic Thickness Determination, will be rejected in 50 m segment lengths.

502-3.15 Hardened Surface Test (Nonprofilographed Concrete). After the concrete has hardened sufficiently, test the entire longitudinal center of each travel lane, including ramps, with a 3 m, minimum, long straight edge laid longitudinally. The Engineer will mark high and low deviations in the pavement surface exceeding 3 mm in 3 m. Diamond grind these deviations such that they do not exceed 3 mm in 3 m when retested with the straight edge.

502-3.16 Profilograph. This section applies to profilographed concrete (and nonprofilographed concrete when a full-width finishing pan or triple transverse screed paving operation is not employed). The Engineer will divide each travel lane into reporting segments that are 160 m long. The Engineer will group segments shorter than 160 m with previous or subsequent segments. Provide survey stationing and develop a reference system that allows the Engineer to readily associate profilograph data to the corresponding reporting segment.

Develop a profile trace for each wheel path in each reporting segment in accordance with Materials Method 24, PCC Pavement Profilograph Operations. Determine an initial profile index (PI) for each reporting segment by averaging the PIs of the wheelpaths. Provide the traces and initial PIs to the Engineer. The Engineer will identify bumps exceeding 10 mm in 7.6 m on each profile trace. Locate and diamond grind these bumps, if any, to 10 mm or less in 7.6 m. If no grinding is required for a given reporting segment, the initial PI may be used to determine the payable Quality Units of Smoothness Quality Adjustment per reporting segment.

Production diamond grinding equipment can be used to increase the amount of Quality Units payable as discussed in §502-3.17, Diamond Grinding. Whether diamond grinding was required through profile trace analysis, or performed as a Contractor option, reprofilograph each reporting segment that was
diamond ground and determine a final PI. Give the Engineer the final profile traces and final PI determined by using both the 5 mm and zero blanking bands.

502-3.17 Diamond Grinding. Diamond grind the pavement longitudinally, beginning and ending at lines normal to the pavement centerline, and in full travel lane width increments. Provide surface drainage by maintaining the proper cross slope on the finished surface and by blending adjacent passes. Continuously vacuum the slurry from the pavement when production grinding. If roadside slurry discharge is not allowed by the contract documents, transfer the slurry into equipment capable of transporting it from the contract site without spills. Dispose of slurry in conformance with all Federal, State, and local regulations.

In any case, do not allow slurry to enter:
- Occupied travel lanes.
- Drainage structures.
- Wetlands, streams, estuaries, or sensitive environmental resources.
- Areas where it will become a public nuisance.

Use of bump grinding equipment is restricted to grinding bumps that exceed 10 mm in 7.6 m in profilographed concrete and bump grinding non-profilographed concrete. Production grinding equipment can be used to grind bumps or increase the amount of Quality Units payable subject to the following:
- For pavements textured with longitudinal tining or artificial turf drag, any amount of a reporting segment surface area may be diamond ground to increase the amount of Quality Units payable.
- For transverse tined pavements, Quality Units are payable if less than 20% or more than 95% of the reporting segment surface area is ground. If more than 20% of the reporting segment area is ground for any reason, diamond grind 95%, minimum, of the entire reporting segment.

502-3.18 Opening to Traffic

A. Construction Traffic. Class C concrete may be opened to construction traffic and paving equipment 7 days after placement. With the Engineer’s approval, this time frame may be shortened to 3 days if cylinders achieve a compressive strength of 17 MPa in accordance with §502-3.18C, Project Strength Determination. Any pavement damaged from opening to construction traffic in a reduced time frame will be treated in accordance with §502-3.14, Damaged or Defective Concrete.

B. General Traffic. Class C concrete placed between June 1 and September 15 may be opened to general traffic 10 days after placement. Class C concrete placed outside this interval may be opened to general traffic 15 days after placement. With the Engineer’s approval, these time frames may be shortened to 4 days if cylinders achieve a compressive strength of 21 MPa in accordance with §502-3.18C, Project Strength Determination, and the joints are addressed in accordance with §502-3.12, Sealing Joints.

If Project Strength Determination testing for construction traffic opening indicates the concrete has achieved a compressive strength in excess of 21 MPa, the concrete may be opened to general traffic after 4 days. Any pavement damaged from opening to general traffic in a reduced time frame will be treated in accordance with §502-3.14, Damaged or Defective Concrete.

C. Project Strength Determination. Provide an ACI Certified Concrete Field Testing Technician, Grade I, or higher, to cast all cylinders. Unless otherwise noted in the contract documents, use an agency accredited by the AASHTO Accreditation Program (AAP) in the field of construction materials testing of portland cement concrete to perform compressive strength testing.

Cast and test in the presence of the Engineer, or the Engineer’s representative. Provide acceptable proof of ACI Certification and AASHTO Accreditation to the Engineer before placing any concrete.

The Engineer, or the Engineer’s representative, will complete the Concrete Cylinder Report as cylinders are cast and tested.

Cast a minimum of 3 cylinder pairs (6 total) from each 300 m of paving length, or fraction thereof, in accordance with Materials Method 9.2, Field Inspection of Portland Cement Concrete. Cast each pair from different delivery trucks. Develop an Engineer-approved marking system that
allows a cylinder to be readily associated with the corresponding placement location and placement time. Mark the cylinders and place them adjacent to the pavement under similar curing conditions. Determine the concrete compressive strength at the desired time in accordance with ASTM C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens. The pavement may be opened to construction (or general) traffic if all the following apply:

- Average compressive strength of all cylinder pairs exceed 17 MPa (or 21 MPa).
- Average compressive strength of each cylinder pair exceeds 14 MPa (or 17 MPa).
- Appropriate time frame has elapsed for the entire area to be opened.

If these conditions are not met, test 3 additional cylinder pairs at a later time, provided the appropriate numbers of additional cylinders were cast. If the above conditions are not met after additional testing, or, if the required number of additional cylinders were not cast, open the pavement in accordance with the nonreduced time frames of §502-3.18A, Construction Traffic, and §502-3.18B, General Traffic.

**D. HES Concrete.** HES concrete may be opened to construction traffic when it has achieved a compressive strength of 17MPa and to general traffic when it has achieved compressive strength of 21 MPa, in accordance with §502-3.18C, Project Strength Determination, and the joints are addressed in accordance with §502-3.12, Sealing Joints.

**502-4 METHOD OF MEASUREMENT.** The Engineer will measure the following quantities for items incorporated into the finished pavement:

**502-4.01 Portland Cement Treated Permeable Base.** The work will be measured for payment as the number of cubic meters of portland cement treated permeable base satisfactorily placed based on the payment lines shown in the contract documents. No deductions will be made for catch basins, manholes, or other similar pavement obstructions.

**502-4.02 PCC Pavement, Unreinforced.** The work will be measured for payment as the number of cubic meters of unreinforced PCC pavement satisfactorily placed based on the payment lines shown in the contract documents. Deductions in 50 m segment lengths will be made for areas that do not meet minimum plastic thickness requirements. Deductions (and separate payment) will be made for catch basins, manholes, or other similar pavement obstructions requiring either mesh reinforced or heavily reinforced placements.

**502-4.03 PCC Pavement, Mesh or Heavily Reinforced.** The work will be measured for payment as the number of cubic meters of reinforced concrete satisfactorily placed. No deductions will be made for drainage and utility structures or other similar pavement obstructions being isolated from the surrounding pavement.

**502-4.04 Smoothness Quality Adjustment (Profilographed Items Only).** The work will be measured for payment as the number of Quality Units of Smoothness Quality Adjustment, if any, payable for each reporting segment determined by the following:

\[
\text{Quality Units (Per Segment)} = (\text{SAF} - 1.00) \times \text{PCC Cubic Meters (Per Segment)}
\]

The Smoothness Adjustment Factor (SAF) from Table 502-4, Smoothness Adjustment Factors, is based on the final PI obtained for each reporting segment using a 5 mm blanking band. No Quality Units are computed for pavements specified as nonprofilographed.
### TABLE 502-4 SMOOTHNESS ADJUSTMENT FACTORS

<table>
<thead>
<tr>
<th>Final Profile Index (mm/km.)</th>
<th>Level 1 SAF</th>
<th>Level 2 SAF</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0 - 16.0</td>
<td>1.05</td>
<td>1.05</td>
</tr>
<tr>
<td>16.1 - 32.0</td>
<td>1.04</td>
<td>1.04</td>
</tr>
<tr>
<td>32.1 - 48.0</td>
<td>1.03</td>
<td>1.03</td>
</tr>
<tr>
<td>48.1 - 64.0</td>
<td>1.02</td>
<td>1.02</td>
</tr>
<tr>
<td>64.1 - 79.9</td>
<td>1.01</td>
<td>1.01</td>
</tr>
<tr>
<td>80</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>80.0 + Grind</td>
<td>Grind</td>
<td></td>
</tr>
<tr>
<td>190.0 +</td>
<td>Not Applicable</td>
<td>Grind</td>
</tr>
</tbody>
</table>

#### 502-4.05 Constructing Transverse Joints.
The work will be measured for payment as the number of meters of transverse joints satisfactorily constructed.

#### 502-4.06 Constructing Longitudinal Joints.
The work will be measured for payment as the number of meters of longitudinal joints satisfactorily constructed.

#### 502-4.07 Sealing Transverse Joints.
The work will be measured for payment as the number of meters of transverse joints satisfactorily sealed, excluding preformed sealers turned down at the pavement edges.

#### 502-4.08 Sealing Longitudinal Joints.
The work will be measured for payment as the number of meters of longitudinal joints satisfactorily sealed.

### 502-5 BASIS OF PAYMENT

#### 502-5.01 Portland Cement Treated Permeable Base.
Include the cost of all labor, material, and equipment necessary to satisfactorily perform the work in the unit price bid for Portland Cement Treated Permeable Base.

#### 502-5.02 PCC Pavement, Unreinforced, Nonprofilographed.
Include the cost of all labor, material, and equipment necessary to satisfactorily perform the work in the unit price bid for PCC Pavement, Unreinforced, Nonprofilographed. No payment will be made for areas that do not meet minimum plastic thickness requirements. No additional payment will be made for Contractor-requested HES concrete mixes.

Also include the cost of all labor, material, and equipment necessary to profilograph and diamond grind the pavement to meet the Level 2 smoothness requirements of Table 502-4, Smoothness Adjustment Factors, if paving equipment other than a paver equipped with a full-width finishing pan or triple transverse screeds is used. In this case, no payment will be made for SAF Quality Units.

PCC Pavement, Unreinforced, Nonprofilographed will be eligible for progress payments in accordance with the following:
- 80% upon satisfactory completion of all work up to, and including, first-stage saw cutting.
- An additional 10% upon satisfactory completion of diamond grinding, if any.
- The remaining 10% upon satisfactory completion of the work.

#### 502-5.03 PCC Pavement, Unreinforced, Profilographed.
Include the cost of all labor, material, and equipment necessary to satisfactorily perform the work in the unit price bid for PCC Pavement, Unreinforced, Profilographed. No payment will be made for areas that do not meet minimum plastic thickness requirements. No additional payment will be made for Contractor-requested HES concrete mixes.

PCC Pavement, Unreinforced, Profilographed will be eligible for progress payments in accordance with the following:
- 80% upon satisfactory completion of all work up to, and including, first-stage saw cutting.
502-5.04 Smoothness Quality Adjustment. Quality Units of Smoothness Quality Adjustment are a fixed price in the bid documents and cannot be changed by the Contractor.

502-5.05 PCC Pavement, Mesh or Heavily Reinforced. Include the cost of all labor, material, and equipment necessary to satisfactorily perform the work in the unit price bid for PCC Pavement, Mesh or Heavily Reinforced. No additional payment will be made for Contractor-requested HES concrete mixes.

502-5.06 Constructing Transverse Joints. Include the cost of all labor, material, and equipment necessary to satisfactorily perform the work in the unit price bid for Constructing Transverse Joints.

502-5.07 Constructing Longitudinal Joints. Include the cost of all labor, material, and equipment necessary to satisfactorily perform the work in the unit price bid for Constructing Longitudinal Joints. Placing the inside shoulder and inside lane simultaneously, at the Contractor’s option, will not generate a Significant Change in the Character of Work. No additional payment will be provided for the additional number of longitudinal joint ties associated with:

- Constructing butt joints between lanes placed separately in a slipform paving operation.
- Constructing longitudinal joints in wheelpaths.

502-5.08 Sealing Transverse Joints. Include the cost of all labor, material, and equipment necessary to satisfactorily perform the work in the unit price bid for Sealing Transverse Joints.

502-5.09 Sealing Longitudinal Joints. Include the cost of all labor, material, and equipment necessary to satisfactorily perform the work in the unit price bid for Sealing Longitudinal Joints. Placing the inside shoulder and inside lane simultaneously, at the Contractor’s option, will not generate a Significant Change in the Character of Work.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>502.0001</td>
<td>Portland Cement Treated Permeable Base</td>
<td>Cubic Meter</td>
</tr>
<tr>
<td>502.RPCF</td>
<td>PCC Pavement</td>
<td>Cubic Meter</td>
</tr>
<tr>
<td>R – Pavement &amp; Reinf.</td>
<td>P – Profilgraphing</td>
<td>C – Concrete Class</td>
</tr>
<tr>
<td>0 – Unreinforced</td>
<td>0 – Nonprofilgraphed</td>
<td>1 – Class C</td>
</tr>
<tr>
<td>1 – Mesh Reinforced</td>
<td>1 – Level 1</td>
<td>3 – HES</td>
</tr>
<tr>
<td>2 – Heavily Reinforced</td>
<td>2 – Level 2</td>
<td></td>
</tr>
<tr>
<td>9 –  Type 9</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

502.9010 Smoothness Quality Adjustment Quality Unit
502.91 Constructing Transverse Joints Meter
502.9110 Constructing Longitudinal Joints Meter
502.92 Sealing Transverse Joints – Silicone Joint Sealant Meter
502.9201 Sealing Transverse Joints – Preformed Elastic Joint Sealer Meter
502.9210 Sealing Transverse Contraction Joints – Highway Joint Sealant Meter
502.93 Sealing Longitudinal Joints – Silicone Joint Sealant Meter
502.9301 Sealing Longitudinal Joints – Preformed Elastic Joint Sealer Meter

SECTION 503 - PORTLAND CEMENT CONCRETE FOUNDATION FOR PAVEMENT

503-1 DESCRIPTION. Construct a portland cement concrete (PCC) foundation for pavements and shoulders, if required, as detailed in the contract documents.

503-2 MATERIALS.

Portland Cement Concrete 501
Anchoring Materials - Chemically Curing 701-07
Premoulded Resilient Joint Filler 705-07
Longitudinal Joint Ties 705-14
Transverse Joint Supports 705-15
Epoxy Coated Bar Reinforcement, Grade 420 709-04
Quilted Covers (for curing) 711-02
Plastic Coated Fiber Blankets (for curing) 711-03
Polyethylene Curing Covers (white opaque) 711-04
Form Insulating Materials for Winter Concreting 711-07
Water 712-01

In addition to meeting the requirements of §701-07, Anchoring Materials - Chemically Curing, the material used to anchor longitudinal joint ties, dowels, or other miscellaneous items into hardened concrete must be a pourable, two-component, 100% solids structural epoxy dispensed:

- From side-by-side cartridges by manual or pneumatically powered injection guns.
- Through a static mixing nozzle that homogeneously mixes the material without any hand mixing.

Apply the requirements of the following in accordance with the contract documents:
§502-2.01, Concrete.
§502-2.02, High-Early-Strength (HES) Concrete.
§502-2.03, Portland Cement Treated Permeable Base.
§502-2.04, Equipment.
§502-2.04A, Slipform Paving.
§502-2.04B, Fixed Form Paving.
§502-2.04C, Vibrators.
§502-2.04D, Permeable Base Paving Equipment.
§502-2.04E, Saw Cutting Equipment.
§502-2.04I, Drills.
§502-2.04L, Air Blasting Equipment.

503-3 CONSTRUCTION REQUIREMENTS. Apply the requirements of §502-3, Portland Cement Concrete Pavement, except as modified herein.

503-3.01 Placement of Reinforcement. Place bar reinforcement around utilities, drainage structures, and other projections into the pavement as depicted in the Standard Sheets for PCC Pavements. Use telescoping manholes when required by the contract documents in accordance with §502-3.06C, Utility and Drainage Structure Isolation Joint Systems and Telescoping Manholes.

503-3.02 Joints. Transverse joint supports are not required for contraction joints. Saw cut skewed contraction joints at a “6 on 1” skew across the pavement (approximately 10° from perpendicular to the centerline) before uncontrolled cracking occurs. Saw cut in accordance with the first-stage saw cut details in the Standard Sheets.

Use a maximum joint spacing of 6 m and a minimum spacing that satisfies the geometric requirements of §502-3.06A, Transverse Joints. Center utilities and drainage structures between saw cuts. Skewed joints may be cut at the same angle across the pavement or chevron-shaped with the vertex at a longitudinal joint between separate placements. Maintain the same technique once selected. Construct transverse construction joints perpendicular to the centerline in accordance with §502-3.06A3, Transverse Construction Joints.

Construct longitudinal joints in accordance with §502-3.06B, Longitudinal Joints.

503-3.03 Finishing. Hand finish the pavement to correct surface irregularities.

503-3.04 Testing the Surface.Immediately after placement, test the entire longitudinal center of each travel lane with a 3 m, minimum, long straight edge laid longitudinally. Immediately correct any surface irregularity exceeding 10 mm in 3 m.
503-3.05 **Texturing.** Immediately after testing the surface, apply an aggressive transverse broom finish.

503-3.06 **Curing.** Cure in accordance with §502-3.11, except the impervious membrane method, i.e., curing compound, is not be permitted.

503-3.07 **Surface Test.** No surface test on the hardened concrete will be required.

503-3.08 **Sealing Joints.** Typically, no joint sealing is required in the PCC foundation course. Seal skewed contraction joints in accordance with §502-3.12A, Sealing Transverse Contraction Joints – Highway Joint Sealant, if a construction delay occurs that prevents the placement of the final pavement course until the subsequent construction season.

503-4 **METHOD OF MEASUREMENT.**

503-4.01 **Portland Cement Concrete Foundation for Pavement.** The work will be measured for payment as the number of cubic meters of Portland Cement Concrete Foundation for Pavement based on the payment lines shown in the contract documents. No deductions will be made for catch basins, manholes, or other similar pavement obstructions.

503-4.02 **Constructing Longitudinal Joints.** The work will be measured for payment as the number of meters of longitudinal joints satisfactorily constructed.

503-5 **BASIS OF PAYMENT.**

503-5.01 **Portland Cement Concrete Foundation for Pavement.** Include the cost of all labor, material, and equipment necessary to satisfactorily perform the work in the unit price bid for Portland Cement Concrete Foundation for Pavement. No payment will be made for areas that do not meet minimum plastic thickness requirements as described in §502-3.08, Plastic Thickness Determination. No additional payment will be made for Contractor-requested HES concrete mixes.

503-5.02 **Constructing Longitudinal Joints.** Include the cost of all labor, material, and equipment necessary to satisfactorily perform the work in the unit price bid for Constructing Longitudinal Joints.

**Payment will be made under:**

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>503.1010</td>
<td>PCC Foundation for Pavement, Class C</td>
<td>Cubic Meter</td>
</tr>
<tr>
<td>503.1011</td>
<td>PCC Foundation for Pavement, Class F</td>
<td>Cubic Meter</td>
</tr>
<tr>
<td>503.1012</td>
<td>PCC Foundation for Pavement, HES Concrete</td>
<td>Cubic Meter</td>
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<tr>
<td>503.9110</td>
<td>Constructing Longitudinal Joints in Foundation Pavement</td>
<td>Meter</td>
</tr>
</tbody>
</table>

SECTIONS 504 THRU 549 (VACANT)
§551

Section 550
STRUCTURES

SECTION 551 - PILES AND PILE DRIVING EQUIPMENT

551-1 DESCRIPTION

551-1.01 Piles. Under this work, the Contractor shall furnish and place piles of the type and size and at the locations indicated on the Plans, or where ordered by the Engineer. The Contractor shall furnish equipment and personnel for dynamic pile tests as required. Timber piles are not covered under this specification.

551-1.02 Splices for Steel Bearing Piles. This is a contingent item and shall apply only when the Engineer directs the Contractor to drive a pile more than one and one-half meters beyond the estimated length provided in the Contract Plans. Pile splices shall be constructed as shown on the Plans, or as approved by the DCES.

551-1.03 Furnishing Equipment for Driving Piles. Under this work, the Contractor shall furnish equipment at the site for driving piles. The Contractor shall submit to the DCES, Form BD 138, “Pile Driving Equipment Data,” for approval. The DCES shall be allowed 15 working days upon receipt for review. Each separate combination of pile and pile driving equipment proposed by the Contractor shall require the submission of a corresponding Form BD 138.

551-2 MATERIALS. Materials for piling shall conform to the requirements of the following Subsections:

Bar Reinforcement, Grade 420 709-01
Casings for Cast-In-Place Concrete Piles 720-03
Steel Bearing Piles 720-04
Pile Shoes 720-05

In addition to the requirements specified in the preceding Subsections, the following shall apply:

551-2.01 Cast-In-Place Concrete Piles

A. Concrete for Cast-In-Place Piles. Concrete placed in the Cast-In-Place Piles shall comply with requirements specified for Class A Concrete in Section 501, Portland Cement Concrete.

B. Paint for Exposed Piles and Pile Casings. The paint shall be in accordance with the Contract Documents. The color shall be as specified on the Plans and Proposal, or as required by the Engineer.

C. Cast-In-Place Concrete Pile Dimensions. Pile dimensions, including the rate of taper for tapered piles, shall be as shown on the Plans, or as approved by the DCES. In no case, however, shall the outside diameter at the toe be less than 200 mm nor shall the outside diameter at the section to be cut off be less than 300 mm.

The Contractor shall furnish the particular type of pile casing shown on the Contract Plans. No used pipe or shell will be permitted.

Pile casings which do not hold their original form during driving, which fracture, or fail during driving, due to manufacturer defect, fabrication, or Contractor's operations, unless otherwise directed, shall be withdrawn and removed from the site at the Contractor's expense. If, at any time during the driving or placing of the pile casings, the DCES determines from the results of the driving that the
551-3 CONSTRUCTION DETAILS

551-3.01 General

A. Storage, Handling and Inspection. The method of storing and handling of piles shall be such as to avoid damage to the piles.

B. Site Preparation. Piles shall not be driven until after the excavation is completed to the elevation required for the bottom of the footing or bottom of tremie. Unless otherwise shown on the Plans, any material forced up or depressions made by the driving shall be removed or filled and the correct elevation of foundation established before any concrete is placed.

C. Preparation Of Piles

1. Shoes

   a. Steel Bearing Piles. Steel Bearing Piles shall be furnished with a shoe. These shall be fabricated as detailed on the Plans, or as approved by the DCES. Substitution of commercial shoes for those detailed on the Plans may be permitted subject to the approval of the DCES. Unless shown on the Plans, the shoes shall be attached by a NYSDOT Certified Welder with a 8 mm thick minimum fillet weld along the entire outside edge of the flanges.

   b. Cast-In-Place Concrete Piles. The ends of all pile casings shall be perpendicular to the longitudinal axis of the casings. All pile casings for "Cast-In-Place Concrete Piles" shall be equipped with a round plate with a diameter of not more than 15 mm larger than the diameter of the pile, and a minimum thickness of 18 mm, unless otherwise indicated on the Plans.

2. Splices

   a. General. Full length piles shall always be used where practicable. Where splices are unavoidable, their number, locations, and details shall be subject to the approval of the DCES.

       Splices to steel piles, and steel pile casings shall be welded in conformance with the provisions of the S.C.M. These requirements include, but are not limited to, a NYS certified welder and a DCES approved welding procedure.

   b. Cast-In-Place Concrete Piles. Where design considerations and soil characteristics permit, the DCES may approve the use of mechanical splices in lieu of the welded splice herein specified under §551-3.01.C.2.a. The mechanical couplings used for such splices shall be subject to the provisions of §715-01, Structural Steel. A seal weld shall be provided completely around the pile casing.

D. Equipment for Driving Piles

1. General. Piles shall be driven only with equipment which has the prior approval of the DCES in accordance with §551-1.03. All malfunctioning equipment, as determined by the Engineer, shall be removed from the site and be replaced with equipment which is satisfactory to the DCES. The minimum rated striking energy of the hammer to be used in driving Steel Bearing Piles and Cast-In-Place Concrete Piles shall be 17.6 KJ per blow.

       Hammers having greater striking energy may be used upon approval by the DCES. These hammers shall produce a minimum of 20 blows/300 mm and a maximum of 120 blows/300 mm at the Ultimate Pile Resistance shown on the Contract Plans. However, if, in the opinion of the
DCES, satisfactory results are not obtained with the hammer furnished by the Contractor, a hammer meeting the approval of the DCES shall be furnished and used.

2. Air/Steam Hammers. Sufficient boiler or compressor capacity shall be provided at all times to maintain the rated speed of air/steam hammers during the full time of pile driving. The valve mechanism and other parts of a single or double-acting hammer shall be maintained such that the number of blows per minute for which the hammer is designated, is satisfied.

3. Diesel Hammers. The valves, pumps, ports, rings, and other hammer parts shall be maintained such that the following condition for which the hammer is designated is satisfied:

<table>
<thead>
<tr>
<th>Hammer Type</th>
<th>Designated Condition</th>
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<tbody>
<tr>
<td>Single Acting</td>
<td>Length Of Stroke Or Blows Per Minute</td>
</tr>
<tr>
<td>Double Acting</td>
<td>Bounce Chamber Pressure</td>
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</tbody>
</table>

All Diesel Hammers shall be provided with an acceptable means of measuring hammer energy. When pressure gages are included as normal equipment, they shall be furnished and maintained in operable condition. Manufacturer's Charts and Graphs, required to calibrate hammer energy, shall be furnished to the Engineer by the Contractor. The Contractor shall also arrange easy access to the pressure gages so that readings may be conveniently taken by the Engineer.

A double acting hammer not operating at the required bounce chamber pressure shall be removed promptly from the work site. It shall be replaced by a hammer acceptable to the Engineer at no cost to the State.

4. An approved hammer cushion block shall be used to transfer pile hammer energy to the pile. Each hammer shall be equipped with a helmet/drive head to fit the type of pile to be driven.

5. Pile driver leads shall be constructed in such a manner as to afford freedom of movement of the hammer. The use of either swinging or hanging leads will be permitted provided the pile or leads are properly supported during driving and the required final position and batter of pile is achieved. In the event the Engineer determines that the use of swinging or hanging leads is producing unsatisfactory results, the Engineer may require the Contractor to hold the leads in position with guys or braces to give the required support. The Contractor may, as an alternative, replace the unsatisfactory equipment with equipment having fixed leads.

Pile driving leads shall be of sufficient length so that the use of a follower will not be necessary. The driving of piles with followers will generally not be permitted and shall be done only with written permission and direction of the DCES.

When directed by the Engineer, either approved steel or wooden spuds shall be used to penetrate consolidated material or obstructions in the upper three meters in order to assist in driving the piles to the required depth and resistance. Augers may be used for this purpose when written permission is obtained from the DCES.

6. Water jets and vibratory hammers shall not be used in driving any pile, unless written approval is given by the DCES. Piles installed with a water jet or vibratory hammer shall be impact driven to secure the final penetration.

E. Methods of Driving. The driving of piles shall be done with an air/steam, diesel, or hydraulic hammer. Piles shall be driven starting from the center of the foundation and proceeding outward from this point, or starting at the outside row and driving progressively across the foundation.

F. Length of Piles. The length of piles will be determined in the field by driving to the driving criteria determined by the DCES. Piles may be completely driven in one operation or, if directed by the DCES, be partially driven and allowed to set from 2 to 24 hours (or as indicated on the Plans) before driving is resumed.
G. Allowable Variation in Pile Alignment. Piles shall be truly vertical or accurately battered as indicated on the Contract Plans. The top of any pile driven its full length into the ground shall not vary from the plan location by more than 100 mm, unless otherwise shown on the Plans. The top of any pile partially exposed or included in an integral abutment shall not vary from the plan location by more than 25 mm, unless otherwise shown on the Plans. In addition, piles may have a variation at their tip of not more than 20 mm per meter from the vertical or from the batter shown on the Plans or permitted by the DCES.

H. Defective Piles. All piles forced up by any cause shall be driven again, as directed by the Engineer.

The following shall be causes for rejection of a pile:
- Pile location or batter is incorrect.
- Pile damaged from any cause whatsoever.
- Pile fails to attain the driving resistance determined by the DCES, or the driving resistance set forth in the Contract Documents.
- Pile tip elevation is not within the limits called for on the Plans, or specified by the Engineer.
- Pile is determined by the Engineer to be unserviceable for other reasons related to the furnishing and installing of the pile.
- Cast-In-Place Concrete Pile Casing not free from water.

No footing concrete shall be placed until all piles within the footing are inspected by the Engineer. The Contractor shall remove such rejected piles, or, at the option of the Engineer, a second pile may be driven adjacent thereto, if this can be done without impairing the structure.

I. Cutting Off Piles and Pile Casings. The tops of all piles and pile casings shall be cut off at the elevation indicated on the Plans, or as established by the Engineer. The cut shall be clean and to a true plane, in accordance with the detail shown on the Plans.

J. Included Work

1. Voids. All cavities, left by the pile driving operation, shall be backfilled, as specified by the Engineer.

2. Concrete. Cast-In-Place Concrete Pile casings shall be inspected immediately prior to placing concrete in the casing. The Engineer may require that all casings in the footing be satisfactorily placed and dry before concrete is placed. Each casing shall be filled with a continuous pour of concrete, mixed and placed in accordance with the Specifications for Concrete for Structures Class A, Section 555, except that the slump of the concrete shall not exceed 125 mm.

Special care shall be exercised in filling the piles to prevent honeycomb and air pockets from forming in the concrete. Internal vibrators and other means shall be used to the maximum depth practicable, as determined by the Engineer, to consolidate the concrete.

3. Reinforcement. Cast-In-Place Concrete Piles shall be reinforced as shown on the Plans and the reinforcement secured in such a manner as to insure its proper location in the finished piles.

K. Painting of Exposed Piles and Pile Casings. All exposed pile or pile casing surfaces not embedded in concrete shall be painted as described in the Contract Documents.

L. Furnishing Equipment And Personnel - Dynamic Testing Of Piles. The Contractor shall furnish pile driving equipment, a source of electrical power, and a suitable test enclosure to perform field testing of piles and evaluate pile hammer efficiency. All incidental labor and material necessary to make the work area accessible shall also be supplied by the Contractor.

The actual tests shall be conducted by the Engineer under the direction of the DCES. The Contractor's responsibility is limited to the supplying of support services for the individual tests.
Tests shall be performed at the locations indicated on the Contract Plans and where ordered by the Engineer.

A Dynamic Testing Procedure, known as the "Impact Driving Method", will be used. This Procedure entails the following steps:

1. Prior to being struck with the pile driving hammer, each pile to be tested will be instrumented with strain and acceleration transducers by State personnel, aided by the Contractor's forces.
2. Dynamic measurements resulting from the pile hammer blows will be automatically recorded on a pile driving analyzer supplied by the State. State personnel will operate the pile driving analyzer.
3. Upon determination by the Engineer that valid data has been recorded, State personnel, assisted by the Contractor's forces, will remove the instrumentation.

The Contractor will schedule equipment movements to ensure that testing is done as part of the normal driving schedule, insofar as it is possible.

551-4 METHOD OF MEASUREMENT

551-4.01 Piles. The quantity of piles to be paid for under the work specified for Steel Bearing Piles or Cast-in-Place Concrete Piles, will be the number of meters of driven, acceptable piles, measured below cut off elevation, remaining in the finished structure in accordance with the Plans, Specifications, and orders of the Engineer.

The length of piles will be determined in the field by driving to the resistance required by the Plans, Specifications, or DCES at the time of driving. The pile lengths indicated on the Plans are for estimating purposes only.

551-4.02 Splices for Steel Bearing Piles. The quantity of splices paid for will be the number of piles that exceed the estimated length by more than one and one half meters. A second splice may be utilized at 8 m beyond the estimated length subject to DCES approval.

551-4.03 Dynamic Pile Tests. The quantity of Dynamic Pile Tests will be made for the number of piles tested. If the pile requires redriving within 28 hours after the initial test, this shall be considered as one Dynamic Pile Test. If redriving is more than 28 hours, this shall be considered as an additional test.

551-5 BASIS OF PAYMENT.

551-5.01 Furnishing Equipment for Driving Piles. The Lump Sum Price Bid shall include the cost of furnishing all labor, materials, and equipment necessary for transporting, erecting, maintaining, making any ordered equipment replacement, dismantling and removing the pile driving equipment.

The furnishing of equipment for driving sheet piling is not included in this work.

Payment will be made at the Lump Sum Price Bid for this Item, as follows: Seventy-five percent (75%) of the amount bid will be paid when the equipment for driving piles is furnished and driving of satisfactory piles has commenced. The remainder will be paid when the work of driving piles is completed.

551-5.02 Piles. The Unit Price Bid Per Meter for each of the respective Pile Items shall include the cost of furnishing all labor, (including the manipulation of pile driving equipment and materials), materials and equipment (excluding pile driving equipment) necessary to complete the work as prescribed in the Specifications, including the following additions:

A. Structure Excavation. Payment for removal of any material forced up above the foundation by the driving of piles shall be included in the cost of the pile.

B. Defective Piles. No payment will be made for piles rejected in accordance with requirements under §551-3.01H, Defective Piles.
§551

C. Backfilling. Payment for backfilling of all cavities left by the extraction of damaged piles or from auger holes or soil deformations necessary to place piles shall be included in the work for the respective Pile Item.

D. Redriving Piles. The cost of driving piles that are forced up by any cause shall be included in the Unit Price Bid for the respective Pile Item.

E. Pile Shoes, Etc. The cost of furnishing and using pile shoes, followers, augers, or spuds shall be included in the unit price bid.

F. Reinforcement and Splices for Cast-In-Place Concrete Piles. Reinforcement and splices for C.I.P. Concrete Piles shall be included in the Unit Price Bid for Cast-in-Place Concrete Piles.

G. Progress Payments for Steel Piles. Progress payments will be made when the piles are properly installed in accordance with the Plans, Specifications, and orders of the Engineer. Payment will be made, at the Unit Price Bid, for 80% of the quantity properly installed, exclusive of cutting off piles, placing concrete in Cast-In-Place Piles and pile casings, and painting of exposed piles and pile casings. The balance of the quantity will be paid for upon completion of the work, including the cutting off, placing concrete in the pile, and painting of the pile and pile casings.

551-5.03 Splices. The Unit Price Bid shall include the cost of furnishing all labor, materials, and equipment necessary to complete each splice to the satisfaction of the Engineer.

551-5.04 Dynamic Pile Test. The cost of furnishing equipment and personnel to perform Dynamic Tests shall be included in the Unit Price Bid.

Payment will be made under:

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<th>Item No.</th>
<th>Item Description</th>
<th>Pay Unit</th>
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<td>Steel Bearing Piles</td>
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<td>551.11</td>
<td>Cast-In-Place Concrete Piles</td>
<td>Meter</td>
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<td>551.12XX</td>
<td>Splices for Steel Bearing Piles</td>
<td>Each</td>
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<tr>
<td>551.13</td>
<td>Furnishing Equipment for Driving Piles</td>
<td>Lump Sum</td>
</tr>
<tr>
<td>551.14</td>
<td>Dynamic Pile Testing</td>
<td>Each</td>
</tr>
</tbody>
</table>

Refer to the Standard Contract Pay Item Catalog for full Item Number and full Description.

SECTION 552 - SUPPORT AND PROTECTION SYSTEMS

552-1 DESCRIPTION

552-1.01 Permanent Sheeting. Under this work, the Contractor shall furnish and place permanent sheeting of the type, at the locations and to the elevation(s) shown on the plans.

All the sheeting and supports will be left in place as a finished structure unless removal of waling and bracing is called for on the plans.

552-1.02 Temporary Sheeting. This work shall include the requirements specified in §552-1.01 Permanent Sheeting with the following addition:

The Contractor shall be required to maintain the sheeting while in place, and remove it from the job site after its function has been accomplished or when ordered by the Engineer. It may be left in place only with the written permission of the Engineer.

552-1.03 Interim Sheeting. Under this work, the Contractor shall furnish and place sheeting of the type, at the locations and to the elevation(s) shown on the plans.

The Contractor shall be required to maintain the sheeting while it is serving its function.

The interim sheeting shall be cut off and removed only to the elevation shown on the plans. The remaining material shall be left in place.
§552

552-1.04 Excavation Protection System. Under this work, the Contractor shall design, furnish, place, maintain and remove an excavation protection system (EPS) at locations shown on the plans or as ordered by the Engineer. Details of the EPS must conform with the requirements of 29CFR1926 and installation shall be in accordance with the State and Federal Safety Codes. A sloping (layback) option will not be allowed.

Sheeting, shoring, a shield system, i.e. trench box or trench shield or other pre-engineered protective system may be used to prevent cave-ins. The requirements of any protective system shall be as contained in 29CFR1926. It may be left in place only with the written permission of the Engineer.

552-1.05 Alternate Design. The Contractor may submit to the Department a construction alternate other than that presented in the contract documents as a Value Engineering Change Proposal. Slope layback will not be allowed. Any geotechnical analysis for a flexible support system shall be done in accordance with the procedures contained in the appropriate Departmental publication, which is available upon request, from the Regional Director or the Director, Geotechnical Engineering Bureau.

552-2 MATERIALS

552-2.01 Permanent Sheeting

A. Permanent Timber Sheeting. Timber sheeting shall be new and unused and consist of any acceptable species which can be placed satisfactorily. The sheeting shall have a preservative treatment conforming to the American Wood-Preservers Association (AWPA) Standard C-2, Soil Contact. The timbers shall not be less in actual cross section or stress grade than that shown on the plans. Stress grading and acceptance shall be in accordance with the requirements and provisions of §712-14, Stress Graded Timber and Lumber. The timbers shall be sound and free from any defects which might impair its strength or tightness. The materials shall include all necessary waling and bracing required.

B. Permanent Steel Sheeting. Steel sheeting shall be new and unused conforming to the requirements of ASTM A328M unless otherwise indicated on the plans. Waling and bracing shall be new and unused conforming to the requirements of ASTM A36M unless otherwise indicated on the plans. The sheeting shall not have a section modulus less than that shown on the plans. Stock steel may be used. The Contractor shall furnish to the Engineer, certified copies of physical and chemical test results which shall include a sworn statement by a qualified mill representative to the effect that the subject material conforms to the requirements of the steel specified.

552-2.02 Temporary Sheeting

A. Temporary Timber Sheeting. The provisions of §552-2.01A Permanent Timber Sheeting shall apply with the following modifications:

The timber sheeting may consist of new or used, treated or untreated material but must be in satisfactory condition and suitable for the intended use. The Engineer may disapprove and reject used materials regarded to be unsatisfactory.

B. Temporary Steel Sheeting. The steel sheeting, waling and bracing may consist of new or used material but must be in satisfactory condition and suitable for the intended use. The section modulus of the sheeting shall not be less than that shown on the plans. The materials shall include all necessary waling and bracing required. The Engineer may, disapprove and reject used materials regarded to be unsatisfactory.

552-2.03 Interim Sheeting

A. Interim Timber Sheeting. The provisions of §552-2.02A Temporary Timber Sheeting shall apply.
§552  

B. Interim Steel Sheeting. The provisions of §552-2.02 B Temporary Steel Sheeting shall apply.

552-2.04 Excavation Protection System. The selection of EPS materials shall be the Contractor's option. The Engineer may disapprove and reject materials regarded to be unsatisfactory.

552-3 CONSTRUCTION DETAILS

552-3.01 General. Any material which stops the driving of sheeting within a depth of three meters from the ground surface at the time of driving, shall be removed by the Contractor. Payment for removal of such material will be made under the appropriate excavation item. If very compact material or boulders prevent the progression of the sheeting to the design tip elevation at a greater depth, the Contractor shall notify the Engineer.

552-3.02 Temporary Sheeting. The requirements of §552-3.01 General shall apply with the following addition:

Upon completion of the structure, the Contractor will remove the sheeting placed under this work, or with the written permission of the Engineer, leave it in place after cutting off the tops at an agreed elevation.

552-3.03 Interim Sheeting. The provisions of §552-3.01 General shall apply with the following modification:

The interim sheeting shall be cut off and removed only to the elevation shown on the plans. The remaining material shall be left in place.

552-3.04 Excavation Protection System. The EPS installed under this item shall be of sufficient size and strength to meet the requirements of Title 29, Code of Federal Regulations, Part 1926, Safety and Health Regulations for Construction (OSHA), and the Live Load requirement as contained in the Standard Specifications for Highway Bridges adopted by AASHTO. Prior to use, the Contractor shall supply the Engineer with documentation of compliance.

All damage to the adjacent pavement or ground caused by the use of the chosen EPS (e.g. Voids beneath the pavement or shoulder, pavement or shoulder cracking or subsidence, ground settlement) shall be repaired to the satisfaction of the Engineer at no additional cost to the State. Severe damage which directly affects the safety of the public shall be immediately repaired to the satisfaction of the Engineer. The operation shall be halted until a satisfactory prevention method is instituted.

552-4 METHOD OF MEASUREMENT

552-4.01 Permanent Sheeting. The quantity of sheeting to be paid for shall be the number of square meters obtained by multiplying the vertical length of sheeting measured between the payment lines herein described, by the horizontal length of sheeting shown on the plans or approved by the Engineer. The vertical length of sheeting is that length measured between the upper and lower payment lines. The upper payment line, unless otherwise specified on the plans or approved by the Engineer, shall be the original ground at the time of commencing work. The lower payment line shall be the elevation shown on the Plans as the minimum embedment depth unless otherwise authorized in writing by the Engineer.

The horizontal length shall be measured along a projection of the sheeting on a plane parallel to and midway between the front and rear face of the sheeting wall.

552-4.02 Temporary Sheeting. The provisions of §552-4.01 Permanent Sheeting shall apply.

552-4.03 Interim Sheeting. The provisions of §552-4.01 Permanent Sheeting shall apply.

552-4.04 Excavation Protection System. The quantity of protection system to be paid for shall be the number of square meters obtained by multiplying the vertical length measured between the payment lines herein described, by the horizontal length of EPS shown on the plans or approved by the Engineer. The vertical length is that length measured between the upper and lower payment line. Unless otherwise specified on the plans, the upper payment line shall be the ground surface existing at the site prior to the
beginning of the work, or as ordered, in writing, by the Engineer. Unless otherwise indicated on the plans or in the proposal, the lower payment line shall be the bottom of the excavation shown on the plans immediately adjacent to the protection system. The horizontal length shall be the actual length of protection system installed measured along the payment lines as shown on the contract plans. Both sides of the excavation shall be measured and computed for payment.

§552-4.05 Stage Construction. When the support system is used in stage construction, the quantity of support system to be paid shall be the maximum number of square meters satisfactorily installed between the payment lines shown in the Contract Documents measured on either, but not both sides, of adjacent construction stages.

§552-5 BASIS OF PAYMENT

§552-5.01 Permanent Sheeting. The unit price bid, per square meter, for this work shall include the cost of furnishing all labor, materials and equipment necessary to complete this work, including driving equipment, waling, bracing and design services when employed. The cost of maintaining the excavated area free from earth, water, ice, and snow will be included in the price bid for the appropriate excavation item.

§552-5.02 Temporary Sheeting. The provisions of §552-5.01 Permanent Sheeting shall apply except that estimate payments in the amount of 75% of the bid amount shall be made upon installation of the sheeting with the remainder paid upon its satisfactory removal. If the Contractor leaves all or part of the sheeting in place, it will be at their own expense and the remaining 25% of the bid amount shall be paid after its function is no longer required.

§552-5.03 Interim Sheeting. The provisions of §552-5.01 Permanent Sheeting shall apply except that estimate payments in the amount of 75% of the bid amount shall be made upon installation of the sheeting with the remainder paid upon satisfactory removal of that portion specified in the contract documents. If the support system is to be left in place in its entirety, the remainder shall be paid after its function is no longer required. The cost of any work necessary to cut off and remove the specified portion shall be included in the unit price bid.

§552-5.04 Excavation Protection System. The unit price bid, per square meter, for this work shall include the cost of furnishing all labor materials and equipment necessary to complete this work, including driving equipment, waling, bracing, and design services when employed.

If the Engineer directs, in writing, that the EPS be left in place, this will be classified as extra work.

Payment will be made under:

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<th>Item No.</th>
<th>Item</th>
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<tbody>
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<td>552.11</td>
<td>Permanent Steel Sheeting</td>
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<td>552.16</td>
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</table>

SECTION 553 - COFFERDAMS AND WATERWAY DIVERSION STRUCTURES

§553-1 DESCRIPTION

§553-1.01 General. All work done under this Section shall conform to all Federal, State, County and Local Regulations and permit conditions.

§553-1.02 Cofferdam. Under this work, the Contractor shall design, furnish, place, maintain, and remove cofferdams together with all necessary waling and bracing, and dewatering equipment within the
limits shown on the plans. The Contractor shall also construct, maintain, stabilize, backfill and restore adequate sediment removal area(s) for water discharge control at location(s) shown on the plans or where allowed by the Engineer in accordance with all applicable permits.

If a waterway diversion structure is proposed as a substitution, approval of the Engineer must be obtained. A review by the appropriate permitting agency(ies) will be required. Any delay due to this review and approval process will not be a basis for an extension of time.

553-1.03 Temporary Waterway Diversion Structure. Under this work, the Contractor shall design, furnish, install, maintain, and remove a temporary water diversion structure at the location(s) shown on the plans or as ordered by the Engineer.

553-1.04 Submittals

A. Cofferdams. Cofferdams shall be designed by a Professional Engineer, licensed and registered to practice in New York State. All systems submitted shall be designed for the static water pressure plus stream pressure and ice pressures as appropriate. Stresses shall not exceed the allowable given in AASHTO Standard Specifications for Highway Bridges. The Contractor shall indicate the water elevation above which the system should be flooded to avoid overloading. The Contractor’s Engineer shall design the cofferdam to conform to all Federal, State, County and Local Regulations and Permits.

1. Cofferdams (Type 1). The Contractor shall submit the design, including computations and method of installation, to the Engineer for review by the Deputy Chief Engineer Structures (DCES). The DCES shall be allowed 20 working days for review. Permission to proceed must be received, prior to beginning construction of any cofferdam. The furnishing of such information and receipt of permission to proceed shall not serve to relieve the Contractor of its responsibility for the safety of the workers, the need to meet permit conditions, and the successful completion of the work.

2. Cofferdams (Type 2). Prior to beginning construction of any cofferdam, the Contractor shall submit the methods to be employed to the Engineer for review and approval. Ten working days shall be allowed for review. Construction shall not be started prior to receipt of approval.

B. Temporary Waterway Diversion Structure. Prior to beginning construction/installation of any temporary waterway diversion structure, the Contractor shall submit the methods to be employed to the Engineer for review and approval. Ten working days shall be allowed for review. Construction shall not be started prior to receipt of approval.

553-2 MATERIALS. The materials shall be timber or steel sheeting of a quality equivalent to that specified in §552-2.02 Temporary Sheeting of Support and Protection Systems, tightly sealed impermeable earth filled bags, precast concrete, a commercially designed system manufactured specifically for the control of water, or other material as indicated in the cofferdam design submitted for review.

553-3 CONSTRUCTION DETAILS

553-3.01 Cofferdams. Cofferdams shall be constructed so as to keep the excavations free from earth, water, ice, or snow, and to permit excavations to be carried to the depths indicated on the plans. Cofferdams, when used in conjunction with a tremie pour, shall be designed and constructed to automatically flood by non-mechanical means such as over topping or flooding ports. The automatic flooding elevation shall be as indicated by note in the plans.

In the event that permanent or temporary sheeting is required by the plans at the location of the cofferdam, the Contractor may elect to incorporate this material into the cofferdam system. Additional bracing may be required to satisfactorily perform excavation, dewatering, and other required construction operations. The permanent sheeting system shall be returned to its intended condition after all cofferdam equipment and material, including any additional bracing, has been removed. All damage done to the
temporary system, if still required, or permanent sheeting, shall be repaired at the Contractor's expense, to
the satisfaction of the Engineer.

Unless otherwise indicated on the plans, cofferdams shall be maintained in a dewatered condition
during foundation construction. The placement of foundation concrete shall not be impeded by water
standing or flowing within the cofferdam.

If a waterway diversion structure is approved as a substitution, all of the requirements of §553-3.02
Temporary Waterway Diversion Structure shall apply.

Dewatering equipment and any additional bracing shall be of adequate quality and capacity and shall
be so arranged as to permit their proper functioning in connection with the cofferdam. Dewatering
equipment and bracing shall be so located to permit construction of the structure in accordance with the
plans.

All damage caused by the failure of a cofferdam to perform its proper functions shall be the
responsibility of the Contractor. It shall also be the Contractor's responsibility to protect all stream banks
from erosion by reason of restriction of the channel caused by the erection of the cofferdam to limits
greater than that shown on the plans for the Contractor's own convenience. In that situation, all material
which erodes from the banks during that time the cofferdam is in place shall be replaced by the Contractor
at the Contractor's own expense. The Engineer, in consultation with the regulatory permit agency(ies)
representative(s), will be the sole determiner of the nature and extent of all damages and mitigation
requirements. The Engineer shall approve all repair methods proposed by the Contractor prior to the
Contractor beginning any remedial activities for which they are liable.

It shall be the Contractor's responsibility to place the cofferdam so that it will not interfere with any
batter piles.

The Contractor shall establish and maintain a sediment removal area(s) to retain the discharge for a
sufficient period of time using equivalent best management practices as approved by the Engineer, in
order that the discharge entering the stream will be as clear as the flowing stream.

553-3.02 Temporary Waterway Diversion Structure. Waterway diversion structures shall be
constructed at the locations(s) as shown on the plans so as to divert the flow of water. The structure shall
be continuous and constructed in accordance with any regulatory agency permit conditions.

If a system commercially designed and manufactured specifically for the control of water is used, it
shall be installed and maintained in accordance with the manufacturer's recommendations.

All damage caused by the failure of the temporary water diversion structure to perform its proper
function shall be repaired by the Contractor at no cost to the State.

553-3.03 Removal. The Contractor shall remove the temporary portion of the cofferdam installation or
the waterway diversion structure, including anchor spuds if used, after such time that it is determined by
the Engineer to be no longer necessary. The removal shall be sequenced to minimize turbidity and the
discharge of materials into the waterway. Additional temporary erosion control measures, as determined
by the Engineer, may need to be employed to facilitate removal.

553-4 METHOD OF MEASUREMENT

553-4.01 Cofferdams. Measurement will be for each cofferdam actually established where indicated
on the plans.

In those cases where approval is given to construct a waterway diversion structure in lieu of a
cofferdam, the cost of the diversion will be paid at the unit price bid for the cofferdam work.

553-4.02 Temporary Waterway Diversion Structure. Measurement will be for each temporary
waterway diversion structure actually constructed in accordance with the requirements of the contract
documents and to the satisfaction of the Engineer.

553-5 BASIS OF PAYMENT

553-5.01 Cofferdams. The unit price bid for each cofferdam shall include the cost of furnishing all
labor, materials, and equipment necessary to complete the work, including pile driving equipment,
waling, and bracing, anchor spudding, maintaining in a dewatered condition, and final removal. No
§553

separate payment will be made for any additional temporary erosion control measures required to facilitate removal. In addition, all costs associated with the removal of any sediment deposited in the waterway due to the Contractor’s operations shall be included. When a cofferdam is installed incorporating permanent or temporary sheeting required by the plans, payment will be made for each cofferdam established, including any miscellaneous sheeting, additional bracing, anchor spudding, or other material necessary to complete the work. The permanent or temporary sheeting, if used as part of the cofferdam, will be paid for under a separate item. The cost of establishing, maintaining, stabilizing, backfilling and restoring the sediment removal area(s) shall also be included in the price bid. No separate payment will be made for any repairs of damage required due to the failure of a cofferdam to perform its proper function.

Progress payments will be made. Seventy-five percent of the bid price will be paid after cofferdam installation, construction of the sediment removal area(s) and initial dewatering. The remaining percentage will be paid upon satisfactory removal of the cofferdam and restoration of the sediment removal area(s).

553-5.02 Temporary Waterway Diversion Structures. The unit price bid for each diversion structure shall include the cost of furnishing all labor, equipment, and materials necessary to satisfactorily install, maintain, and remove the diversion structure and any additional temporary erosion control measures required to facilitate removal.

No separate payment will be made for any repairs of damage required due to the failure of a waterway diversion structure to perform its proper function.

In the event that the Contractor is required to extend the temporary waterway diversion structure beyond the limits shown in the contract documents, changes to the diversion structure will be considered extra work.

When the waterway diversion structure is satisfactorily installed, seventy-five percent of the bid price will be paid. The remaining percentage will be paid when all temporary equipment and material have been removed and the waterway satisfactorily restored to its permanent location.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>553.01nnnn</td>
<td>Cofferdams (Type 1)</td>
<td>Each</td>
</tr>
<tr>
<td>553.02nnnn</td>
<td>Cofferdams (Type 2)</td>
<td>Each</td>
</tr>
<tr>
<td>553.03nnnn</td>
<td>Temporary Waterway Diversion Structure</td>
<td>Each</td>
</tr>
</tbody>
</table>

Note: nnnn denotes serialized pay item.

SECTION 554 - MECHANICALLY STABILIZED EARTH SYSTEM

554-1 DESCRIPTION. Construct a Mechanically Stabilized Earth System (MSES) at the locations indicated on the plans. A Mechanically Stabilized Earth System is comprised of an unreinforced concrete leveling pad, facing units, earth backfill, and a reinforcing material used to stabilize the backfill.

Obtain all necessary materials, except backfill and leveling pad material, from the approved wall system designer-supplier. Approved designers-suppliers, wall systems, and the components of each wall system appear on the Department's approved list located in the office of the Director, Materials Bureau. Obtain from the designer-supplier a Mechanically Stabilized Earth System design stamped by a Professional Engineer licensed and registered to practice in New York State. Submit the MSES design package, including working drawings of the wall design, design calculations, working drawings for all job-specific facing panels not previously approved by the DCES, and the designer-supplier's Installation Manual to the DCES at least 30 working days before starting work. After receipt of all pertinent information, the DCES requires 20 working days to review the submission and reply to the Engineer. Begin work only after receiving DCES written approval.

Supply on-site technical assistance from a representative of the designated designer-supplier during the beginning of the installation until such time as the Engineer determines that outside consultation is no longer required.

554-1.01 Definitions. The following definitions apply:
A. Wall System. A marriage of a specific facing unit, a specific reinforcing and the backfill described in §554-2.09 of this specification.

B. Facing Unit. A precast concrete panel incorporating a means for attaching the reinforcing, forming part of the face area of the mechanically stabilized earth system. A corner unit is a facing unit having two faces.

C. Reinforcing. A metal strip, wire mesh, geogrid or other similar material connected to the facing unit for the purpose of fill stabilization.

D. Attaching Devices. Anything cast into the facing unit to provide a means for attaching reinforcing.

E. Fastener. Anything used to connect the reinforcing to the attaching device.

F. Joint Filler. Material used to fill the joints between units.

G. Slip Joint. A vertical joint specific to the wall system used as a stress relief at wall step locations.

H. Identification Markers. Signs or marking tape buried near the finished grade to identify and prohibit excavation of the reinforced backfill.

554-2 MATERIALS. Not all materials listed are required for each Mechanically Stabilized Earth System. Ensure that the proper materials are supplied for the chosen system design. Provide materials meeting the following requirements:

554-2.01 Facing Units. Fabricate in accordance with the requirements of §704-14 Precast Concrete Panel Units.

Fabricate Precast concrete coping and other incidental precast units in accordance with the requirements of §704-14 Precast Concrete Panel Units. Architectural treatment of the Precast Concrete Panels may be required by special notes shown on the plans.

554-2.02 Reinforcing Strips. Manufacture the reinforcing strips from recognized ASTM Designated metal grades and galvanize in accordance with the requirements of §719-01, Type I. The reinforcing strips associated with each approved wall system appear on the Department’s approved list under wall system components.

554-2.03 Reinforcing Mesh. Shop fabricate the reinforcing mesh from cold drawn steel wire conforming to the requirements of §709-09 and weld into the finished mesh fabric in accordance with the requirements of §709-02. Galvanize in accordance with §719-01, Type I. The reinforcing mesh associated with each approved wall system appear on the Department’s approved list under wall system components.

554-2.04 Geogrid Reinforcing. Provide geogrid reinforcing tested and certified to meet the minimum requirements for geosynthetic products in accordance with AASHTO Specifications for Highway Bridges, Section 5.8.6.1.2, Geosynthetic Reinforcement. Submit the geogrid manufacturer’s certification with the material. Include in the certification: the geogrid manufacturer’s name, the geogrid name, the test lot number, the minimum average roll value for Ultimate Tensile Strength, the long-term design tensile strength, and the reduction factors used to calculate the long-term design tensile strength. The grid(s) associated with each approved wall system appear on the Department’s approved list under wall system components.

554-2.05 Fasteners and Attaching Devices. The fasteners and attaching devices are specific to each wall system and provided by the wall system supplier. The fasteners and attaching devices
associated with each approved wall system appear on the Department’s approved list under wall system components.

**554-2.06 Joint Fillers.** Fill joints with material approved by DCES and supplied by the approved wall system supplier.

**554-2.07 Slip Joints.** The type of slip joints are specific to each wall system and are designed and supplied by the wall system supplier.

**554-2.08 Leveling Pad.** Provide leveling pad material meeting the requirements of Section 501, Class A concrete.

**554-2.09 Backfill.** Provide backfill material for any Mechanically Stabilized Earth System from a single source unless prior approval for use of designated multiple sources is obtained from the Director, Geotechnical Engineering Bureau. Any mineral (inorganic) soil, blasted or broken rock, or similar materials of natural origin, including mixtures thereof, may be suitable materials subject to the following:

**A. Tests, Control and Acceptance Methods.** Perform material tests and control methods pertaining to the backfill requirements in conformance with the procedures contained in the appropriate Departmental publications in effect on the date of the advertisement for bids. These publications are available upon request to the Regional Director, or the Director, Geotechnical Engineering Bureau.

Acceptance of the backfill will be made in accordance with the procedural directives of the Geotechnical Engineering Bureau.

**B. Backfill Material.** Stockpile the backfill material in accordance with the latest “Geotechnical Control Procedures for the Control of Granular Materials”, and grade in accordance with TABLE 554-1.

<table>
<thead>
<tr>
<th>TABLE 554-1 BACKFILL GRADATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sieve Size Designation</td>
</tr>
<tr>
<td>100 mm</td>
</tr>
<tr>
<td>6.3 mm</td>
</tr>
<tr>
<td>425 µm</td>
</tr>
<tr>
<td>75 µm</td>
</tr>
</tbody>
</table>

**C. Plasticity Index.** If the State elects to test for plasticity, the Plasticity Index shall not exceed 5

**D. Durability.** If the State elects to test for durability, material having a Magnesium Sulfate Soundness loss in excess of 30 percent will be rejected and shall not be placed in the work.

**E. Corrosion Potential (Metal Reinforcing and/or Connectors Only).** The State will test for the corrosion potential of any system with exposed metal in the backfill. All stockpiled backfill materials will be tested for resistivity and pH, and may be tested for sulfides at the Department's discretion. Material failing to meet the following requirements of Table 554-2, for those tests that are performed, will be rejected except as specified below:

Material failing to meet the resistivity criterion may be tested for sulfate and chlorides. Material meeting the criteria for both sulfates and chlorides and having a resistivity greater than 10 ohm-m will be acceptable.

<table>
<thead>
<tr>
<th>TABLE 554-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resistivity ρ ≥ 30 ohm-m</td>
</tr>
<tr>
<td>5 ≤ pH ≤ 10</td>
</tr>
<tr>
<td>Sulfides ≤ 300 mg/kg</td>
</tr>
</tbody>
</table>
554-2.10 Identification Markers

A. Signs. These will be 180 mm x 250 mm (minimum) fiberglass.

B. Marking Tape. This will be polyethylene material 75 mm wide, 100 µm thick.

Signs and marking tape are provided by the chosen designer-supplier.

554-2.11 Basis of Acceptance

A. Facing Units. Accepted in accordance with the requirements of §704-14, Precast Concrete Panel Units.

B. Cast-in-Place Concrete. The requirements of Section 501, Class A concrete, apply.

C. Other Materials. These will be accepted by certification. The State, however, reserves the right to sample, test and reject certified material in accordance with Departmental written instructions.

554-3 CONSTRUCTION DETAILS

554-3.01 Excavation and Disposal. Excavate and dispose of all excavated material in accordance with the requirements of Section 203, except as modified herein.

A. Placement Area. Grade the area under the Mechanically Stabilized Earth System, level for a width equal to, or in excess of, the reinforcing length. Prior to wall system construction, thoroughly compact this area to the satisfaction of the Engineer. Treat all soils found to be unsuitable, or incapable of being satisfactorily compacted because of moisture content, in a manner directed by the Engineer, in conjunction with the recommendations of the Regional Geotechnical Engineer.

B. Rock. Remove rock to the limits indicated on the plans.

C. Depth of Excavation. The depth of excavation for the leveling footing is indicated on the plans. Include the cost of this excavation in a separate excavation item.

554-3.02 Facing Unit Inspection, Storage, Repair and Rejection

A. Precast Concrete Facing Units. Precast concrete facing units will be inspected upon arrival at the work site to determine if damage occurred during shipment. An additional inspection will be made prior to installation to determine any damage which may have occurred during storage. Handle and store the units with extreme care to prevent damage.

B. Tolerances. Units not meeting dimensional tolerances, as determined by the Engineer, will be rejected. Replace rejected units with units acceptable to the Engineer.

C. Damaged Units. Repair damaged units in a manner approved by the Engineer. Units that the Engineer determines are not repairable will be rejected. Replace rejected units with units acceptable to the Engineer.

D. Rejection Responsibility. Responsibility for the rejection of units delivered to the job site rests solely with the Engineer.

554-3.03 Structure Erection

A. Methods and Equipment. Install units in accordance with the designer-supplier's working drawings and Installation Manual, unless otherwise modified by the Contract Documents, or the
Engineer. Prior to installation of the units, furnish the Engineer with detailed information concerning the proposed construction method, as well as the specific construction equipment planned for use. Begin work only after receiving the Engineer's written approval of the proposed construction methods.

**B. Unreinforced Concrete Leveling Pad.** Provide an unreinforced concrete leveling pad as required by the plans. Place the concrete in accordance with the requirements §555-3. The Engineer may waive any part of §555-3, that the Engineer determines is impractical.

**C. Unit Installation**

1. Place units such that, after completion of compaction, the requirements of TABLE 554-3 are not exceeded. After placement, maintain each unit in position by a method acceptable to the Engineer. If wedges are used, do not allow them to remain in place below three panel unit heights during installation, and compaction. Remove all wedges remaining in the top three panel unit heights upon completion of the Mechanically Stabilized Earth System. External braces may be required for initial placements. Install joint fillers in the manner indicated by the Installation Manual.

2. Correct all misalignments of installed units in excess of the tolerances allowed by Table 554-3, in a manner satisfactory to the Engineer at no additional cost.

3. Govern the operations and procedures to prevent misalignment of the installed panel units. Precautionary measures include, but are not limited to, keeping vehicular equipment a minimum of one meter from the panel units. Within one meter of the panel units use compaction equipment meeting the requirements of §203-3.12B6.

<table>
<thead>
<tr>
<th>TABLE 554-3 FACING UNIT ALIGNMENT AND JOINT OFFSET TOLERANCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal Alignment</td>
</tr>
<tr>
<td>Joint Offset per Unit</td>
</tr>
<tr>
<td>Overall Vertical Plumbness (Top to Bottom of Wall System)</td>
</tr>
</tbody>
</table>

**D. Backfill**

1. Place backfill materials, other than rock, at a moisture content less than, or equal to, the Optimum Moisture Content. Rework or replace, as determined by the Engineer, all backfill material placed at a moisture content in excess of the Optimum Moisture content. Determine the Optimum Moisture Content in accordance with the latest Geotechnical Test Methods for compaction that incorporate moisture content determination. Rework or replace backfill material at no additional cost to the State.

2. Place granular backfill material in uniform layers not exceeding 300 mm loose lift thickness per layer. Compact each layer to a minimum of 95 percent of Standard Proctor Maximum Density in accordance with §203-3.12.

3. Place rock backfill in uniform layers not exceeding 400 mm loose lift thickness. Compact in accordance with requirements determined by the Engineer.

**E. Reinforcing**

1. Place reinforcing in accordance with the designer-supplier’s recommendations or as described in the designer-supplier’s Installation Manual.

2. Prior to placement of the steel reinforcing, backfill the area within one meter of the panel units horizontally to within 25 mm or less, below the required reinforcing elevation. Roughly grade
the backfill beyond the one meter line to the reinforcing elevation. Roughly grade the backfill for
the geogrid reinforcing to the reinforcing elevation.

3. Before attaching the reinforcing to the panel units, repair all damage to the zinc coating in
accordance with the requirements of §719-01.

4. Prior to the attachment of the reinforcing, as required, fill all openings, or attachment
locations, with grease, or other protective material. Obtain the grease, or other protective
materials from the chosen designer-supplier.

5. Place reinforcing normal to the panel units unless indicated otherwise by the plans. Take care
to avoid breaking, distorting, or disturbing the reinforcing. Replace reinforcing which is broken,
or distorted, as determined by the Engineer.

6. Connect geogrid reinforcing to the facing before placement of subsequent facing units, or as
directed by the approved construction drawings.

7. Operate rubber tired equipment on top of geogrid reinforcing only at low speeds (less than
5mph) and without making sharp turns or braking sharply. Do not operate tracked equipment
directly on geogrid reinforcing. Cover geogrid with a minimum 150 mm thick soil layer prior to
operating tracked equipment over reinforced areas.

8. Repair or replace damaged geogrid in strict accordance with the designer-supplier’s written
instructions.

554-4 METHOD OF MEASUREMENT. Determine the quantity as the total number of square meters
of face area computed from the plans using the following limits:

A. Vertical

1. Topmost surface of the leveling footing.

2. Topmost surface of the facing units.

B. Horizontal. Limits indicated on the plans.

When computing quantity, take into consideration the possible variation in the elevations of the
footing and top of facing units. No field measurements will be made unless the Engineer specifies in
writing a change to the limits indicated on the plans.

554-5 BASIS OF PAYMENT

554-5.01 Mechanically Stabilized Earth System. Include in the unit price bid the cost of all labor,
equipment, technical representation from the designer-supplier, and materials, including backfill,
reinforcing, leveling footing, joint fillers, and coping, unless otherwise modified by the Contract
Documents.

554-5.02 Excavation and Disposal. Excavation and disposal of excavated material will be paid for
under a separate item.

554-5.03 Damaged Units. No payment will be made for damaged units, nor for units that do not meet
dimensional tolerances. Repair, or replace such units as determined by the Engineer, at no additional cost
to the State.

554-5.04 Reinforcing. No payment will be made for reinforcing that the Engineer orders replaced.
Replace such reinforcing at no additional cost.
§554

554-5.05 Water. Include the cost of adding water for backfill compaction in the unit price bid for the Mechanically Stabilized Earth System, unless items for Furnishing Water Equipment and Applying Water are included in the Contract. If these items are included, include the cost of adding water in their bid prices.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>554.01XX</td>
<td>Mechanically Stabilized Earth System, No Color</td>
<td>Square Meter</td>
</tr>
<tr>
<td>554.02XX</td>
<td>Mechanically Stabilized Earth System, Integral Color</td>
<td>Square Meter</td>
</tr>
</tbody>
</table>

XX Surface

01 Plain Concrete Surface
02 Textured Surface (hand tooled, raked, etc.)
03 Exposed Aggregate Surface
04 Architectural Pattern (form liner or stamped)
05 As Shown on Plans

SECTION 555 - STRUCTURAL CONCRETE

555-1 DESCRIPTION. This work shall consist of furnishing and placing portland cement concrete for structures as indicated in the contract documents and as directed by the Engineer.

555-2 MATERIALS

555-2.01 General. The materials used for structural concrete shall comply with the material requirements of Section 501, Portland Cement Concrete, General.

Additional materials, listed below, required specifically for use in conjunction with structural concrete items shall meet the requirements of the following subsections:

Concrete Grout Material 701-05
Vertical and Overhead Patching Material 701-08
Rapid Hardening Concrete Repair Material 701-09
Preformed Cork Joint Filler 705-01
Preformed Rubber Joint Filler 705-03
Caulking Compound for Structures 705-06
Preformed Elastic Bridge Joint Sealer 705-09
Polyvinyl Chloride Extruded Shapes and Sheet Material 705-11
Lubricant for Preformed Elastic Joint Sealer 705-13
Bar Reinforcement, Grade 420 709-01
Wire Fabric for Concrete Reinforcement 709-02
Quilted Covers (for curing) 711-02
Plastic Coated Fiber Blankets (for curing) 711-03
Polyethylene Curing Cover (White Opaque) 711-04
Membrane Curing Compound 711-05
Burlap 711-06
Form Insulating Materials for Winter Concreting 711-07
Admixtures 711-08
Water 712-01
Asphalt Roofing Felt 712-12
Epoxy Resin System 721-01
Epoxy Polysulfide Grout 721-03
Copper Flashing 725-01
Sheet Gasket (treated both sides) 728-06
Concrete Cylinder Curing Box 735-01
555-2.02 **Concrete for Structures.** The class of concrete required for the various structural concrete items will be indicated in the contract documents. The same source of aggregates shall be used for all faces and surfaces of concrete exposed to view.

555-3 **CONSTRUCTION DETAILS**

555-3.01 **Concrete Manufacturing and Transportation.** Unless otherwise specified in the contract documents, the construction details for manufacturing and transporting concrete shall comply with §501-3, Portland Cement Concrete - Construction Details.

555-3.02 **Falsework.** Falsework plans shall be submitted by the Contractor and approved by the Engineer before falsework construction is started. Falsework or centering shall be designed for the dead load of the concrete forms, the dead load of the plastic concrete (based on 2400 kg per cubic meter) and a live load resulting from a mass of 245 kg per square meter applied to all horizontal surfaces. Falsework which cannot be founded upon a solid footing, shall be supported by falsework piling. Screw jacks or hardwood wedges may be required for falsework centering or to take up any slight settlement in the form work, either before or during the placing of concrete. Falsework shall be set to give the finished structure the specified camber, plus allowance for shrinkage and settlement.

555-3.03 **Forms.**

**A. General.** All forms shall be well constructed, carefully aligned, substantial, and firm, securely braced, and fastened together in their final position. They shall be strong enough to prevent the fresh concrete from bulging the forms between supports and to withstand the action of mechanical vibrators. If required by the Engineer, form work plans shall be submitted by the Contractor and approved by the Engineer before forms can be used on the work. Forms shall be designed to resist a dead load resulting from a mass of 2400 kg per cubic meter for the plastic concrete and a live load resulting from a mass of 245 kg per square meter on horizontal surfaces. The form and falsework design shall provide for the loads resulting from any conveyance system in addition to the live load.

When concrete is transported by buggies, conveyor belt, or other approved methods of conveyance, the forms shall be capable of supporting the distribution equipment and any concentrations of concrete which may occur during transportation and distribution. Buggy runways and other supporting platforms shall be supported directly by the forms.

Forms shall be adequately braced to resist concrete design loads. If the forms are inadequately braced concrete placement shall stop until adequate bracing has been provided.

All forms shall be set and maintained true to the line designated until the concrete is sufficiently hardened. Forms shall be maintained to eliminate the formation of joints due to shrinkage of the lumber. Forms shall be sufficiently tight to prevent leakage of mortar.

Forms may be constructed of wood, metal, or other approved materials, except when a particular material is specified in the contract documents. The use of fiber forms will be permitted for round columns only if the interior surface of the forms have been treated in such a manner as to prevent helical corrugation marks on the finished concrete surfaces. Forms shall be filleted 25 mm with forming material at all exposed corners to create a chamfer in the finished concrete unless otherwise shown in the contract documents.

When curved, patterned, or other special forms are required, the Contractor shall submit details of the form construction to the Engineer for approval prior to constructing the forms. Forms shall be so constructed that those surfaces on which finishing may be required may be stripped without disturbing the remaining forms. Premanufactured formliner panels, if used, shall be capable of imprinting the surface of the concrete with a uniform and aligned pattern and texture. The panels shall be composed of elastomeric urethane, polyvinyl chloride (PVC), ABS plastic, or other suitable material for their intended shape and number of reuses to achieve the desired effects. Formliners shall leave crisp, sharp definition of the architectural surface. Sufficient liners shall be used to minimize pattern repeat. Formliners shall not compress more than 6mm (¼ inch) when concrete is poured at a rate of 3 vertical meters per hour.
Any metal ties or anchorages within the forms shall be so constructed that the embedded portion of the ties can be removed to a depth of at least 50 mm from the surface of the concrete without damage to such surface. Wire ties shall not be used without written approval of the Engineer. In case wire ties are approved, all wires, upon removal of the forms, shall be cut back at least 6 mm from the face of the concrete with sharp chisels or nippers (nippers are necessary for green concrete). All cavities produced by the removal of metal ties shall be filled in conformance with requirements of §555-3.11, Corrective Finishing.

For walls where access to the bottom of the forms is not practicable, the lower form boards or panels shall be left loose so that the inside of the forms can be readily cleaned of all chips, dirt, sawdust, or other extraneous material, immediately prior to the placing of concrete.

Forms to be reused shall be maintained in good condition as to accuracy of shape, strength, rigidity, watertightness, and smoothness of surface. Any warped or bulged forms must be carefully resized before being re-used. Forms that are unsatisfactory in any respect shall not be used. All form surfaces that will be in contact with the concrete shall be thoroughly treated with an approved form coating in the manner, and at the rate specified by the manufacturer. Only those coatings listed on the Approved List published by the Materials Bureau are acceptable. Forms so treated shall be protected against damage or dirt prior to placing concrete.

If metal forms are used, the material shall be of such thickness that the forms will remain true to shape. All bolt and rivet heads shall be countersunk. Clamps, pins, or other connecting devices shall be designed to hold the forms rigidly together and to allow removal without damage to the concrete. Metal forms, which do not present a smooth surface or line up properly, shall not be used. Special care shall be exercised to keep metal forms free from rust, grease, or other foreign matter that would tend to discolor the concrete.

B. Foundation Concrete. The footings of structures shown in the contract documents shall be considered as approximate only, and when ordered in writing by the Deputy Chief Engineer (Structures), shall be changed to such dimensions as will give a satisfactory foundation. Concrete shall not be placed in any foundation form without the Engineer’s approval.

555-3.04 Handling and Placing Concrete.

A. Placement Limitations. No concrete shall be placed when the ambient air temperature is below 7°C, unless the Engineer grants approval to a written proposal from the Contractor. No concrete shall be placed during rain.

When concrete is to be placed in contact with steel members, reinforcing steel, or previously placed concrete, the temperature of the steel and concrete shall be raised to approximately 7°C. The use of enclosures and heating equipment, including but not limited to the use of forced hot air, hot water boilers, and hoses, or other methods suitable to the Engineer, may be required before concreting begins.

When concrete is to be placed in contact with earth or rock, within piles, or for tremie placements, the temperature of the earth or rock shall be 2°C or higher. The earth or rock shall not have any snow, ice, frost, or standing water on its surface. The use of insulating materials and heating equipment may be required before concreting begins.

B. Conveyance. Concrete shall be placed so as to avoid segregation of materials and displacement of reinforcement. All equipment used for conveying the concrete mix, from the point of delivery and material acceptance to the discharge point, shall be capable of meeting the permissible variations given in Table 555-1, Concrete Conveyance Uniformity. Prior to the actual placement of concrete, the Contractor shall demonstrate the capability of the equipment to convey the concrete mixture. Tests according to Department written instructions will be performed by, and at the discretion of the Engineer. No further verification of the equipment capability will be required unless evidence of nonuniform concrete is observed during placement.

When concrete pumps are used, the lines shall have a minimum diameter of 125 mm. The pumping operation shall be performed in such a manner as to discharge concrete horizontally a minimum distance of 1 m. Where horizontal discharge is not possible, the use of double 90-degree bends at the end of the pump hose, reducer hoses, or other equipment capable of maintaining a head
of concrete in the pump line may be allowed, subject to the approval of the Director, Materials Bureau.

All chutes, troughs, and pipes shall be kept clean and free from coatings of hardened concrete by thoroughly flushing with water after each use. Water used for flushing shall be discharged clear of the concrete already in place.

Concrete shall not come in contact with any aluminum during conveying and placing operations.

<table>
<thead>
<tr>
<th>TABLE 555-1 CONCRETE CONVEYANCE UNIFORMITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test</td>
</tr>
<tr>
<td>Air Content, % by volume of Concrete</td>
</tr>
<tr>
<td>Slump</td>
</tr>
<tr>
<td>Average slump 100 mm or less</td>
</tr>
<tr>
<td>Average slump greater than 100 mm</td>
</tr>
</tbody>
</table>

**C. Acceptance/Testing.** The concrete mixture, prior to placement into the conveying equipment, shall meet the specified requirements for air content and slump given for the various classes and types of placement under Table 501-3, Concrete Mixtures.

**D. Placement.** All foreign matter of every kind shall be removed from the interior of the forms before placing concrete. Temporary studs or braces within the forms shall be removed when the concrete has reached an elevation rendering their further use unnecessary. Dropping concrete a distance of more than 1.5 m or depositing a large quantity at any point and running or working it along the forms shall not be permitted. Dropchutes shall be used between vertical forms unless conveyance equipment can be inserted between forms.

Special care shall be taken to fill each part of the form by depositing concrete directly into the form as near to its final position as possible, to work the coarser aggregates back from the face of the concrete and to force the concrete under and around the reinforcement without displacing the reinforcement. After the concrete has taken its initial set, care shall be exercised to avoid jarring the forms or placing any strain on the ends of the projecting reinforcement.

Concrete shall be placed in horizontal layers not more than 300 mm thick except as hereinafter provided. When less than a complete layer is placed in one operation, it shall be terminated in a vertical bulkhead. Each layer shall be placed and consolidated before the preceding layer has taken its initial set to prevent damage to the green concrete and avoid cold joints between batches. Each layer shall be consolidated using appropriate vibrating practices so as to avoid the formation of a joint with a preceding layer which has not taken initial set.

When concrete placement is temporarily discontinued, the concrete, after becoming firm enough to retain its form, shall be cleaned of laitance and other objectionable material to a depth sufficient to expose sound concrete. To avoid visible joints as far as possible upon exposed faces, the top surface of the concrete adjacent to the forms shall be smooth and level whenever concreting is discontinued. Where a “feather edge” would be produced at a construction joint, as in the sloped top surface of a wing wall, an inset form work shall be used to produce a blocked out portion in the preceding layer which shall produce an edge thickness of not less than 150 mm in the succeeding layer. Work shall be continuous from the bottom to the top of any face.

When embedding structural shapes in concrete, the placement of concrete shall be progressed on one side of the shape only until it flushes up over the bottom flange of the shape on the opposite side, after which concrete shall be placed on both sides to completion.

**E. Vibration.** During and immediately after deposition, concrete shall be thoroughly consolidated by vibrating the concrete internally with mechanical vibrating equipment. The use of external vibrators will be permitted when satisfactory surfaces cannot be obtained by internal vibration alone or when it is impossible to use internal vibrators. The use of external vibrators shall be subject to the approval of the Engineer. External vibrators shall be attached to or held on the forms in such a manner as to effectively vibrate the concrete in a horizontal plane.
Internal mechanical vibrators shall be adequately powered, capable of transmitting vibration to the concrete in frequencies of not less than 5,000 vibrations per minute while inserted in concrete and shall produce a vibration of sufficient intensity to consolidate the concrete into place without separation of the ingredients. If any of the reinforcing steel has epoxy coating, an internal mechanical vibrator shall have a rubberized or elastomeric cover to prevent damage to the epoxy coating on the reinforcing bars. The vibrators and covers shall be inspected for defects prior to use.

A sufficient number of vibrators shall be employed, so that at the required rate of placement, thorough consolidation occurs throughout the entire volume of each layer of concrete. Extra vibrators shall be on hand for emergency use and when other vibrators are being serviced.

The vibrating element shall be vertically inserted in the concrete mass at a depth sufficient to vibrate the bottom of each layer effectively inserting the vibrator into the underlying lift. It shall be withdrawn completely from the concrete before being advanced to the next point of application.

Internal vibrators shall not be placed directly on the forms or the reinforcing steel. The vibratory element shall be inserted vertically into the concrete at the point of deposit and in areas of plastic concrete at evenly spaced intervals not farther apart than the radius over which the vibration is visibly effective and at a distance close enough to the forms to effectively vibrate the surface concrete. The time of vibration shall be of sufficient duration to accomplish thorough consolidation, complete embedment of the reinforcement, produce dense, smooth surfaces free from aggregate pockets, honeycombing, and air bubbles and to work the concrete into all angles and corners of the forms however, over-vibration shall be avoided. Vibration shall be continued in one place until the concrete has become uniformly plastic, but not to the extent that pools of grout are formed.

Vibration shall be supplemented by working or spading by hand in the corners and angles of forms and along form surfaces while the concrete is plastic. Vibrators shall not be used to push or distribute the concrete laterally.

555-3.05 Depositing Structural Concrete Under Water.

A. General. Use a tremie tube, pipeline, or similar method to place concrete under 0-32°C water in one continuous operation. Since the tremie tube and the pipeline are both tubes, the word "tube" in this specification refers to either type, except where specific reference is made to either the tremie tube or the pipeline.

Unless noted differently on the plans, use Class G concrete as described in Table 501-3, Concrete Mixtures. Substitute Class GG Concrete when clear openings between closely spaced objects such as reinforcement bars are less than 75 mm. Pozzolan replacement may be omitted for small placements in a fresh water environment when approved by the DCES.

In addition to §555-3.03 Forms, place concrete on prepared areas cleaned of all debris, mud, or other unsuitable material.

Submit a list of equipment, including back-up, and a schedule for transporting and placing concrete, to the Engineer for review at least 20 working days prior to concrete placement. The Contractor shall be responsible to design a tremie placement, with appropriate forming, that maintains a minimum vertical rise of 0.3 meters per hour for the overall area and a minimum placement rate of 30 cubic meters per hour, unless fluid concrete pressure requires a reduced placement rate.

Place fresh concrete before stiffening and initial set of the adjacent concrete to ensure a good bond and avoid cold joints. If a delay occurs, determine stiffening and initial set by probes or other methods approved by the Engineer. Stop the operation if the placement cannot be continued before initial set of the adjacent concrete. The Engineer will then immediately contact the DCES.

B. Methods of Placement. The tremie tube and pump and pipeline are the most common methods. Obtain approval of the DCES for any other method.

1. Tremie Tube Method (Open System). This method uses a vertical tube open at the top, where concrete is delivered to the top and falls down the tube.

a. Tremie tube size shall be based on the delivery system used by the Contractor.
b. Use a sturdy hopper or funnel with a bottom opening smaller than the tremie tube diameter to transfer concrete into the tremie tube. The capacity and shape of the hopper or funnel depends on the volume and type of concrete delivery system. A device with the same size bottom opening may be used if a 40 to 50 mm diameter breather tube is installed to reach 0.3 meters or more down into the tremie tube.

c. Install a safe work platform at the top of the tremie tube.

2. **Pump and Pipeline Method (Closed System)** This method uses a vertical tube, attached to a closed tube system, where concrete is pumped to the top and falls down the tube.

   a. Use pipe with a minimum inside diameter of 125 mm.

   b. Install a minimum 50 mm diameter air vent or valve connection, or leave the pipe joint loose without a gasket, near the high point of the downgrade, 0.3 - 1.3 meters below the point where concrete starts falling down the pipe, to allow air displaced by concrete to escape, and admit air to prevent a siphoning effect.

   c. Class G concrete, the mix noted on the plans, or a “cement-water” grout may be used for pipeline lubrication and placed in the forms. Waste any other concrete mix used to lubricate pipeline.

C. **Placement Tubes for Tremie Tube or Pump and Pipeline Method.** Clearly mark each tube in at least 0.5 meter increments (numbered every 2 meters) to show depth to the outlet. Use watertight joints. Place tubes no more than 5 meters from the forms and no more than 10 meters on center.

1. **Open end tubes** Install a separate tube at each placement point, as loss of seal occurs when the embedded end of this tube type is removed from fresh concrete under water. Once started, do not relocate or remove open end tubes until completion of the concrete placement at that location. If loss of seal occurs, remove and seal the tube with a watertight plate or plug for restarting. Restart tremie placement only if a seal can be reestablished using a dewatered tube where the outlet can be surrounded by fresh concrete.

2. **End-valve sealed tubes** Install the number of tubes based on the minimum placement rate defined in A. General, as the seal is maintained when the embedded end of this type is removed from fresh concrete under water. Raise the end of the tube to about 1 meter below the fresh concrete surface. Then, close the valve with the tube ½ full of concrete (½ the water depth), and slowly remove the tube. Reverse this procedure upon relocation in fresh concrete.

D. **Dewatering.** When necessary, proceed with dewatering at least 4 days after completion of concrete placement, unless noted differently on the Contract Plans or as ordered by the Engineer. After dewatering, continue curing and excavate one or more sumps to provide for pumping of accumulated water. Excavate sumps outside of areas which will receive new concrete, or as approved by the Engineer.

E. **Concrete Evaluation.**

1. **Nondestructive Testing.** Use as directed by the Contract, or as approved by the DCES.

2. **Cores.** Obtain cores in the presence of the Engineer at locations and to depths shown on the contract plans. Take NX size (nominal 54 mm) cores, no earlier than 7 days after concrete placement, according to §648-3.04, Rock Core Samples, B. Sampling, the 1st sentence. Use drill bits meeting the requirements of Subsection 732-06, Coring Bits.
Obtain 100% recovery from each core hole, as less is presumed to indicate defective concrete. Use a 1.5 meter nominal length of core drill run. Record core boring log data in accordance with §648-3.01B, Driller’s Logs.

Label and pack all cores according to §648-3.04 C, Marking, Packaging and Transporting Samples. Deliver and store the core boxes at a site approved by the Engineer, where they become the property of the Department. Provide assistance in moving and arranging core boxes at the site to facilitate evaluation by the Department.

F. Defects. Obtain additional cores for further investigation from areas which contain voids, honeycombing, seams, or other defects. The DCES will determine the number and location of additional core holes. Repair defects with grout when approved by the DCES. Placements with defects determined to be unrepairable by grouting will be rejected. Alternate repair techniques require DCES approval.

G. Grout Repairs and Grout Placements. This section only applies for underwater grout placements limited to quickly filled areas, such as core drill holes, small piles up to 0.3 meters in diameter, and other small voids. Use materials meeting §701-05, Concrete Grout Material, for the grout proportioned as specified or as approved by the DCES.

When the DCES grants approval for repairs, the proposed grouting method shall be performed by cleaning out and filling all defects and core drill holes with grout. Position a grout tube (50 mm or less in diameter) about 25 mm off the bottom of the prepared hole until the grouting operation is complete. Start pumping (closed system) or filling a tremie tube (open system) faster than the grout can fall through water. Continue placing grout until the grout coming back out the hole is the same consistency as that going in. Then withdraw the tube.

Additional cores may be required to verify acceptable repairs.

H. Tremie Construction Joints. Prepare the top area of the placement receiving new concrete to within 75 mm of the elevation shown on the plans. When joining fresh concrete to concrete that has already set, the concrete in place shall have its surface scoured or abraded with a suitable tool to remove all loose and foreign materials. After the surface preparation, the concrete surface, and all porous surfaces to be in contact with new concrete shall be thoroughly wet using potable water for 12 hours with soaker hoses or the use of burlap/burlene/etc. to maintain moisture. The Contractor shall remove any puddles of free-standing water with oil-free compressed air, and protect the surfaces from drying, so the existing concrete remains in a clean, saturated, surface-dry condition until placement of the new concrete.

Fill any low areas with a leveling course of Class A concrete (or Class D for 35 to 125 mm thick placements).

Fill sumps with concrete or stone, as ordered by the Engineer.

555-3.06 Concrete Joints.

A. Construction Joints. Construction joints for the purpose of these specifications are joints used to provide for interruptions in the placement of concrete. Construction joints shall be placed only where shown in the contract documents or where approved by the Deputy Chief Engineer (Structures). Bulkheads required during placement shall be constructed at the direction of the EIC.

Unless otherwise shown in the contract documents, a shear key shall be provided at each construction joint by embedding water-saturated wooden blocks in the plastic concrete. The shear key thus provided shall be approximately a of the width of the parts joined. The key depth shall equal the thickness of standard form lumber, approximately ½ the key width. Shear keys need not exceed 140 mm in depth regardless of the key width.

On steel truss or open-spandrel, concrete arch spans, unless otherwise noted in the contract documents, the concrete in the floor system shall be placed about the center line of the span, beginning at the center and working simultaneously toward each end; or beginning at the ends, and working simultaneously toward the center. Care shall be taken to prevent the displacement of reinforcement during the placing of concrete. If, for any reason, it becomes necessary to introduce a construction joint, this shall be formed by means of a vertical bulkhead so constructed as to produce
§555

When joining fresh concrete to concrete that has already set, the concrete in place shall have its surface scoured or abraded with a suitable tool to remove all loose and foreign materials. After the surface preparation, the concrete surface and all porous surfaces to be in contact with new concrete shall be thoroughly wetted, to achieve a saturated surface dry condition, using potable water for 12 hours with soaker hoses or the use of burlap/burlene/etc., to maintain moisture. If conditions or the situation prohibits this, then the surfaces should be wetted for as long as possible. The Contractor shall remove any puddles of free-standing water with oil-free compressed air, and protect the surfaces from drying, so the existing concrete remains in a clean, saturated surface-dry condition until placement of the new concrete. Immediately before placing the new concrete, the forms shall be drawn tightly against the concrete already in place.

Forms for female shear keys shall be beveled on four sides to facilitate their removal and shall be securely fastened to the forms to prevent displacement before the concrete has set. Key forms shall be removed in such a manner as to avoid damage to the concrete.

B. **Contraction Joints.** Contraction joints shall be placed at locations shown in the contract documents and unless otherwise specified, shall be formed the same as construction joints, except that reinforcement shall not extend through the joint.

C. **Expansion Joints.** Expansion joints shall be placed as shown in the contract documents. Expansion joints shall provide for expansion, contraction, and the transfer of shear at the joint, unless otherwise specified. When expansion joints are formed by the insertion and subsequent removal of joint templates, this work shall be done in such a manner that joint edges are not chipped or broken down in the process.

When concrete is to be placed against a joint filler, holes or joints in the filler shall be suitably filled with mastic to prevent mortar or concrete from entering the joint and restricting its movement. The face edges of all joints shall be carefully finished or formed true to line and elevation for a minimum distance of 50 mm back from all exposed surfaces.

When caulking compound is used to seal a joint containing premolded bituminous joint filler, a layer of an approved type of pressure-sensitive release tape shall be placed between these materials due to their incompatibility.

D. **Waterstops.** Waterstops shall be installed in joints to provide for expansion and contraction movements at joints. Place waterstop at all joints exposed to view, as shown in the contract documents, or as ordered by the Engineer. Waterstop shall be a polyvinyl chloride or other approved flexible material, copper strip, zinc strip or lead sheet. The waterstop shall extend at least 75 mm into the concrete on each side of the joint, shall be joined to be continuous and watertight, and shall be carefully protected from damage until covered by concrete or backfill.

555-3.07 Finishing.

A. **General.** All exposed unformed surfaces, whether permanent or at construction joints, shall be finished by placing an excess of material in the forms and striking off the excess with a suitable float, forcing the coarse aggregate below the level of the finished surface, and troweled to a suitable finish. The use of mortar topping for surfaces shall not be permitted.

Following the discontinuance of placing concrete, all accumulation of mortar splashed upon the reinforcing steel and the surfaces of forms shall be removed. Dried mortar chips and dust shall not be puddled into the plastic concrete.

B. **Bearing Surfaces.** The entire surface area of bridge seats or pedestals shall be floated and troweled to true grade or, at the option of the Contractor, left approximately 6 mm high and bush hammered or otherwise finished to the exact elevations indicated in the contract documents.

555-3.08 Curing.
§555

A. General. All structural concrete shall be cured for a minimum of seven curing days unless otherwise stated. The curing period shall begin only after all curing procedures and practices for a given placement are established. A curing day is defined as any day during which the ambient air temperature at the concrete surface is 7°C or higher for the entire day.

Conditions may occur which prevent an entire day from qualifying as a curing day, but do not prevent portions of that day from reaching temperatures that qualify as curing temperatures. If these conditions occur and with the Engineer's approval, the Contractor may aggregate curing hours. A curing hour is defined as any hour during which the curing temperature remains at, or above 7°C. An aggregation of 24 curing hours will be credited as one curing day. Aggregations of less than 24 curing hours will not be credited.

Curing hours will be determined with continuous recording thermometers. The number and placement of the thermometers will be determined by the Engineer. Thermometers used to monitor curing temperatures shall consist of the following types:

1. Continuously Recording Thermometer. The thermometer shall be capable of continuously recording temperatures within a range of -20°C to 50°C for a minimum of 24 hours.

2. Maximum - Minimum Recording Thermometer. For all placements, the thermometer shall be capable of recording maximum and minimum temperatures within a range of -20°C to 50°C.

Provide all equipment, supplies, and labor necessary for calibration.

The curing temperature of concrete is the air temperature at the concrete surface, or the air temperature between the concrete surface and its protective covering. Temperatures at these locations are critical for proper concrete curing. For the purposes of this section the temperatures at the foregoing locations shall be maintained between 7°C and 30°C inclusive.

All structural concrete surfaces must be cured by any one, or a combination of, the following methods unless otherwise noted:

• Polyethylene curing covers - white opaque.
• Plastic coated fiber blankets.
• Clear (fugitive dye) membrane curing compound.
• Continuous burlap wetting.
• Wet burlap and curing covers.
• Forms left in place

Curing shall commence on all exposed surfaces no later than 30 minutes after completion of finishing. Finishing and curing operations shall progress with concrete placement. Curing covers shall be placed as soon after concrete finishing as the Engineer determines will not cause damage to the concrete surface. However, under no circumstances shall the curing be delayed beyond 30 minutes of the completion of finishing. Care shall be taken so as not to damage the finished surface or texturing. Curing covers shall be lapped a minimum of 300 mm. All lapped edges shall be sealed with pressure sensitive tape. Covers shall be protected from displacement.

Clear (fugitive dye) membrane curing compound shall be sprayed on the concrete surface immediately following the finishing operation, or form removal, whichever is applicable. The compound shall be applied by means of a pressure spraying system, or by distributing equipment, at a minimum rate of 0.285 L per m² of surface. The equipment for applying the compound shall be such that the compound is applied as a fine spray with no surface damage to the concrete. The equipment shall also provide for adequate agitation of the compound during application, and shall be approved by the Engineer before work is started. Should the application method produce a nonuniform film, or should the spraying equipment fail and back-up equipment is not immediately available, the application shall cease. Curing shall then be continued by another acceptable method. The Contractor shall provide sufficient approved covers for protection of the concrete surface in the event of rain or equipment breakdown.

If forms are removed during the curing period (refer to §555-3.09), the concrete curing shall be continued using a clear (fugitive dye) membrane curing compound applied immediately after form removal.
§555

B. Provisions for Curing in Hot Weather. When forms are left in place in extremely hot weather the forms shall require wetting to reduce surface heat.

If the ambient air temperature exceeds 30°C, continuous, uniform wetting for curing shall be required until the seven (7) day curing period is complete and forms are removed. Use of plastic sheeting over the established curing is not allowed in hot weather conditions.

C. Provisions for Curing in Cold Weather. If the ambient air temperature falls, or is expected to fall, below 7°C, the requirements of Table 555-2 shall apply.

<table>
<thead>
<tr>
<th>Ambient Temperature (AT) at time of concrete placement and as anticipated during curing duration</th>
<th>Curing requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>0°C &lt; AT &lt; 7°C for less than 24 consecutive hours</td>
<td>Contractor proposed/Engineer approved method for maintaining temperatures used</td>
</tr>
<tr>
<td>0°C &lt; AT &lt; 7°C for more than 24 consecutive hours</td>
<td>Heated enclosure required</td>
</tr>
<tr>
<td>AT &lt; 0°C</td>
<td>Heated enclosure required</td>
</tr>
</tbody>
</table>

Prior to use, all proposed methods must meet the approval of the Engineer. If the curing temperature falls below 0°C at any time during the curing period, the concrete will be rejected.

To provide assurance of the curing temperatures, the Contractor shall supply maximum-minimum thermometers. Temperature measurements will be taken by the Engineer and a record will be maintained for the curing period. As a minimum, thermometers shall be placed adjacent to forms at the bottom, middle, and top of a placement. Additional thermometers may be placed in areas where extreme cold or heat, from external sources, can be expected.

If the existing method employed by the Contractor to maintain the curing temperature fails, the Contractor shall modify the existing method immediately to reestablish an acceptable curing temperature.

The length of the curing period will be extended until the required number of curing days are accumulated.

1. General. When approval is granted in writing by the Engineer for cold-weather concreting, the curing temperature shall be maintained between 7°C and 30°C for the curing durations stated by provision of external heat or utilization of heat of hydration retained by insulated forms.

2. Provision of External Heat. If the Contractor is required, or elects, to maintain curing temperatures by this method, the Contractor shall furnish sufficient canvas and framework, or other type of housing, to enclose and protect the structure in such a way that the air surrounding the fresh concrete on all sides be kept at a temperature between 7°C and 30°C for the specified curing period. At the end of the curing period, the heat shall be gradually reduced at a rate not to exceed 0.5 degree C per hour until the temperature within the enclosure equals the temperature outside the enclosure. Materials and equipment necessary to erect the enclosure and provide external heat shall be present on the job site and approved by the Engineer before any concrete is placed.

External heat shall be provided by means of stoves, salamanders, heated hoses, steam equipment, warmed curing water, or other equipment supplied by, operated by the Contractor. Heating appliances shall not be placed in such a manner as to endanger formwork, centering, or expose any area of concrete to drying out or damage due to excessive temperatures. Sufficient equipment shall be supplied to continuously maintain the specified temperature with a reasonable degree of uniformity in all parts of the enclosure. The enclosures shall be properly vented to prevent surface disintegration of fresh concrete due to an accumulation of carbon dioxide gas. All exposed concrete surfaces within the heated area shall be protected from drying by one of the following methods:
- Use of live steam.
- Continuous wet burlap or wet burlap used with curing covers.
- Curing compounds used with curing covers.

### TABLE 555-3 INSULATION REQUIREMENTS FOR CONCRETE WALLS, PIERS AND ABUTMENTS ABOVE GROUND

**Minimum air temperature allowable - Concrete Placed at 10°C**

<table>
<thead>
<tr>
<th>Wall Thickness mm</th>
<th>Thicknesses of Commercial blanket or bat insulation - Deg. C.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>13 mm</td>
</tr>
<tr>
<td>Portland Cement Content - 300 kg/m³</td>
<td></td>
</tr>
<tr>
<td>150</td>
<td>7</td>
</tr>
<tr>
<td>300</td>
<td>2</td>
</tr>
<tr>
<td>450</td>
<td>-3</td>
</tr>
<tr>
<td>600</td>
<td>-5</td>
</tr>
<tr>
<td>900</td>
<td>-8</td>
</tr>
<tr>
<td>1200</td>
<td>-8</td>
</tr>
<tr>
<td>1500</td>
<td>-9</td>
</tr>
<tr>
<td>Portland Cement Content - 360 kg/m³</td>
<td></td>
</tr>
<tr>
<td>150</td>
<td>7</td>
</tr>
<tr>
<td>300</td>
<td>0</td>
</tr>
<tr>
<td>450</td>
<td>-6</td>
</tr>
<tr>
<td>600</td>
<td>-8</td>
</tr>
<tr>
<td>900</td>
<td>-11</td>
</tr>
<tr>
<td>1200</td>
<td>-12</td>
</tr>
<tr>
<td>1500</td>
<td>-12</td>
</tr>
<tr>
<td>Portland Cement Content - 415 kg/m³</td>
<td></td>
</tr>
<tr>
<td>150</td>
<td>6</td>
</tr>
<tr>
<td>300</td>
<td>-2</td>
</tr>
<tr>
<td>450</td>
<td>-9</td>
</tr>
<tr>
<td>600</td>
<td>-11</td>
</tr>
<tr>
<td>900</td>
<td>-14</td>
</tr>
<tr>
<td>1200</td>
<td>-15</td>
</tr>
<tr>
<td>1500</td>
<td>-16</td>
</tr>
</tbody>
</table>

**NOTES:**
1. This table is based upon the stated thickness of blanket, or bat-type insulation, having a thermal conductivity (K value) of 0.036 [W/m-K].
2. When using concrete containing pozzolans, do not consider the pozzolans as part of the cement content. Use the values given for a portland cement content that are equal to or less than the actual cement content of the mix, due to a lower heat of hydration when using pozzolans.

3. **Heat Retention by Insulated Forms.** Insulated forms may be used to maintain acceptable curing temperatures in accordance with the provisions of Table 555-2, when ambient temperatures will not drop below 0°C. If the Contractor elects to maintain curing temperatures by this method, sufficient insulation shall be furnished to protect and maintain the temperature between the insulation and formwork within the range of 7°C to 30°C for the specified curing period. Discontinuance of protection shall be accomplished in such a manner that the drop in temperature of any portion of the concrete shall be gradual. The surface temperature of concrete sections more than 600 mm in thickness shall not drop faster than 10°C in a 24-hour period. The surface temperature of concrete sections less than 600 mm in thickness shall not drop faster than 20°C in a 24 hour period.

Forms may be removed without restriction, providing the temperature difference between the air and the surface of the concrete is not more than 15°C. If possible, forms shall be removed about the middle of the day to take advantage of the generally higher afternoon temperatures.
Form insulating material shall be installed on the forms in such a manner so as to achieve the full benefit of its insulating properties and at the same time provide against the infiltration of wind and water. All portions of steel forms shall be covered by insulating material so that no steel is exposed to the air. Any tears or damaged areas in the insulating material shall be repaired. Special attention shall be given to ensure that all corners and angles are properly insulated and protected against wind damage.

Where tie rods extend through the form insulating material, a plywood washer (20 mm x 150 mm x 150 mm approx.) shall be placed over the tie rod and secured against the insulating material.

After placement of the concrete, the exposed concrete surfaces shall be covered with insulating blankets, except for areas where protruding reinforcing bars make the use of blankets impracticable. These areas may be covered with hay or other approved insulating material. Tarpaulins shall be used to protect the insulating material.

The insulating material shall be insulating blankets, bat insulation, solid foam, or sprayed foam meeting the requirements of §711-07, Form Insulating Materials for Winter Concreting. The thickness of standard blankets, or bat insulation, required for varying air temperatures, concrete thicknesses, and cement contents of the mix are listed in Table 555-3. The thickness of the insulating material used shall be determined by multiplying the equivalency factor for the insulating material by the thickness shown on Table 555-3. The equivalency factors for all approved insulating materials are given in the Department’s Approved List, Insulating Materials for Winter Concrete (§711-07).

### TABLE 555-4 MINIMUM TIME FOR FORM REMOVAL/FORMING/LOADING LIMITATIONS - SUBSTRUCTURES

<table>
<thead>
<tr>
<th>SUBSTRUCTURE PIECE</th>
<th>STRIPPING (2)</th>
<th>FORMING NEXT PLACEMENT</th>
<th>LOADING</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Footings</td>
<td>2 days</td>
<td>2 days</td>
<td>4 days before next placement</td>
</tr>
<tr>
<td></td>
<td>2 days if less than 3.0 m (avg.). Add 1 day for each additional 1.5 m to 5 days, maximum.</td>
<td>2 days</td>
<td>5 days before placing backwall on stem.</td>
</tr>
<tr>
<td>Abutment stems, backwalls</td>
<td></td>
<td></td>
<td>7 days before backfilling, 14 days before placing superstructure loads. (3)</td>
</tr>
<tr>
<td>Pier Columns, Pier Plinths</td>
<td>2 days if less than 3.0 m high (avg.). Add 1 day for each additional 1.5 m.</td>
<td>4 days - columns</td>
<td>Columns - 7 days before placing cap beam.</td>
</tr>
<tr>
<td></td>
<td>2 days</td>
<td>2 days if forming pedestal</td>
<td>Plinth - 2 days before pedestal placement.</td>
</tr>
<tr>
<td>Pier cap beams</td>
<td>8 days (bottom)</td>
<td>2 days</td>
<td>21 days before placing superstructure loads. (3)</td>
</tr>
<tr>
<td></td>
<td>3 days (sides)</td>
<td></td>
<td>5 days before pedestal placement.</td>
</tr>
<tr>
<td>All pedestals</td>
<td>2 days</td>
<td></td>
<td>21 days before placing superstructure loads. (3)</td>
</tr>
<tr>
<td>Wingwalls or Retaining walls</td>
<td>Same as abutment stems.</td>
<td>__</td>
<td>7 days (class A)</td>
</tr>
<tr>
<td>Arch centers</td>
<td>__</td>
<td></td>
<td>3 days (class F) (4)</td>
</tr>
<tr>
<td>Centering under beams</td>
<td>8 days</td>
<td>__</td>
<td>14 days before backfilling (3)</td>
</tr>
</tbody>
</table>

**NOTES:**
1. The minimum times for loading in this table are NOT applicable when using concrete that contains fly ash or ground, granulated blast furnace slag that is placed and/or cured when ambient temperatures are 16°C or less. The provisions in Note 3 are required for casting, curing, and testing of compressive strength cylinders for concrete that contains fly ash or ground, granulated blast furnace slag that is placed and/or cured when the ambient temperature is 16°C or less. The compressive strength results will be the basis of determining when loading can occur.
2 All concrete shall be cured for a minimum of seven curing days. A “Day” is a curing day as defined in Subsection 555-3.08A. Concrete surfaces being cured using forms, covers, or blankets from which the covers are removed for any purpose prior to the full cure period shall be sprayed with an approved clear (fugitive dye) curing compound within ten minutes of cover removal.

3 When early loading is requested, the minimum time requirements for loading may be reduced (or extended) based on test cylinder compressive strength results. The DCES will establish requirements for early loading upon request. The Contractor shall notify the Engineer, in writing, at least 10 days prior to placement, that early loading is being requested, so that arrangements for test cylinders can be made. Test cylinders shall be prepared in accordance with Materials Method 9.2 - Field Inspection of Portland Cement Concrete. Two test cylinders shall be prepared for each anticipated testing period. These cylinders shall be cured in the same manner as the substructure element which they represent. After the first compression test, the Engineer shall determine subsequent testing periods based on the results of the first test. No more than three tests for each substructure element shall be allowed.

4 Minimum time for loading pedestals shall not compromise minimum loading times specified for other placements.

555-3.09 Form Removal. Forms shall be removed in such a way as to permit the concrete to take the stresses uniformly and gradually. Any method of form removal likely to cause over stressing of the concrete shall not be used.

The forms for any portion of a structure shall not be removed until the concrete is strong enough to resist damage. The earliest time of form removal shall be as specified in Table 555-4, Minimum Time for Form Removal - Substructures. If the form removal causes damage, the operation must stop immediately until such time that sufficient concrete strength is achieved. All damage shall be repaired in conformance with §555-3.13, Damaged or Defective Concrete.

555-3.10 Loading Limitations. Forms used for substructure concrete placements shall be removed in accordance with the requirements of Table 555-4, Minimum Time for Form Removal - Substructures. The minimum times for loading in this table are NOT applicable when using concrete that contains fly ash or ground, granulated blast furnace slag that is placed and/or cured when ambient temperatures are 16°C or less. The provisions in Note 3 are required for casting, curing, and testing of compressive strength cylinders for concrete that contains fly ash or ground granulated blast furnace slag that is placed and/or cured when the ambient temperature is 16°C or less. The compressive strength results will be the basis of determining when loading can occur.

555-3.11 Corrective Finishing. Immediately after forms have been removed, surfaces exposed to view shall have all projections and irregularities carefully removed and all cavities greater than 25 mm in diameter and/or 6 mm in depth neatly filled with mortar of the proportion used in the concrete. The same brand of cement and the same kind of aggregate shall be used for filling cavities as was used in the original concrete mix. Plastering of surfaces shall not be allowed. The surface film (drying cement paste) of all such repaired surfaces shall be carefully removed before setting occurs.

All rust and other stains shall be removed from concrete exposed to view. Removal shall be accomplished using methods and materials approved by the Engineer. Materials used for rust stain removal shall be as listed on the Approved List published by the Department's Materials Bureau.

555-3.12 Weep Holes. The Contractor shall construct weep holes in all retaining walls and abutments as indicated in the contract documents.

555-3.13 Damaged or Defective Concrete. All defects or damaged to concrete which occurs prior to the final acceptance of the work shall be repaired or replaced at no additional expense to the State. The defects shall include but are not limited to spalling and irregular cracking at joints, edge spalls, honeycombing, and damage or other imperfections caused by traffic and/or construction operations. Any concrete requiring complete replacement shall be replaced in kind as concrete originally called for in the contract documents. Any repairs shall be performed to the methods described in these specifications unless otherwise approved by the Engineer. When a repair is made, the defective or damaged concrete shall be removed by saw cutting the perimeter to a depth of 40 mm, chipping the unsuitable material to sound concrete with light, hand held, pneumatic tools at a 45 degree angle into the patch area, and cleaning all exposed reinforcing and concrete surfaces. All surfaces to be repaired shall be thoroughly blast cleaned. Prior to placing repair concrete, all surfaces shall be wetted to a saturated surface dry condition.
Small spalls of 0.1 m$^3$ or less, and areas of 0.25 m$^2$ or less where concrete removal is required may be repaired using approved Concrete repair materials. Vertical or overhead surfaces may be patched with Vertical and Overhead Patching Material. Surface preparation for small repairs shall be according to the material manufacturer’s recommendations. After repair is complete, and curing time has elapsed, the Engineer will hammer sound all repair areas to assure proper bond has been achieved.

Concrete with surfaces misshapen by bulges or deformations caused by inadequate forms, or resulting in insufficient cover of reinforcing, shall be removed or corrected.

555-4 METHOD OF MEASUREMENT

555-4.01 Concrete for Structures. The work will be measured for payment as the number of cubic meters of concrete for structures satisfactorily placed, measured to the nearest 0.1 cubic meters within the lines of the structure as shown in the contract documents. No deductions shall be made for the volume of joint material, embedded metal reinforcement, structural shapes, chamfers, tops of piles, or pipe with an end area of less than 0.1 m$^2$.

555-5 BASIS OF PAYMENT

555-5.01 General. When the Contractor elects to substitute an optional concrete class as permitted by Table 501-1, Concrete Class Options, payment will be made for the originally specified class of concrete using the originally specified method of measurement.

555-5.02 Concrete for Structures. The unit price bid per cubic meter shall include the cost of furnishing all labor, materials and equipment necessary to complete the work, except reinforcement will be paid for separately under its appropriate item. Unless otherwise provided, the unit price bid shall include the cost of furnishing and placing flashing or other metal strips, flexible water stops, sheet packing, pipe drains, bituminous material, water for wetting, joint materials, felt, tar paper, joint sealing compounds, joint fillers, and concrete curing materials.

No extra compensation for falsework or falsework piling will be paid. This work is included as part of the formwork.

No extra compensation for corrective finishing or repairs to damaged or defective concrete will be paid.

Bridge bearings, expansion joints, and anchor bolts will be paid for under their appropriate items.

Progress payments will be made, after the concrete and curing applications have been properly placed, to the extent that payment will be made at 90% of the computed quantity of each concrete placement, with the balance to be paid after completion of all curing and corrective work thereon.

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<td>555.0105</td>
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SECTION 556 - REINFORCING STEEL FOR CONCRETE STRUCTURES

556-1 DESCRIPTION. The work will consist of furnishing and placing reinforcing steel for concrete structures, or stud shear connectors, in accordance with the contract documents, and in a manner satisfactory to the Engineer.

Reinforcing steel for concrete structures may be uncoated, epoxy-coated, galvanized, stainless-steel-
clad, or stainless steel, as indicated in the contract documents.

### 556-2 MATERIALS

Materials for this work shall meet the requirements of the following subsections of Section 700, Materials and Manufacturing:

- Uncoated Bar Reinforcement, Grade 420 709-01
- Wire Fabric for Concrete Reinforcement 709-02
- Epoxy-Coated Bar Reinforcement 709-04
- Stud Shear Connectors 709-05
- Epoxy-Coated Wire Fabric Reinforcement 709-08
- Mechanical Connectors for Reinforcing Bar Splices 709-10
- Galvanized Bar Reinforcement 709-11
- Stainless-Steel-Clad Bar Reinforcement 709-12
- Stainless Steel Bar Reinforcement 709-13
- Uncoated Bar Reinforcement, Grade 520 709-14

### 556-2.01 Devices for Supporting and Tying Reinforcement

Chairs, tie wires, and other devices used to support, position, or fasten the reinforcement shall be made of or coated with, a dielectric (electrically insulating) material. Stainless steel chairs without polyethylene tips and meeting the requirements of ASTM A493, AISI Type 430, may also be used. The specific hardware that the Contractor proposes to use shall be approved by the Engineer.

When forms are to be removed in their entirety, uncoated steel chairs equipped with snug-fitting, high-density, polyethylene tips which provide 6 mm clearance between the metal and any exposed surface may be used.

### 556-3 CONSTRUCTION DETAILS

#### 556-3.01 General

**A. Ordering.** Prior to ordering reinforcing steel, the Contractor shall carefully check all bar lists, and assume full responsibility for their accuracy. No change in the bar list shall be made by the Contractor unless approved by the DCES. If no bar list is provided in the Plans, then §557-3.16 No Bar List Provided shall apply.

**B. Protecting Reinforcement Coatings**

1. **Epoxy-Coated Reinforcing Steel.** All epoxy-coated reinforcement shall be stored above ground on wood or padded supports.

   Epoxy-coated reinforcement stored on-site shall be protected from sunlight and moisture using opaque waterproof covers. Covers shall be placed in a manner that will permit constant air circulation so as to minimize the formation of condensation on the epoxy-coated surface.

   All equipment for handling epoxy-coated steel shall have padded contact areas. All bundling bands shall be padded and all bundles shall be lifted with a strong back, multiple supports, or a platform bridge so as to prevent steel-to-steel abrasion from sags in the bundle.

   Steel shall not be dropped or dragged. Care shall be taken at all times to prevent damage to the epoxy coating.

   Steel that is partially embedded in concrete shall have the exposed sections protected with opaque waterproof covers prior to any winter shutdown of a project.

2. **Galvanized Bar Reinforcement.** All galvanized bar reinforcement shall be stored above ground on wood or padded supports and arranged so that rainwater drains off the bars.

#### 556-3.02 Placing and Fastening Reinforcing Steel

Prior to placing reinforcement, all grease, dirt, mortar, and any other foreign substances shall be removed.

Loose rust and loose millscale on uncoated reinforcement shall be removed by wire brushing.

Steel reinforcement shall be placed in the position indicated in the contract documents and within the
allowable tolerances specified. Before concrete is placed, all reinforcement shall be securely fastened and supported with approved chairs or other approved devices.

D. Inspection. Concrete shall not be placed until the reinforcing steel is inspected, placement of the steel meets applicable tolerances, and permission for placing concrete is granted by the Engineer. All concrete placed in violation of this provision will be rejected and removed.

556-3.02 Steel Fabric Reinforcement.

A. Field Repair of Coatings. Field repair will not be required on areas of minor damage. Minor damage is defined as any defect or break in the coating less than 6 mm x 6 mm. The maximum number of unrepaired minor damaged areas shall not exceed an average of six (6) per 300 millimeters of wire.

Reinforcing fabric having coating damage exceeding the above criteria shall be rejected and immediately removed from the work site.

B. Placement. Steel fabric reinforcement shall be placed as shown in the contract documents. Unless otherwise noted in the contract documents, steel fabric reinforcement shall be overlapped a minimum of the distance between adjacent wires in the panel. Overlapping panels of steel fabric reinforcement shall be wired together to ensure that the location and overlap of the mesh panels is maintained during concrete placement.

556-3.03 Bar Reinforcement

A. Field-Bending. The bar reinforcement shall be bent to the shapes shown in the contract documents. Unless shown otherwise in the contract documents or below, the radii of bends, measured to the inside face of the bend, shall be greater than, or equal to, three times the diameter of the bar. Bends in stirrups shall be greater than, or equal to, the diameter of the bar.

1. Uncoated Bar Reinforcement. When bars are heated for field-bending they shall not be heated to a temperature higher than that producing a dark cherry-red color. Only competent personnel shall be employed and proper equipment provided for cutting and bending.

2. Epoxy - Coated Bar Reinforcement. The alternatives of shop bending or field-bending of epoxy-coated bar reinforcement will be at the option of the Contractor. Field-bending shall be done by cold methods only.

Field-bending operations will be allowed only when ambient and bar temperatures are 5°C or greater. When lower temperatures prevail, the Contractor may supply, for field-bending operations, a fully enclosed space that is heated. Direct heating of the bars shall not be permitted.

Epoxy coatings damaged by field-bending work shall be evaluated and repaired or replaced, in accordance with the requirements of §556-3.03 B.1 Epoxy-Coated Bar Reinforcement.

3. Galvanized Bar Reinforcement. The galvanized bar reinforcement shall be shop bent before galvanizing. Up to 5% of the mass of bars may be field bent to replace missing, damaged, or incorrectly fabricated bars. Field-bending shall be done by cold methods only. When bending galvanized bar reinforcement size 22 and greater, the minimum bend radius measured to the inside face of the bend shall be increased to 4.5 times the bar diameter. For bars numbered 43 and 57, increase the bend radius to 5.5 times the bar diameter.

Field-bending operations will be allowed only when ambient and bar temperatures are 5°C or greater. When lower temperatures prevail the Contractor may supply, for field-bending operations, a fully enclosed space that is heated. Direct heating of the bars shall not be permitted.

The ends of bars cut after galvanizing shall be coated with zinc repair material following the procedures of §719-01, Galvanized Coatings and Repair Methods except that repair materials containing aluminum shall not be permitted.

Galvanizing damaged by field-bending work shall be evaluated and repaired, or replaced, in accordance with the requirements of §556-3.03 B.2 Galvanized Bar Reinforcement.
4. **Stainless-Steel-Clad Bar Reinforcement.** The stainless-steel-clad bar reinforcement shall be shop bent or field bent as shown in the contract documents. All ends of the bar reinforcement where the mild steel core is exposed shall be capped by one of the following:

a. Heat-shrink cap applied in accordance with the cap manufacturer’s instructions.
b. Neoprene cap adhered with silicone or epoxy sealant.
c. Stainless steel cap epoxied in place.
d. Stainless steel seal weld.

The stainless-steel-clad bar reinforcement will be shop bent or field bent as shown in the contract documents. When shop bending is required, up to 5% of the mass of bars may be field bent to replace missing, damaged, or incorrectly fabricated bars. Field-bending shall be done by cold methods only.

5. **Stainless Steel Bar Reinforcement.** The stainless steel bar reinforcement shall be shop bent or field bent as shown in the contract documents. When shop bending is required, up to 5% of the mass of bars may be field bent to replace missing, damaged, or incorrectly fabricated bars. Field-bending shall be done by cold methods only.

**B. Field Repair of Coatings**

1. **Epoxy-Coated Bar Reinforcement.** The Contractor will be required to field repair damaged areas of the bar coating, and to replace bars exhibiting severely damaged coatings. The material used for field repair shall be that supplied by the coating applicator.

   Field repair will be required on all areas of major damage. Major damage is defined as any defect or break in the epoxy coating 6 mm x 6 mm or greater. The total number of all major damaged areas which have been repaired with patching material shall not exceed five (5) in any three-meter length of bar.

   Field repair will not be required on areas of minor damage. Minor damage is defined as any defect or break in the coating less than 6 mm x 6 mm. The maximum number of unrepaired minor damaged areas shall not exceed an average of six (6) per 300 mm on any individual bar.

   A reinforcing bar having coating damage determined by the Engineer to exceed the above criteria shall be rejected and immediately removed from the work site. All such bars shall be replaced, in kind, by the Contractor at no additional cost to the State.

2. **Galvanized Bar Reinforcement.** The Contractor shall field repair damaged areas of the bar coating, and replace bars exhibiting severely damaged coatings. Severe damage is defined as more than five (5) 6 mm by 6 mm or larger areas in a three-meter length. The material and procedures used for field repair shall meet the requirements of §719-01, Galvanized Coatings and Repair Methods, except that repair materials containing aluminum shall not be permitted.

**C. Splices.** Splices will be permitted only where shown in the contract documents. Should the Contractor desire to splice bars at locations other than those shown in the contract documents, written permission to do so shall first be obtained from the DCES. Such permitted splices shall be well distributed or located at points of low tensile stress. Splices shall not be permitted unless a minimum of 50 mm can be provided between the splice and the nearest adjacent bar.

   Splices for bar sizes No. 36 or smaller, shall be made by means of a mechanical connector or by placing the bars in contact and wiring them together for the full length of the splice. Splices for bars larger than No. 36 shall be made by use of a mechanical connector unless welding is specifically required by the contract documents. Mechanical connectors shall be installed in accordance with the manufacturer’s written requirements.

   Arc-welded splices shall be made and will be inspected in accordance with the provisions of the SCM.

   Prior to welding of epoxy-coated reinforcing bars, the epoxy coating shall be removed for the length to be welded plus 150 mm on each side of the weld. After welding, the spliced area shall be
cleaned in accordance with SSPC - Surface Preparation Specification No. 6 (SSPC-SP6), Commercial Blast Cleaning. The surface shall be blast cleaned to SSPC-SP6 Commercial Blast Cleaning standard.

Photographs in SSPC-VIS 1, Guide And Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning, for B SP6, C SP6, D SP6, G1 SP6, G2 SP6, or G3 SP6, can be used as a guide to identify the desired cleaning, depending on the initial condition of the steel. However, the written standard for SP6 will be the primary means to determine conformance with blast-cleaning requirements. The photographs shall not be used as a substitute for the written standards. A compatible epoxy repair material supplied by the coating applicator shall be applied to the spliced area and overlap the original coating by 150 mm. The epoxy repair material shall be applied the same day as the cleaning.

Prior to welding galvanized bar reinforcement, the zinc coating shall be removed for the length of the weld plus 50 mm on each side of the weld. Cleaning shall be the same criteria as for epoxy-coated reinforcing. Coating repair shall be in accordance with the requirements of §556-3.03 B.2 Galvanized Bar Reinforcement.

D. Placement in Structural Slabs. Bar supports shall be spaced no farther apart than 1.2 m center-to-center, nor shall any bar support be closer than 150 mm from the edge of any future concrete surface. Bridge slab bar reinforcement shall be placed in accordance with the following tolerances:

Vertical  ± 6 mm
Horizontal  ± 13 mm

The structural slab bar reinforcement mats (top and bottom) shall be securely connected together. This connection shall be accomplished by wiring or other means approved by the Engineer. Connections shall be placed no farther apart than 1.2 m on center. The bar supports may be utilized for this purpose. Connecting devices shall neither deflect the bar reinforcement nor interfere with the smooth flow of concrete.

Immediately prior to placement of concrete, the Engineer will verify that the reinforcing steel is positioned within the above-stated tolerances.

Subsequent to placement of concrete, the Engineer will verify, at random, that the vertical clear distance from the top of the structural slab to the top mat of main reinforcing, as shown in the contract documents, is correct within a tolerance of plus or minus 13 mm. If the allowable tolerance is exceeded, the Engineer will reject the work and so advise the Contractor and the DCES, in writing, stating the deficiencies upon which the rejection is based. The DCES will review the nature and extent of the deficiencies and shall designate one or more of the following alternatives:
1. The affected concrete placement shall be removed and replaced in whole or in part.
2. The Contractor shall provide special corrective measures as directed by the DCES.
3. The concrete placement shall be accepted without corrective action.

556-3.04 Stud Shear Connectors for Bridges. Stud shear connectors shall be shop or field welded to the structural steel members at the locations indicated in the contract documents. This work shall be done in accordance with the provisions of the SCM.

556-4 METHOD OF MEASUREMENT

556-4.01 Steel Fabric Reinforcement. The quantity of steel fabric reinforcement satisfactorily installed will be measured for payment as the number of square meters of overall surface area of the deck or structure shown on the contract documents, not including clear distance to the edges, measured to the nearest whole square meter. No subtractions will be made for holes smaller than one-half of a square meter, and no additional payment will be made for overlaps.

556-4.02 Bar Reinforcement. These will be measured as the number of kilograms of steel bars placed. The mass of bar reinforcing will be computed by the Engineer utilizing the unit mass for each size bar as given in Table 556-1. No allowance will be made for the mass of any coating on the bars.
TABLE 556-1 UNIT MASS OF DEFORMED BARS

<table>
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<tr>
<th>Bar Number</th>
<th>10</th>
<th>13</th>
<th>16</th>
<th>19</th>
<th>22</th>
<th>25</th>
<th>29</th>
<th>32</th>
<th>36</th>
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<tr>
<td>Mass</td>
<td>(3)</td>
<td>(4)</td>
<td>(5)</td>
<td>(6)</td>
<td>(7)</td>
<td>(8)</td>
<td>(9)</td>
<td>(10)</td>
<td>(11)</td>
<td>(14)</td>
<td>(18)</td>
</tr>
<tr>
<td>(kg/m)</td>
<td>0.560</td>
<td>0.994</td>
<td>1.552</td>
<td>2.235</td>
<td>3.042</td>
<td>3.973</td>
<td>5.060</td>
<td>6.404</td>
<td>7.907</td>
<td>11.38</td>
<td>20.24</td>
</tr>
</tbody>
</table>

NOTE. Numbers in parenthesis are bar sizes in numbers of eighths of inches.

556-4.03 Stud Shear Connectors for Bridges. Stud Shear Connectors will be measured as each connector placed.

556-5 BASIS OF PAYMENT

556-5.01 Steel Fabric Reinforcement. The unit price bid per square meter will include the cost of all labor, materials, and equipment necessary to complete the work. The removal of the concrete placement and its subsequent replacement, or other corrective work which the Contractor is directed to perform, shall be accomplished at no additional cost to the State. No additional payment will be made for the replacement of defective fabric or the replacement of fabric with defective coatings.

556-5.02 Bar Reinforcement. The unit price bid per kilogram shall include the cost of all labor, materials, and equipment necessary to complete the work. The unit price shall also include the cost of chairs, supports, fastenings, connections, and splices not specifically shown in the contract documents. If the Engineer permits the substitution of larger bars than those specified, or the DCES permits splices not shown in the contract documents, payment will be made only for the amount of steel which would have been required if the specified size and length had been used. No additional payment will be made for enclosures constructed for bending of bars or for replacement of defective bars or for replacement of bars with defective coatings.

556-5.03 Stud Shear Connectors for Bridges. The unit price bid per stud shall include the cost of all labor, materials, and equipment necessary to complete the work. If the use of any stud shear connector requires payment of a royalty to the manufacturer, the royalty shall be included in the unit price bid for this work.

Payment will be made under:

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<tr>
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<td>556.0102</td>
<td>Epoxy-Coated Steel Fabric Reinforcement</td>
<td>Square Meter</td>
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<td>556.0201</td>
<td>Uncoated Bar Reinforcement for Concrete Structures</td>
<td>Kilogram</td>
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<td>Epoxy-Coated Bar Reinforcement for Structures</td>
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<tr>
<td>556.03</td>
<td>Stud Shear Connectors for Bridges</td>
<td>Each</td>
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SECTION 557 - SUPERSTRUCTURE SLABS, SIDEWALKS ON BRIDGES, AND STRUCTURAL APPROACH SLABS

557-1 DESCRIPTION. The work shall consist of placing high performance (Class HP) concrete to construct superstructure slabs, sidewalks, safety walks, and structural approach slabs, as required by the contract documents.

557-2 MATERIALS

557-2.01 General. The materials used for superstructure slabs, sidewalks on bridges, and structural approach slabs shall meet the material requirements of the following subsections:
§557

557-2.02 Concrete. This shall meet the material requirements for Class HP in accordance with §501. Unless otherwise directed by the Engineer, all concrete shall contain a water-reducing and retarding admixture, meeting the requirements of §711-08. The quantity of the admixture shall be sufficient to achieve the minimum retardation consistent with placing conditions to keep the entire placement plastic (either one continuous placement or all sections of a sequence placement). The dosage rate used shall be determined by the Contractor in accordance with the manufacturer’s recommendation and in concurrence with the Regional Materials Engineer. The dosage shall remain consistent for the duration of the concrete placement except for minor adjustments to meet changing environmental conditions.

557-3 CONSTRUCTION DETAILS

557-3.01 Concrete Manufacturing and Transportation. The requirements of §501-3 shall apply.

557-3.02 Falsework. The requirements of §555-3.02 shall apply.

557-3.03 Forms. Unless otherwise noted the contractor may use any of the following forming systems to form the underside of the superstructure slabs:

A. Removable Forms. The requirements of §555-3.03A shall apply.

B. Permanent Corrugated Metal Forms for Superstructure Slabs. Where permanent metal forms are employed, the following construction procedures shall apply.

Care and protection shall be given the metal form sheets, supports, and accessory items during handling, shipping, and storage. During loading, hoisting, and unloading operations, extra precaution and care shall be taken to prevent damage to ends, corners, and edges of the form sheets, supports, and accessory items. If the form units and accessories are to be stored prior to installation, they shall not be placed in contact with the ground and the material shall be adequately covered or protected to keep it dry.

Form supports shall be placed in direct contact with the flange of a stringer or floor beam. All attachments shall be made by permissible welds, bolts, clips, or other approved means. The welding of form supports to steel not considered weldable or to portions of flanges subject to tensile stresses shall not be permitted. Welding shall be in accordance with the provisions of the New York State Steel Construction Manual (SCM) except that 3 mm fillet welds will be permitted. All welding shall be performed by a welder certified under the SCM.

Form sheets shall not be permitted to rest directly on the flanges. They shall be securely fastened to form supports by self-tapping screws and shall have a minimum bearing length of 25 mm at each end. Transverse construction joints shall be located at the bottom of a flute and 6 mm weep holes shall be field drilled at not less than 300 mm on centers along the line of the joint.

Screed rail and pouring runway supports shall not be located directly on the form sheets, form supports, or reinforcing steel. No loose sheets or miscellaneous hardware shall be left on the structural slab at the end of the work day. Metal forms shall not be used where longitudinal slab construction joints are located between stringers, nor shall they be used on the fascia overhang.

The corrugated metal sheets shall be fabricated for the placement sequence used with the joints between sections of sheet overlapped or securely fastened to eliminate differential deflections between sections. Any exposed form metal where galvanizing has been damaged, shall be cleaned and repaired as provided for in §719-01, Galvanized Coatings and Repair Methods.

C. Prestressed Concrete Form Units. The applicable requirements of §555-3.03A and the Prestressed Concrete Construction Manual shall apply.

Form supports shall be placed in direct contact with the flange of the stringer. All attachments shall be made by permissible welds, bolts, or other means approved by the Engineer. The welding of
form supports to steel not considered weldable, or to portions of flanges subject to tensile stresses
will not be permitted. Welds and welding shall be in accordance with those portions of the SCM
concerned with fillet weld design, fillet weld details, general workmanship and technique, except that
3 mm fillet welds will be permitted. All welding shall be performed by a welder certified under the
SCM.

D. Restrictions. The following restrictions shall apply to all forms.

1. Fascia overhangs shall be formed with removable forms to provide a flat concrete surface.
2. A bay, constructed in stages such that a longitudinal joint is required, shall only be formed with
removable forms.
3. A haunch which rests upon an end diaphragm shall only be formed with removable or permanent
corrugated metal forms.
4. Prestressed concrete form units shall not be used where the design span is less than 1.5 meters
nor greater than 3.3 meters. The design span is equal to the beam spacing minus one-half the top
flange width.
5. Prestressed concrete form units may be restricted at the ends of some skewed spans. Refer to the
contract documents for details.
6. Prestressed concrete form units shall not be used on prestressed concrete box beam
superstructures unless specifically allowed by the contract documents.

557-3.04 Placing and Fastening Reinforcing Steel. Immediately prior to placement of
concrete, the Engineer will verify that the reinforcing steel is positioned within required tolerances. If
the allowable tolerances are exceeded, the Contractor shall correct the position of the reinforcing steel
before placing concrete. All reinforcing steel and chairs shall be anchored to prevent uplift.

A. Permanent Corrugated Metal Forms or Removable Forms. Except for prestressed
concrete form units the requirements of §556-3.01 and §556-3.03 shall apply.

B. Prestressed Concrete Form Units. The requirements of §556-3.01 and §556-3.03 shall
apply. The top reinforcing steel mat shall be securely connected to the forms and the stud shear
connectors. Connections shall be placed no farther apart than 1.2 meters on center. Connections to
the forms may be made to the form-lifting devices, reinforcing steel projecting from the forms, or
devices in the form supplied for this purpose. Hold-down devices shot into the form will not be
permitted. Connections shall neither deflect the reinforcing steel nor interfere with the smooth flow
of concrete.

557-3.05 Handling and Placing Concrete. The requirements of §555-3.04 Handling and Placing
Concrete shall apply. A Preplacement Meeting is required to be held at least one week prior to the start of
any concrete placement for superstructure slabs. Meeting participants besides the Contractor and Engineer
should include materials suppliers, subcontractors, Regional Materials Engineer, Regional Safety Officer,
and others as deemed appropriate. Participants will review all aspects of the proposed placement
including, but not limited to, the following:
- Equipment proposed for use and for backup.
- Planned workforce, assigned tasks of each designated position, and experience and expertise.
- Proposed construction techniques and crew experience.
- Safety considerations.
- Concrete mix design.
- Admixtures and technical data; dosage rates will be approved by the Regional Materials Engineer.
- Proposed placement rate, curing and loading schedules.
- Curing practices to be employed as well as the workforce designated to the curing process.
- Delivery/conveyance equipment, including deck finishing machine setup and operation.
- Traffic control.
For placements between September 15th and April 1st:

- Expected environmental conditions at time of placement and during curing
- Proposed curing methods to maintain acceptable curing temperature
- Engineers permission to progress cold-weather concreting

No concrete shall be placed until all aspects of the proposed placement are approved by the Engineer. A written report of the preplacement meeting will be established by the Engineer. Modifications shall be submitted in writing to the Engineer for approval. Further, for placements between September 15th and April 1st, no concrete shall be placed until all aspects of the proposed placement are approved by the Regional Construction Engineer.

Before concrete slabs are placed on steel spans, all permanent field connections shall be completed unless otherwise noted on the contract plans, and all temporary supports and mechanisms used in steel erection shall be removed.

No concrete shall be placed until all the provisions of §555-3.04A. Placement Limitations are met, environmental conditions are deemed favorable, and satisfactory means to mitigate adverse environmental conditions exist. Favorable environmental conditions are defined as an expected weather forecast suitable for concrete placement during the entire placement duration, the evaporation rate not to exceed 1.2 kg/m²/hr, and acceptable curing temperatures expected for the duration of the curing period.

The Contractor shall provide any necessary means to mitigate adverse weather conditions and curing temperatures. Failure to maintain acceptable environmental conditions will result in the concrete placement being stopped and a bulkhead put in place.

The Contractor shall take the necessary measurements and calculate the theoretical evaporation rate. The measurements for air temperature, relative humidity, and wind speed shall be taken as near as possible to the final placement location of the concrete.

Concrete temperature will be taken from the same sample used for slump and air content tests. These measurements will be taken prior to commencement of concrete placement. If, in the Engineer's opinion, significant changes occur in atmospheric conditions, additional atmospheric measurements and calculations by the Contractor will be required. The Contractor shall supply all instruments necessary to make the required calculations. All instruments shall be approved by the Engineer, as being in good working order. The Contractor’s measurements and calculations will be subject to the Engineer's approval. To determine the evaporation rate, apply the values taken for relative humidity, plastic concrete temperature, air temperature, and wind velocity to Figure 557-1 Structural Concrete Evaporation Rate.

The placing of concrete for any bridge slab shall be continuous between joints. Conveyance of concrete shall meet the requirements of §555-3.04B.

Vibrating of concrete shall be in accordance with §555-3.04E except the number of vibrators required shall be one for every 30 cubic meters of concrete placed per hour, with a minimum of two vibrators in use at all times, and equally spaced across the placement front. One additional vibrator shall be available for use as a backup.

557-3.06 Cold Joints. “Cold Jointing,” the bonding of fresh concrete to set concrete, shall be done where indicated in the contract documents, or where approved by the DCES.

A. Horizontal Joints. Within 24 hours of the start of the placement, the hardened concrete shall have laitance and dirt removed by a high-pressure water wash. The high-pressure water wash shall be sufficiently strong to remove any laitance and dirt, but not damage the reinforcement or reinforcement coating. The pressure wash equipment shall be capable of providing pressure of 21 MPa to 35 MPa.

After pressure washing, the concrete shall be continuously wetted for a minimum of 12 hours immediately prior to deck placement. Before placing fresh concrete, all standing water shall be removed with oil-free compressed air. The surface shall be protected from drying to maintain a clean, saturated surface dry condition when placing the new concrete.

If the tops of precast/prestressed elements have been sealed with a penetrating sealer, pressure wash the tops a maximum of 2 hours prior to concrete placement. The requirement for prewetting is waived.
§557

B. Construction Joints. The requirements of § 555-3.06 A. shall apply. Construction joints shall be placed only where shown in the contract documents or where permitted by the DCES.

In the event an ongoing placement is delayed excessively, the establishment of a bulkhead shall be required.

557-3.07 Finishing Integral Wearing Surfaces on Superstructure Slabs. Machine finishing shall be used throughout all superstructure concrete placement operations with the exception of areas which are inaccessible to finishing machines.

Machine finishing shall be accomplished with an approved power-driven, one-operation (strike-off and finishing) machine. The finishing machine shall have a strike-off auger set 6 mm to 13 mm above the finished surface, a power-driven roller or oscillating type screed, and a pan float.

Finishing machines shall be equipped with adjustable strike-off and finishing screeds, the bottom surfaces of which shall be adjusted to produce the required contour of the finished surface. Machines shall be kept in true adjustment. Machines out of adjustment shall not be used until proper adjustments have been made and the adjustments have been approved by the Engineer.

The specific method and equipment that the Contractor proposes to use for finishing will be supplied during the Preplacement Meeting and will be subject to approval by the Engineer based on the above listed requirements.

Finishing machine rail supports shall be accurately set and of substantial construction so that the finished deck surface will conform to the profile and transverse sections shown in the contract documents. Finishing machine rail supports shall be placed and adjusted to properly provide for the deflection of forms, falsework, and structural supporting members which will occur during the placement of the concrete. Finishing machine rail supports shall not be attached by welding to portions of flanges subject to tensile stresses. The finishing machine rail supports shall be spaced at a maximum of 600 mm on center. During stage construction, the support system shall be on the stage being placed.

Where the deck surface falls outside the fascia stringer flange, the finishing machine rail supports shall be placed on the forms. The forms shall be designed to take these loads through the use of outriggers or some other approved means.

Prior to commencing concreting operations, the finishing machine shall be given a test run over the full length of the superstructure segment to be paved, with the finishing machine adjusted to its finishing position. While operating the finishing machine during this test, the finishing machine rails shall be checked for deflection and proper adjustment, the cover on slab reinforcement measured, and the controlling dimensions of slab reinforcement and forms checked. All necessary corrections shall be made and verified by the Engineer before concreting is begun.

A sufficient amount of concrete equal to the finishing machine capacity shall be supplied at all times. After the concrete has been placed, spread, and consolidated to provide a uniformly dense structural slab, the surface shall be struck off immediately by a single passage of the transverse finishing machine. The finishing machine shall carry sufficient concrete in front of the screed to fill low and porous places. This operation shall be done only once and shall produce a uniformly consolidated dense smooth surface of the required contour. The passage of the strike-off auger shall provide a concrete surface slightly above grade so that after settlement, if any, and the disappearance of excess water from the surface, the passage of the finishing screed will result in a uniform surface at the required grade and contour over its entire area, and provide the required cover over reinforcing.

In areas which are inaccessible to finishing machines, use of approved manual vibratory equipped power screeds may be used, with written approval of the DCES.

Hand finishing shall be allowed only in areas inaccessible to finishing machines or manually driven vibratory-equipped power screeds. Hand finishing shall be permitted in the same sequence and manner as machine finishing, unless otherwise permitted by the Engineer. Hand finishing shall be performed in such a manner as to produce a concrete surface with quality and uniformity identical to that produced by the finishing machine. Hand screeds or bullfloats shall be magnesium and 250 mm, or more, in width. Care shall be taken not to overwork the concrete surface during any finishing operation.

In the event the placement is delayed as a result of equipment breakdowns or delivery problems, all concrete in place shall be protected from evaporation by covering the surface with wet burlap, curing blankets, or plastic sheets. Excessive delays shall require the establishment of a bulkhead and the ceasing of the placement.
Prior to texturing, the finished concrete surface shall be examined by the Contractor and the Engineer using a straightedge. The straight-edge shall not be less than 3 m long. It shall be furnished by the Contractor and maintained in good, usable condition at the placement site at all times. While the concrete is still plastic, surface depressions shall be filled with concrete of the same class as the placement in progress. Surface irregularities greater than 5 mm in 3 m in either the longitudinal or the transverse direction shall be corrected in a manner acceptable to the Engineer. Thin mortar or laitance, which may have accumulated ahead of the finishing machine screed, shall be removed from the work site. They shall not be used to fill depressions.

After finishing, the surface shall be given a suitable texture with an artificial turf drag made of molded polyethylene with approximately 64,000 synthetic turf blades per square meter, each approximately 13 mm long. The artificial turf drag shall be of a type and brand appearing on the Department's Approved List.

The Contractor may apply texture in a transverse direction, longitudinal direction, or parallel to the finishing machine. Once begun, the direction of texturing shall not change. All texturing shall be done from a work bridge immediately following the finishing operation. Texturing shall be done prior to the beginning of curing operations. Only one pass of the turf drag over the finished area will be permitted.

If texturing is done in a transverse or skewed direction, the Contractor shall texture by hand methods immediately after finishing machine passage.

If texturing is done in the longitudinal direction the turf drag shall be a seamless strip and shall be attached to the work bridge such that the surface of the concrete is textured immediately after finishing machine passage. Small areas, otherwise inaccessible to the attached drag, may be textured by hand methods. Texture resulting from the drag shall stop within 300 mm of curbs.

The finishing movement and resulting progress of the turf drag shall be done in a manner so as to prevent ridges or gouges forming in the concrete surface. The drag shall be weighted and the contact area changed as required to produce an acceptable texture. The drag shall be cleaned periodically to remove all hardened concrete particles.

557-3.08 Finishing Integral Wearing Surfaces on Structural Approach Slabs. The requirements of §557-3.07 shall apply together with the following:

The Contractor may use an approved, manually driven, vibrator-equipped power screed in lieu of a power-driven transverse finishing machine. Only screed model types appearing on the Department's Approved List shall be employed for this work. The Engineer may require the use of a power-driven finishing machine if satisfactory results are not being attained.

557-3.09 Finishing Surfaces to be Overlaid with Portland Cement or Asphalt Concrete.

Machine finishing shall be used throughout all superstructure concrete placement operations, with the exception of areas which are inaccessible to finishing machines. In areas which are inaccessible to finishing machines, use of approved manual vibratory equipped power screeds may be used, with written approval of the D.C. E. S.

Surfaces shall be finished to a surface tolerance of 10 mm in 3 meters. The surface tolerance shall be verified by the Engineer with an approved straightedge not less than 3 meters long. The straightedge shall be furnished by the Contractor who shall maintain it in good condition at the paving site at all times.

Hand finishing shall be allowed only in areas inaccessible to finishing machines or manually driven vibratory-equipped power screeds. Hand finishing shall be performed in the same sequence and manner as machine finishing, unless otherwise permitted by the Engineer. Hand finishing shall be performed in such a manner as to produce a concrete surface with quality and uniformity identical to that produced by the finishing machine. Hand screeds or bullfloats shall be magnesium and 250 mm, or more, in width. Care shall be taken not to overwork the concrete surface during any finishing operation.

Upon completion of screeding, surfaces which will be overlaid with portland cement concrete shall be textured to conform to §557-3.07.

557-3.10 Sidewalk and Safety Walk Finish on Bridges. Sidewalks and safety walks shall be constructed by placing concrete continuously to an elevation slightly higher than shown in the contract documents. The concrete shall then be screeded to the correct elevations and worked with a magnesium float to give uniform surface. Floating shall be kept to a minimum, consistent with the desired finish, in
order to avoid overworking the concrete. Follow floating with a broom finish. Surface scoring will not be permitted.

FIGURE 557-1 STRUCTURAL CONCRETE EVAPORATION RATE

To use this chart:
1. Enter with air temperature, move up to relative humidity.
2. Move right to plastic concrete temperature.
3. Move down to wind velocity.
4. Move left to read approximate rate of evaporation.

557-3.11 Curing. After finishing and plastic-concrete texturing operations are completed, the concrete surface shall be completely covered with clean, prewetted burlap. The allowable time period for wet burlap covering shall not exceed five minutes from the completion of texturing, and 30 minutes from the time of concrete placement. Care shall be taken so as not to damage the finished surface and texturing. The curing shall not be delayed beyond the specified period. Burlap shall be lapped a minimum of 300 mm. Lapped edges are not required to be sealed. Burlap shall be thoroughly saturated over its entire surface area and shall be drained of excess water prior to its application. Burlap shall be kept continuously wet, commencing 10 minutes from the time the wet burlap is placed, and protected from displacement. The Contractor may cover the wet burlap and soaker hoses only if it is necessary to maintain curing temperature.

The curing period shall begin only after all concrete for a given placement is complete. A curing day is defined as any day during which the ambient air temperature at the concrete surface is 7°C or higher for the entire day.
Conditions may occur which prevent an entire day from qualifying as a curing day, but do not prevent portions of that day from reaching temperatures that qualify as curing temperatures. If these conditions occur and with the Engineer's approval, the Contractor may aggregate curing hours. A curing hour is defined as any hour during which the curing temperature remains at, or above 7°C.

An aggregation of 24 curing hours will be credited as one curing day. Aggregations of less than 24 curing hours will not be credited.

Curing hours will be determined with continuous recording thermometers. The number and placement of the thermometers will be determined by the Engineer. Thermometers used to monitor curing temperatures shall consist of the following types:

1. Continuously Recording Thermometer. The thermometer shall be capable of continuously recording temperatures within a range of -20°C to 50°C for a minimum of 24 hours.
2. Maximum - Minimum Recording Thermometer. For all placements the thermometer shall be capable of recording maximum and minimum temperatures in a range of -20°C to 50°C.

The curing temperature of concrete is the air temperature at the concrete surface, or the air temperature between the concrete surface and its protective covering. Temperatures at these locations are critical for proper concrete curing. For the purposes of this section the temperatures at the foregoing locations shall be maintained between 7°C and 30°C inclusive.

A. Superstructure Slabs. After the burlap placement has been fully completed, the concrete surface shall be cured for 14 curing days. The Contractor may use either option listed below. After seven curing days, the Contractor may be permitted to perform incidental work on the structure under the loading limitations of §557-3.14 Loading Limitations for Superstructure Slabs. The burlap may be displaced in limited areas, for short durations, to perform items such as sawcut grooving, placement of sidewalks, safety walks, curbing, bridge rail, and fencing. The amount of burlap displaced to perform these operations shall be limited to the immediate area affected by the Contractor's operations. All concrete surfaces exposed during these operations shall be kept in a saturated condition. Immediately after the work is completed in the affected area, all burlap shall be replaced for the duration of the curing period. Removable forms shall remain in place until the minimum curing period is complete.

1. Fourteen-Day Continuous Wetting. Leave all burlap in place for 14 curing days. Provide continuous, uniform wetting for the entire curing period.

2. Wet Burlap and Curing Covers. Provide continuous uniform wetting for seven curing days. After seven curing days, either of the following methods may be used:

   a. Remove all burlap after seven curing days. Apply curing covers immediately upon burlap removal. Plastic-coated fiber blankets are not required to be laid dry. Application and maintenance of covers shall be in accordance with §555-3.08A General. Concrete cured in this manner shall not be exposed to the atmosphere for more than 10 minutes between burlap removal and curing cover placement.
   b. Apply curing covers directly over the wet burlap. Plastic-coated fiber blankets are not required to be laid dry. Application and maintenance of covers shall be in accordance with §555-3.08A General. The concrete surface shall be inspected periodically to ensure that its condition remains saturated.

The Contractor shall inform the Engineer of the intended curing procedure at the Preplacement Meeting.

B. Structural Approach Slabs, Curbs, Sidewalks and Safety Walks on Bridges. After the burlap placement has been fully completed, leave all burlap in place for 7 curing days. Provide continuous, uniform wetting for the entire curing period. Forms for curbs, sidewalks, and safety walks shall remain in place until the minimum curing period is complete. Forms for structural approach slabs shall remain in place until sufficient strength is achieved to avoid damage to the
557-3.12 Provisions for Concreting in Cold Weather. When permission is granted in writing by the Regional Construction Engineer for cold-weather concreting between September 15th and April 1st, curing temperatures shall be maintained in accordance with §555-3.08C Provisions for Curing in Cold Weather, except as modified here:

- The curing duration shall be 14 days.
- The use of external heat to maintain curing temperatures is required. All concrete surfaces within the heated areas shall be protected from drying by the use of live steam or use of burlap that is continuously wetted.
- Continuously recording thermometers shall be placed on both the top and underside of the deck to monitor areas where extreme cold or heat can be expected.
- The temperature differential between any two locations within the heated enclosure shall not be more than 15°C.
- Upon completion of curing, concrete shall be air dried for 14 days before being exposed to freezing temperatures. Once the drying period is complete, temperatures shall be gradually reduced at a rate not to exceed 0.5°C/hr until the temperature within the enclosure equals the temperature outside the enclosure.

557-3.13 Removal of Forms. Removal of forms for superstructure slabs shall meet the requirements of §555-3.09 Form Removal and as modified herein. The minimum curing period prior to form removal is 10 curing days, except that for cold weather concreting a minimum of 14 curing days is required unless minimum compressive strengths are achieved as determined by the D.C. E. S. A curing day is defined in §555-3.08A. Permanent field connections, if required, shall be made on the same day prior to removal of forms and falsework.

The following inspection procedures will be used as a check to insure the soundness of the concrete structural slab adjacent to the steel forms. Not less than two days after completion of a concrete structural slab pour, but prior to the next slab pour, the Contractor shall remove a section of the steel form from the most recently completed pour of each span, at a location selected by the Engineer, in order to provide visual evidence that the concrete mix or the construction procedures are obtaining the desired results. If either the concrete mix or the construction procedures are varied significantly within a pour, such as a change in the extent of vibration or change in the workability of the mix, the Contractor shall remove another section of form to verify that the new procedures yielded desirable results.

After the concrete has been placed in a span for a minimum of ten days but prior to any further work performed on the superstructure in that span, the Engineer will spot-check the underside areas of the steel forms by sounding with a suitable-weight hammer at least 50% of the area of at least 25% of the individual form panels on a random basis to determine whether any honeycomb or void areas exist. If such areas are detected, the Contractor shall remove the forms from these areas for a visual inspection of the slab.

The amount of sounding and form removal may be reduced after a substantial amount of slab has been constructed and inspected, if the Contractor's methods of construction and the results of the inspections as outlined above indicate that sound concrete is present throughout the slabs.

If, after removing a section of form, the concrete is found to be defective, additional panels shall be removed. All defective concrete shall be repaired to match the adjacent concrete in section and color.

The form sections shall be removed by a metal saw or air-carbon-arc gouging with minimum damage to the concrete. Cuts shall only be sufficiently deep to sever the form. Any other method of removal shall be submitted to the Deputy Chief Engineer (Structures) for approval. Cuts that are parallel to the concrete. After removal of approach slab forms, the formed surfaces shall be cured as per the requirements of §555-3.08A.
corrugations in the forms shall be located on the sloping surface midway between a crest and a valley. Cuts parallel to the supporting beams shall be made through the supporting angles taking care not to damage the structural steel beams. The Contractor will not be required to replace the removed forms.

The Contractor shall provide all the facilities required for safe, suitable and convenient means of access to the forms for the Engineer’s inspection.

557-3.14 Loading Limitations for Superstructure Slabs. Superstructure slabs, during the curing period, may be subjected to a vehicle load not to exceed nine metric tons, or a wheel load not to exceed three metric tons no sooner than seven curing days after placement. Full legal loading may commence using either of the following options:

A. Superstructure slabs may be subjected to full legal loads no sooner than 14 calendar days after completion of the curing period.
B. The Contractor may subject a superstructure slab to its full legal load upon completion of the curing period, or any day thereafter provided that the procedure below is followed:

1. The Contractor shall notify the Engineer at the Preplacement Meeting of the intention to subject the slab to full legal load prior to the 14th day after completion of curing.
2. During the slab concrete placement, the Engineer will cast two sets (pairs) of test cylinders in addition to each set cast for record and cure the cylinders on site in the same manner as the superstructure slab.
3. The Engineer will forward cylinders to the Materials Bureau or Regional Testing Facility. One set will be tested fourteen calendar days after placement and, if necessary, the second set will be tested twenty-one calendar days after concrete placement. Under no circumstances will cylinders be tested sooner than fourteen calendar days after the concrete placement they represent.
4. Concrete cylinder sets (pairs) designated for advance testing shall achieve an average compressive strength of 21 MPa, or greater, with individual cylinders having a compressive strength of 19.5 MPa, or greater.
5. Results of compression tests will be transmitted to the Engineer as soon as possible. The Engineer will inform the Contractor of the cylinder testing results and allow early loading if appropriate. If the required compressive strengths are not achieved, the requirements of §557-3.14A shall apply.

557-3.15 Loading Limitations for Structural Approach Slabs, Sidewalks, and Safety Walks on Bridges. The Contractor may subject structural approach slabs, sidewalks, and safety walks to their full legal load upon completion of the 7-day curing period.

557-3.16 Damaged or Defective Concrete. Damaged or defective concrete shall be defined by, and repaired in accordance with, the requirements of §555-3.13, Defective or Damaged Concrete.

Subsequent to placement of concrete, either before or after setting, the Engineer will verify at random that the vertical clear distance from the top of the structural slab to the top mat of main reinforcing, as shown on the contract plans, is correct within a tolerance of plus or minus 13 mm. If the allowable tolerance is exceeded, the Engineer shall reject the work so advise the Contractor and the Deputy Chief Engineer (Structures), in writing, stating the deficiencies upon which the rejection is based.

The Deputy Chief Engineer (Structures) shall review the nature and extent of the deficiencies and shall designate one or more of the following alternatives:

- The affected placement shall be removed and replaced in whole or in part.
- The Contractor shall provide special corrective measures as directed by the Deputy Chief Engineer (Structures).
- The concrete placement shall be accepted without corrective action.

After the concrete has hardened, the Engineer will examine it using the Contractor’s straightedge. Surface irregularities greater than 5 mm in 3 meters shall be corrected. Unless otherwise directed by the Regional Materials Engineer, the concrete used for repairs shall be of the same materials as that used for the original placement.

557-3.17 No Bar list provided. When no bar lists are provided in the contract documents the following shall apply:
1. At least thirty (30) days prior to fabrication of the reinforcement the Contractor shall submit a minimum of two copies of the bar lists and placement drawings showing the bar locations to the Engineer. The details of the bar list and placement drawings shall meet the requirements of the current edition of the Concrete Reinforcing Steel Institute’s publication Reinforcing Bar Detailing. Placement drawings shall be size “B”. Drawings and bar lists shall be clear and legible.

2. Requests for information or changes along with reasons shall be documented in a separate list.

3. The Engineer will transmit the documents to the designer for review for conformance with the design requirements in accordance with the Shop Drawing Approval process. The designer will not be checking lengths, number of bars, weights or bar marks. Corrections will be returned to the Contractor. When the documents are satisfactory they will be returned to the Contractor stamped “Approved In Conformance With Design Requirements”.

4. Partial submissions that require coordination with other drawings will not be accepted.

557-4 METHOD OF MEASUREMENT. The work will be measured for payment as the number of square meters of slab, sidewalk, or safety walk satisfactorily installed, measured to the nearest 0.1 square meters.

557-5 BASIS OF PAYMENT. The unit price bid per square meter shall include the cost of furnishing all labor, materials, and equipment necessary to complete the work. Unless otherwise provided, the unit price bid shall include the cost of furnishing and placing bar reinforcement, wire fabric for concrete reinforcement, copper flashing, flexible water stops, mechanical connectors where specified, sheet packing, water for wetting, joint sealing compounds, joint fillers, concrete curing materials, and the cost of screed rail supports and other brackets or braces necessary to support finishing machines.

If permanent metal forms are used, the cost of furnishing all facilities required for access, removing the permanent forms for inspection or repair purposes, painting the cut edges of the forms and repairing the concrete as required herein shall be included in the price bid for this work.

No extra compensation for corrective finishing or repairs to damaged or defective concrete will be paid.

Progress payments will be made on a per-span basis as follows:
Forty (40) percent of the area will be paid for after all reinforcing is properly placed. Forty (40) percent of the area will be paid for after the concrete has been properly placed and proper curing applications have been instituted. The remainder will be paid for after completion of all curing, and necessary corrective work.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
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</thead>
<tbody>
<tr>
<td>557.0101</td>
<td>Superstructure Slab with Integral Wearing Surface – Bottom Formwork Required – Type 1 Friction</td>
<td>Square Meter</td>
</tr>
<tr>
<td>557.0102</td>
<td>Superstructure Slab with Integral Wearing Surface – Bottom Formwork Required – Type 2 Friction</td>
<td>Square Meter</td>
</tr>
<tr>
<td>557.0103</td>
<td>Superstructure Slab with Integral Wearing Surface – Bottom Formwork Required – Type 3 Friction</td>
<td>Square Meter</td>
</tr>
<tr>
<td>557.0109</td>
<td>Superstructure Slab with Integral Wearing Surface – Bottom Formwork Required – Type 9 Friction</td>
<td>Square Meter</td>
</tr>
<tr>
<td>557.0501</td>
<td>Superstructure Slab with Integral Wearing Surface – Bottom Formwork Not Required – Type 1 Friction</td>
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<tr>
<td>557.0509</td>
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<td>557.07</td>
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<td>Superstructure Slab with Separate Wearing Surface –</td>
<td>Square Meter</td>
</tr>
</tbody>
</table>
§557

557.13 Class D Concrete

557.2001 Structural Approach Slab with Integral Wearing Surface – Type 1 Friction

557.2002 Structural Approach Slab with Integral Wearing Surface – Type 2 Friction

557.2003 Structural Approach Slab with Integral Wearing Surface – Type 3 Friction

557.2009 Structural Approach Slab with Integral Wearing Surface – Type 9 Friction

557.22 Structural Approach Slab with Separate Wearing Surface

557.30 Sidewalks and Safety Walks

SECTION 558 - LONGITUDINAL SAWCUT GROOVING OF STRUCTURAL SLAB SURFACE

558-1 DESCRIPTION. Sawcut grooves into the surface of a portland cement concrete structural slab at the locations indicated in the contract documents.

The Contractor is hereby notified that concrete curing requirements, combined with structural slab loading restrictions, may have a significant effect upon the specific time, relative to concrete placement, at which sawcut grooving may be performed. The Contractor shall be familiar with the limits imposed by these factors and conduct operations accordingly.

558-2 MATERIALS. Use multibladed wet saw cutting equipment using circular saw blades. The Engineer may allow the use of single blade, circular saw equipment, where it is determined such equipment is necessary to complete the work as required. The equipment the Contractor proposes to use will be subject to the approval of the Engineer, prior to use.

Use water which meets the requirements of §712-01.

558-3 CONSTRUCTION DETAILS. Sawcutting concrete produces silica dust. Include sawcutting of concrete in the Health and Safety Plan in accordance with the silica safety requirements of §107-05 L.4.

Start sawcutting only after the specified curing period has elapsed, unless otherwise allowed by the applicable specification.

Cut longitudinal grooves parallel to the centerline of roadway using a single pass. Space the center-to-center of grooves at 19 mm ± 2 mm. Cut all grooves rectangular in shape conforming to the following dimensions:

Width 2.5 mm (+ 0.5 mm, - 0.0 mm)   Depth 4 mm ± 2 mm

During the grooving operations, the Engineer will verify, at random, that the minimum groove depth is being achieved. Should the Engineer determine that minimum groove depth is not being achieved, the Contractor shall stop grooving operations and make all adjustments necessary to achieve the minimum depth.

Supply the Engineer with two (2) accurate, easily readable gauges with which to verify groove depth. Deliver the gauges and applicable manufacturer’s instructions for use, if necessary, no later than one week prior to the anticipated beginning of grooving operations.

Terminate grooves within the following limits unless otherwise indicated on the contract documents:

<table>
<thead>
<tr>
<th>Location</th>
<th>Closest Allowable Distance</th>
<th>Farthest Allowable Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drainage structure</td>
<td>100 mm</td>
<td>380 mm</td>
</tr>
<tr>
<td>Vertical face (curb or parapet), or face of railing (no curb)</td>
<td>100 mm</td>
<td>380 mm</td>
</tr>
<tr>
<td>Joint System (Dimension measured perpendicular to the centerline of the joint system)</td>
<td>100 mm</td>
<td>380 mm</td>
</tr>
</tbody>
</table>
§558

Using a self-contained system, continuously collect any slurry or debris created by the grooving operation such that it does not accumulate on the surface.

558-4 METHOD OF MEASUREMENT. The quantity will be measured as the number of square meters of structural slab satisfactorily grooved, measured between the faces of barrier, curb, or rail, and between the ends of the slabs, computed to the nearest whole square meter. No deduction will be made for areas left ungrooved near curbs, barriers, rails, joints, drainage structures, or other objects embedded in the slab.

558-5 BASIS OF PAYMENT. The unit price bid per square meter shall include the cost of all labor, materials, and equipment necessary to complete the work.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
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</thead>
<tbody>
<tr>
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<td>Longitudinal Sawcut Grooving of Structural Slab Surface</td>
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</tbody>
</table>

SECTION 559 (VACANT)

SECTION 560 - MASONRY

560-1 DESCRIPTION. Under this work the Contractor shall furnish and place masonry, with or without coping, of the type, shape, size, color and location indicated in the plans, proposal or as directed by the Engineer.

560-2 MATERIALS. Materials shall meet the requirements specified in the following subsections of 700 - Materials:

- Split Faced Concrete Brick 704-10
- Precast Concrete Coping 704-11
- Caulking Compound for Structures 705-06
- Premolded Resilient Joint Filler 705-07
- Masonry Mortar 705-21
- Bar Reinforcement - Grade 420 709-01
- Wire Fabric for Concrete Reinforcement 709-02
- Admixtures 711-08

560-2.01 Dimension Stone Masonry. All stone shall be sound, durable, free from reeds, rifts, seams, laminations and minerals which would cause discoloration or deterioration from weathering. The stone shall be of size, quality and color acceptable to the Regional Director. Duplicate samples of stone showing the complete color range shall be submitted to the Regional Director for approval. Stone shall be quarried so the stratification will be radial or parallel to the bed when set in place except where split face or seam face finish is called for on the plans. All beds and joints shall have a "Fine Point or Sawn Finish" for at least 50 mm from the arris lines. The balance shall not fall off from a straight line for more than 1/6 of the stone's minimum dimension. When stones project beyond adjoining faces, the fine pointing shall be carried at least 50 mm in from the adjoining surfaces (arris lines of stone or face of concrete).

Soffits of ring stones shall be cut to the curve of the arch and shall have a “Fine Point or Sawn Finish” unless otherwise shown on the plans. All other showing surfaces shall be finished as indicated on the plans.

On square bridges and on bridges where the skew is 30 degrees or less, the ring stones shall be cut so the joint sides are parallel to the faces of the abutments. On bridges with a skew greater than 30 degrees the ring stones shall be cut so the joint sides of each stone will be at right angles with the face. Soffit joints shall lie in a horizontal plane.

“Fine Point or Sawn Finish” shall be as described in §560-2.07, Definition of Finishes.
560-2.02 Split Faced Concrete Masonry. Split faced concrete masonry units shall be new, sound, durable, true to size, free from laminations and cracks, and uniform quality which complies with the requirements of §704-10. All split face concrete masonry units delivered to the site shall be of the sizes necessary to produce the wall pattern as indicated on the plans.

An approved mechanical self-leveling splitting machine with two steel knives, one directly above the other will be used for all field splitting. Four samples of each thickness of each split faced concrete masonry unit shall be submitted to the Engineer for tentative approval. They shall be labeled with the contract title and number, the Contractor's name, and manufacturer's name. The split faced concrete masonry units used in the work shall be equal in all respects, color, quality, texture and surface to the approved samples.

Anchors shall be a metal slot formed from sheet zinc not less than 0.5 mm in thickness, bent to form a dovetail channel 16 mm wide at the front, 25 mm wide at the rear, 25 mm deep and with wings 3 mm to 6 mm wide. The slots shall be provided with a felt insert to prevent the entrance of fresh concrete. These inserts shall be removed just prior to the insertion of the ties. Ties shall be formed of zinc not less than 2 mm thick, 25 mm wide with one end designed to fit snugly into the anchor slots and shall be crimped with corrugations 3 mm deep, but no less than 2 mm deep.

The ties shall be at least 100 mm long. The Contractor shall submit to the Engineer for tentative approval four samples of the material used to fabricate the ties, i.e. anchors, felt and ties.

560-2.03 Stone Masonry. All stone shall be sound, durable, properly quarried, free from reeds, rifts, seams, laminations and minerals which would cause discoloration from weathering. Samples of stone shall be submitted to and be approved by the Regional Director prior to the beginning of any work on this masonry. The size, color and quality of the stone delivered to the site shall be substantially in accordance with the approved samples.

The stones may have an average variation of 1/6 of the thickness shown on the plans, however, they shall have a minimum thickness of at least 2/3 that shown on the plans and a maximum thickness of 1/6 over the maximum thickness shown on the plans.

560-2.04 Rubble Stone Masonry. All stones shall be clean, free from structural defects and acceptable to the Engineer. Selected stones, roughly squared and pitched to line, shall be used at all angles and ends of walls.

560-2.05 Precast Concrete Coping. Precast concrete coping units shall be new, sound, durable, true to size, free from laminations and cracks and of uniform quality which complies with the requirements of §704-11.

560-2.06 Mortar. Use 705-21 Masonry Mortar.

560-2.07 Definition of Finishes. Finishes of stone or manufactured masonry units shall be defined as shown in Table 560-1.

560-3 CONSTRUCTION DETAILS

560-3.01 General. Masonry or precast concrete coping shall not be constructed when the ambient temperature is 5°C or below, or when the stone or masonry units contain frost, except by written permission of the Engineer and subject to any conditions the Engineer may require.

Stone, masonry units or coping units shall not be dropped upon or slid over existing masonry, nor shall hammering or turning of stones, masonry units or coping on the masonry be allowed. Stones, masonry unit or coping units shall be carefully set without jarring masonry already laid, and they shall be handled in a manner so as not to cause disfigurement.
### TABLE 560-1 MASONRY UNITS, SURFACE FINISH

<table>
<thead>
<tr>
<th>Finish Name</th>
<th>Maximum Surface Projection Beyond Pitch Lines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smooth Finish</td>
<td>2 mm</td>
</tr>
<tr>
<td>Fine Point or Sawn Finish</td>
<td>6 mm</td>
</tr>
<tr>
<td>Rough Finish</td>
<td>13 mm</td>
</tr>
<tr>
<td>Scabbed Finish</td>
<td>20 mm</td>
</tr>
<tr>
<td>Seam and Split Face</td>
<td>25 mm</td>
</tr>
<tr>
<td>Rock Face</td>
<td>1/10 the vertical height of the individual stone</td>
</tr>
<tr>
<td>Thermal Finish</td>
<td>6 mm</td>
</tr>
</tbody>
</table>

NOTE: All faces of Dimension Masonry shall extend to the pitch lines shown on the plans.

#### 560-3.02 Dimension Stone Masonry.

The provisions of §560-3.01 shall apply with the following additional requirements:

**A. Preparation of Stone and Bed.** Each stone shall be cleaned and thoroughly saturated with water before being set. The bed which is to receive the masonry shall also be cleaned and moistened.

**B. Bedding of Stone.** All stone shall be well bedded in mortar and settled in place with a suitable wooden maul before the setting of the mortar.

**C. Spalls not Permitted in Mortar Beds.** No pinning up of stones with spalls will be permitted, and no spalls will be permitted in beds.

**D. Expansion Joints.** All surfaces of stone in contact with expansion joint material shall be made smooth, unless otherwise shown on the plans. The joints shall be filled with premolded resilient joint filler and sealed with an approved joint sealer as shown on the plans, or as ordered by the Engineer.

All joints in concrete backing shall be made smooth, unless otherwise shown on the plans. The joints shall be filled with premolded resilient joint filler and sealed with an approved joint sealer as shown on the plans, or as ordered by the Engineer.

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In case any stone is moved or the joint broken, the stone shall be taken up, the mortar thoroughly cleaned from beds and joints, and the stone reset in fresh mortar.

Joints shall not be filled by pouring in a thin or liquid mortar.

**E. Pointing (new construction) and Tuck Pointing (raking out and repointing).**

1. **Pointing.** Tool the face joints with a pointing tool before the mortar sets, as approved by the Engineer. Avoid smearing the masonry surfaces with excess mortar forced out of the joints. For joints not pointed when the masonry is laid, prepare the joints for pointing by following the tuck pointing procedures. There will be no separate payment for this work.

2. **Tuck Pointing (Repointing).** Repoint the joints in masonry where indicated on the Contract plans or directed by the Engineer. Use an Item 705-21 Type M, S or N masonry or mortar cement, tuck pointing mortar (or a specially designed one) with the same or weaker strength than the original mortar, as approved by the Engineer.

Remove soft, loose, cracked and deteriorated mortar to a minimum depth (measured from the wall face) of twice the average joint width, and remove all deteriorated mortar beyond the minimum depth, as ordered by the Engineer. Do not damage the masonry during the removal process. Clean all contamination from the prepared joints.

Prior to repointing, flush with water and leave all surfaces to be re-mortared in a dampened, surface dry state. Pack the prepared joints in layers with mortar that closely matches the original...
color and texture, allowing each layer to become thumb-print hard before the next. Use at least two layers when the joint depth is twice the joint width. Apply a final layer thickness that does not exceed the joint width. When the final layer is thumb-print hard, finish with a pointing tool that recreates the original joint shape, or as approved by the Engineer.

Perform pointing when the ambient temperature is 5°C or above, and the masonry is frost free. Avoid recessed joints that hold water.

After the mortar sets, clean all mortar and cement stains from other surfaces. In direct sunlight, keep the newly pointed masonry moist for at least 3 days. In shade, moisten 2 to 3 times a day for at least 3 days.

**F. Drawings.** The contract plans show the general character of the masonry. Prior to the beginning of any work, the Contractor shall prepare and submit for the approval of the Regional Director, three sets of detail plans for all dimension masonry shown on the plans. The Contractor shall carefully check and assume full responsibility for the accuracy of this work. These detail plans will be examined and either approved or returned without approval to the Contractor, who shall check the indicated corrections and resubmit two sets of prints of revised details. When the detail plans have been approved, the Contractor shall furnish the Regional Director with three sets, one of which shall be reproducible. The drawings shall conform to the size and type of requirements for Shop Drawings set forth in the New York State Steel Construction Manual.

**560-3.03 Split Faced Concrete Masonry.** The provisions of §560-3.01 shall apply with the following additional requirements:

**A. Sample Wall.** The Contractor shall construct a split faced concrete masonry wall 2 m long and 1.2 m high of approved units and matching mortar at a location designated. This procedure shall be repeated until a sample wall is approved by the Engineer. The approved sample wall shall be maintained intact until the Engineer directs its removal.

In lieu of the field sample wall, the Contractor may show, for approval, a building constructed with units of the same type, color, texture and surface finish required. The field sample wall shall be required if the building masonry is not approved.

Upon approval of the sample wall or building, the Contractor shall furnish and lay split masonry to conform with the approved sample wall.

**B. Protection and Handling.** Split faced concrete masonry units shall be protected by a wrapping of 100 µm polyethylene, and shall be handled on pallets by mechanical means, or by hand or tongs. Dumping of the masonry units from trucks, wheel barrows or other conveyances is prohibited. Particular care shall be taken to protect all edges and the face of the masonry units. Distorted, laminated, checked or cracked masonry units will be rejected and removed from the site of construction.

On delivery to the site, the masonry units shall be neatly piled off the ground, on pallets or other approved implements, and protected from moisture by wrapping them with 100 µm polyethylene. Masonry units which become wet, shall not be laid in the wall until their conformance with the specifications for §704-10 is shown by tests. The cost of these tests shall be borne by the Contractor.

**C. Laying.** The split faced concrete masonry shall be laid up, in the pattern shown on the plans, by skilled masons and in a first-class manner. The masonry shall be laid true to line and grade in level horizontal beds and be properly anchored. Each masonry unit shall be laid in a full mortar bed and in a manner to form a full end joint in one operation. The space between the split face masonry and the supporting concrete shall be filled with mortar and rodded until the mortar rises to the top of the masonry unit as each unit is placed.

**D. Bonding.** The split faced concrete masonry shall be bonded to the supporting concrete. Dovetail anchors shall be continuous, set vertically and spaced on centers not exceeding 300 mm on the concrete walls. Ties shall be installed in the anchor slots at a maximum vertical height of 300 mm on centers.
§560

E. Joints. Joints in the exposed face shall be struck with a concave jointing unless otherwise specified. The joints shall be 10 mm wide and the concave jointing shall be 3 mm deep at the center.

F. Protection Against Weather. The split faced concrete masonry shall be protected against the action of the weather. The tops and at least 600 mm down the sides of all walls not completed shall be constantly protected with suitable waterproof covering properly secured in place during periods of suspended work. The facing shall be so protected until it has been bonded to the concrete wall and completely sealed against moisture. During hot dry weather, the masonry shall be protected from the sun and kept moist for at least three days after completion.

G. Protection Against Damage. Projections and angles exposed to damage shall be boxed or otherwise protected to prevent damage. Any units damaged during the progress of the work shall be replaced with new units at the Contractor's expense.

H. Cleaning of Exposed Faces of Mortar and Drippings. Exposed faces of split faced concrete masonry units shall be cleaned free of excess mortar and mortar drippings, as the work progresses, to prevent excessive rubbing during final cleaning operations.

I. Expansion and Contraction Joints. Expansion and contraction joints shall be constructed as shown on the plans. The surfaces of the joints shall be plumb, true to line and smooth to the caulking compound.

J. Final Cleaning. After the completion of adjacent work likely to soil the masonry, the split faced concrete masonry shall be thoroughly cleaned, removing all dirt, dust, mortar, stains, etc. The concrete masonry shall be brushed, while dry, with stiff fiber brushes. If this brushing does not clean the masonry to the satisfaction of the Engineer, then the Contractor shall clean the facing with soap powder in clean water applied with stiff fiber scrub brushes. After scrubbing with soap and water the Contractor shall rinse the masonry with clean water. The Contractor may, with the Engineer's approval, substitute a cleaning solution that will not harm the concrete or mortar joints. The cleaning operation shall in all cases start at the top and proceed downward.

K. Caulking. When the split faced concrete masonry has received the final cleaning, all expansion and contraction joints shall be filled at least 25 mm deep with caulking compound.

All surfaces to receive the caulking compound shall be clean, free of loose materials, dirt, dust, frost, moisture, oils, laitance or curing compounds and shall be primed with clear lacquer, shellac or the manufacturer's recommended primer after the surfaces have been cleaned. A bond breaker shall be used as a release material back of the caulking compound. The bond breaker may be polyethylene, specially treated bond inhibiting pressure sensitive tape or any approved equal. The caulking compound shall be tooled with a concave joint finishing tool to provide a neat smoothly finished joint of uniform width. Where solvents are required on the jointing tool, they shall be as recommended by the manufacturer of the caulking compound.

560-3.04 Stone Masonry. The construction provisions of §560-3.02 shall apply. The individual stones shall be trimmed, recut and dressed, as may be necessary at the site, to obtain a pattern in the finished wall which will be in character with the requirements of drawings, specifications and the approved sample wall.

The following general requirements will apply to the placing of stone masonry:

A. Cross-Joints, Steps or Ladders. There shall be no cross-joints, steps or ladders.

B. Subdivision of Rectangles. There shall be no subdivision of rectangles.

C. Stone Shapes. There shall be no unusually shaped stone.

D. Clusters. There shall be no clusters of stone of the same length and height.
§560

**E. Horizontal Joint Length.** There shall be no continuous horizontal joint greater in length than 3 meters.

**F. Vertical Joints.** There shall be no more than five stones abutting any one vertical joint.

**G. Stone Proportions.** There shall be no stone longer than six times its height nor shorter than one and one half times its height. The length of the average stone shall be three to five times its height.

**H. Horizontal Joints.** Horizontal joints shall not have a slope varying from the horizontal by more than one percent.

**I. Color.** Where stone masonry and dimension masonry are specified, for the same structure or in close proximity to each other, there shall be no great contrast in size or color between the Stone Masonry and the Dimension Masonry.

Prior to beginning the work the Contractor shall lay up a sample wall conforming to the requirements of §560-3.03A except that the material details for the work shall conform to those for Stone Masonry.

**560-3.05 Rubble Stone Masonry.** The provision of §560-3.01 shall apply with the following additional requirements:

The stone shall be laid to form substantial masonry presenting a neat, finished appearance. The minimum size of stone to be used shall be 100 mm in depth or rise, 230 mm in width, and 300 mm long. Spalls and pinners will not be allowed to show on the face of the work and shall be used otherwise only where necessary. All stones shall be soundly and completely bedded in the mortar. The length of stretchers shall not exceed three times their rise, and the width of stretchers shall in no case be less than one and one-half times their rise. At least one-fourth of the stones in the face shall be headers and shall be evenly distributed. The length of headers shall be not less than 810 mm nor more than the thickness of the wall, where the work is 1.2 m or less in thickness. Where the work is more than 1.2 m thick, the length of headers shall be not less than 810 mm. The width of headers shall be not less than their rise. All stones shall be laid to break joints 150 mm or more and to thoroughly bond the work. No joint in the face shall be over 25 mm in width. Backing shall be good-sized, well-shaped stones so laid as to break joints. Spaces between stones shall be filled with spalls set in mortar. The degree of roughness of exposed faces shall be measured with a two meter straight edge supported between adjacent projections on the stone face. Variations in the stone face, in excess of 100 mm, measured from the straight edge to the extreme depression in stone or mortar will not be permitted. Rear faces shall present approximately plane surfaces.

Pointing shall conform to the requirements of §560-3.02E.

**560-3.06 Rubble Stone Masonry Laid Dry.** The specifications of §560-3.05, Rubble Stone Masonry, shall apply except that no mortar shall be used and the requirements of §560-3.01 Construction Details (General), pertaining to frost shall not apply unless otherwise directed by the Engineer.

**560-3.07 Precast Concrete Coping.** The provisions of §560-3.02, Dimension Stone Masonry and §560-3.03, Split Faced Concrete Masonry, shall apply with exception of §560-3.02D, §560-3.03A, and §560-3.03D.

**560-3.08 Tuck Pointing.** Apply the provisions of §560-3.02E2 Tuck Pointing. For re-caulking work, rake out any old caulkimg to a minimum 25 mm depth and follow the provisions of §560-3.03K. Caulking. Do not damage masonry during the removal and cleaning process.

**560-4 METHOD OF MEASUREMENT**

**560-4.01 Dimension Masonry.** Dimension masonry will be measured as the number of square meters (including joints within the dimension masonry) measured on the plane of all the exposed surfaces of the dimension masonry incorporated in the work.
§560

560-4.02 Split Faced Concrete Masonry. Split faced concrete masonry will be measured as the number of square meters (including joints within the masonry and between the split faced concrete masonry and the concrete wall, and the mortar bed for precast concrete coping), on the plane of all exposed surfaces of the masonry incorporated in the work. Split faced masonry below the finished surface of the ground or paving shall be considered as exposed in computing the area for payment. The approved, constructed, split faced concrete masonry sample wall will be paid for as split face concrete masonry.

560-4.03 Rubble Stone Masonry. Payment for rubble stone masonry will be made for the number of cubic meters within the payment lines shown on the plans and placed in accordance with the specifications. Concrete, mortar or any joint material within these payment lines will, for the purpose of payment, be classified as stone masonry and will not be paid for under any other item.

560-4.04 Stone Masonry. Payment for stone masonry will be made for the number of square meters (including joints within the stone masonry) measured on the plane of all the exposed surfaces of the stone masonry incorporated in the work. Mortar joints between concrete and stone masonry will be paid for as stone masonry.

Stone masonry shown on the plans below the finished grade or sidewalk (to prevent the possible exposure of unfaced concrete) shall be considered as exposed in computing the payment area for this item.

2.5 square meters will be used in payment for the complete accepted sample wall required in this specification.

560-4.05 (Vacant)

560-4.06 Precast Concrete Coping. The quantity to be paid for will be the number of meters of precast concrete coping (including the joints between the coping units) placed in accordance with the plans, specification and orders of the Engineer.

560-4.07 Tuck Pointing. The Engineer will measure this work in the field as the number of square or linear meters of masonry pointed and cleaned, as bid. Linear measurements will be made along the joint centerline.

560-5 BASIS OF PAYMENT

560-5.01 Dimension Stone Masonry. The unit price bid per square meter shall include the cost of furnishing all labor, materials and equipment necessary to complete the work.

Concrete, dimension masonry, mortar or any joint material within the nominal thickness of the dimension masonry will, for the purpose of payment, be classified as dimension masonry and will not be paid for under any other item. Projections, if any, into the concrete beyond the nominal thickness of dimension masonry will be paid for as the class of concrete displaced by the stone. No deduction will be made for railing post holes.

Mortar Joints between Dimension Masonry and Concrete will be paid for as Dimension Masonry.

Mortar Joints between Dimension Masonry and Stone Masonry will be paid for as Stone Masonry.

560-5.02 Split Faced Concrete Masonry. The unit price bid per square meter shall include the cost of furnishing all labor, materials (including anchors, ties, premolded bituminous joint material, and caulking compound) and equipment necessary to complete the work. The payment shall also include the labor, materials and equipment necessary to remove and dispose of all constructed sample masonry panels when directed by the Engineer.

No payment shall be made to the Contractor for the submitted alternate sample walls or for any unapproved sample walls.

The cost of furnishing and placing anchoring devices shall be included in the unit price bid for this work.

The cost of erecting and disposing the sample wall shall be included in the unit price bid for this item.
560-5.03 Stone Masonry. The unit price bid per square meter shall include the cost of furnishing all labor, materials and equipment necessary to complete the work.

Concrete, stone masonry, mortar or any joint material within the nominal thickness of the stone masonry will, for the purpose of payment, be classified as stone masonry and will not be paid for under any other item. Projections, if any, into the concrete beyond the nominal thickness of stone masonry will be paid for as the class of concrete displaced by the stone. No deduction will be made for railing post holes.

The cost of furnishing and placing anchoring devices shall be included in the unit price for this item.

560-5.05 Rubble Stone Masonry. The unit price bid per cubic meter for Rubble Stone Masonry with joints or laid dry, shall include the cost of furnishing all labor, materials and equipment necessary to complete the work except excavation will be paid for under the appropriate excavation item.

560-5.06 Precast Concrete Coping. The unit price bid per meter shall include the cost of furnishing all labor, materials (including anchors, reinforcement, premolded resilient joint materials, and caulking compound) and equipment necessary to complete the work.

560-5.07 Tuck Pointing. Include all labor, material (including any re-caulking material), and equipment to complete the work in the unit bid price.

560-5.08 Progress Payments. Progress payments will be made, at the unit price bid, for 75% of the quantity properly placed. The balance of the quantity will be paid for upon proper cleaning and caulking of the joints.

**Payment will be made under:**

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>560.01</td>
<td>Dimension Stone Masonry</td>
<td>Square Meter</td>
</tr>
<tr>
<td>560.02</td>
<td>Split Faced Concrete Masonry</td>
<td>Square Meter</td>
</tr>
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<td>560.0401</td>
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<td>Rubble Stone Masonry</td>
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<tr>
<td>560.06</td>
<td>Rubble Stone Masonry Laid Dry</td>
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<td>560.07</td>
<td>Precast Concrete Coping</td>
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<td>560.08</td>
<td>Tuck Pointing</td>
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</tr>
<tr>
<td>560.09</td>
<td>Tuck Pointing</td>
<td>Square Meter</td>
</tr>
</tbody>
</table>

SECTIONS 561 (VACANT)

SECTION 562 - REINFORCED CONCRETE THREE-SIDED STRUCTURES

562-1 DESCRIPTION. The work consists of designing and constructing reinforced concrete three-sided structure(s) at the location(s) indicated on the Plans.

A reinforced concrete three-sided structure is composed of some of the following discrete elements:

1. Span Unit
2. Span Unit Footing
3. Wing Wall with Footing
4. Headwall
5. Invert Slab with Cut-off Wall
6. Apron with Cut-off Wall

**NOTE:** Any of the above elements may be cast in place at no additional cost to the State.

562-2 MATERIALS. Materials for all precast concrete components shall meet the requirements of the PCCM. Materials for cast-in-place concrete shall be Class A concrete meeting the requirements of Section 555 and reinforcement meeting the requirements of Section 556.
§562

562-3 CONSTRUCTION

562-3.01 Design. An appropriate structure design and all details necessary for construction meeting the Design parameters given in these specifications shall be developed and submitted to the DCES for approval. All design work, detail development, and proposed handling and installation procedure development, shall be done by a Professional Engineer. The design submittal shall conform to the requirements stated in the PCCM. The DCES reserves the right to reject a proposed design(s) if the structure type is determined to be unsuitable for the proposed application based on safety, durability, serviceability, or maintainability.

The Load Rating shall be determined in accordance with the AASHTO "Manual for Condition Evaluation of Bridges, 1994 - Second Edition," with all interim provisions in effect. The contractor shall show which method (working stress or load factor) was used in load rating computations. The load rating shall be shown on the Production Note Sheet of the shop drawings. The contractor shall include all load rating computations in the design calculation submittal.

562-3.02 Design Parameters. The design of the structure(s) described above shall meet the following:

2. Live Load    : MS 23
3. Highway Profile Section : As shown in the contract documents.
4. Soil Parameters  : As shown in the contract documents.
5. Layout, Span, Rise, and Length of the Bridge Structure
6. Staged Construction : Construction staging shall be as shown in the contract documents.
7. Wing Walls   : As shown in the contract documents.
8. Railing or Barrier : The railing anchorages or barrier anchorages on the structure shall be designed to develop adequate global and local capacities required to resist the loads in Section 2 of the New York State Standard Specifications for Highway Bridges.
9. Hydraulics : The proposed structure shall provide hydraulic area (effective flow area) below the design high water elevation shown in the contract documents.
10. Allowable concrete stress : As per the provisions of the Standard Specifications, except that maximum tensile stress in concrete for handling and erection loads when analyzed according to the proposed handling and installation procedures, shall not exceed 0.40 \( \sqrt{f'ci} \), where \( f'ci \) is the concrete compressive strength at the time being considered.
11. Joints : All joints between Span Units shall be designed to be leak proof. The determination of the acceptability of the proposed joint system by the DCES shall be final.

NOTE: The shape(s) of the Span Unit shown in the contract documents is for illustration purposes only. Other shapes meeting the design parameters are acceptable, unless otherwise noted in the contract documents.

562-3.03 Changes to Design Parameters. If the Contractor wants to propose a structure not in full compliance with the design parameters in the contract, a preliminary proposal, fully explaining the changed design parameters shall be submitted to the DCES for review and approval. The Contractor is not expected to develop a detailed design until the proposed design parameters have been approved by the DCES.

562-3.04 Design Computations, Shop Drawings/Detail Drawings. The preparation and submission for review and approval shall be according to the PCCM. Shop drawings shall show detailed handling procedure to be used during fabrication, storage, and transportation of the precast elements. All necessary supporting calculations shall be included in the design computation package.

Fabrication of all steel components shall meet the requirements of the SCM. Shop drawings shall show the required tolerances for the geometry of all precast components, placement of reinforcement, location of all inserts, etc. Design shall consider the effects of these tolerances.
§562

562-3.05 Fabrication. Fabrication of all precast elements shall be according to the PCCM.

562-3.06 Installation Drawings. Installation drawings shall meet the requirements of the PCCM and the following:

A. Details of all joints including all materials and a step-by-step procedure for installing them shall be shown on the installation drawings.

B. All welding operations during installation shall be shown on the installation drawings and shall meet the requirements of the SCM.

C. Details for all cast-in-place concrete not detailed in the contract documents.

562-3.07 Installation. Installation of all precast elements shall be according to the approved installation drawings. All elements after installation and prior to backfilling will be inspected for cracks or other visible defects. All defective elements shall either be replaced or be repaired using procedures approved by the DCES and at no additional cost to the state.

562-3.08 Erection Drawings. A separate set of erection drawings shall be prepared and submitted for review and approval of the Department as per the provisions of Section 2.6 ERECTION DRAWINGS of the PCCM.

562-3.09 Tolerances (After Erection)

A. Joint Width: ± 10 mm

B. Vertical Difference Between Top of Adjacent Units: ± 13 mm

C. Span - Variation From Post-Pour Measurement Recorded on the Shipping Paperwork: ± 8 mm

562-3.10 Backfilling

A. Backfilling operations shall not begin until:

1. Span units to span unit footing key joints are grouted as shown on the approved installation drawings and have cured a minimum of 24 hours.
2. Transverse connections between unit segments are placed and secured (if required).
3. Joint seals are properly placed and approved by the Engineer.

B. Backfilling operations shall be conducted in accordance with Section 203 - Excavating and Embankment, with the following modifications:

1. Fills shall be placed and compacted in layers not exceeding 300 mm in depth.
2. Dumping for filling operations shall not be nearer than 900 mm to a plane passing vertically through the back face of any footing.
3. Backfill shall be placed as symmetrically as possible around the structure with differential depths of backfill on opposite sides of the structure span units not exceeding 450 mm.
4. Fill within 300 mm of any surface of the structure shall be compacted with hand compaction equipment.
5. Vibratory rollers shall not be used within 3.0 m of any surface of the structure.
6. Construction equipment shall not travel or rest on an uncompleted structure unless the designer of the structure span unit has evaluated the loading conditions, submitted calculations to the DCES, and has received written approval of the proposed loading. Actual conditions at the time of loading, including both the weight of the fill and the equipment, shall be part of the analysis. The Contractor shall repair any damage resulting from equipment passage at no additional cost to the State.
§562

562-4 METHOD OF MEASUREMENT. Measurement for payment for the Reinforced Concrete Span Units, Wing Walls, Apron, and Invert Slabs will be computed from the payment lines shown on the plans. No field measurements will be made.

562-5 BASIS OF PAYMENT. The Contractor shall include the cost of all engineering, labor, materials, and equipment necessary to complete the work in the unit price bid. The Contractor shall include the costs of the footings, headwalls, and cut-off walls in the unit price bid of the element to which it is attached.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>562.01nn M</td>
<td>Reinforced Concrete Span Units</td>
<td>square meter</td>
</tr>
<tr>
<td>562.02 M</td>
<td>Invert Slab With Cut-Off Wall</td>
<td>square meter</td>
</tr>
<tr>
<td>562.03 M</td>
<td>Wing Wall with Footing</td>
<td>square meter</td>
</tr>
<tr>
<td>562.04 M</td>
<td>Concrete Apron With Cut-off Wall</td>
<td>square meter</td>
</tr>
</tbody>
</table>

NOTE: Serialization for the Span Units: nn represents the specific structure identifier.

SECTION 563 - PRESTRESSED CONCRETE UNITS (STRUCTURAL)

563-1 DESCRIPTION. This work shall consist of furnishing and placing prestressed concrete units for structures, as specified in the contract documents.

The Contractor shall notify the Deputy Chief Engineer, Structures (DCES) of the name and address of the fabricator of all prestressed concrete units (structural) in accordance with §106-01 Sources of Supply.

563-2 MATERIALS

563-2.01 Prestressed Units. The Contractor shall notify the DCES of the source of prestressed units, for approval within (7) days after the award of the contract. Prestressed concrete units shall meet the requirements of the P.C.C.M.

563-2.02 Transverse Tie Rods or Strands. Refer to P.C.C.M., Section 4.

563-2.03 Shear Key Material. Refer to P.C.C.M., Section 4.

563-2.04 Anchorage Block-Out Grout. Refer to P.C.C.M., Section 4.

563-2.05 Concrete. The concrete shall meet the requirements of §718-06, High Performance Concrete For Precast and Prestressed Bridge Beams.”

563-3 CONSTRUCTION DETAILS. The requirements of the P.C.C.M. shall apply.

563-4 METHOD OF MEASUREMENT

563-4.01 Prestressed Concrete I-Beam Units. The quantity to be paid for under this work shall be the number of meters (horizontal length center-to-center of bearings or anchor dowels, as shown on the plans) of each unit furnished and placed in accordance with the plans and specifications.

563-4.02 Prestressed Concrete Box-Beam Units and Hollow and Solid Slab Units. The quantity to be paid for under this work shall be the number of square meters of plan area of each prestressed unit installed. Plan area is defined as the area bounded by the centerline of bearings and the outer edges of each prestressed unit. No deductions will be made for chamfers, shear keys, or notch cuts. Space between the units shall not be included in any measurement.
§563

563-5 BASIS OF PAYMENT. The unit price bid for these units shall include all labor, materials and equipment necessary to complete the work except that bearings shall be paid for under their respective items.

Damaged units which cannot be satisfactorily repaired or which do not meet dimensional and camber tolerances shall be replaced by the Contractor at no cost to the State.

Progress payments will be made when each unit is furnished and placed in accordance with the plans and specifications exclusive of preparing and filling joints. Payment will be made at the unit price bid for 90% of the quantity properly placed. The balance of the quantity will be paid for upon completion of the work. The completion of work will include the correct preparation and filling of the joints as well as the tightening of transverse ties.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>563.010X</td>
<td>Prestressed Concrete I-Beam Units (Types 1-6)</td>
<td>Meter</td>
</tr>
<tr>
<td>563.02</td>
<td>Prestressed Concrete Box Beam Units</td>
<td>Square Meter</td>
</tr>
<tr>
<td>563.03</td>
<td>Prestressed Concrete Hollow Slab Units</td>
<td>Square Meter</td>
</tr>
<tr>
<td>563.04</td>
<td>Prestressed Concrete Solid Slab Units</td>
<td>Square Meter</td>
</tr>
</tbody>
</table>

$X =$ Type Designation (1 through 6)

SECTION 564 - STRUCTURAL STEEL

564-1 DESCRIPTION. Under this work, the Contractor shall fabricate, furnish and erect structural steel and other metal parts in accordance with the contract documents.

The Contractor shall notify the Deputy Chief Engineer, Structures (DCES) of the name and address of the fabricator of all structural steel in accordance with §106-01 Sources of Supply.

564-2 MATERIALS. Materials for this work shall meet the requirements of the New York State Steel Construction Manual and the following subsections of Section 700 - Materials:

- Structural Steel 715-01
- High Strength Bolts, Nuts and Washers 715-14
- Pins and Rollers 715-15
- Vertical Load Transmitting Devices 728

Certified copies of the results of tests conducted by the manufacturer shall be furnished to the Engineer in accordance with the requirements of §715-01, Structural Steel.

564-2.01 Structural Steel Replacement - Stock Steel Option. Stock steel may be furnished for this work. If furnished, the stock steel shall comply with the provisions of §715-01, Structural Steel. Positive heat identification will be required for all stock steel. Certified copies of the results of chemical analysis and physical tests shall be furnished to the Department. Shop inspection will be provided unless otherwise noted on the contract plans, or waived by the DCES. The provisions of this subsection shall apply only to pay items entitled “Structural Steel Replacement (kg.)” or “Structural Steel Replacement (Each).”

564-3 CONSTRUCTION DETAILS. All structural steel work, including, but not limited to fabrication inspection, transportation, and erection shall be done in accordance with the provisions of the SCM.

Shop drawings prepared for pay items titled Structural Steel Replacement (Kg.) and Structural Steel Replacement (Each) shall be prepared, approved and distributed in accordance with the provisions of the SCM, except that the term “DCES” shall be interpreted as “the Engineer.”

564-4 METHOD OF MEASUREMENT. Measurement will be made by one, or combinations of the following methods as indicated in the contract documents.

- Kilogram
- Each
- Lump Sum

NEW YORK STATE DEPARTMENT OF TRANSPORTATION
STANDARD SPECIFICATIONS of May 4, 2006

375
§564

564-4.01 Kilogram. Measurement will be made on a kilogram basis. The mass of each shipping unit shall be clearly shown on the approved shop drawings. For the purpose of measurement, such items as castings, anchor bolts, forgings, fasteners, cable and other metal parts used in the construction shall, unless otherwise provided, be considered to be structural steel even if made of other materials.

A. Payment Mass. Payment will be based on the computed mass of metal as shown on the approved shop drawings, and shall include permanent bolts and welds in the structure as erected. The mass of all erection materials including but not limited to bolts, pilot and driving nuts, temporary protective coatings, and all boxes, crates or other containers used for packing, together with sills, struts, and rods used for supporting members during transportation, shall be excluded.

The mass of all required bolt heads, nuts and washers will be estimated, making no allowance for waste, and included in the mass for which payment will be made.

The mass of all required welds will be estimated and included in the mass for which payment will be made.

B. Computed Mass. The mass of steel shall be assumed as 7850 kg/m$^3$. The mass of cast iron shall be assumed as 7210 kg/m$^3$.

The masses of rolled shapes and of plates of all dimensions shall be computed on the basis of their nominal masses as required by the dimensions shown on the approved shop drawings. If the Contractor, however, elects to use for his convenience, steel members with masses that are greater than the nominal masses specified on the approved drawings, the computations shall be based on the nominal mass values on the drawings. Deductions shall be made for copes, cuts and all holes except those holes required for high-strength bolts.

The mass of fillet welds shall be computed from the following:

<table>
<thead>
<tr>
<th>TABLE 564-1 MASS OF DEPOSITED METAL PER METER OF FILLET WELD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size of Fillet (mm)</td>
</tr>
<tr>
<td>Deposited Metal (kg/m)</td>
</tr>
</tbody>
</table>

The masses of castings shall be computed from the dimensions shown on the approved shop drawings, with an addition of 10% for fillets and overrun.

The mass of high-strength bolts, nuts and washers, exclusive of grip, shall be computed from the following:

<table>
<thead>
<tr>
<th>TABLE 564-2 MASSES OF HIGH-STRENGTH BOLTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bolt Diameter (mm)</td>
</tr>
<tr>
<td>Mass of 100 Bolts with Nut and 2 Washers (kg)$^1$</td>
</tr>
</tbody>
</table>

NOTE 1. Measured mass will be exclusive of grips.

564-4.02 Each Unit. Measurement will be made for each unit of structural steel as indicated on the contract plans. The provisions of §564-4.01, concerning castings, anchor bolts, forgings, fasteners, cable, and other metal parts, shall apply.

564.4.03 Lump Sum. No measurement will be taken. The provisions of §564-4.01 concerning castings, anchor bolts, forgings, fasteners, cable and other metal parts, shall apply.

564-5 BASIS OF PAYMENT

564-5.01 General. The price bid shall include the cost of furnishing all labor, materials and equipment necessary to complete the work. For the purpose of payment, castings, forgings, fasteners, anchor bolts
for other than bridge bearing installation, cables and other metal parts used in the construction, will be considered to be structural steel, even if made of other materials.

§564-5.02 Additional Work. Items that are included in the price bid and are the Contractor's responsibility are as follows:

A. Shop Drawings, including Paper Prints and Reproducible Prints. The cost of all shop drawings, prints, reproducible prints and microfilm required by the specifications or the Steel Construction Manual shall be included in the unit price bid for the payment item requiring the drawings.

Any prints and reproducible prints required beyond the number specified shall be furnished by the Contractor at cost.

B. Laminar Defects at the Boundary of Tension Groove Welds. The cost of all work and materials required for the correction or elimination of laminar defects at the boundary of tension groove welds shall be included in the price bid for structural steel.

The cost of all ultrasonic testing and repairs and the cost of replacement of defective portions of plates where partial replacement is approved shall be borne by the Contractor and included in the price bid for structural steel.

C. Inspection of Bolted Connections. All labor and equipment necessary for the performance of inspection of bolt tightness during structural steel fabrication and erection shall be provided by the Contractor and included in the price bid for structural steel. The State shall witness the bolt testing, but will not provide equipment or labor.

D. Qualification Test for Welders, Welding Procedures and Electrode and Flux Combinations. The cost of tests required to qualify welders, welding procedures and electrode and flux combinations shall be included in the unit price bid for the steel with the exception that the State will witness tests and perform Charpy V-Notch Impact Tests without cost to the Contractor.

E. Radiographic Inspection. The cost of radiographic inspection and of preparation for radiography, together with the cost of providing access and of furnishing adequate facilities for the review of radiographs in the shop or field, shall be included in the price bid for structural steel.

F. Ultrasonic Inspection. Ultrasonic inspection, when required, will be performed by the State or its representatives unless otherwise provided for in the contract documents. The cost of any required preparation and of furnishing access to the joints shall be included in the price bid for structural steel.

G. Magnetic Particle Inspection. The cost of magnetic particle inspection when specified or required by the inspector to verify limits of defects discovered during visual inspection shall be included in the unit price bid for structural steel.

H. Repair of Defects in Welds and Base Metal. The cost of repairing defects found by visual inspection or nondestructive tests shall be included in the unit price bid for structural steel.

I. Field Inspection of Rejected Material or Material Not Offered for Shop Inspection even though Required to be Shop Inspected by the Contract Documents. When the Department, at its discretion, permits inspection of the subject materials to be performed at the project site, all costs of this inspection shall be borne by the Contractor as a condition of the Department's approval of inspection of this material. All costs associated with the inspection of rejected material, which has been shipped to the field without approval, shall be borne by the Contractor.

J. Straightening Bent Material and Correcting Camber Deficiencies. All corrective work required to straighten bent material and correct camber deficiencies, when permitted, shall be performed at no additional cost to the State.
K. Field Repair, Reaming and Drifting of Holes. All work permitted for the correction of unacceptable holes shall be provided at the Contractor's expense.

L. Metal Scuppers. Metal scuppers shall be paid for as structural steel unless otherwise noted on the plans.

M. Adjustment and Alignment of Bearings. All labor, materials and equipment required for adjustment and alignment of bearings shall be included in the unit price bid for structural steel.

N. Field Splices. When the specific location for a bolted or welded field splice in stringers and girders is not shown on the plans, the Contractor will be permitted to introduce splices at locations of his choice. The splices shall be made in accordance with the provisions of the SCM. No payment will be made for labor, material, and equipment required to make a splice if the splice is not shown on the contract plans. Also, payment will not be made for increases in the thickness of webs or flanges made necessary by the requested splice.

O. Photographs. Photographs requested by the DCES in accordance with the provisions of the SCM, shall be furnished at no additional cost.

P. Testing of Stock Steel. All labor, materials and equipment necessary to perform chemical and physical tests on stock steel when such tests are required shall be furnished by the Contractor and included in the price bid for structural steel.

Q. Heat-Curving and Cambering. All costs of nondestructive testing, repairs or replacement of material damaged due to over stressing or destructive heating during heat-curving or cambering shall be borne by the Contractor.

564-5.03 Progress Payments for Fabricated Steel. Upon application by the contractor, payments for some of the cost of fabricated steel will be made to the contractor prior to shipping and incorporation of such material in the permanent work, subject to the following:

A. To be eligible for progress payment, the steel must meet all of the following conditions:
1. Include all the structural steel required for one or more spans of the bridge. If stage construction of the bridge is required by the Contract this will be interpreted as all the steel required for one or more stages of one or more spans of the bridge. The mass of steel extending beyond the end of the span to a splice point will be included for payment.
2. Have a minimum mass of 10,000 kg.
3. Be materials which will be incorporated into permanent work.
4. a. For unpainted (weathering) steel, be in a condition which is ready for on-site installation without further fabrication.
   b. For steel that will be coated or painted, be completely fabricated, inspected and ready for shipment to a coating shop.

B. With application for progress payments, the contractor shall provide documentation as follows:
1. Bill of sale or vouchers indicating the actual dollar value paid by the contractor for the materials as stored;
2. Certification of Title showing that title to the materials, without encumbrances, is in the name of the contractor and that title is warranted to the Department of Transportation;
3. Documented evidence of acceptability of the materials;
4. A release and waiver covering such materials, and providing access to the storage site, which release and waiver shall be executed by the property owner in favor of the New York State Department of Transportation or its agents.

C. For rolled beam and plate girder bridges, the amount of progress payments shall not exceed the total invoice amount for stored materials, nor shall the partial payment exceed eighty five percent (85%) of the pro rata value of the lump sum bid. The pro rata values shall be calculated by multiplying the lump sum
price bid by the ratio which represents the structural steel members fabricated and stored during the payment period in question. The ratio will be computed by dividing the mass of the steel by the Total Mass for Progress Payments for the appropriate item. See §564-5.04.

D. For truss bridges, arches, or other construction identified in the Contract Documents, the amount of progress payments shall not exceed the total invoice amount for stored materials, nor shall the partial payment exceed seventy five percent (75%) of the pro rata value of the lump sum bid. The pro rata values shall be calculated by multiplying the lump sum price bid by the ratio which represents the structural steel members fabricated and stored during the payment period in question. The ratio will be computed by dividing the mass of the steel by the Total Mass for Progress Payments for the appropriate item. See §564-5.04.

E. When progress payments are made in accordance with this subsection, no application for partial payment will be considered by the Department.

The making of progress payments shall not be deemed to be a final acceptance of materials, nor shall it relieve the contractor of responsibility for such materials. The contractor shall be responsible for assuring that only those materials which comply with the specifications are incorporated into the project.

564-5.04 Progress Payments - Lump Sum. Progress payments shall be calculated by multiplying the lump sum price bid by the ratio which represents the structural steel members erected during the payment period in question and then subtracting any partial and progress payments made. The ratio will be computed by dividing the shipping mass of the erected steel by the Total Mass for Progress Payments for the appropriate item indicated in the contract documents.

564-5.05 Other Work. Work not included in the unit price bid for the structural steel item is as follows:

A. Setting Anchor Bolts for Bridge Bearings. The pipe sleeves, anchor bolts and work required to furnish, set and grout the anchor bolts, shall be included in the price bid for the respective bearing item.

B. Vertical Load Transmitting Devices. The furnishing and installing of vertical load transmitting devices, such as; rubber impregnated random fiber pad, and plain rubber pad, shall be included in the price bid for the respective item.

**Payment will be made under:**

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>564.05XX</td>
<td>Structural Steel (Type 1-22)</td>
<td>Lump Sum</td>
</tr>
<tr>
<td>564.10nnn</td>
<td>Structural Steel Replacement</td>
<td>Kilogram</td>
</tr>
<tr>
<td>564.51nnn</td>
<td>Structural Steel</td>
<td>Kilogram</td>
</tr>
<tr>
<td>564.70nnn</td>
<td>Structural Steel Replacement</td>
<td>Each</td>
</tr>
</tbody>
</table>

**NOTE:** nn denotes a serialized pay item.

**SECTION 565 - BRIDGE BEARINGS**

565-1 DESCRIPTION. The work shall consist of furnishing, placing and setting bridge bearings at the locations indicated on the plans.

The Contractor shall notify the Deputy Chief Engineer, Structures (DCES) of the name and address of the fabricator of all bridge bearings in accordance with §106-01 Sources of Supply.

565-1.01 Bearing Types. There are various types of bearings. The specific type required will be indicated on the plans. Bearing types are:
A. Type S.R. - Steel Rocker Bearings. These accommodate rotation by pivoting around a pinned joint. They are fabricated in fixed and expansion versions. The expansion version accommodates longitudinal movement by means of a curved rocker rotating on the bearing surface. Steel rocker bearings do not allow for transverse movement. This type of bearing shall only be used in rehabilitation situations where only one or two bearings are to be replaced on a bridge.

B. Type S.S. - Steel Sliding Bearings. These accommodate rotation by means of a rocker. They are fabricated in fixed and expansion versions. The expansion version accommodates movement with a sliding element. Steel sliding bearings do not allow for transverse movement. This type of bearing shall only be used in rehabilitation situations where only one or two bearings are to be replaced on a bridge.

C. Type M.R. - Multi-Rotational Bearings. These accommodate rotation by the deformation of a confined elastomeric element, or an unconfined urethane disc. Multi-rotational bearings are fabricated in fixed and expansion versions. The expansion version accommodates movement by means of sliding elements. Expansion versions may be guided, allowing movement in only one direction, or non-guided, allowing multi-directional movement.

D. Type E.P. - Plain Elastomeric Bearings. These accommodate rotation by the deformation of a plain elastomeric pad. They may be used for both fixed and expansion applications without changes in details. The bearings will accommodate longitudinal, transverse, and rotational movements.

E. Type E.L. - Steel Laminated Elastomeric Bearings. These accommodate rotation by the deformation of a laminated elastomeric and steel pad. They may be used for both fixed and expansion applications without changes in details. The bearings will accommodate longitudinal, transverse, and rotational movements.

F. Type E.B. - Elastomeric Bearings with External Load Plates. These accommodate rotation by the deformation of a plain or steel laminated elastomeric pad. Elastomeric bearings with external load plates are fabricated in fixed and expansion versions. The fixed version will accommodate rotational movements. The expansion bearings will accommodate longitudinal, transverse, and rotational movements.

565-2 MATERIALS

565-2.01 General. Materials shall meet the following requirements:

Concrete Grouting Material 701-05
Steel Anchor Dowel 709-01
Disc-Design Structural Bridge Bearings 716-06
Pot-Design Structural Bridge Bearings 716-07
Plain Elastomeric Bridge Bearings 716-10
Steel-Laminated Elastomeric Bridge Bearings 716-11
Elastomeric Bridge Bearings with External Load Plates 716-12
Rubber-Impregnated Woven Cotton Fabric 728-01
Rubber-Impregnated Random Fiber Pad 728-02
Plain Rubber Pad 728-03
Nuts ASTM A563 M
Washers ASTM F436 M
Anchor Studs ASTM F568 M, class 8.8 or 8.8.3
Cap Screws ASTM F835M or A574M
Structural Steel Paint Class 1 708-01

NOTE a. Steel anchor dowels shall meet the requirements of §709-01 - Bar Reinforcement.
565-2.02 Fabrication. Steel components of bridge bearings shall be fabricated in accordance with the applicable requirements of the NYS Steel Construction Manual (SCM). In addition, component parts of individual bearings shall meet fabrication details as shown in the contract documents.

A. Type S.R. Bearings. These shall conform to the plans and other contract documents.

B. Type S.S. Bearings. These shall conform to the plans and other contract documents.

C. Type M.R. Bearings. These shall conform to the requirements of either §716-06.01 or §716-07.01 as applicable, and other contract documents. When type M.R. bearings are specified, the Contractor may supply either disc design or pot design bearings. Only one bearing design, disc or pot, shall be supplied for any one bridge.

D. Type E.P. Bearings. These shall conform to the requirements of §716-10 and other contract documents.

E. Type E.L. Bearings. These shall conform to the requirements of §716-11 and other contract documents.

F. Type E.B. Bearings. These shall conform to the requirements of §716-12 and other contract documents.

565-2.03 Drawings. Shop drawings shall meet the requirements specified in the following:

- Type S.R. and S.S. Bearings: SCM
- Type M.R. Bearings: §716-06.01 or §716-07.01
- Type E.L. Bearings: §716-11
- Type E.B. Bearings: §716-12

565-2.04 Protective Coatings

A. Machine finished surfaces in contact, including pins, pin holes, surfaces in sockets at the top of rocker bearings, and bronze or copper plates in sliding contact shall receive one coat of automotive grease as soon as machining is complete. None of these surfaces shall be painted.

B. Stainless steel and polytetrafluoroethylene surfaces shall not be painted or otherwise coated.

C. Metal to metal surfaces to be field welded shall be given a coat of clear lacquer or other protective coating approved by the Engineer, or Inspector, if exposure is to exceed three months prior to welding. The coating shall be removed at the time of welding. Painting, if required, will be done only after the completion of welding. Surfaces to be painted shall be primed and painted in accordance with §565-2.04D.

D. All other metal surfaces shall be cleaned to meet SSPC-SP10, “Near-White Metal Blast Cleaning” and painted in accordance with section 572, Structural Paint System: Shop Applied. The paint shall be selected from the Department’s Approved List, Structural Steel Paints – Class 1. For bearings used in conjunction with unpainted steel, the color of the finish coat shall Weathered Brown as defined by §708-05.

565-2.05 Shipping. Each bearing shall be shipped as an assembled unit, except for elastomeric bearings. Elastomeric bearings may be shipped in packages containing more than one bearing, provided the package can be handled with normal construction equipment. Bearings shall be packaged in such a manner to protect all rotating and sliding surfaces from the intrusion of outside material. Bearings shall be packaged securely to prevent separation of the elements during shipping.

565-3 CONSTRUCTION DETAILS

565-3.01 Concrete Bearing Surface Elevations
§565

A. General. The elevation of the concrete bearing surface for all types of bearings, except Type M.R. bearings, shall be as given on the plans.

B. Type M.R. Bearings. The elevation of the concrete bearing surface may vary from that given on the plans depending on the vertical dimension of the actual bearing supplied. The Contractor shall notify the Engineer of all required elevation changes. Changes to the roadway profile will not be allowed. All elevation adjustments necessary to maintain the profile shall be made to the concrete bearing surfaces. Any adjustments, including changes to the reinforcement, will be made at no additional cost to the State.

565-3.02 Concrete Bearing Surface Preparation. No bearing shall be placed upon a concrete bearing surface which is deformed, irregular, or poorly finished. The entire bearing surface area shall be floated and troweled.

565-3.03 Setting Anchor Studs. Anchor studs shall be set as shown on the plans unless changes are permitted by the DCES. If anchor studs are cast in substructure concrete, templates, or other suitable means, shall be used to keep the studs vertical at the required embedment and in the correct horizontal position during concrete placement. If the Contractor elects to drill the finished, cured concrete in order to set the anchor studs, the reinforcing steel shall be positioned prior to casting the concrete so that it will not be damaged during drilling. If anchor studs are drilled and grouted, material and construction details shall be in conformance with §586-2 and §586-3.

565-3.04 Bearing Pad Installation. Bearing pads placed between concrete, or other masonry, and steel masonry plates shall be located to correct alignment and elevation, and placed at the time of masonry plate installation. Bearing pads shall conform to §728-01, §728-02, or §728-03 at the Contractor’s option. Each bearing pad shall be the same size in plan as the masonry plate it supports. Holes to accommodate anchor studs shall be cleanly and accurately cut prior to bearing pad placement.

565-3.05 Bearing Installation and Alignment

A. Type S.R. and Type S.S. Bearings

1. General

   a. The centerline of sole plates or fixed portions of bearing assemblies attached to the structural steel shall not be offset from the centerline of bearing stiffeners or diaphragm connection plates by more than one-half the thickness of the flange at that location, or the thickness of the bearing stiffener or connection plate, whichever is the lesser distance.

   b. The bearing shall be cleaned and regreased with automotive grease at the time of installation.

2. Fixed. No additional requirements apply.

3. Expansion. These may vary from perfect alignment. Therefore, expansion bearings shall be set in accordance with the following.

   a. Type S. R. Bearings

      (1) The bearing shall be set vertical under full dead load at an ambient temperature of 20°C.

      (2) The maximum variation from perfect alignment is a function of the bearing height. The bearing height is the distance between the upper and lower contact surfaces of the movable portion of the bearing. For bearings with a height of 510 mm or less, the maximum variation from perfect alignment, taking into account the effect of temperature and load at the time of measurement, shall be calculated by the following formula:

      \[ M = \pm (13 \text{ mm} + \left( \frac{L}{356,000} \right) ) \]
where “M” = maximum variation from perfect alignment measured as the horizontal
distance between the centerline of the cap plate and the centerline of the masonry plate in
millimeters and “L” = total expansion length in millimeters between the centerline of the
movable bearing being considered and the centerline of the fixed bearing, from which motion
must progress. Such variations shall not exceed 25 mm offset, or a five degree rotation of
the movable portion of the bearings from the required alignment, whichever is less.

The maximum variation of all bearings having a height exceeding 510 mm shall be
approved on an individual basis by the DCES.

(3) No bearing adjustments shall be made until the completed structural slab has been in place
for at least seven curing days. Any adjustments needed to meet the above requirements may
require jacking the superstructure. All adjustments shall be accomplished according to a
written procedure submitted by the Contractor for DCES approval. All adjustments shall be
made at no additional cost to the State.

b. Type S. S. Bearings

(1) The sliding plate shall be centered on the masonry plate under full dead load at an ambient
temperature of 20°C.

(2) The maximum variation from perfect alignment between the centerlines of the fixed and
movable portions of the bearing device, taking into account the effect of temperature and load
at the time of measurement, shall not exceed plus or minus 13 mm longitudinally. This
variation shall be measured as the horizontal distance between the centerline of the sliding
plate and the centerline of the masonry plate. The movable portion of the bearing device
shall be fully supported by the fixed portion under all temperature and loading conditions.

(3) No bearing adjustments shall be made until the completed structural slab has been in place
for at least seven curing days. Any adjustments needed to meet the above requirements may
require jacking the superstructure. All adjustments shall be accomplished according to a
written procedure submitted by the Contractor for DCES approval. All adjustments shall be
made at no additional cost to the State.

B. Type M.R. Bearings

1. General. The centerline of sole plates or other fixed portions of bearing assemblies attached
to the structural steel shall not be offset from the centerline of bearing stiffeners or diaphragm
connection plates by more than one-half the thickness of the flange at that location, or the
thickness of the bearing stiffener or connection plate, whichever is the lesser distance.

2. Fixed. No additional requirements apply.

3. Expansion. These may vary from perfect alignment. Therefore expansion bearings shall be
set in accordance with the following:

a. The sliding plate shall be centered on the masonry plate under full dead load at an ambient
temperature of 20°C.

b. The maximum variation from perfect alignment between the centerline of the fixed and
movable portions of the bearing device, taking into account the effects of temperature and load
at the time of measurement, shall not exceed plus or minus 25 mm longitudinally unless otherwise
indicated on the plans. This variation shall be measured as the horizontal distance between the
centerline of the sliding plate and the centerline of the masonry plate.

C. No bearing adjustments shall be made until the completed structural slab has been in place for
at least seven curing days. Any adjustments needed to meet the above requirements may require
jacking the superstructure. All adjustments shall be accomplished according to a written
procedure submitted by the Contractor for DCES approval. All adjustments shall be made at no
additional cost to the State.
C. Type E.P. and Type E.L. Bearings

1. General

a. These bearings are designed to function properly provided that minimum distortion occurs along the beam axis under full dead load at an ambient temperature of 20°C. Elastomeric bearings shall be installed when the ambient temperature is between 5° and 26° C inclusive. The Contractor may elect to install the bearings when the ambient temperature is outside of the allowable range, provided the Contractor submits, and receives DCES approval, of an installation procedure that either resets the bearings when the temperature is in the allowable range or deforms the bearings so that they perform as if they were installed at 20°C.

b. For prestressed concrete superstructures, the bearing shall be anchored to establish the fixed end of the bridge as soon as possible after stringer erection. For adjacent prestressed box beams, or prestressed slab superstructures, the anchorage shall be completed prior to filling the shear keys. The method of anchorage shall be in accordance with the details shown on the plans. Anchor dowel holes shall be core drilled to the nominal size and depth and at the locations required by the plans. In lieu of core drilling, the Contractor may submit an installation procedure that incorporates the use of either preset anchor bolts or pipe sleeves to the DCES for approval. Prior to placing the anchor dowel, the hole shall be inspected and approved for filling by the Engineer. Fill material shall be in accordance with the details on the plans.

2. Fixed. No additional requirements apply.

3. Expansion

a. These may vary from perfect alignment. The maximum variation from perfect alignment under full dead load shall not exceed the value shown on the plans. This variation shall be measured as the horizontal distance between the centerline of the highest elastomer surface and the centerline of the lowest elastomer surface.

b. No bearing adjustments shall be made until the completed structural slab has been in place for at least seven curing days. Any adjustments needed to meet the above requirements may require jacking the superstructure. All adjustments shall be accomplished according to a written procedure submitted by the Contractor for DCES approval. All adjustments shall be made at no additional cost to the State.

D. Type E.B. Bearings

1. General

a. The centerline of sole plate or other fixed portions of bearing assemblies, attached to steel stringers, shall not be offset from the centerline of bearing stiffeners of diaphragm connection plates by more than one-half the thickness of the flange at that location, or the thickness of the bearing stiffener or connection plate, whichever is the lesser distance.

b. These bearings are designed to function properly provided that minimal distortion occurs along the beam axis under full dead load at an ambient temperature of 20°C. Elastomeric bearings shall be installed when the ambient temperature is between 5° and 26° C inclusive. The Contractor may elect to install the bearings when the ambient temperature is outside of the allowable range, provided the Contractor submits, and receives DCES approval, of an installation procedure that either resets the bearings when the temperature is in the allowable range or deforms the bearings so that they perform as if they were installed at 20°C.

2. Fixed. No additional requirements shall apply.

3. Expansion

a. These may vary from perfect alignment. The maximum variation from perfect alignment under full dead load shall not exceed the value shown on the plans. This variation shall be
measured as the horizontal distance between the centerline of the highest elastomer surface and the centerline of the lowest elastomer surface.

b. No bearing adjustments shall be made until the completed structural slab has been in place for at least seven curing days. Any adjustments needed to meet the above requirements may require jacking the superstructure. All adjustments shall be accomplished according to a written procedure submitted by the Contractor for DCES approval. All adjustments shall be made at no additional cost to the State.

565-3.06 WELDING

**A. Type S.R. Bearings.** Bearings shall be welded permanently to the structural steel only after all necessary adjustments have been made. All welding shall be done in accordance with the requirements of the SCM. The Contractor shall submit a Welding Procedure Specification to the DCES. No welding shall be performed until the manufacturer receives an approved Welding Procedure Specification.

**B. Type S.S. Bearings.** The requirements of §565-3.06A shall apply.

**C. Type M.R. Bearings.** The requirements of §565-3.06A shall apply except that during field welding operations the temperature of the steel adjacent to the rotational element shall not exceed $90^\circ$C. Temperature shall be controlled by welding procedures and monitored using temperature indicating crayons, or other devices. Procedures, crayons, and other devices shall be acceptable to the Engineer. If the temperature limit is exceeded, the DCES and the Director, Materials Bureau shall be immediately notified. The DCES will provide the proper repair procedure, which may include complete replacement of the bearing. All repair work shall be done at no additional cost to the State.

**D. Type E.B. Bearings.** The requirements of §565-3.06A and §565-3.06C shall apply.

565-3.07 Grouting Anchor Bolt Holes. All slotted anchor bolt holes in masonry plates shall be filled with concrete grouting material to the top edge of the hole. All excess grout material shall be cleaned from the bearing surfaces in a manner satisfactory to the Engineer. Slotted anchor bolt holes in fixed bearings may be filled any time subsequent to stringer placement. Slotted holes in expansion bearings shall be filled only after all necessary bearing adjustments have been made.

565-3.08 Final Verification. Prior to final acceptance of the bridge, the Engineer will verify that all necessary adjustments have been made; that all steel bearings, or external load plates, are permanently welded or attached with cap screws to the superstructure steel as shown on the contract plans; that all slotted holes are completely filled with grout; that all anchor studs are firmly tightened; and that all other work required to make the bearings completely functional has been completed.

565-4 METHOD OF MEASUREMENT. Measurement will be taken as the number of bearings installed in accordance with the Contract Documents.

565-5 BASIS OF PAYMENT. The unit price bid for each bearing shall include the cost of all labor, materials, equipment and adjustment necessary to complete the work. All material between the bottom of the superstructure, and the top of the substructure, including anchor studs and sole plates, shall be included in the price bid for this item.

565-5.01 Progress Payments. Eighty percent of the quantity will be paid for after the bearing is installed. The remainder of the quantity will be paid for after the bearing is aligned.

*Payment will be made under:*

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>565.1121</td>
<td>Type S.R. Expansion Bearing (All Load Ranges)</td>
<td>Each</td>
</tr>
<tr>
<td>565.1221</td>
<td>Type S.R. Fixed Bearing (All Load Ranges)</td>
<td>Each</td>
</tr>
</tbody>
</table>
### 565.1321 Type S.S. Expansion Bearing (All Load Ranges) Each

### 565.1421 Type S.S. Fixed Bearing (All Load Ranges) Each

### 565.1521 Type M.R. Expansion Bearing (0 to 1000 kN) Each

### 565.1522 Type M.R. Expansion Bearing (1001 to 2000 kN) Each

### 565.1523 Type M.R. Expansion Bearing (2001 to 3000 kN) Each

### 565.1524 Type M.R. Expansion Bearing (3001 to 4000 kN) Each

### 565.1525 Type M.R. Expansion Bearing (Over 4000 kN) Each

### 565.1721 Type M.R. Fixed Bearing (0 to 1000 kN) Each

### 565.1722 Type M.R. Fixed Bearing (1001 to 2000 kN) Each

### 565.1723 Type M.R. Fixed Bearing (2001 to 3000 kN) Each

### 565.1724 Type M.R. Fixed Bearing (3001 to 4000 kN) Each

### 565.1725 Type M.R. Fixed Bearing (Over 4000 kN) Each

### 565.1821 Type E.P. Bearing (All Load Ranges) Each

### 565.1921 Type E.L. Bearing (0 to 250 kN) Each

### 565.1922 Type E.L. Bearing (251 to 500 kN) Each

### 565.1923 Type E.L. Bearing (501 to 750 kN) Each

### 565.1924 Type E.L. Bearing (751 to 1000 kN) Each

### 565.1925 Type E.L. Bearing (Over 1000 kN) Each

### 565.2021 Type E.B. Fixed Bearing (0 to 250 kN) Each

### 565.2022 Type E.B. Fixed Bearing (251 to 500 kN) Each

### 565.2023 Type E.B. Fixed Bearing (501 to 750 kN) Each

### 565.2024 Type E.B. Fixed Bearing (751 to 1000 kN) Each

### 565.2025 Type E.B. Fixed Bearing (Over 1000 kN) Each

### 565.2031 Type E.B. Expansion Bearing (0 to 250 kN) Each

### 565.2032 Type E.B. Expansion Bearing (251 to 500 kN) Each

### 565.2033 Type E.B. Expansion Bearing (501 to 750 kN) Each

### 565.2034 Type E.B. Expansion Bearing (751 to 1000 kN) Each

### 565.2035 Type E.B. Expansion Bearing (Over 1000 kN) Each

### 565.30 Rubber Impregnated Woven Cotton-Polyester Fabric Each

## SECTION 566 - MODULAR EXPANSION JOINT SYSTEMS

### 566-1 DESCRIPTION.

The work shall consist of fabricating, furnishing, and installing a modular expansion joint system at the locations indicated on the Contract Plans.

### 566-1.01 Modular Joint Systems.

Modular expansion joint systems are manufactured in various sizes, defined by their total movement capability. The correct movement capability required at any one location is indicated on the Contract Plans.

### 566-1.02 Sealing Elements.

On each individual structure, all the box seals used in the modular joints shall be of the same configuration and shall be from the same manufacturer.

### 566-1.03 Modular Joint System Suppliers

#### A. Multicell Modular Joint Systems.

Only firms which appear on the Department’s Approved List will be acceptable suppliers. No supplier other than those listed will be considered.

#### B. One Cell Modular Joint Systems.

Firms that do not appear on the Department’s Approved List may supply one cell Modular Joint Systems. Firms which appear on the Department’s Approved List will also be acceptable suppliers.

### 566-1.04 Terminology.

The following terminology will be used throughout this section:

#### A. Joint System.

This term is used to describe the installation with all of its component parts as installed in the structure slab, and if applicable in sidewalks, barriers and other bridge components.
B. Segment. A modular joint system manufactured at less than full roadway width. No segment shall be less than a single lane width long.

C. Joint. The separation between two elements of a bridge to allow for movement.

566-2 MATERIALS. Materials shall conform to the following requirements.

566-2.01 Modular Joint System. The modular joint system and all its component parts, including stiffening plates and anchorages, shall be supplied by the Manufacturer. The Manufacturer shall certify that the following components meet the listed requirements:

Hollow Beams, Steel Extrusions and Milled Steel Shapes  ASTM A588M
Box Seals  705-09a
Strip Seal  ASTM D2628b
Adhesive  567-2.02A6
Stud Shear Connectors and Threaded Studs  709-05
Connecting and Sliding Plates - 10 mm Thickness  ASTM A588M
Parapet Cover Plates - 13 mm Thickness  ASTM A36Mc

NOTES:
a. Shape approval by the Director of Materials is not required. Hardness, Type A Durometer shall be 60 ± 5; ASTM Method D2240. A 1 meter sample of the seal shall be submitted for testing to the Materials Bureau. No splices shall be permitted in permanent seals for any reason whatsoever.
b. Recovery test not required.
c. Parapet Cover Plates shall be Galvanized in accordance with §719-01, Type I.

566-2.02 Shop Drawings

A. Shop Drawings shall be required for any joint system supplied as part of this work. Shop Drawings shall be prepared and reviewed in accordance with the applicable provisions of the SCM and this Specification and submitted to the DCES for approval. All Shop Drawings shall note the name and address of the Joint System Fabricator, including the actual location (address) where the fabrication will take place.

B. The Modular Joint System Manufacturer's instructions for the proper installation of the joint system shall be entered on the Shop Drawings. Manufacturer's instructions shall include the proper width settings for various ambient temperatures. Shop Drawings which lack Manufacturer's installation instructions shall be returned without examination.

C. Filler metal shall be qualified in accordance with Section 7 of the SCM. Welding Procedure Specifications (WPS) shall be submitted for approval to the DCES with the Shop Drawings for each combination of joint type and welding process shown on the Shop Drawings. Shop Drawing Approval shall be withheld until this requirement has been met.

566-2.03 Fabrication

A. All steel fabrication (shop and field) shall be done in accordance with the requirements of the SCM. Mill inspection of the steel will not be required.

B. All metal surfaces to come in contact with the neoprene sealer shall be blast cleaned in accordance with the requirements of Steel Structures Painting Council Surface Preparation No. 6 (SSPC-SP6) - Commercial Blast Cleaning. After cleaning, all cleaned surfaces shall exhibit a clean quality of CSP6, or better, as defined by Steel Structures Painting Council Standard SSPC Vis 1.

C. The cleaned metal surfaces shall be protected from rusting until such a time as the sealer, and lubricant adhesive are placed against the metal surface. Any cleaned metal surface upon which rusting appears shall be recleaned in accordance with the foregoing, at no additional expense to the State.

D. The curb and parapet sliding plates, if required, shall be shop assembled to fit the modular joint system. The plates may be disassembled from the joint system for shipment to the project site.

E. Unless otherwise noted, each modular expansion joint system shall be fabricated as a single entity. It shall fit the full width of the structure as indicated on the Contract Plans. The system shall be preset by
the Manufacturer prior to shipment. Presetting shall be done in accordance with the joint opening at 20°C. The joint opening will be indicated on the Contract Plans. Should the plans indicate that segmental fabrication is permissible, or required, each segment shall be fabricated to exactly fit that portion of the superstructure under construction, including sidewalks. Segments shall be fitted with temporary seals. Temporary seals will not require lubricant adhesive.

F. Shop inspection shall be conducted at the discretion of the Department.

566-2.04 Acceptance. The fabricated joint system will be accepted at the work site by the Engineer after a visual inspection and upon receipt of the Manufacturer's Certification Report (MCR) that the materials and the fabricating procedures were in accordance with the Approved Shop Drawings and this Specification. The Manufacturer shall submit, with the MCR, a Certified Copy of the Mill Test Report (MTR) for all steel used to fabricate the joint system.

566-3 CONSTRUCTION DETAILS

566-3.01 Manufacturer's Representative. During the initial stages of the joint system installation the Contractor shall have present at the installation site a Representative of the Joint System Manufacturer. This person shall be competent in all respects regarding the proper installation procedures to be used. The Representative shall advise the Contractor of, and certify to the Engineer that, the proper procedures are being followed. All certifications to the Engineer shall be in writing. A Manufacturer’s Representative is not required for One Cell Modular joint Systems.

566-3.02 Field Inspection. Immediately prior to installation, the joint system shall be inspected by the Engineer, for proper alignment, and complete bond between the neoprene sealer and the steel, and proper stud placement and effectiveness. No bends or kinks in the joint system steel shall be allowed (except as necessary to follow the roadway grades). Nor shall the straightening of such bend or kinks be allowed. Any joint system exhibiting bends or kinks shall be removed from the work site, and replaced by a new joint system, at no additional cost. Neoprene sealer not fully bonded to the steel shall be fully bonded at the expense of the Contractor. Studs shall be inspected visually, and shall be forgiven a light blow with a hammer. Any stud which does not have a complete end weld, or does not emit a ringing sound when struck a light blow with a hammer, shall be replaced. Studs located more than 25 mm, in any direction, from the location shown on the Shop Drawings, shall be carefully removed and a new stud placed in the proper location. All stud replacements shall be at no additional cost.

566-3.03 Installation

A. Manufacturer’s Instructions. The modular expansion joint system shall be installed in strict accordance with the Manufacturer's instructions, and the advice of their Official Representative. Two weeks prior to the intended installation, the Engineer shall be supplied with two copies of the written instructions. The permanently installed joint system shall match exactly the finished roadway profile and grades. The words “permanently installed”, shall be interpreted to mean that any work necessary to be done to any other part of the structure, in order to achieve a truly complete permanent installation, has been done. This will apply even if the other work is to be paid for under other items of the Contract.

B. Joint System Width, Splices, and Installation Equipment. The modular expansion joint system shall be set to the proper width for the ambient temperature at the time of setting, as indicated on the Shop Drawings. If the joint system has been fabricated in segments, they shall be field spliced to create a single unbroken system.

All mechanical devices, supplied by the Joint System manufacturer, used to set the joint system to the proper width, will remain the property of the Manufacturer. When no longer required, the devices shall be returned to the Manufacturer.

C. Sliding Plate. In order to perform the work of installing the joint systems in a proper manner, some portions of the curb and parapet cannot be constructed until after the sliding plates of the joint system are installed. This surface shall be scrubbed with wire brooms. After the surface preparation
has been accepted, every effort should be made to thoroughly wet the concrete surface, and all porous surfaces to be in contact with new concrete, for 12 hours. If, in the opinion of the Engineer, conditions or the situation prohibits this, then the surfaces should be wetted for as long as possible. Construction joints must be wetted by continuous spraying with hoses using potable water. The Contractor shall remove any puddles of free standing water with oil-free compressed air, and protect the surfaces from drying, so the existing concrete remains in a clean, saturated surface dry condition until placement of the new concrete.

D. Permanent Seals. After the joint system has been completely installed over the full width of the structure, including sidewalks, the temporary seals shall be removed and replaced with permanent seals. After the temporary seals are removed, all metal surfaces which will be in contact with the permanent seals shall be commercially blast cleaned (SSPC-SP6) to visual standard CSP6 as defined by SSPC Vis 1-89.

E. Final Placement. After the modular joint system has been set to its final line and grade, the recess opening shall be filled with Class E Concrete. This surface shall be scrubbed with wire brooms. After the surface preparation has been accepted, every effort should be made to thoroughly wet the concrete surface, and all porous surfaces to be in contact with new concrete, for 12 hours. If, in the opinion of the Engineer, conditions or the situation prohibits this, then the surfaces should be wetted for as long as possible. Construction joints must be wetted by continuous spraying with hoses using potable water. The Contractor shall remove any puddles of free standing water with oil-free compressed air, and protect the surfaces from drying, so the existing concrete remains in a clean, saturated surface dry condition until placement of the new concrete. The uppermost surface of the concrete placement shall be finished in accordance with the requirements of Section 557 except that machine finishing will not be required. The cost of this work shall be included in the unit price bid for the slab item(s).

F. Watertight Integrity Test. After the joint system is permanently installed, including plates and all concrete placements, a watertight integrity test shall be performed. The test shall be done in accordance with the requirements of §567-3.01H.

566-4 METHOD OF MEASUREMENT. The work will be measured as the number of meters of joint system completely installed. Measurement will be taken horizontally and vertically along the centerline of the joint system between the outer limits indicated on the Contract Plans. The words “completely installed” shall be interpreted to mean the joint system in-place with the following operations completed, where applicable:
- Nuts tightened, or retightened, as required.
- Concrete placed and finished.
- Watertight integrity tests performed.

566-5 BASIS OF PAYMENT

566-5.01. The unit price bid per meter shall include the cost of all labor, materials and equipment necessary to complete the work.

566-5.02. No payment will be made for any work noted to be done at the expense of the Contractor, or any work noted to be paid for under other items of the Contract.

Payment will be made under:

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<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
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<tbody>
<tr>
<td>566.01</td>
<td>Modular Expansion Joint System - One Cell</td>
<td>Meter</td>
</tr>
<tr>
<td>566.02</td>
<td>Modular Expansion Joint System - Two Cell</td>
<td>Meter</td>
</tr>
<tr>
<td>566.03</td>
<td>Modular Expansion Joint System - Three Cell</td>
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<td>566.04</td>
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<tr>
<td>566.06</td>
<td>Modular Expansion Joint System - Six Cell</td>
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</tbody>
</table>
SECTION 567 - BRIDGE JOINT SYSTEMS

567-1 DESCRIPTION. The work shall consist of furnishing and installing bridge joint systems. The particular bridge joint system required will be indicated on the contract plans.

The Contractor shall notify the Deputy Chief Engineer, Structures (DCES) of the name and address of the fabricator of all bridge joint systems in accordance with §106-01 Sources of Supply.

567-1.01 Bridge Joint Systems. There are various kinds of bridge joint systems. Those included as part of the work required by this section are:

A. Armored Joint System with Elastomeric Sealer. The system shall consist of armored joint segments, angles, anchor studs, threaded studs, bolts, nuts, lock washers, expansion bolt anchors, and sealant, all combined as noted in the contract documents so that a fully operational and waterproof system shall seal the joint in which it is installed.

B. Armored Joint System with Compression Seal. This system shall consist of angles, preformed compression seal, anchor studs, threaded studs, bolts, nuts, lock washers all combined as noted in the contract documents so that a fully operational and waterproof system shall seal the joint in which it is installed. The system shall provide for the full expansion and contraction movements of the joint.

This system is fabricated as a single entity designed to be installed across the full width of the bridge as measured along the centerline of joint. If the bridge in question has a raised median, one field splice of the joint system will be allowed at the raised median.

Type. Preformed compression seals are manufactured in various type sizes, defined by a literal-numerical type designation (e.g. Type A1, etc.). The type of seal to be installed in any one armored joint system will be indicated on the contract plans.

C. Armored Joint System with Preformed Elastic Strip Seal. This system shall consist of structural steel components, angles, anchor studs, threaded studs, bolts, nuts, washers, lock washers, anchor bolts, preformed elastic strip seal and adhesive, all combined in the manner required by the Contract Documents so that a fully operational, waterproof system will seal the joint over which it is installed. Armored joint systems of this nature are installed by various methods. The required method for a particular installation will be indicated on the Contract Plans.

Type. Preformed elastic strip seals are manufactured in various sizes, defined by a type number. The type of strip seal to be installed in any one joint system will be indicated on the Contract Plans.

D. Armorless Bridge Joint System. The system shall consist of components shown on an Approved Materials Detail Sheet for a Manufacturer and System whose name appears on the Materials Bureau Approved List. The required method of installation will be shown on the Approved Materials Detail Sheet.

567-1.02 Terminology. The following terminology will be used throughout this section:

A. Armored Joint System. This term is used to describe the installation with all of its component parts as installed in the structure slab. Terminology used to differentiate one kind of joint system from another will be found in the title of the various subsections (e.g. 567-2.01 Armored Joint System with Elastomeric Sealer, etc.)

B. Segment. A joint system manufactured at less than full roadway width. No segment shall be less than a single lane width long.

C. Joint. The separation between two elements of a bridge structure to allow for movement.
§567

D. Materials Detail Sheet (MDS). A sheet approved by the DCES and containing all material requirements and installation information for Armorless Bridge Joints which are included on the Materials Bureau Approved List.

567-2 MATERIALS. Material and Fabrication requirements shall be as described for the various bridge joint systems.

567-2.01 Armored Joint System with Elastomeric Sealer

Elastomer (Polychloroprene or Natural Rubber)  Table 567-1
Structural Steel Segment Angles  ASTM A242M and 715-01, or ASTM A36M
Headed Concrete Anchor Studs and Threaded Studs  709-05
(Dimensions as shown on the contract plans)
Bolts, Nuts and Washers Steel  ASTM F568 Class 4.6 or ASTM A325M
Expansion Bolt Anchor Steel  U.S. Government GSA FF-S-325  Group III, Type 1 or Group VIII, Type 1
Bonding Tape  (to bond end surfaces of the preformed elastomeric joint sealer to each other)  Fed. Spec MIL C 18969a, Type II, Class B  Polyisobutylene-based extrusion, with aggressive tack

A. Physical Composition. Armored segments shall be comprised of elastomer or natural rubber, and structural steel components in the manner indicated on the contract plans.

B. Length. Armored segments shall be furnished in lengths not less than a single lane width, excluding length of tongues. Shorter lengths may be used at locations requiring special treatment or to provide the closing sections.

C. Steel Fabrication. All steel fabrication work shall be done in accordance with the requirements of the SCM. Mill inspection will not be required. Shop inspection will be conducted at the discretion of the Department.

D. Cleaning. The surface of the armored joint segment, to which the preformed elastomer is to be heat bonded, shall be thoroughly cleaned of all dirt, oil, grease, scale and oxides by grinding or sandblasting immediately prior to the heat bonding process. The metal surface after cleaning, shall be defined by SSPC Vis 1-89 Pictorial Standard, and shall meet the requirements of SSPC-SPC-6, Commercial Blast Cleaning, but shall not be of a quality less than CSP6.

### TABLE 567-1 ELASTOMER MATERIAL REQUIREMENTS

<table>
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<th>Property</th>
<th>ASTM Test</th>
<th>Polychloroprene</th>
<th>Natural Rubber</th>
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<tr>
<td>Tensile Strength</td>
<td>D412</td>
<td>12.5 MPa</td>
<td>15.5 MPa</td>
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<tr>
<td>Tensile Elongation at break</td>
<td>D412</td>
<td>400 percent minimum</td>
<td>400 percent minimum</td>
</tr>
<tr>
<td>Hardness, Shore A Durometer</td>
<td>D2240</td>
<td>45 (±5)</td>
<td>50 (±5)</td>
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<tr>
<td>Compression Set (22 hrs at 70°C)</td>
<td>D395 Method B</td>
<td>20 percent maximum</td>
<td>20 percent maximum</td>
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<tr>
<td>Low Temperature</td>
<td>D746 Procedure B</td>
<td>Not brittle at -40°C</td>
<td>Not brittle at -54°C</td>
</tr>
<tr>
<td>Oil Deterioration (Volume increase after immersion in ASTM Oil No. 3 for 70 hrs @ 100°C)</td>
<td>D471</td>
<td>120 percent maximum</td>
<td>Not Applicable</td>
</tr>
</tbody>
</table>
§567

E. Basis of Acceptance. All materials used for this item, regardless of whether they are employed for fabrication or installation, shall be accepted at the work site upon certification, by the proper manufacturer, that all of the requirements of the contract documents have been met.

567-2.02 Armored Joint System with Compression Seal

Compression Seal          705-091
Angles, Plates and Bars (Structural Steel)    ASTM A242M, A588M2, 715-01 and SCM
Headed Concrete Anchor Studs and Threaded Studs (Dimensions as shown on the contract plans) 709-05
Bolts, Nuts and Washers    ASTM F568 Class 4.6 or ASTM A325M
Support Bar for the compression seal  ASTM A242M, AISI 1018 or AISI 1020
Expansion Bolt Anchors    U.S. Government GSA FF-S-325
Adhesive (to bond the preformed compression seal to the steel surfaces) Table 567-2, Moisture Curing Urethane with hydrocarbon solvent

NOTES:
1. The sealer shall be applied in one piece for the full length of each joint. Splices will not be permitted if the full length of joint is less than 15 m. If the full length of joint is more than 15 m, but less than 30 m long, one shop splice in the sealer will be permitted. If the full length of joint is greater than 30 m, shop splices in the sealer will be permitted at approximately 15 m intervals.
2. Support angles may be ASTM A36M
3. If AISI 1018 or AISI 1020 steel is used it shall be painted in accordance with the requirements of the contract documents.

TABLE 567-2 MOISTURE CURING URETHANE ADHESIVE

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<th>Property</th>
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<tbody>
<tr>
<td>Average weight per liter</td>
<td>0.96 kg ± 10%</td>
</tr>
<tr>
<td>Solids Content</td>
<td>72% - 74% by Weight</td>
</tr>
<tr>
<td>Adhesive to remain fluid, from</td>
<td>-15°C to 50°C</td>
</tr>
<tr>
<td>Film Strength (ASTM D412)</td>
<td>8.5 MPA</td>
</tr>
<tr>
<td>Elongation</td>
<td>350%</td>
</tr>
</tbody>
</table>

A. Assembly. The joint system shall be shop assembled and delivered to the work site ready for installation.

If the Contractor desires to assemble the joint system at the work site, prior permission to do so must be obtained from the DCES.

Joint systems assembled at the work site shall have all materials certified by the respective manufacturers that the respective materials meet the requirements of §567-2.02A. Field methods of fabrication shall be in accordance with the requirements of this subsection.

B. Procedures. Steel fabrication shall be done in conformance with the requirements of the SCM. Mill inspection will not be required. Shop inspection will be conducted at the discretion of the Department.

C. Cleaning. Metal surfaces which are to be coated with adhesive shall be cleaned in accordance with Steel Structures Painting Council, Surface Preparation No. 6, Commercial Blast Cleaning (SSPC SP6) with the following modifications and additions:

1. The cleaned surfaces shall have adhesive applied before detrimental rusting occurs.
2. A commercial blast cleaned surface shall be as defined by SSPC SP6 and SSPC Vis 1-89 pictorial references BSP6 and CSP6 only.

D. Basis of Acceptance. The armored joint system with preformed compression seal will be accepted at the work site upon certification to the Engineer by the Contractor, that the materials used and the fabricating procedures were in accordance with this specification.

The certification shall include the name of the sealer manufacturer, the lot numbers of all sealers used in the fabrication of the armored joint system and the statement that all sealer used in the
§567

fabrication of the armored joint system was appropriately identified as accepted materials by the presence of Department security seals when received by the fabricator.

567-2.03 Armored Joint System with Preformed Elastic Strip Seal. Since there are various methods of installing the joint system, all of the materials listed in this Subsection may not be applicable for a particular installation. It is the Contractor's responsibility to ensure that only those materials necessary are actually installed, where required, or as specified on the Approved Shop Drawings.

Angles, Plates, Extrusions and Milled Shapes
    ASTM A588M and 715-01
Headed Concrete Anchor Studs and Threaded Studs
    (Dimensions indicated on the Contract Plans)
    709-05
Bolts and Nuts
    ASTM A307M or A325M.
Anchor Bolts
    ASTM F568 Class 4.6
Anchor bolt grout
    701-07
Preformed Elastic Strip Seal
    ASTM D2628 modified1
Adhesive(to bond the strip seal to the steel surfaces)
    Table 567-2, Moisture Curing Urethane with Hydrocarbon Solvent
Concrete
    501, Class E
Elastomeric Concrete
    Contract Documents

NOTES:
1. Recovery Test is not required. The sealer shall be supplied in one piece for the full length of each joint.
2. Concrete and Elastomeric Concrete, if used, shall be placed and paid under a separate item.

A. Steel Fabrication. Steel fabrication shall be done in conformance with the requirements of the SCM. Mill inspection will not be required. Shop inspection will be conducted at the discretion of the Department.

B. Cleaning. Metal surfaces which are to be coated with adhesive shall be thoroughly cleaned of all dirt, oil, grease, scale and oxides by grinding or sandblasting. Metal surfaces after cleaning shall exhibit a clean quality of CSa2, or better, as defined by the Steel Structures Painting Council Standard SSPC Vis1.

C. Adhesive Coating. The recess of the steel extrusions shall be thoroughly coated with adhesive. The strip seal shall be installed within the recess in such a manner that it will be completely and firmly bonded to the recess surface over the total length of the joint system.

D. Basis of Acceptance. The fabricated joint system will be accepted at the work site by the Engineer after a visual inspection and upon receipt of the Manufacturer's Certification Report (MCR) that the materials and the fabricating procedures were in accordance with the Approved Shop Drawings and this Specification. The Manufacturer shall submit, with the MCR, a Certified Copy of the Mill Test Report (MTR) for all steel used to fabricate the joint system.

567-2.04 Armorless Bridge Joint. The material requirements shall be as shown on the Approved Materials Detail Sheet corresponding to a Manufacturer and System listed on the Materials Bureau Approved List.

567-2.05 Shop Drawings. Shop drawings will be required for any joint system supplied as part of this work. Shop drawings shall meet the various applicable requirements of this subsection. All shop drawings shall note the name and address of the joint system (or segment) fabricator as well as the location where the joint system (or segments) are to be fabricated.

A. General. The applicable provisions of Section 2-Drawings, of the New York State Steel Construction Manual shall apply with the following modifications

1. Shop Drawings. Shop drawings shall be submitted for review, approval and distribution in accordance with the requirements of the SCM, Section 2. The shop drawings shall indicate the
type, location and details of the mechanical devices required to compress the joint to its required
width based on the ambient temperature at the time of installation. All references, within Section
2 to the DCES, shall be interpreted as the Regional Director, with the following exceptions:
• 202.7 - Distribution of Approved Shop Drawings.
• 202.8 - Disposal of Original Reproducibles.

No shop drawing approval will be issued for shop drawings unaccompanied by current
WPS(s). No shop work shall begin prior to the Contractor's receipt of approved shop drawings.

2. Welding Procedure Specifications. The Contractor shall submit with the shop drawings
a Welding Procedure Specification (WPS), approved by the DCES for each combination of joint
system type and welding process shown on the shop drawings.

The WPS approval date shall be within 36 months of the joint system fabrication date. A
submitted WPS showing an approval date earlier than 36 months prior to joint system fabrication
will be rejected and the Contractor shall be required to submit shop drawings accompanied by a
currently approved WPS(s). No extension of time, nor additional payment will be forthcoming
for delays caused by the Contractor's failure to submit current WPS(s).

567-3 CONSTRUCTION DETAILS. The construction details shall be as required for the various joint
systems and the approved shop drawings.

567-3.01 Armored Joint System with Elastomeric Sealer

A. Manufacturer's Representative. The joint system shall be installed in strict accordance with
the manufacturer's instructions and this subsection. In the event of a conflict, the terms of this
subsection shall rule. A representative of the manufacturer shall be present at the beginning of the
installation. The representative shall be fully conversant in all respects with the correct installation
methods. The representative shall be responsible to advise both the Engineer and the Contractor, that
the proper installation method is being followed.

B. Preparation. The preformed recess which is to receive the joint system shall be air blown or
vacuum-cleaned in order that all loose or foreign matter is removed prior to installation of the system.

C. Storage Inspection and Handling. The joint system shall be stored, inspected and handled
in accordance with the following:

1. Handling and Storing. All material shall be handled and stored in a manner approved by
the Engineer, and consistent with the requirements of the SCM. No material shall be dropped,
thrown, or dragged upon the ground. Material shall be kept clean, properly drained and stored on
proper supports above the ground. All material shall be adequately shored, braced, or clamped to
resist lateral forces which might occur. Permanent distortion will be cause for rejection of
material.

If the shop applied protective coating deteriorates to the point that the Engineer considers it
unacceptable, the contractor shall restore the shop applied coating to a condition acceptable to the
Engineer. This work shall be done before other coatings are applied. The work shall be done in
accordance with the requirements of the contract documents.

2. Field Inspection. All installation work shall be subject to the Engineer's inspection. The
Engineer shall be given all facilities required for a thorough inspection. Materials and
workmanship subject to shop inspection shall be identified by the acceptance stamp of the Shop
Inspector. Materials and workmanship not required to be shop inspected will be inspected by the
Engineer. Certified copies of the results of tests conducted by the manufacturer shall be furnished
to the Engineer in accordance with the requirements of 715-01.

D. Installation Inspection. Immediately prior to installation, the armored segments shall be
inspected by the Engineer for proper alignment and complete bond between the polychloroprene and
§567

the steel, and proper stud placement and effectiveness. No bends or kinks in the armoring steel shall be allowed, nor shall straightening of such bends or kinks be allowed. Armored segments exhibiting bends or kinks shall be removed from the work site, and replaced with new armored segments at the Contractor's expense. Armored segments which exhibit any separation of the polychloroprene and the armoring steel shall be removed from the work site and replaced with new armored segments at the Contractor's expense. Studs shall be inspected visually and shall be given a light blow with a hammer. Any threaded stud which does not have a complete end weld or does not emit a ringing sound when struck a light blow with a hammer shall be replaced. Studs located more than 25 mm from the location shown on the shop drawings shall be carefully removed and a new stud placed in the proper location.

E. Mechanical Devices. In order for the armored segments to be installed properly, they must be set at a width which is directly dependent upon the ambient temperature at the start of installation, as shown on the shop drawings. The width setting shall be accomplished through the use of mechanical devices supplied by the armored segment fabricator. After the armored segment has been set to its proper line and grade and securely attached to its supports, the mechanical devices shall be removed and returned to the armored segment manufacturer.

F. Sealing Segment Surfaces. The mating surfaces of the armored segments shall be scrubbed with wire brushes, or other means satisfactory to the Engineer, to remove any rust from the steel and roughen the polychloroprene. This operation shall immediately precede the application of tape to the mating surfaces.

G. Concrete Placement and Finishing. After the joint system has been fully installed, concrete shall be placed in accordance with the contract plans. The concrete shall be finished in accordance with 557-3.07 - Finishing Integral Wearing Surfaces on Superstructure Slabs.

H. Watertight Integrity Test At least five work days after the joint system has been fully installed the Contractor shall test the entire (full length) joint system for watertight integrity employing a method satisfactory to the Engineer. The entire joint system shall be covered with water, either ponded or flowing, for a minimum duration of 15 minutes. The concrete surfaces under the joint shall be inspected, during this 15 minute period and also for a minimum of 45 minutes after the supply of water has stopped, for any evidence of dripping water or moisture. Water tightness shall be interpreted to be no free dripping water on any surface on the underside of the joint. Patches of moisture shall not be cause for non-acceptance.

Should the joint system exhibit evidence of water leakage at any place whatsoever, the Contractor shall locate the place(s) of leakage and take all measures necessary to stop the leakage. This work shall be done at the Contractor's expense. A subsequent water integrity test shall be performed subject to the same conditions and consequences as the original test.

567-3.02 Armored Joint System with Compression Seal

A. Delivery. The joint system shall be delivered to the work site ready for installation in accordance with the requirements of 567-2.02B1.

B. Preparation. The requirements of 567-3.01B, shall apply.

C. Storage Inspection and Handling. The requirements of 567-3.01C shall apply.

D. Installation Inspection. The armored joint system with compression seal shall be inspected in the same manner as required for armored segments under 567-3.01D. All of the requirements of 567-3.01D shall apply, except that compression seal not fully bonded to the armoring angles will not mandate replacement of the joint system. However, compression seal not fully bonded, shall be fully bonded to both armoring faces, by the Contractor, at no expense to the State.

E. Mechanical Devices. The requirements of 567-3.01E shall apply.
§567

F. Concrete Placement and Finishing. The requirements of 567-3.01G shall apply.

G. Watertight Integrity Test. Not required.

567-3.03 Armored Joint System with Preformed Elastic Strip Seal

A. Site Delivery. The joint system shall be shop assembled and delivered to the work site ready for installation, unless prior permission to field assemble has been granted by the Engineer.

B. Field Assembly.

1. If the Contractor desires to assemble the joint system at the work site, prior permission to do so shall be obtained from the Engineer, in writing.
2. Joint systems assembled at the work site shall have all materials certified by the respective Manufacturers. The certifications shall state that the Materials requirements of this Specification have been met.

C. Storage Inspection and Handling. The requirements of 567-3.02C shall apply.

D. Installation Inspection. The requirements of 567-3.02D shall apply. The term “compression Seal” shall be interpreted as “preformed elastic strip seal.”

E. Mechanical Devices. The requirements of 567-3.01E shall apply.

F. Recess Finishing. If the joint system is installed within a preformed concrete or asphalt recess, the recess will be filled and finished to grade with either structural concrete or elastomeric concrete. The exact materials will be indicated on the Contract Plans. The respective materials will be installed in the following manner:

1. Concrete. Placement shall be in accordance with 555. Finishing shall be done in accordance with 557-3.07. Machine finishing will not be required.
2. Elastomeric Concrete. Placement shall be in accordance with the requirements of the elastomeric concrete specification.

G. Watertight Integrity Test. The requirements of 567-3.01H shall apply.

567-3.04 Armorless Bridge Joint System

A. Manufacturer's Representative. The joint system shall be installed in strict accordance with the manufacturer's instructions and the Approved Materials Detail Sheet. In the event of a conflict, the terms of the Approved Materials Detail Sheet shall rule. A representative of the bridge joint system manufacturer shall be present prior to placement to inspect the prepared surfaces and remain at the job during all phases of the installation. The representative shall be fully conversant in all respects with the correct installation methods. The representative shall be responsible to advise both the Engineer and the Contractor on properly installing the joint system. The representative may be excused from the project site at the discretion of the EIC.

B. Preparation. All surfaces shall be prepared as per the Approved MDS. At a minimum, the preformed recess which is to receive the joint system shall be air blown using air free of water and oil or vacuum-cleaned so that all loose or foreign matter is removed prior to installation of the system. The substrate shall be dry for a minimum of 24 hours prior to installation for the joint system.

C. Storage Inspection and Handling. The joint system shall be stored, inspected and handled in accordance with the Approved Materials Detail Sheet.
D. Installation Inspection. All installation work shall be subject to the Engineer's inspection.

E. Watertight Integrity Test. At least five work days after the joint system has been fully installed the Contractor shall test the entire (full length) joint system for watertight integrity. The entire joint system shall be covered with water, either ponded or flowing, for a minimum duration of 15 minutes.

The concrete surfaces under the joint shall be inspected during this 15 minute period, and also for a minimum of 45 minutes after the supply of water has stopped, for any evidence of dripping water or moisture. Water tightness shall be interpreted to be no free dripping water on any surface on the underside of the joint. Patches of moisture shall not be cause for non-acceptance.

Should the joint system exhibit evidence of water leakage at any place whatsoever, the Contractor shall locate the place(s) of leakage and take all measures necessary to seal the leak. A subsequent water integrity test shall be performed subject to the same conditions and consequences as the original test.

567-4 METHOD OF MEASUREMENT. Measurement will be made as the number of meters of joint system completely installed, measured horizontally and vertically along the centerline of joint system between the outer limits as indicated on the contract plans.

The words “completely installed” shall be interpreted to mean the joint system in place with the following operations completed where applicable:

- All sealant in its proper position.
- All nuts tightened or retightened as required.
- Concrete placed and finished.
- Elastomeric concrete placed and finished.
- Water-tight integrity tests.

567-5 BASIS OF PAYMENT. The unit price bid per meter shall include all labor, materials and equipment necessary to complete the work. No additional payment will be made for corrective actions.

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>567.31</td>
<td>Armored Joint System with Compression Seal-Type A1</td>
<td>Meter</td>
</tr>
<tr>
<td>567.32</td>
<td>Armored Joint System with Compression Seal-Type A2</td>
<td>Meter</td>
</tr>
<tr>
<td>567.33</td>
<td>Armored Joint System with Compression Seal-Type A3</td>
<td>Meter</td>
</tr>
<tr>
<td>567.34</td>
<td>Armored Joint System with Compression Seal-Type A4</td>
<td>Meter</td>
</tr>
<tr>
<td>567.35</td>
<td>Armored Joint System with Compression Seal-Type A5</td>
<td>Meter</td>
</tr>
<tr>
<td>567.36</td>
<td>Armored Joint System with Compression Seal-Type A6</td>
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<td>Armored Joint System with Compression Seal-Type A7</td>
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<td>567.50</td>
<td>Armored Joint System with Preformed Elastic Strip Seal - Type as Noted</td>
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</tr>
<tr>
<td>567.60</td>
<td>Armorless Bridge Joint System</td>
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</tr>
</tbody>
</table>

SECTION 568 - BRIDGE RAILING

568-1 DESCRIPTION. This work shall consist of furnishing and erecting bridge railing as shown on the contract plans and in accordance with the specifications.

The Contractor shall notify the Deputy Chief Engineer, Structures (DCES) of the name and address of the fabricator of all bridge railing in accordance with §106-01 Sources of Supply.

As soon as the Contract is awarded, the Contractor shall notify the DCES of the name and address of the Fabricator of all bridge railing. This notification shall list the specific shop or shops in which the railing will be fabricated.

568-2 MATERIALS. Materials shall meet the requirements of the following subsections:

Concrete Grouting Material 701-05
Steel Bridge Railing 710-23
When Steel Bridge Railing - Rustic is specified, the Contractor shall supply all unpainted, weathering steel railing or all galvanized and painted steel railing, unless the Contract Documents require a particular method of obtaining the rustic appearance. A combination of unpainted weathering steel and galvanized, painted steel will not be permitted.

568-3 CONSTRUCTION DETAILS

568-3.01 Erection of Railing

A. Inspection of Railing. Immediately prior to erection, the railing shall be inspected for damage. Significant bends or kinks in the railing not specifically called for in the contract documents shall constitute sufficient cause for rejection. Straightening of such bends or kinks shall not be allowed. Bending or curving rails in the field in order to fit alignment requirements, shall not be permitted. The Engineer may order some bending or curving to allow for necessary minor adjustments.

B. Inspection of Galvanizing. Damage to galvanizing of steel bridge railing shall constitute sufficient cause for rejection except for the following conditions:

1. If the damaged area is not required to be repaired under the provisions of 710-23, Steel Bridge Railing.
2. If the total damaged area of a single piece (i.e. post or rail) is 4000 mm$^2$ or less. Total damaged area is exclusive of the damaged area as described under 568-3.01B1.

C. Field Galvanizing for Repair. Field galvanizing repair shall be allowed to be performed upon damaged areas meeting the requirements of 568-3.01B2.

   Field galvanizing repair shall be made by painting zinc repair material onto the damaged area in accordance with the requirements of 719-01, Galvanized Coatings and Repair Methods.

   All finished surfaces of welds and adjacent surfaces of rails and posts upon which galvanizing has been removed, due to any field welding operation, shall be field galvanized.

D. Field Welding. Field welding shall not be permitted unless noted in the contract documents or ordered by the Engineer.

E. Erection. All railing shall be erected in accordance with the contract documents or, when required, the approved shop drawings prepared and submitted as specified in the New York State Steel Construction Manual.

F. Positioning Railing. Railing shall be erected so that the rails are parallel to each other and to the top of parapet, sidewalk or structural slab.

G. Positioning Posts. Posts shall be set vertical.

H. Base Plates. Post base plates shall be perpendicular to the post, unless otherwise noted. When the railing is to be placed on a preformed surface, the base plate may be placed parallel to the grade or may be perpendicular to the post and made level by the use of beveled shims conforming to the applicable requirements of 710-23, Steel Bridge Railing.

I. Non-Metallic Pads. Posts which are to be placed on a preformed surface shall be mounted on a non-metallic pad conforming to the requirements of 728-02. Beveled Shims, if required, shall be inserted between the non-metallic pad and the post base plate.
**J. Jacking Nuts.** For railings set on jacking nuts, the railing posts shall be erected to proper line and grade before concrete under the post and in back of the granite curb is placed or before the mortar pad is placed.

**K. Rail Span.** The rails of railings shall span the following minimum number of posts:

<table>
<thead>
<tr>
<th>Railing Type</th>
<th>Number of Posts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two-Rail, Steel</td>
<td>3*</td>
</tr>
<tr>
<td>Four-Rail, Steel</td>
<td>3</td>
</tr>
<tr>
<td>Five-Rail Steel</td>
<td>3</td>
</tr>
</tbody>
</table>

**NOTE:** If this is not possible, the absolute minimum shall be 2 posts if approved by the DCES.

**L. Anchor Studs.** After the anchor stud nuts have been tightened in a manner satisfactory to the Engineer, the studs shall be flame cut 25 mm above the nut. The first thread of the stud above the nut shall be damaged. The cut end of the anchor stud shall be coated in conformance with the requirements of §719-01, Galvanized coating and Repair Methods.

**M. Touch-Up Painting.** Any damage to the paint on a railing system shall be repaired in accordance with §657 Painting Galvanized Surfaces.

**N. Inspection.** All erection shall be subject to the inspection of the Engineer who shall be given all facilities required for a visual inspection of workmanship and materials.

Any single piece of the railing system with a total damaged area in excess of the amount specified in 568-3.01B2 shall be rejected and replaced.

### 568-3.02 Cement Mortar Pads

**A. Proportioning.** Cement mortar pads shall consist of a concrete grouting material.

The concrete grouting material shall meet the requirements of §701-05, Concrete Grouting Material. The grouting material shall be mixed with water, in the ratio recommended by the manufacturer, to produce a trowelable mix.

**B. Mixing.** Mixing shall be carried out in strict accordance with the manufacturers recommendations or the following as determined by the Engineer.

- All necessary mixing equipment shall be present and in good working order prior to the start of mixing.
- Mixing time shall not exceed three minutes unless otherwise permitted. No mixing shall be started until all preparations have been made to place the mortar.
- All mortar in any individual batch shall be used within 25 minutes after the start of mixing.
- Retempering will not be allowed.

**C. Surface Preparation.** All concrete surfaces to receive the mortar shall be free from laitance, oil, grease, paint, dust, loose particles or other foreign material.

The concrete surface shall be cleaned by sandblasting to the satisfaction of the Engineer, followed by a thorough vacuum cleaning.

The bottom surfaces of the base plates shall be free of oil, dirt and other foreign matter.

The concrete surface shall be lightly moistened with water.

**D. Form Preparation.** The forms shall be positioned about the base plate as shown in the plans or as directed by the Engineer. If the forms are to be coated with a release agent, it shall not be deleterious to the physical properties of the mortar system being used as determined by the Engineer.

**E. Application.** After the concrete surfaces and the base plates surfaces have been properly prepared the mortar shall be placed within the limits of the forms and tamped into place to assure that there are no voids in the completed pad. Exposed surfaces of the mortar shall be screeded and
troweled to the level of the bottom of the base plate. The mortar pads shall be protected from rain for at least 24 hours.

**F. General.** In all cases, the installation of the mortar pads shall be made when the concrete and ambient air temperatures are above 10°C.

### 568-4 METHOD OF MEASUREMENT

**568-4.01 Bridge Railing.** The quantity to be paid for bridge railing shall be the number of meters measured along the centerline of railing anchorage between the extreme outer limits indicated on the contract plans.

**568-4.02 Transition Bridge Railing.** The quantity to be paid for transition railing shall be the number of meters measured along the axis of the top rail between the limits shown on the plans.

### 568-5 BASIS OF PAYMENT

**568-5.01 Bridge Railing.** The unit price bid shall include the cost of furnishing all labor, materials and equipment necessary to complete the work. All pads (including Mortar Pads), shims, splices with their hardware, railing anchor studs with nuts, washers and anchor plates, and hand rails when specified shall also be included in the price bid.

No payment shall be made for those railing pieces which are replacements for those railing pieces that have been rejected.

Progress payments will be made when the railing is erected in accordance with the contract documents as specified in the New York State Steel Construction Manual exclusive of the cutting, peening and galvanizing of studs. Payment will be made at the unit bid price for 90% of the quantity erected. The balance of the quantity will be paid for upon proper completion of the work.

*Payment will be made under:*

<table>
<thead>
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<td>568.52</td>
<td>Steel Bridge Railing (Five-Rail)</td>
<td>Meter</td>
</tr>
<tr>
<td>568.53</td>
<td>Steel Bridge Railing (Two-Rail) with Handrail</td>
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</tr>
<tr>
<td>568.54</td>
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<td>Steel Bridge Railing - Rustic (Two-Rail)</td>
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<td>Steel Bridge Railing - Rustic (Four-Rail)</td>
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<td>Steel Bridge Railing-Rustic (Two-Rail) with Handrail</td>
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<td>Pedestrian and Bicycle Railing (Two-Rail)</td>
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<td>568.82</td>
<td>Pedestrian and Bicycle Railing (Three-Rail)</td>
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<td>Pedestrian and Bicycle Railing (Four-Rail)</td>
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<td>Meter</td>
</tr>
</tbody>
</table>
SECTION 569 - PERMANENT CONCRETE TRAFFIC BARRIER FOR STRUCTURES

569-1 DESCRIPTION

569-1.01 Work. The work shall consist of constructing concrete traffic barrier, of the configuration and at the locations indicated on the Contract Plans.

569-1.02 Methods. Construction of the barrier shall be accomplished by cast-in-place or precast methods. Slip forming will be allowed as an acceptable cast-in-place method, unless the plans show anchor bolts projecting beyond concrete limits; in this instance slipforming procedures will require the approval of the DCES.

569-1.03 Shape Modification. The barrier shape indicated on the plans shall not be altered. Minor modifications, to allow slip-forming, will be submitted to the Regional Construction Engineer for approval.

569-1.04 Approvals. For approval requirements and procedures refer to the Construction Details.

569-2 MATERIALS

569-2.01 Fabrication. Materials used for traffic barrier fabrication shall meet the following requirements:

<table>
<thead>
<tr>
<th>Material</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precast Concrete Barrier</td>
<td>704-03 and 704-05</td>
</tr>
<tr>
<td>Cast-In-Place Concrete (Constructed Forms)</td>
<td>501, Class A Concrete</td>
</tr>
<tr>
<td>Cast-In-Place Concrete (Slip Formed)</td>
<td>501, Class J</td>
</tr>
<tr>
<td>Epoxy Coated Reinforcing Bars</td>
<td>709-04</td>
</tr>
<tr>
<td>Steel Tubes</td>
<td>ASTM A500M, Grade B</td>
</tr>
<tr>
<td>Steel Plates, or Bars</td>
<td>ASTM A36M or A588M</td>
</tr>
<tr>
<td>Anchor Bolts (Fully Threaded)</td>
<td>ASTM F568M, Grade 8.8</td>
</tr>
<tr>
<td>Nuts</td>
<td>ASTM F563M, Class 10S HH</td>
</tr>
<tr>
<td>Washers</td>
<td>ASTM F436M, Type 1 or 3</td>
</tr>
<tr>
<td>Concrete Grouting Material</td>
<td>701-05</td>
</tr>
<tr>
<td>Concrete Repair Material</td>
<td>701-04</td>
</tr>
<tr>
<td>Joint Filler</td>
<td>ASTM D 1056, Grade 2B1 or 2B2.</td>
</tr>
<tr>
<td>Curing Compound</td>
<td>711-05</td>
</tr>
<tr>
<td>Locking and anchoring devices for precast units</td>
<td>715-01 and 709-04, as applicable</td>
</tr>
<tr>
<td>Galvanizing</td>
<td>719-01</td>
</tr>
</tbody>
</table>

All steel, except reinforcing steel, shall be galvanized.

569-2.02 Fabrication Tolerances. All cast-in-place concrete barrier, regardless of the method of construction, shall conform to the following finished tolerances:

<table>
<thead>
<tr>
<th>Feature</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bar Reinforcement Cover</td>
<td>-0 , +13 mm</td>
</tr>
<tr>
<td>Width (Top)</td>
<td>-0 , + 6 mm</td>
</tr>
<tr>
<td>Width (Bottom)</td>
<td>-0 , +13 mm</td>
</tr>
<tr>
<td>Surface Straightness</td>
<td>13 mm in 6 meters</td>
</tr>
<tr>
<td>(Deviation from theoretical centerline)</td>
<td></td>
</tr>
<tr>
<td>Vertical Alignment</td>
<td>13 mm in 6 meters</td>
</tr>
<tr>
<td>(Deviation from a line parallel to the theoretical grade line)</td>
<td></td>
</tr>
<tr>
<td>Horizontal and Vertical Misalignment</td>
<td>4 mm</td>
</tr>
<tr>
<td>(between adjacent precast units)</td>
<td></td>
</tr>
</tbody>
</table>
All precast concrete barrier shall conform to the tolerances contained in §704-03, §704-05 and to the foregoing misalignment tolerance. Reinforcement cover shall be verified while the concrete is still plastic, except in the case of cured precast units. In that case, cover will be verified in accordance with established Department procedures. These procedures may include coring.

569-3 CONSTRUCTION DETAILS

569-3.01 Approvals

A. Cast-In-Place Concrete - Modifications to Contract Plans. The DCES shall be supplied with three copies of pertinent details and necessary design computations. Every effort will be made to render a decision, in a timely manner, after all pertinent information has been received. However, the time required to render a determination will not be taken into account should the Contractor request an extension of time.

B. Precast Concrete. Precast barrier systems shall be approved by the DCES prior to the contract award in order to be used in the contract.

569-3.02 General: Cast In Place Concrete

A. Cleaning. Surfaces against which barrier is to be placed shall be thoroughly cleaned and vacuumed to remove any dirt or other foreign substances, laitance or partially loose chips of concrete.

B. Defects. Defects are divided into two categories: minor defects and major defects. Minor defects in the barrier shall be repaired. Major defects shall be cause for rejection of the section. Such rejected sections shall be removed and replaced or, upon approval of the Engineer, the section shall be repaired to the satisfaction of the Engineer.

1. Minor Defects. Minor defects are defined as holes, honeycombing or spalls which are 150 mm or less, in diameter, and which do not expose the outermost surface of the steel reinforcement. Surface voids 15 mm, or less, in diameter, and 6 mm, or less in depth are not considered defects. They do not require repair.

2. Major Defects. Major defects are defined as:

   a. Any defect, except as noted in §569-3.02 B.1. above which does not meet the definition of a minor defect.

   b. Minor defects which, in aggregate, comprise more than five percent (5%) of the surface of the barrier section.

C. Repair. Repair shall be made with a material acceptable under §701-04. Methods of repair shall be acceptable to the Engineer. The color of the repaired portion shall match, as nearly as practicable, the color of the surrounding concrete. Repaired portions shall exactly match shape requirements. The repaired portion shall withstand a moderate blow from a .5 kg hammer. Repair shall be done at no cost to the State.

569-3.03 General: Precast Concrete. The definition of defects and the repair requirements contained in 704-03 shall apply.

569-3.04 Cast-In-Place Concrete - Constructed Forms. The requirements of 555 and 556 shall apply with the following modification:

Thoroughly wet the structural slab surface and all porous surfaces to be in contact with new concrete for at least 12 hours immediately prior to placement. Remove all standing water with oil-free compressed air, and protect the surfaces from drying, so the concrete remains in a saturated surface dry condition until
placement of the new concrete. If the forms are removed before seven curing days have passed, the concrete shall be cured by means of a clear curing compound. No curing blankets will be required.

Curing compound shall be sprayed on the concrete surface immediately following the slipforming and hand finishing operations. The compound shall be applied by means of pressure spraying or distributing equipment at the rate directed by the Engineer, but not less than 1 L per 3.5 square meters of surface. The equipment for applying the compound shall be such that the compound is applied as a fine spray with no surface damage to the concrete. The equipment shall also provide adequate agitation of the compound during application, and shall be approved by the Engineer before work is started. Should the method of applying the compound produce a non-uniform film, or should the spraying equipment fail and duplicate equipment not be immediately available, the application of curing compound shall be discontinued immediately and the curing shall be accomplished by another method acceptable to the Engineer. The Contractor shall stockpile sufficient approved coverings for protection of the concrete in the event of rain, non-uniform film application, or breakdown of spray equipment.

569-3.05 Cast-In-Place Concrete - Slipformed. The requirements of Section 555, Section 556 and the following, shall apply:

A. The forming of the barrier shall be accomplished by self-propelled equipment approved by the Engineer. The requirements of 555-3.03 shall not apply. Thoroughly wet the structural slab surface and all porous surfaces to be in contact with new concrete for at least 12 hours immediately prior to placement. Remove all standing water with oil-free compressed air, and protect the surfaces from drying, so the concrete remains in a saturated surface dry condition until placement of the new concrete.

B. After all reinforcing bars have been placed, all bridge joints installed, and all other hardware placed in the area of the barrier, the Contractor shall perform a "dry run" over the entire length of the barrier installation location. It is necessary only to "dry run" a single day's placement during any given day; however, the entire barrier length shall be traversed. The "dry run" may be made with either the actual slip forming equipment, or with an exact "mock-up" of the equipment. The "mock-up"; if utilized, shall be the exact size, shape and dimensions of the slip forming equipment. It shall be a minimum of 1.2 m long. Its movement shall be able to be correlated with a string, or survey, line indicating the correct offset location of the barrier.

C. After the "dry run" portion of the work has been completed and all obstructions have been cleared, the slip-forming equipment shall be demonstrated for capability. The demonstration shall be done in the presence of the Engineer. The Contractor shall make all adjustments, or alterations, to ensure that the equipment has the capability to produce an acceptable product. No work shall be done without the Engineer's approval. The capability demonstration will be required only once for each piece of forming equipment used on the project.

D. The Engineer's approval is for equipment capability only. The Contractor shall be entirely responsible for meeting the tolerances given under MATERIALS, 569-2.03. Fabrication Tolerances. Sections which do not meet tolerance requirements are subject to removal and replacement at no cost to the State, at the discretion of the Engineer.

E. Central and Transit Mixed Concrete. The provisions of 501-3.03 C and D shall apply for Central Mixed and Transit Mixed Concrete respectively, except that water may be added to the mixture one additional time at the point of deposition to maintain the desired slump. The water addition may be made anytime after the beginning of discharge until approximately two-thirds of the load, as determined by the Engineer, has been discharged. After the water addition, the concrete shall be mixed at least 30 revolutions in the mixing range. When the water addition is made after discharge the total number of revolutions shall not be more than 190.

Truck Mixed Concrete. The provisions of 501-3.03 E shall apply except that after initial slump has been achieved, water may be added to the mixture one additional time to maintain the desired slump. The water addition may be made anytime after the beginning of discharge until approximately
two-thirds of the load, as determined by the Engineer, has been discharged. After the water addition, the concrete shall be mixed at least 30 revolutions in the mixing range.

**F.** Concrete supply shall be sufficient to produce a continuous, completely shaped barrier. If concrete placement is interrupted, for any reason, the placement shall be protected from drying by several layers of wet burlap. A construction dam, or bulkhead, shall be installed if the interruption exceeds 30 minutes. If the interruption exceeds 90 minutes, further placement shall be discontinued. Concrete placement at this location may then resume only after 12 hours, measured from the time of delay, has elapsed.

**G.** Concrete placement may begin at the joint beyond the bulkhead without time constraints. If the length of placement between the bulkhead and the next joint is such that, in the opinion of the Engineer, it may not be slipformed, the Contractor shall form the section by methods other than slipforming.

**H.** Cold joints in the barrier, that is, joints formed due to the attachment of fresh concrete to set concrete, shall be made in the following manner. The set concrete shall have its surface cut to remove all loose, and otherwise unsatisfactory materials. Tools used for this purpose shall be approved by the Engineer, prior to use. The surface shall be scrubbed with wire brooms and shall be kept wet until new concrete is placed.

**I.** The Contractor shall make provisions to allow hand finishing, should it be necessary, on all surfaces. Hand finishing, if done, shall be done immediately after the passage of the slipforming equipment. Curing compound shall be applied only after hand finishing has been completed at any particular location.

**J.** Concrete shall be cured by means of a clear curing compound in accordance with the requirements of 569-3.04.

**K.** Joints and construction grooves shall be introduced at the locations indicated on the Contract Plans. If sawcutting methods are employed the following requirements shall apply:

1. The equipment shall be demonstrated, for capability, to the Engineer.
2. No sawcuts, for any purpose, shall be made in the structural slab.
3. In order to avoid sawcuts in the structural slab, the portion of the joint 75 mm directly above the structural slab shall be hand tooled immediately after finishing.
4. All sawcuts shall be made normal to the structural slab surface. The joints shall be sawcut as soon as no damage to the concrete will result with a maximum time of 8 hours. The clear curing compound shall be reapplied at the sawcut.

### 569-3.06 Precast Concrete

**A.** Immediately prior to installation, the barrier units shall be inspected for defects. Defects which conform to the definition of minor defects as given in §704-03 shall be repaired in accordance with the requirements of that subsection.

After the inspection for defects has been completed, the contact surface of all precast barrier shall be sandblast cleaned in accordance with the requirements of §584-3.02A, and §584-3.02C. After sandblasting operations are completed the surfaces shall be thoroughly vacuum cleaned.

**B.** After the cleaned surface has been accepted, thoroughly wet the surface over which the precast barrier will be placed for at least 12 hours immediately prior to placing the grout bed. Remove all standing water with oil-free compressed air, and protect the surface from drying, so the surface remains in a saturated surface dry condition when placing the grout bed. All precast barrier shall be installed on grout beds conforming to the requirements of §701-05 as modified herein. The exact bedding placement requirements shall be established by the barrier system manufacturer. However,
no grout bed shall be greater than 13 mm in thickness after the barrier has been installed in its permanent position. All grout bedding material shall be tooled flush with the barrier edge.

Care shall be taken to prevent grout from setting prior to barrier unit installation. If, in the opinion of the Engineer, the grout has set, or has begun to set, it shall be removed. No retempering will be permitted. The affected installation area shall be thoroughly cleaned of grout, by methods acceptable to the Engineer, and new grout shall be placed, all at no additional cost. All vertical adjustments shall be made by the addition, or removal, of grout. No wedges will be permitted.

Lifting of the barrier which, in the Engineer's opinion, will result in permanent voids occurring between the barrier unit and the grout bed, will not be permitted.

C. Unless otherwise noted joints between units shall utilize materials required by ASTM D 1056, Grade 2B1 or 2B2 and shall be installed in the manner indicated on the approved precast barrier system drawings.

D. Units which are damaged during installation, due to the Contractor's operations, shall be repaired, or replaced, as determined by the Engineer. Repair or replacement shall be done at no cost to the State.

E. Precast barrier anchored to the underlying support by means of drilled-in-bolts, may be anchored by one of two methods:

1. **Bolts chemically anchored to the underlying support.** Holes drilled for this method will not go completely through the underlying support. Bolt installations will be subjected to load testing acceptance requirements.

2. **Bolts mechanically anchored to the bottom of the underlying support.** Holes drilled for this method will go completely through the underlying support. Bolt installations will not be load tested.

### 569-3.07 Requirements for Method permitted under §569-3.06E1

A. Drilling shall be done by means of a rotary impact drill. Hole diameter shall be in strict accordance with the grout manufacturer's instructions. If reinforcing steel is encountered, the reinforcing shall be cut and removed by means of a core drill. If approved by the Engineer, hole locations may be moved to avoid encountering reinforcing steel. The remainder of the drilling shall be done by rotary impact drill.

Drilling with a lubricant will not be permitted. Water use is permissible. Concrete spalled, or otherwise damaged by the contractor's operations shall be repaired, in a manner approved by and, to the satisfaction of the Engineer, at no additional cost.

B. Unless otherwise specified in the Contract Documents, the minimum depth of embedment of the anchor bolt shall be in accordance with Table 569-1.

The Contractor may increase the embedment length beyond that shown on the Plans or specified in the above table provided 1) the increase is done at no additional cost to the State and 2) the hole stops at least 50 mm from the bottom of the structural slab.

<table>
<thead>
<tr>
<th>TABLE 569-1 MINIMUM EMBEDMENT AND REQUIRED TEST LOAD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal Anchor Bolt Diameter (mm)</td>
</tr>
<tr>
<td>Embedment Length (mm)</td>
</tr>
<tr>
<td>Test Load (kN)</td>
</tr>
</tbody>
</table>

C. Grouting material shall be a non-metallic, non-shrink grout, or polymer resin. It shall contain no products which promote the corrosion of steel. When cured, the material shall exhibit a maximum loss of four percent (4%) when tested for freeze-thaw resistance. Freeze-thaw testing will be done in accordance
§569

with Materials Test Method 502-3P, except that the material will be subjected to 50 cycles of testing. Cured material shall not be reactive with salt water, portland cement, or petroleum products.

The contractor shall supply the Engineer with two copies of the grout manufacturer's certification that the material meets the foregoing requirements.

D. All anchor bolts shall be inserted at least the specified depth into the hole. After insertion of the bolt, all excess grout shall be struck-off flush with the concrete face. Should the grout fail to fill the hole, additional grout shall be added to the hole to allow a flush strike-off.

E. A portion of each lot of grouted-in anchor bolts shall be designated by the Engineer for load testing. The first lot shall consist of the first 10 grouted in anchor bolts. The remaining lots shall be defined by the Contractor subject to the following:

- The lot size shall not exceed 600 anchor bolts.
- A lot shall only include anchor bolts installed during a single construction season.
- A lot shall only include anchor bolts grouted with the same grout or resin.

Unless otherwise specified in the Contract Documents, the minimum load applied during the load testing shall be in accordance with Table 569-1.

Table 569-2 shows the lot size (column L), the initial number of anchor bolts selected for testing (column N1) and the number of anchor bolts selected for additional testing (column N2).

<table>
<thead>
<tr>
<th>Lot Size</th>
<th>Initial Sample Size</th>
<th>Additional Test Sample Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>N1</td>
<td>N2</td>
</tr>
<tr>
<td>1-30</td>
<td>All the bolts in the lot</td>
<td>---</td>
</tr>
<tr>
<td>31-50</td>
<td>30</td>
<td>---</td>
</tr>
<tr>
<td>51-75</td>
<td>38</td>
<td>---</td>
</tr>
<tr>
<td>76-100</td>
<td>44</td>
<td>21</td>
</tr>
<tr>
<td>101-200</td>
<td>49</td>
<td>26</td>
</tr>
<tr>
<td>201-300</td>
<td>50</td>
<td>30</td>
</tr>
<tr>
<td>301-600</td>
<td>55</td>
<td>30</td>
</tr>
</tbody>
</table>

NOTES:
1. If all of the N1 anchor bolts selected for testing pass the load test, then the lot shall be accepted.
2. If the lot size is 75 or less and one or more of the N1 anchor bolts fail the load test, then all the anchor bolts in the lot shall be tested.
3. If the lot size is 76 or greater and only 1 of the N1 anchor bolts fails the load test, the Engineer shall designate an additional N2 anchor bolts for testing. If none of the N2 anchor bolts fail the load test, the lot shall be accepted. If any of the N2 anchor bolts fails the load tests all of the anchor bolts in the lot shall be tested.
4. If the lot size is 76 or greater, and more than one of the N1 anchor bolts fail the load testing then all the anchor bolts in the lot shall be tested.

Anchor bolts shall be deemed to pass if the specified test load is attained without permanently displacing the anchor bolts. THIS LOAD TESTING SHOULD BE NON-DESTRUCTIVE. LOADING SHOULD BE STOPPED AS SOON AS THE MINIMUM ACCEPTABLE PULL-OUT RESISTANCE IS ATTAINED.

F. The testing equipment shall consist of a calibrated jack system, a frame to distribute the jack load, couplers to connect the jack to the anchor bolts, and safety devices. Prior to starting the testing, the Contractor shall supply the Engineer with a certificate of calibration for the jack less than 6 months old.

Supports for the frame used to distribute the jack load shall be located outside a circle centered at the anchor bolt and of a diameter equal to 50 mm plus twice the anchor bolt embedment length but need not exceed 600 mm. The frame and jack shall be positioned so that the load is applied along the centerline of the anchor bolt. Chains or cables shall be used to connect the various pieces of the tensioning system so that free projectiles will not be created by a failure of an anchor bolt anchorage, coupling or other portion of the tensioning system.

G. All anchor bolts which fail load testing shall be replaced and load tested in accordance with the foregoing requirements at no additional cost.
§569-3.08 Requirements for Method permitted under §569-3.06E2

A. The requirements of §569-3.07A shall apply.
B. Grouting material shall meet the requirements of §701-05. It shall be mixed and placed in strict accordance with the grout manufacturer's instructions unless otherwise modified by the contract documents.
C. Both hole and bolt shall be clean and dry at the time of bolt insertion. The bolt shall be held in place such that it will remain vertical during subsequent grout placement. The method of bolt retention shall be such that the grout will be held within the hole until setting is complete.

Barrier units mechanically anchored to the underlying support by means of bolting shall be grouted into place in accordance with the following:
- Grout shall be prepared in accordance with the grout manufacturer's written instructions. Two copies of the manufacturer's instructions shall be delivered to the Engineer a minimum of two weeks prior to the beginning of barrier installation work.
- Grout shall be placed only if the ambient air temperature is at least 10°C and is predicted to rise. No grout shall be placed if the ambient air temperature falls below 7°C, unless external heat has been provided in the manner required by §555-3.08. The underlying support may be used as the floor of the enclosure if the Engineer approves.
- External heat shall be maintained for a minimum of seven curing days. A curing day is defined by §555-3.08A. After seven curing days have passed, or the grout has reached a minimum compressive strength of 25 MPa, whichever occurs last, the enclosure may be removed. All work of providing external heat shall be done at no additional cost.

569-4 METHOD OF MEASUREMENT. The work will be measured as the number of meters of concrete traffic barrier installed. Measurement will be taken along the centerline of the top of the barrier. No deduction will be made for joints.

569-5 BASIS OF PAYMENT

A. The unit price bid per meter shall include the cost of all labor, materials and equipment necessary to complete the work. This price shall also include the cost of bar reinforcement, drilling, and testing.
B. In the case of barrier constructed by cast-in-place methods, 40% of the quantity will be paid for after all of the bar reinforcement has been placed and approved by the Engineer. This payment shall include the cost of chairs, supports, fastenings, connections and any splices not specifically indicated on the plans. If the Engineer permits the substitution of larger bars than those specified, or the DCES permits splices not indicated on the plans, the payment will not be increased nor will any extra compensation be considered.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>569.01</td>
<td>Permanent Concrete Traffic Barrier for Structures (Full Section)</td>
<td>Meter</td>
</tr>
<tr>
<td>569.02</td>
<td>Permanent Concrete Traffic Barrier for Structures (Half Section)</td>
<td>Meter</td>
</tr>
<tr>
<td>569.03</td>
<td>Vertical Faced Concrete Parapet</td>
<td>Meter</td>
</tr>
<tr>
<td>569.04</td>
<td>Single Slope (Half-Section) Concrete Bridge Barrier</td>
<td>Meter</td>
</tr>
<tr>
<td>569.05</td>
<td>Single Slope (Full-Section) Concrete Bridge Barrier</td>
<td>Meter</td>
</tr>
<tr>
<td>569.06</td>
<td>F-Shaped (Half-Section) Concrete Bridge Barrier</td>
<td>Meter</td>
</tr>
<tr>
<td>569.07</td>
<td>F-Shaped (Full-Section) Concrete Bridge Barrier</td>
<td>Meter</td>
</tr>
<tr>
<td>569.08</td>
<td>Texas Aesthetic Concrete Bridge Barrier</td>
<td>Meter</td>
</tr>
</tbody>
</table>

SECTION 570 - PAINT REMOVAL OPERATIONS

570-1 DESCRIPTION. This work shall consist of providing environmental protection and developing and implementing a worker Lead Health Safety program during paint removal operations.
Whenever a structure spans over a railroad, covers shall be placed and maintained in accordance with §105-09 Work Affecting Railroads. Structures that span a navigable waterway may be subject to regulation by various agencies.

570-1.01 Lead-Exposure Control Plan (LECP). This work shall consist of the development and implementation of a Lead Exposure Control Plan to protect workers from the harmful effects of lead exposure in accordance with 29 CFR Subpart D. Work activities which may expose workers to health hazards include, but are not limited to abrasive blasting, paint removal, torch-cutting, welding, grinding, and rivet busting.

570-1.02 Medical Testing. This work shall consist of medical testing to monitor the safety of workers with lead exposures.

570-1.03 Personal-Exposure-Monitoring Sample Analysis. This work shall consist of monitoring the exposure levels of workers to define the hazard and/or to verify the effectiveness of control measures.

570-1.04 Decontamination Facilities. This work shall consist of installation, operation, maintenance, and cleaning of decontamination facilities for personnel with lead exposures.

570-1.05 Environmental Ground Protection. This work shall consist of the collection and removal of waste materials, including old paint chips, corrosion residues, spent abrasives, and newly applied paint that result from cleaning and painting operations as specified in the contract documents or as directed by the Engineer.

570-1.06 Environmental Water Protection. This work shall consist of the collection and removal of waste materials, including paint chips, corrosion residues, spent abrasives and newly applied paint that result from cleaning and painting operations as specified in the contract documents or as directed by the Engineer.

570-1.07 Class B Containment. This work shall consist of furnishing, installing, and removing a containment enclosure around the work area used to contain and collect debris generated during paint removal and surface preparation using vacuum shrouded power tools, vacuum blasters, and hand tools. Open abrasive blasting shall not be conducted in a Class B containment.

570-1.08 Class A Containment. This work shall consist of furnishing, installing, and removing a total containment enclosure around the immediate work area to contain and collect debris generated during paint removal and surface preparation operations as specified in the contract documents or as directed by the Engineer.

570-2 MATERIALS. A high-efficiency particulate air (HEPA) filter shall be defined as a filter that is at least 99.97% efficient against particles that are 0.3µm in diameter.

570-3 CONSTRUCTION DETAILS

570-3.01 Lead-Exposure Control Plan (LECP). At least 20 calendar days prior to starting any work which could entail employee exposure to lead, the Contractor shall submit two copies of a written Lead-Exposure Control Plan (LECP) to the Engineer for review and acceptance. This LECP shall address all of the elements required by 29 CFR Subpart D and shall be coordinated with, and need not be repeated in, the site-specific Health and Safety Plan. The Contractor shall not begin any work which could entail lead exposure until the LECP has been accepted by the Engineer.

Submission of the LECP and its acceptance by the Engineer shall not be construed to imply approval of any particular method for addressing lead health and safety concerns, or to relieve the Contractor of the responsibility for adequately protecting the health and safety of all workers.

A competent person shall have current training as SSPC C-3, Competent Person Training for Deleading of Industrial Structures, or the SSPC C-5 refresher training class.
A. **Industrial Hygienist.** Where required, the Contractor shall engage an Industrial Hygienist (IH) meeting one or more of the following qualifications:

- Current certification by the American Board of Industrial Hygiene.
- A Bachelor's Degree in engineering, chemistry, physics, biological sciences, industrial hygiene, toxicology, the environmental sciences or a related field, and at least three years of documented full-time work as an IH, including field and sampling experience.
- A Master's Degree in one of the above fields, and at least two years of documented full-time work as an IH, including field and sampling experience.

The IH shall have the following responsibilities:

- Development of a written LECP, LECP updates, and preparation of monthly summary reports.
- Provide general oversight of all aspects of the LECP.
- Review all employee medical tests and exposure monitoring results. If required, take corrective actions.
- Intervention by the IH, consisting of an on-site investigation by the IH, implementation of corrective action, and notification of the Engineer in the next monthly report if either of the following conditions are encountered:
  - Blood Lead Level (BLL) > 40 µg/dL (micrograms/deciliter) for one or more workers.
  - BLL increase of 10 µg/dL or more between successive tests for any individual worker.
- Inspect the work site at least monthly during work which produces a potential lead exposure, except where the Contractor documents that employee lead exposure will be below the Permissible Exposure Limit (PEL).

B. **Exposure Below the Action Level.** If the Contractor can document by air monitoring or the use of appropriate historical data that lead exposure for all employees will be below the Action Level (µg/m³), then the Contractor shall develop a written LECP including, but not limited to the following:

- A description of the Contractor's lead health and safety organization, including the responsibilities and qualifications of the competent person, and the project Health and Safety Officer.
- A description of OSHA required lead training provided to both supervisors and workers.
- A description of each activity which will entail a risk for lead exposure.
- An initial assessment of anticipated exposure level(s), including any relevant historical exposure monitoring data.
- A description of arrangements for ensuring that Subcontractors will comply with the LECP.
- Plans for updating the LECP.
- Plans for keeping and maintaining records.
- Exposure monitoring.

C. **Exposure Above the Action Level and Below the Permissible Exposure Limit.** If the Contractor can document by air monitoring or the use of appropriate historical data that the highest employee lead exposure will be above the Action Level (30 µg/m³), but below the Permissible Exposure Limit (50 µg/m³), then the Contractor shall develop a written LECP under the direction of an IH, with day-to-day supervision by the competent person, including, but not limited to, the items listed under paragraph B above and the following:

- Medical surveillance and removal program.
- Notifying employees and the Engineer of the results of exposure monitoring and medical tests.
- Worker and supervisor training.
- Monthly summary reports.
- Plans for worker and supervisor lead training.
- Plans for performing exposure monitoring and for notifying employees and the Engineer of results.
- A description of the Contractor's medical surveillance and removal program, including plans for notifying employees and the Engineer of results. This description shall include the names and
addresses of the clinic(s) where testing will be performed and of the OSHA-approved laboratory
where blood samples will be analyzed.

D. Exposure At or Above the Permissible Exposure Limit. When the highest employee
lead exposure will be above the Permissible Exposure Limit (50 µg/m³), the Contractor shall develop
a written LECP under the direction of an IH, with day-to-day supervision by the competent person.
The LECP shall include, but not be limited to, the items listed under paragraphs B and C above and
the following:

- A description of the engineering, administrative, and work practice controls which will be used to
  reduce exposure. All feasible engineering, administrative, and work practice controls shall be
  implemented before considering the use of respirators to reduce exposure.
- Decontamination facilities to be provided including a description and floor plan, a description of
  any hand-wash stations to be provided, and a description of mandatory hygiene practices which
  employees will be required to follow.
- A description of a Respirator Program including respirator-fit testing and respirator training.
- A description of Provision of Personal Protective Equipment (PPE), including required cleaning
  and/or replacement.
- Plans for posting and maintenance of warning signs in high-exposure areas.
- Schedule of periodic work site inspections by the IH and the competent person.

E. Monthly Summary Reports. Except where the Contractor can document that employee lead
exposure will be below the Action Level, for each month of work which entails potential lead
exposure, the Contractor shall submit a monthly summary report to the Engineer which has been
reviewed and signed by the IH not later than the 15th of the following month. This report shall contain
the following elements:

1. A summary of the work producing potential lead exposure completed in the past month.
2. A description of any interventions or deficiencies noted, and a summary of corrective actions.
3. A summary of exposure monitoring or medical testing results which were completed in the past
   month. To protect worker privacy, these results shall not include individual names; instead, workers
   shall be identified by trade and with an individual control number (not Social Security Number) to
   allow tracking of their exposure.
4. A certification that, with the exception of any deficiencies noted, the past month's work has been
   in compliance with the requirements of 29 CFR 1926.62 and this specification.

§570-3.02 Medical Testing. The Contractor shall arrange for employees to receive all required
medical tests. All medical tests shall be completed by, or under the supervision of, a licensed physician.
Blood sampling and analysis shall meet the accuracy requirements of 29 CFR Subpart D and shall be
conducted by an OSHA-approved laboratory. The Contractor shall provide the Engineer a summary of
medical testing results which were completed in the past month prior to a request for payment. The
Contractor shall provide documentation of any medical removals, a description of what triggered them,
and the corrective measures taken. The Contractor shall provide an exit medical exam consisting of blood
sampling and analysis for lead and zinc protoporphyrin (ZPP) levels for all workers who were potentially
exposed within 5 work days of the time a worker completes or is removed from all work which entails a
potential for lead exposure. Exit exams shall also be offered within 5 work days of seasonal shutdown or
for other periods exceeding 30 calendar days in which no work involving potential lead exposure is
scheduled or anticipated. The results of all medical tests shall be provided to affected workers within 5
work days of receipt, and to the Engineer in the next monthly report.

For employees who are offered an exam but choose not to participate or fail to respond, the
Contractor shall provide a written declination signed by the worker or, for workers who are no longer on
the payroll, a registered letter to the worker's last known address.

§570-3.03 Personal-Exposure-Monitoring Sample Analysis. The Contractor shall conduct
exposure monitoring. Exposure monitoring samples shall be obtained by the IH, a competent person
under the direction of the IH, or other qualified persons as specified in the LECP. Exposure monitoring
samples shall be analyzed by a laboratory selected by the Contractor, using a method which meets the
accuracy requirements of 29 CFR Subpart D. The Contractor shall provide the Engineer a summary of
exposure monitoring sample test results which were completed in the past month prior to a request for payment.

570-3.04 Decontamination Facilities. Except where the Contractor can document that employee lead exposure will be below the PEL, a minimum of one climate-controlled decontamination facility shall be provided, and shall be utilized by all workers with potential lead exposure. The number of facilities to be provided will be dictated by site conditions and by the Contractor's sequence of operations and shall be approved by the IH and the Engineer.

Each facility shall consist of a "clean" area where workers can remove and store their street clothing when they arrive on site; a shower room with hot and cold running water, soap and clean towels; and a "dirty" area where workers can remove and store their work clothing and PPE at the end of their work shift. The "clean" area and the "dirty" area shall each have a separate entrance. Decontamination facilities shall be cleaned as required, or at least once every week of use. All waste water generated from showers or as a result of cleaning operations shall either be tested and filtered through a 5 µm filter or considered as lead contaminated, and disposed of in accordance with State and Federal regulations.

570-3.05 Environmental Ground Protection.

A. General. Covers shall be provided on or over the ground under all structures that are to be cleaned and painted. Depositing or dropping waste materials into water and onto the ground or roadways outside the specified collection areas is not permitted.

The length of the cover shall be 3 m longer on each end than the length of the work area, and the width shall be at least 3 m wider on each side of the work area. The cover shall be positioned in such a manner as to contain and prevent the loss of waste materials.

Environmental Ground Protection shall consist of covers or other material capable of catching and holding waste materials on or over the ground under the structure in the work area. A bridge deck or a highway pavement and paved shoulder under a structure from which wastes may be collected and removed by vacuuming may be used in place of a cover providing that within that area such usage is confined to lanes and shoulders closed to traffic.

Covers on or over roadways or railroads or sidewalks or other similar areas shall not present a hazard of any kind and no cover shall remain in place overnight unless otherwise authorized by the Engineer.

B. Containment Operations. Cleaning or painting operations shall not be performed when the direction or velocity of prevailing winds causes waste materials to fall outside the collection area. If wind or other factors prevent collection, the Contractor may, with the approval of the Engineer, use drapes or other means to prevent drift beyond all specified collection areas.

C. Waste Collection. All waste materials shall be removed from the ground protection by vacuuming. Sweeping, shoveling, or other mechanical means to remove the waste materials from the ground protection is not permitted. Air exhausted from vacuuming equipment shall pass through a HEPA filtering system.

All waste materials that collect on a bridge deck, or on a highway pavement and paved shoulder under a structure or on covers shall be removed at least once a day or more frequently if directed by the Engineer. No waste material shall remain on the bridge deck, pavement, pier, pedestals, abutments, or containment covers overnight.

570-3.06 Environmental Waterway Protection.

A. General. Covers shall be provided under all structures that span bodies of water, waterways, and stream beds, and that are to be cleaned and painted in the field. Depositing or dropping waste materials into water and onto the ground or roadways outside the specified collection areas is not permitted.

A cover shall be suspended from the structure and shall, as measured over the water, be at least 3 m greater in length and at least 3 m wider than each side of the area on which work is underway.
The cover shall be positioned in a manner so as to collect and prevent the loss of waste materials. The cover shall not remain in place overnight if it presents a hazard of any kind.

If floating waste materials form on the water surface, they shall be contained from moving upstream or downstream. Floating waste material shall be collected daily, or more frequently. Straw or screening used in the fabrication of water booms shall be replaced with clean material weekly or as otherwise directed by the Engineer.

**B. Containment Operations.** Cleaning or painting operations shall not be performed when the direction or velocity of prevailing winds causes waste materials to fall outside the collection area. If wind or other factors prevent collection the Contractor may, with the approval of the Engineer, use drapes or other means to prevent drift beyond all specified collection areas.

**C. Waste Collection.** All waste materials shall be removed from the waterway protection by vacuuming. Sweeping, shoveling, or other mechanical means to remove the waste materials from the waterway protection is not permitted. Air exhausted from vacuuming equipment shall pass through a HEPA filtering system.

All waste materials that collect on a bridge deck, or on a highway pavement and paved shoulder under a structure or on covers shall be removed at least once a day or more frequently if directed by the Engineer. No waste material shall remain on the bridge deck, pavement, pier, pedestals, abutments, or containment covers overnight.

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**570-3.07 Class B Containment.**

**A. General.** The containment system includes the cover panels, screens, tarps, scaffolds, supports, and shrouds used to enclose an entire work area. The purpose of the containment is to prevent debris generated during surface preparation from entering the environment and to facilitate the controlled collection of the debris for disposal.

The containment shall meet the requirements of SSPC-Guide 6, Class 2P. The containment may have either air penetrable or impenetrable walls, rigid or flexible framing, shall have fully sealed joints, and shall have overlapping entry ways. Flexible covers for flooring shall be impermeable and will be allowed only if the ground or paved surfaces are smooth enough to vacuum debris. If a smooth surface is not available, rigid materials shall be used for the floor of the enclosure.

**B. Containment Operations.** All cleaning and paint removal work and all work associated with the collection of paint waste debris, including the subsequent air blow-down or vacuuming of debris from the steel surfaces on the structure in preparation for painting, shall be performed inside the containment enclosure.

The Contractor shall make every attempt to limit workers from entering or exiting the containment enclosure when paint removal operations are being performed.

**C. Waste Collection.** Following paint removal work, all steel surfaces inside containment shall be vacuumed of debris. All waste material that results from paint removal operations shall be cleaned up and collected from the floor, walls, and other surfaces inside of the containment enclosure by vacuuming. Sweeping, shoveling, or other mechanical means to remove the waste materials will not be allowed. Cleanup operations shall be performed daily, prior to inspection, before new paint is applied or before a prolonged work stoppage, such as for weather interruptions.

Prior to disassembly or moving of the containment enclosure, the inside surfaces of the enclosure shall be cleaned of dust and other spent material by vacuuming. The Contractor shall take all measures necessary to prevent the release of waste material during moving or removal of the containment.

All vacuum equipment that is used for collection and clean up work shall be equipped with HEPA filters. All used filters from dust collectors, vacuums, and straw and screening from dam devices, shall be disposed of in accordance with all applicable local, State, and Federal Laws, regulations, and codes. The cost for disposing of these materials shall be included in the lump sum price bid for this item.
D. Ventilation. Ventilation inside the enclosure is not specifically required and may be by natural means. It may be necessary to provide mechanical ventilation to meet OSHA requirements for worker exposure to lead and other provisions. If mechanical ventilation is provided to address these requirements, filtration of exit air is not required.

E. Lighting. Light intensity by natural or artificial means inside the containment enclosure shall be maintained at a minimum of 535 lux on the steel surface. During inspection activities, light shall be maintained at a minimum of 1075 lux. Auxiliary lighting shall be provided as necessary. The Contractor shall provide the Engineer with one portable light meter with a scale of 0 to 1075 lux. This meter will be returned to the Contractor at the completion of work. All lighting used in the containment shall be explosion-proof.

F. Containment Performance. The effectiveness of the containment enclosure shall be determined by visual inspection for dust plumes or other visible evidence of emissions materials into the environment. Throughout the duration of work there shall be no visible discharges. If there is a visible discharge the Contractor shall immediately stop work and perform necessary repairs to the containment enclosure or modifications to cleaning operations to the Engineer's satisfaction.

The Engineer may direct the Contractor to stop all work activities and immediately clean up all waste materials within the enclosure when threatening weather conditions exist or are predicted. This measure may be exercised when an apparent threat exists that could cause the release of waste material to the surrounding environment, such as high winds or heavy rain.

If the wind velocity causes the containment enclosure to billow, or to emit dust, or to otherwise be a hazard in the opinion of the Engineer, the Contractor shall immediately cease work and clean up all the debris. Under severe conditions the Contractor shall disassemble the containment enclosure.

G. Releases From the Containment. For structures that are located over or adjacent to water, if floating waste materials form on the water surface, they shall be contained from moving upstream or downstream by the use of floating water booms. Floating waste material shall be collected daily, or more frequently.

Any waste material that is released outside the containment enclosure shall be immediately cleaned up using vacuums. Care shall be taken on pavement and other surfaces to collect all waste material so as to prevent it from being redistributed into the air and environment by traffic or other means.

All used filters from dust collectors, vacuums, and straw and screening from dam devices, shall be disposed of in accordance with all applicable Local, State, and Federal Laws, regulations and codes. The cost for disposing of these materials shall be included in the lump sum price bid for this item.

570-3.08 Class A Containment. Fifteen (15) days prior to the start of any abrasive-blast cleaning or paint removal work, the Contractor shall submit for approval detailed working drawing(s) of the Class A containment system that is to be supplied for each structure. The drawings shall be prepared and stamped by a Professional Engineer. Six (6) complete copies of the working drawings shall be submitted for approval.

The working drawings shall detail the proposed containment enclosure and include the following information at a minimum:

- Plan and elevation of the containment enclosure in relation to the structure.
- The type of solid or rigid floor and working platform with appropriate safety and fall protection measures. A description of worker access to the enclosure and the procedures and equipment that will be used to provide fall-protection. If a barge or another type of floating platform is used, include details regarding its construction, such as materials and dimensions, how the platform will be tied-off, how the debris will be collected and off-loaded, etc.
- A description of how the existing drainage will be routed through the enclosure.
- A description of the type of material(s) for the containment walls, floor, and ceiling.
- The type of support structure that will be used for the floor, walls, and ceiling, including the attachment of the enclosure materials to the support structure.
• The method by which the enclosure will be supported or attached to the bridge, i.e., rollers, clamps. Welding, bolting, or similar connections will not be allowed.
• The method that will be used to seal the joints (seams) formed when fabricating the containment enclosure, and the method that will be used to seal the mating joints between the containment enclosure and the bridge structure.
• The method that will be used to seal the entryway. At a minimum, the use of multiple overlapping door tarps shall be provided to minimize dust escape through the entryway.
• The ventilation system including open-air make-up points, dust collector and exhaust fan(s), location, type of equipment, manufacturer's data sheets, and airflow capacities.
• The type, size, and configuration of auxiliary lighting provided inside the containment enclosure. All lighting must be explosion proof.
• A design analysis of the loads on the structure due to the containment enclosure including: maximum dead and live loads of the enclosure, the workers, blast abrasive, and equipment; maximum allowable load for the floor and working platform; wind loads imposed on the structure by the enclosure; and maximum wind velocity that the containment enclosure is designed to withstand.
• If the containment system is supported by the structure, the working drawing submittal shall include certification by the Professional Engineer that the loads imposed do not cause the overall stress level of any element of the bridge to exceed the Operating Rating Allowable Stresses defined in AASHTO Manual for Maintenance Inspection of Bridges.
• The analysis shall account for all loads on the structure, including the enclosure dead load, worker live load, blast-abrasive load, equipment load, wind load, structure dead load, and highway live load using M18 loading unless other-wise specified plus impact. The highway live load used for analysis purposes shall be either an MS18 truck or equivalent lane loading, whichever is greater, unless a different highway live load is shown in the contract documents. Except as noted, the analysis shall use the loadings and design assumptions in the NYSDOT Standard Specifications for Highway Bridges.
• Details on how the enclosure is assembled, disassembled and moved to a new location on the structure as surface preparation work progresses. Indicate how the dust collector will be included in the containment enclosure. All other pertinent details relating to the containment enclosure shall be included with the working drawings as notes or as written narrative.
• Details on how the use of the enclosure will be coordinated with the maintenance and protection of traffic. Encroachments onto roadways and clearances over waterways and railroads shall be clearly identified.

A. General. The containment system includes the cover panels, screens, tarps, scaffolds, supports, and shrouds used to enclose an entire work area. The purpose of the containment is to prevent all debris generated during surface preparation from entering the environment and to facilitate the controlled collection of the debris for disposal.

The containment shall meet the requirements of SSPC-Guide 6, Class 1A. The containment shall have air impenetrable-walls, rigid or flexible framing, fully sealed joints, and resealable entry ways. Negative air shall be achieved by forced air flow. Exhaust air shall be filtered.

Flexible covers for flooring shall be impermeable and will be allowed only if the ground or paved surfaces are smooth enough to vacuum debris. If a smooth surface is not available, rigid materials shall be used for the floor of the enclosure.

B. Containment Operations. All abrasive-blast cleaning and paint removal work, and all work associated with the collection of paint waste debris, including the subsequent air blow-down or vacuuming of debris from the steel surfaces on the structure in preparation for painting and inspection, shall be performed inside the containment enclosure.

The Contractor shall attempt to limit workers from entering or exiting the containment enclosure when blast cleaning and paint removal operations are being performed.

C. Waste Collection. All waste material that results from abrasive blasting and paint removal operations shall be cleaned up and collected from the floor, walls, and other surfaces inside of the containment enclosure by vacuuming. Sweeping, shoveling, or other mechanical means to remove the waste materials will not be allowed unless the containment is intact and the vacuuming system is
operating. Clean up operations shall be performed daily, prior to inspection, before new paint is applied or before a prolonged work stoppage, such as for weather interruptions.

Prior to disassembly or moving of the paint enclosure, the inside surfaces of the enclosure (walls, floors, ceiling, etc.) shall be cleaned of dust and other spent material by vacuuming. The Contractor shall take all measures necessary to prevent the release of waste material during moving or removal of the containment.

All vacuum equipment that is used for collection and cleanup work shall be equipped with HEPA filters. All used filters from dust collectors, vacuums, and straw and screening from dam devices, shall be disposed of in accordance with all applicable local, State, and Federal Laws, regulations, and codes. The cost for disposing of these materials shall be included in the lump sum price bid for this item.

D. Ventilation. The size of the exhaust-fan system supplied shall be designed to produce an average minimum cross-draft air velocity or an average minimum downdraft air velocity inside the containment enclosure. For enclosures designed with horizontal air flow, the exhaust fan shall have the capacity to produce an average minimum cross-draft velocity of 0.5 m/s, based on theoretical calculations. For enclosures designed with vertical air flow, the exhaust fan shall have the capacity to produce an average minimum downdraft velocity of 0.25 m/s, based on theoretical calculations. Forced exhaust air shall flow into dust collectors. The dust collectors shall be used and appropriately sized for the type, size of particulate matter, volume, and velocity of air moved through the containment. All air exhausted from the containment enclosure shall pass through the dust collection system.

Proper operation of the ventilation system shall be maintained after each assembly of the containment and during all phases of work.

E. Lighting. Light intensity by natural or artificial means inside the containment enclosure shall be maintained at a minimum of 535 lux on the steel surface. During inspection activities, light shall be maintained at a minimum of 1075 lux. Auxiliary lighting shall be provided as necessary. The Contractor shall provide the Engineer with one portable light meter with a scale of 0 to 1075 lux. This meter will be returned to the Contractor at the completion of work. All lighting used in the containment shall be explosion-proof.

F. Containment Performance. NYSDOT will perform air quality monitoring (AQM) for ambient particulate and lead during abrasive blasting/cleanup. Real-time AQM will be used for all Class A containments. High-volume AQM may be used in addition to real-time AQM. The effectiveness of the containment and accessory equipment in preventing unacceptable levels of particulate and lead emissions will be assessed based on established AQM criteria for both the real-time and high-volume monitoring. Throughout the duration of work, there shall be no visible discharges. If the Engineer observes a visible discharge, the Contractor shall immediately stop work and perform necessary repairs to the containment enclosure or modifications to blast cleaning operations to the Engineer’s satisfaction.

The Engineer may direct the Contractor to stop all work activities and require the Contractor to immediately clean up all waste materials within the enclosure when severe weather conditions exist or are predicted. This measure may be exercised when an apparent threat exists that could cause the release of waste material to the surrounding environment, such as high winds or heavy rain.

If the wind velocity causes the containment enclosure to billow or to emit dust, or to otherwise be a hazard in the opinion of the Engineer, the Contractor shall immediately cease work and cleanup all the debris. If severe conditions are predicted, the Contractor shall disassemble the containment enclosure.

G. Releases From the Containment. For structures that are located over or adjacent to water, if floating waste materials form on the water surface, they shall be contained from moving upstream or downstream by the use of floating water booms. Floating waste material shall be collected daily, or more frequently.

Any waste material that is released outside the containment enclosure shall be immediately cleaned up using vacuums. Care shall be taken on pavement and other surfaces to collect all waste
material so as to prevent it from being redistributed into the air and environment by traffic or other means.

All used filters from dust collectors, vacuums, and straw and screening from dam devices, shall be disposed of in accordance with all applicable Local, State, and Federal Laws, regulations and codes. The cost for disposing of these materials shall be included in the lump sum price bid for this item.

570-4 METHOD OF MEASUREMENT.

570-4.01 Lead-Exposure Control Plan (LECP). The work under the Lead Exposure Control Plan will be measured for payment on a lump sum basis.

570-4.02 Medical Testing. The work under medical testing will be measured for payment on a dollars-cents basis.

The amount shown in the itemized proposal for this work will be considered the price bid even though payment will be made for actual work performed. This amount is not to be altered in any manner by the bidder. Should the bidder alter the amount shown, the altered figure will be disregarded, and the original price will be used to determine the total amount bid.

570-4.03 Personal-Exposure-Monitoring Sample Analysis. The work under the personal exposure monitoring sample analysis will be measured for payment on a dollars-cents basis.

The amount shown in the itemized proposal for this work will be considered the price bid even though payment will be made for actual work performed. This amount is not to be altered in any manner by the bidder. Should the bidder alter the amount shown, the altered figure will be disregarded, and the original price will be used to determine the total amount bid.

570-4.04 Decontamination Facilities. The quantity to be measured for payment will be in calendar weeks.

570-4.05 Environmental Ground Protection. This work will be measured for payment on a lump sum basis.

570-4.06 Environmental Water Protection. This work will be measured for payment on a lump sum basis.

570-4.07 Class B Containment. This work will be measured for payment on a lump sum basis.

570-4.08 Class A Containment. This work will be measured for payment on a lump sum basis.

570-5 BASIS OF PAYMENT.

570-5.01 Lead-Exposure Control Plan (LECP). The lump sum price bid shall include the cost of all labor, materials and equipment necessary to satisfactorily complete the work.

570-5.02 Medical Testing. Payment shall include all reasonable and customary costs incurred (based on receipted bills submitted to the Engineer, plus 5% overhead and profit).

No payments shall be made for additional medical tests or laboratory analyses required due to an increase in the blood lead level of any employee above the OSHA threshold.

570-5.03 Personal-Exposure-Monitoring Sample Analysis. Payment shall include all reasonable and customary costs incurred (based on receipted bills submitted to the Engineer, plus 5% overhead and profit), for laboratory analysis of exposure monitoring samples.

570-5.04 Decontamination Facilities. The unit price bid per week for each facility shall include the cost of all labor, materials, equipment, utility, and disposal charges necessary to satisfactorily complete the work.
570-5.05 Environmental Ground Protection. The lump sum price bid shall include the cost of all labor, materials and equipment necessary to complete the work.

570-5.06 Environmental Water Protection. The lump sum price bid shall include the cost of all labor, materials and equipment necessary to complete the work.

570-5.07 Class B Containment. The lump sum price bid shall include the cost of all labor, materials and equipment necessary to complete the work.

Progress payments will be made based upon the amount of work completed using a daily rate of payment determined from the estimate of work days of cleaning and painting shown in the Contractor’s approved progress schedule and the lump sum price bid.

Should the Engineer request a revised progress schedule and use that schedule to establish a new daily rate, the lump sum price bid shall be reduced by the total of the amounts previously authorized for payment, prior to the establishment of the new daily rate.

570-5.08 Class A Containment. The lump sum price bid shall include the cost of all labor, materials and equipment necessary to complete the work.

No payment will be made for each calendar day during which there are substantial deficiencies. Substantial deficiencies are defined as: (1) The second occurrence of a visible emission for a cause which has been previously identified and corrected, or (2) air quality monitoring produces unacceptable results as defined in the Department’s Air Quality Monitoring (AQM) Protocols.

The nonpayment will be calculated as follows:

\[
\text{Nonpayment} = \frac{\text{Lump Sum Price Bid}}{\text{Actual # of Work Days}} \times \text{# of Days with Substantial Deficiencies}
\]

In addition to the non payment for substantial deficiencies, the costs of any extension of the Air Quality Monitoring beyond the basic monitoring program or random audits defined in the AQM Protocol, which are necessitated by unacceptable AQM results, will also be charged to the Contractor.

Both of these amounts will be deducted from monies due to the Contractor.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>570.01</td>
<td>Lead-Exposure Control Plan</td>
<td>Lump Sum</td>
</tr>
<tr>
<td>570.02</td>
<td>Medical Testing</td>
<td>Dollars-Cents</td>
</tr>
<tr>
<td>570.03</td>
<td>Personal-Exposure-Monitoring Sample</td>
<td>Dollars-Cents</td>
</tr>
<tr>
<td>570.04</td>
<td>Decontamination Facilities</td>
<td>Calendar Week</td>
</tr>
<tr>
<td>570.09nnn</td>
<td>Environmental Ground Protection</td>
<td>Lump Sum (each structure)</td>
</tr>
<tr>
<td>570.10nnn</td>
<td>Environmental Waterway Protection</td>
<td>Lump Sum (each structure)</td>
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<td>570.15nnn</td>
<td>Class A Containment</td>
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<tr>
<td>570.16nnn</td>
<td>Class B Containment</td>
<td>Lump Sum (each structure)</td>
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NOTE: nnnn denotes serialized pay item.

SECTION 571 - TREATMENT AND DISPOSAL OF PAINT REMOVAL WASTE

571-1 DESCRIPTION. The work shall consist of accumulating, packaging, labeling, loading, transporting, treating, and disposing paint removal waste declared to be a hazardous waste containing lead.

571-1.01 Hazardous Waste Disposal Facility. Prior to generating any paint removal waste, the Contractor shall supply the Engineer with a letter from a legally permitted Hazardous Waste Disposal Facility, stating that the Facility has agreed to accept the paint removal waste generated by the work requirements of this project; is authorized to accept paint removal waste under the laws of the State of residence; has the required capacity to treat and dispose of the material; and will provide, or assure the ultimate disposal method indicated on the Uniform Hazardous Waste Manifest. The letter shall be signed by a representative of the Disposal Facility who is legally authorized to sign such an agreement. The Engineer shall be given an original, signed letter. Facsimile copies will not be acceptable.
§571

571-1.02 Waste Transporter. The Contractor shall present evidence that they have a 6NYCRR Part 364 Waste Transporter Permit to haul to the selected facility, or have contracted with a permitted Hazardous Waste Transporter to remove the waste to the selected facility.

571-1.03 Paint Removal Waste. For purposes of this item, paint removal waste is defined as removed paint particles combined with any material used to remove the paint. Paint removal waste will be referred to throughout the item text as 'waste'. Declaration of the waste as 'hazardous' is based on the Department's knowledge that the waste contains lead.

571-1.04 Waste Transport. All waste resulting from paint removal operations shall be in transit to the disposal site no later than 45 calendar days subsequent to 1000 kilograms of waste accumulated at the site, or two weeks following demobilization of the site, whichever occurs first. Waste shall be accumulated, handled, packaged, loaded, transported, treated and disposed in accordance with all applicable Federal, State and local laws, rules, regulations, and codes. The Contractor's failure to comply with the aforementioned deadlines may result in the actions described under §571-5 Basis of Payment.

571-1.05 Minimum Work Requirements. The Contractor is hereby notified that this work requires the following as a minimum:
- Waste transporter identification number issued by USEPA.
- Disposal facility identification number issued by USEPA. (This will be supplied by the Disposal Facility).
- Generator site identification number issued by USEPA. (This will be supplied by the State through the Engineer).

Conformance to 6NYCRR364. Part 364 governs waste transporters. The Contractor shall furnish a copy of the Part 364 permit to the Engineer.
Conformance to 6NYCRR372. Part 372 governs manifest requirements.
Conformance to 6NYCRR373. Part 373 governs treatment, storage and disposal facilities and contains specific generator requirements.
Conformance to 40 CFR 268 promulgated by the Environmental Protection Agency pursuant to the Hazardous and Solid Waste Amendments to the Resource Conservation and Recovery Act. That law prohibits the land disposal of hazardous wastes unless they are treated to diminish the toxicity of the migration of hazardous constituents from the waste.

NOTE: NYCRR regulations are administered by the NYS Department of Environmental Conservation, Albany, N.Y. EPA regulations are administered by the US Environmental Protection Agency, Region II, New York, N.Y.

571-1.06 Bridge Washing Waste. For the purposes of this item, bridge washing waste is defined as paint chips and any organic or inorganic materials dislodged from bridge surfaces by bridge washing operations. The paint chips are known to contain lead, the combined waste stream may therefore be hazardous waste. The Department has presumed that the waste will test as hazardous. Bridge washing waste shall be kept segregated from bridge paint removal waste and shall be placed in containers or roll-offs with additional labeling identifying it as “Bridge Washing Waste”.

571-2 MATERIALS. The waste shall be accumulated in clean, dry, weatherproof, watertight containers or roll-offs furnished by the Contractor. The Contractor shall furnish the Engineer with a signed statement from the Disposal Facility that the containers or roll-offs proposed for use by the Contractor are acceptable to the Facility. The dry volume capacity of the container, in cubic meters, shall be clearly marked upon each container, in a location easily readable by the Engineer.
All equipment and containers or roll-offs shall be approved by the Engineer prior to use.

571-3 CONSTRUCTION DETAILS

571-3.01 Containers. All generated waste shall be deposited and sealed, in containers or roll-offs concurrent with generation. No container or roll-off shall be filled to a capacity in excess of that marked
§571.3.02 Labeling. All labeling, marking (except date mark), and placarding shall be the responsibility of the Contractor and shall be done under the supervision of the Engineer. This work shall be completed to the Engineer's satisfaction prior to the filling or transportation of any particular container or roll-off. All label markings shall be permanent, printed in English, displayed on a background of contrasting color un-obscured by other labels, or attachments. Labeling shall be located away from other markings that could substantially reduce its effectiveness.

§571.3.03 Document Preparation. All document preparation and distribution, including the Uniform Hazardous Waste Manifest, shall be the responsibility of the Contractor. The Engineer will sign the Generator's Certification on the Uniform Hazardous Waste Manifest. The LDR (Land Disposal Restricted) certification shall be completed and attached to the manifest, as required by 40 CFR Part 268, “Land Disposal Restrictions.” All waste shall be documented, transported, treated, and disposed as required by the current Federal, State and local laws, rules and codes.

§571.3.04 Multiple Collection. It is permissible for the transporting vehicle to pick up paint waste debris, in bulk, from one or more bridge sites for delivery to an authorized treatment, storage and disposal facility (TSDF) if the following conditions are met:

The materials picked up at each site must be essentially identical in physical and chemical characteristics. No materials, other than paint waste debris, may be included if wastes from several individual generating sites are to be combined on the same truck.

All of the component shipments are presumed to be D008 hazardous wastes, and disposed as such.

A manifest is prepared for each generating bridge site. Each manifest must reflect a bulk shipment, and all manifests being carried by the same transporting vehicle must express the quantity in cubic meters. In sum total, the manifests accompanying the shipment must account for the entire volume transported.

All component shipments are intended to be conveyed to the same TSDF, and the TSDF has agreed to accept consolidated bulk loads.

All component shipments must have originated at sites that are under the authority of DOT. No loads may be included that were generated at a site for which another agency is responsible.

Measures must be taken to prevent the blowing or dispersion of the waste during each loading operation and while being transported.

§571.3.05 Paint Waste Composition. The Contractor is responsible to ensure that only dry paint removal waste is deposited into the containers or roll-offs.
Provided in the proposal is a note entitled “Typical Paint Removal Waste Composition” which provides typical chemical composition of paint removal waste based on previous chemical testing. The determination has been made that such waste contains less than 2% by weight of organic material. The Contractor is specifically forewarned that disposal facilities perform spot tests and may refuse to accept waste in excess of 2% organic content or that is otherwise different than the Typical Paint Waste Composition. Waste contaminated in this manner will be the Contractor's responsibility. All penalties and costs associated with the refusal of a disposal facility to accept waste not meeting its requirements will be borne by the Contractor. All testing of the waste necessary to satisfy the requirements of the chosen Disposal Facility or Transporter shall be the responsibility of the Contractor.

571-3.06 Paint Waste Stabilization. For the purposes of this item, treatment of the paint removal and washing waste as required by Federal regulations is presumed to require stabilization of the waste such as mixing it with portland cement and water as necessary at a permitted Hazardous Waste Treatment or Disposal Facility. The stabilized waste shall meet the treatment standards of the Federal regulations prior to disposal in a permitted Hazardous Waste Disposal Facility.

571-3.07 Bridge Washing Waste Composition. The Contractor is responsible for ensuring that only dried bridge washing waste is deposited into the containers or roll-offs. The contractor is warned that the bridge washing waste may contain more that 2% organic content. A typical waste composition profile is not available. All testing of the waste necessary to satisfy the requirements of the Disposal Facility or Transporter shall be the responsibility of the Contractor.

571-4 METHOD OF MEASUREMENT. The work will be measured as the number of dry cubic meters of waste accumulated, packaged, transported, treated, and disposed in accordance with the requirements of this item. The actual quantity within a single container or roll-off will be determined by the Engineer. Once the Engineer determines the quantity within a specific container or roll-off, that container or roll-off shall be properly sealed and not thereafter be tampered with. No additional waste shall be placed in it, nor shall any be removed from it. Under no circumstances will a container or roll-off be measured as containing more than the maximum dry volume capacity marked on it.

571-5 BASIS OF PAYMENT. The unit price bid per cubic meter shall include the cost of all labor, materials, equipment, sampling, testing, and fees necessary to complete the work based on the assumption that treatment by stabilization will satisfy the applicable Federal regulations. Should this prove not to be the case on an industry wide basis, as opposed to an individual Treatment or Disposal Facility, the difference in cost between the cost of treatment by stabilization and the method subsequently found to be necessary shall provide the basis for an order on contract. Only waste for which manifest copies are returned to the Engineer by the Contractor and Disposal Facility will be authorized for payment.

If the Department is fined or penalized as a result of the Contractor's performance or lack thereof on this item, in addition to other remedies the Department may possess, said fine or penalty will be deducted from monies due the Contractor. The extent of the Contractor's compliance with the provisions under timeliness of disposal will be considered as relevant in any future determination of an award to the Contractor as the lowest responsible bidder for any project under the supervision of the Department.

Payment will be made under:

<table>
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<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
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<tr>
<td>571.01nnnn</td>
<td>Treatment and Disposal of Paint Removal Waste</td>
<td>Cubic Meter</td>
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NOTE: nnnn represents numbers assigned by the designer and keyed to a particular structure. See elsewhere in these contract documents for a list of structures and the numbers assigned to nnnn.

SECTION 572 - STRUCTURAL STEEL PAINTING: SHOP APPLIED

572-1 DESCRIPTION. This work shall consist of preparing and painting new steel surfaces in a permanent facility, enclosure, or building, with four walls to grade and a roof, where surface preparation and painting activities are conducted in an environment not subject to outdoor weather conditions and/or
blowing dust. All painting work, except field touchup and bolt painting, shall be conducted inside this facility. See special note entitled “Structural Painting Details” for the description and requirements of serialized items.

§572 MATERIALS

572-2.01 Paints. Paints shall meet the requirements of §708-01 Structural Steel Paints – Class 1, and shall appear on the Department’s Approved List, “Structural Steel Paints - Class 1”. All paint applied to a single structure shall be produced by the same manufacturer. Any exception must be approved by the Engineer and the Materials Bureau Director.

A. Shelf Life. The shelf life of all paint shall be a maximum of 12 months from the date of manufacture. Paint and thinner shall arrive at the work site in new, unopened containers. The label shall include the manufacturer’s name, batch number, color, paint name, and date of manufacture.

B. Paint Storage. Paint in storage shall be protected from damage and maintained in accordance with manufacturer’s recommendations. Paint will be considered in storage if it is onsite for more than 8 hours prior to application.

C. Color. Each single coat of paint shall be a different color and provide substantial contrast with the underlying substrate and previous coats. The colors of the primer, stripe coat, and intermediate coat will be the Contractor's option. The color of the finish coat shall be as specified in contract documents.

D. Data Sheets. The Contractor shall supply the Engineer with the paint manufacturer's technical data and materials safety data sheets for each paint to be applied. The data sheets will be delivered to the Engineer a minimum of five work days prior to beginning of work. Data sheets shall include all information required by §708-01 Structural Steel Paints - Class 1.

572-2.02 Abrasive for Blast Cleaning. Abrasive material for blast cleaning shall be selected by the Contractor. Silica sand and other types of nonmetallic abrasive containing more than one percent free silica, by weight, will not be allowed. The abrasive blasting shall produce an angular anchor profile suitable for the paint system to be applied.

572-2.03 Paint Inspection Equipment. Prior to the start of work, the Contractor shall supply the Engineer with the following specifications and equipment in good working order:

1. One bound copy of the Steel Structures Painting Council, surface preparation specification, SSPC-SP 10 - Near-White Metal Blast Cleaning.
2. One bound copy of the Steel Structures Painting Council, surface preparation specification, SSPC SP-1 - Solvent Cleaning.
3. One bound copy of the most current Steel Structures Painting Council Pictorial Standards, SSPC-VIS 1, Guide and Reference photographs for steel surfaces prepared by dry-abrasive blast cleaning.
4. One bound copy of the Steel Structures Painting Council method SSPC-PA2, Paint Application Specification No. 2 - Measurement of Dry Film Thickness With Magnetic Gages.
5. One copy of ASTM D 4417 Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel.
6. One copy of ASTM D 4285 Test Method for Indicating Oil or Water in Compressed Air.
7. One Air Thermometer, pocket type, -10°C to +40°C.
8. One non-contact Infrared Thermometer, -10°C to +40°C.
9. One Contact Thermometer, -10°C to +40°C.
10. One Magnetic Dry-Film Thickness Gage, Type 2 (as defined per SSPC PA-2), with a display capable of measuring 1 µm to 1500 µm in 1 µm increments, with calibration shims.
11. Two Wet-Film Thickness Gages, Prong-Type, capable of measuring 25 µm to 250 µm in 25 µm increments.
13. Profile micrometer with extra coarse replica tape.

All equipment will be returned to the Contractor upon completion of the work.

572-3 CONSTRUCTION DETAILS. All structural steel members and other miscellaneous steel items shall be cleaned and painted as per contract documents.

The Contractor shall provide adequate access, suitable lighting, and time for inspections to be made. Any work completed while the Engineer has been restricted from access, shall be recleaned and repainted at no additional cost to the State.

572-3.01 Quality Control Plan. The Contractor shall provide the Engineer with a copy of the Contractor's Quality Control (QC) procedures and/or Quality Control Plan (QCP). The QCP describes the minimum QC activities that will be performed by Contractor's QC personnel to ensure compliance. The QCP shall at a minimum, include operating procedures and maintenance records for equipment on site, proof of formal QC training for the Contractor's QC personnel on site, and daily reports including the following information:

- Compressed Air Cleanliness
- Dry Film Thickness
- Air Temperature
- Humidity and Dew Point
- Surface Temperature
- Abrasive Cleanliness Checks
- Degree of Cleanliness Achieved
- Surface Profile
- Batch Numbers of Paint Used
- Batch Numbers of Thinner Used
- Mixing According to Specification

The Contractor shall provide daily reports to the Engineer upon request. The reports shall be submitted no later than 24 hours following the completion of the day’s work.

572-3.02 SURFACE PREPARATION.

A. Abrasive Blast Cleaning.

1. Atmospheric Conditions. Abrasive blast cleaning operations shall not be conducted under the following conditions:
   - a. The relative humidity exceeds 85%.
   - b. When the substrate is damp or covered by frost.
   - c. The surface temperature is less than 3°C above the dew point.

2. Solvent Cleaning. Before abrasive blast cleaning begins, steel shall be solvent cleaned of all deposits of oil, grease, dirt, salt, or other contaminants by methods specified in SSPC-SP1, Solvent Cleaning.

3. Steel Cleanliness and Profile. All structural steel surfaces to be painted shall be abrasive-blast cleaned in accordance with SSPC-SP10, Near-White Metal Blast Cleaning. All abrasive blast cleaning and painting shall be performed at the same facility.

   The anchor profile shall be measured in accordance with ASTM D4417, Method C. The Contractor shall ensure that the anchor profile is within the range indicated on the paint manufacturer’s data sheets. The profile shall, at a minimum, be measured once per shift and three
times in various locations for every 200 square meters prepared, unless otherwise ordered by the Engineer. The anchor profile shall not exceed 75 µm.

All fins, tears, slivers, burred and sharp edges that are present or occur during the blasting operation shall be removed by grinding, and then the area shall be reblasted to provide the required profile.

4. Equipment. All equipment and compressors used in the cleaning operation shall be equipped with filters and traps to prevent moisture, oil, and other contaminants from being deposited on clean surfaces. The air cleanliness shall be verified by the Contractor with the white blotter test in accordance with ASTM D4285 at least once per shift for each compressed air system.

B. Cleaning Area. The area cleaned shall be limited to that which can be cleaned and prime coated within an 8-hour period. Cleaned areas shall be approved by the Engineer prior to priming. Areas that exhibit flash rusting within the 8-hour period shall be recleaned.

C. Visual Standards. After abrasive blasting is completed, cleaned surfaces shall be compared to SSPC-Vis 1, "Guide and Reference Photographs for Steel Surfaces Prepared By Dry Abrasive Blast Cleaning" Pictorial Standards as applicable. All surfaces shall be free of blasting products and other residues when blasting operations are completed. Surfaces shall be cleared of all foreign matter by means of oil-free, moisture-free, compressed air or vacuum systems.

572-3.03 PAINTING. The Contractor shall apply three full coats and a stripe coat of paint to all surfaces cleaned to SP-10. In addition, all cleaned steel surfaces within 2 meters from a bridge joint shall receive an additional coat of intermediate paint, resulting in four coats of paint in these areas. The paint shall be applied in the following order: primer, intermediate, stripe, and the finish coat. Damage resulting from fabrication, handling and storage in the shop shall be restored before leaving the shop.

Unless otherwise noted, the contractor shall adhere to the procedures and methods for application as described in SSPC-PA 1, Section 7.

A. Atmospheric Conditions. Paint shall not be applied when the receiving surface and ambient temperatures are less than 5°C or greater than 38°C. If the temperature range listed on the manufacturer’s data sheets is more restrictive, the manufacturer’s range shall be used. No paint shall be applied unless the receiving surface is dry.

Paint shall not be applied when the relative humidity is more than 85% unless the painting manufacturer’s data sheets have a more restrictive range. Paint shall not be applied if the receiving surface is less than 3°C above the dew point temperature.

B. Paint Mixing. All paint shall be thoroughly mixed with mechanical mixers in accordance with the manufacturer's recommendations. After mixing, the bottom of the container shall be free of any unmixed pigment prior to use.

C. Solvents and Thinners. Paint may be thinned if recommended by the manufacturer and approved by the Engineer. The primer shall not be thinned such that the resulting VOC level exceeds 500 g/L. Intermediate and finish coats shall not be thinned where the resulting VOC level exceeds 340 g/L. The manufacturer’s data sheets shall advise the Contractor and Engineer of the maximum amount of thinner allowed.

Use of unauthorized thinners, or using excess amounts of thinners is prohibited. Any area where unauthorized solvents or thinners are used shall recleaned and repainted at no additional cost.

D. Paint Application. Painting shall not begin until cleaned surfaces have been inspected and approved by the Engineer. Paint may be applied using spray, brush, or roller, unless otherwise indicated by the contract documents. All paint shall be applied so as to produce a uniform, even coating free of runs, sags, drips, ridges, or other defects. Roller nap shall be limited in accordance with the paint manufacturer’s recommendation. Brushes and rollers used to apply the paint must be of a quality to produce a smooth uniform coating without leaving fibers in the coating.
All metal surfaces in contact with concrete shall not be painted. Priming shall begin only after all welding and fabrication work is completed.

E. Stripe Coat. A stripe coat shall extend a minimum of 25 mm away from the following surfaces: all welds, rivets, bolts, nuts, edges of plates and structural members, angles, bearings, lattice pieces or other shapes, corners, and crevices. To provide contrast, paint for stripe coating shall be a different color than the receiving surface. The stripe coat shall use the intermediate paint and be applied after the intermediate coat. The stripe coat shall be brush applied without being thinned. The stripe coat will be applied in accordance with manufacturer’s recommendations, with particular attention to the film thickness, recoat window, and cure schedule. Areas near bridge joints that are to receive an additional coat of intermediate paint shall also receive a stripe coat where necessary as described above.

A stripe coat shall not be applied to any slip critical surfaces.

F. Paint Film Thickness. Paint shall be applied to produce the specified dry-film thickness as directed by the range listed on the paint manufacturer’s data sheets. The dry-film thickness (DFT) shall be determined in accordance with SSPC-PA 2, Paint Application Specification No. 2 - *Measurement of Dry Film Thickness with Magnetic Gages*, using a Type 2 fixed probe magnetic gages. Dry film thickness gauges shall be calibrated over a blasted, approved surface.

DFTs of the intermediate and finish coats shall be determined by subtracting the average DFT readings of the previous coat(s) from the actual DFT reading. An average DFT value shall be recorded and calculated for every 100 m² prepared. The average shall be calculated using a minimum of 5 spot measurements as defined by SSPC-PA2.

Areas failing to meet the specified minimum dry-film thickness shall be top coated with the same paint to produce the total dry-film thickness required. The top coating must be performed within the paint manufacturer’s specified recoat window.

The Engineer may require any area exceeding the manufacturer’s recommended dry-film thickness to be blast cleaned to the SP-10 condition.

Slip Critical Connections. All metal to metal, slip-critical contact surfaces shall not be painted unless the paint system is identified as being ‘Slip-B Approved’ on the Department’s Approved List, ‘Structural Steel Paints - Class 1’. Painted slip-critical connection surfaces shall receive primer only.

Each painted connection shall receive a minimum of 5 spot measurements and analyzed in accordance with SSPC-PA2. DFT ranges for slip-critical surfaces can be found on the Department’s Approved List, ‘Structural Steel Paints - Class 1’. Slip-critical primed surfaces exceeding the listed DFT range shall be cleaned and restored to SP-10 at no additional cost to the State.

G. Painting Schedule. Primer shall be applied to approved, abrasive-blasted surfaces within 8 hours of the final cleaning operation. If the Contractor fails to apply primer to the surface within 8 hours of cleaning, the surface shall be restored in accordance with the SP-10 requirements, at no additional cost to the State.

To prevent intercoat adhesion failure, recoating must be performed within the manufacturer’s recommended recoat window, or 14 days, whichever is shorter. If the contractor fails to recoat within the specified time period, the surface to be painted shall be cleaned and abraded, in accordance with manufacturer’s recommendations, to ensure adhesion of the following coat at no additional cost.

If the steel has become dirty between coats, the Contractor shall wash the bridge at no additional cost to the State.

Manufacturer’s recommendations shall be observed for cure to handle, and cure to top coat schedules.

H. Stenciling. The following information shall be stenciled on at least one steel element or on the inside web of a fascia member coated under this specification, unless otherwise directed by the Engineer:

1. Month and year of completion
2. Contract number
3. SP10
4. Name of Paint Manufacturer
5. Name of Shop that performed painting
6. Primer, Intermediate, and Finish coat names

The stenciled lettering should be approximately 150 mm in height and be a contrasting paint color to the top coat.

572-3.04 Field Painting. The only field work allowed is touch-up work after steel erection and subsequent concrete placement has been completed. All field painting shall be done at no additional cost to the State. All the requirements of this specification shall apply to field painted material with the following modifications:

A. Hardware. Bolt heads, washers, nuts, bolt thread extensions, and other miscellaneous steel surfaces not painted in the shop shall be cleaned as per SSPC SP-1 and painted after the bolts have been installed and accepted. Abrasive blasting of the bolts is not required. Any dye present on galvanized hardware shall be cleaned in accordance with manufacturer’s recommendation prior to painting. The Contractor shall submit the dye-cleaning procedure to the Engineer five days prior to cleaning.

B. Surface Preparation of Damaged Areas. All visible dirt, grease, and other foreign matter shall be removed first by pressure washing and solvent cleaning as per SSPC SP-1 as needed. Areas exhibiting damaged or deteriorated paint not extending to the steel surface shall be hand or power-tool cleaned as necessary to remove damaged or deteriorated, loosely adhered paint. Loosely adhered paint will lift when scraped with a dull putty knife. All edges of paint surrounding the repair area shall be tightly adherent and feathered. These edges and the surrounding painted surfaces to receive a (repair) topcoat(s) shall be abraded to provide a suitable anchor profile for the paint. Areas that exhibit damage of the paint system down to the steel surface shall be cleaned with power tools to SSPC SP-11 and shall exhibit a suitable anchor profile for the primer paint. All power and blasting tools will be vacuum-sealed units. All surrounding steel that has been previously painted in the shop shall be protected from damage during cleaning operations. Repairs shall be smoothly transitioned into surrounding new paint.

C. Application. Application shall be made by brush and roller only. Areas of steel exhibiting damage not extending down to the steel surface shall receive two coats of paint: intermediate and finish coat. Damage extending to the steel surface shall receive three coats of paint: primer, intermediate and finish coat. These coats of paint shall be applied at a dry film thickness as recommended by the paint manufacturer for such (repair) application.

572-4 METHOD OF MEASUREMENT. The quantity to be measured for payment will be in square meters of structural steel painted, measured to the nearest whole square meter. The total payment quantity will be the number of square meters of structural steel to be painted. Structural elements less than 1 square meter will not be included in the total payment quantity.

572-5 BASIS OF PAYMENT. The unit price bid shall include the cost of all labor, materials, and equipment necessary to complete the work.

Progress payments will be made for 80% of total payment quantity upon delivery. Shop-painted steel will be considered properly painted only when accompanied by the Engineer's or Inspector's written certification that the delivered steel was painted in accordance with the requirements of this Section. The remaining 20% of payment will be made upon completion of cleaning and painting all bolt heads, nuts, washers, bolt thread extensions, and damaged areas.

Payment will be made under:

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<th>Item No.</th>
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<td>Structural Steel Painting: Shop Applied</td>
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NOTE: mnn denotes a serialized pay item.

SECTION 573 - STRUCTURAL STEEL PAINTING: FIELD APPLIED - TOTAL REMOVAL

573-1 DESCRIPTION. This work shall consist of pressure washing, abrasive blast cleaning to remove all paint, rust, rust scale, mill scale, corrosion producing contaminants, and other foreign matter, and painting structural steel surfaces. See Special Note entitled Structural Painting Details for the description and requirements for serialized items.

573-2 MATERIALS

573-2.01 Paints. Paints shall meet the requirements of §708-01 Structural Steel Paints – Class 1, and shall appear on the Department’s Approved List, ‘Structural Steel Paints – Class 1’. All new paint to be applied to a single structure shall be produced by the same manufacturer. Any exception shall be approved by the Engineer and the Materials Bureau Director.

A. Shelf Life. The shelf life of all paint shall be a maximum of 12 months from the date of manufacture. Paint and thinner shall arrive at the work site in new, unopened containers. The label shall include the manufacturer’s name, batch number, color, paint name, and date of manufacture.

B. Paint Storage. Paint in storage shall be protected from damage and maintained in accordance with manufacturer’s recommendations. Paint will be considered in storage if it is onsite for more than 8 hours prior to application.

C. Color. Each single coat of paint shall be a different color and provide substantial contrast with the underlying substrate and previous coats. The colors of the primer, stripe coat, and intermediate coat will be the Contractor’s option. The color of the finish coat shall be as specified in contract documents.

D. Technical Data. The Contractor shall supply the Engineer with the paint manufacturer’s technical data and material safety data sheets for each paint to be applied. The data sheets shall be delivered to the Engineer a minimum of five work days prior to beginning of work. Data sheets shall include all information required by §708-01 Structural Steel Paints – Class 1.

573-2.02 Water for Washing. Water for pressure washing shall be potable water. Any detergent or soluble salt remover used must receive approval by the paint manufacturer and the Materials Bureau. Water shall not be recycled.

573-2.03 Abrasive for Blast Cleaning. Abrasive blast media for blast cleaning shall be recyclable, ferrous metallic, abrasive grit. All new metallic abrasive shall be in compliance with the specifications of SSPC-AB 3 Ferrous Metallic Abrasive. All ferrous metallic abrasive used shall be recycled and cleaned in accordance with SSPC-AB 2. The Contractor shall select the size, blend, and hardness of the abrasive to produce an angular anchor profile of a recommended depth as indicated on the manufacturer’s data sheets.

All ferrous metallic abrasive arriving on the job site shall be new, and invoices shall be submitted for acceptance. All recycling equipment shall arrive empty and clean.

573-2.04 Paint Inspection Equipment. Prior to the start of work the Contractor shall supply the Engineer with the following specifications and equipment in good working order:

1. One bound copy of the Steel Structures Paining Council surface preparation specification, SSPC SP-1 – Solvent Cleaning.
2. One (1) bound copy of the Steel Structures Painting Council surface preparation specification, SSPC-SP 10 – Near-White Metal Blast Cleaning.
3. One bound copy of the most current Steel Structures Painting Council Pictorial Standards, SSPC-VIS 1, *Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning.*
4. One bound copy of the Steel Structures Painting Council specification SSPC-PA2, Paint Application Specification No. 2 - Measurement of Dry Film Thickness With Magnetic Gages.
5. One bound copy of Steel Structures Painting Council specification SSPC AB-2 *Specification for Cleanliness of Recycled Ferrous Metallic Abrasives.*
6. One bound copy of Steel Structures Painting Council specification SSPC AB-3 *Specification for Newly Manufactured or Re-Manufactured Steel Abrasive.*
7. One copy of ASTM D 4417 Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel.
8. One copy of ASTM D 4285 Test Method for Indicating Oil or Water in Compressed Air.
9. One Air Thermometer, pocket type, -10°C to +40°C.
10. One non-contact Infrared Thermometer, -10°C to +40°C.
11. One Contact Thermometer, -10°C to +40°C.
12. One Magnetic Dry-Film Thickness Gage, Type 2 (as defined per SSPC PA-2), with a display capable of measuring 1 µm to 1500 µm in 1 µm increments, with calibration shims.
13. Two Wet-Film Thickness Gages, Prong-Type, capable of measuring 25 µm to 125 µm in 25 µm increments.
15. Profile micrometer with extra coarse and extra coarse plus replica tape.

All equipment will be returned to the Contractor upon completion of the work.

573-3 CONSTRUCTION DETAILS. The Contractor shall clean and paint all structural steel members, railings, downspouts, and other miscellaneous steel items as indicated in the contract documents.

The Contractor shall provide adequate access, suitable lighting, and time for inspections to be made. Any work done while the Engineer has been restricted from access, shall be re-cleaned and repainted, at no additional cost to the State to the State.

573-3.01 Quality Control Plan. The Contractor shall provide the Engineer with a copy of the Contractor's Quality Control (QC) procedures and/or Quality Control Plan (QCP). The QCP describes the minimum QC activities that will be performed by Contractor's QC personnel to ensure compliance. The QCP shall minimally include operating procedures and maintenance records for equipment on site, proof of formal QC training for the Contractor’s QC personnel on site, and daily reports including the following information:

- Compressed Air Cleanliness
- Dry Film Thickness
- Air Temperature
- Humidity and Dew Point
- Surface Temperature
- Abrasive Cleanliness Checks
- Degree of Cleanliness Achieved
- Surface Profile
- Batch Numbers of Paint Used
- Batch Numbers of Thinner Used
- Mixing According to Specification

The Contractor must provide daily reports to the Engineer at the conclusion of cleaning work and painting work and prior to inspection of such work by the Engineer. Reports at the conclusion of cleaning and painting work shall include all pertinent information listed above that relate to such work and shall be in a format previously agreed to under the QCP.

573-3.02 Surface Preparation. Steel surfaces shall be prepared for painting by a combination of pressure washing, solvent cleaning, and abrasive blast cleaning.
Pressure washing shall be performed first, followed by abrasive blast cleaning to remove all paint, rust, rust scale, and mill scale, as per SSPC SP-10, *Near-White Metal*. If heavy deposits of rust and scale are present, they shall be removed by hand or power tool prior to pressure washing. Deposits of bird droppings taller than 13 mm shall be removed prior to pressure washing.

**A. Pressure Washing and Solvent Cleaning.** All steel surfaces to be painted shall be pressure washed, using an operating pressure range of 12.5 MPa to 14 MPa, a minimum flow of 13 L/minute, and a water temperature of 85°C to 93°C. The nozzle shall be held at a distance of 150 mm to 300 mm from the steel surface. Pressure washing shall only be allowed when ambient air temperatures are greater than 4.5°C and rising. In no case will pressure washing be conducted when spent wastewater could freeze on roadway or bridge surfaces or in any other way create a hazardous situation. The washing is intended to remove contaminants from the surface, not to remove tightly adhered paint. Oil and grease shall be removed by solvent cleaning as described in SSPC SP1, *Solvent Cleaning*. The areas shall be pressure washed again following this cleaning.

When the washing is completed, the cleaned surfaces shall be free of dust, dirt, oil, grease, animal waste, salts, and other debris.

A containment shall be suspended around and beneath the work area during pressure washing. The containment for pressure washing is intended to capture solid paint chips and other solid debris that may become dislodged from washing operations. Unless otherwise noted, spent wash water will not require collection and will be allowed to fall to the underlying ground or waterway, provided that the other requirements of this specification are met.

Special note, Structural Painting Details, will provide scheduling requirements for washing a structure over a body of water. Spent wash water over a public water supply or the New York City watershed shall be collected and diverted to the adjoining land mass.

If steel surfaces become contaminated or 7 calendar days elapse between washing and abrasive blasting cleaning, they shall be rewashed at no additional cost to the State.

The surface shall be allowed to dry before subsequent abrasive blast cleaning begins.

**B. Abrasive Blast Cleaning.**

1. **Atmospheric Conditions.** Blast cleaning operations shall not be conducted under the following conditions:
   a. The relative humidity exceeds 85%.
   b. When the substrate is damp or covered by frost.
   c. The surface temperature is less than 3°C above the dew point.

2. **Steel Cleanliness and Profile.** All structural steel surfaces shall be blast cleaned to SSPC SP-10, *Near-White Metal*.

   The anchor profile shall be measured in accordance with ASTM D4417, Method C. The Contractor shall ensure that the anchor profile is within the range indicated on the paint manufacturer’s data sheets. The profile, at a minimum, shall be measured five times in various locations every 200 square meters prepared and once per work shift, unless otherwise ordered by the Engineer. The anchor profile shall not exceed 100 µm unless approved by the Engineer. The Engineer may approve a profile greater than 100 µm if an area is severely corroded or pitted. If the Contractor exceeds the 100 µm profile, the Contractor will be required to measure the profile using extra-coarse-plus replica tape and apply an additional mist coat of primer in accordance with manufacturer’s recommendations to obtain a minimum 50µm film build over the profile peaks, at no additional cost to the State.

   All fins, tears, slivers, flame-cut edges, burred and sharp edges that are present or occur during the blasting operation shall be removed by grinding, and then the area shall be reblasted to provide the required profile.

   Special attention shall be given to the edges of beam flanges, angles and plates, bearings, rivets, the heads of nuts and bolts, structural steel surrounding bridge joints, and similar surfaces that are marginally accessible and difficult to clean.

   Upon completion of blast cleaning and prior to inspection, the containment shall be vacuumed and the cleaned surfaces shall be free of all blasting products and paint debris.
Surfaces shall be free of all abrasive prior to inspection. Surfaces shall be cleared of all foreign matter by means of oil-free, moisture-free, compressed air or vacuum systems.

All cleaned surfaces will be inspected by the Engineer prior to painting. Any areas that are painted before being inspected shall be cleaned and restored to the SP-10 standard and repainted at no additional cost to the State. If the cleaned surface begins to rust or becomes contaminated in any matter prior to applying primer, the surface shall be restored to SP-10 standard.

3. **Steel Grit.** The recyclable abrasive shall be cleaned of all paint, chips, rust, mill scale, and other foreign material after each use, prior to reuse. The cleanliness of the recycled abrasive during use shall be confirmed in accordance with SSPC-AB2. The Contractor shall execute, record, and provide the Engineer results of the nonabrasive residue test, water soluble test, and oil content test daily. The Engineer may be present during this testing. The Contractor shall also execute and provide lead content test results weekly. All equipment used for cleaning abrasive shall be specifically designed for this purpose and accepted by the Engineer.

The Contractor shall maintain a balance in the size distribution of the abrasive work mix for the duration of the abrasive blasting operations to maintain a uniform profile across the surfaces to be blasted. The work mix shall not be predominantly coarse or fine, and shall be maintained through proper removal of expended abrasive and its timely replenishment.

4. **Protection of Newly Painted Surfaces.** Throughout abrasive blast cleaning work, care shall be taken to protect newly painted surfaces from the cleaning operations. Tarps, covers, or other devices shall be used to protect new paint from contamination or damage. Contaminated areas of new paint shall be cleaned as necessary prior to the next coat of paint. Damaged paint shall be blast cleaned to the required condition, and then repainted at no additional cost to the State.

5. **Vacuuming.** After cleaning operations are completed, all debris generated by the cleaning work shall be removed by vacuuming using HEPA-filtered vacuums. A HEPA filter shall be defined as a filter that is at least 99.97% efficient for particles that are 0.3\(\mu\text{m}\) in diameter, or larger.

6. **Equipment.** All equipment and compressors used in the cleaning operation shall be equipped with filters and traps to prevent moisture, oil, and other contaminants from being deposited on clean surfaces. The air cleanliness shall be verified by the Contractor with the white blotter test in accordance with ASTM D4285 at least once per shift for each compressed air system.

7. **Cleaning Area.** The area cleaned shall be limited to that which can be cleaned, inspected and prime coated within a 10-hour period. Cleaned areas shall be inspected by the Engineer prior to priming. Areas that exhibit flash rusting or fail to meet the local standard prior to painting shall be re-cleaned to the approved standard at no additional cost to the State.

C. **Visual and Project Standards.** The Contractor shall prepare at least one project cleaning standard for each representative area on the structure that is being prepared for painting. Multiple standards may be required if the cleaned steel differs significantly from the photographic standards due to surface conditions, or other factors such as distance of the standard from the work area.

The prepared cleaning standard shall conform to SSPC VIS 1, "Guide and Reference Photographs for Steel Surfaces Prepared By Dry Abrasive Blast Cleaning" Pictorial Standard as applicable, and shall be approved by the Engineer before the start of general cleaning work. Each cleaning standard shall be at least 300 mm x 300 mm in size, and shall be located in an area of the structure that is easily accessible, and approved by the Engineer. The Contractor shall protect the work standard from corrosion and contamination throughout the duration of work by applying a clear coat of polyurethane. At the completion of cleaning work, the cleaning standard shall be cleaned and painted. If the project standard becomes deteriorated, or otherwise ineffective, it shall be
reestablished at no additional cost to the State. In case of a dispute over the visual standard, the written standard shall take precedence.

§573-3.03 PAINTING. The Contractor shall apply three full coats of new paint and one stripe coat to all surfaces cleaned to SP-10. The paint shall be applied in the following order: primer, intermediate coat, stripe coat, and the finish coat. All steel surfaces within 2 meters of a bridge joint shall receive an additional full coat of intermediate paint.

A. Atmospheric Conditions. Paint shall not be applied when the receiving surface and ambient temperatures are less than 5°C or greater than 38°C, unless the manufacturer’s recommendations for temperature are more restrictive. No paint shall be applied unless the receiving surface is absolutely dry.

Paint shall not be applied when the relative humidity is more than 85% unless the paint manufacturer’s requirements are more restrictive. No paint shall be applied during rain or when rain is forecast to occur by the National Weather Service for the project location during painting operations. All painted surfaces shall be protected from direct exposure to rain for the time interval recommended by the paint manufacturer for proper cure. The Contractor shall observe the dew point and humidity restrictions listed on the manufacturer’s data sheets.

If an epoxy coating is exposed to temperatures or humidity conditions outside of the manufacturer’s recommended values prior to cure, all affected surfaces shall be visually examined for greased or oily surfaces which may have formed. The Engineer may require the Contractor to use a commercially available amine blush test kit at locations chosen by the Engineer. If testing indicates the presence of an amine blush or if there is any oily film on the surface, the surfaces shall be cleaned and prepared for topcoating in accordance with paint manufacturer’s recommendations at no additional cost to the State.

B. Paint Mixing. All paint shall be thoroughly mixed with mechanical mixers in accordance with the manufacturer's recommendations. After mixing, the bottom of the container shall be free of any unmixed pigment prior to use.

C. Solvents and Thinners. Paint may be thinned if recommended by the manufacturer and approved by the Engineer. The primer shall not be thinned such that the resulting VOC exceeds 500 g/L. The intermediate and finish paints shall not be thinned such that the resulting VOC level exceeds 340 g/L. The manufacturer’s data sheets shall advise the Contractor and Engineer of the maximum amount of thinner allowed.

Use of unauthorized thinners, or using excess amounts of thinners is prohibited. Any area where unauthorized or improper amounts of solvents or thinners are used shall be recleaned and repainted at no additional cost to the State. All thinning shall be performed in the presence of the Engineer.

D. Paint Application. Painting shall not begin until cleaned surfaces have been inspected and approved by the Engineer. Paint may be applied using spray or brush and roller, unless otherwise indicated by the contract documents. All paint shall be applied so as to produce a uniform, even coating free of runs, sags, drips, ridges, or other defects. Roller nap shall be limited in accordance with the paint manufacturer’s recommendation. Brushes and rollers used to apply the paint must be of a quality to produce a smooth uniform coating without leaving fibers in the coating.

Protection against paint spatter, spillage, wind blown paint, or similar releases of paint shall be provided. Covers, tarps, mesh, and similar materials shall be placed around the work area to protect public and private property, pedestrian, vehicular or marine traffic, all portions of the bridge, highway appurtenances, waterways, and similar surrounding areas and property, upon, beneath, or adjacent to the structure. The use of spray equipment for paint application shall be allowed within containments provided that the aforementioned protection against paint release is provided, all equipment used (including tarps, mesh and similar materials) meets all safety requirements for such enclosed use with paint spraying, and all OSHA requirements for safety and ventilation are met.

E. Stripe Coat. A stripe coat shall extend a minimum of 25 mm away from the following surfaces: all welds, rivets, bolts, nuts, edges of plates and structural members, angles, bearings, lattice pieces or
other shapes, corners, and crevices. Areas near bridge joints that are to receive an additional coat of intermediate paint shall also receive a stripe coat where necessary as described above. To provide contrast, paint for stripe coating shall be a different color than the receiving surface. The stripe coat shall use the intermediate paint and be applied after the intermediate coat. The stripe coat shall be brush applied without being thinned. The stripe coat will be applied in accordance with the manufacturer’s recommendations, with particular attention to the film thickness, recoat window and cure schedule.

**F. Paint Film Thickness.** Paint shall be applied to produce the specified dry-film thickness as directed by the range listed on the paint manufacturer’s data sheets. The dry-film thickness shall be determined in accordance with SSPC-PA 2, Paint Application Specification No. 2 - *Measurement of Dry Film Thickness with Magnetic Gages*, using a Type 2 fixed probe magnetic gages. Dry-film thickness gauges shall be calibrated over a blasted, approved surface.

DFTs of the intermediate and finish coats shall be determined by subtracting the average DFT readings of the previous coat(s) from the actual DFT reading. An average DFT value shall be recorded and calculated for every 100 m² prepared. The average shall be calculated using a minimum of 5 spot measurements as defined by SSPC-PA2.

Areas failing to meet the specified minimum dry-film thickness shall be top coated with the same paint to produce the total dry film thickness required. The top coating must be performed within the paint manufacturer’s specified recoat window.

The Engineer may require any area exceeding the manufacturers recommended dry-film thickness to be blast cleaned to the SP-10 condition.

**G. Painting Schedule.** Primer shall be applied to approved, abrasive-blasted surfaces according to section §573-3.02, B. 7 of this specification.

The intermediate coat shall be applied within 72 hours of the final cleaning operation. To prevent intercoat adhesion failure, the topcoat shall be applied within the manufacturer’s recommended recoat window, or 14 days, whichever is shorter. If the contractor fails to topcoat within the specified time period, the surface to be painted shall be cleaned and abraded, in accordance with manufacturer’s recommendations, to ensure adhesion of the following coat at no additional cost.

If the steel has become dirty between coats, the Contractor shall wash the bridge again at no additional cost to the State.

Manufacturer’s recommendations shall be observed for cure to handle, and cure to top coat schedules.

**H. Stenciling.** After the finish coat of paint has cured, the Contractor shall stencil the following information on the inside web of the fascia member, near the BIN plate, unless otherwise directed by the Engineer:
1. Month and year of completion
2. Contract number
3. SP10
4. Name of Paint Manufacturer
5. Name of Contractor
6. Primer, Intermediate, and Finish coat names

The stenciled lettering should be approximately 150 mm in height and be a contrasting paint color to the top coat.

**573-4 METHOD OF MEASUREMENT**

The work under this item will be measured on a lump sum basis per structure.

**573-5 BASIS OF PAYMENT**

The lump sum price bid shall include the cost of all labor, materials, and equipment necessary to satisfactorily complete the work, including the cost of providing protection against damage to public and private property during surface preparation and paint application. Payment for the containment, collection and disposal of dust and paint waste generated by surface preparation work shall be paid for separately.
§573

Progress payments will be based on the percentage of steel cleaned and painted. No more than 60% of the quantity will be paid for surface preparation and priming. The remaining amount will be paid following the satisfactory completion of work.

Payment will be made under:

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<th>Item</th>
<th>Pay Unit</th>
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<tr>
<td>573.01nnn</td>
<td>Structural Steel Painting Field Applied - Total Removal</td>
<td>Lump Sum</td>
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NOTE: nnnn denotes a serialized pay item.

SECTION 574 - STRUCTURAL STEEL PAINTING: OVERCOATING AND LOCALIZED

574-1 DESCRIPTION. This work shall consist of pressure washing and power-tool or vacuum-blast cleaning of damaged paint areas and corroded structural steel surfaces, and painting surfaces described in contract documents. See Special Note entitled Structural Painting Details for the description and requirements of serialized items.

574-2 MATERIALS

574-2.01 Paints. Paints shall meet the requirements of §708-02 Structural Steel Paints Class 2 and shall appear on the Department’s Approved List, “Structural Steel Paints – Class 2”. Paints shall be approved for either localized application, overcoating application, or both.

All new paint to be applied shall be produced by the same manufacturer. Any exception must have prior approval of the director of the Materials Bureau and the Engineer.

A. Shelf Life. The shelf life of all paint shall be a maximum of 12 months from the date of manufacture. Paint and thinner shall arrive at the work site in new, unopened containers. The label shall include the manufacturer’s name, batch number, color, paint name, and date of manufacture.

B. Paint Storage. Paint in storage shall be protected from damage and maintained in accordance with manufacturer’s recommendations. Paint will be considered in storage if it is onsite for more than 8 hours prior to application.

C. Color. Each single coat of paint shall be a different color and provide substantial contrast with the underlying substrate and previous coats. The color of the finish coat shall be as specified in contract documents. The color of the other coats will at the Contractor’s option.

D. Technical Data. The Contractor shall supply the Engineer with the paint manufacturer's technical data and materials safety data sheets for each paint to be applied. The data sheets shall be delivered to the Engineer a minimum of five work days prior to beginning of work. Data sheets shall include all information required by §708-02 Structural Steel Paints Class 2.

574-2.02 Water for Washing. Water for pressure washing shall be potable water. Any detergent or soluble salt remover used must receive approval by the paint manufacturer and the Materials Bureau. Water shall not be recycled.

574-2.03 Abrasive for Blast Cleaning. Abrasive material for blast cleaning shall be selected by the Contractor. Silica sand and other types of nonmetallic abrasive containing more than one percent free silica, by weight, will not be allowed. The abrasive blasting shall produce an angular anchor profile suitable for the paint system to be applied.

574-2.04 Paint Inspection Equipment. Prior to the start of work the Contractor shall supply the Engineer with the following specifications and equipment in good working order:
1. One bound copy of the Steel Structures Painting Council surface preparation specification, SSPC-SP 1 – *Solvent Cleaning*.
2. One (1) bound copy of the Steel Structures Painting Council surface preparation specification, SSPC-SP 11 – *Power Tool Cleaning to Bare Metal*.
3. One (1) bound copy of the Steel Structures Painting Council surface preparation specification, SSPC-SP 10 – *Near-White Metal Blast Cleaning*.
5. One bound copy of the most current Steel Structures Painting Council pictorial standards, SSPC-VIS 1, *Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning*.
7. One copy of ASTM D 4417 *Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel*.
9. One Air Thermometer, pocket type, -10°C to +40°C.
10. One noncontact Infrared Thermometer, -10°C to +40°C.
11. One Contact Thermometer, -10°C to +40°C.
12. One Paint Thermometer, -10°C to +40°C.
13. One Magnetic Dry-Film Thickness Gage, Type 2 (as defined per SSPC PA-2), with a display capable of measuring 1 µm to 1500 µm in 1 µm increments, with calibration shims.
14. Two Wet-Film Thickness Gages, Prong Type, capable of measuring 25 µm to 125 µm in 25 µm increments.
16. Profile micrometer with extra coarse replica tape.

All equipment will be returned to the Contractor upon completion of the work.

574-3 CONSTRUCTION DETAILS. Overcoating is defined as spot cleaning and priming corroded areas followed by applying two coats of paint to all existing painted steel surfaces. Localized cleaning and painting is defined by spot cleaning and applying three coats of paint to spot-cleaned steel only.

The Contractor shall provide adequate access, suitable lighting, and time for inspections to be made. Any work done while the Engineer has been denied, or restricted from access, shall be recleaned and repainted at no additional cost to the State.

574-3.01 Quality Control Plan. The Contractor shall provide the Engineer a copy of the Contractor's Quality Control (QC) procedures and/or Quality Control Plan (QCP). The QCP describes the minimum QC activities that will be performed by Contractor's QC personnel to ensure compliance. The QCP shall minimally include operating procedures and maintenance records for equipment on site, proof of formal QC training for the Contractor’s QC personnel on site, and daily reports including the following information:

- Compressed Air Cleanliness
- Dry-Film Thickness
- Air Temperature
- Humidity and Dew Point
- Surface Temperature
- Abrasive Cleanliness Checks
- Degree of Cleanliness Achieved
- Surface Profile
- Batch Numbers of Paint Used
- Batch Numbers of Thinner Used
- Mixing According to Specification

The Contractor must provide daily reports to the Engineer upon request. The reports shall be submitted no later than 24 hours following the completion of the days work.
§574-3.02 Surface Preparation for Overcoating. Steel surfaces shall be prepared for painting by a combination of pressure washing and power-tool or vacuum-shrouded blast cleaning. Pressure washing of all areas to be painted shall be performed first, followed by power-tool cleaning of areas demonstrating corrosion of the steel substrate to remove all paint, rust, rust scale, and mill scale, as per SSPC SP-11, *Power Tool Cleaning to Bare Metal or SSPC SP-10, Near-White Metal Blast Cleaning* as applicable. If heavy deposits of rust and scale are present, they shall be removed by hand or power tool prior to pressure washing. Areas of tightly adhered coating to remain shall be abraded to provide an anchor profile for overcoat paint. Large deposits of bird droppings shall be removed prior to pressure washing.

A. **Pressure Washing and Solvent Cleaning.** All steel surfaces to be painted shall be pressure washed, using an operating pressure range of 12.5 MPa to 14 MPa, a minimum flow of 13 L/minute, and a water temperature of 85ºC to 93ºC. The nozzle shall be held at a distance of 150 mm to 300 mm from the steel surface. Pressure washing shall only be allowed when ambient air temperatures are greater than 4.5ºC and rising. In no case will pressure washing be conducted when spent wastewater could freeze on roadway or bridge surfaces or in any other way create a hazardous situation. The washing is intended to remove contaminants from the surface, not to remove tightly adhered paint. Oil and grease shall be removed by solvent cleaning as described in SSPC SP1, *Solvent Cleaning*. The areas shall be pressure washed again following this cleaning.

When the washing is completed, the cleaned surfaces shall be free of dust, dirt, oil, grease, animal waste, salts, and other debris.

A containment shall be suspended around and beneath the work area during pressure washing. The containment for pressure washing is intended to capture solid paint chips and other solid debris that may become dislodged from washing operations. Unless otherwise noted, spent wash water will not require collection and will be allowed to fall to the underlying ground or waterway, provided that the other requirements of this specification are met.

Special note, Structural Painting Details, will provide scheduling requirements for washing a structure over a body of water. Spent wash water over a public water supply or the New York City watershed shall be collected and diverted to the adjoining land mass.

If steel surfaces become contaminated or 7 calendar days elapse between washing and abrasive blasting cleaning, they shall be rewashed at no additional cost to the State.

B. **Power Tool Cleaning.** Power tools as described in SSPC-SP 11 shall be used to clean corroded steel. Vacuum-shrouded abrasive blasting may be allowed. Steel cleaned using vacuum-shrouded blasters shall be cleaned to SSPC-SP 10.

1. **Atmospheric Conditions.** No cleaning operations will be conducted under the following conditions:
   - The relative humidity exceeds 85%.
   - When the substrate is damp or covered by frost.
   - The surface temperature is less than 3ºC above the dew point.

2. **Steel Cleanliness and Profile.** Surfaces which have become visibly corroded shall be cleaned in accordance with SSPC-SP 11 or SSPC-SP 10, as applicable. Areas where the existing paint has peeled, flaked, blistered, or otherwise become deteriorated shall be cleaned until only sound paint, tightly adherent paint remains. These areas need not be cleaned to SP-11 or SP-10 if the damage does not extend to the steel surface and corrosion of the steel substrate or the mill scale is not evident.

   Equipment used shall produce an anchor profile meeting the manufacturer’s requirements as reported on the manufacturer’s data sheets.

   Special attention shall be given to the edges of beam flanges, angles and plates, bearings, rivets, the heads of nuts and bolts, structural steel surrounding bridge joints, and similar surfaces that are marginally accessible and difficult to clean.

   The edges of intact paint shall be feathered back and the adjoining paint must be tightly adhered. Ragged or lifting edges on adjoining paint will not be allowed. Adherence will only be considered satisfactory if the adjoining paint is smoothly feathered back, and cannot be removed by lifting with a dull putty knife.
3. **Vacuuming.** The vacuum assembly on all tools shall be capable of containing all visible dust and debris produced by the operation of the cleaning equipment. Air passing through the vacuum assembly shall be exhausted through a HEPA filter. A HEPA filter shall be defined as a filter that is at least 99.97% efficient for particles that are 0.3 µm in diameter, or larger.

4. **Preparation of Remaining Coating.** Areas exhibiting damaged or deteriorated paint not extending to the steel shall be power-tool cleaned to remove all damaged or loosely adhered paint and provide a suitable surface for top coating. Loosely adhered paint will lift when scraped with a dull putty knife.

   After cleaning and feathering edges, all remaining tightly adhered coating shall be abraded. The abrading operation shall not fracture or remove a significant amount of existing coating, only provide surface profile suitable to receive additional coats of paint. The degree of abrading shall be in accordance with the manufacturer’s recommendations.

   The Contractor shall choose the method of abrasion. No additional payment will be made for the appropriate containment and waste collection required to abrade the surface. Open abrasive blasting to abrade the surface shall require a Class A containment, in accordance with Section 570 Paint Removal Operations. All other methods of abrasion shall minimally require the same level of containment as specified in contract documents for a particular structure.

   If the Contractor chooses a wet-abrasive method for abrasion, the containment must meet the requirements of SSPC – Guide 6, Class 2W. All water and abrasive must be collected and disposed of as hazardous waste.

   All dust, powder, or residual abrasive remaining on the surface after the abrading operation shall be thoroughly removed and the remaining surface clean prior to painting.

5. **Cleaning Area.** The area cleaned shall be limited to that which can be cleaned, inspected and prime coated within a 10 hour period. Cleaned areas shall be inspected by the Engineer prior to priming. Areas that exhibit flash rusting within the 10-hour period or fail to meet the project cleaning standard prior to painting shall be recleaned.

C. **Visual and Project Standards.** The Contractor shall prepare at least one project cleaning standard for each representative area on the structure that is being prepared for painting. Multiple standards may be required if the cleaned steel differs significantly from the photographic standards due to surface conditions, location from work area, or other factors such as distance of the standard from the work area.

   The prepared standard shall generally conform to SSPC VIS 3, Visual Standard for Power- and Hand-Tool Cleaned Steel, and shall be approved by the Engineer before the start of general cleaning work. Each cleaning standard shall be at least 300 mm x 300 mm in size, and shall be located in an area of the structure that is accessible to, and approved by the Engineer. The Contractor shall protect the cleaning standard from corrosion and contamination throughout the duration of work by applying a clear coat of polyurethane. At the completion of cleaning work, the project standard shall be recleaned and painted. If the project cleaning standard becomes deteriorated, or otherwise ineffective, it shall be reestablished at no additional cost to the State. Corroded and deteriorated surfaces that have been cleaned using power tools shall be accepted by visual comparison to the project prepared standard(s) for each structure. In case of a dispute over the visual standard, the written standard shall take precedence.

574-3.03 **Surface Preparation for Localized Cleaning and Painting.** All of the requirements of §574-3.02 shall apply with the exception of abrading the remaining coating. Only tightly adherent existing coating within 150 mm of a power tool cleaned surface shall be abraded.

574-3.04 **Overcoat Painting.** The paint shall appear on the Department’s Approved List, ‘Structural Steel Paints - Class 2’ and be approved for overcoating application.

   The Contractor shall apply each coat of paint in the order listed on the Department’s Approved List ‘Structural Steel Paints - Class 2.’
A. Atmospheric Conditions. Paint shall not be applied when the receiving surface and ambient temperatures are less than 5°C or greater than 38°C, unless the manufacturer’s recommendations for temperature are more restrictive. No paint shall be applied unless the receiving surface is absolutely dry.

Paint shall not be applied when the relative humidity is more than 95% unless the paint manufacturer’s requirements are more restrictive. No paint shall be applied during rain.

The Contractor shall observe the dew point restrictions listed on the manufacturer’s data sheets.

If an epoxy coating is exposed to cold temperatures or humid conditions outside of the manufacturer’s recommended values prior to cure, the surface shall be visually examined for greased or oily surfaces which may have formed. The Engineer may also require the Contractor to use a commercially available amine blush test kit in various locations. If testing indicates the presence of an amine blush or if there is any oily film on the surface, the surfaces shall be cleaned in accordance with paint manufacturer’s recommendations at no additional cost to the State.

B. Paint Mixing. All paint shall be thoroughly mixed with mechanical mixers in accordance with the manufacturer's recommendations. After mixing the bottom of the container shall have no unmixed pigment.

C. Solvents and Thinners. Paint may be thinned if recommended by the manufacturer and approved by the Engineer. The primer, if classified as metallic pigmented, shall not be thinned such that the resulting VOC exceeds 500 g/L. The subsequent coats of paints shall not be thinned such that the resulting VOC level exceeds 340 g/L.

Use of unauthorized thinners, or using excess amounts of thinners is prohibited. Any area where unauthorized solvents or thinners are used shall be recleaned and repainted at no additional cost to the State. All thinning shall be performed in the presence of the Engineer.

D. Paint Application. Painting shall not begin until cleaned surfaces have been inspected and approved by the Engineer. Paint may be applied using spray, brush, or roller, unless otherwise indicated by the contract documents or prohibited by the paint manufacturer. All paint shall be applied so as to produce a uniform, even coating, free of runs, sags, drips, ridges or other defects. Roller nap shall be limited in accordance with the paint manufacturer’s recommendation. Areas exhibiting trapped fiber or bristles shall be rejected. Prepared areas that exhibited damaged paint not extending to the steel substrate shall receive two coats of paint: intermediate and finish coat.

Complete protection against paint spatter, spillage, wind-blown paint, or similar releases of paint shall be provided. Covers, tarps, mesh, and similar materials shall be placed around the work area to protect public and private property, pedestrian, vehicular, marine, or other traffic, all portions of the bridge, highway appurtenances, waterways, and similar surrounding areas and property, upon, beneath, or adjacent to the structure. The use of spray equipment for paint application shall be allowed within containments provided that the aforementioned protection against paint release is provided, all equipment used (including tarps, mesh and similar materials) meets all safety requirements for such enclosed use with paint spraying, and all OSHA requirements for safety and ventilation are met.

E. Paint Film Thickness. Paint shall be applied to produce the specified dry-film thickness (DFT) as directed by the range listed on the paint manufacturer’s data sheets. The dry-film thickness shall be determined in accordance with SSPC-PA 2, Paint Application Specification No. 2 - Measurement of Dry Film Thickness with Magnetic Gages, using a Type 2, fixed-probe magnetic gages. Dry-film thickness gauges shall be calibrated over a cleaned, approved surface.

DFTs of the all coats applied subsequent to the primer shall be determined by subtracting the average DFT readings of the previous coat(s) from the actual DFT readings. An average DFT value shall minimally be recorded and calculated for every 100 m² prepared. The average shall be calculated using a minimum of 5 spot measurements as defined by SSPC-PA2.

Areas failing to meet the specified minimum dry-film thickness shall be top coated with the same paint to produce the total dry film thickness required. The top coating must be performed within the paint manufacturer’s specified recoat window.
The Engineer may require any area exceeding the manufacturers recommended dry film thickness to be cleaned to the SSPC-SP 11 or SSPC-SP 10 condition.

**F. Painting Schedule.** Primer shall be applied as per §574-3.02, B.5 of this specification.

The second coat shall be applied within 72 hours of the final cleaning operation.

To prevent intercoat adhesion failure, recoating must be performed within the manufacturer’s recommended recoat window, or 14 days, whichever is shorter. If the contractor fails to recoat within the specified time period, the surface to be painted shall be cleaned and abraded in accordance with manufacturer’s recommendations. This work shall be done at no additional cost to the State.

If the steel has become dirty between coats, the Contractor shall wash the bridge again at no additional cost to the State.

**574-3.05 Painting for Localized Cleaning and Painting.** The paint shall appear on the Department’s Approved List, “Structural Steel Paints - Class 2” and be approved for localized application.

The Contractor shall apply each coat of paint in the order listed on the Department’s Approved List “Structural Steel Paints - Class 2”.

All of the requirements of §574-3.04 shall apply with the exception of area painted. Only areas that have been cleaned shall be painted. Paint shall not extend more than 150 mm beyond all power-cleaned areas.

**574-4 METHOD OF MEASUREMENT**

**574-4.01 Overcoating - Lump Sum.** The work under this item will be measured on a lump sum basis, per structure.

**574-4.02 Overcoating - Square Meter.** The measurement of this item will include the area requiring overcoating, measured to the nearest whole square meter.

**574-4.03 Localized - Square Meter.** The quantity to be measured will be in square meters of area of steel cleaned and painted, measured the nearest whole square meter.

**574-5 BASIS OF PAYMENT**

The lump sum price bid shall include the cost of all labor, materials, and equipment necessary to complete the work, including the cost of providing protection against damage to public and private property during pressure washing and paint application. Payment for the containment, collection and disposal of dust and paint waste generated by surface preparation work shall be paid for separately.

Progress payments will be based on the percentage of steel cleaned and painted. 60% of the quantity will be paid for surface preparation and priming. The remaining amount will be paid following the satisfactory completion of work.

**Payment will be made under:**

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NOTE: nnnn denotes a serialized pay item.

**SECTION 575 (VACANT)**

**SECTION 576 - BRIDGE DRAINAGE SYSTEM**

**576-1 DESCRIPTION.** This work shall consist of furnishing and placing scuppers, drainage troughs and downspout systems for bridge drainage as shown on the plans and in accordance with the specifications.
§576  MATERIALS

Cast Iron Scuppers
Fabricated Steel Scuppers (Except Gratings)
    Plates or Bars
    Tubes
    Headed Concrete Anchor Studs
Grating Plates and Bars
Bolts and Cap Screws
Drainage Troughs (PVC)
Steel For Erection of Trough
    Bars2(A1, A2) and Plates2(B1, B2, C1 and C2)
    Rods (fully threaded) and Bolts4
    Clamps, Malleable Iron
Ductile Iron Downspout Pipe and Pipe Fittings
Pipe Couplings (Ductile Iron or Malleable Iron)
Hoppers7
Pipe Brackets and Supports
Anchors
Nuts and Bolts7
PVC Downspout Pipe, Fittings and Solvent Cement
Protective Cover (Cellular Polystyrene)

NOTES:
1. In addition to the requirements of 715-01, Structural Steel, the Contractor will be required to furnish the Deputy Chief Engineer (Structures), two (2) certified copies of the records of the chemical analysis of the steel.
2. Bars shall be 16 mm diameter. Plates shall be 50 mm x 6 mm.
4. All pipe shall be groove cut around the full pipe circumference at both ends. The grooves shall be radius cut in accordance with AWWA C606. The grooves shall be such that a keyed housing clamp coupling shall fit into them. The grooves shall be such that a keyed housing clamp coupling shall fit into them. Unless otherwise approved, all pipe bends (elbows) shall be of the long radius type.
5. All couplings shall be gasketed, double keyed, housing clamps designed to lock and seal the joint between two grooved pipes, or fittings, when the housing clamp is bolted and tightened in place. The gasket shall be a molded or extruded compound of Butyl or EDPM, suitable for water service.
6. Galvanized in accordance with the requirements of 719-01. Nuts and bolts shall be galvanized in accordance with 719-01, Type II.

576-3 CONSTRUCTION DETAILS

576-3.01 Fabrication

A. Shop Drawings. Shop drawings will not be required for scuppers, drainage troughs or downspout systems.

B. Welding

1. Fabricated Steel Scuppers, Gratings. Welding shall conform to the provisions of the SCM. Weld inspection shall be done in accordance with the requirements of the SCM but radiographic testing will not be required. All groove welds shall be complete joint penetration groove welds unless otherwise approved by the DCES.

2. Drainage Troughs. Field Welding (by heat) of the polyvinyl chloride trough material shall not be allowed without written permission of the Deputy Chief Engineer (Structures).

C. Galvanizing
1. Scuppers and Troughs. Galvanizing shall conform to the requirements of §719-01, Galvanized Coatings and Repair Methods. Galvanizing shall be done after all welding and fabrication is completed.

2. Bolts, Fully Threaded Rods and Nuts. All bolts and rods shall have a ANSI B1.13M Class 6H thread. All galvanized nuts shall have a standard oversize tap to allow for the galvanizing on the bolts, rods and nuts.

D. Gratings. Gratings for Types B1 and B2 scuppers shall have a full and even bearing on the underlying surface.

E. Basis of Acceptance. Scuppers, drainage troughs and downspouts shall be accepted at the work site by the Engineer-in-Charge upon certification of the manufacturer that the materials used and fabrication procedure employed conform to the requirements of section 576. The Engineer may reject any scupper, drainage trough or downspout system which, in his opinion, exhibits poor quality or workmanship.

576-3.02 Erection of Downspout Systems

A. General

1. Pipe Installation. The pipe shall be laid true to line and grade as shown on the plans or as directed by the Engineer, with joints close and even, so that a true and even surface of invert will be made over the joints throughout its entire length. Horizontal pipe shall be installed so that the minimum slope shall not be less than 1:50. Pipe shall be placed in accordance with the requirements of this specification unless special methods are called for on the plans or in the itemized proposal.

2. Field Testing. Prior to the acceptance of the structure by the Department, the downspout system should be flushed out and tested to insure that it is flowing at full capacity. Any obstruction in the downspout system preventing the free flow of drainage or its operation at full capacity shall be removed to the complete satisfaction of the Engineer.

B. Ductile Iron Downspouts

1. Pipe Supports. Supports for horizontal piping shall be spaced 1.5 m maximum. Supports for vertical piping shall be spaced 1.8 m maximum.

2. Pipe Joints. All joints in pipe, except when encased in concrete, shall be made with groove type couplings. Pipes encased in concrete shall have joints formed in accordance with the pipe manufacturer's recommendations.

3. Painting. All metal embedded in concrete shall not be painted. All other metallic portions of the downspout system shall be painted in the field in accordance with the requirements of the contract documents. Color shall be as shown on the plans.

C. PVC Downspouts and Protective Insulator

1. Pipe Joints. PVC pipe joints shall be sealed in the following manner: All necessary cuts shall be square and clean from burrs. Mating surfaces of pipe and fittings shall be cleaned with methyl ethyl ketone or acetone prior to solvent cement application. The solvent cement shall be applied as recommended by the manufacturer. The pipe and fitting should be joined with a twisting motion to distribute cement uniformly. The solvent cement manufacturer's recommendations for cure time shall be followed.
2. **Protective Insulator.** The protective insulator shall be attached to the pipe in such a manner so as to prevent its dislodgement as the concrete is placed. Suitable methods would include taping the joints with a weather resistant tape or bonding with a non-metallic substance.

3. **Form Wire.** The PVC pipe and its protective insulator shall be held in place by form wire in such a manner as to provide sufficient lateral support to prevent movement as the concrete is placed.

4. **Vibrator.** Particular caution shall be taken to prevent the vibrator from striking the pipe and its protective insulator during the placing of concrete.

576-4 **METHOD OF MEASUREMENT**

576-4.01 Scuppers. Payment will be made at the unit price bid for each type of scupper furnished and placed as shown on the plans and in accordance with the specifications.

576-4.02 Drainage Troughs. The trough shall be measured as the number of meters measured along the center line of each polyvinyl chloride section, furnished and placed as shown on the plans and in accordance with the specifications.

576-4.03 Downspout System. The downspouts will be measured as the number of meters measured along the center line of pipe between the extreme outer limits of downspouts, including hoppers, furnished and placed as shown on the plans and in accordance with the specifications.

576-5 **BASIS OF PAYMENT**

576-5.01 Scuppers. The unit price bid for each type of scupper shall include the cost of furnishing all labor, equipment and materials necessary to set the scupper to its proper line and grade. No additional payment will be made for furnishing and placing the grating for the Type B1 or B2 scupper.

576-5.02 Drainage Troughs. The unit price bid per meter shall include the cost of furnishing all labor, materials and equipment necessary to erect the trough and its threaded rod supports as indicated on the plans.

576-5.03 Downspout System

   **A. General.** The unit price bid per meter shall include the cost of furnishing all labor, materials and equipment necessary to erect the pipe and pipe fittings, pipe supports, hoppers, nuts, bolts, washers, to provide cleanouts if indicated on the plans, straps to cap and plug the pipe if necessary, and to replace cracked or otherwise defective material necessary to complete the work.

   **B. Ductile Iron Downspouts.** The unit price bid per meter shall also include the cost of furnishing and placing pipe hangers and brackets, grooved type couplings and paint.

   **C. PVC Downspouts and Protective Insulator.** The unit price bid per meter shall also include the cost of furnishing and placing the protective insulator and all adaptor fittings required at the juncture of PVC Pipe and Ductile Iron Pipe.

   **D. Excavation.** All required excavation will be paid for under pay item 206.02 M Trench and Culvert Excavation and 206.04 M Trench and Culvert Excavation - O.G.

**Payment will be made under:**

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<tr>
<td>576.02</td>
<td>Scuppers (Type B)</td>
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<td>576.10</td>
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SECTION 577 (VACANT)

SECTION 578 - BONDED CONCRETE OVERLAY FOR STRUCTURAL SLABS

578-1 DESCRIPTION. Prepare the surfaces that will be in contact with slab reconstruction concrete and place slab reconstruction concrete. Prepare the structural slab surface and place a Class E, bonded concrete overlay.

578-1.01 Scope. Concrete removal work will be paid for under the appropriate item(s). Minimum thickness of the overlay concrete is 75 mm. Include the cost of any grade changes necessitated by this requirement in the unit bid price for overlay concrete.

578-1.02 Definitions

A. Overlay Concrete. Class E Concrete placed over existing and slab reconstruction concrete.

B. Slab Reconstruction Concrete. Concrete placed completely around the exposed top mat of bar reinforcement. Slab reconstruction concrete will be Class D for Method 1 and Class E for Method 2, as described in §578-1.03 Placement Methods.

578-1.03 Placement Methods.

A. Method 1 - Separate Placement. Place Class D slab reconstruction concrete and Class E overlay concrete separately.

B. Method 2 - Integral Placement (Optional). When 100% of the top mat of bar reinforcement is exposed or when all of the following conditions are satisfied, Class E overlay concrete and Class E slab reconstruction concrete may be placed in a single lift.

1. The area of the exposed top mat of bar reinforcement is 5% or less of the placement area, per span.
2. No individual area of the exposed top mat of bar reinforcement exceeds 2.5 square meters.
3. No dimension of any area of the exposed top mat of bar reinforcement exceeds 2 meters.

578-2 MATERIALS. All material listed under §557-2.

578-3 CONSTRUCTION DETAILS .

578-3.01 Blast Cleaning. §584-3.02

578-3.02 Preplacement Wetting. §584-3.03

578-3.03 Vacant

578-3.04 Handling and Placing Concrete. §584-3.05

578-3.05 Construction Joints. §584-3.07

578-3.06 Finishing and Curing Slab Reconstruction Concrete - Separate Placement. §584-3.09

578-3.07 Finishing Bonded Concrete Overlay. §557-3.07
§578-3.08 Curing Bonded Concrete Overlay. §557-3.11 with the following: Cure concrete with wet burlap for 7 days. Provide uniform continuous wetting until concrete curing is complete. The wet burlap and curing cover option is not allowed.

578-3.09 Opening to Traffic. Traffic is allowed only after completion of the required curing period.

578-3.10 Defective or Damaged Concrete. §584-3.08

578-4 METHOD OF MEASUREMENT. For placements with 100% exposure of the top mat of bar reinforcement, the number of square meters of slab reconstruction concrete will be equal to the number of square meters of overlay concrete.

For placements with less than 100% exposure of the top mat of bar reinforcement, measure slab reconstruction concrete prior to overlay concrete placement.

A. Method 1- Separate Placement. Measure slab reconstruction concrete as the number of square meters of Class D slab reconstruction concrete placed. Measure overlay concrete as the number of square meters of plan area of Class E overlay concrete placed.

B. Method 2- Integral Placement (Optional). Measure slab reconstruction concrete as the number of square meters of Class E slab reconstruction concrete placed. Measure overlay concrete as the number of square meters of plan area of Class E overlay concrete placed.

578-5 BASIS OF PAYMENT. Include the cost of all labor, materials and equipment necessary to complete the work in the unit bid price.

Payment will be made under:

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<td>578.1300nn</td>
<td>Slab Reconstruction Concrete, Class D or E</td>
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NOTE: nn denotes a serialized pay item.

SECTION 579 - STRUCTURAL SLAB RECONSTRUCTION PREPARATION

579-1 DESCRIPTION. The work shall consist of initially preparing an existing structural slab for reconstruction. Generally, this work shall entail the removal of concrete to the depths, and at the locations, required by the contract documents.

579-1.01 Structural Slab Scarification

A. This work shall consist of removing the top surface of structural slab concrete. Removal shall be done by scarification to the following limits, unless a greater depth is indicated on the plans:
   • Minimum of 6 mm
   • Maximum of 13 mm

B. After scarification, if a structural slab survey is required, the surface to be surveyed shall be cleaned sufficiently to allow the survey to be taken. The Engineer will determine if the surface is cleaned sufficiently to allow performance of the necessary delamination and potential survey tests.

C. All removed materials shall be transported from the work site and disposed of or disposed of in an area on the job site approved by the Engineer.
§579

579-1.02 Exposure of Reinforcing Bars

A. Definitions

1. Bar Mat. That combination of transverse and longitudinal reinforcing steel placed with the structural slab to absorb stresses. Structural slabs generally contain two bar mats; an upper mat and a lower mat.

2. Upper Mat. That bar mat closest to the existing top surface of the structural slab. Only the upper mat is relevant to this work, except in localized areas.

3. Localized Area. An area where full depth removal and subsequent patching will be done as part of this work. For the work of this section a localized area shall not exceed 2.5m$^2$. The sum of the localized areas shall comprise no more than five percent (5%) of the structural slab area to be prepared.

B. The work shall consist of structural concrete removal from the periphery of the upper mat reinforcing bars to provide a minimum clearance of 25 mm between the reinforcing bar surface and the remaining concrete surface. In addition, the Engineer may order the removal of other concrete. (Refer to 579-3, Construction Details).

C. All work performed under the requirements of this subsection shall not extend beyond a plane which is 125 mm below the original top of slab, except for localized areas.

D. Removed materials shall be disposed of in accordance with 579-1.01B.

579-2 MATERIALS

Class A Concrete 5012
Quilted Covers (for curing concrete) 711-02
Plastic-Coated Fiber Blankets (for curing) 711-03

NOTES:
1. 501, Class D Concrete, may be substituted at no extra cost.
2. For quantities of four cubic meters of total project placement, or less, automatic batching equipment will not be required.

579-2.01 Equipment

A. Power Operated Scarifier. The specific equipment the Contractor proposes to use shall be approved by the Engineer prior to use. Power bush hammers, or other impact type devices which indent or pulverize the surface shall not be allowed under any circumstances.

B. Pneumatic Hammers and other equipment. These shall be subject to the Engineer's approval prior to use. Pneumatic hammers shall meet the requirements of §580-3.02

C. Other Equipment. All other equipment proposed for use shall be approved by the Engineer prior to actual employment in the work.

579-3 CONSTRUCTION DETAILS. The Contractor shall exercise care during the execution of the work to avoid damaging or loosening material that is to remain. All damage caused by the Contractor's operations to material that is to remain shall be repaired, or the material replaced as determined by the Engineer. All repair and replacement work shall be done in a manner satisfactory to the Engineer.

579-3.01 Structural Slab Scarification. Scarification of designated areas shall be accomplished with a power operated scarifier. Inaccessible areas will be scarified with pneumatic hammers.
§579-3.02 Reinforcing Bar Exposure

A. Concrete shall be removed from the uppermost reinforcing bars of the structural slab to the limits designated by §579-1.02B. The Contractor may remove concrete, to the designated minimums, from around both sets of bars in the upper mat.

B. If concrete is removed only from the periphery of the uppermost bar, removal shall be done in accordance with those details indicated on the plans.

C. If the Contractor chooses to remove concrete from the periphery of both bars of the upper mat, or if the Engineer determines that:
   • The lower bar is corroded; OR
   • The concrete around the lower bar is deteriorated; OR
   • Delamination extends to the level of, or below, the lower bar; OR
   • The lower bar is debonded;

then the concrete shall be removed from the periphery of the lower bar in accordance with the details indicated on the plans.

D. At locations where deteriorated concrete extends beyond the minimum removal limits, the Engineer will order its removal. The Engineer will be the sole determiner of what constitutes deteriorated concrete. This ordered removal shall be part of this work, except that removal of deteriorated concrete below the limit established by §579-1.02C, shall be part of this work only within the limits of localized areas.

   Locations where concrete is removed beyond minimum limits, lacking specific orders from the Engineer directing such removal, will be designated as damage locations. All damage locations shall be repaired in a manner satisfactory to the Engineer, at no additional cost to the State.

E. At localized areas, the Engineer may order concrete removal below the plane established by 579-1.02C. When such removal reaches the uppermost bar of the lower reinforcing bar mat, removal shall be continued until full depth removal is achieved.

F. Care shall be exercised when removing concrete to avoid damaging reinforcement, or other materials, which are to remain in place. Reinforcing steel damaged by the Contractor's operations shall be replaced with new reinforcing steel of the same size, appropriately spliced. Reinforcing steel splices shall be made in accordance with the details shown on the plans. Other materials designated to remain in place, which are damaged by the Contractor's operations, shall also be replaced.

§579-3.03 Full Depth Patches. Refer to the details indicated on the plans.

A. Immediately prior to placing new concrete, the reinforcing bars and the edges of the existing structural slab, which will be in contact with new concrete, shall be blast cleaned. Forms shall be drawn tightly. Preparation and formwork shall be approved by the Engineer prior to any concrete placement. "After blast cleaning has been accepted, thoroughly wet the structural slab surface and all porous surfaces to be in contact with new concrete for at least 12 hours immediately prior to placement. Remove all standing water with oil-free compressed air, and protect the surface from drying, so the concrete remains in a saturated surface dry condition when placing bonding grout.

B. Concrete shall be placed and consolidated in accordance with the requirements of 555-3.04. The uppermost surface of the concrete patch shall be level with the highest of the surrounding prepared surfaces. The uppermost surface shall be intentionally roughened. The Engineer may require that a coarse textured drag be used on the plastic concrete surface.

C. Concrete shall be cured, in a manner approved by the Engineer, for a minimum of 72 curing hours prior to any other concrete placement work in contact with the curing concrete. A curing hour is defined as any hour, starting from the hour of placement, during which the ambient air temperature at the concrete surface remains at, or above 7°C as measured by a recording thermometer. Curing shall be done by means of quilted covers (711-02), or plastic coated fiber blankets (711-03). Quilted covers, if used, shall be kept wet during the entire curing period. The use of curing compounds shall not be allowed.

§579-3.04 Hydrodemolition Equipment. Hydrodemolition equipment, if approved by the Engineer, shall be subject to the following:
**A. Water Filtration and Disposal.** At least two weeks prior to the employment of any hydrodemolition equipment, the Contractor shall submit to the Engineer, for approval, a comprehensive plan for the filtration and disposal of hydrodemolition water.

This plan shall ensure, to the extent practical, that all debris particles will be removed from hydrodemolition water, prior to its being introduced into any lake, river, stream, or any drainage system which empties into a lake, river or stream.

The Contractor is specifically notified that use of the existing bridge drainage system for hydrodemolition water disposal will not be permitted.

**B. Water Retention.** Hydrodemolition water shall be prevented from running onto, or over all portions of the project site not immediately subject to hydrodemolition work. In addition, the Contractor shall provide shielding, acceptable to the Engineer, that protects traffic and prevents all debris from escaping the immediate work location. A comprehensive plan for accomplishing these requirements shall be submitted to the Engineer, for approval, at least two weeks prior to the beginning of any hydrodemolition work.

The Contractor is specifically notified that use of the existing bridge drainage system, for this purpose, will not be permitted.

The plan for this work may be submitted as part of the requirements of §579-3.04A.

**C. Adherence.** Once approved, the water filtration and disposal, as well as the water retention plans shall be strictly adhered to by the Contractor. Should the Engineer determine that these plans are not being followed as approved, the Contractor will be required to immediately cease work until the conditions are rectified in a manner satisfactory to the Engineer.

Should the Contractor fail to rectify the situations to the Engineer's satisfaction, the Engineer may, with the concurrence of the D.C.E.C., require the Contractor to use equipment other than hydrodemolition equipment.

No extension of time will be granted, nor will any additional compensation be granted, for either the ceasing of work, or the substitution of equipment, if either one is required as a result of the Contractor's failure to follow the approved plans.

**D. Debris Removal.** All debris shall be removed quickly enough to prevent rebonding of the debris to the concrete surface. All debris which rebonds shall be removed in a manner satisfactory to the Engineer at no cost to the State.

Material designated to be left in place, which is damaged by rebonded debris removal work, shall be repaired in a manner satisfactory to the Engineer at no cost to the State.

### §579-4 METHOD OF MEASUREMENT

**579-4.01 Structural Slab Scarification.** The work will be measured as the number of square meters stated in the Estimate of Quantities shown on the plans. Except to allow for progress payments, no field measurements will be taken. Field measurements for progress payments shall not exceed the Estimate of Quantities figure.

**579-4.02 Reinforcing Bar Exposure.** The work will be measured as the number of square meters of concrete removed. Quantities will be determined from field measurements.

### §579-5 BASIS OF PAYMENT

**579-5.01 Reinforcing Bar Exposure.** The unit price bid per square meter shall include the cost of all labor, material and equipment necessary to perform full depth patching in localized areas. Full depth concrete removal, and full depth patching, in excess of the limits established for localized areas will be paid for as extra work.
Payment will be made under:

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<td>579.02</td>
<td>Reinforcing Bar Exposure</td>
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SECTION 580 - STRUCTURAL CONCRETE REMOVAL

580-1 DESCRIPTION. The work shall consist of removal of structural concrete from structural concrete elements, steel supported structural slabs (with and without shear connectors), concrete approach slabs, concrete bridge pylons, concrete from structural steel members, and other concrete removal indicated on the plans or ordered by the Engineer. All removed material shall become the property of the Contractor and shall be removed from the work site. All work shall be done where indicated on the contract plans or where ordered by the Engineer.

580-1.01 Removal of Structural Concrete. All concrete shall be removed to a pay line shown on the plans, or to sound surface as determined by the Engineer.

Reinforcing bars and miscellaneous material shall be removed as part of this work unless the contract plans or the Engineer specifically direct otherwise. Surfaces from which structural concrete has been removed shall be cleaned, except that surfaces not designated to come in contact with new concrete placements, need not be cleaned.

580-1.02 Removal of Concrete Bridge Pylons. Reinforcement left exposed due to the removal of the pylon shall also be removed. Surfaces exposed by the removal of the pylon shall be brought even with the neat lines of the structure, and repaired.

580-1.03 Removal of Steel Supported Structural Slab (with and without Shear Connectors). All materials, carried by the supporting steel members of the superstructure, shall be removed unless the plans specifically indicate removal under another item or that the material is to remain in place.

In the case of structural slab removal where shear connectors are present the Contractor has the following options:

- Retain and reuse the existing shear connectors. OR
- Remove existing shear connectors; replace with new stud shear connectors.

580-1.04 Removal of Concrete from Structural Steel Members. Concrete removed as part of this work shall be understood to be portland cement concrete of any nature (e.g. shotcrete), as well as portland cement mortar. In addition, any material used directly or indirectly to anchor the concrete in place shall also be understood to be concrete as it pertains to this work.

580-2 MATERIALS. Materials used in this work shall conform to the following requirements:

- Stud Shear Connectors: 709-05
- Mortar Sand: 703-03
- Epoxy Resin System: 721-01
- Epoxy Polysulfide Grout: 721-03
- Sandblasting Sand: No. 40 Boiler Slag Grit or No. 2 Sandblast Sand

580-3 CONSTRUCTION DETAILS

580-3.01 General. Care shall be exercised in removing concrete so as not to damage material designated to remain in place. Reinforcement designated to remain in place shall be cleaned in a manner satisfactory to the Engineer.

Saw cutting of concrete shall be performed only where indicated on the contract plans or where ordered by the Engineer.

All concrete surfaces which require cleaning, after the concrete removal has been performed, shall be thoroughly blast cleaned, or abraded by other mechanical means satisfactory to the Engineer. After blast cleaning...
cleaning, the surface shall be air-blown or vacuum cleaned. Air-blowing may be used on vertical or overhead surfaces. Vacuum cleaning will be required for all other surfaces.

For any structural concrete removal item, where a hammer size limitation is specified on the plans or in the specification, the Engineer-in-Charge may order the Contractor to use a lighter hammer than that specified, if, in his opinion, the hammer being used is destroying concrete that should remain. A hammer heavier than that specified may be used if written permission is secured from the Deputy Chief Engineer (Structures).

580-3.02 Removal of Structural Concrete. Chipping hammers shall weigh no more than 20 kg with the bit and muffler removed. The hammer shall deliver no more than 1600 blows per minute. The Contractor shall provide the Engineer information from the hammer manufacturer that these requirements are not exceeded. The air pressure used to power the hammer shall not exceed 0.75 MPa measured at the air compressor. An air pressure gauge in proper working condition shall be provided. Only sharp chisel point bits, a minimum of 50 mm wide, shall be used. All bits determined by the Engineer to be dull shall be sharpened or replaced. If the Engineer determines that the Contractor's operations are resulting in damage to concrete that is to remain, the Contractor shall make immediate corrections. These corrections shall include the use of a lighter chipping hammer if so ordered by the Engineer.

580-3.03 Removal of Concrete Bridge Pylons. Pylons shall be removed to a plane approximately 6 mm above the supporting concrete surface. All reinforcement, exposed by the pylon removal, shall be removed to the depth shown on the contract plans. However, the depth shall be a minimum of 25 mm below the final finished concrete surface. The remainder of the pylon shall be brought flush with the supporting concrete surface either by bush hammer or other finishing methods approved by the Engineer.

All holes in the final finished concrete surface, left as a result of reinforcement removal, as well as any other depressions shall be filled with epoxy mortar. The epoxy mortar shall be comprised of three parts mortar sand to one part of either 721-01, or 721-03. Measurement shall be by volume. Mortar sand shall be absolutely dry immediately prior to being mixed with any epoxy system. All holes and depressions shall be fully cleaned and thoroughly dried immediately prior to the addition of the epoxy mortar.

580-3.04 Removal of Steel Supported Structural Slab. If existing shear connectors are present and the Contractor elects to remove them, the new stud shear connectors shall be furnished and installed as indicated on the contract plans. Existing shear connectors shall be removed by oxygen cutting. The remaining cut surface shall be 6 mm to 10 mm from the surface of the main material. Oxygen cutting shall be performed in such a manner that the main material is not damaged. The remaining cut surface need not be ground or finished in any manner unless required by the contract documents. New stud shear connectors shall be installed in accordance with the provisions of the SCM, Section 7, Part C.

All unpainted structural steel surfaces exposed by concrete removal, against which new concrete will be subsequently placed, shall be cleaned sufficiently to ensure proper bond between the steel and concrete. Cleaning methods shall be chosen by the Contractor. Cleaning results shall be satisfactory to the Engineer.

580-3.05 Removal of Concrete from Structural Steel Members. Structural steel members shall have all concrete removed from their surfaces. It will not be necessary to remove the concrete to such an extent that bare steel is exposed. However, the concrete must be removed to such an extent that subsequent cleaning operations will remove any concrete residue. The Engineer shall be the sole judge as to whether or not the concrete has been sufficiently removed under the terms of this subsection.

Portions of concrete may be anchored by material welded to the structural steel member. Under the foregoing circumstances the welds shall be ground flush with the steel surface.

Care shall be taken to insure that the structural steel members are not damaged due to the Contractor's operations. Should a structural steel member be damaged due to the Contractor's operations, the Engineer shall be the sole judge as to whether or not the structural steel member may be in need of repair. Should the Engineer decide that repair may be in order, notification shall be made to the DCES who shall make the final determination. The DCES determination will be one of the following:

No repair is necessary.
§580

Repair is necessary. In this case, the DCES shall determine the method(s) of repair. The Contractor shall perform all repair work in strict accordance with the DCES instructions.

Replacement of the structural steel member is necessary. In this case, the DCES shall determine the material(s) and method(s) of replacement. The Contractor shall perform the replacement work in strict accordance with the DCES instructions.

The DCES will make every effort to render the necessary determinations without appreciable delay. However, all expenses caused by any delay attributable to the time required for the DCES to render those determinations, shall be borne by the Contractor.

Any required repair, or replacement of structural steel members performed under the terms of this subsection, shall be done at the expense of the Contractor.

Chipping hammers shall meet the requirements of §580-3.02.

580-4  METHOD OF MEASUREMENT

580-4.01 Removal of Structural Concrete. The work shall be measured as the actual number of cubic meters of concrete removed and disposed of.

580-4.02 Removal of Concrete Bridge Pylons. The work shall be measured as the number of concrete bridge pylons removed and disposed of.

580-4.03 Removal of Steel Supported Structural Slab (with and without shear connectors); Removal of Concrete Approach Slabs. The work will be measured as the number of square meters of structural slab removed and disposed of. Measurement will be taken in the field without any deductions for openings unless otherwise indicated on the contract plans.

580-4.04 Removal of Concrete from Structural Steel Members. The work will be measured as the number of meters of structural steel member from which all the concrete indicated to be removed by the plans, has been removed. The distance shall be measured along the longitudinal axis of the member.

580-5  BASIS OF PAYMENT

580-5.01 Removal of Structural Concrete. The unit price bid per cubic meter shall include the cost of all labor, materials and equipment necessary to complete the work.

580-5.02 Removal of Concrete Bridge Pylons. The unit price bid for removal of each concrete bridge pylon shall include the cost of all labor, materials and equipment necessary to complete the work.

580-5.03 Removal of Steel Supported Structural Slab (with and without shear connectors); Removal of Concrete Approach Slabs. The unit price bid per square meter shall include the cost of all labor, materials and equipment necessary to complete the work.

580-5.04 Removal of Concrete from Structural Steel Members. The unit price bid per linear meter shall include the cost of all labor, material and equipment necessary to complete the work.

Conditions and work for which compensation will not be made, are noted under §580-3.04.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>580.01</td>
<td>Removal of Structural Concrete</td>
<td>Cubic Meter</td>
</tr>
<tr>
<td>580.02</td>
<td>Removal of Steel Supported Structural Slab (with shear connectors)</td>
<td>Square Meter</td>
</tr>
<tr>
<td>580.03</td>
<td>Removal of Steel Supported Structural Slab (without shear connectors)</td>
<td>Square Meter</td>
</tr>
<tr>
<td>580.04</td>
<td>Removal of Concrete Approach Slab</td>
<td>Square Meter</td>
</tr>
<tr>
<td>580.11</td>
<td>Removal of Concrete Pylons</td>
<td>Each</td>
</tr>
<tr>
<td>580.21</td>
<td>Removal of Concrete from Structural Steel Members</td>
<td>Meter</td>
</tr>
</tbody>
</table>
SECTION 581 - REMOVAL OF BRIDGE OVERLAYS

581-1 DESCRIPTION. The work shall consist of the removal and disposal of bridge overlays, reinforcement, if present, and any miscellaneous materials encountered, as shown on the contract plans.

581-2 MATERIALS. Not specified.

581-3 CONSTRUCTION DETAILS. Not specified.

581-4 METHOD OF MEASUREMENT. The work shall be measured by the area of bridge overlay, removed and disposed of. The quantities will be determined from field measurements.

581-5 BASIS OF PAYMENT. The unit price bid per square meter shall include the cost of furnishing all labor and equipment to complete the work.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>581.01</td>
<td>Removal of Bituminous Concrete Overlay (Bridge)</td>
<td>Square Meter</td>
</tr>
<tr>
<td>581.02</td>
<td>Removal of Cement Concrete Overlay (Bridge)</td>
<td>Square Meter</td>
</tr>
</tbody>
</table>

SECTION 582 - REMOVAL AND REPLACEMENT OF STRUCTURAL CONCRETE

582-1 DESCRIPTION. The work shall consist of the removal and disposal of unsound structural concrete from an existing structure and its replacement with new structural concrete, or an approved patching material, as indicated on the contract plans, or as ordered by the Engineer. All work shall be done at the locations indicated on the contract plans, or where ordered by the Engineer.

All miscellaneous materials, not including bar reinforcement, encountered during the removal of unsound structural concrete, shall be removed and disposed of unless otherwise indicated on the contract plans, or ordered by the Engineer.

582-2 MATERIALS. Materials used in this work shall conform to the following requirements:

- Vertical and Overhead Patching Material 701-08
- Water 712-01
- Quilted Covers (for curing) 711-02
- Plastic Coated Fiber Blankets (for curing) 711-03
- Membrane Curing Compound 711-05
- Admixtures 711-08

582-2.01 Replacement Concrete. Concrete shall be Class A or Class D concrete for structures. It shall conform to the requirements of Section 501 - Portland Cement Concrete - General.

582-2.02 Vertical and Overhead Patching Material. The patching material used shall be a brand that appears on the Department's Approved List.

582-3 CONSTRUCTION DETAILS

582-3.01 Repair Determinations. The choice of replacement material will be indicated on the plans, determined by the Engineer, or determined by the contractor. The Contractor's determinations shall be made in accordance with the criteria of this subsection, and only in the absence of directions from the plans, or the Engineer. The Contractor's determinations shall be approved by the Engineer prior to the actual performance of the work.

A. Horizontal or Essentially Horizontal Locations. Class A or Class D concrete shall be used. Class A concrete shall be placed only at locations where removal depths average greater than 125 mm. Class D concrete shall be placed only at locations where removal depths average between
40 mm and 125 mm. Average depths shall be determined by a measurement procedure acceptable to
the Engineer.

B. Vertical or Essentially Vertical Locations. Class A concrete, Class D concrete, or
approved patching material shall be used. Concrete classes shall be restricted to the depth limitations
noted for horizontal locations. Patching material shall be placed at locations where removal depths
average between 13 mm and 40 mm. Average depths shall be determined by a measurement
procedure acceptable to the Engineer.

C. Overhead. Approved patching material shall be used. Lift thicknesses shall not exceed 25 mm,
unless formwork or anchoring devices are employed.

D. Pockets. Locations, within locations of 40 mm in average depth or less, which exceed this
average depth, shall be filled with Class A, or Class D, concrete in accordance with the limitations
outlined under horizontal locations.

582-3.02 Removal of Unsound Concrete. All unsound concrete shall be removed to a sound
surface as determined by the Engineer. If called for on the plans, the existing concrete shall be saw-cut to
obtain a straight joint between the existing concrete and the new material. Care shall be exercised while
removing the unsound concrete so as not to damage materials which are to remain in place. Exposed
reinforcement remaining in place shall be cleaned in accordance with the requirements of 584-3.02A.
Chipping hammers shall meet the requirements of 580-3.02.

A. Removal for Concrete Replacement. The minimum depth of removal shall be the greater of
the following:
- A depth no less than 40 mm from the rear most point of reinforcement to sound concrete.
- The depth necessary to reach sound concrete.

Should the removal depth exceed 150 mm, the Engineer may order supplementary anchoring as
part of the replacement procedure. The sides of the cavity shall be made at a slight angle, so that the
width of the base of the cavity is greater than the opening at the surface, thereby providing a key.

B. Removal for Patching material Replacement. Feather edges shall not be permitted. The
minimum patch depth shall be 13 mm as measured from the theoretical plane of the original concrete
surface.

582-3.03 Preparation of Surface
A. All surfaces receiving new material shall be blast cleaned in accordance with the requirements of
584-3.02.
B. Bar reinforcement shall be placed at the location indicated on the plans, and at all additional locations
determined by the Engineer.
C. Existing reinforcement, which, in the Engineer's opinion, has lost significant section, shall be repaired
in a manner satisfactory to the Engineer.
D. Bar placement, and bar repair work directed by the Engineer will be paid for separately.

582-3.04 Placement. Air clean the surface with oil-free compressed air. After the surface preparation
has been accepted, every effort should be made to thoroughly wet the concrete surface, and all porous
surfaces to be in contact with new concrete, for 12 hours. This may be accomplished by continuous
wetting with soaker hoses or the use of burlap/burlene/etc. where moisture can be maintained. If, in the
opinion of the Engineer, conditions or the situation prohibits this, then the surfaces should be wetted for
as long as possible. Surfaces must be wetted by a means acceptable to the Engineer using potable water.

The Contractor shall remove any puddles of free standing water with oil-free compressed air, and
protect the surfaces from drying, so the existing concrete remains in a clean, saturated surface dry
condition until placement of the new concrete. No material shall be placed if the ambient air, or
concrete surface temperature is at, or below 7°C.
A. Concrete Placement. All concrete placements shall be in accordance with the applicable requirements of the following subsections:

555-3.02, 555-3.03A, 555-3.04, 555-3.06, 555-3.07, 555-3.08.

If formwork configuration, or clearances between formwork, steel and existing concrete are such that Class A, or D, concrete cannot be placed without voids, or honeycombing, the Contractor may, with the Engineer's permission, use an approved high range water reducer to increase the concrete's workability. Approved high range water reducers appear on the Department's Approved List.

The high range water reducer shall be added at the work site only and shall be dispersed uniformly throughout the plastic concrete. The Engineer shall approve the Contractor's dispersal methods and devices prior to their actual use.

The high range water reducer shall be added only after the concrete has reached the proper slump and contains the required quantity of air. No more than two additions of the admixture shall be made, and the manufacturer's maximum dosage rate shall not be exceeded. After the admixture has been added, the concrete shall be mixed an additional 30 revolutions. The second admixture addition shall be made only after the 30 revolutions required for the first addition have been completed. It is the responsibility of the Contractor to ensure that concrete slump does not exceed 230 mm, and air content remains within specification requirements. Plastic concrete mixes failing to meet the foregoing requirements will be subject to rejection. Replacement will be done at the Contractor's expense.

The Engineer may allow high range water reducer to be added at the concrete batching facilities. Consideration for this procedure will be undertaken only after the Contractor has clearly demonstrated the capability of providing concrete which meets the requirements of this subsection.

B. Vertical and Overhead Patching Material Placement. Patching material shall be prepared in accordance with the directions provided by the manufacturer. The Engineer shall be given two copies of the manufacturer's printed instruction at least two weeks prior to the start of all patching work. This shall include the mixing proportions and the mixing method. The manufacturer's literature shall be consulted for surface preparation and priming instructions. The material shall be troweled on in layers, the thickness of which depends on the material consistency and the location and profile of the surface to which it is applied. However, lift thickness in excess of 25 mm will not be permitted without the use of anchoring devices or formwork at overhead locations. Special curing procedures are generally not required, except under conditions of high heat, low humidity, or strong winds, as defined by the manufacturer. The manufacturer should be consulted for specific curing procedures under these adverse conditions.

582-3.05 Form Removal. Form removal shall be in accordance with §555-3.09 with the following exception:

Forms shall be removed from thin concrete placements 24 curing hours after placement has been completed unless the Engineer determines the concrete is not strong enough to withstand damage. For purposes of this subsection, a thin concrete placement begins at the outermost surface of the new concrete and generally terminates at, or before, the midpoint of the main reinforcing steel. Concrete may be removed and replaced completely around one or two main reinforcing steel members to a depth no greater than 25 mm from the innermost surface of those members and still be considered a thin concrete placement. Main reinforcing steel members include reinforcing bars, but not spiral reinforcement or stirrups. Curing procedures shall be implemented immediately upon form removal.

582-3.06 Curing. Curing shall be performed according to the following:

A. Concrete. This shall be done in accordance with §555-3.08.

B. Vertical and Overhead Patching Material Curing. Manufacturer's recommendations for curing shall be followed for the patching material applications.
§582

582-4 METHOD OF MEASUREMENT

582-4.01 Removal of Structural Concrete - Replacement with Class A Concrete. Measurement shall be made as the number of cubic meters of concrete placed where indicated on the contract plans, or where ordered or approved by the Engineer.

582-4.02 Removal of Structural Concrete - Replacement with Class D Concrete. Measurement shall be made as the number of square meters repaired as indicated on the contract plans, or where ordered or approved by the Engineer.

582-4.03 Removal of Structural Concrete - Replacement with Vertical and Overhead Patching Material. Measurement shall be made as the number of square meters of the plane projection of the repaired area as indicated on the contract plans, or where ordered or approved by the Engineer. Measurement shall be made prior to the placement of patching material.

582-5 BASIS OF PAYMENT

582-5.01 Removal of Structural Concrete - Replacement with Class A Concrete. The unit price bid per cubic meter shall include the cost of furnishing all labor, materials and equipment necessary to complete the work, except that bar reinforcement removal and replacement shall be paid for separately. Progress payments will be made in accordance with §582-5.04.

582-5.02 Removal of Structural Concrete - Replacement with Class D Concrete. The unit price bid per square meter shall include the cost of furnishing all labor, materials and equipment necessary to complete the work, except that bar reinforcement removal and replacement shall be paid for separately. Progress payments will be made in accordance with §582-5.04.

582-5.03 Removal of Structural Concrete - Replacement with Vertical and Overhead Patching Material. The unit price bid per square meter shall include all labor, materials and equipment necessary to complete the work. Progress payments will be made in accordance with §582-5.04.

582-5.04 Progress Payments. Progress payments will be made when the concrete removal is completed. Payment will be made at the unit price bid for 50% of the quantity removed. The balance of the quantity will be paid upon completion of the work.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>582.05</td>
<td>Removal of Structural Concrete - Replacement with Class A Concrete</td>
<td>Cubic Meter</td>
</tr>
<tr>
<td>582.06</td>
<td>Removal of Structural Concrete - Replacement with Class D Concrete</td>
<td>Square Meter</td>
</tr>
<tr>
<td>582.07</td>
<td>Removal of Structural Concrete - Replacement with Vertical and Overhead Patching Material</td>
<td>Square Meter</td>
</tr>
</tbody>
</table>

SECTION 583 - SHOTCRETE

583-1 DESCRIPTION

583-1.01 Work. The work shall consist of removal and disposal of unsound structural concrete and replacement with shotcrete where indicated in the contract documents and where ordered by the Engineer. The Contractor has the option of using either the Dry Mix Process or the Wet Mix Process.

583-1.02 Definitions

A Shotcrete. This is mortar conveyed through a hose and pneumatically projected at high velocity onto a surface.
B. Dry Mix Process. This is a process in which the dry cement-sand mixture is carried by compressed air to the nozzle where water is injected and the resulting mixture is jetted from the nozzle at high velocity onto the surface to be shotcreted.

C. Wet Mix Process. This is a process in which all the ingredients including water are thoroughly mixed and then jetted from the nozzle at high velocity onto the surface to be shotcreted.

D. Delivery System. This consists of the nozzle, water ring or air ring, and any necessary valves, connected to the delivery hose.

583-2 MATERIALS. Materials used in this work shall conform to the following requirements:

<table>
<thead>
<tr>
<th>Material</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portland Cement, Types 1 or 2</td>
<td>701-01 Quilted Covers (for curing)</td>
</tr>
<tr>
<td>Concrete Sand</td>
<td>703-07 Plastic Coated Fiber Blankets</td>
</tr>
<tr>
<td>Water</td>
<td>712-01 Membrane Curing Compound</td>
</tr>
<tr>
<td>Wire Fabric For Concrete Reinforcing1</td>
<td>709-02 GSA FF-S-325,Group III,Type 1</td>
</tr>
<tr>
<td>Expansion Bolt Anchors</td>
<td></td>
</tr>
<tr>
<td>Hook Bolts Inserted in Expansion Bolt Anchors</td>
<td>GSA FF-S-325,Group VIII,Type 1</td>
</tr>
</tbody>
</table>

NOTE. The wire fabric shall be galvanized in accordance with ASTM A641M regular coatings. The wire fabric shall be fabricated from No. 12 wire spaced 50 mm (nominal) in each direction or No. 10 wire spaced 75 mm (nominal) in each direction. Wire used shall have a minimum yield strength of 240 MPA.

583-2.01 Equipment

A. Batching and Mixing Equipment. The mixing equipment shall be capable of thoroughly mixing the materials in sufficient quantity to maintain placing continuity.

B. Air Supply. The compressor shall be of adequate capacity to maintain a sufficient, constant nozzle velocity for all parts of the work while simultaneously operating a blow pipe for cleaning away rebound. The air hose shall be equipped with a filter to prevent any oil or grease from contaminating the shotcrete.

C. Delivery Equipment

1. Dry Mix Process. The delivery equipment shall be capable of delivering a continuous, smooth, uniformly mixed material to the nozzle. The nozzle shall be equipped with a water ring and valve to permit adjustment of the water. The water added to the dry mix material at the nozzle shall be maintained at a pressure at least 110 KPa greater than the air pressure. The nozzle shall be capable of delivering a conical discharge stream.

2. Wet Mix Process. Only pneumatic-feed type of delivery equipment will be allowed. Positive displacement type of equipment will be allowed pending a qualification test prior to the beginning of the work, which will also be the qualification test for the operator. The nozzle shall be equipped with an air ring for injecting compressed air into the material flow.

583-2.02 Qualification Test. If encasement of reinforcing bars is required, this test shall be performed to qualify the shotcrete operator and the equipment, prior to beginning work. Each shotcrete operator shall be qualified by constructing a 600 mm x 600 mm test panel fabricated to duplicate the project shotcreting. Reinforcement shall be placed in the panel to provide a minimum 25 mm (front and rear) embedment and be of the same size and spacing encountered in the structure. Panels shall be shot in the vertical, horizontal, and overhead positions as expected to be encountered. After setting, the test panel shall be broken open in a manner approved by and in the presence of the Engineer, to verify the reinforcement embedment. If voids are discovered, the work shall not proceed; additional panels shall be constructed until results acceptable to the Engineer are achieved. Small non-interconnected voids, as determined by the Engineer, shall not constitute failure.
Additional qualification panels will be required whenever, in the opinion of the Engineer, the shotcrete operation significantly changes.

583-3 CONSTRUCTION DETAILS

583-3.01 Preparation of Surfaces. All unsound concrete shall be removed until there are no offsets in the cavity which would cause an abrupt change in thickness, except for a transition from above to below reinforcement. Minimum 13 mm square shoulders shall be left at the perimeter of the cavity. The final cut surface shall be sound and properly shaped. The sound surface shall be blast cleaned. Abrasive material used for blast cleaning shall contain no more than one percent free silica by weight. Air clean the surface with oil-free compressed air. After the surface preparation has been accepted, every effort should be made to thoroughly wet the concrete surface and all porous surfaces to be in contact with new concrete for 12 hours. This may be accomplished by continuous wetting with soaker hoses or the use of burlap/burlene/etc. where moisture can be maintained. If in the opinion of the Engineer conditions or the situation prohibits this then the surfaces should be wetted for as long as possible. Surfaces must be wetted by a means acceptable to the Engineer using potable water. The Contractor shall remove any puddles of free standing water with oil-free compressed air, and protect the surfaces from drying, so the existing concrete remains in a clean, saturated surface dry condition until placement of the new concrete.

<table>
<thead>
<tr>
<th>Thickness of Placement</th>
<th>Underside &amp; Vertical Surfaces Nominal Size and Spacing</th>
<th>Topside Nominal Size and Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 mm</td>
<td>6 mm dia. @ 450 mm ctrs.</td>
<td>6 mm dia. @ ctrs. 600 mm</td>
</tr>
<tr>
<td>100 mm</td>
<td>10 mm dia. @ 600 mm ctrs.</td>
<td>10 mm dia. @ ctrs. 900 mm</td>
</tr>
<tr>
<td>125 mm</td>
<td>10 mm dia. @ 530 mm ctrs.</td>
<td>10 mm dia. @ ctrs. 900 mm</td>
</tr>
<tr>
<td>150 mm</td>
<td>10 mm dia. @ 500 mm ctrs.</td>
<td>10 mm dia. @ ctrs. 900 mm</td>
</tr>
<tr>
<td>175 mm</td>
<td>10 mm dia. @ 450 mm ctrs.</td>
<td>10 mm dia. @ ctrs. 900 mm</td>
</tr>
<tr>
<td>200 mm</td>
<td>14 mm dia. @ 580 mm ctrs.</td>
<td>14 mm dia. @ ctrs. 900 mm</td>
</tr>
<tr>
<td>225 mm</td>
<td>14 mm dia. @ 550 mm ctrs.</td>
<td>14 mm dia. @ ctrs. 900 mm</td>
</tr>
<tr>
<td>250 mm</td>
<td>14 mm dia. @ 530 mm ctrs.</td>
<td>20 mm dia. @ ctrs. 600 mm</td>
</tr>
<tr>
<td>275 mm</td>
<td>14 mm dia. @ 500 mm ctrs.</td>
<td>20 mm dia. @ ctrs. 600 mm</td>
</tr>
<tr>
<td>300 mm</td>
<td>14 mm dia. @ 450 mm ctrs.</td>
<td>20 mm dia. @ ctrs. 600 mm</td>
</tr>
</tbody>
</table>

NOTE: 1. Bolt diameters may be increased but not decreased. Spacing may be decreased but not increased.

No material shall be placed if the ambient air, or concrete surface temperature is at, or below 7°C.

Reinforcement may consist of either existing reinforcing bars or welded galvanized wire fabric, depending on the conditions and shall be clean and free from loose mill scale, loose rust, oil or other coatings that interfere with bonding.

Chipping hammers shall meet the requirements of §580-3.02.

Sufficient clearance shall be provided around the reinforcement to permit complete encasement with sound shotcrete. The minimum clearance between the reinforcement and the form or other backup material shall be 25 mm.

Where the chipped area is equal to or less than 50 mm in depth, the use of wire fabric or mechanical concrete anchors will not be required except for overhead surfaces. Where the chipped areas are overhead, and are 25 mm in depth or greater, galvanized wire fabric and mechanical concrete anchors shall be used. Mechanical concrete anchors shall be placed as required by Table 583-1.

Where the chipped area is over 50 mm in depth and existing bar reinforcement is available, galvanized wire fabric shall be attached to the bars with tie wires. If existing bar reinforcement is not available, wire fabric shall be installed by means of mechanical concrete anchors in accordance with the requirements of Table 583-1.

Wire fabric shall be cut in sheets of the proper size and shall be carefully bent in such a manner as to follow closely the contours of the areas to be repaired. The wire fabric shall be securely tied to the hook-type bolts or the reinforcing bars.
Where sheets meet, they shall be lapped a minimum of 100 mm and shall be securely fastened together.

Expansion bolt anchors shall be placed in holes drilled in the existing concrete surface to the diameter and depth recommended by the manufacturer of the expansion bolt anchors. Hook-type bolts of the proper length shall be inserted and securely attached to the expansion bolt anchors so as to provide a positive connection to sound concrete.

Where the chipped area is 150 mm or greater in depth, the Contractor shall place galvanized wire fabric in layers 100 mm apart.

Where it is necessary to place more than one layer of galvanized wire fabric in an area to be repaired, the innermost layer shall be covered by a shotcreting prior to the installation of the next outermost layer.

Existing reinforcement which has lost significant section shall be repaired in a manner satisfactory to the Engineer as extra work.

583-3.02 Preparation of Materials

A. General. The sand shall be measured either by volume or weight, by means of batch boxes approved by the Engineer, or in a proportioning plant approved in accordance with section 501, Portland Cement Concrete - General. Wheelbarrows or shovels will not be permitted for measuring. The same source of sand shall be used throughout each structure.

B. Dry Mix Process. Dry mix shotcrete shall be composed of one part of cement to three to four and one-half parts of sand.

Prior to mixing, the moisture content of the sand shall be between 3 and 6%. The sand shall be dampened or dried as required to bring the moisture within these limits.

A wetting agent approved by the Engineer may be used at the Contractor’s option in the dry mix process.

Sand-cement mixtures shall be applied within 75 minutes of the time the sand initially contacts the cement. Sand-cement mixtures which exceed the 75 minute limit shall not be incorporated in the work. They shall be disposed of in a manner acceptable to the engineer.

C. Wet Mix Process. Wet mix shotcrete shall be composed of one part of cement to three parts of sand. The cement, sand and water shall be premixed to a desired consistency and in accordance with 501-3.03, Handling, Measuring and Batching Materials, and 501-3.04, Concrete Mixing, Transporting and Discharges - General Requirements.

583-3.03 Placement

A. Weather. Shotcrete shall not be applied during any precipitation which is of sufficient intensity to cause the placed shotcrete to run. Shotcrete shall not be placed during a wind that disrupts the nozzle spray.

Shotcrete shall not be applied when the ambient air temperature is below 7°C unless it is placed in accordance with 555-3.08C.2., Provision of External Heat. Receiving surfaces shall be heated to, and maintained at, approximately 7°C by a method approved by the Engineer before shotcreting operations begin. Under no conditions shall shotcrete be applied against surfaces upon which any frost adheres.

B. Application. Before starting to shoot, precautions shall be taken to protect property in the area. Adjacent construction, openings, shrubbery, and all areas that might be discolored or damaged by rebound, cement, water or dust must be covered with tarpaulins or plastic sheets to protect them from damage.

When projecting the shotcrete, the stream of flowing materials shall be directed from the nozzle as nearly at a right angle as possible to the surface being treated, and shall be held uniformly at the same distance, less than 1.5 m away from the surface at all times. Manufacturer's recommendations shall be followed. The size of the nozzle shall be consistent with the manufacturer's recommendation for the maximum size of the sand used. The use of rebound material shall not be permitted.
Shotcrete on vertical and overhead surfaces shall be built up in 20 mm maximum layers to prevent sloughing in heavy applications. Succeeding layers shall be applied just prior to the initial set to maintain a good bond.

When encasing reinforcing steel, the stream from the nozzle shall be directed at an angle so as to fill the space behind the bars. An air jet shall be used to blow out any rebound ahead of the application of shotcrete. Should any such deposit of sand rebound be covered with shotcrete, it shall be cut out and removed by the Contractor without compensation.

Ground wires may be installed to establish the thickness and surface planes of the shotcrete build up. Both horizontal and vertical ground wires may be installed at corners and offsets not clearly established by exterior corners of walls, column or beam corners, and other locations. They may also be used as screed guides. Eighteen or 20 gage hard steel piano wire is recommended for this purpose. Ground wires shall be tight and true to line, and placed in such a manner that they may be further tightened.

C. Quality Control

1. Test Panels. This test shall be used to determine the physical quality of the shotcrete and shall be performed immediately before shotcreting operations begin, after each additional 10 square meters, and immediately after operations are ended.

   The test panels shall be 300 mm square, 20 mm thick plywood boards with galvanized mesh (13 mm square openings) strips projecting 100 mm attached around the perimeter of the board. The boards shall be erected horizontally, vertically, or overhead, depending on the anticipated shooting positions. The shotcrete operator shall completely fill the test panel, after which it shall be screeded or cut with a trowel such that it contains a 100 mm uniform depth of shotcrete. The test panels shall then be covered with wet quilted covers or wet polyethylene-coated blankets; put in a shaded, protected place; kept wet and cured for a minimum of seven days. The test panels shall be sent to the Department of Transportation's Materials Bureau for testing at fourteen days. Cores will be drilled from the panels and compressive strengths at fourteen days will be reported to the Engineer. Additional information on the conditions of the shotcrete such as sand pockets, voids, and laminations will also be reported with the strength results.

2. Coring. The Contractor shall take a core, at a location determined by the Engineer, from each structural element, such as pier, abutment, arch, etc., to verify acceptability of reinforcement encasement. Cores which do not contain reinforcing bars will not be used to determine encasement acceptability. If interconnected voids are found, the structural element represented by that core shall be rejected. All rejected shotcrete shall be repaired or replaced at the Contractor's expense. Repair methods shall be proposed by the Contractor for approval by the Engineer. The Contractor may take additional cores at locations approved by the Engineer to establish the limits of rejected work. The additional coring shall not jeopardize the design integrity of the structural element. If additional cores are not taken, all work on that structural element shall remain rejected. Core holes shall be patched with an applicable concrete repair material from the Approved List.

D. Finishing. The natural gun finish will be sufficient unless the plans call for one of the following finishes:

1. Screed Finish. After the surface has taken its initial set, excess material outside the forms and ground wires shall be sliced off with a sharp-edged cutting screed. After screeding, the ground wires shall be removed.

2. Broom Finish. This type of finish may be applied after screeding.

3. Flash Coat Finish. This is a thin surface coating containing finer sand than normal, and the application nozzle is held well back from the work. This finish shall be applied to the surface as soon as possible after screeding. Any of the remaining three types of finish may be applied following flash coat:
a. **Wood Float Finish.** This gives a granular finish.

b. **Rubber Float Finish.** This gives a coarse finish.

c. **Steel Trowel Finish.** This gives a very smooth finish.

**E. Curing.** Curing shall be in accordance with 555-3.08, Curing, and the following modifications:
- All curing covers shall be pre-wet and kept wet during the entire curing period in a manner satisfactory to the Engineer.
- Curing compounds shall be applied twice. The second application shall be done when the first application has become tacky. The second application shall be done at a right angle to the first application. The rate of each application shall be that given in 555-3.08A.

**583-4 METHOD OF MEASUREMENT.** The quantity to be paid for under this item will be the number of square meters of finished shotcrete installed. Measurement will be taken as the plane projection of the finished surface. Measurement shall be made prior to the placement of shotcrete.

**583-5 BASIS OF PAYMENT.** The unit price bid per square meter shall include the cost of furnishing all labor, materials and equipment necessary to complete the work.

**583-5.01 Removal of Structural Concrete - Replacement with Shotcrete.** No Reinforcement Bar Encasement. The unit price bid per square meter shall include the cost of furnishing all labor, materials and equipment necessary to complete the work.

**583-5.02 Removal of Structural Concrete - Replacement with Shotcrete, Reinforcement Bar Encasement.** The unit price bid per square meter shall include the cost of furnishing all labor, materials and equipment necessary to complete the work, except that replacement of deteriorated reinforcement shall be paid for separately. Payment shall not be made until cores verify acceptability.

**Payment will be made under:**

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>583.02</td>
<td>Removal of Structural Concrete - Replacement with Shotcrete, No Reinforcement Bar Encasement</td>
<td>Square Meter</td>
</tr>
<tr>
<td>583.03</td>
<td>Removal of Structural Concrete - Replacement with Shotcrete, with Reinforcement Bar Encasement</td>
<td>Square Meter</td>
</tr>
</tbody>
</table>

**SECTION 584 - SPECIALIZED OVERLAYS FOR STRUCTURAL SLABS**

**584-1 DESCRIPTION.** Prepare the surfaces that will be in contact with slab reconstruction concrete and place slab reconstruction concrete. Prepare the structural slab surface and place a specialized concrete overlay.

**584-1.01 Scope.** Concrete removal work will be paid for under the appropriate item(s). Minimum thickness of overlay concrete is 40 mm. Include the cost of any grade changes necessitated by this requirement in the unit bid price for overlay concrete. Use only one type of overlay concrete on any one structure.

**584-1.02 Definitions**

**A. Class DP Concrete.** A homogeneous mixture of portland cement, fly ash, microsilica admixture, fine and coarse aggregates, air entraining agent, set retarding water reducing admixture and water.

**B. Microsilica Concrete.** A homogeneous mixture of portland cement, microsilica admixture, fine and coarse aggregates, air entraining agent, high range water reducing admixture and water.
C. **Overlay Concrete.** Concrete placed over existing and slab reconstruction concrete. Overlay concrete will be Microsilica concrete for Method 1 and Method 2, and Class DP concrete for Method 3, as described in 584-1.03 Placement Methods.

D. **Slab Reconstruction Concrete.** Concrete placed completely around the exposed top mat of bar reinforcement. Slab reconstruction concrete will be Class D or Class DP concrete for Method 1, Microsilica concrete for Method 2, and Class DP concrete for Method 3, as described in 584-1.03 Placement Methods.

E. **Positive-tie-downs.** Anchors drilled into the structural slab and connected to reinforcing steel.

584-1.03 Placement Methods.

A. **Method 1 - Separate Placement.** Place Class D or Class DP slab reconstruction concrete and Microsilica overlay concrete separately. Use only one type of slab reconstruction concrete on each placement.

B. **Method 2 - Integral Placement of Microsilica Concrete (Optional).** When all of the following conditions are satisfied, Microsilica overlay concrete and Microsilica slab reconstruction concrete may be placed in a single lift:
   - The area of the exposed top mat of bar reinforcement is 5% or less of the placement area, per span.
   - No individual area of the exposed top mat of bar reinforcement exceeds 2.5 square meters.
   - No dimension of any area of the exposed top mat of bar reinforcement exceeds 2 meters.

C. **Method 3 - Integral Placement of Class DP Concrete (Optional).** When 100% of the top mat of bar reinforcement is exposed, Class DP overlay concrete and Class DP slab reconstruction concrete may be placed in a single lift.

584-2 MATERIALS

584-2.01 General. All materials listed in 557-2 with the following:

A. **Air Entraining Admixture.** 711-08 with the following: For Microsilica concrete, use only a vinsol resin-based air entraining agent.

B. **Microsilica Admixture**
   1. Follow the requirements of §501-2 and §501-3.01.
   2. Samples will be taken in accordance with Materials Method 9.1M and Materials Procedure 90.1.
   3. Blended Portland Cement, §701-03 (Type SF) may also be used for the Portland cement/microsilica portion of the Class DP and the Microsilica Concrete designed mix.

C. **Vacant**

584-2.02 Manufacture of Class DP Concrete

A. **Proportioning.** The initial ingredient proportions, except for admixtures, are given in TABLE 584-1.

B. **Handling, Measuring and Batching.** Follow the requirements of §501-3.02 and §501-3.03, except that water reduction must be accomplished using only a water-reducing and retarding admixture (§711-08, ASTM Type D). If a microsilica slurry is used, include the slurry water as mix water.
### TABLE 584-1 MIX CRITERIA - CLASS DP CONCRETE

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cement Content (kg/m³)</td>
<td>318</td>
</tr>
<tr>
<td>Fly Ash Content (kg/m³)</td>
<td>86</td>
</tr>
<tr>
<td>Microsilica Content (kg/m³)</td>
<td>26</td>
</tr>
<tr>
<td>Sand Percent Total Aggregate (solid volume)</td>
<td>45.8</td>
</tr>
<tr>
<td>Designed Water/Total Cementitious Content</td>
<td>0.4</td>
</tr>
<tr>
<td>Desired Air Content (%)</td>
<td>7.5</td>
</tr>
<tr>
<td>Allowable Air Content (%)</td>
<td>6.0 - 9.0</td>
</tr>
<tr>
<td>Desired Slump (mm)</td>
<td>100</td>
</tr>
<tr>
<td>Allowable Slump (mm)</td>
<td>50 - 125</td>
</tr>
<tr>
<td>Type of Coarse Aggregate Gradation</td>
<td>CA 1</td>
</tr>
</tbody>
</table>

**NOTE:** The criteria are given for design information and the data is based on a fine aggregate modulus of 2.80 and a CA1 coarse aggregate gradation. Adjust the mixture proportions using actual fineness modulus and bulk specific gravities (saturated surface dry for aggregates). Compute the adjustments according to Department instructions.

#### 584-2.03 Manufacture of Microsilica Concrete

**A. Proportioning.** The initial ingredient proportions except for admixtures are in TABLE 584-2.

### TABLE 584-2 MIX CRITERIA - MICROSILICA CONCRETE

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cement Content (kg/m³)</td>
<td>390</td>
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<tr>
<td>Microsilica Content (kg/m³)</td>
<td>36</td>
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<tr>
<td>Sand Percent Total Aggregate (solid volume)</td>
<td>53</td>
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<tr>
<td>Designed Water/Total Cementitious Content</td>
<td>0.37</td>
</tr>
<tr>
<td>Desired Air Content (%)</td>
<td>6.5</td>
</tr>
<tr>
<td>Allowable Air Content (%)</td>
<td>5.0 - 8.0</td>
</tr>
<tr>
<td>Desired Slump (mm)</td>
<td>100</td>
</tr>
<tr>
<td>Allowable Slump (mm)</td>
<td>50 - 150</td>
</tr>
<tr>
<td>Type of Coarse Aggregate Gradation</td>
<td>CA 1</td>
</tr>
</tbody>
</table>

**NOTE:** The criteria are given for design information and the data is based on a fine aggregate modulus of 2.80 and a CA1 coarse aggregate gradation. Adjust the mixture proportions using actual fineness modulus and bulk specific gravities (saturated surface dry for aggregates). Compute the adjustments according to Department instructions.

**B. Handling, Measuring and Batching.** Follow the requirements of Subsection 501-3.02 and 3.03, except that water reduction must be accomplished using only a High-Range Water-Reducing Admixture (§711-08, ASTM Type F). Add the High-Range Water Reducer at the batching facility.

The Regional Materials Engineer may allow a maximum of two additions of water and/or admixture at the work site. Provide an additional 30 mixing revolutions for each addition of water and/or admixture. However, once the concrete has reached the desired slump, only the High-Range Water Reducer may be used to adjust the concrete slump. The maximum total mixing revolutions is 200. Observe the Manufacturer’s maximum dosage rate for the admixture, regardless of where the admixture is added. If a microsilica slurry is used, include the slurry water as mix water.

#### 584-2.04 Equipment

**A. Microsilica Admixture.** Follow Subsection 584-2.01B.

**B. Finishing Machine.** A finishing machine capable of self propulsion in forward and reverse, raising the screeds above the screeded surface when traveling in reverse, and meeting one of the two sets of requirements below.

1. **Roller Screed.** Must be equipped with a power driven strike-off auger, power driven finishing roller, vibrating pan or roller producing 3000 to 7000 vpm, and pan float.
2. **Dual Oscillating Screed.** Must be equipped with at least 2 oscillating screeds producing between 3000 and 7000 vpm, strike-off auger, and control of each screed's vertical position and tilt angle.

The specific method and equipment used for finishing will be approved by the Regional Construction Engineer before use. Provide access to the machine at the work site for one working day, for inspection by the Engineer. Have a qualified Finishing Machine Operator present at the time of inspection. Two weeks prior to the inspection date, provide the Engineer with a copy of the operating manual for their exclusive use.

Use supporting rails with no bends or kinks. Support the rails with fully adjustable supports (no shims), spaced a maximum of 300 mm on center. When placing concrete adjacent to a completed placement, set the supporting rails for one side of the finishing machine on the completed placement.

C. **Recording Thermometer.** A continuous recording thermometer capable of measuring temperatures in the range of \(-1^\circ C\) to \(38^\circ C\) for a minimum of 24 hours. Include the cost of calibration in the unit price bid.

D. **Vacant.**

**584-3 CONSTRUCTION DETAILS**

**584-3.01 Limitation of Operations**

A. No structural concrete removal work is permitted in areas adjoining new concrete during the new concrete's specified curing period.

B. No loads, other than construction loads which are less than 1800 kg and approved by the Engineer, are permitted on areas of the structural slab where concrete has been removed.

C. No loads are permitted on concrete until completion of the specified curing period.

**584-3.02 Blast Cleaning**

A. Blast clean all surfaces to be in contact with new concrete. Remove all grease and dirt. Remove all rust and mortar which is not firmly bonded to the surface being cleaned. Rust and concrete deposits which are firmly bonded and cannot be removed by blast cleaning may remain. A light coating of orange rust, that forms on steel surfaces after blast cleaning, is not considered detrimental to bond and may remain. Remove all debris created by blast cleaning.

B. Place reinforcing steel supports and positive-tie-downs at a maximum spacing of 1.2 m.

C. Repeat blast cleaning if more than 48 hours pass before concrete placement begins.

**584-3.03 Preplacement Wetting.** After blast cleaning has been accepted, thoroughly wet the structural slab surface and all porous surfaces to be in contact with new concrete for at least 12 hours immediately prior to placement. Remove all standing water with oil-free compressed air, and protect the deck from drying, so the concrete remains in a saturated surface dry condition.

**584-3.04 Vacant.**

**584-3.05 Handling and Placing Concrete.** 557-3.05 and 557-3.12 with the following:

A. Place concrete only when the ambient air temperature and deck surface temperature (after wetting) will be below \(30^\circ C\) during the entire placement.

B. Place overlay concrete only if preplacement wetting has been completed on an area large enough to require one working day for placement, at least one span length.

C. When using concrete transporting devices on a prepared surface, protect exposed reinforcing steel from deformation and prevent contamination of the surface.
D. If operations are delayed for more than 30 minutes, install a construction dam or bulkhead. If placement operations are delayed for more than 60 minutes or if the concrete attains initial set, discontinue placement for at least 48 hours. This restriction does not prohibit continuation of the placement provided a gap is left in the placement. This gap is to be sufficient in length to allow the finishing machine to clear the previously placed concrete. Prepare the gap area for concrete placement in accordance with this specification, after the previously placed concrete, on both sides of the gap, has cured for 48 hours.

584-3.06 Finishing and Curing

A. Slab Reconstruction Concrete - Separate Placement. 557-3.09 and 557-3.11 with the following:

1. For areas less than 2.5 square meters, hand finishing of slab reconstruction concrete is acceptable. For areas greater than 2.5 square meters, use either a manually driven vibrator equipped power screed from the Department’s Approved List or the same machine to be used to finish the overlay.
2. Screed to the level of the surrounding concrete. When 100% of the reinforcing steel is exposed, screed to a minimum 10 millimeters above the reinforcing steel. Roughen the screeded surface with a tining rake or similar device.
3. Cure concrete with wet burlap for 3 days. Provide uniform continuous wetting until concrete curing is complete. The wet burlap and curing cover option is not allowed.
4. Blastclean the surface, according to 584-3.02, after the curing period is over, but prior to wetting. Expose approximately 50% of the surface coarse aggregate, and leave an irregular texture.

B. Overlay Concrete. 557-3.08, 557-3.11, and 557-3.12 with the following:

1. Finish overlay concrete to a minimum depth of 40 mm and a minimum total cover over top mat of bar reinforcement of 60 mm. Use a finishing machine meeting the requirements of this specification.
2. Machine finish the concrete within 10 minutes of its deposition onto the deck. If the machine cannot finish the concrete within the 10 minute time limit, stop all further placement, immediately cover the fresh concrete with plastic curing covers, and keep the unfinished concrete covered until it is machine finished. Once concrete being placed can be machine finished within the 10 minute time limit, resume placing concrete.
3. Apply curing within 10 minutes after machine finishing. Provide uniform continuous wetting until concrete curing is complete. Cure Microsilica concrete with wet burlap for 4 days. Cure Class DP concrete with wet burlap for 7 days. The wet burlap and curing cover option is not allowed.

584-3.07 Construction Joints. For the purpose of this specification, construction joints provide for interruptions in overlay concrete placement.

At transverse and longitudinal construction joints, place the overlay concrete a distance at least equal to the depth of the overlay, beyond the intended joint location. After the overlay concrete has cured for 48 hours, sawcut along the joint to a depth of 20 ± 3 mm. Chip the extra overlay concrete to the level of the original prepared surface at a 45° angle. Do not undercut existing concrete.

584-3.08 Defective or Damaged Concrete. 557-3.16 with the following:

A. Defects and damage, for the purposes of this specification, are imperfections caused by the Contractor's operations, including, but not limited to: cracking, tearing, and open areas. Repair all defective or damaged concrete at no cost to the Department, using the same class of concrete originally placed.
B. Make all repairs rectangular in plan shape and as close to square as possible. Sawcut the perimeter of the repair to a depth of 20 mm ± 3 mm. Chip out the damaged or defective concrete to the level of the original prepared surface. Angle the walls of the repair cavity at 45° toward the center of the repair. Do not undercut existing concrete. Prepare the surfaces of the repair cavity and place new concrete in accordance with this specification.
**§584**

**584-4 METHOD OF MEASUREMENT.** For placements with 100% exposure of the top mat of bar reinforcement, the number of square meters of slab reconstruction concrete will be equal to the number of square meters of overlay concrete.

For placements with less than 100% exposure of the top mat of bar reinforcement, measure slab reconstruction concrete prior to overlay concrete placement.

**A. Method 1 - Separate Placement.** Measure slab reconstruction concrete as the number of square meters of Class D or Class DP slab reconstruction concrete placed. Measure overlay concrete as the number of square meters of plan area of Microsilica overlay concrete placed.

**B. Method 2 - Integral Placement of Microsilica Concrete (Optional).** Measure slab reconstruction concrete as the number of square meters of Microsilica slab reconstruction concrete placed. Measure overlay concrete as the number of square meters of plan area of Microsilica overlay concrete placed.

**C. Method 3 - Integral Placement of Class DP Concrete (Optional).** Measure slab reconstruction concrete as the number of square meters of Class DP slab reconstruction concrete placed. Measure overlay concrete as the number of square meters of plan area of Class DP overlay concrete placed.

**584-5 BASIS OF PAYMENT.** Include the cost of all labor, materials and equipment necessary to complete the work in the unit bid price.

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**Payment will be made under:**

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>584.3001nn</td>
<td>Overlay Concrete, Microsilica Concrete – Type 1 Friction</td>
<td>Square Meter</td>
</tr>
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<td>584.3002nn</td>
<td>Overlay Concrete, Microsilica Concrete – Type 2 Friction</td>
<td>Square Meter</td>
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<td>584.3003nn</td>
<td>Overlay Concrete, Microsilica Concrete – Type 3 Friction</td>
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<td>584.3109nn</td>
<td>Overlay Concrete, Class DP – Type 9 Friction</td>
<td>Square Meter</td>
</tr>
<tr>
<td>584.3200nn</td>
<td>Slab Reconstruction Concrete, Class D, DP or Microsilica Concrete</td>
<td>Square Meter</td>
</tr>
</tbody>
</table>

**NOTE:** nn denotes a serialized pay item.

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**SECTION 585 - STRUCTURAL LIFTING OPERATIONS**

**585-1 DESCRIPTION.** The work shall consist of raising, supporting and lowering each bearing point designated on the plans in order to perform the work to be done under other items.

**585-1.01 Bearing Point.** For purposes of this specification the term bearing point is defined as a point on the structure, designated on the plans, to be raised in order to perform other work.

**585-1.02 Lift Point.** For purposes of this specification, the term lift point is defined as a point on the structure where the lifting force is applied.

**585-1.03 Type.** Some bearing point locations may require different methods of accomplishing the work. Such situations will be noted on the contract plans. They will be defined by a type designation. The type designation will be reflected in the pay item title (e.g., 585.01 Structural Lifting Operations - Type A, etc.).

**585-2 MATERIALS**
585-2.01 Used Materials. Used materials will be allowed, except that materials that are permanently attached to the structure shall be in conformance with the current New York State Department of Transportation Standard Specifications.

585-2.02 Lifting Equipment. Unless otherwise specified on the plans, the choice of lifting equipment shall be at the Contractor's option, subject to the following provisions:

If jacks are used for the lifting operations, each jack shall have the rated capacity clearly shown on the manufacturer's name plate attached to each jack. Jacks or other lifting equipment shall have a rated capacity of at least one and a half times the calculated lifting force. The Engineer may require that any lifting equipment deemed to be inadequate or faulty be removed from the project site.

Jacks or other lifting equipment shall be equipped with pressure gages or other load measuring devices that will enable the applied lifting force to be monitored at all times.

585-3.01 General. The plans designate, by type, the bearing points that must be raised in order to perform the work. The loads at each bearing point are shown on the plans.

The Contractor shall select the location of the lift points, subject to the approval of the Deputy Chief Engineer (Structures), and calculate the required lifting force.

Unless a specific distance is shown on the plans, each designated bearing point shall be raised the minimum distance that will allow the work to be completed.

The Contractor shall engage the services of a New York State Licensed Professional Engineer (PE) to design and detail the structural lifting system. The PE shall be available for consultation in interpreting his plans and in the resolution of problems which may arise during the performance of the work.

All design and details shall be in conformance with the current New York State Department of Transportation Standard Specifications for Highway Bridge and the current New York State Steel Construction Manual.

585-3.02 Working Drawings. The Contractor shall furnish working drawings, prepared, stamped and signed by a New York State Licensed Professional Engineer, for the system proposed to raise, support and lower each designated bearing point. The working drawings shall not alter the number or location of designated bearing points.

The drawings shall include, but need not be limited to the following:

- Lift point locations.
- Calculated lifting forces.
- Details for all lifting equipment and support systems.
- Type and grade of all materials.
- Distance that each bearing point is to be raised.
- Schematic hydraulic layout.
- All disconnections, reconnections or adjustments that are necessary to properly complete the lifting operations. This includes but is not limited to railings, joints, power lines, gas lines, water lines, etc.

Three legible, standard sized (560 mm x 910 mm nominal, 530 mm x 850 mm working area) prints of each drawing, together with three copies of all design computations shall be submitted to the Deputy Chief Engineer (Structures) for approval. Failure to submit drawings of the required size will be cause for their return without examination.

The Deputy Chief Engineer (Structures) shall be allowed the longest of the following time durations to examine design computations and working drawings:

- Fifteen working days.
- Two working days for each drawing of a set of working drawings.
- One working day for every four (4) design computation sheets. Any design computation sheet written on both sides will be considered as two design computation sheets.

All time for examination shall begin upon receipt of all pertinent information by the Deputy Chief Engineer (Structures).

The Deputy Chief Engineer (Structures) comments shall be indicated on the returned copies. Should the proposed system not be approved, the reasons shall be indicated with the return of the material. The
Contractor shall then submit revised drawings for approval, subject to the same terms as the first submission. Resubmission shall not be considered a legitimate reason to request an extension of time.

All work shall be done in accordance with the approved working drawings. The Contractor must have approved working drawings prior to the start of any structural lifting operations.

The Contractor shall bear all costs and/or damages which may result from the ordering of any materials, or equipment; or the use of any preparatory labor prior to the approval of the working drawings.

585-3.03 Lifting Operations. The Contractor shall raise each designated bearing point by applying the necessary lifting force at each lift point. At no time will the Contractor be allowed to apply a lifting force in excess of one and a half times the calculated lifting force.

During all phases of the operation, the differential lift between any two adjacent bearings on a common centerline of bearing shall not exceed 15 mm unless otherwise noted on the Plans.

The Contractor shall, at the earliest possible moment during or after each lift, safely secure the structure with shims, cribbings, bolsters or other suitable supports. Details to be used shall be shown on the working drawings.

Unless otherwise indicated on the plans, vehicular traffic or construction equipment shall not be permitted on the lifted span until shims, cribbing, bolsters or other suitable supports are in their required position.

The lifting operation shall be conducted such that the distance between the structure and the shims, cribbing, bolsters or other suitable supports do not exceed 10 mm at any time.

Any replacement, repair, or adjustments to the superstructure steel shall be performed in conformance with the current New York State Steel Construction Manual.

All welding shall comply with the requirements specified in the current New York State Steel Construction Manual.

All materials required for temporary support of the structure shall remain the property of the Contractor and shall be removed from the site after the work is completed, unless otherwise agreed to.

585-4 METHOD OF MEASUREMENT. The quantity to be paid for under this item shall be the number of bearing points designated on the plans, actually raised, supported and lowered. Payment will be made only once at each bearing point regardless of the number of times the bearing point is raised, supported and lowered during the course of the planned work.

585-5 BASIS OF PAYMENT. Payment will be made at the unit price bid for each bearing point actually raised, supported and lowered. The unit price bid per bearing point shall include the cost of all labor, materials and equipment necessary to complete this work.

For payment purposes each bearing point will be considered a separate unit. After all lifting has been performed and all temporary supports have been installed for any one bearing point, payment will be made for seventy percent of that particular unit. The remainder of the unit will be paid for after the bearing point has been lowered to its final permanent position and the lifting equipment and temporary supports have been removed.

*Payment will be made under:*

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>585.XX</td>
<td>Structural Lifting Operations - (Types A - K)</td>
<td>Each</td>
</tr>
<tr>
<td>XX (01 through 11) = Type Designation (A through K)</td>
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</tbody>
</table>

SECTION 586 - MISCELLANEOUS STRUCTURAL RECONSTRUCTION

586-1 DESCRIPTION. The work of this section shall consist of the following:

- Drilling and Grouting Bolts, or Reinforcing Bars.
- Removal of Rivets-Replacement with High Strength Bolts.
- Field Drill Holes in Existing Structural Steel.

586-1.01 Drilling and Grouting Bolts, or Reinforcing Bars. For the purposes of this section the terms bolts and reinforcing bars are identical.
586-1.02 Field Drill Holes in Existing Structural Steel. Existing structural steel is that structural steel in service prior to the beginning of construction.

586-2 MATERIALS

586-2.01 Drilling and Grouting Bolts. Grout material shall conform to §701-07; Anchoring Materials - Chemically Curing.

586-2.02 Removal of Rivets - Replacement with High Strength Bolts. High strength bolts, nuts and washers shall meet the requirements of §715-14.

If paint color is not specified, the color selected shall match the existing paint. Paint shall be selected from the Department’s Approved List for Structural Steel Paint - Class 2.

586-3 CONSTRUCTION DETAILS

586-3.01 Equipment - General. All equipment proposed for use shall be approved by the Engineer prior to actually performing the work.

586-3.02 Drilling and Grouting Bolts

A. All holes shall be drilled by means of a rotary impact drill. If reinforcing steel is encountered, the reinforcing steel shall be cut and removed by means of a core drill. The remainder of the drilling shall be done with the rotary impact drill.

B. Drilling with a lubricant will not be permitted. Water is not considered a lubricant. Drilling methods shall not cause spalling, or other damage to concrete. Concrete spalled, or otherwise damaged by the Contractor's operations shall be repaired in a manner satisfactory to the Engineer. Such repair shall be done at the expense of the Contractor.

C. Holes shall be surface dry and shall have had all foreign and loose material removed immediately prior to grout placement.

D. Grout shall be mixed and placed in strict accordance with the manufacturer's instructions, unless modified here, or elsewhere, in the contract documents. No grout shall be placed at a temperature below that recommended by the grout manufacturer.

E. Prior to bolt placement in the grouted hole, all material which might interfere with bond between the bolt and the grout shall have been removed. This includes, but is not limited to: moisture, grease, dirt, mill scale and rust. Rust which cannot be removed even by vigorous scrubbing with a wire brush is considered firmly bonded and may remain. The hole diameter shall be in accordance with the grout manufacturer's recommendation. The bolts shall be inserted full depth into the hole and shall be manipulated to ensure complete coverage by the grout. After insertion of the bolt, all excess grout shall be struck-off flush with the concrete face. Should the grout fail to fill the hole after bolt insertion, additional grout shall be added to the hole to allow a flush strike-off.

F. If the bolt is inserted in a hole with an axis predominantly horizontal to the ground surface, care shall be taken to prevent grout from running down the face of the concrete. These precautions shall be done in a manner satisfactory to the Engineer.

586-3.03 Removal of Rivets-Replacement with High Strength Bolts

A. Paint Removal. If the steel is painted, then prior to the beginning of any other work operations, the paint shall be removed for a minimum distance of 100 mm on each side of the centerline of work location. The paint removal work shall be done in accordance with the requirements of Section 574 Structural Steel Painting: Localized. In cases where the contractor can clearly demonstrate through exposure monitoring that other work practices and engineering controls, under the oversight of a certified industrial hygienist, can effectively maintain actual worker exposure below the permissible exposure level, exceptions to this requirement may be granted by the Engineer.
B. Unless otherwise noted in the contract documents, all bolts shall be the same diameter as the rivets they replace.

C. Rivets shall be removed by one of the following methods:

1. Shear rivet head using a pneumatic rivet breaker (helldog), and drive out rivet shank with a pneumatic punch.
2. Flame cut rivet head 2 mm above the base metal using a rivet scarfing tip, and drive out shank using a pneumatic punch.

If, in the Engineer's opinion, punching will damage the base metal, the shank shall be removed by drilling.

D. High strength bolts shall be installed after the nicks, burrs and foreign substances that might interfere with seating of the bolt head and nut washers are removed. Light grinding may be ordered by the Engineer.

E. Installation and inspection of high strength bolts shall be done in accordance with the New York State Steel Construction Manual requirements.

F. If it becomes necessary to disconnect, or adjust, steel remaining as part of the structure to complete the work the Contractor shall obtain the Engineer's approval prior to performing disconnections or adjustments.

G. If the bolt will not fit the rivet hole, the hole may be reamed sufficiently to accommodate the bolt.

H. If the contract does not include an item(s) for cleaning, priming and painting of structural steel, cleaning and painting of the bolt and immediate surrounding area shall be done as part of this work. Cleaning and painting shall be done in accordance with the requirements of Section 574 Structural Steel Painting: Localized. All steel exposed by the cleaning operations shall be painted. However, at least 50 mm in every direction, measured from the washer's edge, shall be painted.
A. The unit price bid per millimeter shall include the cost of all labor, materials, and equipment necessary to complete the work.
B. Payment will not be made for holes which do not contain both grout and bolts.
C. The cost of the bolts will be paid for under a separate, appropriate item.

586-5.02 Removal of Rivets - Replacement with High Strength Bolts

A. The unit price bid for each installed bolt shall include the cost of all labor, material and equipment necessary to complete the work including paint removal and when appropriate painting.
B. Payment will be made for each installed bolt regardless of whether or not, a rivet had been removed from the location in question.

586-5.03 Field Drill Holes in Existing Steel

A. The unit price bid for each hole drilled shall include the cost of all labor, equipment and materials necessary to complete the work, including paint removal when required.
B. No extra compensation will be paid for holes drilled through different thicknesses, or through different numbers of plates.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>586.01</td>
<td>Drilling and Grouting Bolts, or Reinforcing Bars</td>
<td>Millimeter</td>
</tr>
<tr>
<td>586.05</td>
<td>Removal of Rivets-Replacement with High Strength Bolts</td>
<td>Each</td>
</tr>
<tr>
<td>586.10</td>
<td>Field Drill Holes in Existing Structural Steel</td>
<td>Each</td>
</tr>
</tbody>
</table>

SECTION 587 - BRIDGE RAILING RECONSTRUCTION

587-1 DESCRIPTION. The work shall consist of the following:
- The removal and disposal of bridge railing.
- The Removal and storage of bridge railing.
- The installation of stored bridge railing.
- The furnishing and installing of box beam bridge railing.
- The furnishing and installing of thrie beam bridge railing.

587-1.01 Bridge Railing Removed and Disposed; and Stored Bridge Railing Installed.
Material removed for disposal and material not used for installation shall become the property of the Contractor and shall be removed from the work site.

587-1.02 Bridge Railing Removed and Stored. All bridge railing removed shall remain the property of the State and shall be transported to a location within the project site designated by the Engineer.

587-2 MATERIALS

587-2.01 New Material. Materials shall meet the requirements of §710-23, Steel Bridge Railing and the following:

<table>
<thead>
<tr>
<th>Component</th>
<th>ASTM Designation or Standard Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>S75 x 8.5 Post</td>
<td>A36M</td>
</tr>
<tr>
<td>Post Plate</td>
<td>A36M</td>
</tr>
<tr>
<td>Spacer Brackets</td>
<td>A36M</td>
</tr>
<tr>
<td>Rail Connection Angles</td>
<td>A36M</td>
</tr>
<tr>
<td>Rail Plates</td>
<td>A36M</td>
</tr>
<tr>
<td>“U” Bolts, Nuts and Washers</td>
<td>F568 Class 4.6 or A307</td>
</tr>
<tr>
<td>Anchor Bolts, Nuts and Washers</td>
<td>A325M</td>
</tr>
</tbody>
</table>
§587

**Thrie Beam** 710-201
**W150 x 37.1 Post** A36M
**Anchor Bolts (Thrie Beam)** A449
**Carriage Bolts (Thrie Beam)** F568 Class 4.6 or A307
**Nuts and Washers for Carriage Bolts** A563 and F436
**Attachment Plate** A36M
**Concrete Grouting Material** 701-05

**NOTE:** 1. Thrie Beam Bridge Railing shall be fabricated from 10 gage material.

**587-2.02 Stored Material.** The Contractor shall choose the best available material for installation, subject to the approval of the Engineer.

**587-3 CONSTRUCTION DETAILS**

**587-3.01 Bridge Railing Removal.** If so indicated on the plans, the existing anchorages shall be reused for anchoring new or stored railing. Should this be the case, the Contractor shall exercise care removing the railing so as not to damage the existing anchorages. The provisions of §589-3.01 shall apply for the removal of any painted bridge railing.

**587-3.02 Bridge Railing Storage.** The Contractor shall remove, transport, unload and store bridge railing. Care shall be taken not to damage the railing during the various operations. In the event railing is damaged it shall be repaired or replaced in kind as directed by the Engineer. Such repair or replacement shall be done at no expense to the State.

**587-3.03 Stored Bridge Railing Installation.** Installation of the railing shall be done in accordance with the following subsections of section 568, Bridge Railing:

- **Inspection of Railing** 568-3.01A1
- **Field Welding** 568-3.01D
- **Positioning Railing** 568-3.01F
- **Positioning Posts** 568-3.01G
- **Base Plates** 568-3.01H
- **Non-Metallic Pads** 568-3.01I
- **Anchor Studs** 568-3.01L
- **Inspection** 568-3.01N

**NOTE:** 1. Bends or kinks in the railing which were present at the place of storage will not be cause for rejection.

**587-3.04 Box Beam Bridge Railing Installation.** Erection shall be in accordance with requirements of 568-3.01, Erection of Bridge Railing.

The installation procedure shall be coordinated to provide the least disturbance of pedestrian and vehicular traffic, if such traffic is maintained during the course of the work.

**587-3.05 Thrie Beam Installation**

**A. Direct Attachment to Existing Railing.** The railing shall be installed in accordance with the following:

- **Inspection of Railing** 568-3.01A
- **Field Galvanizing for Repair** 568-3.01C
- **Inspection of Galvanizing** 568-3.01B
- **Inspection** 568-3.01N

The railing shall be installed such that the bottom edge is parallel to the roadway profile.

**B. Separate Post Installation - Concrete Support Surface.** The posts and railing shall be installed in accordance with the following:

- **Inspection of Railing** 568.3.01A
Mortar leveling courses shall be made from Concrete Grouting Material (§701-05). Manufacturer's instruction shall be strictly followed. Railing shall be installed such that the bottom edge is parallel to the roadway profile.

C. Separate Post Installation - Steel Support Surface. The posts and railing shall be installed in accordance with the following:

Inspection of Railing 568-3.01A  
Positioning Posts 568-3.01G  
Inspection of Galvanizing 568-3.01B  
Base Plates 568-3.01H  
Field Galvanizing for Repair 568-3.01C  
Anchor Studs 568-3.01L  
Field Welding 568-3.01D  
Inspection 568-3.01N  
Erection 568-3.01E

Railing shall be installed such that the bottom edge is parallel to the roadway profile.

587-4 METHOD OF MEASUREMENT

A. All Railing Removal and Installation Except Thrie Beam Railing Installation. Measurement will be taken as the number of meters of railing removed, or installed. Measurement will be taken along the centerline of the top rail, end-to-end of railing between the limits indicated on the contract plans. No deduction will be made for open joints. If there is only one rail it will be considered the top rail.

B. Thrie Beam Railing Installation. Measurement will be taken as the number of meters of railing installed. Measurement will be taken along the top of the thrie beam, end-to-end of railing between the limits indicated on the contract plans. No additional measurement will be taken for overlapping sections of railing. If transition sections are installed, measurement will be taken to the end of the transition section indicated on the contract plans.

587-5 BASIS OF PAYMENT. The unit price bid shall include the cost of all labor, materials and equipment necessary to complete the work. When required, mortar leveling courses, anchor bolts, nuts and washers shall be included in the unit price bid. The drilling and grouting of anchor bolts, when required will be paid for under a separate item.

Painting of the railing, if required, shall be paid under a separate item.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>587.01</td>
<td>Bridge Railing Removal and Disposal</td>
<td>Meter</td>
</tr>
<tr>
<td>587.02</td>
<td>Bridge Railing Removal and Storage</td>
<td>Meter</td>
</tr>
<tr>
<td>587.03</td>
<td>Installation of Stored Bridge Railing</td>
<td>Meter</td>
</tr>
<tr>
<td>587.1001</td>
<td>Box Beam Bridge Rail, One Rail</td>
<td>Meter</td>
</tr>
<tr>
<td>587.1002</td>
<td>Box Beam Bridge Rail, Two Rail</td>
<td>Meter</td>
</tr>
<tr>
<td>587.20</td>
<td>Thrie Beam Bridge Rail - Attachment to Existing Bridge Rail</td>
<td>Meter</td>
</tr>
</tbody>
</table>
SECTION 588 (VACANT)

SECTION 589 - REMOVAL OF EXISTING STEEL

589-1 DESCRIPTION. The work shall consist of removal and disposal of existing steel where indicated on the contract plans, or where ordered by the Engineer. Unless otherwise noted, all materials removed as part of this work shall become the property of the Contractor, and shall be removed from the work site.

589-2 MATERIALS. Not applicable.

589-3 CONSTRUCTION DETAILS. The removal of existing steel requires the submittal of a written work plan. This plan shall meet the requirements of §202-3.01; General and Safety Requirements. The work plan shall set forth all expected supports, disconnections and adjustments to steel which is to remain. If, during the course of the work it becomes necessary to support, disconnect, or adjust steel, not previously noted in the work plan, the contractor shall submit a revised work plan to the Engineer for approval. All such proposals shall be approved prior to implementation.

In addition, the requirements of §202-3.05; Demolition of Structures shall also apply.

All work performed on steel which is to remain as part of the structure shall be in accordance with the applicable requirements of the SCM.

Actual removal procedures shall conform to the following requirements:

589-3.01 Paint. If the steel is painted, then prior to the beginning of any steel removal operations, the paint shall be removed for a minimum distance of 100 mm on each side of the centerline of cut, bolt row, rivet row, or weld as applicable. The paint removal work shall be done in accordance with the requirements of Section 574 Structural Steel Painting: Localized. In cases where the contractor can clearly demonstrate through exposure monitoring that other work practices and engineering controls, under the oversight of a certified industrial hygienist, can effectively maintain actual worker exposure below the permissible exposure level, exceptions to this requirement may be granted by the Engineer.

589-3.02 Cutting. All cutting work shall be done in accordance with the requirements of the SCM, part 601, and when applicable, part 602.

589-3.03 Fastener Removals

A. Bolts. Nuts shall be removed with wrenches, wherever possible, and the bolts driven out with a hand held punch. Alternate removal procedures shall be set forth in the work plan.

B. Rivets. Rivets shall be removed by either of the following methods:

- Shear rivet head, using a pneumatic rivet breaker (helldog), and drive out rivet shank with a pneumatic punch, OR
- Flame-cut rivet head 2 mm above the base metal, using a rivet scarfing tip, and drive out shank using a pneumatic punch.

If, in the opinion of the Engineer, rivet shanks, or bolts, cannot be removed by punching, without damaging the base metal, the rivet shank, or bolt, shall be removed by drilling.

589-3.04 Welded Connections. Welded connections shall be disassembled in accordance with the following:

A. The affected weld shall be removed by means of air carbon arc gouging equipment. To ensure that base metal remaining in place is not damaged, at least 3 mm of weld material shall be left in place. If it is necessary to gouge into base metal to remove the weld fusion, the least critical member, as determined by
the Engineer, shall be damaged. If the damaged member is permitted to remain, it shall be repaired by procedures approved by the DCES.

B. The weld material left in place shall be ground flush with the base metal surface. No base metal shall be removed by grinding.

C. The Engineer shall perform a careful visual inspection of all weld removal locations. If damage is suspected the Engineer will direct the Contractor to perform a dye penetrant inspection in accordance with the requirements of the SCM.

If the Contractor's operations damage existing steel which is to remain in place, the damaged steel shall be repaired, or replaced, as determined by the DCES. The Contractor shall be required to repair damage, or replace damaged material, caused by the Contractor's operations, at no additional expense to the State.

589-4 METHOD OF MEASUREMENT

589-4.01 Removal of Existing Steel (kg.) Measurement will be taken as the number of kilograms of existing steel removed and disposed of.

The mass of existing steel removed shall be computed from the nominal sizes indicated on the contract plans. If the nominal size is not indicated on the contract plans, field measurements shall be used to determine the mass, using 7850 kg per cubic meter as the mass of steel. The weight of bolts, rivets and welds shall be neglected, and no deductions in mass shall be made for any rivet, or bolt holes, in the existing steel, or for any loss of steel section due to corrosion.

589-4.02 Removal of Existing Steel (Each). Measurement will be taken as each unit of existing steel removed, and disposed of.

589-5 BASIS OF PAYMENT. The unit price bid per kilogram, or per each unit, shall include the cost of all labor, materials and equipment necessary to complete the work, including the removal of fasteners, and disconnecting, supporting, or adjusting steel as necessary.

No payment will be made for repair of, or replacement of, damaged material, which was made necessary due to the Contractor's operations.

No separate payment will be made for the removal of paint.

The treatment, handling and disposal of the paint removal waste will be paid under a separate item.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>589.01mnnn</td>
<td>Removal of Existing Steel</td>
<td>Kilogram</td>
</tr>
<tr>
<td>589.52mnnn</td>
<td>Removal of Existing Steel</td>
<td>Each</td>
</tr>
</tbody>
</table>

NOTE: mnnn denotes a serialized pay item.

SECTION 590 - ADJUSTMENT OF BRIDGE APPURTEANCES

590-1 DESCRIPTION. This work shall consist of adjusting the elevation of bridge joints and drainage devices to meet the proposed finished elevations in the manner indicated on the Contract Plans.

In order to perform the work, it may be necessary to remove structural concrete. Structural concrete removal, if performed, shall be done under its respective item.

590-2 MATERIALS. Materials shall meet the following requirements:

- **Structural Steel**:
  - ASTM A36M, A242M or A588M
- **Nuts, Bolts, and Washers**:
  - ASTM F568 Class 4.6
- **Galvanized Coatings and Repair Methods**:
  - 719-01
- **Preformed Elastic Joint Sealer**:
  - 705-09

590-3 CONSTRUCTION DETAILS. All steel materials, including nuts, bolts, and washers, used as a part of this work, shall be galvanized in accordance with §719-01. Any galvanized surface, either
existing or installed as a part of this work, which is damaged by welding or abrasion, shall be repaired in accordance with §719-01.

All welding shall be done in accordance with the applicable requirements of the New York State Steel Construction Manual.

The Contractor shall take suitable precautions to prevent damage to materials designated to remain-in-place. Damage to such material, due to the Contractor's operations, shall be repaired or the damaged material replaced, as determined by the Engineer.

Dimensions shown on the plans shall be verified by the Contractor and any necessary changes approved by the Engineer prior to construction of any needed fabrications.

Preformed elastic joint sealer, where required, shall be installed in accordance with the Contract Plans.

590-4 METHOD OF MEASUREMENT

590-4.01 Bridge Drainage Devices. The work will be measured as each bridge drainage device as defined by the Contract Plans which has had its elevation adjusted in accordance with the Contract Plans.

590-4.02 Bridge Joints. The work will be measured as the number of meters of joint system which has had its elevations adjusted in the manner indicated on the Contract Plans.

Measurement will be taken only between curb lines. No measurements will be taken across sidewalks, or raised medians. In the event that curbs are not present, measurement will be taken only to those points where the elevations have actually been adjusted.

590-5 BASIS OF PAYMENT

590-5.01 Bridge Drainage Devices. The unit price bid for each bridge drainage device adjusted shall include the cost of all labor, materials, and equipment necessary to complete the work.

No payment will be made for work done to repair damage due to the Contractor's operations, nor for any material supplied as replaced material made necessary due to damage attributable to the Contractor's operations.

590-5.02 Bridge Joints. The unit price bid per meter shall include the cost of all labor, materials and equipment necessary to complete the work.

No payment will be made for work done to repair damage due to the Contractor's operations, nor for any material supplied as replacement material made necessary due to damage attributable to the Contractor's operations.

Any concrete removal or replacement will be paid for under the appropriate items.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>590.01</td>
<td>Vertical Adjustment of Bridge Drainage Devices - 1</td>
<td>Each</td>
</tr>
<tr>
<td>590.02</td>
<td>Vertical Adjustment of Bridge Drainage Devices - 2</td>
<td>Each</td>
</tr>
<tr>
<td>590.03</td>
<td>Vertical Adjustment of Bridge Drainage Devices - 3</td>
<td>Each</td>
</tr>
<tr>
<td>590.04</td>
<td>Vertical Adjustment of Bridge Drainage Devices - 4</td>
<td>Each</td>
</tr>
<tr>
<td>590.05</td>
<td>Vertical Adjustment of Bridge Drainage Devices - 5</td>
<td>Each</td>
</tr>
<tr>
<td>590.21</td>
<td>Vertical Adjustment of Joint System - 1</td>
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<td>590.22</td>
<td>Vertical Adjustment of Joint System - 2</td>
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<td>590.23</td>
<td>Vertical Adjustment of Joint System - 3</td>
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<td>590.24</td>
<td>Vertical Adjustment of Joint System - 4</td>
<td>Meter</td>
</tr>
<tr>
<td>590.25</td>
<td>Vertical Adjustment of Joint System - 5</td>
<td>Meter</td>
</tr>
</tbody>
</table>

SECTIONS 591 THRU 593 (VACANT)
SECTION 594 - TIMBER AND LUMBER

594-1 DESCRIPTION. Under this work the Contractor shall furnish and place timber and lumber of various sizes and types as may be specified for sills or platforms beneath the road, for culverts, bridges reinforcing existing structures, and for other similar purposes as shown on the plans or specified by the Engineer.

594-2 MATERIALS. Materials shall meet the following requirements:

Wood Preservative - Creosote Oil, Type I  708-30
Wood Preservative - Water Borne    708-31
Wood Preservative - Oil Borne     708-32
Timber and Lumber        712-13
Stress Graded Timber and Lumber    712-14
Steel Plates as Specified       715-01

594-2.01 Fasteners. Fasteners such as: spikes, nails, screws, timber connectors, bolts, nuts and washers shall meet the standard industrial fastener specifications for the intended application.

594-2.02 Approval of Order. Prior to ordering timber and lumber, the Contractor shall submit to the Engineer for approval, a detailed statement of his proposed order. No material shall be ordered until the statement is approved.

594-2.03 Preservative Treatment. The preservative treatment shall be applied to stress graded lumber and timber and shall conform to the requirements of the AWPA C2, C3, and C18.

594-2.04 Sampling and Inspection. Sampling and inspection will be done by an accredited representative of the Department. The Inspector shall have the power to take samples of the material for analysis and to reject those materials which do not fulfill the requirements of these specifications as to either quality or workmanship. The acceptance of any materials by the Inspector shall not be a bar to their subsequent rejection if found defective. The Contractor shall furnish all facilities and equipment for the inspection and testing of materials and workmanship and the Inspector shall be allowed free access to all premises where inspections can be made.

The Contractor shall give the Department and Department's Inspection Agents ample notice relative to the location of, and time when, treating operations will take place. Inspection of all timber and lumber will be made by the Department's Inspection Agents before, during, and after pressure treatment at the treating plant. No treated timber and lumber shall be shipped which does not bear, in legible form, the Inspector's stamp of approval.

594-3 CONSTRUCTION DETAILS

594-3.01 General. Timber and lumber shall be placed or erected as shown on the plans or specified by the Engineer.

Any surface breaks resulting from storage and handling which do not warrant rejection shall be treated in accordance with AWPA M4 with the addition that at least three coats of preservative shall be applied.

Paint, where specified, shall be applied as required by the Contract Documents.

594-3.02 Treatment after Fabrication. All cutting, framing and boring of timber and lumber shall be done before treatment whenever practicable. Cutting and boring below high water shall be particularly avoided in material which is to be used in waters infested with marine borers.

All cut surfaces and all bolt holes bored subsequent to treatment shall be treated in accordance with AWPA M4 with the addition that at least three coats of preservative shall be applied. Any unfilled holes, after being treated with preservative shall be plugged with preservative treated plugs.

All cut surfaces and bolt holes below the high water line shall, in addition to the AWPA M4 preservative treatment, be coated with a thick application of a mixture of 30% creosote and 70% pitch.
The Contractor shall obtain all necessary permits pertaining to the purchase and field application of wood preservatives from the U.S. Environmental Protection Agency (EPA) and the New York State Department of Environmental Conservation.

§594

594-4 METHOD OF MEASUREMENT. The quantity to be paid for timber and lumber will be the number of cubic meters placed in the completed work. In measuring dressed timber and lumber, the cross-section of any piece will be taken as the minimum nominal commercial size of undressed material from which the piece could have been cut. When round timber is used, it shall be estimated as square timber of the smallest undressed commercial size from which the timber can be manufactured. The length of any piece will be taken as the actual length in the finished work, making no deductions for bevels, notches or splices. If the measured quantity is first computed in board feet, the conversion factor shall be 0.00235974 cubic meters per board feet.

594-5 BASIS OF PAYMENT. The unit price bid per cubic meter shall include the cost of furnishing all spikes, nails, screws, timber connectors, bolts, nuts, washers, hardware, preservative treatment and other required materials together with labor and equipment necessary to complete the work.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>594.01 M</td>
<td>Timber and Lumber</td>
<td>Cubic Meter</td>
</tr>
<tr>
<td>594.02 M</td>
<td>Stress Graded Timber and Lumber</td>
<td>Cubic Meter</td>
</tr>
<tr>
<td>594.03 M</td>
<td>Treated Timber and Lumber</td>
<td>Cubic Meter</td>
</tr>
</tbody>
</table>

SECTION 595 (VACANT)

SECTION 596 - OPEN STEEL FLOOR

596-1 DESCRIPTION. The work shall consist of furnishing and placing open steel floor in structural slabs, at the locations indicated on the contract plans.

596-2 MATERIALS

596-2.01 Steel. All steel for the component parts shall conform to the requirements of ASTM A36M or A588M. If steel conforming to ASTM A36M is used, it shall be furnished with a minimum copper content of 0.20 percent.

The Contractor shall furnish the Department with two certified copies of the record of physical tests and chemical analysis of the steel used.

596-2.02 Fabrication. All the requirements and provisions of the SCM shall apply.

596-2.03 Shop Painting. The open steel floor shall be painted in accordance with the contract documents. Surfaces which are to be welded shall not be painted until all welding is completed.

596-3 CONSTRUCTION DETAILS

596-3.01 Placement. Open steel floor shall be placed true to line and grade and shall make full and even bearing on the underlying surface.

596-3.02 Field Welding. All the requirements and provisions of the SCM shall apply.

596-3.03 Field Painting. The requirements of §596-2.03 shop painting, shall apply.

596-4 METHOD OF MEASUREMENT. The quantity to be measured will be the actual area, in square meters, of open steel floor furnished and installed, including any portions that are filled with concrete.
§596

596-5 BASIS OF PAYMENT. The unit price bid per square meter shall include the costs of all labor, material (including fabrication) and equipment necessary to complete the work.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>596.01</td>
<td>Open Steel Floor</td>
<td>Square Meter</td>
</tr>
</tbody>
</table>

SECTION 597 - TIMBER BRIDGE RAILING AND TRANSITIONS

597-1 DESCRIPTION. The work shall consist of furnishing and erecting timber bridge railing and transitions as shown on the contract plans and in accordance with the specifications. As soon as the Contract is awarded, the Contractor shall notify the DCES of the name and address of the fabricator of all timber bridge railing. This notification shall list the specific shop or shops in which the railing will be fabricated.

597-2 MATERIALS. Materials for this work shall meet the following requirements:

<table>
<thead>
<tr>
<th>Component</th>
<th>ASTM or SAE Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal Steel Plates</td>
<td>A36M (A709, Grade 250)</td>
</tr>
<tr>
<td>Rail Splice Plate</td>
<td>A36M (A709, Grade 250)</td>
</tr>
<tr>
<td>Tension Rods and Connection Bolts</td>
<td>F568, Class 8.8</td>
</tr>
<tr>
<td>Round Head Square Neck Threaded Bolt</td>
<td>F568, Class 4.6</td>
</tr>
<tr>
<td>Nuts</td>
<td>A563M Class 10S, Type HH</td>
</tr>
<tr>
<td>Washers</td>
<td>F436M, Type 1</td>
</tr>
<tr>
<td>Thrie Beam</td>
<td>A588M or A572M (A709, Grade 345 or 345W)</td>
</tr>
<tr>
<td>Thrie Beam to W-Beam Transition Piece</td>
<td>A588M or A572M (A709, Grade 345 or 345W)</td>
</tr>
<tr>
<td>Dome Head Drive Spike</td>
<td>Industry Standard</td>
</tr>
<tr>
<td>Split Rings</td>
<td>SAE 1010 Hot Rolled Carbon Steel</td>
</tr>
<tr>
<td>Shear Plates</td>
<td>ASTM A47/A47M, Grade 32510</td>
</tr>
</tbody>
</table>


Glued laminated timber shall comply with the requirements of the American Institute of Timber Construction (AITC). All wood products shall be pressure treated with wood preservative in accordance with §708-31 or §708-32 except that laminations for glue laminated timbers shall be treated prior to gluing with wood preservative designated as light pentain oil as in AWPA C28 and glued with wet-use adhesives conforming to Sections 4.5.1.2 of ANSI/AITC A190.1-1983.

The bridge rail shall be horizontally laminated glued laminated timber, visually graded Western species combination No. 2 or visually graded Southern Pine Combination No. 48. Other species and grades of glued laminated timber may be substituted provided that the minimum values tabulated in the latest edition of the National Design Specification for Wood Construction (ANSI/NFoPA NDS) are not less than the following:

\[
F_{b,y} = 12.4 \text{ MPa} \\
E = 12,410 \text{ MPa}
\]

Posts, curbs, scuppers, and spacing blocks may be sawn lumber or glued laminated timber. When sawn lumber is used, material shall be visually graded No. 1 Southern Pine or visually graded No. 1 Douglas Fir-Larch. Other species and grades of lumber may be substituted provided that the minimum values tabulated in the latest edition of the National Design Specification for Wood Construction (ANSI/NFoPA NDS) or obtained through a Machine Stress Rated (MSR) procedure approved by the American Lumber Service (ALS) are not less than the following:

\[
F_b = 9.30 \text{ MPa} \\
E = 10,342 \text{ MPa}
\]
597-3 CONSTRUCTION DETAILS

597-3.01 Fabrication. Timber bridge railing shall be fabricated to the dimensions shown on the Contract plans and in compliance with the specifications.

A. Shop Drawings. Shop drawings shall be provided in accordance with the Steel Construction Manual (S.C.M.) except as follows:
- The drawings shall be submitted to the Engineer for review and approval; and
- The computed weights need not be shown.

B. Galvanizing. Galvanizing shall conform to the requirements of §719-01, Galvanized Coatings and Repair Methods, Type I. All steel components of the railing, including the round head square necked threaded bolts, shall be galvanized. Galvanizing of high-strength steel tension rods shall follow the recommendations of the tension rod manufacturer so as not to adversely affect the mechanical properties of the steel. All steel components shall be galvanized after welding and other fabrication.

Shop galvanizing repair of uncoated areas will be permitted on localized areas. Repair of localized areas is limited to a total of 1,300 mm$^2$ on any one component. Any component requiring more than 1,300 mm$^2$ of galvanizing repair shall be stripped and regalvanized.

Shop repair shall be in accordance with the methods given in §719-01.
The following areas shall not require galvanizing repair: One 3 mm maximum dimension spot of tight flux remaining in the fusion line of any 180 mm length of weld after blast cleaning, pickling and galvanizing.

C. Shop Wood Repair. All cutting, framing and boring of timber shall be done before treatment whenever practicable.

All cut surfaces shall be treated in accordance with AWPA M4 with the addition that at least three coats of preservative shall be applied.

All bolt holes bored subsequent to treatment shall be treated with preservative by means of an approved pressure bolt hole treater. Any unfilled holes, after being treated with preservative shall be plugged with preservative treated plugs.

597-3.02 Erection of Timber Bridge Railing and Transitions

A. Inspection of Railing. Prior to installation, all timber and lumber shall be examined for shakes, holes, knots, checks, splits, and decay. The Materials Requirements under "Defects" of §712-17 shall apply. Any piece of timber or lumber exhibiting any one of the aforementioned defects shall be subject to rejection as determined by the Engineer.

B. Inspection of Galvanizing. Immediately prior to erection, the railing shall be inspected for damage. Damage to the galvanizing of steel railing components shall constitute sufficient cause for rejection except for the following conditions:
1. If a damaged area is not required to be repaired under the provisions of §710-23, Steel Bridge Railing.
2. If the total damaged area of a single piece is 4000 mm$^2$ or less. Total damaged area is exclusive of the damaged area described under §597-3.02B1.

C. Field Wood Repair. All cut surfaces shall be treated in accordance with AWPA M4 with the addition that at least three coats of preservative shall be applied.

All bolt holes bored subsequent to treatment shall be treated with preservative by means of an approved pressure bolt hole treater. Any unfilled holes, after being treated with preservative shall be plugged with preservative treated plugs.

The Contractor shall obtain all necessary permits pertaining to the purchase and field application of wood preservatives from the U.S. Environmental Protection Agency (EPA) and the New York State Department of Environmental Conservation.
D. Field Galvanizing Repair. Field galvanizing repair shall be allowed to be performed upon damaged areas meeting the requirements of §597-3.02B2.

Field galvanizing repair shall be made by painting zinc repair material onto the damaged area in accordance with the requirements of §719-01, Galvanized Coatings and Repair Methods.

All finished surfaces of welds and adjacent surfaces where galvanizing has been removed, due to any field welding operation, shall be field galvanized.

E. Holes in Metal Plates. Prior to galvanizing, any necessary holes in the metal plates shall be made in the shop in accordance with the requirements of the S.C.M.

F. Installation. The installation work shall be done by bolting methods alone. The requirements of the S.C.M. shall apply.

G. Posts. Bridge railing posts shall be installed as truly vertical as possible within the following tolerance limit: 8 mm in any direction as measured from the top of the deck to the top of the post.

Bridge railing transition posts shall be installed at the location and in the manner indicated on the Contract plans. The Contractor shall carefully excavate for all post holes. Post holes and post foundation structures shall be backfilled and compacted in accordance with §203-3.15, “Fill and Backfill at Structures, Culverts, Pipes, Conduits and Direct Burial Cables”. Prior to acceptance, all posts shall be plumb to a tolerance of +/- 8 mm.

Posts, in their final position, shall satisfy the Material Requirements for "Defects" of §712-17.

The tops of all posts and the top of the rail splice plate kerf shall be sealed with roofing cement or otherwise protected from direct exposure to weather.

H. Rails. The rails of timber railings shall span a minimum of four (4) posts. Bolts on traffic face of rail shall be round head square neck threaded bolt. Railing splices shall be installed in the manner indicated on the Contract plans.

I. Washers. Unless otherwise noted, malleable iron washers shall be provided under bolt heads and under nuts that are in contact with wood. Washers may be omitted under heads of dome-head timber bolts when the size and strength of the head is sufficient to develop connection strength without wood crushing.

J. Erection Inspection. All erection shall be subject to the inspection of the Engineer who shall be given all facilities required for a visual inspection of workmanship and materials.

597-4 METHOD OF MEASUREMENT

597-4.01 Timber Bridge Railing. The quantity to be paid for timber bridge railing shall be the number of meters measured along the centerline of railing between the extreme outer limits indicated on the Contract plans.

597-4.02 Timber Bridge Railing Transition. The quantity to be paid for timber bridge railing transition shall be the number of transitions required.

597-5 BASIS OF PAYMENT. The unit price bid per linear meter of the timber railing shall include the cost of all labor, material and equipment necessary to do the work.

The price bid per timber bridge railing transition shall include the cost of all labor, material and equipment necessary to do the work.

All drilling and grouting work, if permitted, will be done at the contractor’s expense.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
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<tr>
<td>597.10</td>
<td>Timber Railing</td>
<td>Meter</td>
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<tr>
<td>597.20</td>
<td>Timber Railing Transition</td>
<td>Each</td>
</tr>
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</table>

SECTIONS 598 AND 599 (VACANT)
Section 600
INCIDENTAL CONSTRUCTION

SECTION 601 (VACANT)

SECTION 602 - REHABILITATION OF CULVERT AND STORM DRAIN PIPE

602-1 DESCRIPTION. Rehabilitate culvert and storm drain pipe in accordance with these specifications, the contract documents, and as directed by the Engineer.

602-2 MATERIAL REQUIREMENTS.

602-2.01 General. Materials requirements are specified in the following subsections:

<table>
<thead>
<tr>
<th>Material</th>
<th>Code</th>
<th>Description</th>
<th>Code</th>
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</thead>
<tbody>
<tr>
<td>Portland Cement Concrete</td>
<td>501</td>
<td>Tunnel Liner Plate (relining)</td>
<td>707-05</td>
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<tr>
<td>Shotcrete</td>
<td>583</td>
<td>(Steel)</td>
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</tr>
<tr>
<td>Concrete Repair Material</td>
<td>701-04</td>
<td>(Aluminum)</td>
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<tr>
<td>Vertical Overhead Patching Material</td>
<td>701-08</td>
<td>Corrugated Aluminum Pipe</td>
<td>707-13</td>
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<tr>
<td>Grout Sand</td>
<td>703-04</td>
<td>Corrugated Aluminum Structural</td>
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<tr>
<td>Polyester Formed In Place Pipe Liner</td>
<td>706-06</td>
<td>Plate for Pipe and Pipe Arches</td>
<td>707-14</td>
</tr>
<tr>
<td>PVC Pipe (relining)</td>
<td>706-10</td>
<td>Anchor Bolts for Corrugated Culverts</td>
<td>707-20</td>
</tr>
<tr>
<td>(Profile Wall)</td>
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<td>Zinc Chromate Primer</td>
<td>708-04</td>
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<tr>
<td>(Corrugated)</td>
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<td>Membrane Curing Compound</td>
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<td>Coal Tar Epoxy Paint</td>
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<td>(Profile Wall)</td>
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<td>(Smooth Wall)</td>
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<td>(Smooth Wall)</td>
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<td>Corrugated Steel Pipe (Concrete Lined)</td>
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<td>(Aluminum Coated (Type 2))</td>
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<tr>
<td>(Polymer Coated)</td>
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</tbody>
</table>

Materials referencing SSPC will be accepted on the basis of Manufacturer’s certification.

602-2.02 Fill Material for Annular Space. Design the fill material for the annular space between the existing and new liner pipe in accordance with the pipe Manufacturer’s recommendations. Calculate the required fill material based on the existing culvert/storm drain internal diameter (minus deformations) and the external diameter of liner pipe.

602-3 CONSTRUCTION DETAILS. Provide the Engineer with written details of how the work is to be progressed a minimum of 10 days prior to starting. Include pipe manufacturer’s instructions, dewatering, assembly drawings, necessary insertion and bracing methods, and proposed shotcreting, concrete, and void filling methods.

602-3.01 Existing Pipe Preparation. Dewater, clean and inspect the existing pipe. Determine the location of and remove obstructions that may prevent proper installation of the paving or the relining material. Locate holes and perforations and hammer sound the interior walls of the existing pipe to identify all voids around the pipe’s periphery. For small inaccessible pipes, generally less than 1200 mm in diameter, sounding is not required; use a closed circuit television and camera to provide a visual inspection. Fill all voids within 300 mm of the existing pipe’s circumference. Provide strutting and bracing as required to insure stability of the pipe. For small inaccessible pipes, less than 1200 mm in diameter, preliminary filling of voids in the existing pipe’s periphery is not required.
602-3.02 Handling & Installing Relining Materials

**A. General.** Install each run of pipe with the same material for the entire run unless otherwise identified in the contract documents or approved by the Engineer. Do not allow water to flow along the invert during concrete or fill material placement.

**B. Paving Inverts with Concrete.** Apply §603-3.07 Concrete Paving for Corrugated Structural Plate Pipe.

**C. Lining with Shotcrete.** Apply the requirements of Section 583, Shotcrete with the exception of the following:
- The application is not limited to repair of concrete surfaces. Corrugated metal pipe is another material that can be shotcreted.
- Apply 50 mm minimum over the crests of the corrugations.

**D. Lining with Polyester Formed-in-Place Pipe Liner.** Provide the Engineer with written design details and calculations for determining the thickness of the cured-in-place-pipe (CIPP), the minimum pressure required to hold the tube tight against the existing conduit, and the maximum allowable pressure so as not to damage the tube.

Use a liner with the following criteria:
- One or more layers of flexible needled felt or an equivalent material as approved by the Materials Bureau.
- Be flexible enough to fit irregular pipe sections and be able to negotiate pipe bends.
- Use a plastic coated outside layer that is compatible with the resin system.
- Must use either a styrene based, thermoset resin and catalyst system or an epoxy resin and hardener that is compatible to the inversion system being used.
- Vacuum impregnate the tube with the resin and use a volume of resin that fills all voids in the tube material at nominal thickness and diameter. Adjust the volume by adding a minimum of 5% excess resin for the change in resin volume due to polymerization and to allow for any migration of resin into the cracks and joints in the original pipe.

1. **Installation.** A cured-in-place-pipe (CIPP) may be installed by either a hydrostatic head or air pressure inversion system. Maintain the pressure between the minimum and maximum during the inversion process and a continuous record of the pressure during the cure period. If the pressure deviates such that it is outside the range of the minimum and maximum pressure, remove the installed tube from the conduit.

   a. **Hydrostatic Head.** Insert the tube into the vertical inversion standpipe with the impermeable plastic membrane side out. At the lower end of the inversion standpipe, turn the tube inside out and attach it to the standpipe thereby creating a leakproof seal. Apply a hydrostatic head to fully extend the liner to the next designated manhole or termination point. Insert the tube into the vertical standpipe. Do not over-stress the felt fiber during the inversion process. Alternative methods using a hydrostatic head will be subject to approval of the Engineer.

   b. **Air Pressure.** Connect the tube to the upper end of the guide chute to create a leak proof seal with the impermeable plastic membrane side out. Turn the tube inside out as it enters the guide chute. Adjust the inversion air pressure to cause the impregnated resin tube to invert from point to point and to hold the tube tight against the pipe wall to produce dimples at the side connections.

2. **Curing.** Cure the liner with heated water circulated throughout the section so as to uniformly raise the temperature above that required to cure the resin. Monitor the temperature of the incoming and outgoing water supply from the heat source to the circulating equipment. Initial cure occurs during temperature heat-up and is considered complete when the remote temperature sensor indicates the temperature has reached the Manufacturer’s recommendation for the initial
resin cure. After reaching the initial cure temperature, raise and hold the temperature to the post-cure temperature as recommended by the Manufacturer.

Cool the liner to a temperature of 38°C before relieving the static head in the inversion standpipe. Cool-down may be accomplished by adding cool water to the inversion standpipe to replace warm water being drained from a small hole made in the downstream end. Alternative methods of curing will be subject to approval of the Engineer.

3. Workmanship. The finished pipe liner should be continuous over the entire length of an inversion run and be free of dry spots, lifts and delaminations. If any dry spots, lifts and delaminations exist, remove the liner in those areas. Mark a line 1 m from both ends of the distressed area, cut the distressed area out, and replace it to the satisfaction of the Engineer. If the Cured-In Place-Pipe (CIPP) does not fit against its termination point, seal the space between the pipe and liner with a resin mixture compatible with the CIPP.

4. Storm Drain Lateral Connections. Reconnect the existing storm drain lateral connections after the liner has cured in place. Use robotic cutting devices to reestablish tie-ins in non-man entry pipes.

E. Lining with a new Liner Pipe. Liner pipe sections may be pushed or pulled into place. Prior to relining, install skids or place a concrete or grout bed in the invert. Finish the bed to the specified line and grade depicted in the contract plans, and taper the edges to allow the annular fill material to flow freely in the space between the liner pipe and the bed. If installing skids, use 2 m lengths staggered to allow the annular fill material to flow beneath and around the liner pipe. Secure the skids to the invert of the existing pipe such that the bottom of the liner pipe does not drag along the invert during relining, or the skids may be welded or banded to the liner pipe’s exterior in a manner approved by the Engineer. Before relining, pull or push a single piece of liner through the pipe to verify liner clearance.

Follow the Manufacturer's instructions for handling and assembling the pipe, except as modified in the Contract Documents or as directed by the Engineer. Brace the liner against the existing pipe such that it maintains line and grade during filling of the annular space. Place the bracing so as to allow unimpeded flow of fill material into the entire annular space. Secure the liner before filling the annular space.

When required, reconnect existing storm drain lateral connections by utilizing an open cut excavation, internal connection or remote installation using robotics. Prior to filling the annular space connect and seal all laterals between the new liner pipe and the existing lateral.

Fill the entire annular space. Provide a minimum annular space of 25 mm for fill material between the new and existing pipes, and details on how to hold the liner pipe to line and grade until the fill material has set.

If the actual fill material used is less than the anticipated (calculated) fill or an inspection of the relined culvert indicates that there are voids in the annular space, the Contractor must provide the EIC with a plan to correct voids found. Depending on the location and size of the voids, additional grouting may be required in these areas. This may be accomplished by re-grouting in those areas within the culvert. The voids must be filled to the satisfaction of the Engineer at no additional cost to the state.

1. Lining with Polyethylene Pipe. Prior to relining, install skids or place a concrete or grout bed as per §602-3.02 E. Lining with a new Liner Pipe.

Reline with Smooth Wall Polyethylene Pipe or Profile Wall Polyethylene Pipe. Insert one end of the liner into the existing pipe leaving approximately 1.5 m outside. Place the opposing end of the second section against the exposed end of the first section. Assure that the two sections are in alignment and have the same slope.

Install a gasket on the male end of the liner pipe. Pull the couplings together until the female and male ends are locked together. Install joined liners into the culvert and repeat until completely lined.
Install all pipe, fittings, adapters and appurtenances according to the Manufacturer’s recommendations. Limit joint separations to less than 12 mm between adjoining sections. Field cuts will be permitted only at the terminal ends. No pipe length less than 1 m will be allowed.

Perform all butt fusion, welding and extrusion welding of HDPE pipe in accordance with the Manufacturer’s recommendation. Have a Manufacturer’s representative present during any fusion or welding operations.

2. **Lining with Corrugated Metal Pipe.** Use Corrugated Aluminum Pipe, Aluminum-Coated (Type 2) Corrugated Steel Pipe, Concrete Lined Corrugated Steel Pipe, or Polymer Coated Corrugated Steel Pipe. Apply zinc-chromate primer, or an equivalent as approved by the Materials Bureau, to all aluminum surfaces that will come in contact with concrete or grout.

Prior to relining, install skids or place a grout bed as per §602-3.02 E. Lining with a new Liner Pipe.

Insert and brace the liner pipe to the specified line and grade, and align adjacent pipe sections such that port holes, if used, are placed as detailed in the contract plans (Alignment bolts are not adequate bracing by themselves). Sever all alignment bolts not fully turned out and grind them flush to the new pipe interior. If port holes are used, provide fittings and plugs compatible with the delivery equipment. Insert the plugs into the fittings as the operation is completed. Limit joint separations to 12 mm between adjoining sections. To insure that fill material remains in the annular space, place internal expanding joint bands with annular corrugations and foam gaskets at each joint. Before filling the annular space brace, strut the bands. Remove the bracing and struts upon completion of this work.

3. **Lining with Polyvinyl Chloride Pipe.** Prior to relining, install skids or place a concrete or grout bed as per §602-3.02 E. Lining with a new Liner Pipe.

Reline with a Profile Wall PVC Pipe or Corrugated Wall PVC Pipe with integral bell and spigot joints.

Place a nose cone over the leading pipe spigot to protect the edge as it is pulled or pushed through the culvert. Use a pushing or pulling ring/plate to install the liner. Monitor the jacking and pushing loads in accordance with the Manufacturer’s specifications and guidelines.

4. **Lining with Corrugated Aluminum Structural Plate Pipe.** Prior to relining, install skids or place a concrete or grout bed as per §602-3.02 E. Lining with a new Liner Pipe. Apply zinc-chromate primer, or an equivalent as approved by the Materials Bureau, to the entire exterior surface of the pipe.

Submit fabrication details, including assembly drawings, pipe insertion methods, and bracing details, to the Engineer.

Align adjacent pipe sections such that port holes, if used, are placed as detailed in the contract plans. If port holes are used, provide port hole fittings and plugs compatible with the delivery equipment. Insert the plugs into the fittings as the grouting operation is completed. Alignment bolts are not adequate bracing by themselves. Sever all alignment bolts not fully turned out and grind them flush to the new pipe interior. Do not impede the flow of fill material into the annular space with bracing material.

5. **Lining with Steel or Aluminum Tunnel Liner Plate.** Install two flange liner plates. Use a lap type longitudinal seam. Fabricate the lap to allow a continuous cross section of the plates through the seam. Use an offset depth equal to the metal thickness for the full width of plate, including flanges. Drilling, punching or drifting to correct defects in manufacturing will not be permitted. Plates with improperly punched holes will be rejected.

Use 5 bolts per 450 mm width of plate in each lapped longitudinal joint and stagger the bolts in the ridges and valleys. Follow the Manufacturer’s recommendation for circumferential and longitudinal bolt spacings.

602-3.03 **Damaged Pipe and Repair.** Repair any damage to the existing pipe caused by the relining operation consistent with Section 603 Culverts and Storm Drains.
602-4 METHOD OF MEASUREMENT

602-4.01 Relining with new pipe. This work will be measured as the number of meters along the bottom centerline, measured to the nearest meter.

602-4.02 Paving inverts. This work will be measured as the number of square meters, determined by the paved width measured along the pipes circumference and the length along the centerline of the pipe measured to the nearest square meter.

602-4.03 Shotcreting. This work will be measured as the number of square meters, determined by the shotcreted width measured along the pipes circumference and the length along the centerline of the pipe measured to the nearest square meter.

602-5 BASIS OF PAYMENT. Include the cost of furnishing all labor, materials, and equipment necessary to complete the work in the unit price bid. Include the cost of all fill material needed to fill the annular space between the existing pipe and the liner pipe, and the removal of any obstructions, intrusions or damaged pipe prior to relining. The quantity of fill material required to fill voids beyond 300 mm outside of the existing pipe’s circumference will be paid under a separate item.

For Paving Inverts and Shotcreting, include the cost of furnishing all labor, materials and equipment necessary to complete the work for the unit price bid and include all necessary preparations to the existing pipe.

Payment will be made under:

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<thead>
<tr>
<th>Item No.</th>
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<td>Paving Inverts with Portland Cement Concrete</td>
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<td>602.2101</td>
<td>Lining Culvert with Shotcrete</td>
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<td>Lining with Polyester Formed in Place Pipe Liner</td>
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<td>602.70xx</td>
<td>Lining with Concrete-Lined CSP (125x25)</td>
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<td>Lining with Polymer Coated CSP 12ga, (75x25) or (125x25)</td>
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Refer to Contract Proposal for full Item Number and full description.

SECTION 603 - CULVERTS AND STORM DRAINS

603-1 DESCRIPTION. Construct culverts and storm drains in accordance with these specifications, the contract plans, and the appropriate standard sheets.
§603

603-2 MATERIALS

603-2.01 General. Materials requirements are specified in the following subsections:

<table>
<thead>
<tr>
<th>Material</th>
<th>Section</th>
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</thead>
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<td>Geotextile</td>
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<td>Portland Cement</td>
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<tr>
<td>Masonry Cement</td>
<td>701-02</td>
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<td>Concrete Repair Material</td>
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<td>Mortar Sand</td>
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<td>Reinforced Concrete Elliptical Pipe</td>
<td>706-03</td>
</tr>
<tr>
<td>Reinforced Concrete End Sections</td>
<td>706-07</td>
</tr>
<tr>
<td>Smooth Interior Corrugated</td>
<td>706-12</td>
</tr>
<tr>
<td>Polyethylene Pipe</td>
<td>707-02</td>
</tr>
<tr>
<td>Corrugated Steel Pipe</td>
<td>707-09</td>
</tr>
<tr>
<td>Ductile Iron Pipe (Non-Pressure)</td>
<td>707-10</td>
</tr>
<tr>
<td>Galvanized Steel End Sections</td>
<td>707-11</td>
</tr>
<tr>
<td>Corrugated Aluminum Pipe</td>
<td>707-13</td>
</tr>
<tr>
<td>Zinc Chromate Primer</td>
<td>707-14</td>
</tr>
<tr>
<td>Anchor Bolts for Corrugated Culverts</td>
<td>707-20</td>
</tr>
<tr>
<td>Zinc Chromate Primer</td>
<td>708-04</td>
</tr>
<tr>
<td>Wire Fabric for Concrete Reinforcement</td>
<td>709-02</td>
</tr>
<tr>
<td>Plastic Coated Fiber Blankets</td>
<td>710-03</td>
</tr>
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<td>711-05</td>
</tr>
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<td>Water</td>
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603-3 CONSTRUCTION DETAILS

603-3.01 Excavation. Apply the requirements specified in Section 206, Trench, Culvert and Structure Excavation, except as modified by the Contract Documents or as directed by the Engineer.

603-3.02 Laying Pipe

A. General. Lay all pipe in close conformity to line and grade having a full, firm and even bearing at each joint and along the entire length of pipe. Lay all pipe beginning at the downstream end and progress upstream. Use the same material in each run of pipe unless otherwise directed by the Engineer.

B. Handling and Assembly of Pipe. Follow the Manufacturer's instructions or approved Materials Details except as modified on the Contract Plans or as directed by the Engineer.

C. Bell and Spigot Type Pipe. Lay all pipe with the bells upstream. Where the spigot end of an existing pipe does not fit the bell end of a new pipe, construct a concrete collar as shown on the Standard Sheets. Fill the bottom half of the space on the inside of the pipe between the existing spigot and the new bell with an approved concrete repair material (§701-04). Alternate designs may be submitted to the Director, Materials Bureau, for approval.

Where the spigot end fits into the bell end and the clearance is so great as to render the elastomeric gasket or preformed sealer ineffective, join the pipe by caulking a gasket of jute or oakum into the joint space and then fill with mortar of equal parts of Portland Cement and Mortar Sand or a preformed or poured caulking compound of a type approved by the Engineer.

D. Round Corrugated Metal Pipe and Pipe-Arches. Place steel or aluminum pipe with longitudinal seams located at the sides. Place circumferential seams with laps in the downstream direction so flow of water is directed over instead of under each succeeding downstream section.

E. Corrugated Structural Plate Pipe and Pipe-Arches. Assemble the plates for corrugated steel or aluminum structural plate pipe and pipe-arches to form the circular pipe or pipe-arch cross section as defined by the pipe manufacturer.

For metal pipe arches, install the bolts nearest the visible edge of the lapped joint in the valley at the top of the corner plate of the corrugations. Cover the joint with the top of the corner plate on the outside of the structure with a geotextile conforming to Geotextile Underdrain from the Department's
Materials Bureau Approved List. Extend the covering a minimum of 300 mm beyond each side of the joint for its entire length. A minimum of 300 mm is required for any longitudinal lap.

**F. Polyethylene Pipe.** Handle, store and assemble all pipe in accordance with the Approved Materials Details except as modified in the Contract Documents or by the Engineer. Joint misalignment resulting in offsets greater than 6 mm or joint separations greater than 13 mm between adjoining sections of pipe will not be allowed. Field cuts are permitted only at the terminal ends and with a minimum pipe length of one (1) meter.

**G. Corrugated Metal End Sections.** Assemble all pipe end sections in accordance with the Contract Documents or as approved by the Engineer.

**H. Thickness Measuring Equipment.** Prior to laying any pipe, provide the Engineer with equipment to measure gauge and steel coating thickness. Gauge shall be measured with a micrometer caliper. Measure steel coating thickness with a Type II Fixed Probe Magnetic Gauge meeting the requirements of Steel Structures Painting Council Specification SSPC-PA2. When the Engineer verifies the required gauge and coating thickness the pipe may be laid. Micrometer calipers and Type II probes shall remain the property of the Contractor.

**603-3.03 Bedding and Backfilling Pipe.** Apply the standards of 203-3.15, Fill and Backfill at Structures, Culverts, Pipes, Conduits, and Direct Burial Cables and the appropriate NYSDOT Standard Sheets. Select Granular Fill used to backfill around aluminum or aluminum coated pipes will be free of portland cement unless the pipe sections are thoroughly coated with Zinc Chromate Primer, §708-04 or an equivalent alternative as approved by the Materials Bureau. 100% of the Select Granular Fill used around Type IR and IIR corrugated aluminum pipe must pass a 50 mm sieve.

**603-3.04 Damaged Pipe and Repair**

**A. General.** Repair, realign or replace pipe that is damaged or disturbed through any cause occurring prior to acceptance of the contract. Pipe which is defective, and determined by the Engineer as unrepairable, will be unacceptable for installation and shall be replaced as directed by the Engineer at no cost to the State.

**B. Concrete Pipe.** Repair concrete pipe in accordance with the requirements set forth in §706-02 Reinforced Concrete Pipe. The repairs will be acceptable if they are sound, properly finished and cured, as determined by the Engineer, and the repaired pipe conforms to the requirements of the Contract Documents.

**C. Damaged Bituminous Coating and Paving.** Damage to bituminous coating shall be repaired with asphalt repair material. The repair material shall appear on the Department's Approved List. Damage to bituminous paving shall be repaired by an application of the original hot material for areas 0.2 m² or less in each pipe section. Damage to bituminous paving in areas greater than 0.2 m² in a pipe section will be cause for rejection of that section.

**D. Polyethylene Pipe.** Polyethylene pipe with damaged ends may be incorporated into the work at terminal locations provided the damaged portion is totally removed by the field cut. Repair or replacement of pipe that is disturbed, damaged or misaligned must provide the same product as a new pipe installation, as determined by the Engineer. After backfilling operations are complete, inspect the pipe for deflection. No more than 5% deflection of the internal diameter will be allowed. If this is exceeded, the pipe will be rejected and removed at the Contractors expense.

**603-3.05 Field Strutting of Corrugated and Structural Plate Pipe.** Field strutting of corrugated metal pipe and structural plate pipe may be done at the Contractor's option and expense to provide added protection from construction equipment and other loads during installation, backfilling and filling above the pipe. The method and scheduling of installation and removal of strutting, must be approved by the
Engineer. Field strutting shall constitute installation of structurally sound timber sills, compression caps and struts.

603-3.06 Joints

A. Corrugated Metal Pipe. Use corrugated band field connections for corrugated metal pipe and pipe arch connections. Lap the band on equal portions of each culvert section to be connected. All connections shall be an approved type, fabricated and installed so that a secure and firm pipe connection may be readily made in the field. Thoroughly coat all aluminum or aluminum coated field connections in contact with concrete with Zinc Chromate Primer §708-04 or an equivalent alternative as approved by the Materials Bureau and permit to dry prior to concrete placement.

B. Structural Plate Pipe. Assemble plates for structural plate pipe and pipe arches with joints staggered such that not more than three (3) plates come together at any one point. Tighten all nuts for field or shop assembled plates to at least 200 but not more than 400 N•m of torque, before filling and backfilling are commenced. Supply the Engineer-in-Charge with an approved torque wrench.

C. Concrete Pipe. For round concrete pipe, use flexible water-tight elastomeric gaskets. For elliptical pipe and cattle pass use concrete pipe joint sealing compound meeting the requirements of §705-16. Install all sealants at the time the pipe is being laid to line and grade.

To detect leakage in the finished installation, internal pressure tests will be required in concrete pipe only when specified in the Contract Documents. If a leakage test is required, use an exfiltration test between consecutive manholes. Perform the test by filling the pipe with water to a height 600 mm above the top of the pipe at the upstream manhole and allowing the pipe to remain saturated for a period of 72 hours prior to checking for leakage. No more than 23 L/m of pipe diameter per meter of pipe length in a 24 hour period will be allowed.

Where a culvert or a storm drain system is open at either one or both ends, with or without end sections, use a minimum of 2300 mm. Round pipe less than 600 mm in diameter, elliptical pipe, and larger diameter round pipe beginning with 1675 mm diameter where the weight of the pipe section requires a shorter length shall have a minimum length of 1800 mm.

Shorter sections will be permitted where they are required to obtain an exact length of culvert. Use of shorter sections requires approval by the Engineer. For closed storm drain systems, drains having structures such as drop inlets on each end, the length of sections is unspecified.

Connect the first three full sections at the open end(s) of a culvert or storm drain system together to restrain movement of the sections. A full section is defined as a section with a minimum laying length of 2300 or 1800 mm as defined in the preceding paragraph. An end section is considered as the first section. If a short section is used at the end or within the first three full sections of a culvert, connect it together with the first three full sections.

Use a device at the springline on each side of the pipe to restrain the sections from movement. Use a device at least 3600 mm in length when using 2300 mm minimum length pipe sections and at least 3000 mm in length when used with 1800 mm minimum length sections. Securely anchor the devices to the pipe, with minimum slack in the device and the joints. Locate anchoring points a minimum of 450 mm from the end of the pipe sections and the flared end sections. Anchor each end of the device with a 25 mm diameter bolt with a nut and washer, or its equivalent, through the section wall. Apply ANSI B 18.2.1, ANSI B 18.2.2 and ANSI B 27.2, Grade A or B respectively for all nuts, bolts, and washers. For all round pipe 1300 mm in diameter and smaller, and/or equivalent diameter elliptical pipe use a steel strap for the restraining device conforming to ASTM A36 with a minimum width of 57 mm, 6 mm minimum thickness with 30 mm maximum diameter holes centered 38 mm from each end. For pipe larger than 1300 mm in diameter and for cattle pass, the requirements for the restraining devices will be shown on the contract plans. Apply the requirements of §719-01, Galvanized Coatings and Repair Methods: Type I for straps and Type II for nuts, bolts, and washers for the steel strap and anchoring hardware.

Alternative designs of the restraining device and anchoring hardware will be considered for approval by the Director of the Materials Bureau if they provide equivalent restraining properties and durability.
Restraining devices may be placed on either the inside or outside of the pipe. If placed on the inside, the device shall not protrude from the wall to the degree where flow would be obstructed. Only cold bending of the restraining device is allowed. Holes in the pipe and end sections required for the anchor bolts may be drilled in the field.

**D. Ductile Iron Pipes.** Form joints by caulking a gasket of jute or oakum into the hubs and then filling with mortar consisting of equal parts of Portland Cement Type I or Type II, Mortar Sand, or at the Contractor's option, a preformed or poured caulking compound of a type approved by the Engineer. For sanitary sewer systems, apply the joint requirements of ASTM C425.

**E. Polyethylene Pipe Connections.** Manufactured ends shall be used for joint assemblies; no field cuts are permitted unless approved by the Engineer. No separations greater than 13 mm are permitted between adjoining sections of pipe. Use only appropriate fittings for lateral connections supplied by the pipe manufacturer and shown on the standard sheet titled, “Drainage Structure Details” except that the pipe shall protrude 50 mm into the basin to provide a 45° battered grout seal. Apply the battered grout seal to both the interior and exterior faces of the basin.

**F. Dissimilar Metal Pipe Connections.** Use a sleeve gasket when joining corrugated pipe or end sections to pipes or end sections fabricated of dissimilar metals between the pipe(s) and the coupling band. Keep the ends apart, to prevent electrical contact between the dissimilar metals. Apply the requirements of AASHTO M36 for all gaskets.

**G. Breaking into Existing Drainage Structures.** When breaking into existing drainage structures to make a pipe connection remove only the minimum amount of material from the wall of the structure. After inserting the pipe, fill the cavity between the pipe exterior and the wall of the drainage structure with mortar made from mortar sand, masonry cement, and water mixed three parts sand to one part cement. Large spaces may be chinked with brick, block, or approved stones.

**H. Tolerance.** A 13 mm difference in diameter is allowed when joining round pipes or the spans or rises of pipe-arches. A 38 mm difference is allowed in the perimeters. These tolerances may be attained by proper production control or by match-marking pipe ends.

**603-3.07 Concrete Paving for Corrugated Structural Plate Pipe.** Place reinforced Portland Cement Concrete over the inverts of corrugated structural plate pipe where specified and indicated on the Contract Documents, so as to form a smooth interior. Do not place pavement until the embankment has been completed over the pipe and settlement has been completed to the satisfaction of the Engineer.

Pave the bottom 25 percent of the inside circumference for round pipe, the bottom 30 percent of the inside periphery for arch spans of 3125 mm and shorter and the bottom 35 percent of the inside periphery for arch spans longer than 3125 mm unless otherwise specified by the Engineer. A minimum cover of 100 mm is required over all corrugations. Schedule and conduct the diversion of water operations prior to and during the placement of pavement in a manner satisfactory to the Engineer. Prior to placing pavement clean and dry the surfaces to be in contact with concrete to the satisfaction of the Engineer.

Place the steel fabric reinforcement on the crests of corrugations and securely fasten to the pipe or pipe-arch by welding or by other methods acceptable to the Engineer. Place the reinforcement to provide a 100 millimeter minimum clearance from the edges of concrete and lap 150 mm minimum. Unless otherwise shown on the plans, the steel fabric reinforcement shall consist of No. 6 gauge wire at 150 mm centers transversely and longitudinally.

Finish the pavement to a smooth surface acceptable to the Engineer. Within 18 hours after completion of finishing, protect the surface by either an approved curing cover or an approved membrane curing compound applied at a minimum rate of 0.27 L/m². However, any concrete in the invert that would be exposed to sunlight must be cured immediately after the finishing operations have been completed and the surface water has evaporated.

Cure the concrete for a minimum period of 48 hours before water is permitted to flow on the invert. If the atmospheric temperature is below 7°C, the requirements of 555-3.08C, Provisions for Concreting in Cold Weather, shall apply.
§603

603-3.08 Relaying Pipe. Carefully remove, clean, preserve, haul and relay pipe as directed by the Engineer or as called for in the Contract Documents. The relaid pipe shall be true to line and grade, and have a full, firm, even bearing and be comparable to newly laid pipe. Construct joints of relayed pipe as specified in §603-3.06. When existing pipe is damaged during removal or relaying, rendering it unfunctional, replace it with new pipe at no additional cost to the State. Existing pipe which is determined by the Engineer to be unfit for relaying may be destroyed before removal. Apply the requirements of §603-3.03 for backfill and placement.

603-3.09 Anchor Bolts. Unless instructed otherwise, use anchor bolts, as specified in §707-20 to anchor the ends of corrugated metal pipes, and sectional plate arches to either reinforced or plain concrete headwalls.

603-4 METHOD OF MEASUREMENT

603-4.01 Pipe. The Engineer will measure the pipe, in meters along the bottom centerline, furnished and incorporated into the work in accordance with the Contract Documents.

603-4.02 End Sections. The Engineer will count the number of units of each size or diameter furnished and incorporated into the work in accordance with the Contract Documents.

603-4.03 Relaying Pipe. The Engineer will measure the existing pipe relayed and any new pipe laid and furnished to replace existing pipe, in meters along the bottom centerline, incorporated into the work in accordance with the Contract Documents.

603-4.04 Concrete Collars. The Engineer will count the number of concrete collars furnished and incorporated into the work in accordance with the Contract Documents.

603-5 BASIS OF PAYMENT

603-5.01 General. The accepted quantities of all pipe construction and reconstruction will be paid for at the contract price bid which will include the cost of furnishing all labor, materials and equipment necessary to complete the work including those joints made with oakum, portland cement and mortar or poured caulking compounds.

For concrete end sections include the cost of the restraining devices and their installation. If no end sections are specified and restraining devices are required, include the cost of the restraining devices in the unit price bid for the pipe. Include the cost of bituminous coating or concrete paving including steel wire fabric reinforcement, when specified in the unit price bid for the respective pipe items. Include the cost of breaking into existing drainage structures to connect new pipe in the unit bid price for the respective pipe items. Include the cost of anchor bolts, when required, in the unit bid price for pipe items.

Progress payment may be made to the extent of 80% of the price bid for pipe items requiring concrete invert paving when the installation is substantially completed and backfilled to a minimum of 600 mm over the top of the pipe plus whatever additional cover is necessary to protect the installation from construction traffic. The remaining 20% will be paid upon completion of the invert paving.

Excavation, granular fill and backfill will be paid for separately under their appropriate items in Sections 203 and 206, as applicable except include the additional costs necessary for the special gradation for Backfill Material for Corrugated Aluminum Pipe-Type IR and the additional cost necessary to assure the backfill material be free of portland cement in the unit bid price for these pipes.

Include the cost of adding water for compaction in the price bid, unless items for furnishing water equipment and applying water are included in the proposal.

Payment for the geotextile material and its installation is included under the structural pipe arch item.

603-5.02 End Sections. Include the cost of all labor, materials and equipment necessary to complete the work as specified in the contract documents. The cost of the restraining devices and their installation, required for concrete pipe, shall be included in the unit price bid for the end sections.
§603

603-5.03 Concrete Collars. Include the cost of all labor, materials (including concrete repair material) and equipment necessary to complete the work as specified in the contract documents.

Payment will be made under:

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§603

603.60xx Reinforced Concrete Pipe Class III
603.61xx Reinforced Concrete Pipe Class IV
603.62xx Reinforced Concrete Pipe Class V
603.66xx Reinforced Concrete Horizontal Elliptical Pipe Class HE II
603.67xx Reinforced Concrete Horizontal Elliptical Pipe, Class HE III
603.68xx Reinforced Concrete Horizontal Elliptical Pipe, Class HE IV
603.69xx Reinforced Concrete Vertical Elliptical Pipe, Class VE IV
603.70xx Reinforced Concrete Vertical Elliptical Pipe, Class VE V
603.71xx Reinforced Concrete Vertical Elliptical Pipe, Class VE VI
603.72xx Reinforced Concrete Cattle Pass
603.73xx Reinforced Concrete Pipe End Sections
603.74xx Reinforced Concrete Pipe Class II
603.80xxxx Corrugated Steel Pipe-Polymer Coated (68x13)
603.81xxxx Corrugated Steel Pipe-Polymer Coated Paved Invert (68x13)
603.82xxxx Corrugated Steel Pipe-Arch Polymer Coated (68x13)
603.83xxxx Corrugated Steel Pipe-Arch Polymer Coated Paved Invert (68x13)
603.84xxxx Corrugated Steel Pipe-Polymer Coated (75x25) or (125x25)
603.85xxxx Corrugated Steel Pipe-Polymer Coated Paved Invert (75x25) or (125x25)
603.86xxxx Corrugated Steel Pipe-Arch Polymer Coated (75x25) or (125x25)
603.87xxxx Corrugated Steel Pipe-Arch Polymer Coated Paved Invert (75x25) or (125x25)
603.88xxxx Corrugated Steel Pipe-Aluminum Coated (Type II) (68x13)
603.89xxxx Corrugated Steel Pipe-Arch Aluminum Coated (Type II) (68x13)
603.90xxxx Corrugated Steel Pipe-Aluminum Coated (Type II)
603.91xxxx Corrugated Steel Pipe-Arch Aluminum Coated (Type II)
603.92xxxx Corrugated Steel Pipe-Aluminum Coated (Type 2) Type IR
603.93xxxx Corrugated Steel Pipe-Arch Aluminum Coated (Type 2) Type IIR
603.95xx Ductile Iron Pipe
603.96xxxx Smooth Lined Corrugated Aluminum Pipe (68 x 13)
603.97xxxx Smooth Lined Corrugated Aluminum Pipe (75 x 25)
603.98xx Smooth Interior Corrugated Polyethylene Culvert and Storm Drain Pipe
603.99 Relaying Pipe

Refer to Standard Contract Pay Item Catalog for full Item Number and full Description. Numbers in parentheses (without denotation) are spacing and depth of corrugations in millimeters.

SECTION 604 - DRAINAGE STRUCTURES

604-1 DESCRIPTION

604-1.01 General. This work shall consist of the construction or alteration of drainage structures, manholes, leaching basins and transverse drainage interceptors in accordance with these specifications, the contract plans and the standard sheets.

604-1.02 Adjustment Rings and Frames for Drainage Structures and Manholes. The Contractor shall furnish and install prefabricated adjustment rings and frames for drainage structures and manholes. The extensions shall elevate and support drainage structure grates or manhole covers without the necessity of removing the original drainage structure frame or manhole casting, when the roadway is resurfaced.
604-2 MATERIALS

604-2.01 Drainage Structures and Manholes. Materials used for the construction of drainage structures and manholes shall be as indicated on the plans, and/or Standard Sheets, and shall conform to the requirements of the following:

- Cast-in-Place Concrete - Class A 501
- Frames and Grates 655
- Concrete Repair Material 701-04
- Concrete Grouting Material 701-05
- Precast Concrete Driveway and Sidewalk Pavers. 704-13
- Premolded Resilient Joint Filler 705-07
- Masonry Mortar 705-21
- Reinforced Concrete Pipe 706-02
- Precast Concrete Drainage Units 706-04
- Bar Reinforcement, Grade 420 709-01
- Wire Fabric for Concrete Reinforcement 709-02
- Cold Drawn Wire for Concrete Reinforcement 709-09
- Steps for Manholes 725-02

604-2.02 Transverse Drainage Interceptors. Materials used for the construction of transverse drainage interceptors shall meet the requirements of §604-2.01, except that bar reinforcement shall meet the requirements of §709-04, Epoxy Coated Bar Reinforcement, Grade 420.

- Transverse drainage interceptors, if precast, shall meet the requirements of §706-04, Precast Concrete Drainage Units.
- Dowels shall be fabricated from epoxy coated bar reinforcement conforming to §709-04.

604-2.03 Leaching Basins. Materials used for the construction of leaching basins shall conform to the requirements of §604-2.01 and shall be as indicated on the plans. Concrete for precast units shall conform to the requirements of §706-04, Precast Concrete Drainage Units.

604-2.04 Adjustment Rings and Frames for Drainage Structures and Manholes. Materials for prefabricated adjustment rings and frames for drainage structures and manholes shall conform to the following:

- Prefabricated Adjustment Rings & Frames for Drainage Units & Manholes 715-13

604-2.05 Altering Drainage Structures, Leaching Basins and Manholes. Materials for the repair and alteration of existing structures shall meet the requirements of §604-2.01 and shall be as indicated on the contract plans. Structures originally constructed with concrete block, common brick or concrete brick shall be altered with Precast Concrete Driveway and Sidewalk Pavers, §704-13, unless indicated otherwise on the contract plans.

604-3 CONSTRUCTION DETAILS

604-3.01 Excavation. Excavation shall be in conformance with the Construction Details of §206-3 Trench, Culvert and Structure Excavation.

604-3.02 Concrete Drainage Structures and Manholes. Concrete drainage structures and manholes shall be constructed in accordance with the requirements of these specifications, the Standard Sheets and plans. The Contractor shall have the option of erecting either cast-in-place or precast drainage structures unless specified otherwise. Cast-in-place drainage structures shall be constructed of Class A concrete and to the requirements of Section 555 Structural Concrete.

- The Contractor shall have the option of constructing either a rectangular or circular drainage structure when such option is specified and allowed in the contract documents. When the circular structure is
selected, it shall conform to the requirements of §706-04 and will require submission of complete working drawings to the Engineer for review and approval.

Contractor proposed changes to drainage structures shown on the Standard Sheets or on the plans, other than minor changes approved by the Engineer, shall require submission of complete working drawings to the Engineer for review and approval.

Unless prohibited in the contract documents, the Contractor shall have the option of reducing the size of the drainage structure riser above the uppermost pipe entry in accordance with the requirements of the Standard Sheets. Flat slab reducer designs proposed by the Contractor shall be subject to the review and approval of the Engineer and shall be accompanied by the following:

1. Working drawings prepared by a Professional Engineer licensed to practice in New York State.
2. The design calculations used in the preparation of the working drawings.

Acceptance of flat slab tops or platforms for flat slab reducer designs will be on the Basis of Proof-of-Design Test or on the Basis of Rational Design as required by ASTM C478.

604-3.03 Masonry Construction. Masonry construction, when indicated on the plans or standard sheets, shall consist of concrete pavers laid in full mortar beds. All joints shall be full mortar joints not greater than 12 mm wide. When specified, the outside of the masonry construction shall be plastered with 12 mm thick mortar coat.

604-3.04 Leaching Basins. Leaching basins shall be constructed in accordance with these specifications and the contract plans.

604-3.05 Pipe Entries. All pipe(s) built into the wall(s) of a drainage structure shall be flush with the inside face of the drainage structure wall and shall project outside a sufficient distance to allow connection with the adjoining section. The wall knockouts and sealing the space around the pipe shall be in accordance with the Standard Sheets. The bell of concrete pipe shall be cut off at every pipe entry where the bell enters the drainage structure.

604-3.06 Steps. Drainage structures steps may be cast or bolted in place during construction, mortared with a concrete grouting material after the structure is completed or attached by friction locking into preformed or drilled holes. The steps shall clear all pipes. Steps in risers and conical top sections shall be aligned to form a continuous ladder with rungs equally spaced vertically in the completed structure at a maximum distance of 400 mm. Steps shall be embedded into the walls of the riser or conical top section a minimum of 75 mm. The rung shall project a minimum clear distance of 100 mm from the walls of the riser or conical sections measured from the point of embedment.

604-3.07 Frames and Grates. Frames and grates shall be as specified in the contract documents. Frames located in the top slab or top of the uppermost riser shall be secured and held in place by a minimum of 4 stirrups or studs per frame, welded to the frame near the corners. Parallel bar frames shall contain shear stud anchors, for the purpose of transferring loads, as required and detailed on the standard sheet for parallel bar grates and frames. Shear stud anchors, when required, shall replace the frame securing stirrups or studs.

604-3.08 Altering Drainage Structures, Leaching Basins and Manholes. Reconstruction and adjustment of existing drainage structures shall be as detailed and specified on the contract plans. Construction with cast-in-place concrete shall conform to the requirements of Section 555, Structural Concrete.

Frames, grates and covers to be reused shall be removed, cleaned and reset at the required elevations. New frames, grates and manhole covers shall be installed when specified. Upon completion, each structure shall be cleaned of any accumulation of silt, debris or foreign matter of any kind and shall be kept clear of such accumulation until final acceptance of the work.

604-3.09 Adjustment Rings and Frames for Drainage Structures and Manholes. Prior to the placement of the surface course and after the placement of the binder course, when required, the
Contractor shall install adjustment rings and frames for manholes and drainage units. The adjustment ring or frame shall be placed so the manhole cover or drainage unit grate will not protrude above the finished surface of the pavement.

To assure a firm and secure fit with the adjustment ring or frame, the seat of the existing manhole casting or drainage unit frame shall be free of all foreign material at the time of installation. The entire assembly shall be set on the seat of the existing manhole casting or drainage unit frame and the locking devices shall be tightened evenly. The manhole cover or drainage unit grate shall then be set upon the seat of the adjustment ring or frame.

The Contractor shall be responsible for insuring that the adjustment rings and frames are compatible with the existing manhole castings and covers or drainage frames and grates.

All rings or frames shall be protected from displacement caused by traffic maintained on the roadway or equipment used in the paving operation.

The Contractor shall have the option of removing and resetting the existing manhole casting or drainage unit frames to the required grade where shown on the plans or approved by the Engineer.

604-3.10 Transverse Drainage Interceptors. This work shall consist of the construction of reinforced concrete transverse drainage interceptors with frames and grates, and dowels as shown on the plans or Standard Sheets. Unless specifically designated on the plans and/or in the proposal, the Contractor shall have the option of constructing cast-in-place or precast transverse drainage interceptors.

A. Cast-in-Place. Cast-in-place transverse drainage interceptors shall conform to the requirements of Section 555 Structural Concrete. The cast-in-place interceptors shall be constructed so that they have construction joints at a maximum spacing of 7.3 m, unless the Engineer gives written directions otherwise or a longer length is specified on the plans.

B. Precast Interceptors. Precast interceptors shall be laid in reasonably close conformity to line and grade and shall have a full, firm and even bearing at each joint and along their entire length.

They shall be handled and assembled in accordance with the manufacturer's instructions, except as modified on the plans or by the Engineer's written directions. Six (6) millimeter thick Premoulded Resilient Joint Filler shall be placed in the joint between the units, and the lifting hole and dowels shall be grouted with material conforming to §701-04 or §701-05.

Underdrain and Underdrain Filter shall be installed when shown on the plans or directed by the Engineer.

The underdrain pipe shall be installed in accordance with §605-3.01, and the underdrain filter shall be placed in accordance with §605-3.02 except when the details of either or both are modified on the plans or by the Engineer's written order.

604-3.11 Backfill. No structure shall be backfilled until all the mortar has completely set. The requirements of §203-3.15, Fill and Backfill at Structures, Culverts, Pipes, Conduits and Direct Burial Cable, shall apply.

604-4 METHOD OF MEASUREMENT

604-4.01 Drainage Structures, Leaching Basins and Manholes. Drainage structures, leaching basins and manholes will be measured for payment by the number of linear meters of height measured to the nearest tenth of a meter from the bottom of the base to the top of the masonry, including the top slab.

604-4.02 Transverse Drainage Interceptors

A. Cast-In-Place. Cast-in-place transverse drainage interceptors will be measured by the actual length of interceptor placed.

B. Precast. Precast transverse drainage interceptors will be measured by multiplying the number of whole units by the nominal length of each unit and adding thereto the length of any fractional units incorporated in the work. The nominal length of the units shall be indicated on the Standard Sheet.
604-4.03 Altering Drainage Structures, Leaching Basins and Manholes. Altering drainage structures, leaching basins and manholes will be measured by the number of structures altered.

604-4.04 Adjustment Rings and Frames for Drainage Structures and Manholes. This work will be measured by the number of prefabricated adjustment rings or frames furnished and installed.

604-5 BASIS OF PAYMENT

604-5.01 Drainage Structures, Leaching Basins and Manholes. The unit price bid per linear meter shall include the cost of all labor, equipment and materials, including bar reinforcement and welded wire fabric, necessary to complete the work, except the following:

A. Excavation. Excavation will be paid for under Trench and Culvert Excavation.

B. Backfill. Backfill of drainage structures and leaching basins will be paid for under the item(s) shown in the contract documents.

C. Frames, Covers and Grates. Frames, covers and grates will be paid for under the appropriate payment items for Frames and Grates in Section 655.

604-5.02 Contractor Options. When the specifications allow the Contractor to substitute a precast circular drainage unit in lieu of a rectangular drainage unit or the Contractor constructs a flat slab reducer design under the provisions of §604-3.02, the following basis of payment provisions will apply.

1. §604-5.01 will apply.
2. Payment for excavation and backfill will be for those quantities determined for the original structure.
3. No adjustments will be made to the unit price bid for the original structure.

604-5.03 Altering Drainage Structures, Leaching Basins and Manholes. The unit price bid for each shall include the cost of all materials, labor and equipment necessary to satisfactorily complete the work including all necessary cleaning, excavation, backfill, and replacement of any pavement, shoulder and sidewalk courses, subcourses, curbs, drives, lawns and any other surface. Frames, covers or grates to be reused that are broken by the Contractor's operations shall be replaced at the Contractor's expense. New frames, covers and grates will be paid for under the appropriate payment items for Frames and Grates in Section 655.

604-5.04 Adjustment Rings and Frames for Drainage Structures and Manholes. The unit price bid for each adjustment ring or frame shall include the cost of all material, labor and equipment necessary to satisfactorily install the adjustment rings and frames. If the Contractor elects to reset the existing casting or frames, the costs of the work involved in the removal and replacement of existing disturbed pavement shall be included in the price bid for the adjustment rings and frames.

604-5.05 Transverse Drainage Interceptors. The price per linear meter bid for this work shall include the cost of furnishing all labor, materials and equipment necessary to complete the work, except the excavation will be paid for under Trench and Culvert Excavation, and the Underdrain and Underdrain Filter will be paid for under their respective items.

Payment will be made under:

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<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
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<td>604.06</td>
<td>Transverse Drainage Interceptors</td>
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<td></td>
<td>YY = Serialized 01 to 99 *</td>
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<tr>
<td>604.10</td>
<td>Prefabricated Adjustment Rings for Manholes</td>
<td>Each</td>
</tr>
<tr>
<td>604.11</td>
<td>Prefabricated Adjustment Frames for Drainage Structures</td>
<td>Each</td>
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</table>
604.30XXYY Rectangular Drainage Structure
   XX = Structure Type **
   YY = Frame No. **

604.31XXYY Rectangular Drainage Structure with Round Option
   XX = Structure Type **
   YY = Frame No. **

604.32XXYY Rectangular Drainage Structure with Concrete Cap
   XX = Structure Type **
   YY = Frame No. **

604.40XX M Round Precast Manhole
   XX = Type **

604.50XXYY Special Drainage Structure
   XX = Region (01 through 11)
   YY = Serialized 01 to 99 *

* Serialized number identified structure detailed on the plans.
** Structure type and frame number are as defined on the Drainage Structure Details Standard Sheets and the Grate and Frame Standard Sheets.

SECTION 605 - UNDERDRAINS

605-1 DESCRIPTION. The work shall consist of constructing underdrain installations in accordance with these specifications and in conformity with the lines, grades, and cross-sections shown on the plans or established by the Engineer.

605-2 MATERIALS

605-2.01 Underdrain Pipe. Underdrain pipe shall meet the requirements specified in the following subsections of Section 700-Materials Details for the type of pipe specified in the contract documents:

- Corrugated Steel Pipe - Type III 707-02
- Porous Concrete Pipe Underdrain 706-05
- Extra Strength Porous Concrete Pipe Underdrain 706-05
- Perforated Corrugated Polyethylene Underdrain Tubing 706-13
- Corrugated Aluminum Pipe - Type III 707-13
- Perforated Polyvinyl Chloride Underdrain Pipe 706-18

Optional underdrain pipe shall meet the requirements of any of the above listed subsections of Section 700-Materials Details at the Contractors option except that porous concrete and vitrified clay pipe shall not be permitted in an edge of pavement underdrain installation. Aluminum and steel shall be 16 gage.

605-2.02 Granular Filter Materials. Underdrain Filter Material shall consist of crushed stone, sand, gravel or screened gravel. Material tests and quality control methods pertaining to the item requirements and work of this Section will be performed in conformance with the procedures contained in the appropriate Departmental publication in effect on the date of advertisement of the project. These publications are available upon request to the Regional Director or the Director, Geotechnical Engineering Bureau.

   The procedure for acceptance or rejection of these materials shall be as described in the appropriate Soil Control Procedure (SCP) manual.

   Underdrain Filter Type I and Type II shall be stockpiled.

A. Underdrain Filter Type I

1. Soundness:
   The soundness of material meeting the requirements of §703-02, Coarse Aggregates or §703-10, Lightweight Aggregates, is acceptable for Underdrain Filter Type I. When the Contractor elects to use material from sources not approved under §703-02 or §703-10, the soundness of the
material shall be tested and shall have a loss not exceeding 20 percent by weight after four (4) cycles of the Magnesium Sulphate Soundness Test.

2. Gradation:

<table>
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<tr>
<th>Sieve Designation</th>
<th>Percent Passing by Weight</th>
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<tbody>
<tr>
<td>25.0 mm</td>
<td>100</td>
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<tr>
<td>12.5 mm</td>
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<tr>
<td>6.3 mm</td>
<td>0 - 30</td>
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<tr>
<td>2.0 mm</td>
<td>0 - 10</td>
</tr>
<tr>
<td>850 µm</td>
<td>0 - 5</td>
</tr>
</tbody>
</table>

B. Underdrain Filter Type II

1. Soundness:
   The soundness of material meeting the requirements of §703-02, Coarse Aggregates or §703-10, Lightweight Aggregates, is acceptable for Underdrain Filter Type II. When the Contractor elects to use material from sources not approved under §703-02 or §703-10, the soundness of the material shall be tested and shall have a loss not exceeding 20 percent by weight after four (4) cycles of the Magnesium Sulphate Soundness Test.

2. Gradation:

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<td>100</td>
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<tr>
<td>6.3 mm</td>
<td>20 - 100</td>
</tr>
<tr>
<td>2.0 mm</td>
<td>0 - 15</td>
</tr>
<tr>
<td>850 µm</td>
<td>0 - 5</td>
</tr>
</tbody>
</table>

C. Underdrain Filter Type III. Material for Underdrain Filter Type III shall meet the gradation and quality requirements of §703-07 Concrete Sand.

605-3 CONSTRUCTION DETAILS

605-3.01 Underdrain Pipe. The construction details of Section 603 shall apply. The type of filter material to be used at any location will be as shown on the plans unless otherwise directed by the Engineer. A carefully levelled and compacted bed of this material shall be prepared just prior to the placement of the underdrain pipe. The upgrade end of corrugated polyethylene underdrain pipe shall be closed with a solid plastic cap; the upgrade end of all other types of underdrain pipe shall be closed with a suitable plug. Unless otherwise shown on the plans or specified by the Engineer, the underdrain pipe shall be placed with the perforations down. In the event that the semi-circular option of the Steel Pipe underdrain is utilized, the pipe shall be placed such that the flat surface is on the top.

A. Perforated Corrugated Polyethylene Underdrain Tubing and Perforated Polyvinyl Chloride Underdrain Pipe. When these underdrains are daylighted through the side slope they shall be protected from sunlight by using a minimum one meter long section of corrugated steel or aluminum pipe at the outlet. The metal pipe, shielding the underdrain, shall extend a minimum of 150 mm into the ground and overlap the underdrain by a like distance for 100 mm and 150 mm underdrains. For underdrains from 200 mm through 300 mm the shielding pipe shall extend at least 300 mm into the ground and overlap the underdrain by a like distance. In no case shall the outlet end of the underdrain be exposed or extend beyond the end of the metal pipe shielding it. The metal pipe for shielding the underdrain shall be of such internal diameter to easily slip over the underdrain. To prevent intrusion of the filter material into the joint between the metal and underdrains, one of the
following methods shall be used: A reducer fitting placed over the joint, roofing felt wrapped around the joint, or another method approved by the Engineer. Perforated corrugated polyethylene underdrain tubing and perforated polyvinyl chloride underdrain pipe will melt and burn when exposed to flame. Flame damage or damage by deterioration, crushing or stretching will be cause for rejection.

**B. Optional Underdrain Pipe.** The Contractor shall not intermix types of underdrain in the same run of pipe.

**605-3.02 Underdrain Filter.** After the pipe installation has been inspected and approved, Underdrain Filter shall be loosely placed around and over the pipe to such a depth that, after compaction, Underdrain Filter will extend to a level 150 mm above the underdrain pipe or to the next course, whichever is less. Subsequent lifts of Underdrain Filter shall be no more than 150 mm thick prior to compaction and shall be compacted by two passes of an approved vibrating pad or drum type compactor. The remainder of the installation shall be in accordance with the applicable standard sheet or as indicated on the plans.

For corrugated polyethylene underdrain tubing the filter material shall be placed around and over the tubing to such a depth that, after compaction, the underdrain filter material shall extend to a level 300 mm or to the next course whichever is less above the tubing. At this stage the surface of the filter material shall be compacted by three passes of a vibrating pad or drum type compactor. The remainder of the backfill shall be placed in maximum 600 mm loose lift thicknesses and compacted by three passes of a vibrating pad or drum type compactor after the placement of each lift.

In the event that a pipe is not included in this installation, the filter shall be placed in horizontal layers not exceeding 150 mm in thickness prior to compacting. Each lift shall be compacted by two passes of an approved vibrating pad or drum type compactor.

No compaction control tests will be required.

**605-3.03 Underdrain Filter at Structures.** Underdrain Filter, Type I material, shall be placed adjacent to structures as specified on the contract plans. The lift thickness for the loose Type I material shall not exceed 150 mm and shall precede the placement of each lift of the adjacent backfill material. A physical barrier may be used to facilitate placement of the Underdrain Filter and adjacent backfill. This barrier shall not be left in place and shall be removed prior to compaction of the material. Each lift of filter material and backfill material located within a minimum distance of one meter from the backwall plus the footing heel projection shall be compacted simultaneously. Compactive effort for this material shall be provided by two passes of a vibratory compactor approved by the Engineer. Placement and compaction operations shall be conducted in a manner so as to insure that the top surface of each lift of Type I filter material shall not be contaminated by the adjacent backfill materials. No compaction control tests will be required for the Type I filter material.

**605-4 METHOD OF MEASUREMENT**

**605-4.01 Underdrain Pipe.** The quantity of underdrain pipe to be paid for will be the number of linear meters of pipe incorporated in the completed work in accordance with the plans and specifications and as directed by the Engineer.

**605-4.02 Underdrain Filter.** The quantity of underdrain filter material to be paid for under this item will be the number of cubic meters of material computed between the payment lines as shown on the plans, or where changes have been ordered, as established by the Engineer. A deduction shall be made for pipes (based on nominal diameters) and other payment items, when the combined cross-sectional area exceeds 0.1 m$^2$, unless otherwise shown on the plans. No deduction will be made for the cross-sectional area of an existing facility.

If the excavation for the underdrain extends outside these payment lines, it shall be backfilled with Underdrain Filter material meeting the requirements of this specification, furnished and installed at the Contractor's expense.

**605-4.03 Underdrain Filter at Structures.** The quantity of Underdrain Filter Type I material shall be computed for payment as the number of cubic meters within the payment lines shown on the contract...
plans or as modified by the Engineer. No deduction will be made for the volume occupied by the underdrain pipe.

605-5 BASIS OF PAYMENT

605-5.01 Underdrain Pipe. The unit price bid per linear meter for this work shall include the cost of furnishing all labor, materials and equipment necessary to complete the work. Excavation, granular fill and backfill will be paid for separately under their appropriate items in Sections 203 and 206, as applicable.

605-5.02 Underdrain Filter. The unit price bid per cubic meter shall include the cost of furnishing all labor materials and equipment necessary to complete the work. No direct payment will be made for any losses of material which may result from compaction, foundation settlement, erosion, or any other causes; the cost of such losses shall be included in the price bid for this item. Any contaminated underdrain filter material shall be replaced by the Contractor as directed by the Engineer at no cost to the State. Excavation, granular fill and backfill will be paid for separately under their appropriate items in Sections 203 and 206, as applicable.

Payment will be made under:

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<th>Item No.</th>
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<td>Extra Strength Porous Concrete Pipe Underdrain</td>
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<td>605.07xx</td>
<td>Corrugated Steel Pipe - Type III</td>
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<td>Corrugated Aluminum Pipe - Type III</td>
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<td>Optional Underdrain Pipe</td>
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Refer to the Standard Contract Pay Item Catalog for full Item Number and full Description.

SECTION 606 - GUIDE RAILING

606-1 DESCRIPTION. This work shall consist of the construction, reconstruction, removal, disposal, storage, and resetting of highway barrier systems and component parts in accordance with the specifications, standard sheets, manufacturer’s drawings, manufacturer’s directions and contract documents to the lines and grades shown on the plans or established by the Engineer.

The types of barrier systems are designated as follows:

- Cable Guide Railing
- Corrugated Beam Guide Railing and Median Barrier
- Heavy Post Blocked-Out Corrugated Beam Guide Railing and Median Barrier
- Box Beam Guide Railing and Median Barrier
- Concrete Barrier
- Pier Protection

606-1.01 I-Beam Posts for Existing Highway Barrier. Under this work the Contractor shall furnish and install I-beam posts and necessary hardware for existing highway barriers in accordance with the plans, specifications, and as directed by the Engineer.

606-1.02 Guide Railing with Extra Long Posts. Under this work the Contractor shall furnish and install guide railing of the type specified with extra long (2135 mm) posts in accordance with the contract documents, and as directed by the Engineer.
606-1.03 Retensioning Existing Cable Guide Railing. Under this work the Contractor shall retension existing guide rail cables in accordance with the plans, specifications and as directed by the Engineer.

606-2 MATERIALS. Materials shall meet the requirements specified in the following subsections of Section 700--Materials and ASTM Specifications:

- Concrete Grouting Material 701-05
- Precast Concrete Median Barrier 704-05
- Premoulded Resilient Joint Filler 705-07
- Joint Filler ASTM D 1056 Grade 2B1 or 2B2
- Wire Fabric For Concrete Reinforcement 709-02
- Epoxy Coated Bar Reinforcement, Grade 420 709-04
- Wood and Timber Posts and Timber Blockouts 710-13
- Galvanized Steel Barrier Posts 710-14
- Corrugated Beam Guide Railing and Median Barrier 710-20
- Box Beam Guide Railing and Median Barrier 710-21
- Cable Guide Railing 710-22
- Box Beam End Assembly Type III and Box Guide Rail and Median Barrier End Assembly, Type C 710-24
- Galvanized Coatings And Repair Methods 719-01
- Epoxy Polysulfide Grout 721-03
- Anchor Bolts 723-60
- Reflective Sheeting 730-05 (Materials Designation 730-05.02)
- Paint for Galvanized Surfaces 708-06
- Rolled Steel Channels for Continuity Connections ASTM A36
- Steel Plates for Continuity Connections ASTM A36

606-2.01 Steel Hardware. Steel posts, plates, channels, stiffeners, block-outs, angles, brackets, slipbases and other miscellaneous steel hardware not referenced to or specified by §710-14, §710-20, §710-21, §710-22, §710-24 or other sections of this specification shall be fabricated as shown in the contract plans and documents from steel meeting the requirements of ASTM A36 unless specified otherwise. All components shall be galvanized in accordance with §719-01, Type I or II. Components shall be fabricated prior to galvanizing. Similar hardware associated with Rustic barrier systems shall meet the requirements of §710-25.

606-2.02 Anchor Bolts and Studs. Anchor bolts and studs embedded or grouted in concrete for securing post and railing base plates shall meet the requirements of §723-60. Nuts and washers shall meet the requirements of ASTM A325M.

Anchor studs, bolts or rods embedded in concrete anchorage units for terminating guide rail and median barrier systems shall have minimum yield and tensile strength meeting the requirements of ASTM F568 Class 4.6.

Anchor studs, bolts, rods, nuts and washers shall be galvanized in accordance with §719-01, Galvanized Coatings and Repair Methods, Type II unless indicated otherwise on the plans or standard sheets.

Grout for anchor studs and bolts shall conform to the requirements of §721-03 or §701-05.

606-2.03 Fasteners. Bolts, nuts and washers shall conform to the following unless specified otherwise on the plans, standard sheets, manufacturer’s drawings’, or in the contract documents.

- Bolts ASTM F568 Class 4.6
- Nuts ASTM A563M Grade A or Better
- Washers ASTM F436M
Bolts, nuts and washers shall be galvanized in accordance with the provisions of §719-01 Galvanized Coatings and Repair Methods, Type II. Fasteners associated with Rustic barrier shall meet the requirements of §710-25 Guide Rail And Median Barrier Systems (Rustic).

606-2.04 I-Beam Posts for Existing Highway Barrier. I-beam posts for existing highway barrier shall conform to the requirements of §710-14 Galvanized Steel Barrier Posts or §710-25 Guide Rail And Median Barrier Systems (Rustic) as specified or required in the contract documents. Posts shall conform to the details shown on the plans or the latest edition of the standard sheet for the guide railing or median barrier affected. Hardware (nuts, bolts, “J” bolts, offset beams or block-outs, back up plates, washers, and shelf angles) necessary shall conform to the requirements of the current specifications and standard sheets for the highway barrier affected.

606-2.05 Extra Long Guide Rail Posts. Extra long Guide Rail Posts shall conform to the requirements of §710-14 Galvanized Steel Barrier Posts or §710-25 Guide Rail And Median Barrier Systems (Rustic) as specified or required in the contract documents. The posts shall conform to the details for extra long posts shown on the standard sheets or plans.

606-2.06 Concrete for End Assembly Anchors And Post Embedments. Cast-in-place concrete shall meet the requirements of Class A Concrete in Section 501 Portland Cement Concrete-General. The Contractor may submit, for approval by the Director of the Materials Bureau, a mix at least equivalent to the specified Class A Concrete, with a minimum cement content of 340 kg/m3. Precast concrete anchorage units, when selected as an alternate to cast-in-place units by the Contractor, shall meet the requirements of Section 704-03 Precast Concrete-General.

606-2.07 Concrete Barrier

A. Precast Concrete Barrier. The requirements of §704-05 shall apply

B. Cast-in-Place Concrete Barrier. Concrete shall meet the requirements specified for Class A Concrete in §501, Portland Cement Concrete--General. Reinforcement shall meet the material requirements §606-2 and be of the type and sizes as indicated on the standard sheets and plans.

C. Machine Formed Concrete Barrier. The concrete shall meet the requirements specified for Class I Concrete in §501, Portland Cement Concrete--General. Reinforcement shall meet the material requirements of §606-2 and shall be of the type and sizes as indicated on the standard sheets and plans.

606-2.08 Resetting Guide Railing, Median Barrier, Anchorage Unit Assemblies and End Assemblies. The materials comprising the existing system shall be used if they conform to the materials requirements specified for new guide rail systems and are found to be in satisfactory condition as determined by the Engineer. The Contractor shall supply all new hardware (splice tongues, plates, nuts, bolts, washer, etc.) Replacement materials shall meet the material requirements specified for new guide rail systems. Galvanizing of railing and posts may be repaired in accordance with §719-01, Galvanized Coatings and Repair Methods.


606-2.10 Corrugated Beam Guide Rail Transition To Bridge Rail, Concrete Barrier and Concrete Parapets. Corrugated beam rail sections shall conform to the requirements of §710-20. All remaining material shall conform to the requirements of §710-23 except that:
A. Posts for rustic barrier shall conform to the requirements of §710-25.
B. Block-outs and stiffening channels shall conform to ASTM A36.
C. All components shall be galvanized in accordance with §719-01 *Galvanized Coating and Repair Methods*, Type I or Type II. If required by the plans, the components shall be painted to match the existing railing. Painting shall be done in accordance with Section 657 except that:

1. Painting with rollers will not be permitted.
2. Spray painting will be allowed only if the components are painted at a location away from the work site, acceptable to the Engineer.

D. Shop drawings will not be required. Approval of the system will be made by the Engineer.

**606-2.11 Rustic Barriers.** Materials for rustic box beam and corrugated beam guide rail and median barrier systems respectively shall meet the requirements of §710-25. When rustic posts are specified for cable barriers the posts shall meet the requirements for posts of §710-25.

**606-2.12 Pier Protection.** Half section concrete barrier units shall be precast and conform to the requirements of §704-05 Precast Concrete Median Barrier. The box beam guide rail shall conform to the requirements of §710-21 Box Beam Guide Railing and Median Barrier.

**606-2.13 Object Marker.** All object markers required at vehicle openings or driveways shall be fabricated from the following materials conforming to Section 700 Materials:

- Aluminum Sign Panels 730-01
- Reflective sheeting, Materials Designation 730-05.02 or Materials Designation 730-05.03 730-05
- Acrylic Plastic Reflex Reflectors 730-10

The posts for mounting object markers shall be galvanized steel U section posts weighing 1.6 kg/m.

**606-2.14 Transitions Constructed of, or with, Concrete.** Concrete transition between concrete barriers of different shapes and the concrete elements of transitions between metal barriers and concrete barriers shall conform to §606-2.07 Concrete Barrier, A. Precast Concrete Barrier or, with the permission of the Engineer, B. Cast-in-Place Concrete Barrier.

**606-3 CONSTRUCTION DETAILS**

**606-3.01 General.** All barrier systems and transitions described by these specifications shall be subject to the following requirements.

**A. Inspection of Rail Elements.** Immediately prior to erection, the rail elements shall be inspected for damage. Bends or kinks in the railing, not specifically required by the contract documents, shall constitute sufficient cause for rejection. Straightening of such bends or kinks will not be allowed.

Erection of all guide rail, median barrier, transitions and connections shall be subject to the inspection of the Engineer who shall be given all facilities required for a visual inspection of workmanship and materials.

**B. Field Galvanizing For Repair.** Field galvanizing repair shall be allowed only when the total damaged area on each piece or component is less than 2 percent of the coated surface, or 10 000 mm², whichever is less. Any single piece or component with total damaged area greater than the amount specified above shall be rejected and replaced by the Contractor. Field galvanizing repair shall be done in accordance with the requirements of the Repair section of §719-01 Galvanized Coating And Repair Methods.
C. Field Welding. Field welding shall not be permitted unless noted in the contract documents. When specified, welding shall comply with the requirements of the SCM.

D. Erection. Posts, railing, barrier systems, rail transitions, end assemblies, anchorage units, and pier protection shall be erected in the position and manner indicated on the standard sheets, manufacturer’s drawings, manufacturer’s directions and contract plans and in a manner approved by the Engineer. Rail mounting height shall be within ± 6 mm of that indicated on the standard sheets and plans.

Prior to installing guide rail, median barrier, transitions, or end terminals, the Contractor shall determine the locations of all structures, including underground structures, that may be affected by the installation. If the determinations disclose that there are conflicts between the proposed installation of guide rail, median barrier, transition, or end terminal and other structures, including underground structures, the Contractor shall discuss with and recommend to the Engineer alternative locations or types of guide rail, median barrier, transition, or end terminal, subject to the approval of the Engineer, that will not be in conflict with the structure, including underground structure.

Posts and foundation tube(s) shall be driven unless otherwise specified by the Engineer. The driving shall be accomplished with approved equipment and methods that will leave the posts and foundation tube(s) in their final position, free of any distortion, burring or other damage. When posts and foundation tube(s) are driven through asphalt concrete or a bituminous treated material, the Contractor shall take care to prevent damage to the paved or treated areas. Large holes and voids caused by driving the posts and foundation tube(s) shall be filled and compacted with a bituminous treated material or asphalt concrete similar to that damaged. The small area adjacent to the post and foundation tube(s) disturbed during installation or where gaps exist at the post and foundation tube(s) after pavement repairs shall be sealed with a bituminous material approved by the Engineer.

As an alternate to driving posts and foundation tube(s) on unpaved medians and where site conditions are such that driving is not possible, the Contractor shall carefully excavate for all post and foundation tube(s) holes. Post and foundation tube(s) holes and post and foundation tube(s) foundation structures shall be backfilled and backfilled material compacted in accordance with §203-3.15, Fill and Backfill at Structures, Culverts, Pipes, Conduits and Direct Burial Cables.

On structures and paved medians, base plates for posts shall be anchored as shown on the plans and as specified by the Engineer. Where drilling and grouting is required, the Contractor shall take care to prevent damage to the concrete, asphalt or other paved surfaces. The proposed construction method and equipment for drilling and grouting of holes shall be submitted to the Engineer for approval before drilling and grouting operations begin. Anchoring devices shall be grouted with §701-05, Concrete Grouting Material or §721-03 Epoxy Polysulfide Grout.

The work of installing the guide railing system when it abuts stabilized shoulder courses shall be coordinated and progressed to provide the least disturbance between the two phases of the work.

All posts shall be aligned to a tolerance of 6 mm for plumb and grade line.

Curved box beam and corrugated beam guide railing and median barrier rail elements shall require shop curving in accordance with Table 606-1.

| TABLE 606-1 SHOP CURVED GUIDE RAILING AND MEDIAN BARRIER |
|-----------------------------|------------------|
| Barrier Type                | Radius Requiring Shop Curving |
| Box Beam Guide Railing      | Equal to or less than 220 m |
| Box Beam Median Barrier     | Equal to or less than 465 m |
| Corrugated Beam Guide Railing | Equal to or less than 45 m |
| Corrugated Beam Median Barrier | Equal to or less than 45 m |

When shop curving is required, the rail element shall be shop-worked to the radius that the barrier will be installed on.

E. Concrete Anchorage Units. Concrete anchors shall be constructed as detailed on the standard sheets. Excavation shall meet the requirements of §206-3 of the Standard Specifications. The bottom of the anchor shall have a full and even bearing on the surface under it. After the concrete anchor is in place, the excavation shall be backfilled in accordance with §203-3.15 of the Standard Specifications.
F. End Terminals and Assemblies. The following shall apply to end terminals or assemblies to be installed under this section.

1. Drawings. For end terminals and end assemblies not shown on standard sheets or detailed in the plans, the Contractor shall submit two copies of the manufacturer’s drawings, modified as necessary to reflect site conditions, to the Engineer for approval prior to ordering any materials required under this section. Drawings of parts not detailed on the plans, but which are necessary to develop the full performance of the end assemblies or terminals shall also be provided. The Contractor shall commence work of installation of end assemblies or terminals only after approval of the above mentioned drawings and authorization from the Engineer to do so.

2. Manuals. In addition to the drawings mentioned above, the Contractor shall deliver to the Engineer two (2) copies of design manuals, installation manuals, parts lists, and maintenance manuals prepared for each type end terminal or assembly being installed but not shown on the standard sheet.

3. Coordination with Other Work. The work of furnishing and installing all types of end assemblies shall be coordinated with the removal of existing impact attenuators or end assemblies, the installation of guide railing or median barrier, or the installation of the object to be shielded, so as to minimize the time that motorists are exposed to the possibility of collision with the shielded object, unprotected ends of barriers, or incomplete end terminals or assemblies. Also, the contractor shall minimize exposure of approaching vehicular traffic to the possibility of impact on the back of the end assembly. Unless modified in the Contract Documents, minimization shall mean seven (7) or fewer calendar days.

4. Traffic Protection. Traffic protection devices, such as cones, drums, lights, signs, barricades, or other articles directed by the Engineer, shall be provided and maintained under their respective pay items. These devices shall not be removed until the end assembly, including required transition pieces, is fully operational. If the end assembly is to be installed in lighted areas, or in areas to be lighted, the mentioned traffic protection articles shall also be maintained until the lighting system is operational.

606-3.02 Cable Guide Railing. Commencing with the first post where the rail is parallel to the edge of pavement, every sixth post in the line of guide rail shall be reflectorized (30 m spacing for reflectors) except those posts in the approach terminal and intermediate anchorage area which curve away from the shoulder. The reflector and method of attachment shall be as indicated on the standard sheet.

A. Anchorage Unit Assemblies. After the end posts are driven to the specified line and grade, the “clamped on” bearing angles shall be adjusted in the field to provide a full and even bearing on the underlying surface.

B. Cable Guide Railing Tensioning. The Contractor shall install and tension the cable guide railing as follows. Properly seat the spring compensation device and then permanently mark the unloaded position. Complete the assembly of the guide railing and set the compensating devices to a spring compression of 90 mm. Leave the springs at this setting for at least 2 weeks, then set them to the proper setting according to temperature from the data in the table on the standard sheet for Cable Guide Railing.

606-3.03 Box Beam Guide Railing and Median Barrier. Rail sections for tangent runs shall be at least 5.5 m long. Rail splices shall be a minimum of 45 mm from the centerline of any post.

During non-working hours, exposed approach ends (free ends) of the box beam guide railing or median barrier shall be temporarily terminated with box beam guide railing end assemblies utilizing two splice plates and eight bolts per temporary termination connection. No posts for anchorages will be required. Special temporary splice plates will be needed to adapt box beam guide railing end assemblies to box beam median barrier.
606-3.04 Corrugated Beam Guide Railing and Median Barrier, and Heavy Post Blocked-Out Corrugated Beam Guide Railing and Median Barrier. In the erection procedures, the free end of the rail element shall not be allowed to swing free and cantilever around the mounting bolt. The free end shall be supported in a manner approved by the Engineer while the splice bolts and mounting bolts are fastened.

During non-working hours, exposed approach ends (free ends) of the guide railing or median barrier shall be dropped to the ground and pinned in a manner approved by the Engineer.

A. Corrugated Beam Guide Railing and Median Barrier. The rail elements shall be installed so the weight of the beam rests on the double nutted support bolt before the 8 mm mounting bolts are torqued. Before the final torquing, six of the 8 mm mounting bolts in the installation shall be selected at random and with a suitable torque wrench tightened to failure. The six readings shall be averaged, the six failed bolts replaced and all the mounting bolts in the installation torqued to 50% of the average value.

Support bolts shall be installed on all the guide rail posts except the three posts adjacent to the anchors.

B. Heavy Post Blocked-Out Corrugated Beam Guide Railing and Median Barrier. The heavy post blocked-out corrugated beam guide railing shall be erected from the approach end anchorage unit and downstream along the flow of traffic.

The heavy post blocked-out median barrier shall be erected from one of the anchorage sections and shall be completed as the work progresses. During non-working hours no uncompleted anchorage units or heavy posts without rail will be permitted on either heavy post blocked-out guide railing or median barrier.

For heavy post blocked-out corrugated beam guide railing connections to walls (trailing ends), the holes for the expansion anchors shall be drilled to the minimum depths and diameters shown on the plans or standard sheets or to larger values if specified by the manufacturer. The holes shall be drilled with care to avoid damage to the wall. Any damage caused by the drilling operation shall be repaired by the Contractor and to the satisfaction of the Engineer.

606-3.05 Concrete Barrier. Unless specified otherwise in the contract documents the Contractor shall have the option of providing precast concrete barrier, cast-in-place concrete barrier, or machine formed barrier. No intermixing in any run of barrier will be permitted unless shown otherwise in the contract documents except that precast transition sections and ends may be used with cast-in-place or machine formed concrete barriers.

Half section concrete barrier shall be erected with the appropriate back-up posts and continuity plates or earth back-up as shown on the standard sheets and plans.

A. Precast Concrete Barrier

1. Placement. Immediately prior to installation, the Engineer shall inspect the sections for manufacturing defects or shipment damage. Damaged or defective sections shall be rejected or repaired in accordance with §704-05. Precast Concrete Barrier, Repair. The sections shall be placed in accordance with the contract plans and proposals.

2. Vertical Expansion Joint. Sections shall be separated by 13 mm nominal joint openings. The joint opening, at any point in the plane of the joint, shall be not less than 12 mm and no more than 13 mm. Premoulded Resilient Joint Filler conforming to the requirements of §705-07 or Joint Filler conforming to the requirements of ASTM D 1056 Grade 2B1 or 2B2 shall be placed in the joint as shown on the plans, standard sheet or as directed by the Engineer.

3. Dimensional Tolerance.

a. Cross-sectional dimensions shall not vary from the dimensions shown by more than 5 mm.
b. The barrier shall not be out of plumb by more than 5 mm.
c. Longitudinal dimensions shall not vary from the dimensions shown by more than 5 mm per 3.0 m of the barrier.
d. When checked with a 3.0 m straight edge, irregularities shall not exceed 5 mm.

**B. Cast-in-Place Concrete Barrier**

1. **Placing.** The Contractor shall have the option of placing the cast-in-place concrete barrier in monolithic form or with a horizontal construction joint between the stem and the rectangular footing.

   a. **Horizontal Construction Joint Option.** When the Contractor elects to use a horizontal construction joint between the stem and the rectangular footing, joint details must be prepared and submitted to the Regional Director for approval. The footing shall be placed in lengths not exceeding 18 m except when the barrier system abuts a reinforced Portland Cement concrete pavement, then it shall match the length of the pavement slab. Every third vertical joint of the barrier stem shall exactly match the joint formed in the footing.

      When the barrier abuts an unreinforced pavement slab, the vertical joint in the footing and stem shall match the pavement joint at every third pavement slab.

   b. **Monolithic Barrier.** When the Contractor elects to use a monolithic barrier the lengths of the sections shall not exceed 6 m except when the barrier abuts a Portland Cement concrete pavement. Then the sections shall be cast in uniform lengths so that every third joint will exactly match the transverse joint in the pavement when reinforced concrete is used and every joint when unreinforced concrete is used.

2. **Joints.** The sections of barrier, in monolithic barrier, and of stem in horizontal construction joint barrier shall be separated by vertical expansion joints with provisions for expansion of 13 mm at each joint. Premoulded Resilient Joint Filler conforming to the requirements of §705-07 shall be placed in the joint as shown on the plans, standard sheet, or as directed by the Engineer.

3. **Forms.** Forms shall be metal and of such construction that there will be minimum interference to inspection for grade and alignment. Forms shall be braced and secured adequately so that no discernible displacement from alignment or grade will occur during placement of concrete.

4. **Concrete Placing and Vibrating.** Concrete shall be placed in the barrier forms in accordance with the requirements of §555-3.04 Handling and Placing Concrete. Concrete shall be compacted by means of immersion type mechanical vibrators approved by the Engineer. The vibrator shall be inserted into the concrete at 300 mm intervals. The vibrators shall be of size and weight sufficient to thoroughly vibrate the entire concrete mass without damaging or misaligning the forms or reinforcement.

5. **Removal of Forms and Finishing Surfaces.** Forms shall be left in place for 24 hours or until, in the judgment of the Engineer, the concrete has sufficiently set so that the forms may be removed without injury to the barrier. Immediately after the forms have been removed, surfaces exposed to view shall have all projections and irregularities carefully removed and all cavities neatly filled with mortar of the proportion used in the concrete. The same brand of cement and the same kind of fine aggregate shall be used for filling cavities as was used in the original concrete mix. Surfaces repaired by plastering will not be allowed.

6. **Concrete Curing.** Curing of concrete median barriers shall conform to the requirements given in 555-3.08 Curing. Other methods of curing may be used only when so indicated on the plans or in the itemized proposal.

7. **Reinforcement.** The Contractor shall incorporate reinforcement as indicated on the standard sheets and plans. All reinforcing steel shall be epoxy coated meeting the requirements of §709-04.
8. Placement Adjacent to Cement Concrete Pavement or Shoulders. The barrier shall be separated from the cement concrete pavement or shoulder by a 13 mm wide vertical joint extending down to the bottom of the pavement or shoulder. The joint shall be formed with and contain Premoulded Resilient Joint Filler conforming to the requirements of §705-07. A recess of approximately 25 mm shall be provided at the top of the joint for installation of a backer rod and joint sealant. The joint sealant shall be a silicone sealant appearing on the Department’s Approved List and shall be applied in accordance with the manufacturer’s instructions.

9. Dimensional Tolerance

a. Cross-sectional dimensions shall not vary from the dimensions shown by more than 5 mm.
b. The barrier shall not be out of plumb by more than 5 mm.
c. Longitudinal dimensions shall not vary from the dimensions shown by more than 5 mm per 3.0 m of the barrier.
d. When checked with a 3.0 m straight edge, irregularities shall not exceed 5 mm.

C. Machine Formed Concrete Barrier

1. Weather Limitations. The requirements of §502-3.01 shall apply.

2. Equipment. The slipforming equipment shall be self-propelled and shall be capable of placing, consolidating and finishing concrete to the proper line and grade. The Engineer may require the Contractor to demonstrate that the specific equipment proposed for use is capable of satisfactorily placing the concrete mix. The Contractor shall furnish the manufacturer's data regarding machine operation to the Engineer.

3. Preparation of the Subbase Course. Before any concrete may be placed, the subbase course shall be compacted and fine graded to a tolerance of 13 mm of the true grade at any location under the barrier. Whenever possible, as determined by the Engineer, concrete placing operations shall not begin until the subbase course has been fine graded ahead at least 300 m.

4. Reinforcement. The Contractor shall incorporate reinforcement as indicated on the standard sheets and plans. All reinforcing steel shall be epoxy coated meeting the requirements of §709-04.

5. Placing Operations

a. Central and Transit Mixed Concrete. The provisions of §501-3.03 C and D shall apply for Central Mixed and Transit Mixed Concrete respectively, except that water may be added at the point of deposition to maintain the desired slump. The water addition may be made at any time after the beginning of the discharge until approximately two-thirds (2/3) of the load, as determined by the Engineer, has been discharged. After the water addition the concrete shall be mixed at least 30 revolutions in the mixing range. When the water additions made after discharge the total number of revolutions shall not be more than 190.

b. Truck Mixed Concrete. The provisions of §501-3.03 E shall apply except that after the initial slump has been achieved, water may be added to the mixture one additional time to maintain the desired slump. The water addition may be made anytime after the beginning of discharge until approximately two-thirds (2/3) of the load, as determined by the Engineer, has been discharged. After the water addition, the concrete shall be mixed at least 30 revolutions in the mixing range.

The slipforming equipment shall have as nearly a continuous forward movement as possible to provide uniform progress with stopping and starting of the equipment held to a minimum. Any edge slump resulting from slipforming operations in excess of 6 mm, as measured from the top surface of the median barrier, exclusive of edge rounding, shall be corrected before the concrete has hardened.
Concrete supply shall be sufficient to produce a continuous, completely shaped barrier. If concrete placement is interrupted for a period of time where the delay will affect the quality and structural integrity of the barrier, the contractor shall terminate his operations by one of the following procedures. The Engineer shall determine when the slipform operation is to be terminated.

**Method A.** Construct a cast in place expansion joint system as detailed on the standard sheets.

**Method B.** Remove existing unset concrete to a vertical score line with hand tools. The vertical surface resulting from the removed concrete shall remain reasonably rough and unfinished to facilitate interlock and increased bond area when concrete operations are to be resumed. The vertical surface shall be touched up with hand tools, as directed by the Engineer, to correct unacceptable voids, tears and lack of consolidation resulting from the concrete removal. The surface shall be covered with several layers of wet burlap to prevent drying. All reinforcing steel shall extend beyond the face to provide adequate lapping.

Concreting operations may resume at the terminated face when the terminated portion has achieved enough rigidity to withstand the sequence of operations it will be subjected to without sustaining damage. All loose or unacceptable concrete and material shall be removed from the terminated face as directed by the Engineer. Concrete barrier damaged as a result of the contractor's operations shall be repaired to the satisfaction of the Engineer.

Termination of slipform operations at the end of the day for an uncompleted run shall be by method A or B above.

6. **Curing.** The median barrier shall be cured using a clear curing compound meeting the requirements of §711-05. The compound shall be sprayed on the concrete surface immediately following the placing operation at a rate of 1 L /3.5 m$^2$.

7. **Placement Adjacent to Cement Concrete Pavement or Shoulders.** The barrier shall be separated from the cement concrete pavement or shoulder by a 13 mm wide vertical joint extending down to the bottom of the pavement or shoulder. The joint shall be formed with and contain Premoulded Resilient Joint Filler conforming to the requirements of §705-07. A recess of approximately 25 mm shall be provided at the top of the joint for installation of a backer rod and joint sealant. The joint sealant shall be a silicone sealant appearing on the Department's Approved List and shall be applied in accordance with the manufacturer's instructions.

8. **Contraction Joints.** Contraction joints shall be formed or saw cut normal to the pavement. The spacing shall be every 6 m, as shown on the plans or as ordered by the Engineer. The joints shall conform to the dimensions as shown on the plans or standard sheets. If the joints are saw cut, they shall be saw cut as soon as no damage to the concrete will result, with a maximum time of 8 hours. The clear curing compound shall be reapplied at the saw cut.

9. **Expansion Joints.** Expansion joints shall be formed normal to the pavement with Premoulded Resilient Joint Filler meeting the requirements of §705-07 and shall provide for expansion of 13 mm. The filler material shall be cut to conform to the cross section of the barrier.

The expansion joints shall be located at all immovable objects (bridge substructures, etc.), where shown on the plans, and/or as directed by the Engineer. Expansion joints shall not be required at regular intervals unless shown on the plans.

10. **Tolerances.** All concrete barrier produced by this method shall conform to the following tolerances:

   a. **Placing Tolerances**

   (1) Bar Reinforcement Cover 0 to +13 mm.
   (2) Width (top) 0 to +6 mm.
(3) Width (base) 0 to + 13 mm.

b. Dimensional Tolerance

(1) Cross-sectional dimensions shall not vary from the dimensions shown by more than 5 mm.
(2) The barrier shall not be out of plumb by more than 5 mm.
(3) Longitudinal dimensions shall not vary from the dimensions shown by more than 5 mm per 3.0 m of the barrier.
(4) When checked with a 3.0 m straight edge, irregularities shall not exceed 5 mm.

11. Defects. Defects are divided into two categories: Minor defects and major defects. Minor defects in the barrier may be repaired in the field. Major defects shall be cause for rejection of the section, or the section shall be repaired in the manner directed by the Engineer.

a. Minor Defects. Minor defects are defined as holes, honeycombing or spalls which are 150 mm or less in diameter, and which do not expose the outermost surface of the steel reinforcement. Surface voids 15 mm, or less, in diameter and 6 mm, or less, in depth are not considered defects and they do not require repair.

b. Major Defects. Major defects are defined as:

(1) Any defect which does not meet the definition of a minor defect.
(2) Minor defects which, in aggregate, comprise more than five percent (5%) of the surface area of the barrier section.

12. Repair. Repair of hardened concrete shall be as follows:

a. Minor Defect Repair. Repair shall be made with a material meeting the requirements of §701-04. Methods of repair shall be acceptable to the Engineer. The color of the repaired portion shall match as nearly as practicable, the color of the surrounding concrete. Repaired portions shall exactly match shape requirements. The repaired portion shall withstand a moderate blow from a 0.5 kg hammer.

b. Major Defect Repair. Major defect repair shall be preapproved by the Engineer.

13. Hand Finishing. The Contractor shall make provisions to allow hand finishing, when directed by the Engineer, on all surfaces. Hand finishing, if done shall be done immediately after the passage of the slipforming equipment. Curing compound shall be applied only after hand finishing has been completed at any particular location.

14. Transitions and Tapered End Sections. Transitions and tapered end sections shall be either cast-in-place or precast, at the Contractor’s option.”

606-3.06 Resetting Guide Railing, Median Barrier and Precast Concrete Barrier. The Contractor shall remove, store, clean and reset railing, posts, and precast concrete barrier as shown on the plans or as directed by the Engineer. The reset guide railing and/or median barrier shall be placed in accordance with the requirements of §606-3.01 General. Reset concrete barrier shall be placed in accordance with the requirements of §606-3.05 Concrete Barrier. During non-working hours, exposed approach ends (free ends) of the reset guide railing and/or median barrier shall be temporarily terminated as follows: Box beam guide railing and/or median barrier shall be temporarily terminated with box beam guide railing end assemblies utilizing two (2) splice plates per temporary termination connection. No posts for anchorages shall be required. Special temporary splice plates will be needed to adopt box beam guide rail end assemblies to box beam median barriers. Corrugated guide railing and/or median barrier, and heavy post blocked-out corrugated guide railing and/or median barrier shall be temporarily terminated by dropping the exposed approach ends (free ends) of the rail element to the ground and
pinning it in a manner approved by the engineer. Any rail element or component of the barrier damaged shall be replaced by the Contractor.

606-3.07 Resetting Guide Railing and Median Barrier (New Posts). The construction details of §606-3.06 shall apply, except that the Contractor shall furnish and install new posts.

606-3.08 Removing and Storing Guide Railing, Median Barrier, and Precast Concrete Barrier. The Contractor shall remove designated existing guide railing, median barrier and precast concrete barrier and neatly store the component parts in separate piles at locations designated for future pick up by Department forces, or its designee. The work shall be done in a workmanlike manner so as to salvage all usable parts. Unusable material shall be disposed of by the Contractor.

606-3.09 Removing and Disposing of Guide Railing, Median Barrier, Concrete Barrier, Guide Posts, Guide Rail Posts, and Median Barrier Posts. The Contractor shall remove designated existing guide railing, median barrier, concrete barrier, guide posts, guide rail posts, and median barrier posts and remove them from the site of work. Holes shall be backfilled with a suitable material and compacted in a manner approved by the Engineer.

606-3.10 I-Beam Posts for Existing Highway Barrier. I-beam posts for existing highway barrier shall be installed at the locations indicated in the contract documents or where directed by the Engineer. The driving shall be in accordance with the requirements of §606-3.01 and the applicable standard sheet(s). All hardware necessary for mounting the rail elements or cable to the post shall be supplied by the Contractor. New heavy post steel block-outs shall be supplied to replace damaged or unusable block-outs. S75x8.5 posts installed as intermediate posts to reduce post spacing on corrugated beam guide railing, corrugated beam median barrier, and box beam guide railing shall not be attached to the rail element.

All reflectors, delineators, reference markers, or other items, which are to remain in place, that are damaged by the Contractor's operations shall be replaced by the Contractor.

606-3.11 Retensioning Existing Gable Guide Railing. Cable guide rail shall be retensioned at the locations indicated in the contract documents and as directed by the Engineer. Retensioning shall be performed in accordance with the requirements of §606-3.02.

606-3.12 Resetting Anchorage Unit Assemblies and End Assemblies for Guide Railing and Median Barrier. The Contractor shall remove, store, clean and reset existing anchorage units and end assemblies for Guide Railing and Median Barrier as shown on the plans or as directed by the Engineer. The anchorage units and end assemblies shall be reset and placed in accordance with the requirements of §606-3.01 General.

Existing concrete anchors and deadman may be left in place and replaced with new ones if the top of the existing anchor or deadman is at least 150 mm below final grade and the anchor or deadman will not be an obstruction to other construction.

The Contractor shall take care so reusable parts are not damaged by his operations. Any parts damaged in handling and placing shall be replaced by the Contractor. Unusable material shall be disposed of by the Contractor.

Surface areas disturbed during the removal operations shall be reestablished, as nearly as possible, to match the adjacent surfaces to remain.

606-3.13 Removing and Storing Anchorage Unit Assemblies and End Assemblies for Guide Railing and Median Barriers. The construction details of §606-3.08 shall apply. Excavation and backfill shall be in conformance with the requirements outlined in §606-3.01E.

Existing concrete anchors and deadman may be left in place if the top of the existing anchor or deadman is at least 150 mm below final grade and the anchor or deadman will not be an obstruction to other construction.

606-3.14 Removing and Disposing Anchorage Unit Assemblies and End Assemblies for Guide Railing and Median Barriers. The construction details of §606-3.13 shall apply except the
§606 Contractor shall dispose of the Anchorage Unit Assemblies and End Assemblies in a manner approved by the Engineer.

606-3.15 Box Beam Guide Rail Transition to Concrete Barrier. The contractor shall construct a guide rail transition from concrete barrier to box beam guide rail at the locations indicated and as detailed on the contract plans. The work shall conform to the requirements of §606-3.01.

606-3.16 Corrugated Beam Guide Rail Transition to Bridge Rail, Concrete Barrier and Concrete Parapets. The contractor shall construct corrugated beam guide transitions to bridge rail, concrete barrier and/or concrete parapets at the locations and as detailed on the contract plans. The requirements of §606-3.01 shall apply together with the following:

Railing shall be erected so that the rails are parallel to the roadway, except in those sections where it is necessary to vertically transition the highway barrier to the bridge railing, or barrier. Bending or curving of rail elements in order to fit alignment requirements in the field shall not be permitted. The Engineer may order some bending or curving to allow for necessary minor adjustments. The Contractor shall exercise care in attaching the guide rail to the bridge rail so as not to damage the rails, posts, or joints, or splices. Any damage to the material attributable to the Contractor's operation shall require that the material be repaired, or replaced. The decision to repair, or replace, shall rest solely with the Engineer.

606-3.17 Rustic Barrier. In order to develop the aesthetic property of rustic barrier to its maximum the Contractor shall remove all mill scale from the surfaces of all weathering steel that will be exposed to view from the roadway. All surfaces are to be free of mud, grease, oil and paint. When either materials or finished products are in storage or transit, all necessary precautions shall be taken to prevent water stains and other surface adulteration that will deter from ultimately achieving the uniform and sound weathering characteristics of the base metal.

Care shall be taken during the field erection of the barrier system to avoid surface scratches and gouges. The Contractor is put on notice that cleanliness is most important in obtaining the early and uniform weathered surface. Where soilage is too severe to be removed by hand cleaning, the soiled areas shall be cleaned by other methods such as power brush cleaning in a manner approved by the Engineer.

606-3.18 Pier Protection. Pier protection shall be installed in accordance with the standard sheets, contract documents and directions of the Engineer. The half section precast concrete barrier units shall be backed up with either fully compacted excavated material or steel backup posts except when only one method is specified or indicated in the contract documents. Steel continuity connections shall be required on the half section barrier units when back up posts are utilized.

606-3.19 Transitions Constructed of, or with, Concrete. Transitions constructed of concrete and the concrete elements of transitions constructed of metal components and concrete elements shall be constructed at the locations indicated in the contract documents, or those indicated by the Engineer, in accordance with these specifications, the contract documents, and the directions of the Engineer. The shapes indicated on the Standard Sheets are standard. The Deputy Chief Engineer (Design) will consider other shapes for approval.

§606-3.05 Concrete Barrier, A. Precast Concrete Barrier and B. Cast-in-Place Concrete Barrier shall apply.

606-4 METHOD OF MEASUREMENT

606-4.01 Cable, Corrugated Beam or Box Beam Guide Railing and Median Barrier. The quantity of guide railing or median barrier measured for payment will be the number of meters measured along the axis of the railing and between its extreme outer limits as shown on the plans and/or standard sheets or as directed by the Engineer. The quantity of shop curved guide railing or median barrier shall be the number of meters measured along the axis of the curved railing. Shop curved guide railing or median barrier is defined as that which will require shop working in accordance with the requirements of these specifications and not that curvature which may be attained by springing or bending in the field. If the
railing is anchored to a structure instead of an anchorage unit or end assembly, the railing will be measured up to the structure.

Where curved corrugated beam guide railing or median barrier is specifically called for on the contract plans or ordered in writing by the Engineer and no provision for such curved beam railing is included in the contract proposal, the quantity of railing measured for payment will be as described above plus an additional allowance of 33 1/3% of the curved lengths at a factor of 1.0 measured along the horizontal center line of the beam.

**606-4.02 Anchorage Units, End Assemblies and Transitions for Guide Railing or Median Barrier.** Anchorage units, end assembly units and transitions between various highway guide railing and median barrier systems will be measured by the actual number of units installed in accordance with the plans, standard sheets, manufacturer’s drawings’, manufacturer’s directions and/or as directed by the Engineer.

The payment limits for the Box Beam Guide Rail End Assembly Type III and Box Beam Median Barrier End Assembly, Type C will be separated by a distance of 15 meters extending along the end assembly from the front of the Nose Assembly to a point 15 meters removed. These payment limits apply regardless of whether the Type III End Assembly or Type C End Assembly employs crushable fiberglass elements or beam bursting type mandrels to absorb the energy of the impacting vehicle.

**606-4.03 Concrete Barrier and Terminal Sections.** The quantity of concrete barrier and terminal sections measured for payment will be the number of meters placed in accordance with the plans and specifications, measured along the axis of the barrier and between its extreme outer limits, unless otherwise indicated on the plans or in the proposal.

**606-4.04 Resetting Guide Railing, Median Barrier and Precast Concrete Barrier.** The quantity of reset guide railing or median barrier measured for payment will be the number of meters reset in accordance with the specifications, plans and as directed by the Engineer, exclusive of anchorage units and end assemblies. If the guide railing is anchored to a structure instead of an anchorage unit or end assembly, measurement will be made up to the structure. The quantity of reset precast concrete barrier measured for payment will be the number of meters placed in accordance with the plans and specifications measured along the axis of the barrier between its extreme outer limits.

**606-4.05 Resetting Guide Railing and Median Barrier (New Posts).** The Method of Measurement of §606-4.04 will apply.

**606-4.06 Removing and Storing Guide Railing, Median Barrier and Precast Concrete Barrier.** The quantity of removed and stored guide rail and median barrier measured for payment will be the number of meters removed in accordance with the specifications, plans and as directed by the Engineer, exclusive of anchorage units and end assemblies. If the guide rail or median barrier is anchored to a structure instead of an anchorage unit or end assembly, measurement will be made up to the structure. The quantity of removed and stored precast concrete barrier measured for payment will be the number of meters removed in accordance with the specifications and plans, measured along the axis of the barrier between its extreme outer limits.

**606-4.07 Removing and Disposing of Guide Railing, Median Barrier and Concrete Barrier.** The quantity of guide rail and median barrier measured for payment will be the number of meters removed and disposed of in accordance with the specifications, plans, and as directed by the Engineer, exclusive of anchorage units and end assemblies. The quantity of concrete barrier measured for payment will be the number of meters removed and disposed of in accordance with the specifications and plans measured along the axis of the barrier between its extreme outer limits.

**606-4.08 Removing and Disposing of Guide Posts, Guide Rail Posts, and Median Barrier Posts.** The quantity to be measured for payment will be the number of posts removed and disposed of in accordance with the specifications and plans and as directed by the Engineer.

**606-4.09 Resetting Anchorage Unit Assemblies and End Assemblies for Guide Railing and Median Barrier.** This work shall be measured by the number of anchorage units and/or end
assemblies reset in accordance with the requirements of the contract documents and in a manner approved by the Engineer.

606-4.10 Removing and Storing or Disposing of Anchorage Unit Assemblies and End Assemblies for Guide Railing and Median Barrier. This work shall be measured by the number of Anchorage Units or End Assemblies properly removed and stored for pick up by others or removed and disposed of in accordance with the contract documents and to the satisfaction of the Engineer.

606-4.11 Retensioning Existing Gable Guide Railing. Method of measurement will be the number of sections retensioned. A section shall consist of the length of cable guide rail running between two concrete anchorage units.

606-4.12 Heavy Post Blocked-Out Corrugated Beam Guide Railing Connections to Walls (Trailing Ends). Guide railing connections to walls will be measured by the number furnished and installed in accordance with the plans, specifications, standard sheets, and as directed by the Engineer.

606-4.13 Corrugated Beam Guide Rail Transition to Bridge Rail, Concrete Barrier and Concrete Parapets. Measurement will be taken as the actual number of transition units installed in accordance with the plans and specifications.

606-4.14 Box Beam Guide Rail Transition to Concrete Barrier. Measurement will be taken as the actual number of transition units installed in accordance with the specifications, plans and standard sheets.

606-4.15 Pier Protection. Pier protection shall be measured by the number of meters measured along the top centerline of the steel box beam and between the pay limits as shown on the plans and/or standard sheets.

606-4.16 I-Beam Posts for Existing Highway Barrier. I-beam posts for existing highway barrier will be measured by the actual number of posts installed in accordance with the contract documents and as directed by the Engineer.

606-4.17 Transition between Concrete Sections. Transitions will be measured by the actual number of units installed in accordance with the plans, standard sheets and/or as directed by the Engineer.

**TABLE 606-2 PAYMENT FACTORS FOR GUIDE RAIL AND MEDIAN BARRIER POST SPACING**

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<th>1.4</th>
<th>1.6</th>
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<td>---</td>
<td>---</td>
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<td>950</td>
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* For cable guide rail, the post spacing in the typical approach, terminal sections and typical intermediate anchorage sections as indicated on the standard sheets, shall have payment factors of 1.0.

606-5 BASIS OF PAYMENT

606-5.01 Guide Railing, Median Barrier, Concrete Barrier and Terminal Sections; Various Types. The unit price bid per meter for the above work shall include the cost of all labor, equipment and material necessary to complete the work, including the cost of any repairs required, and the costs of bending any rail element to the required curvature.

Payment for guide rail and median barrier shall include the unit price bid and the measured quantity multiplied by the payment factor for the various typical post spacings listed in Table 606-2.
Payment for box beam guide rail terminating and buried in a backslope with the posts embedded in rock shall have a payment factor of 2 for the last 6 meters.

When posts are driven through asphalt concrete or bituminous treated material, any repairs to damage paved or treated areas shall be at the Contractor's expense. Progress payments will be made when the metal railing and/or metal barrier is erected in the position and manner indicated on the standard sheets and in a manner approved by the Engineer, exclusive of bituminous repair and final alignment. Payment will be made, at the unit price bid, for 90% of the measured quantity erected. The balance of the quantity erected will be paid for upon proper repair to the bituminous surfaces and alignment of the metal railing and/or metal barrier to the specified tolerances.

606-5.02 End Assembly, End Anchorage Units and Transitions for Guide Railing and Median Barrier. The unit price bid for each end assembly, end anchorage unit or transition shall include the cost of furnishing all labor, materials and equipment necessary to complete the work, including the necessary concrete, excavation, backfill, reflectorization, object markers when required at driveways and vehicle openings, and spring cable assembly (compensating device) and/or steel turnbuckle cable end assembly required for cable guide rail.

606-5.03 Resetting; Removing and Storing; Removing and Disposing; of Guide Railing, Median Barrier and Concrete Barrier. The unit price bid per meter for the above work items shall include the cost of furnishing all labor, equipment and materials necessary to complete the work.

Any materials damaged due to Contractor's operation shall be replaced by him and the cost shall be included in the price bid for this item.

Payment for resetting guide rail and median barrier shall include the unit price bid multiplied by the measured quantity multiplied by the payment factor for the various typical post spacings listed in Table 606-1, except that posts required to reduce the post spacing from the original post spacing shall be paid for under the appropriate I-beam post for existing highway barrier item.

A. Progress payments for resetting guide rail, median barrier and precast concrete barrier will be made as follows:

1. 25% of the unit price bid for the quantity of guide rail, median barrier or precast concrete barrier removed and stored in accordance with the provisions of §606.3-06 Resetting Guide Railing, Median Barrier and Precast Concrete Barrier.
2. 65% of the unit price bid for the measured quantity of guide railing, median barrier or precast concrete barrier cleaned and reset in accordance with the provisions of §606-3.06.
3. The balance of the unit price bid for the quantity of the guide railing, median barrier or concrete barrier will be paid upon repair to the bituminous surfaces damaged by the resetting operations.

B. Progress payments for removing and disposing or storing of guide railing, median barrier or concrete barrier will be made as follows:

1. 75% of the unit price bid for the measured quantity of guide railing, median barrier or concrete barrier removed and stored or disposed of as specified.
2. The balance of the unit price bid for the measured quantity of guide railing and/or median barrier removed and stored or disposed of as specified will be paid when any voids have been backfilled and disturbed areas are reestablished to the satisfaction of the Engineer.

606-5.04 Removing and Disposing of Guide Posts, Guide Rail Posts and Median Barrier Posts. The unit price bid per post for the above work items shall include the cost of furnishing all labor, equipment and material necessary to complete the work.

606-5.05 Resetting; Removing and Storing; Removing and Disposing; of Anchorage Unit Assemblies and End Assemblies for Guide Railing and Median Barrier. The unit price bid for each of these items shall include the cost of furnishing all labor, equipment and material necessary to complete the work including excavation and backfill.
If the Contractor elects to install new concrete anchors, in lieu of removing and resetting the existing ones, the cost of furnishing and installing the new anchor as well as the cost for necessary adjustments to the existing one shall be included in the price bid for these items.

A. Progress payments for resetting anchorage unit assemblies and end assemblies for guide railing and median barrier will be made as follows:

1. 25% of the unit price bid for the quantity of anchorage unit assemblies and/or end assemblies removed and stored in accordance with the provisions of §606-3.12 Resetting Anchorage Unit Assemblies and End Section Assemblies for Guide Railing and Median Barrier.
2. 65% of the unit price bid for the quantity of anchorage unit assemblies and/or end assemblies cleaned and reset in accordance with the provisions of §606-3.12 Resetting Anchorage Unit Assemblies and End Section Assemblies for Guide Railing and Median Barrier.
3. The balance of the unit bid price for the quantity of anchorage units assemblies reset upon the reestablishment of surface areas disturbed.

B. Progress payments for removing and storing or removing and disposing of anchorage unit assemblies and/or end assemblies for guide railing and/or median barriers will be made as follows:

1. 75% of the unit price bid for the quantity of anchorage unit assemblies and/or end assemblies removed and stored or disposed of as specified.
2. The balance of the unit price bid for the quantity of anchorage unit assemblies and/or end assemblies removed and stored or disposed of as specified will be paid upon the establishment of surface areas disturbed.

606-5.06 Heavy Post Blocked-Out Corrugated Beam Guide Railing Connections to Walls (Trailing Ends). The price bid for each guide railing connection shall include the cost of all labor, material, equipment and the repair of any damage caused by the Contractor's operations.

606-5.07 Corrugated Beam Guide Rail Transition to Bridge Rail, Concrete Barrier and Concrete Parapets. The unit price bid per guide rail transition shall include the cost of all labor, materials, and equipment necessary to satisfactorily complete the work, including back-up posts, connections and hardware.

606-5.08 Box Beam Guide Rail Transition to Concrete Barrier. The unit price bid per guide rail transition shall include the cost of all labor, equipment, and material necessary to satisfactorily complete the work, including back-up posts, necessary rail curvature, splices, connections and hardware.

606-5.09 Pier Protection. The price bid per meter of pier protection shall include the cost of all labor, materials and equipment necessary to complete the work. The curved box beam guide rail at each end of the assembly designed for two way traffic and on the approach end of the assembly designed for one way traffic, and the terminal sections shall be paid for under their own items.

606-5.10 I-Beam Posts for Existing Highway Barrier. The unit price bid for I-beam posts for existing highway barrier shall include the cost of furnishing all labor equipment and material necessary to complete the work. Removal of damaged posts and hardware is included in other items of work.

When posts are driven through asphalt concrete or bituminous treated material, any repairs to damaged paved or treated areas shall be at the Contractor's expense.

606-5.11 Retensioning Existing Gable Guide Railing. The unit price bid for retensioning a section of cable guide railing shall include the cost of all labor and equipment necessary to complete the work.

606-5.12 Transition between Concrete Sections. The unit price bid per concrete transition shall include the cost of all labor, equipment, and material necessary to satisfactorily complete the work, including back-up posts, connections and hardware.
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§606

606.325101 Heavy Post Blocked-Out Corrugated Beam Guide Railing
   With Extra Long Posts (Rustic) (Shop Curved) Meter

606.33 Heavy Post Blocked-Out Corrugated Beam Median Barrier Meter

606.330001 Heavy Post Blocked-Out Corrugated Beam Median Barrier (Shop Curved) Meter

606.3350 Heavy Post Blocked-out Corrugated Beam Median Barrier (Rustic) Meter

606.335001 Heavy Post Blocked-Out Corrugated Beam Median Barrier (Rustic) (Shop Curved) Meter

606.34 Anchorage Units for Heavy Post Blocked-Out Corrugated Beam
   Guide Railing Each

606.3450 Anchorage Units for Heavy Post Blocked-out Corrugated
   Beam Guide Railing (Rustic) Each

606.35 Anchorage Units for Heavy Post Blocked-Out Corrugated
   Beam Median Barrier Each

606.3550 Anchorage Units for Heavy Post Blocked-out Corrugated
   Beam Median Barrier (Rustic) Each

606.36 Heavy Post Blocked-Out Corrugated Beam Guide Railing
   Connections to Walls Trailing Ends Each

606.3650 Heavy Post Blocked-out Corrugated Beam Guide Railing
   Connections to Walls Trailing Ends (Rustic) Each

606.48 Retensioning Existing Cable Guide Railing Each

606.4801 I-Beam Posts for Existing Cable Guide Railing Each

606.4802 I-Beam Posts for Existing Cable Guide Railing (Rustic Posts) Each

606.4803 Extra Long I-Beam Posts for Existing Cable Guide Railing Each

606.4804 Extra Long I-Beam Posts for Existing Cable Guide Railing
   (Rustic Posts) Each

606.4805 I-Beam Posts for Existing Corrugated Beam Guide Railing
   Each

606.4806 I-Beam Posts for Existing Corrugated Beam Guide Railing (Rustic)
   Each

606.4807 Extra Long I-Beam Posts for Existing Corrugated Beam Guide Railing
   Each

606.4808 Extra Long I-Beam Posts for Existing Corrugated Beam
   Guide Railing (Rustic) Each

606.4809 I-Beam Posts for Existing Box Beam Guide Railing Each

606.4810 I-Beam Posts for Existing Box Beam Guide Railing (Rustic)
   Each

606.4811 Extra Long I-Beam Posts for Existing Box Beam Guide Railing
   Each

606.4812 Extra Long I-Beam Posts for Existing Box Beam Guide Railing (Rustic)
   Each

606.4813 I-Beam Posts for Existing Corrugated Beam Median Barrier
   Each

606.4814 I-Beam Posts for Existing Corrugated Beam Median Barrier (Rustic)
   Each

606.4815 I-Beam Posts for Existing Box Beam Median Barrier
   Each

606.4816 I-Beam Posts for Existing Box Beam Median Barrier (Rustic)
   Each

606.4817 I-Beam posts for Existing Heavy Post Blocked-Out Corrugated Beam
   Guide Railing Each

606.4818 I-Beam posts for Existing Heavy Post Blocked-Out Corrugated Beam
   Guide Railing (Rustic) Each

606.4819 Extra Long I-Beam posts for Existing Heavy Post Blocked-Out
   Corrugated Beam Guide Railing Each

606.4820 Extra Long I-Beam posts for Existing Heavy Post Blocked-Out
   Corrugated Beam Guide Railing (Rustic) Each

606.4821 I-Beam posts for Existing Heavy Post Blocked-Out Corrugated Beam
   Median Barrier Each

606.4822 I-Beam posts for Existing Heavy Post Blocked-Out Corrugated Beam
   Median Barrier (Rustic) Each

606.4823 Extra Long I-Beam posts for Existing Heavy Post Blocked-Out
   Corrugated Beam Median Barrier Each

606.4824 Extra Long I-Beam posts for Existing Heavy Post Blocked-Out
   Corrugated Beam Median Barrier (Rustic) Each

606.50  Resetting Cable Guide Railing Meter

606.5048 Resetting Cable Guide Railing (New Posts) Meter
### §606

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606.7945 Removing and Disposing Anchorage Units for Heavy Post Blocked-Out Corrugated Beam Median Barrier Each
606.8101 Guide Rail Transition Weak-Post Corrugated Beam to Box Beam Guide Rail (One or Two Way Operation) Each
606.8151 Guide Rail Transition Weak-Post Corrugated Beam to Box Beam Guide Rail (One or Two-Way Operation) (Rustic) Each
606.8201 Guide Rail Transition Box Beam to Weak-Post Corrugated Beam Guide Rail (One Way Only) Each
606.8251 Guide Rail Transition Box Beam to Weak-Post Corrugated Beam Guide Rail (One-way only) (Rustic) Each
606.83 Guide Rail Transition Cable to Box Beam (One or Two Way Operation) Each
606.8350 Guide Rail Transition Cable to Box Beam (One or Two-way Operation) (Rustic Posts and Box Beam) Each
606.84 Guide Rail Transition Box Beam to Cable (One Way Only) Each
606.8450 Guide Rail Transition Box Beam to Cable (One-Way Only) (Rustic Posts and Box Beam) Each
606.8501 Median Barrier Transition Weak-Post Corrugated Beam to Box Beam Each
606.8551 Median Barrier Transition Weak-Post Corrugated Beam to Box Beam (Rustic) Each
606.86 Guide Rail Transition Corrugated Beam to Thrie Beam Each
606.8701 Corrugated Beam Guide Railing Transition Assembly Two Rail Steel Bridge Railing Each
606.8702 Corrugated Beam Guide Railing Transition Assembly Four Rail Steel Bridge Railing Each
606.8703 Corrugated Beam Guide Railing Transition Assembly Discontinuous Steel Bridge Railing Each
606.8704 Corrugated Beam Guide Railing Transition Assembly Concrete Parapets, or Concrete Barrier Each
606.8705 HPBO Corrugated Median Barrier Transition to Single Slope Concrete Median Barrier Each
606.8706 HPBO Corrugated Median Barrier Transition to Jersey Shape Concrete Median Barrier Each
606.8707 Transition Between Concrete Half Section Barrier and HPBO Corrugated Beam Guide Railing Each
606.8755 HPBO Corrugated Median Barrier Transition to Single Slope Concrete Median Barrier (Rustic) Each
606.8756 HPBO Corrugated Median Barrier Transition to Jersey Shape Concrete Median Barrier (Rustic) Each
606.8757 Transition Between Concrete Half Section Barrier and HPBO Corrugated Beam Guide Railing (Rustic) Each
606.8801 Box Beam Guide Rail Transition to Concrete Barrier (One or Two Way Operation) Each
606.8802 Box Beam Guide Rail Transition to Concrete Barrier (One Way - Trailing End) Each
606.8803 Transition Between Box Beam Guide Rail and Single Slope Half Section Concrete Barrier (One or Two Way Operation) Each
606.8804 Transition Between Single Slope Half Section Concrete Barrier and Box Beam Guide Rail (One Way - Trailing End of Barrier) Each
606.8805 Transition Between Box Beam Median Barrier and Single Slope Concrete Median Barrier Each
606.8853 Transition Between Box Beam Guide Rail and Single Slope Half Section Concrete Barrier (One or Two Way Operation) (Rustic) Each
606.8854 Transition Between Single Slope Half Section Concrete Barrier and Box Beam Guide Rail (One Way - Trailing End of Barrier) (Rustic) Each
### SECTION 606 - MEDIAN BARRIERS

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<td>Guide Rail Transition Box Beam to Heavy Post Blocked-Out Corrugated Beam (Rustic)</td>
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<td>606.9001</td>
<td>Transition between Standard (NJ) Concrete Barrier and Single-Slope Concrete Barrier</td>
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<td>Transition between Wide and Normal Single Slope Concrete Median Barrier</td>
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<td>Pier Protection (Two Way)</td>
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<td>Median Barrier Transition Weak-Post Corrugated Beam to Heavy Post Blocked-out Corrugated Beam (Rustic)</td>
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### SECTION 607 - FENCES

#### 607-1 DESCRIPTION
This work shall consist of furnishing and erecting fencing and metal fence gates of the type and size, and at the locations shown on the plans or as directed by the Engineer. Construction of fencing and gates shall be done in accordance with the specifications, the standard sheets, and the plans, and in reasonable close conformity with the lines and grades shown on the plans or established by the Engineer.

#### 607-1.01 Fence Types
The fence shall be designated as follows:

- Optional Chain Link Fence Type I
- Optional Chain Link Fence Type II
- Vinyl Coated Chain Link Fence on Plastic Coated Frame
- Right-of-Way Fencing

The options for Type I and Type II chain link fences shall be as follows:

**TYPE I**

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<tr>
<th>Fabric Options</th>
<th>Frame Options</th>
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<tr>
<td>Coated Steel Fence Fabric</td>
<td>Mischmetal Alloy Coating (95% Zinc 5% Aluminum)</td>
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<tr>
<td>(95% Zinc 5% Aluminum- Mischmetal Alloy)</td>
<td>Galvanized Steel</td>
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<tr>
<td>Galvanized Steel</td>
<td>Combined Coating on Steel</td>
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<tr>
<td>Aluminum</td>
<td>Aluminum</td>
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<tr>
<td>Aluminum Coated Steel</td>
<td>Aluminum Coated Steel</td>
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**TYPE II**

<table>
<thead>
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<td>Mischmetal Alloy Coating (95% Zinc 5% Aluminum)</td>
</tr>
<tr>
<td>(95% Zinc 5% Aluminum- Mischmetal Alloy)</td>
<td>Galvanized Steel</td>
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<td>Combined Coating on Steel</td>
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<td>Vinyl Coated Steel</td>
<td>Plastic on Steel</td>
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<tr>
<td>Aluminum</td>
<td>Aluminum</td>
</tr>
<tr>
<td>Aluminum Coated Steel</td>
<td>Aluminum Coated Steel</td>
</tr>
</tbody>
</table>
Fence gates for Type I and Type II optional fences shall be consistent with the fabric and frame option selected for the contract. Fence frame and fabric selected shall be consistent throughout the contract except where intermixing is permitted by the Engineer.

### §607 MATERIALS

Materials shall conform to the requirements specified in the following subsections of Section 700 - Materials:

- Zinc Chromate Primer: 708-04
- Aluminum Fence Fabric: 710-01
- Galvanized Steel Fence Fabric: 710-02
- Vinyl Coated Steel Fence Fabric: 710-03
- Aluminum Coated Steel Fence Fabric: 710-04
- Coated Steel Fence Fabric (95% Zinc 5% Aluminum-Mischmetal Alloy): 710-05
- Steel and Iron Posts, Rails, Braces and Fittings for Chain-Link Fence: 710-10.03
- Aluminum Posts, Rails, Braces and Fittings for Chain-Link Fence: 710-11
- Plastic Coated Posts, Rails, Braces and Fittings for Chain-Link Fence: 710-12
- Right-of-Way Fencing: 710-30

#### §607-2.01 Portland Cement Concrete for Bases

Portland Cement concrete used for bases shall be Class A or C conforming to the requirements of Section 501 Portland Cement Concrete--General except that requirements for automated batching shall not apply.

#### §607-2.02 Right-of-Way Fencing

The Contractor has the option of using posts and braces fabricated from either high carbon shapes of steel or pressure treated wood meeting the requirements of §710-30 Right-of-Way Fencing.

#### §607-2.03 Fence Gates

Fence gates for Right-of-Way Fencing shall Conform to the requirements for Right-of-Way Fence Gates of §710-30. Fence gates for Chain-Link Fence shall conform to the following:

**A. Gate Frames.** Frames shall be constructed of tubular members welded at all corners or assembled with corner fittings. Where corner fittings are used gates shall have 10 mm nominal diameter truss rods to prevent sag or twist. Gate leaves shall have vertical intermediate bracing so that no vertical members are more than 2.4 m apart. Gate leaves over 3 m long shall have a horizontal brace or a 10 mm nominal diameter diagonal truss rod. Gate leaves over 5 m shall have both a horizontal brace and a 10 mm nominal diameter truss rod.

**B. Gate Fabric.** Gate fabric shall conform to the requirements of the fabric used in the fence construction.

**C. Gate Hinges.** Hinges shall be weldable steel, cast steel or malleable iron 180° offset industrial type. The hinges shall not twist or turn under the action of the gate. The gates shall be capable of being opened and closed easily by one person. Hinges shall be galvanized in accordance with §719-01 Type I.

**D. Gate Latches.** Latches, stops and keepers shall be provided for all gates. Latches shall have a plungerbar arranged to engage the center stop, except that single left gate openings with an opening of less than 3 m may use a forked latch. Latches shall be arranged for locking and the Contractor shall provide a lock with triplicate keys for each gate. Center stops shall consist of a device arranged to be set in concrete and to engage a plunger-bar of the latch of double leaf gates. No stop is required for single leaf gates. Keepers shall consist of a mechanical device for securing the free end of the gate when in the full open position.
§607-3 CONSTRUCTION DETAILS

607-3.01 General. The Contractor shall perform such clearing and grubbing as may be necessary to construct the fence to the required grade and alignment.

At locations where breaks in a run of fencing are required, or at intersections with existing fences, appropriate adjustment in post spacing shall be made to conform to the requirements for the type of closure indicated.

When the plans require that the posts, braces, or anchors be embedded in concrete, the Contractor shall install temporary guys or braces as may be required to hold the posts in proper position until such time as the concrete has set sufficiently to hold the posts. Unless otherwise permitted, no materials shall be installed on posts or strain placed on guys and bracing set in concrete until seven days have elapsed from the time of placing the concrete.

All posts shall be set vertically and to the required grade and alignment. Cutting of the tops of the posts will be allowed only with the approval of the Engineer and under the Engineer's specified conditions.

Wire or fencing of the size and type required shall be firmly attached to the posts and braces in the manner indicated. All wire shall be stretched taut and be installed to the required elevations.

At each location where an electric transmission, distribution or secondary line crosses any of the types of fences covered by these specifications, the Contractor shall furnish and install a ground conforming to the requirements of Subsection 9 of the National Electric Safety Code.

Fence shall generally follow the contour of the ground, with the bottom of fence fabric no less than 25 mm nor more than 150 mm from the ground surface. Grading shall be performed where necessary to provide a neat appearance.

Line posts shall be spaced equidistant in the fence line at the spacing shown on the plans, standard sheets or as directed by the Engineer. End, corner, and intermediate posts shall be placed at the locations indicated on the plans, standard sheets or as directed by the Engineer, and shall be braced as shown on the plans or standard sheets. When chain link fence is on a long curve intermediate posts shall be evenly spaced so that the strain of the fence will not bend the line posts.

All end, corner, and intermediate posts shall be set plumb in concrete bases of the depth and diameter shown on the plans or standard sheets. The Contractor shall have the option of setting the line posts in concrete bases or using methods of driving and anchoring specified by the fence manufacturer and approved by the Engineer.

The concrete bases shall be rough cast in the ground around the posts. The top surfaces shall be domed to shed water and provide a neat workmanlike appearance when completed. Extensions of up 45 minutes for the allowed time for pouring the concrete will be permitted.

607-3.02 Chain-Link Fencing with Top Rail. Posts shall be set so they are equidistant with a maximum of 3 m centers.

All top rails shall pass through the base of the post caps and shall form a continuous brace from end to end of each stretch of fence. Top rail lengths shall be joined with sleeve couplings with expansion sleeves provided at 30 m intervals. Top rails shall be securely fastened to end posts by means of approved rail end connectors. Horizontal braces shall be provided at all intermediate posts, midway between the top rail and ground as shown on the plans or standard sheets.

Diagonal truss rods shall be installed with the horizontal braces as indicated on the plans or standard sheets.

Fence fabric shall be installed approximately 50 mm above the ground level and securely fastened along the bottom, and to all braces, top rails, line and pull posts, at the intervals indicated on the standard sheets by approved methods. The fabric shall be secured to all end, corner and gate posts with stretcher bars fastened to the posts, with stretcher bands spaced at a maximum of 355 mm and in a manner permitting adjustment of the fabric tension.

If the Contractor elects the option of using one piece roll-formed sections, the fence fabric shall be integrally woven into the fabric loops on the end, corner, pull and gate posts. The fabric shall be attached to the top braces and line posts as shown on the standard sheets.

607-3.03 Chain-Link Fencing with Top Tension Wire. The construction details specified in §607-3.02 Chain Link Fencing with Top Rail shall apply with the following modifications:
A. Top tension wire shall be installed as shown on the plans, standard sheets, or as directed by the Engineer.
B. All posts shall be spaced equidistant in the fence line on a maximum of 2.4 m centers.
C. Additional pull posts shall be placed at locations indicated on the plans or standard sheets. Brace assemblies shall be installed at each intermediate post as indicated on the plans or standard sheets.

**607-3.04 Vinyl Coated Chain-Link Fencing on Plastic Coated Frame.** The construction details specified in §607-3.02 Chain-Link Fencing with Top Rail or §607-3.03 Chain-Link Fencing with Top Tension Wire shall apply with the following addition:

If any of the resin clad material specified under this item has the protective resin coating damaged so its effectiveness to prevent corrosion of the base material is impaired, the Contractor shall repair such parts by applying one coat of an approved compound of a color to match original material.

**607-3.05 Aluminum Posts.** Aluminum posts shall be set in accordance with requirements pertaining to fence posts of §607-3.01 General, and §607-3.02 Chain-Link Fencing with Top Rail or §607-3.03 Chain-Link Fencing with Top Tension Wire and with the following additional requirement: The portions of aluminum posts that will be in contact with the concrete bases shall be coated with Zinc Chromate Primer conforming to the requirements of §708-04. The primer shall be thoroughly dry before setting of the post in the concrete.

**607-3.06 Right-of-Way.** Fencing posts shall be set plumb and firm to the satisfaction of the Engineer in properly prepared post holes, as indicated on the plans or standard sheet. The concrete for post holes where required shall be placed in accordance with the requirements of §607-3.01 General.

All line posts of the type and size shown on the plans or standard sheets shall be placed equidistant in the fence line. Wood line posts shall be placed on a maximum of 4.5 m centers and metal line posts shall be placed on a maximum of 3 m centers.

Intermediate posts and post assemblies, end posts, corner posts, approach spans, and bracing shall be as shown on the plans or standard sheets.

The woven wire fencing shall be fastened to all steel line posts with at least 5 galvanized wire fasteners or clamps and to all steel end, intermediate and corner posts with aluminum wire not less than 4 mm diameter.

The woven wire fencing shall be fastened to all wood posts with either 40 mm galvanized or aluminum staples. The top and bottom wires and every other in-between wires shall be stapled, alternating the stapling of the in-between wires on successive posts.

**607-3.07 Fence Gates.** The Contractor shall construct metal fence gates of the type and size as indicated on the plans or standard sheets, and in the location shown or ordered by the Engineer.

**607-4 METHOD OF MEASUREMENT**

**607-4.01 General.** The quantity to be paid for all fencing exclusive of fence gates and fencing of the types listed in subsequent subsections, will be the number of linear meters of chain-link fencing measured along the top of fencing, center to center of end posts, properly furnished and installed in accordance with the plans, specifications, standard sheets and directions of the Engineer. An allowance of 3 m will be added for each end post, corner post and pull post installed in accordance with the plans, specifications, standard sheets and directions of the Engineer.

**607-4.02 Right-of-Way Fencing.** Right-of-Way Fencing shall be measured as the number of meters along the top of the fencing from center to center of the end posts, properly furnished and installed in accordance with the plans, specifications, standard sheets and directions of the Engineer. An allowance of 6 m will be added for each end post, corner post, intermediate post, and approach post installed in accordance with the plans, specifications, standard sheets and directions of the Engineer.

**607-4.03 Fence Gates.** Fence gates shall be measured as the number of complete gates furnished and erected in accordance with the specifications, plans, standard sheets and directions of the Engineer.
§607

607-5 BASIS OF PAYMENT

607-5.01 General. The unit price bid per linear meter of fencing shall include the cost of furnishing all labor, materials, tools and equipment necessary to satisfactorily complete the work.

607-5.02 Fence Gates. The unit price bid for each size gate shall cover the cost of furnishing all labor, materials, tools and equipment necessary to satisfactorily complete the work and shall include all necessary clearing, grubbing, excavation and disposal, fill, concrete, gates, gate posts, lock, bracing and all other necessary materials.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>607.051X</td>
<td>Vinyl Coated Steel Chain-Link Fencing on Plastic Coated Frame with Top Rail</td>
<td>Meter</td>
</tr>
<tr>
<td>607.052X</td>
<td>Vinyl Coated Steel Chain-Link Fencing on Plastic Coated Frame with Top Tension Wire</td>
<td>Meter</td>
</tr>
<tr>
<td>607.16xx</td>
<td>Fence Gate with Vinyl Coated Steel Chain-Link Fencing on Plastic Coated Frame</td>
<td>Each</td>
</tr>
<tr>
<td>607.19</td>
<td>Right-of Way Fencing</td>
<td>Meter</td>
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<td>607.20xx</td>
<td>Right-of Way Fence Gates</td>
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<td>607.31xx</td>
<td>Optional Chain-Link Fence, Type I, with Top Tension Wire</td>
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<td>Optional Chain-Link Fence, Type II, with Top Rail</td>
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<td>607.40xx</td>
<td>Optional Fence Gates</td>
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Refer to the Standard Contract Pay Item Catalog for full Item Number and full Description.

SECTION 608 - SIDEWALKS, DRIVEWAYS AND BICYCLE PATHS

608-1 DESCRIPTION. This work shall consist of the construction of either a Portland Cement concrete sidewalk, an asphalt concrete sidewalk, an asphalt concrete driveway, bicycle paths, or furnishing and placing precast concrete paving, brick paving or grouted stone block paving. All work shall be in accordance with these specifications and in reasonably close conformity with the lines and grades shown on the plans or established by the Engineer.

608-2 MATERIALS. Materials shall meet the requirements specified in the following subsections of section 700 - Materials:

<table>
<thead>
<tr>
<th>Material</th>
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<tr>
<td>Portland Cement</td>
<td>701-01</td>
</tr>
<tr>
<td>Bituminous Materials (As specified)</td>
<td>702-00</td>
</tr>
<tr>
<td>Asphalt Cement for Paving</td>
<td>702-02 or 702-03</td>
</tr>
<tr>
<td>Fine Aggregates</td>
<td>703-01</td>
</tr>
<tr>
<td>Coarse Aggregates</td>
<td>703-02</td>
</tr>
<tr>
<td>Mortar Sand</td>
<td>703-03</td>
</tr>
<tr>
<td>Cushion Sand</td>
<td>703-06</td>
</tr>
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<td>Concrete Sand</td>
<td>703-07</td>
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<tr>
<td>Mineral Filler</td>
<td>703-08</td>
</tr>
<tr>
<td>Brick Pavers</td>
<td>704-08</td>
</tr>
<tr>
<td>Stone Blocks</td>
<td>704-09</td>
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<tr>
<td>Precast Concrete Driveway and Sidewalk Pavers</td>
<td>704-13</td>
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<tr>
<td>Premoulded Resilient Joint Filler</td>
<td>705-07</td>
</tr>
<tr>
<td>Masonry Mortar</td>
<td>705-21</td>
</tr>
<tr>
<td>Wire Fabric For Concrete Reinforcement</td>
<td>709-02</td>
</tr>
<tr>
<td>Water</td>
<td>712-01</td>
</tr>
</tbody>
</table>
608-2.01 Portland Cement Concrete Sidewalk and Driveways. The material requirements and composition shall comply with the specifications for Class A concrete in §501-2 under “Portland Cement Concrete--General.” Concrete shall be proportioned in accordance with the aggregate weights specified for Class A concrete in Table 501-3, Concrete Proportions.

608-2.02 Asphalt Concrete Sidewalks, Driveways, and Bicycle Paths. The mixture requirements for these items shall either be 9.5 mm or 19.0 mm mixtures. These mixtures shall be designed for <0.3 million ESALs and produced in accordance to Section 401 using coarse aggregate Type F9. The number of courses and course thicknesses shall be as given in Table 608-1, Hot Mix Asphalt Composition.

<table>
<thead>
<tr>
<th>Total Paved Thickness</th>
<th>9.5 mm Mix</th>
<th>19.0 mm Mix</th>
<th>Number of Courses</th>
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</thead>
<tbody>
<tr>
<td>40 mm</td>
<td>40 mm</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>50 mm</td>
<td>50 mm</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>80+ mm</td>
<td>40 mm</td>
<td>40+ mm</td>
<td>2+</td>
</tr>
</tbody>
</table>

NOTES:
1. For the 19.0 mm mixture, the maximum thickness that can be placed in one pass is 75 mm.
2. A course shall consist of one or more separate lifts of hot mix asphalt, as directed by the Engineer, to attain the indicated thickness.

608-2.03 Brick Paved Sidewalks and Driveways. Brick pavers shall meet the requirements of §704-08 and shall be the size(s), shape(s) and color(s) as specified in the contract documents.

A. Neoprene-Modified Asphalt Adhesive. Neoprene-modified asphalt adhesive shall consist of 2% neoprene, grade WM1, oxidized asphalt with a R & B softening point of 68°C minimum and a penetration of 80, and 10% asbestos-free fibers.

B. Mortar for Brick Paving. Mortar for brick paving shall meet the requirements outlined in §705-21 Masonry Mortar.

C. Sand-Cement Setting Bed. Sand-Cement Setting Bed shall consist of 1 part Portland Cement Type 2, §701-01 and 6 parts of Fine Aggregate, §703-01 by volume.

608-2.04 Grouted Stone Block Paved Sidewalks and Driveways. Stone blocks shall meet the requirements of §704-09 and shall be the size(s), shape(s) and color(s) as specified in the contract documents.

A. Sand-Cement Setting Bed. Sand-cement setting bed shall consist of 1 part Portland Cement Type 2, §701-01, and 6 parts of Fine Aggregate, §703-01 by volume.

B. Mortar For Stone Block Paving. Mortar for stone block paving shall meet the requirements outlined in §705-21 Masonry Mortar.

608-2.05 Precast Concrete Block Paved Sidewalks and Driveways. Precast Concrete Driveway and Sidewalk Pavers shall meet the requirements of §704-13 and shall be the size(s), shape(s) and color(s) as specified in the contract documents. Unless otherwise specified in the contract documents the setting bed material shall consist of hard, durable; uncoated particles of soil or rock, free from lumps of clay and all deleterious substances.

Setting Bed Material shall meet the following gradation requirements:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing by Weight</th>
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</thead>
<tbody>
<tr>
<td>6.3 mm</td>
<td>100</td>
</tr>
<tr>
<td>2.0 mm</td>
<td>50-85</td>
</tr>
<tr>
<td>425 µm</td>
<td>20-45</td>
</tr>
<tr>
<td>75 µm</td>
<td>3-10</td>
</tr>
</tbody>
</table>
§608-3 CONSTRUCTION DETAILS

608-3.01 Concrete Sidewalk and Driveways. The general construction details for manufacturing and transporting concrete shall meet the requirements of Section 501, Portland Cement Concrete-General. Placing and curing of concrete shall meet the requirements of Section 502, Portland Cement Concrete Pavement except that when a membrane curing compound is used it shall be clear with fugitive dye unless otherwise permitted by the Engineer.

The concrete shall be placed in one course to the full depth shown in the contract documents. Wire fabric for concrete reinforcement, §709-02, shall be embedded at mid-depth in the slab. The wire fabric shall consist of MW19 or MW20 wire at 150 mm centers transversely and longitudinally.

Transverse construction joints shall extend to the full depth of the slab and shall be spaced 6 m to 8 m apart. The edges of such joints shall be finished with an edging tool having a 6 mm radius. “Saw cutting shall be in accordance with Subsection 502-2.04E.

The concrete shall be finished to produce a smooth surface and then lightly broomed to a uniform texture. The edges of all sidewalk slabs shall be tooled. Unless otherwise specified in the contract documents the concrete surface shall be scored and tooled at intervals of 1.5 m.

A premoulded resilient joint filler, §705-07, shall be installed at all joints between sidewalk and curb, pavement, building, etc.

608-3.02 Asphalt Concrete Sidewalks, Driveways, and Bicycle Paths. The provisions under §402-3 Construction Details for Hot Mix Asphalt (HMA) Pavements, shall apply.

The sidewalks, driveways, and bicycle paths shall be constructed as indicated in the contract documents (including the Standard Sheets).

608-3.03 Brick Paved Sidewalks and Driveways. All brick pavers shall be laid in the pattern shown in the contract documents or as directed by the Engineer to provide a uniformly even surface. Joints shall be hand tight unless otherwise specified. No brick pavers shall be laid or grouted in freezing weather.

A dry mixture of mortar for brick paving shall be swept over the brick pavers until the joints are completely filled. The joints shall be lightly wetted with water. Brick pavers shall be cleaned of excess mortar, and joints shall be finished prior to the mortar setting up. All brick paving shall be kept moist for 4 days after filling the joints with mortar. After the 4 day curing period, removal of remaining mortar film may be accomplished by the use of a light acid wash (10% solution of hydrochloric or muriatic acid) followed by flushing clean with water or as approved by the Engineer. Care shall be taken to avoid the use of acid in areas where runoff could damage trees or other vegetation.

All brick pavers used over tree pits shall be laid in a 75 mm bed of cushion sand with sand filled joints.

A. Brick Paved Sidewalks and Driveways (Sand Setting Bed). Brick pavers shall be laid in a properly compacted 50 mm bed of cushion sand over the specified subbase or subgrade.

B. Brick Paved Sidewalks and Driveways (Mortar Setting Bed). Brick pavers shall be laid in a bed of mortar with a minimum thickness of 25 mm over the specified concrete or bituminous subbase.

C. Brick Paved Sidewalks and Driveways (Bituminous Setting Bed). Brick pavers shall be laid in a 20 mm thick bituminous setting bed over the specified concrete or bituminous subbase. The setting bed shall consist of asphalt cement meeting the requirements outlined in either §702-02 or §702-03 mixed with fine aggregate meeting the requirements of §703-01. The asphalt cement shall be 7.0% of the total batch weight. The mix shall be heated to approximately 163°C. A coating of neoprene-modified asphalt adhesive shall be applied by mopping, squeegeeing or troweling over the top surface of the setting bed to provide bond under the bricks.
D. Brick Paved Sidewalks and Driveways (Sand-Cement Setting Bed). Brick pavers shall be laid on a 50 mm setting bed of sand-cement over the specified subbase. The sand-cement setting bed shall not be placed more than 4 hours prior to installing the brick paving.

E. Brick Paved Sidewalks and Driveways (Optional Concrete Setting Bed). The Contractor shall have the option of installing Brick Paved Sidewalks and Driveways by one of the following methods:

1. Bricks shall be laid on a bed of cement concrete as specified in the contract documents. The bricks shall be laid in the cement concrete while it is still fresh as approved by the Engineer and they shall be firmly positioned to provide a uniformly even surface, and a solid bedding under each brick.
2. Bricks shall be laid as provided for under “Brick Paved Sidewalks and Driveways (Mortar Setting Bed)” provided the finished surface shall conform to the lines and grades shown in the contract documents.

608-3.04 Grouted Stone Block Paved Sidewalks and Driveways. All grouted stone block pavers shall be laid in the pattern shown in the contract documents or as directed by the Engineer to provide a uniformly even surface. Joints between blocks shall be a maximum of 32 mm or as specified. No blocks shall be laid or grouted in freezing weather.

Unless otherwise approved by the Engineer, a dry mixture of mortar as specified for Brick Paved Sidewalks and Driveways, §608-2.03, shall be swept over the stone blocks until the joints are completely filled and the joints lightly wetted with water prior to the mortar setting up. All grouted stone block paving shall be kept moist for four days after filling the joints with mortar. After the four day curing period, removal of remaining mortar film may be accomplished by the use of a light acid wash (10% ± solution of hydrochloric acid) followed by flushing clean with water, or as approved by the Engineer. Care shall be taken to avoid the use of acid in areas where runoff could damage trees or other vegetation.

All blocks used over tree pits shall be laid in a 25 mm bed of cushion sand with sand filled joints.

A. Grouted Stone Block Paved Sidewalks and Driveways (Sand Setting Bed). Blocks shall be laid in a 75 mm bed of cushion sand over the specified subbase or subgrade.

B. Grouted Stone Block Paved Sidewalks and Driveways (Mortar Setting Bed). Blocks shall be laid in a bed of mortar with a minimum thickness of 25 mm over the specified concrete or bituminous subbase.

C. Grouted Stone Block Paved Sidewalks and Driveways (Sand-Cement Setting Bed). Blocks shall be laid on a 50 mm setting bed of sand-cement over the specified subbase. The sand-cement setting bed shall not be placed more than 4 hours prior to installing the block paving.

D. Grouted Stone Block Paved Sidewalks and Driveways (Optional Concrete Setting Bed). The Contractor shall have the option of installing Grouted Stone Block Paved Sidewalks and Driveways by one of the following methods:

1. Blocks shall be laid on a bed of cement concrete as specified in the contract documents. The blocks shall be laid in the cement concrete while it is still fresh as approved by the Engineer and they shall be firmly positioned to provide a uniformly even surface, and a solid bedding under each stone block.
2. Blocks shall be laid as provided for under “Grouted Stone Block Paved Sidewalks and Driveways (Mortar Setting Bed)” provided the finished surface shall conform to the lines and grades shown in the contract documents.

608-3.05 Precast Concrete Block Paved Sidewalks and Driveways. Precast Concrete Driveway and Sidewalk Pavers shall be laid in the pattern shown in the contract documents or as directed by the Engineer to provide a uniformly even surface. Joints shall be hand tight unless otherwise specified. No pavers shall be laid in freezing weather.

After the pavers are in place, an approved sand joint filler shall be swept over the pavers until the joints are completely filled.
Unless otherwise specified in the contract documents, or directed by the Engineer, the Contractor shall install the pavers in accordance with the manufacturer’s recommended procedures.

Precast Concrete Block Paved Sidewalks and Driveways (Granular Material Setting Bed). Unless otherwise specified in the contract documents, Precast Concrete Driveway and Sidewalk Pavers shall be laid on a setting bed not to exceed 50 mm of uniformly compacted material placed over the specified subbase.

608-4 METHOD OF MEASUREMENT

608-4.01 Concrete Sidewalks and Driveways. Portland Cement concrete sidewalks and driveways will be measured by the number of cubic meters of cement concrete necessary to construct sidewalks and driveways shown in the contract documents or as ordered by the Engineer.

608-4.02 Asphalt Concrete Sidewalks, Driveways and Bicycle Paths. Asphalt concrete sidewalks, driveways and bicycle paths will be measured by the number of metric tons of asphalt concrete furnished and incorporated in the work. Quality payment adjustments will be measured as outlined in §402-4, Method of Measurement.

608-4.03 Brick Paved Sidewalks and Driveways. Brick paving shall be measured as the number of square meters placed as shown in the contract documents or as ordered by the Engineer.

608-4.04 Grouted Stone Block Paved Sidewalks and Driveways. Grouted stone block paving shall be measured as the number of square meters placed as shown in the contract documents or as ordered by the Engineer.

608-4.05 Precast Concrete Block Paved Sidewalks and Driveways. Precast concrete paving will be measured by the number of square meters placed as shown in the contract documents, or as ordered by the Engineer.

608-5 BASIS OF PAYMENT

608-5.01 Concrete Sidewalks and Driveways. The unit price bid per cubic meter shall include the cost of preparing the subgrade, all materials, equipment and labor necessary to complete the work “including saw cutting and wire fabric reinforcement) as specified except that any necessary excavation and subbase course will be paid for under their appropriate items.

Payment at the unit bid price will be made after the concrete sidewalk or driveway, and curing application have been properly placed.

608-5.02 Asphalt Concrete Sidewalks, Driveways, and Bicycle Paths. The unit price bid per metric ton shall include the cost of preparing the subgrade and all materials, equipment and labor (including milling, cleaning surfaces, tack coat, saw cut, trueing and leveling courses, etc.) necessary to complete the work as specified except that any necessary excavation and subbase course will be paid for under their appropriate items. Payment of Quality Units will be made based on the Index Price listed in the contract documents. The index price shown in the itemized proposal for each Quality Unit shall be considered the price bid. The unit (index) price is NOT to be altered in any manner by the bidder.

Should the bidder alter the amount shown, the altered figure will be disregarded and the original price will be used to determine the total amount bid for the Contract.

608-5.03 Brick Paved Sidewalks and Driveways. The price bid per square meter shall include the cost of furnishing all labor, materials and equipment necessary to complete the work, including setting bed material, as specified except that any necessary excavation and subbase course will be paid for under their appropriate items;

608-5.04 Grouted Stone Block Paved Sidewalks and Driveways. The unit bid per square meter shall include the cost of furnishing all labor, materials and equipment necessary to complete the work,
including setting bed material, as specified except that any necessary excavation and subbase course will be paid for under their appropriate items.

**608-5.05 Precast Concrete Block Paved Sidewalks and Driveways.** The unit price bid per square meter shall include the cost of all labor, materials and equipment necessary to complete the work, including setting bed material, except that any necessary excavation and subbase course will be paid for under their appropriate items.

**Payment will be made under:**

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<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
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<td>Cubic Meter</td>
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<td>608.020101</td>
<td>Asphalt Concrete Sidewalks, Driveways and Bicycle Paths</td>
<td>Metric Ton</td>
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<td>608.12</td>
<td>Precast Concrete Block Paved Sidewalks and Driveways (Granular Material Setting Bed)</td>
<td>Square Meter</td>
</tr>
</tbody>
</table>

**SECTION 609 - CURB AND CURB & GUTTER**

**609-1 DESCRIPTION.** Construct and place curb, and curb & gutter, and/or reset curb as specified in the Contract Documents or established by the Engineer.

**609-2 MATERIALS.** The materials shall meet the requirements of the following subsections of Section 700 -Materials Details.

- Portland Cement, Type II 701-01
- Concrete Repair Material 701-04
- Concrete Grouting Material 701-05
- Anchoring Material - Chemically Curing 701-07
- Coarse Aggregate 703-02
- Concrete Sand 703-07
- Premoulded Resilient Joint Filler 705-07
- Masonry Mortar 705-21
- Stone Curb Anchor Bars 709-07
- Quilted Covers (for Curing) 711-02
- Plastic Coated Fiber Blankets (for Curing) 711-03
- Polyethylene Curing Covers (White Opaque) 711-04
- Membrane Curing Compound 711-05
- Stone Curb 714-01
- Precast Concrete Curb 714-04
- Asphalt Concrete or Hot Mix Asphalt Curb 714-06
White and Yellow Pavement Marking Paints shall meet the requirements of Section 640 - Reflectorized Pavement Marking Paints.

609-2.01 (Vacant)

609-2.02 Concrete for Cast-in-Place Concrete Curb and Curb & Gutter.

A. Conventionally Formed Curb and Curb & Gutter. The material requirements, mix preparation and manufacturing of the concrete shall conform to the requirements for Class A Concrete as specified in Section 501, Portland Cement Concrete - General.

B. Machine Formed Concrete Curb and Curb & Gutter. Use Class J Concrete as specified in Section 501, Portland Cement Concrete - General.

609-2.03 Stone Curb and Granite Curb. Stone curb shall conform to §714-01 and shall be either sandstone or bluestone. Granite curb shall conform to the requirements for granite under Stone Curb §714-01.

609-2.04 Curb Anchors. Curb anchors for cast-in-place concrete curb, and curb & gutter shall be fabricated from material conforming to the requirements for Longitudinal Joint Ties §705-14 and to the details shown on the standard sheet for concrete curb or as indicated in the contract documents.

609-2.05 Concrete for Backing and Bedding Precast Concrete Curb, Stone Curb, and Granite Curb. The Contractor shall use any Class Concrete or a concrete mix proportioned as follows:

<table>
<thead>
<tr>
<th>KILOGRAMS OF AGGREGATE PER BAG OF CEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific Gravity of Aggregate</td>
</tr>
<tr>
<td>2.60</td>
</tr>
<tr>
<td>2.70</td>
</tr>
<tr>
<td>2.80</td>
</tr>
<tr>
<td>2.90</td>
</tr>
<tr>
<td>Concrete Sand</td>
</tr>
<tr>
<td>148</td>
</tr>
<tr>
<td>153</td>
</tr>
<tr>
<td>159</td>
</tr>
<tr>
<td>165</td>
</tr>
<tr>
<td>Coarse Aggregate, CA 2 Gradation</td>
</tr>
<tr>
<td>243</td>
</tr>
<tr>
<td>252</td>
</tr>
<tr>
<td>253</td>
</tr>
<tr>
<td>271</td>
</tr>
</tbody>
</table>

609-3 CONSTRUCTION DETAILS

609-3.01 General. Curb, or curb & gutter found to be dirty, damaged or out of alignment shall be cleaned, repaired, or replaced as necessary by the Contractor to the satisfaction of the Engineer prior to final acceptance of the work. When the Contract Documents have no reference to placing curb across driveway entrances, no curb shall be placed across driveway entrances.

609-3.02 Precast Concrete Curb, Stone Curb, and Granite Curb. All precast concrete curb, stone curb, and granite curb shall be set on a 75 mm thick continuous bed of dry concrete mix, or on a 75 mm thick dry concrete mix bed at the joints as shown on the Standard Sheets and plastic concrete between the joints, or on a 75 mm minimum thick continuous bed of compacted granular material, at the Contractor's option.

Precast concrete curb, stone curb, and granite curb shall be backed up with concrete using one of the following methods depending on the type of pavement:

A. Portland Cement Concrete (Rigid) Pavement. The Contractor shall place concrete backing behind the curb at each joint. The backing shall extend a minimum of 300 mm on both sides of the joint. The minimum height of the concrete backing shall be one half of the concrete pavement thickness and shall be measured from the bottom of the curb.

B. Hot Mix Asphalt (Flexible) Pavement. The Contractor shall place a continuous concrete backing behind the curb. The minimum height of the concrete backing shall be 255 mm or to the top of the hot mix asphalt pavement, whichever is greater, measured from the bottom of the curb.

Precast curb and stone curb with and without sawed ends, not on structure, shall be butted together with no mortar between the joints.
When the curb is set next to a concrete (rigid) pavement, grout conforming to §701-04 Concrete Repair Material or §705-21 Masonry Mortar shall be placed in the joint formed between the curb and the pavement. The grout shall extend from the bottom to the top of the pavement slab.

Before proceeding with any further work adjacent to the curb, the curb shall be backfilled with material approved by the Engineer and the backfill material shall be thoroughly tamped.

**609-3.03 Stone Curb and Granite Curb - Bridge Type.** The requirements of §609-3.02 shall apply with the following modifications:

A. Unless special construction details are called for in the contract documents, Type A and Type T2 curbs, when not on structures, shall be set true to line and grade on a concrete bedding.

B. Types F1, G1, M, R1, R2, S and T1 curbs shall be set in full mortar beds on structures. Excess mortar which extrudes around the curb shall be struck off flush with the front face of the curb and the top surface of the roadway.

C. Anchor bars for stone and granite bridge curb shall be installed where and as indicated in the contract documents.

All curb on structures shall be fitted together allowing 6 mm full mortared joints finished flush with exposed curb surfaces. Curb surfaces shall be cleaned of excess mortar to the satisfaction of the Engineer.

Mortar used for bedding and filling of joints shall conform to §705-21 Masonry Mortar or §701-04 Concrete Repair Material.

**609-3.04 Cast-In-Place Concrete Curb and Curb & Gutter.** Cast-in-place concrete curb and curb & gutter shall either be conventionally formed or machine formed to the size and shape shown on the standard sheets or as indicated in the contract documents.

Curb anchors, as required on the standard sheets or the contract documents, shall not be coated with materials which impair bonding. Curb anchors shall be installed a minimum of 300 mm from the ends of a pavement slab. Curb anchors for new concrete pavement, when placed simultaneously with pavement concrete, shall be placed by equipment which can demonstrate to the satisfaction of the Engineer placement of the anchors in accordance with these specifications. Curb anchors, when not placed simultaneously with pavement concrete, shall be placed rigidly secured by chairs or other supports to prevent displacement of the anchors when pavement concrete is placed. Curb anchors for existing concrete pavement shall be inserted into holes drilled in the side of the existing concrete pavement. The holes shall be thoroughly cleaned and filled with Concrete Grouting Material §701-05 or Anchoring Materials - Chemically Curing §701-07 immediately before placing the curb anchor. The curb anchor shall be securely supported in position until the grout has hardened.

Curing of the curb and curb & gutter shall comply with the requirements of §502-3.11 Curing, except that a clear membrane curing compound with fugitive dye conforming to the requirements of Membrane Curing Compound §711-05 may be used in lieu of the white pigmented membrane.

**A. Conventionally Formed Curb and Curb & Gutter**

1. **Forms.** Forms shall be free from warp and of such construction that there will be no interference to inspection for grade and alignment. All forms shall extend to the full curb depth and be secured so no displacement will occur during the placement of concrete.

2. **Casting Segments.** Curb and curb & gutter shall be cast in segments having a uniform length of approximately 3 m. The joints between segments shall not exceed 6 mm in width. When curb and curb & gutter is constructed next to concrete pavement, the curb and curb & gutter joints shall line up with the pavement joints or additional joints shall be provided in the curb and curb & gutter which line up with the pavement joints.

3. **Expansion Joints.** Expansion joints shall be 18 mm wide and contain Premoulded Resilient Joint Filler §705-07. The filler shall be cut to conform to the cross section of the curb and curb & gutter.
Expansion joints shall be located at all immovable objects (bridge structures, etc.), adjacent to expansion joints in the pavement, and where shown in the contract documents or directed by the Engineer. Expansion joints will not be required at regular intervals unless otherwise shown in the contract documents.

4. Concrete Placing and Vibrating. Concrete shall be placed in the forms in accordance with the applicable requirements of §555-3.04 and shall be compacted with an immersion type mechanical vibrator. The vibrator shall be of a size and weight capable of thoroughly vibrating the concrete without damaging or misaligning the forms. The forms shall be left in place until the concrete has hardened sufficiently to permit removal without damage to the curb and curb & gutter. The front form may be removed before the other forms to facilitate finishing the curb and removal of the joint dividers. After removal of the forms, the exposed faces of the curb and curb & gutter shall be immediately rubbed to a uniform surface. No plastering will be permitted.

B. Machine Formed Concrete Curb and Curb & Gutter. The equipment proposed for use by the Contractor shall demonstrate, to the satisfaction of the Engineer, the capability of placing the concrete in accordance with these specifications.

When machine forming, the Contractor may provide additional width of curb without any other change in shape or dimension, if provided by the Contractor at no additional cost to the State. If the Contract Documents or the Engineer require no curb be placed across driveway entrances or the Contract Documents have no reference to placing curb across driveway entrances, the Contractor may continue placing curb across driveway entrances but the curb placed across driveway entrances, excluding transitions, must be cut out and the concrete disposed in a manner approved by the Engineer.

Any curb and curb & gutter placed outside the tolerance of 12 mm of the established line or 6 mm of the established grade shall be removed and replaced by the Contractor.

1. Crack Control Joints. Crack control joints shall be formed or saw cut to a width of 3 mm minimum, 6 mm maximum and to a depth of 38 mm. The cut or formed joints shall extend slightly below the surface of the adjacent pavement and shall be spaced at 3 m intervals. When the curb, and curb & gutter is constructed next to concrete pavement, the curb and curb & gutter joints shall line up with the pavement joints or additional joints shall be provided in the curb and curb & gutter which line up with the pavement joints. The saw cut or formed joints shall be left unfilled.

2. Expansion Joints. Expansion joints shall be 18 mm wide and contain Premoulded Resilient Joint Filler §705-07. The filler shall be cut to conform to the cross section of the curb and curb & gutter.

The expansion joints shall be located at all immovable objects (bridge structures, etc.), adjacent to expansion joints in the pavement, where shown in the contract documents, or directed by the Engineer. Expansion joints shall not be required at regular intervals unless otherwise shown in the contract documents.

609-3.05 (Vacant)

609-3.06 Optional Curb. Under optional curb, the Contractor shall have the option of placing precast concrete curb, or cast-in-place concrete curb, or granite curb. Precast concrete curb or granite curb shall be placed in accordance with the requirements of §609-3.02. Cast-in-place curb shall be placed in accordance with the requirements of §609-3.04. No intermixing of curb will be allowed without the Engineer's written permission.

609-3.07 Hot Mix Asphalt Curb. Hot mix asphalt curb shall conform to the construction requirements of §402-3, except as follows:

A. Preparation of Mixture. The hot mix asphalt for curb shall be mixed in a batch type bituminous concrete mixing plant. The additive as specified in §714-06 shall be introduced into the
pugmill within an accuracy of ± 0.1% of the total batch weight. The additive may be introduced through a mineral filler feed system only if the above delivery tolerance can be maintained. The dry mixing time shall be a minimum of 15 seconds after the complete introduction of aggregates and additive into the pugmill. The wet mix time shall be a minimum of 45 seconds.

**B. Preparation of Surface.** When hot mix asphalt curb is constructed on a freshly laid hot mix asphalt surface, the curb shall be laid only on a clean dry surface. When curb is to be laid on a cured or aged concrete base, hot mix asphalt pavement, or performance grade binder treated base, the surface shall be thoroughly swept and cleaned by compressed air. The surface shall be thoroughly dried and, immediately prior to placing of the hot mix asphalt mixture, shall receive a tack coat of asphalt emulsion, Material Designation 702-3001 as specified in Table 702-5. The tack coat shall be applied at a rate of 0.15 to 0.50 L/m². The tack coat shall be prevented from spreading to areas outside of the area to be occupied by the curb.

**C. Placing.** Hot mix asphalt curb shall be constructed by machine to the size and shape shown on the standard sheets.

The machine shall be capable of placing the hot mix asphalt in accordance with these specifications to the satisfaction of the Engineer. Prior to placement, the Contractor shall demonstrate to the satisfaction of the Engineer the machine meets the following requirements:

1. The machine shall be self propelled and capable of forming curb which is uniform in texture, shape, and density.
2. The weight and the material extrusion rate of the machine shall be such that the required compaction is obtained without the machine riding above the bed on which curbing is constructed.

When short sections of hot mix asphalt curb or sections with short radii are required, the Engineer may permit construction by other means, as long as the resulting curb conforms to the curb produced by machine.

**D. Painted Hot Mix Asphalt Curb.** When painted hot mix asphalt curb is specified, it shall be painted yellow or white in accordance with the Manual of Uniform Traffic Control Devices. The paint shall be placed in accordance with the following:

1. After a curing period of not less than 72 hours, exposed surfaces of the curbing shall be sprayed or hand brushed with two coats of pavement marking paint, yellow or white as required. Each coat of paint shall be applied at the rate of 1 L per 16 m of curb.
2. The curb shall be clean and free of all foreign matter before painting. Paint shall be applied only when the air temperature is above 10°C and rising. Paint shall not be applied when there is reasonable expectation of rain. In the event the first or final coat of paint is rain damaged, as determined by the Engineer, the Contractor shall clean and repaint the curb at no additional cost to the State.

**609-3.08 Resetting Curb.** Care shall be taken in removing the curb to be reset so that there will be no unnecessary breakage. All curb damaged in removing, hauling, storing, or resetting shall be replaced by the Contractor.

The curb shall be reset, in accordance with the requirements of §609-3.02 or §609-3.03 for resetting bridge type curbs, to the lines and grades specified in the contract documents.

**609-4 METHOD OF MEASUREMENT.** All curb and curb & gutter placed and curb reset under these specifications will be measured by the number of linear meters, rounded to the nearest tenth of a meter. The measurement will be taken along the top front arris line of full height, transition and terminal sections. The measurement will be taken along the top front arris line of curb reveals across driveway entrances only when placed and not removed.

**609-5 BASIS OF PAYMENT**
609-5.01 Concrete Curb, Curb & Gutter, Stone Curb, Granite Curb, Optional Curb. The unit price bid per meter shall include the cost of all labor, materials, curb anchors, equipment, and excavation to, in accordance with these specifications, place, backfill, grout and caulk the curb, curb & gutter. When select backfill is specified, the select backfill shall be paid under its respective items. No additional payment will be made to the Contractor when more than the minimum width of curb is placed. No additional payment will be made to the Contractor when curb is placed across driveway entrance, to facilitate concrete machine forming operations, and removed.

609-5.02 Stone Curb and Granite Curb - Bridge Type. The unit price bid per meter shall include the cost of furnishing all labor, equipment, and materials including concrete bedding, mortar for stone and granite curbs, chemically curing anchoring materials, and stone and granite curb anchors required to bed and place stone and granite bridge curb, in accordance with these specifications.

609-5.03 Hot Mix Asphalt Curb. The unit price bid per meter shall include the cost of furnishing all labor, materials, and equipment to prepare the surface for curb placement, and place the curb. If painted hot mix asphalt curb is specified, the Contractor shall also include the cost of preparing the curb for painting, furnishing the paint, and applying the paint. Progress payments will be made after the curb has been constructed to the shape and size shown on the standard sheet and/or plans. Payment will be made, at the unit price bid, for 90% of the quantity properly constructed exclusive of painting. The balance of the quantity will be paid for upon completion of the work.

609-5.04 (Vacant).

609-5.05 Resetting Curb. The unit price bid per meter shall include the cost of furnishing all labor, equipment, and materials to remove, haul, store and reset curb, in accordance with these specifications. In addition, the unit price shall also include any re-dressing of tops and joints of bridge type curb, as directed by the Engineer, and replacement of curb damaged by the Contractor's operations.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>609.01XX</td>
<td>Stone Curb* (Various Types as indicated)</td>
<td>Meter</td>
</tr>
<tr>
<td>609.02XX</td>
<td>Granite Curb* (Various Types as indicated)</td>
<td>Meter</td>
</tr>
<tr>
<td>609.03XX</td>
<td>Granite Bridge Curb* (Various Types as indicated)</td>
<td>Meter</td>
</tr>
<tr>
<td>609.035X</td>
<td>Stone Bridge Curb* (Various Types as indicated)</td>
<td>Meter</td>
</tr>
<tr>
<td>609.04XX</td>
<td>Cast-in-Place Concrete Curb* (Various Types as indicated)</td>
<td>Meter</td>
</tr>
<tr>
<td>609.05XX</td>
<td>Cast-in-Place Concrete Curb &amp; Gutter* (Various Types as indicated)</td>
<td>Meter</td>
</tr>
<tr>
<td>609.08XX</td>
<td>Precast Concrete Curb* (Various Types as indicated)</td>
<td>Meter</td>
</tr>
<tr>
<td>609.0901</td>
<td>Optional Curb (Precast Concrete Type PVF150 or Cast-In-Place Concrete Type VF150 or Granite Type C)</td>
<td>Meter</td>
</tr>
<tr>
<td>609.0902</td>
<td>Optional Curb (Precast Concrete Type PM100 or Cast-In-Place Concrete Type M100 or Granite Type E100)</td>
<td>Meter</td>
</tr>
<tr>
<td>609.0903</td>
<td>Optional Curb (Precast Concrete Type PT100 or Cast-In-Place Concrete Type T100)</td>
<td>Meter</td>
</tr>
<tr>
<td>609.15</td>
<td>Resetting Existing Curb</td>
<td>Meter</td>
</tr>
<tr>
<td>609.21XX</td>
<td>Painted Hot Mix Asphalt Curb* (Various Types as indicated)</td>
<td>Meter</td>
</tr>
<tr>
<td>609.22XX</td>
<td>Unpainted Hot Mix Asphalt Curb* (Various Types as indicated)</td>
<td>Meter</td>
</tr>
</tbody>
</table>

* Refer to Standard Pay Item Catalog for full Item Number and Description.

SECTION 610 - TURF AND WILDFLOWER ESTABLISHMENT

610-1 DESCRIPTION. The work covered by this section includes work necessary to establish and care for turf and wildflowers.
610-1.01 Applying Soil Amendments. The work consists of furnishing and placing soil amendments as specified at the locations indicated in the contract documents or where directed by the Engineer.

610-1.02 Establishing Turf. The work consists of preparing ground surfaces for seeding; furnishing and installing fertilizer, seed, mulch, and mulch anchorage on areas indicated in the contract documents or where directed by the Engineer. The work also consists of producing a satisfactorily established turf and caring for the turf as specified. The work may also include furnishing and applying limestone as specified in the contract documents.

610-1.03 Establishing Wildflowers. The work consists of preparing ground surfaces for seeding; furnishing and installing seed, mulch and mulch anchorage on areas indicated in the contract documents or where directed by the Engineer; and caring for and establishing the work specified.

610-2 MATERIALS

610-2.01 Applying Soil Amendments. The materials shall meet the requirements of the following subsections of section 700-Materials Details and/or as further specified in the contract documents.

<table>
<thead>
<tr>
<th>Material</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limestone</td>
<td>713-02</td>
</tr>
<tr>
<td>Fertilizer</td>
<td>713-03</td>
</tr>
</tbody>
</table>

610-2.02 Establishing Turf. The materials shall meet the requirements of the following subsections of section 700-Materials Details and/or as further specified in the contract documents.

<table>
<thead>
<tr>
<th>Material</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limestone</td>
<td>713-02</td>
</tr>
<tr>
<td>Fertilizer</td>
<td>713-03</td>
</tr>
<tr>
<td>Hay</td>
<td>713-18</td>
</tr>
<tr>
<td>Straw</td>
<td>713-19</td>
</tr>
<tr>
<td>Mulch anchorage</td>
<td>713-12, Type A</td>
</tr>
</tbody>
</table>

Turf establishment materials not otherwise specified in the contract documents shall be as follows:

<table>
<thead>
<tr>
<th>Material</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fertilizer Type No. 3</td>
<td>713-03</td>
</tr>
<tr>
<td>10-6-4 (50% N-UF)</td>
<td></td>
</tr>
<tr>
<td>Hay or Straw</td>
<td>713-18 or 713-19</td>
</tr>
<tr>
<td>Mulch anchorage Type A</td>
<td>713-12</td>
</tr>
<tr>
<td>Seeds</td>
<td>713-04 and as follows:</td>
</tr>
<tr>
<td>Name</td>
<td>Variety</td>
</tr>
<tr>
<td>Red Fescue (Festuca rubra)</td>
<td>Commercial</td>
</tr>
<tr>
<td>Perennial Ryegrass (Lolium perenne)</td>
<td>Commercial</td>
</tr>
<tr>
<td>White Clover (Trifolium repens)</td>
<td>Commercial</td>
</tr>
<tr>
<td>Total</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

610-2.03 Establishing Wildflowers. The materials shall meet the requirements of the following subsections of section 700-Materials Details and/or as further specified in the contract documents.

<table>
<thead>
<tr>
<th>Material</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seeds</td>
<td>713-04</td>
</tr>
<tr>
<td>Straw</td>
<td>713-19</td>
</tr>
</tbody>
</table>

610-3 CONSTRUCTION DETAILS

610-3.01 Applying Soil Amendments. Fertilizer and/or limestone shall be evenly spread over the surface of the soil in the areas described in the contract documents or where directed by the Engineer. The rates of application shall be as specified in the contract documents. Any method of application that will insure an even distribution will be acceptable. When hydraulic application is used the minimum rate of water shall be 0.5 L/m² unless otherwise specified in the contract documents.
§610

610-3.02 Establishing Turf

A. Rates. Application rates for turf establishment materials shall be specified in the contract documents. When no rates for establishing turf are specified in the contract documents, the following shall apply:

<table>
<thead>
<tr>
<th>Material</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fertilizer</td>
<td>90 g/m²</td>
</tr>
<tr>
<td>Seed</td>
<td>10 g pure live seed/m²</td>
</tr>
<tr>
<td>Mulch</td>
<td>0.5 kg/m²</td>
</tr>
<tr>
<td>Mulch Anchorage</td>
<td>Manufacturer's recommended rate</td>
</tr>
</tbody>
</table>

B. Limitations. The contractor shall notify the Engineer at least 2 working days before the start of any seeding operation and shall not begin the work until the Engineer has given permission. When sodding and turf establishment are to be done in the same general areas, the sodding shall be done first, and equipment used during turf establishment shall not damage the sodded areas.

C. Inoculation of Leguminous Seeds. All seeds of leguminous plants requiring inoculation shall be inoculated prior to mixing or sowing unless otherwise specified or approved or unless accompanied by a certificate of preinoculation. When seeds requiring inoculation are to be sown dry, the inoculant shall be applied in accordance with its accompanying instructions and the seeds allowed to dry sufficiently for proper handling. Seeds shall be sown within thirty hours after this treatment. When seeds requiring inoculation are to be sown by water pressure, the inoculant may be added to the water and seed mixture, together with limestone and/or fertilizer as specified, providing the pH of the solution does not exceed 8.

D. Ground Preparation and Seeding. All turf establishment areas shall be approved by the Engineer prior to seeding. Areas to be seeded with turf seeds shall be maintained at approved grades and irregularities that will hold water shall be eliminated. Weed growth that, in the Engineer's judgment, may adversely affect germination or growth shall be removed or controlled as approved or as directed by the Engineer prior to seeding. Limestone, fertilizer and seeds in the amounts specified shall be evenly distributed on the areas to be seeded. All mechanical equipment used for soil preparation for seeding shall be as approved. Equipment shall pass parallel to the contours unless otherwise approved except that crawler tractors shall pass at right angles to the contours.

Establishing turf shall be done using Method No. 1, unless Method No. 2 is specified. Regardless of the method used, the finished surface of any area that is seeded shall not be rougher, more uneven or have more or larger stones, clods, roots, or other foreign materials than the area it adjoins. In built up and residential areas handraking will usually be necessary to produce the required smoothness and uniformity, particularly where grading and turf establishment is to be adjacent to lawns.

Method No. 1. Areas to be seeded shall be scarified sufficiently to break up the surface crust immediately before seeding except where, in the judgment of the Engineer, the ground is already loose and friable as immediately following grading. Where topsoil is not specified, all loose stones and other objects over 50 mm in greatest dimension, or other sizes as specified, shall be removed and disposed of as approved. All embedded stones and other objects protruding more than 50 mm above the surface, or other heights specified, shall also be removed and disposed of as approved. Where topsoil is specified the maximum loose stone size shall be 50 mm or as otherwise specified under §613-2. Unless otherwise specified in the contract documents, only limestone and/or fertilizers may be mixed together with the seeds (including legume inoculants when required) immediately before sowing. Any method of sowing that does not injure the seeds in the process of spreading will be acceptable.

Method No. 2. Areas to be seeded shall be harrowed, disked, or otherwise completely pulverized to a state of tillage acceptable to the Engineer. All stones and other undesirable material over 25 mm in greatest dimension or other sizes as specified shall be removed and disposed of as approved. Fertilizer and/or limestone as specified shall be uniformly distributed...
on the area to be seeded. Seeds shall be distributed uniformly by any approved method that does not injure the seeds in the process of spreading. Following distribution, seeds shall be incorporated into the soil to a depth not exceeding 5 mm by raking, rolling brush or chair harrowing, or any other approved method.

**E. Mulching.** Mulch shall be spread uniformly in a continuous blanket of sufficient thickness to hide the soil from view, taking care not to over apply. Mulch may be spread by hand or by machinery. Mulch shall not be spread before seeding turf unless otherwise approved or directed. Anchorage for hay and/or straw mulch is required unless otherwise specified in the Contract Documents. Mulch and mulch anchorage shall be applied separately from seeds unless otherwise specified in the Contract Documents. When use of wood fiber mulch is specified, it shall be spread in accordance with the manufacturer’s instructions and/or recommendations.

**F. Liability.** When the Engineer determines that any seeded area has failed for any reason to produce a satisfactorily established turf after a suitable period of time has elapsed, the Contractor shall repeat all the work required by the Section until a satisfactory growth of turf has been established. Any work to be corrected shall be at the Contractor's expense. The contract will not be accepted until a satisfactory turf has been established.

**G. Care During Construction.** The Contractor shall care for seeded turf areas until final acceptance of the contract. Care shall consist of providing protection against traffic by providing approved warning signs or barricades; and shall consist of repairs to any seeded turf areas damaged by wind, water, fire, traffic or other causes. Damaged areas shall be repaired to re-establish the condition and grade of the area prior to seeding and shall then be refertilized, reseeded and remulched as specified herein.

**Method No. 1.** The Contractor shall mow all turf establishment areas seeded on 1 on 3 or flatter slopes unless otherwise specified or directed by the Engineer. Such turf areas shall be mowed to a height of 100 mm when growth reaches 200 mm and thereafter as directed by the Engineer.

**Method No. 2.** The Contractor shall mow all turf establishment areas seeded under Method No. 2 to a height of 75 mm after initial growth reaches 125 mm, and then once a week thereafter unless otherwise approved. Clippings from the first mowing shall be removed.

### 610-3.03 Establishing Wildflowers

**A. Rates.** Application rates for wildflower establishment materials shall be as specified in the contract documents.

**B. Limitations.** The contractor shall notify the Engineer at least 2 working days before the start of any seeding operation and shall not begin the work until the Engineer has given permission.

**C. Inoculation of Leguminous Seeds.** Shall be as required under §610-3.02 C. Inoculation of Leguminous Seeds.

**D. Ground Preparation and Seeding.** All wildflower establishment areas shall be approved by the Engineer prior to seeding. Areas to be seeded with wildflower seeds shall be maintained at approved grade sand irregularities that will hold water shall be eliminated. Weed growth that, in the Engineer's judgment, may adversely affect germination or growth shall be removed or controlled as approved or as directed by the Engineer prior to seeding. Seeds in the quantities specified shall be evenly distributed on the areas to be seeded. All mechanical equipment used for soil preparation or seeding shall be as approved and shall pass parallel to the contours unless otherwise approved except that crawler tractors shall pass at right angles to the contours. Areas to be seeded shall be scarified sufficiently to break up the surface crust immediately before seeding except where the ground is already loose and friable as immediately following grading. All stones and other objects over 50 mm in greatest dimension or other sizes as specified shall be removed and disposed of as approved. Any
method of sowing that does not injure the seeds in the process of spreading will be acceptable. The finished surface of any area that is seeded shall not be rougher, more uneven or have more or larger stones, clods, roots, or other foreign materials than the area it adjoins.

**E. Mulching.** Mulch shall be spread uniformly in a continuous blanket of sufficient thickness to hide the soil from view, taking care not to over apply. Mulch may be spread by hand or by machinery. Mulch shall not be spread before seeding turf unless otherwise approved or directed. Anchorage for hay and/or straw mulch is required unless otherwise specified in the Contract Documents. Mulch and mulch anchorage shall be applied separately from seeds unless otherwise specified in the Contract Documents. When use of wood fiber mulch is specified, it shall be spread in accordance with the manufacturer’s instructions and/or recommendations.

**F. Liability.** When the Engineer determines that any seeded area has failed for any reason to produce a satisfactorily established growth of wildflowers after a suitable period of time, the Contractor shall reseed such areas in the same manner as specified in the contract until a satisfactorily established growth of wildflowers has been established. Any work to be corrected shall be at the Contractor's expense. The contract will not be accepted until a satisfactory growth of wildflowers has been produced.

**G. Care of Wildflowers During Construction.** The Contractor shall care for the seeded wildflower areas until final acceptance of the contract or as required under §610-3.04. Care of wildflowers shall consist of keeping the wildflowers in a healthy growing condition by watering, controlling weeds, and by any other necessary operations. Care shall also consist of providing protection against traffic by providing approved warning signs or barricades, and shall consist of repairs to any seeded wildflower area damaged by wind, water, fire, traffic or other cause. Damaged areas shall be repaired to re-establish the condition and grade of the area prior to seeding and shall be reseeded and remulched as specified herein. The Contractor shall mow wildflower establishment areas once a year in the autumn after the seed heads have matured, as approved by the Engineer for the duration of the contract.

### 610-3.04 PERIOD OF ESTABLISHMENT FOR WILDFLOWERS.

The Period of Establishment for Wildflowers shall begin immediately following the satisfactory completion of all the wildflower seeding as confirmed in writing by the Engineer. The Contractor shall be required to continue the work specified under §610-3.03 G. Care of Wildflowers During Construction for a period of one year or until the contract is complete, whichever is later.

In the event the Contractor requests acceptance of the contract and the “Period of Establishment” is not yet completed, the State, if approved by the Commissioner, may pay the Contractor monies retained under provisions of Section 38 Subdivision 7 of the Highway Law upon receipt of a certified check or securities as are listed in Subdivision 3 of Section 139 of the State Finance Law, in the amount of at least double the value of the uncompleted work under “Period of Establishment”. For the purpose of determinations for contract acceptance prior to completion of the work under “Period of Establishment”, the value of the work required under “Period of Establishment”, including necessary reseeding, shall be considered as a sum equal to 10% of the price bid for the item of Establishing Wildflower unless otherwise specified.

When all work in the contract excepting §610-03, Establishing Wildflowers, has been completed and accepted, the Contractor agrees to procure and maintain for the duration and purposes of any such work of establishment, and at the Contractor's expense, insurance for liability for damages imposed by law, in insurance companies authorized to do such business in the State covering all such operations, whether performed by the Contractor or subcontractors.

Before commencing any such work, the Contractor agrees to furnish to the Commissioner a certificate or certificates of insurance, in a form satisfactory to the Commissioner, showing that the Contractor has complied with this provision as to insurance, which certificate or certificates shall provide that the policies shall not be changed or cancelled until 30 days written notice has been given to the Commissioner.

The kind and amounts of insurance are as specified under §611-3.06 Period of Establishment.
At the conclusion of the Period of Establishment the Contractor shall remove any trash or debris from
the wildflower planting area. Areas that, in the judgment of the Engineer, have failed to produce an
established growth of wildflowers shall be noted for reseeding in accordance with the contract
specifications.

This requirement shall not prevent the release of the retained monies as herein defined at the
expiration of the Period of Establishment but a certified check or securities, as previously described, equal
to at least double the value of any uncompleted work will be required. No work other than re-grading to
establish condition of the area, reseeding and remulching will be required after the conclusion of the
Period of Establishment for Wildflowers.

610-4 METHOD OF MEASUREMENT

610-4.01 Applying Soil Amendments. Applying soil amendments will be measured as the number
of kilograms of soil amendments that have been acceptably applied.

610-4.02 Establishing Turf. Establishing turf will be measured as the number of square meters of
surface area that have been satisfactorily seeded.

610-4.03 Establishing Wildflowers. Establishing wildflowers will be measured as the number of
square meters of surface area that have been satisfactorily seeded.

610-5 BASIS OF PAYMENT

610-5.01 Applying Soil Amendments. The unit price bid per kilogram shall include the cost of all
labor, equipment, materials and incidentals, including water necessary to complete the work as specified.

610-5.02 Establishing Turf. The unit price bid per square meter shall include the cost of all labor,
equipment, materials and incidentals, including water necessary to complete the work as specified.

610-5.03 Establishing Wildflowers. The unit price bid per square meter shall include the cost of all
labor, equipment, materials and incidentals, including water and watering necessary to complete the work
as specified.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
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</thead>
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<tr>
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<td>Applying Soil Amendments</td>
<td>Kilogram</td>
</tr>
<tr>
<td>610.0203</td>
<td>Establishing Turf</td>
<td>Square Meter</td>
</tr>
<tr>
<td>610.03</td>
<td>Establishing Wildflowers</td>
<td>Square Meter</td>
</tr>
</tbody>
</table>

SECTION 611 - PLANTING

611-1 DESCRIPTION. This work consists of furnishing, planting and caring for plants as specified in
the contract documents. This work shall include all care of planting operations and establishment
necessary to complete the work as specified.

611-2 MATERIALS

611-2.01 Plants. Trees, shrubs and vines, groundcovers and special plants shall be as specified under
§713-06 and as further specified in the contract documents. The Contractor shall be responsible for
furnishing the vendor with a copy of the appropriate contract documents containing the plant material
specifications.

611-2.02 Planting Materials. Topsoil, organic materials, fertilizer, mulch and materials for the
protection of plants shall be specified under §713, Landscape Development Materials and as further
specified in the contract documents.

    Water shall be specified under §712-01 Water.
611-3 CONSTRUCTION

611-3.01 General

A. Planting Season. The planting seasons shall be as specified in the contract documents. No planting shall be done when the soil is frozen or otherwise in an unsatisfactory condition for working as determined by the Engineer.

B. Obstructions below Ground. The Contractor shall verify the locations of underground tanks, utilities and other nonmovable obstructions. Where nonmovable obstructions are encountered, the plant pits shall be relocated, as directed by the Regional Landscape Architect.

C. Delivery. The Contractor shall notify the Engineer at least two full working days before intended delivery of plants or planting materials, to the site. The Engineer shall be furnished legible copies of the certificates of inspection of plant materials as specified in §713-06 and a copy of the invoice for each shipment showing point of origin, sizes, quantities, sizes, and kinds of materials supplied. Plants which fail to meet the specifications, as determined by the Regional Landscape Architect, will be rejected. All rejected plants shall be promptly removed from the project site.

D. Storage. All plants shall be properly protected from damage and drying out. Such protection shall include the time when the plants are in transit, being handled or in temporary storage. Bare root plants not planted immediately shall be puddled and heeled in. The bundles of heeled in plants shall be opened and the plants shall be spaced separately. The roots of the heeled in plants shall have their earth balls protected by earth, mulch or straw, or they may be heeled in. All plants not planted immediately shall be watered as approved by the Regional Landscape Architect.

611-3.02 Ground Preparation

A. Layout. Locations for plants and outlines of areas to be planted shall be staked or marked out on the ground by the Contractor to the satisfaction of the Regional Landscape Architect before any plant pits or plant beds are dug.

B. Undesirable Material. When rock, construction debris or other undesirable materials is encountered while digging, the materials shall be removed to the depth and width necessary to obtain the specified plant pit diameter and depth, or the plant pit may be relocated as directed by the Regional Landscape Architect.

C. Plant Pit Diameter. The minimum plant pit diameter shall bear the following relationship to the diameter of the root spread or root balls of the plants to be planted in them, unless otherwise specified in the contract documents.

<table>
<thead>
<tr>
<th>Root Spread/Root Ball Diameter</th>
<th>Plant Pit Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>under 0.6 m</td>
<td>Twice the root spread or root ball diameter</td>
</tr>
<tr>
<td>from 0.6 m to 1.2 m</td>
<td>Equal to the root spread or root ball diam. plus 0.6 m</td>
</tr>
<tr>
<td>over 1.2 m</td>
<td>One and one half times the root spread or root ball diameter</td>
</tr>
</tbody>
</table>

The sides of the plant pits shall be loose and friable at the time of planting.

D. Plant Pit Depth. The depth of all plant pits shall allow the root ball to sit on undisturbed subgrade unless otherwise specified in the contract documents. Pit depth for bare root plants shall be as specified in the contract documents.

E. Planting Beds. Plants in planting beds shall either be planted in individual plant pits, or the entire planting bed shall be excavated and backfilled with planting soil as specified in the contract.
documents. Existing vegetation shall be removed from all planting beds as specified in the contract documents or as directed by the Regional Landscape Architect.

**F. Drainage.** Where an impervious layer of soil is encountered during the excavation of plant pits or beds, all such soil shall be removed to a depth as approved by the Engineer and the pits or beds shall be backfilled with acceptable planting soil.

**G. Planting Soil.** Planting soil shall be unamended existing soil excavated from the plant pit unless one of the following alternates is specified elsewhere in the contract documents.

*Alternative 1.* Amended existing soil excavated from the plant pit.
*Alternative 2.* Unamended approved topsoil.
*Alternative 3.* Amended approved topsoil thoroughly premixed with specified soil amendments at the specified rates.

When specified, fertilizer shall be applied within the plant saucers or over the plant beds, unless otherwise specified in the contract documents.

**H. Disposal of Excess Soil.** Excess soil shall be removed immediately and disposed of in disposal areas designated in the contract documents or at an on-site or off-site location, consistent with law, rule or regulation, and as approved by the Engineer.

§611-3.03 Setting Plants

**A. General.** All plants shall be set plumb at such a level that they bear the same relation to the surface of the surrounding ground as they bore to the ground from which they were dug. Planting soil shall be carefully backfilled into plant pits in layers not to exceed 0.1 meter in depth, and shall be tamped to prevent voids and settling before additional planting soil is placed. Thorough watering shall accompany backfilling of planting soil unless otherwise approved. A saucer shall be formed around each plant pit as specified in the contract documents.

**B. Balled Plants.** Following placement in the plant pit, balled plants shall have all natural burlap cloth, ropes, wire baskets, twine, and nonbiodegradable woven and nonwoven fabrics completely removed from the upper one third (1/3) sides and top of the root ball to a maximum depth of 0.5 meter. There is no requirement to remove the fabric or basket from the bottom of the root ball.

**C. Container Grown Plants.** Container grown plants shall be removed from their containers. Roots which are matted or entangled shall be straightened or cut and removed. Encircling roots shall be cut in a vertical direction.

**D. Bare Root Plants.** Roots of bare root plants shall be properly spread out in a radial position and planting soil shall be carefully worked in among them. All dead, broken, frayed and twisted roots shall be cleanly cut off.

**E. Wrapping.** When wrapping is specified in the contract documents, the wrapping material shall be a single layer of burlap bandage or paper. The wrapping shall extend from the ground line to the height of the first branch, and be wound spirally upwards from the ground line, overlapping 40 mm. The wrapping shall be securely tied in place with biodegradable twine at 0.4 meter intervals, or by other means approved by the Regional Landscape Architect.

**F. Staking, Guying and Anchoring.** No tree shall be staked, guyed or anchored, unless otherwise specified in the contract documents. When staking is specified, stakes shall be placed in the plant pit prior to backfilling.

**G. Pruning.** Plants pruned before their arrival will be rejected unless such pruning is specified in the contract documents. Pruning at the time of planting shall be limited to the removal of dead,
conflicting and broken branches; and to other pruning consistent with good horticultural practice unless otherwise specified in the contract documents or as directed by the Regional Landscape Architect.

**H. Mulching.** Where mulching is specified, it shall completely cover the area of the plant pit or planting bed to the depth specified in the contract documents. Mulch shall be placed at the time of planting.

**611-3.04 Restoration.** Areas disturbed by the planting operations shall be restored by disposing of excess soil, stones and rubbish such as twine, pruned limbs, tree wrap, containers, burlap and wire baskets as approved by the Engineer. Existing turf areas disturbed by planting operations shall be restored to a satisfactory condition which may include topsoil, regrading, fertilizing, seeding and mulching. All waste material generated as a result of the work shall be properly disposed of in accordance with law, rule or regulation, and in a manner approved by the Engineer.

**611-3.05 Care of Planting.**

**A. General.** Care of planting shall begin immediately after each plant is planted and shall continue until the final acceptance of the contract and as required under §611-3.06, Period of Establishment. Care of planting shall consist of keeping the plants in a healthy growing condition by watering, weeding, cultivating, pruning, tightening of guys if staked, remulching, applying approved antidesiccants and pesticides, and by other operations as necessary.

**B. Care of Planting Work Schedule.** The Contractor shall prepare and submit a Care of Planning Work Schedule to the Engineer for approval. The schedule shall identify how and when all other work specified under §611-3.05 Care of Planting will be accomplished. Exceptions to the approved schedule shall be subject to advance written approval of the Engineer.

**C. Watering.** All plants shall be watered at the directed times and at the rates specified in the contract documents, or as ordered by the Engineer. Each watering shall provide not less than 20 L of water per plant pit. Payment for the furnishing and applying of water shall be as stated in §611-5 Basis of Payment.

**D. Weeding.** All plant pits and planting beds shall be maintained weed free by methods approved by the Regional Landscape Architect.

**E. Remulching.** All plant pits and planting beds shall be remulched as necessary to maintain the required depth specified in the contract documents.

**F. Pruning.** All dead, injured or diseased wood shall be removed in accordance with good horticulture practice and as approved by the Regional Landscape Architect.

**G. Remedial Measures.** In the event of the threat of serious damage from insect or diseases, the plants shall be treated by preventative or remedial measures according to good horticultural practice as approved or as directed by the Regional Landscape Architect.

**H. Antidesiccants.** When specified in the contract documents, plants shall be sprayed with an antidesiccant meeting the requirements of §713-08, Materials for the Protection of Plants. The antidesiccant shall be applied according to the manufacturer's recommendations to thoroughly cover all above ground parts.

**I. Removal and Replacement.** At the conclusion of the essential portion of the planting work all plants shall be in a healthy, unimpaired and undamaged condition as determined by the Regional Landscape Architect. All plants that are dead, missing, or in an unhealthy or badly impaired condition, as determined by the Regional Landscape Architect, shall be removed and replaced with
new, healthy plant material as specified. All planting to be completed or replaced shall be planted not later than the next succeeding planting season as specified in the contract documents.

### 611-3.06 Period of Establishment

**A. General.** The Contractor shall be required to continue the work specified under §611-3.05 Care of Planting for a period of one year following the satisfactory completion of all of the planting on the contract as confirmed in writing by the Engineer, or for the duration of the contract, whichever is later. The Period of Establishment applies to all planting unless otherwise specified.

**B. Period of Establishment Work Schedule.** The Contractor shall prepare and submit a Period of Establishment Work Schedule to the Engineer. The schedule shall describe how and when all work specified under §611-3.06 A. General shall be accomplished. The schedule shall be approved by the Engineer prior to the beginning of the Period of Establishment.

**C. Contract Acceptance.** In the event the Contractor requests acceptance of the contract and the Period of Establishment is not yet complete, the State, if approved by the Commissioner, may pay the Contractor monies retained under provisions of Section 38 subdivision 7 of the Highway Law upon receipt of certified check or securities as are listed in subdivision 3 of section 139 of the State Finance Law, in the amount of at least double the value of the uncompleted work under Period of Establishment.

For the purpose of determinations for contract acceptance prior to completion of the work under “Period of Establishment,” the value of the work required under “Period of Establishment,” including necessary replacement, shall be considered as a sum equal to 10% of the price bid for the item of planting unless otherwise specified.

**D. Insurance.** When all contract work excepting Section 611 Planting, has been completed and accepted, the Contractor agrees to procure and maintain insurance for the duration and purposes of any such work of establishment, at no additional expense to the State.

**E. Requirements.** At the conclusion of the Period of Establishment the Contractor shall remove all stakes, guy wires and tree wrappings unless otherwise approved. All plants in an unhealthy or badly impaired condition, as determined by the Regional Landscape Architect, shall be removed and replaced or removed and noted for replacement at the next succeeding planting season.

**F. Conclusion of the Period of Establishment.** These requirements shall not prevent the release of the retained monies as herein defined at the expiration of the Period of Establishment. However, a certified check or securities, as previously described, equal to at least double the value of any uncompleted work will be required. No work other than replacement will be required after the conclusion of the Period of Establishment.

### 611-4 METHOD OF MEASUREMENT.

Planting will be measured as the number of plants of each kind, size or quality as set forth in the contract documents which are counted in place as having been completed and accepted.

### 611-5 BASIS OF PAYMENT.

The unit price bid for each plant of each kind, size or quality, as set forth in the contract, which has been acceptably planted shall include the cost of all labor, equipment, materials and incidentals, including watering and planting soil to complete the work specified.

Furnishing water and watering plants as required under §611-3.05 Care Of Planting will be paid for under the pay item for Watering Vegetation when this item is specified in the contract documents. No separate payment will be made for water used in the initial planting operation, as required in §611-3.03A. No separate payment will be made for water used during the Period of Establishment.

Progress payments for work satisfactorily performed in the excavation and backfilling of plant pits and plant beds may be made in amounts not to exceed twenty percent (20%) of the unit price bid for the respective plants.
Payment will be made under:

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<tr>
<td>611.0201XY</td>
<td>Planting - Minor Deciduous Trees</td>
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<td>Planting - Coniferous Trees</td>
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</tr>
<tr>
<td>611.0701XY</td>
<td>Planting - Special Plant Materials</td>
<td>Each</td>
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</table>

Refer to the Contract Proposal for full item number and full description.

SECTION 612 - SODDING

612-1 DESCRIPTION. This work shall consist of preparing the sod bed including topsoil, furnishing, delivering, placing, and caring for sod in the locations shown and specified in the contract documents.

612-2 MATERIALS. Materials for sodding shall meet the following requirements.

- Water 712-01
- Topsoil 713-01
- Sod 713-14
- Fertilizer As specified in the contract documents. Where not specified, fertilizer shall be 713-03 Type No. 1 or as approved by the Engineer.

612-3 CONSTRUCTION DETAILS.

612-3.01 Limitations. The Contractor shall notify the Engineer at least two working days before beginning to place sod. The Contractor shall not begin the work until written permission from the Engineer has been received.

No frozen sod shall be placed nor shall sodding be done when the ground surface is frozen. When frost or excessive moisture exist that will prevent satisfactory results from being obtained for any stage of work, the Engineer will stop the work and it shall be resumed only when allowed by the Engineer.

612-3.02 Procuring Sod. The Contractor shall exercise maximum care to retain the soil existing on the roots of the sod during transporting, handling and transplanting operations. Dumping or dropping of sod from vehicles will not be permitted. Sod shall be planted within twenty-four hours from the time of harvesting, unless it is tightly rolled, or stored roots-to-roots. All sod in stacks shall be kept moist and protected from exposure to the sun and from freezing. The maximum period of time from harvesting to planting shall not exceed forty-eight hours. Sod that is stored on the project site prior to planting shall meet the moisture requirements of §713-14 at the time of planting.

612-3.03 Ground Preparation. There shall be a minimum of 50 mm of topsoil under all sod unless otherwise specified. The subgrade of areas to be sodded shall be excavated and firmed to a sufficient depth below the finished grade of the sod to accommodate the tamped or rolled thickness of topsoil and sod.

Fertilizer shall be applied at a rate of 6 grams of nitrogen per square meter unless otherwise specified in the contract documents.

Fertilizer applied under this work shall be uniformly mixed with the topsoil to a depth of at least 50 mm before the sod is laid, unless otherwise specified or approved.

612-3.04 Finished Grade for Sod. When laid in strips adjacent to paths, pavements, drain inlets and other structures, the finished sod surface shall be flush with surface of the adjacent soil and the adjacent structures. Sod laid in drainage ways, and areas to be continuously or solidly sodded shall meet the finished grades as shown in the contract documents. Grades shall be formed with special care at the junction of drainage ways.
612-3.05 Placing Sod.  The soil on which the sod will be laid shall be moist.  The soil shall be watered prior to sodding, if so directed.  The sod shall be laid smoothly, edge to edge and all openings shall be plugged with sod.  In drainage ways and where continuous or solid sodding is indicated and/or specified in the contract documents, the sod shall be laid with the longest dimension parallel to the contours.  Sodding shall start at the base of slopes and progress upwards in continuous parallel rows.  Vertical joints between sides shall be staggered.  Immediately after laying, sod shall be pressed firmly into contact with the sod bed by tamping, rolling, or by any other method that will eliminate air pockets, provide true and even surfaces, ensure knitting and protect all exposed sod edges, but without damaging or displacing the sod or deforming the finished sod surface.  At the time of placing, the sodded areas shall be watered evenly and at a rate of 20 liters per square meter.

612-3.06 Anchoring.  Sod shall be firmly anchored in all drainage ways, on slopes 1 on 2 or steeper, and wherever else specified or directed.  Sod shall be anchored immediately after tamping.  All anchors shall be driven flush to the ground.

612-3.07 Finishing.  Excess sod or excess soil resulting from the sodding operation shall be disposed of by the Contractor.  Excess soil shall not be left to form a ridge adjacent to the sodded area or sodded strips.

612-3.08 Care During Construction.  The Contractor shall care for the sodded areas until all work on the entire contract has been completed and accepted.  When necessary, such care shall consist of providing protection against traffic by warning signs or barricades.  In locations where mowing is specified, the grass shall be mowed until the acceptance of the Contract to a height of 75 mm when the growth reaches a height of 125 mm or as directed.  All sod shall be watered at weekly intervals for a minimum of four weeks following installation and in accordance with §615-3.01, unless otherwise specified or directed.  Additional watering shall be performed if specified in contract documents.  When watered, sufficient water shall be applied to wet the sod at least 50 mm into the sod bed.  Watering shall be done in a manner that will not cause erosion or other damage to the finished surfaces.  Any surfaces that have settled, become gullied or otherwise damaged shall be repaired at the Contractor’s expense to re-establish the grade and conditions of the soil prior to sodding and shall then be re-fertilized and re-sodded as specified under this work.

612-3.09 Period of Establishment.  When the Engineer decides that any area that has been sodded fails for any reason to produce a satisfactory turf after a suitable period of time has elapsed, the Contractor shall re-sod such areas in the same manner as specified in the contract until a satisfactory turf has been established.  Any work to be corrected shall be at the Contractor’s expense.  The contract will not be accepted until a satisfactory turf has been produced unless the work necessary to assure satisfactory turf will be done under the provisions of an uncompleted work agreement.

612-4 METHOD OF MEASUREMENT.  Sodding including top soil bed will be measured as the number of square meters of surface area that have been acceptably completed.

612-5 BASIS OF PAYMENT.  The unit price bid per square meter shall include the cost of all labor, equipment, materials, including topsoil placed under the sod, water used during planting, and necessary excavation, equipment and incidentals necessary to acceptably complete and care for the work as specified.  When the quantity of sod is equal to or less than 400 square meters, the watering necessary to establish the sod after planting shall be included in the price bid for sodding including top soil bed.  When the quantity of sod exceeds 400 square meters, the watering, except initial watering at time of planting, shall be paid for under the watering vegetation item in the Contract.

Payment will be made under:

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<th>Item</th>
<th>Pay Unit</th>
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<tr>
<td>612.01</td>
<td>Sodding including Top Soil Bed</td>
<td>Square Meter</td>
</tr>
</tbody>
</table>

NEW YORK STATE DEPARTMENT OF TRANSPORTATION
STANDARD SPECIFICATIONS of May 4, 2006

545
SECTION 613 - TOPSOIL

613-1 DESCRIPTION. This work shall consist of furnishing and placing topsoil in conformance with the lines, grades and thicknesses shown in the contract documents or as designated by the Engineer.

613-2 MATERIALS. Topsoil shall conform to the requirements §713-01, Topsoil. Unsuitable material from required excavations, that meets these requirements, is acceptable.

613-3 CONSTRUCTION DETAILS

613-3.01 Preparation of Areas to be Topsoiled. The subsoil within the areas to be covered by topsoil shall be graded so that the completed work after topsoil is placed, shall conform to the specified lines and grades. Where specified or directed, the Contractor shall scarify or till the surface of the subsoil before the topsoil is placed to permit bonding the topsoil with the subsoil. Tillage by diskig, harrowing, raking or other approved methods shall be accomplished in such a manner that depressions and ridges formed by tillage shall be parallel to the contours.

613-3.02 Placing and Spreading of Topsoil. Topsoil in an unworkable condition due to excessive moisture, frost or other conditions shall not be placed until it is suitable for spreading. Topsoil shall be placed on the designated area and spread to the specified thickness. After the topsoil is spread, all large stiff clods, rocks, roots or other foreign matter shall be cleared and disposed of by the Contractor as approved so that the finished surface will be acceptable for subsequent work such as seeding, sodding, mulching or planting.

613-3.03 Restoration. The sites of all stockpiles and areas adjacent thereto which have been disturbed by the Contractor shall be graded if required and put into a condition acceptable for seeding. Surplus topsoil shall be used to flatten embankment slopes or placed in other locations approved by the Engineer.

613-4 METHOD OF MEASUREMENT. Topsoil quantities shall be in cubic meters, computed from payment lines shown on the plans or standard sheets, except where revised payment lines are established by the Engineer prior to performing the work.

613-5 BASIS OF PAYMENT. The unit price bid shall include the cost of furnishing all equipment, labor and materials required to complete the work as specified.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>613.0101</td>
<td>Topsoil</td>
<td>Cubic Meters</td>
</tr>
</tbody>
</table>

SECTION 614 - CARE, THINNING AND REMOVAL OF TREES

614-1 DESCRIPTION. This work shall consist of care of trees, selective thinning and tree removal as specified.

614-1.01 Care of Trees. The work shall be performed on existing trees shown in the contract documents or designated by the Engineer and shall include one or both of the following operations, or as specified: Pruning; Fertilizing.

614-1.02 Selective Thinning. The work shall consist of felling specifically identified trees, disposing of all wood and debris, and will usually require topping, limbing, stump removal and restoration as shown in the contract documents, in the proposal or as directed.

614-1.03 Tree Removal. The work shall consist of felling trees, disposing of all wood and debris, and may require topping, stump removal and other work as shown in the contract documents or as directed by the Engineer.
614-2 MATERIALS

614-2.01 Care of Trees. Mulch, and other special materials shall be as specified in the contract documents. Fertilizer shall be §713-03, Type 3, 10-6-4, unless otherwise specified. Water shall be as specified under §712-01. Materials for the protection of plants shall be as specified under §713-08.

614-2.02 Selective Thinning. Pesticides §713-13 for basal treatment of stumps shall be as specified.

614-2.03 Tree Removal. The materials for backfilling the stump holes and for establishing grass on the stump hole areas shall be as specified or as approved.

614-3 CONSTRUCTION DETAILS

614-3.01 Care of Trees

A. Equipment. Workers shall not be permitted to climb trees with climbing spurs but they shall employ accepted tree climbing methods. All tools used and methods employed shall be as approved except that no anvil type pruners will be permitted. The cutting surfaces of all tools, ladders, ropes, soles of workers shoes and other objects coming into contact with the tree shall be washed with an approved disinfectant at the start of any work on a tree to prevent the spread of plant diseases when ordered by the Engineer.

B. Pruning. When pruning is specified, the quantity of trees as shown in the contract documents shall be pruned of undesirable wood and the resulting crown shaped to the natural habit of the kind of the tree and as approved. Any and all branches interfering with or hindering the healthy growth of the tree shall be removed. All diseased branches and all dead branches 25 mm or more in diameter shall be removed. Any branch which may be partly dead, yet has a healthy lateral branch at least one-third the diameter of the parent branch shall be removed beyond the healthy branch. All branches less than 5 meters above any part of the roadway or interfering with sight distance or signs shall be removed as directed. All stubs or improper cuts resulting from former pruning shall be removed. All cuts shall be cleanly made with sharp tools as close to the parent trunk or limb as possible without disturbing the callus collar. All large bark wounds shall be scar traced in accordance with good horticultural practice to the satisfaction of the Engineer. All existing nails, spikes, wire or other materials found driven into or fastened to the trunk or branches shall be removed or if approved they shall be cut flush in a manner to permit complete healing over.

C. Fertilizing. When fertilizing is specified, the quantity of trees shown in the contract documents shall be fertilized as specified for Method No. 1, No. 2 or No. 3.

Method No. 1. Holes shall be made in the earth about 400 mm deep and 400 mm apart, and located in the outer two-thirds (as measured on the radius) of the circular area lying under the limits of the tree branches. The holes shall be made with a crowbar, soil auger, pneumatic equipment or other approved tools and care shall be taken to avoid injury to the roots. Fertilizer shall be applied at the rate specified and shall be evenly distributed over the area to be fertilized by placing equal amounts of fertilizer in the lower 300 mm of each hole.

Method No. 2. Fertilizer shall be applied at the rate specified with sufficient water pressure to saturate the soil for the area and depth of the tree roots. Standard high pressure power tree spraying equipment with a valve controlled pipe used as a jet irrigator or other approved equipment may be used.

Method No. 3. Fertilizer rate and method of application shall be as specified in the contract documents.

D. Cleanup and Disposal. All trunks, branches, rubbish and debris resulting from the work shall be removed and disposed of by the Contractor as specified in §201-3.03, Disposal.
§614-3.02 Selective Thinning. All trees and shrubs to be removed will be designated by the Engineer either by separate marking, marking in sample areas, or otherwise, to guide the Contractor on the scope and detail of the work. All stumps shall be cut to a height of about 150 mm above the ground unless otherwise specified or approved. An approved pesticide shall be applied to all live stumps in accordance with the manufacturer's recommendations. An approved dye shall be added to the pesticide mixture to identify treated stumps and stubble.

Care shall be taken in the felling of trees and the operation of equipment to prevent injury to trees and shrubs which are to be preserved. All injuries to the limbs, bark and roots of such plants shall be repaired as directed by the Engineer.

Selective thinning work shall be completed in any area before any planting or seeding work is begun in that area unless otherwise approved.

All wood, stumps, brush and other debris resulting from the work shall be disposed of as specified in §201-3.03, Disposal.

614-3.03 Tree Removal

A. General. No tree shown in the contract documents or listed for removal under this section shall be cut until it is approved by the Engineer. All work involving public utilities shall be coordinated with the respective utility company.

All trees shall be “topped” and “limbed” before felling unless otherwise approved.

Stumps of trees removed under this item and existing stumps listed for removal shall be grubbed, ground or cut as specified. Stumps shall include all visible wood and roots and shall be grubbed, ground or cut to the depth specified below the average grade or as directed by the Engineer. All stump holes shall be backfilled with the specified or approved materials compacted to the satisfaction of the Engineer within one week after start of work on the tree. The work of establishing grass on the stump hole areas shall be performed as specified or approved.

If, in the opinion of the Engineer, unsafe tools, equipment or methods are employed, work shall be stopped until such unsafe conditions have been corrected.

B. Disposal of Wood. The requirements of §201-3.03, Disposal, shall apply.

C. Liability. The Contractor shall protect and shall be liable for injuries to all plants, curbs, pavements, structures, utility lines and other features on the highway right-of-way and adjacent property. Replacements and restoration shall be as approved by the Engineer.

614-4 METHOD OF MEASUREMENT

614-4.01 Care of Trees. Care of trees shall be measured by the number of trees of each size group as set forth in the contract which are counted in place as having been completed and accepted.

614-4.02 Selective Thinning. Selective thinning shall be measured by the number of square meters satisfactorily completed.

614-4.03 Tree Removal. Tree removal shall be measured by the number of trees of each size group which have been satisfactorily removed. All trees shall be measured before they are cut. Measurements shall be made 1.4 meters (commonly referred to as D.B.H. -Diameter Breast High) above the ground. Removal of Existing stumps shall be measured by the number of stumps which have been satisfactorily removed.

614-5 BASIS OF PAYMENT

614-5.01 Care of Trees, Selective Thinning and Tree Removal. Payment for each item of work will be based on the unit price bid, which payment shall constitute full compensation for all labor, materials, equipment and incidentals necessary to complete the work as specified.
When trees and their respective stumps are specified in the contract documents for removal, payment for each tree removal shall include the work required for removal of the respective stump. Removal of existing stumps shall be paid for separately. Tree removal on an each basis shall be limited to those trees specifically listed for removal in the proposal or designated by the Engineer to be removed under this item.

**Payment will be made under:**

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>614.01xx</td>
<td>Care of Trees</td>
<td>Each</td>
</tr>
<tr>
<td>614.02</td>
<td>Selective Thinning</td>
<td>Square Meter</td>
</tr>
<tr>
<td>614.03xx</td>
<td>Tree Removal</td>
<td>Each</td>
</tr>
</tbody>
</table>

NOTE: xx denotes serialized pay item.

**SECTION 615 - LANDSCAPE MISCELLANEOUS**

615-1 DESCRIPTION. This work shall include watering plants, shrubs, ground covers, vines and other plants as specified in the contract documents. This work shall also include other landscape development items as specified in the contract documents, applicable standard sheets and in accordance with the specifications.

615-2 MATERIALS

615-2.01 Watering Vegetation. The materials shall meet the requirements of the following subsection of section 700-Materials Details.

Water 712-01

615-3 CONSTRUCTION DETAILS

615-3.01 Watering Vegetation. Water shall be applied in such a manner that the required volume of water will be provided without damage to plants, mulch, stakes, plant saucers, sod or other areas to be watered. Damage resulting from watering operations shall be repaired at the Contractor's expense.

615-4 METHOD OF MEASUREMENT

615-4.01 Watering Vegetation. This work will be measured in kiloliters of water applied. The quantity applied will be determined from approved meters, or by measurement in tanks or tank trucks of predetermined capacity.

615-5 BASIS OF PAYMENT

615-5.01 Watering Vegetation. The unit price bid shall include the cost of furnishing and applying water, all labor, equipment and incidentals necessary to satisfactorily complete the work.

**Payment will be made under:**

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>615.03</td>
<td>Watering Vegetation</td>
<td>Kiloliter</td>
</tr>
</tbody>
</table>

**SECTIONS 616 AND 617 (VACANT)**

**SECTION 618 - BITUMINOUS MATERIAL**

618-1 DESCRIPTION. Under this work the Contractor shall furnish and place bituminous material of the type and quantity specified on the plans or in the specifications.
§618-2 MATERIALS. The bituminous materials shall meet the requirements of the following subsections of Section 700 - Materials:

<table>
<thead>
<tr>
<th>Material Type</th>
<th>Code</th>
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</thead>
<tbody>
<tr>
<td>Paving Asphalt (AC-2.5)</td>
<td>702-0100</td>
</tr>
<tr>
<td>Paving Asphalt (AC-5)</td>
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<tr>
<td>Paving Asphalt (AC-10)</td>
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<td>Paving Asphalt (AC-15)</td>
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<td>702-0500</td>
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<tr>
<td>Misc. Asphalt Cement (85-100)</td>
<td>702-0600</td>
</tr>
<tr>
<td>Misc. Asphalt Cement (18-60)</td>
<td>702-0700</td>
</tr>
<tr>
<td>Rapid Curing Liquid Asphalt (RC-30)</td>
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<tr>
<td>Rapid Curing Liquid Asphalt (RC-70)</td>
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</tr>
<tr>
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<td>702-20</td>
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<tr>
<td>Medium Curing Liquid Asphalt (MC-70)</td>
<td>702-21</td>
</tr>
<tr>
<td>Medium Curing Liquid Asphalt (MC-250)</td>
<td>702-22</td>
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<td>702-24</td>
</tr>
<tr>
<td>Medium Curing Liquid Asphalt (MC-3000)</td>
<td>702-25</td>
</tr>
<tr>
<td>Asphalt Emulsion (RS-1)</td>
<td>702-3001</td>
</tr>
<tr>
<td>Asphalt Emulsion (RS-2)</td>
<td>702-3101</td>
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<tr>
<td>Cationic Asphalt Emulsion (CSS-1h)</td>
<td>702-4501</td>
</tr>
<tr>
<td>Asphalt Emulsion Tack Coat</td>
<td>702-90</td>
</tr>
</tbody>
</table>

§618-3 CONSTRUCTION DETAILS. The construction details for the application of bituminous materials specified in sections 401, 402, 403, 405, 407 and 410 shall apply.

§618-4 METHOD OF MEASUREMENT. The quantity to be paid for will include the number of liters measured at a temperature of 16°C and incorporated in the work as directed by the Engineer.

§618-5 BASIS OF PAYMENT. The unit price bid shall include the cost of furnishing all labor, materials and equipment necessary to incorporate the bituminous material in the work.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>618.01</td>
<td>Paving Asphalt (AC-2.5)</td>
<td>Liter</td>
</tr>
<tr>
<td>618.02</td>
<td>Paving Asphalt (AC-5)</td>
<td>Liter</td>
</tr>
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<td>618.03</td>
<td>Paving Asphalt (AC-10)</td>
<td>Liter</td>
</tr>
<tr>
<td>618.04</td>
<td>Paving Asphalt (AC-15)</td>
<td>Liter</td>
</tr>
<tr>
<td>618.05</td>
<td>Paving Asphalt (AC-20)</td>
<td>Liter</td>
</tr>
</tbody>
</table>
§618

618.06 Misc. Asphalt Cement (85-100) Liter
618.07 Misc. Asphalt Cement (16-60) Liter
618.10 Rapid Curing Liquid Asphalt (RC-30) Liter
618.11 Rapid Curing Liquid Asphalt (RC-70) Liter
618.12 Rapid Curing Liquid Asphalt (RC-250) Liter
618.13 Rapid Curing Liquid Asphalt (RC-250 with additive) Liter
618.14 Rapid Curing Liquid Asphalt (RC-800) Liter
618.15 Rapid Curing Liquid Asphalt (RC-800 with additive) Liter
618.16 Rapid Curing Liquid Asphalt (RC-3000) Liter
618.20 Medium Curing Liquid Asphalt (MC-30) Liter
618.21 Medium Curing Liquid Asphalt (MC-70) Liter
618.22 Medium Curing Liquid Asphalt (MC-250) Liter
618.23 Medium Curing Liquid Asphalt (MC-250 with additive) Liter
618.24 Medium Curing Liquid Asphalt (MC-800) Liter
618.25 Medium Curing Liquid Asphalt (MC-3000) Liter
618.3001 Asphalt Emulsion (RS-1) Liter
618.3101 Asphalt Emulsion (RS-2) Liter
618.3102 Asphalt Emulsion (HFRS-2) Liter
618.3201 Asphalt Emulsion (MS-2) Liter
618.3301 Asphalt Emulsion (HFMS-2) Liter
618.3401 Asphalt Emulsion (HFMS-2h) Liter
618.3402 Asphalt Emulsion (HFMS-2s) Liter
618.3501 Asphalt Emulsion (SS-1) Liter
618.3601 Asphalt Emulsion (SS-1h) Liter
618.4001 Cationic Asphalt Emulsion (CRS-1) Liter
618.4101 Cationic Asphalt Emulsion (CRS-2) Liter
618.4201 Cationic Asphalt Emulsion (CMS-2) Liter
618.4301 Cationic Asphalt Emulsion (CMS-2h) Liter
618.4401 Cationic Asphalt Emulsion (CSS-1) Liter
618.4501 Cationic Asphalt Emulsion (CSS-1h) Liter
618.90 Asphalt Emulsion Tack Coat Liter

SECTION 619 - MAINTENANCE AND PROTECTION OF TRAFFIC

619-1 DESCRIPTION

619-1.01 General. This work shall consist of maintaining traffic and protecting the public from damage to person and property within the limits of and for the duration of the contract.

619-1.02 Basic Maintenance and Protection of Traffic. Traffic shall be maintained over a reasonably smooth traveled way which shall be so marked by signs, delineators, guiding devices and other methods that a person who has no knowledge of conditions may safely and with a minimum of discomfort and inconvenience ride, drive or walk, day or night, over all or any portion of the highway and/or structure under construction where traffic is to be maintained. All work shall conform to the requirements of the M.U.T.C.D. The basic maintenance and protection requirements shall be as follows:

A. Surface. Maintain the surface condition of the traveled way so it is consistent with the appropriate speed limit.

B. Drainage. Maintain the drainage facilities and other highway elements, old or new, including those on detours.

C. Bus Stops. Maintain existing bus stops so bus passengers are reasonably accommodated.

D. Pedestrian Traffic. Provide adequate protection for pedestrian traffic during all phases of construction.
§619

**E. Intersecting Highways.** Provide ingress and egress to and from intersecting highways, homes, business and commercial establishments.

**F. Dust Control and Spillage.** Control dust and keep the traveled way free from materials spilled from hauling equipment. This shall also apply to dust control and spilled material resulting from the Contractor's operations in the areas outside the contract limits.

**G. Flagger.** Provide the necessary traffic control equipment and flaggers for adequate traffic control.

**H. Repairs.** Make the necessary repairs to existing pavement and structure wearing surfaces as required to provide a reasonably smooth roadway where vehicle operation is maintained.

**I. Responsibility to the Public.** Protect the public from damage to person and property which may result directly or indirectly from any construction operation.

**J. Schedule.** Schedule work to keep to a minimum, and consistent with the physical requirements of the contract, the amount of existing pavement and/or facilities that are destroyed or substantially torn-up at any one time. Unless otherwise indicated on the plans or in the proposal the length of existing facility destroyed shall not exceed two kilometers, nor shall any part be closed to traffic during seasonal shutdown periods, unless the Contractor has submitted and the Engineer has approved a detailed schedule of operations reflecting a proposal to the contrary.

**K. Snow and Ice Control.** Maintain the traveled way in such a condition and conduct operations in such a manner that snow and ice may be readily controlled by others as and when necessary, and in such a manner that proper drainage is provided for the melting of snow in the banks resulting from normal plowing. This shall include, but not be limited to, the cutting of weeps through banked or accumulated snow to provide proper drainage of surface runoff into the highway ditches and/or culverts. The Contractor shall not, however, be responsible for snow and ice control on the pavement or shoulders.

**L. Delineation and Guiding Devices.** Provide and maintain delineation and channelization devices which shall include delineators, plastic drums, cones, temporary curb 300 x 300 mm and smaller exposed section, and other similar materials or methods acceptable to the Engineer.

The installation, moving and removing of any such delineators or channelization devices together with removal of existing pavement markings shall be included in the work.

**M. Project Site Patrol.** The Contractor shall provide personnel to patrol the contract area as necessary to ensure that conditions on the site are adequate for public safety and convenience at all times. The Contractor is placed on notice that maintenance and protection of traffic over a highway during construction is considered as important as the construction itself. The Contractor shall, therefore, at all times conduct the operations in a manner to ensure the convenience of all travelers and the abutting property owners and their safety as well as the safety of the Contractor's own employees.

Such conduct shall include, but not be limited to: ensuring that all construction materials and equipment are removed from the work site during non-working hours, or are protected in such manner that they shall not constitute a traffic hazard; conducting the operations in such a manner as to minimize the amount of time during which fixed objects and steep side slopes are without guide rail protection; conducting shoulder construction and paving operations in such a manner as to minimize the period of time the traveling public is exposed to sharp dropoffs; and not allowing workers to park personal vehicles in the shoulder area on roads with operating speeds less than 70 km/h and within ten meters of the traveled way on other roads, unless protected by barrier.

**N. Shadow Vehicle.** For purposes of these specifications, a shadow vehicle is defined as a slowly moving or stopped vehicle operating or placed in a traffic lane, or adjacent thereto, upstream of a
construction work zone. The purpose of shadow vehicles is to guide traffic around a construction work area or to reduce the possibility of harm to workers in the work area. Shadow vehicles shall be required when shown on the plans or for all slowly moving work areas in travel lanes, except where the travel lane is closed to traffic by barrier, barricades, plastic drums, arrow panels, flagpersons or cones. Slowly moving work areas are those which move at a speed of 2km/h or more but at least 25km/h less than the legal speed limit. Shadow vehicles shall weigh 8200 kg to 9100 kg. Ballast may be used to bring a lighter weight vehicle up to the indicated weight. Shadow vehicles shall be equipped with Mobile Construction Zone Impact Attenuators, §712-06 and one Type B Arrow Panel as described in the M.U.T.C.D. On roads with posted speed limits of 65 mph within 335 meters upstream of the shadow vehicle, or whenever indicated on the plans or in the proposal, the Mobile Construction Zone Impact Attenuator shall be listed as a National Cooperative Highway Research Report 350 Test Level 3 device on the Approved List. On other roads the attenuator shall meet the requirements of NCHRP 350 Test Level 3 or Test Level 2, NCHRP 230, or other testing protocol as stated in §712-06.

619-1.03 Construction Signs, Temporary Box Beam Barrier, Temporary Concrete Barrier, Construction Barricades, and Lighting for Construction Barricades. The Contractor shall furnish, install, move, and maintain construction signs, temporary box beam barrier, temporary concrete barrier, construction barricades, and lighting for construction barricades where shown on the plans or when ordered by the Engineer, and in accordance with the M.U.T.C.D.

619-1.04 Temporary Structures and Approaches. The Contractor shall construct, move or remove, as directed, temporary structures, approaches, detours, pavements and necessary appurtenances.

619-1.05 (Vacant).

619-1.06 Short-Term Pavement Markings. Short-term pavement markings are intended for use on any new pavement or milled surface until the subsequent pavement course is placed or the final pavement markings are installed. The Contractor shall furnish, apply and when so ordered, remove short-term pavement markings where shown on the plans, or directed by the Engineer, in accordance with these specifications.

619-1.07 Temporary Traffic Signals. The Contractor shall furnish, install, move, remove and maintain temporary traffic signals and necessary components where indicated on the plans or as directed by the Engineer. The temporary traffic signals and necessary components that are furnished by the Contractor shall remain the property of the Contractor.

619-1.08 Mailboxes. During construction, the Contractor shall maintain in a usable condition and location specified by U.S. Postal requirements, postal route mailboxes serviced from motor vehicles.

619-1.09 Opening Highway to Traffic Prior to Contract Acceptance. This work includes the maintenance and protection of traffic on any portion of pavement, structure, or ramp directed in writing by the Regional Director to be opened to traffic prior to contract acceptance and on which traffic was not specified to be maintained and protected during construction. Pavement sections on new locations which are indicated to be used in the maintenance of traffic plan or which are requested by the Contractor to be used to maintain traffic, shall not fall in this category.

619-1.10 (Vacant).

619-1.11 Duration of Contract. The duration of the contract, for the purpose of this work, shall be from the date any work is started on the contract, including moving in equipment, signs, offices, shops and the like, until the date the contract is officially accepted.

619-1.12 Maintain Traffic Signal Equipment. The Contractor shall maintain in proper operation, existing, relocated, modified or newly installed traffic signals indicated in the contract documents or directed by the engineer for the period specified in the contract documents.
§619

619-1.13 Flashing Arrow Board. Furnish, install, maintain and remove Flashing Arrow Board warning devices in accordance with plans, NYS Manual of Uniform Traffic Control Devices or the directions of the Engineer. Flashing arrow boards are intended for use as temporary traffic warning devices during construction and obstruction periods, and under this item the Contractor shall provide Flashing Arrow Boards made necessary by the operations. The number and type required shall be the number and type necessary, in accordance with the criteria given below, to satisfactorily guide traffic through the construction. The actual number will depend on the Contractor’s sequence of operations.

619-1.14 Construction Zone Pavement Markings. The Contractor shall furnish, apply, maintain and remove construction zone pavement markings conforming to the NYSMUTCD at the locations, and in accordance with the patterns, indicated in the contract documents or directed by the Engineer. These pavement markings are intended for use in detours, temporary pavement realignments and crossovers, lane shifts and closures, and other temporary traffic patterns associated with the construction activities.

619-1.15 Maintenance and Protection of Traffic During Nighttime Operations. Nighttime operations consists of work specifically scheduled to occur after sunset and before sunrise. In addition to the requirements of basic maintenance and protection of traffic, additional requirements for maintenance and protection of traffic during nighttime operations shall be as follows:

A. Traffic Control Supervision. The Contractor shall provide a full-time traffic control supervisor for nighttime operations with adequate training, experience, and authority to implement and maintain all traffic control operations. The traffic control supervisor must be approved by the Engineer based on a written request by the Contractor detailing the training and experience of the traffic control supervisor. The traffic control supervisor shall be assisted by a full-time traffic control crew equipped with a suitable vehicle or vehicles and a mobile communications system consisting of radios or cellular phones. The duties and responsibilities of the traffic control supervisor shall be included in the plan of nighttime operations. During setup and removal of lane closures and other traffic control setups, the traffic control supervisor and crew shall be assisted by additional workers as necessary.

B. Plan of Nighttime Operations. Thirty days prior to the start of night work, the contractor shall submit a written plan for nighttime operations to the Engineer. The plan shall detail all aspects of the traffic control setup; lighting plans; the functions, responsibilities and identities of the traffic control supervisor and crew; and other details as necessary. It shall include a contingency plan identifying foreseeable problems and emergencies that may arise, and the approach that will be used to address them. This plan shall be revised and updated by the contractor as necessary during the progress of the work to accommodate actual conditions on the project.

C. Project Site Patrol. During nighttime operations, the traffic control supervisor and crew shall constantly patrol the contract area to ensure that conditions on the site are adequate for public safety and convenience at all times, to ensure worker safety from intrusions into the worksite, and to ensure that the provisions for maintenance and protection of traffic in the contract documents and in the plan for nighttime operations are adhered to. The traffic control crew shall maintain and adjust signs, channelizing devices, area lighting and other traffic control devices as necessary.

D. Waiver of Requirements. When the work does not require closure of an active lane, roadway, or ramp and when no construction operations occur adjacent to active traffic lanes; the requirements for a full-time traffic control supervisor and full-time project site patrol shall be waived. However, the contractor shall provide a competent supervisor and workers to install, maintain, adjust, and remove traffic control devices as required by the work operations. The details of the supervision and site patrol to be provided under this waiver shall be included in the plan of nighttime operations.

E. Trained Flaggers. All flaggers used in nighttime operations shall be formally trained in flagging operations. This training may consist of ATSSA (American Traffic Safety Services Association), Union, or trade association training, or training by an individual who has received
formal training from a recognized program or agency in work zone traffic control. Prior to the start of work, the contractor shall provide the Engineer with a written summary of training for each individual flagger. When requested by the Engineer, flaggers shall demonstrate their competency in flagging procedures. Flaggers not thoroughly competent in flagging procedures to the satisfaction of the Engineer shall be replaced at once.

**F. Emergency Flares.** A supply of emergency flares shall be maintained by the Contractor for use in the event of unanticipated situations such as traffic accidents, equipment breakdowns, failure of lighting equipment, etc.

619-1.16 (Vacant)

619-1.17 Temporary Rumble Strips. Work shall consist of installing, maintaining, and removing temporary rumble strips in construction work zones at the locations shown in the contract documents or as directed by the Engineer.

619-2 MATERIALS. All materials used shall comply with the requirements of the appropriate subsections of Section 700, Materials, or as established by this section, the applicable standard sheets or the plans.

619-2.01 Existing Pavement Repair. Existing pavements shall be kept in repair using materials compatible with the pavement. In general, plant-mixed bituminous concrete is suitable for all pavement surfaces. Material other than plant-mixed bituminous concrete may be used if approved by the Engineer.

619-2.02 Construction Signs, Other Signs, and Sign Covers. Rigid sign panels may be aluminum, fiberglass, galvanized steel, or plywood, except that sign panels placed on Type III Breakaway Barricades shall be aluminum.

Rigid lightweight plastic may also be used for sign panels, but not for panels larger than 1200 X 1200 mm. The rigid lightweight plastic substrate shall consist of at least two parallel surfaces of plastic separated by plastic foam or stiffener/spacers. A single piece plastic extrusion simulating this construction will also be acceptable. External stiffeners may be used to prevent warping and excessive flexing, or to attach the panel to posts. If through bolting is used to attach the panel to stiffeners, or to attach the panel directly to the posts, the bolt heads shall be provided with clear washers to minimize obscuring the legend. The rigid lightweight plastic substrate, plus any external stiffeners, shall not have a combined mass of more than 6 kg/m2.

On rigid panels, all colors of sign faces, except orange, shall be reflectorized and meet the requirements of §730-05 Reflective Sheeting, Materials Designation 730-05.02 (Class B). When orange signs on rigid panels are specified they shall be fabricated using reflectorized fluorescent orange colored sheeting meeting Materials Designation 730-05.04 (Class D).

Flexible sign panels shall be a solid, orange colored, durable elastomeric material. Flexible sign panels fabricated from mesh will not be allowed.

Flexible signs shall be orange in color and a reasonable visual match to Munsell Book Notation 2.5 YR 5.5/14. The orange color flexible panels shall be approved by the Engineer prior to use. Flexible sign panels need not be reflectorized.

Black sign characters shall be non-reflective, and shall conform to the requirements of §730-13 Reflectorized Sheeting Sign Characters (Type V).

White sign characters shall meet the requirements of either §730-12 Reflectorized Sheeting Sign Characters (Type IV) or §730-13 Reflectorized Sheeting Sign Characters (Type V).

Covers used to inactivate unneeded signs shall match the size and shape of the sign and shall cover the entire sign face. More than one layer of fabric may be required to prevent legibility of the sign legend to be covered. The covers shall be a heavy duty, opaque material; and dark green, brown, or black, in color. The sign cover shall be attached to the sign in a secure manner using straps or other means approved by the Engineer. The finished sign covers shall be neat in appearance, with all fasteners secured on the backside of the sign face.
§619.2.03 Delineators, Temporary Box Beam Barrier, Temporary Concrete Barrier, Construction Barricades, Lighting for Construction Barricades, Tubular Markers, and Short-Term Pavement Markings. Delineators, barricades, lighting for construction barricades, short-term pavement markings, tubular markers and similar materials shall meet the requirements of these specifications and shall be in accordance with the plans, applicable standard sheets and the M.U.T.C.D. No materials or methods which will cause damage to any pavement or paving course that will be retained shall be employed in the removal of pavement markings.

Tubular markers shall meet the requirements of §730-09 Tubular Markers for Construction Zone Channelization. Tubular markers and cones purchased after October 1, 1998 shall be certified by their manufacturers or vendors as complying with NCHRP 350 testing requirements. The basis for such certifications shall be full or simplified crash testing or satisfactory in-service performance of identical or similar devices.

Temporary box beam barrier shall meet the requirements of box beam median barrier as specified in §710-21 Box Beam Guide Railing and Median Barrier. After the removal of the barrier, the pavement repairs shall be made in accordance with the applicable requirements of Section 402 - Hot Mix Asphalt (HMA) Pavements or Section 502 Portland Cement Concrete Pavement.

Temporary concrete barriers shall conform to the dimensions, joint connections, materials details, and anchoring details shown on the standard sheet or approved material details. The barrier sections shall be precast concrete units. The Manufacturer shall certify that the temporary concrete barrier units conform to the details shown on the standard sheet or approved materials details.

The details for temporary concrete barrier shown on the standard sheet or approved materials details are standard. Designs, other than those shown on the standard sheet or the approved materials details, may be proposed and, if found acceptable, they will be placed on the approved list. No variation in the method of connecting the units together will be approved unless evidence that the temporary concrete barrier, with the proposed joint system, has been successfully crash tested by a recognized testing agency. The test vehicle shall be smoothly redirected without showing any evidence of penetrating or vaulting. The tests shall be conducted in accordance with NCHRP 350 under the following criteria:

1. Test vehicle shall be the 2000P
2. Impact angle 25° ± 2°
3. Impact speed 100 km/h.

In no case shall the tested deflection of the barrier exceed 400 mm.

The cross sectional dimensions shown on the standard sheet shall be used in all cases without variation.

The Engineer will inspect the temporary concrete barrier sections upon delivery to the project site for conformance to specifications. Any barrier sections having damage and/or defects in the concrete and/or joint connections will be rejected by the Engineer when, in the Engineer's judgement, the performance of the barriers will be affected.

The temporary concrete barrier sections shall form a smooth and continuous barrier when joined together. Any sections damaged or misaligned while in service shall be corrected or replaced to the satisfaction of the Engineer.

When reflectorization is required by the M.U.T.C.D. reflective sheet material shall be used and it shall conform to §730-05, Reflective Sheeting, Material Designations 730-05.02 (Class B) or 730-05.03 (Class C), except where glass or plastic buttons are used as delineators. Construction barricades, cones and drums may be reflectorized with reflective sheeting conforming to the requirements of §730-05, Reflective Sheeting, Materials Designation 730-05.01 (Class A). All traffic cones 700 mm in height, when used after dark, shall have two (2) white horizontal stripes of reflective material near the tip. The reflective material shall conform to the requirements of §730-05 Reflective Sheeting, Class A, B or C. The upper stripe shall be 150 mm wide with its upper edge 75 to 100 mm below the top of the cone. The lower stripe shall be 100 mm wide with its upper edge 50 mm below the upper stripe.

When reflectorization is not required, any paints utilized shall be of an exterior type conforming to the appropriate Highway Color Tolerance Chart PR Colors No. 1 through No. 6. These requirements must be maintained throughout the period of the contract with repair or replacement made by the Contractor as necessary.
Short-term pavement markings shall consist of reflectorized pavement marking paints, removable reflectorized pavement marking tape, non-removable reflectorized pavement marking tape, or removable raised reflectorized pavement markers. Removable reflectorized pavement marking tape and raised reflectorized pavement markers shall be selected from the Department's Approved List of “Removable Reflectorized Pavement Markings”. Pavement marking paints shall meet the material requirements of Section 640 Reflectorized Pavement Markings. Non-removable pavement marking tape shall be specifically designed for use as a pavement marking and shall be approved by the Engineer prior to application. All line segments shall be not less than 100 nor more than 150 mm in width and the colors shall be as specified in the M.U.T.C.D.

619-2.04 Temporary Structures and Approaches. When specific details are shown on the plans for temporary structures, the materials specified shall be used, except that substitutions or alterations may be permitted if approved by DCES. Mill inspection will not be required for structural steel furnished under this item. Certified copies of the manufacturer's test results shall be submitted to the Engineer. When specific details are not shown on the plans, the Contractor shall assume all liability and responsibility for determining that all materials required conform to the current AASHTO specifications for Highway Bridges unless otherwise approved by the DCES. Used material shall not be furnished for Fracture Critical Members. Excluded from this provision are pedestrian and pre-engineered (fabricated) proprietary structures.

619-2.05 Temporary Traffic Signals. All span wire, inductance loop wire, shielded lead-in cable, traffic signal cable, and other wire used for temporary traffic signals shall be new material meeting the applicable requirements of §680-2 of the Standard Specifications.

All other equipment for temporary traffic signals shall meet the requirements of §680-2 of the Standard Specifications except for the following modifications:

A. Used Equipment. Used equipment in good operating condition may be furnished to provide the required operation of the signals.

B. Manufacturer's Certification. Manufacturer's certification of compliance will not be required.

C. Signal Controller. The signal controller may be either solid state or electro-mechanical.

D. Traffic Signal Heads. The material and painting requirements of §724-04 Traffic Signal Heads, shall not apply except that the signal head housing shall be made of aluminum alloy and shall be painted with an exterior dark green enamel paint or epoxy powder coating.

E. Conflict Monitor. Means shall be provided to prevent the signal from displaying indications which will result in two or more conflicting traffic movements being permitted simultaneously.

619-2.06 Type III Construction Barricades. Type III construction barricades shall meet the requirements of the following specifications:

A. Barricade Frames. Barricade frames for Type III construction barricades shall meet the requirements of the following specifications:

1. PVC Pipe Barricade Frames for Alternate “A” and “B”. PVC Pipe barricade frames shall be fabricated from plastic pipe conforming to the following table:
### TABLE OF ACCEPTABLE MATERIALS FOR PVC PIPE BARRICADES

<table>
<thead>
<tr>
<th>NPS DESIGNATION</th>
<th>A.S.T.M. PIPE</th>
<th>*SDR RANGE</th>
<th>FITTINGS ALTERNATE A</th>
<th>FITTINGS ALTERNATE B</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>D2241</td>
<td>21.0 TO 32.5 D2665 OR D2466</td>
<td>D2468, D2661, D2665, D2466</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>D2665</td>
<td>---</td>
<td>D2665 OR D2466</td>
<td>D2468, D2661, D2665, D2466</td>
</tr>
<tr>
<td>3-½ **</td>
<td>D2241</td>
<td>21.0 TO 41.0 D2466</td>
<td>D2468, D2466</td>
<td></td>
</tr>
<tr>
<td>4 **</td>
<td>D2241</td>
<td>21.0 TO 64.0 D2665 OR D2466</td>
<td>D2468, D2661, D2665, D2466</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>D2665</td>
<td>---</td>
<td>D2665 OR D2466</td>
<td>D2468, D2661, D2665, D2466</td>
</tr>
<tr>
<td>4</td>
<td>D2729</td>
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<td>D2729</td>
<td>D2729</td>
</tr>
</tbody>
</table>

* SDR (Standard Dimension Ratio) as specified in the various A.S.T.M. Designations.

** NPS 3-½ OR 4 A.S.T.M. D2241 SDR 21 to SDR 26 shall be used on barricades which are extended for sign mounting. These pipes shall not be used on other barricades.

- All joints in Alternate “A” shall be glued with a solvent cement compatible with the PVC pipe chosen by the Contractor.
- All joints in Alternate “B” shall be free to separate upon vehicle impact. Pipes and fittings shall be tied together with a braided nylon rope as shown on the Standard Sheet.

2. **Metal Barricade Frames for Alternate “M”**. Square tubing for the Alternate “M” barricades shall be either perforated or unperforated steel conforming to one of the following:

- 12 Ga. ASTM A653M Grade A
- 14 Ga. ASTM A1011 Grade 50

The brackets shall be fabricated from 6 mm plate conforming to ASTM A653M Grade A or ASTM A1011 Grade 50.

The bolts shall be ASTM F568 Class 4.6 and the nuts shall be ASTM A563M Grade 0. Both the nuts and the bolts shall be galvanized in accordance with the requirements of §719-01 Type II.

The Contractor may at its option supply ungalvanized square steel tube and brackets. However, any rust which may, as determined by the Engineer, impair the collapse of the barricade upon impact may result in the rejection of the barricade unit.

3. **Polyethylene Barricade Frames for Alternate “C”**. Base and upright for the Alternate “C” barricade shall consist of molded medium density polyethylene tubing meeting the requirements of ASTM D1248-IIA3. The angled brace shall consist of extruded high density PE meeting the requirements of ASTM D1248-IIIA4. Polyethylene tubing and miscellaneous hardware shall be of the dimensions and sizes indicated on the standard sheets. All joints in the PE components shall have tight friction fits designed to withstand normal wind and construction site conditions but to separate on impact.

B. **Panels for Rails or Signs**. Barricade rails and signs mounted on the barricade shall be aluminum or high density polyethylene (HDPE) panels. Aluminum rail and sign panels shall be 0.635 and 3.2 mm thick respectively and shall conform to the requirements of §730-01 Aluminum Sign Panels. HDPE panels shall be 3.2 mm nominal thickness and shall conform to the requirements of ASTM D1248-IIIA5.

The three rails of the barricade shall have 150 mm wide reflectorized orange and white diagonal stripes sloping at an angle of 45°. The stripes shall slope downward toward the side on which traffic is to pass. The reflective sheeting for the stripes shall conform to the requirements of §730-05 Reflective Sheeting, Materials Designation 730-05.01 (Class A) or 730-05.02 (Class B) or 730-05.03 (Class C) at the Contractor's option.

619-2.07 **Maintain Traffic Signal Equipment**. All traffic signal hardware including but not limited to wire, cable, conduit, pullboxes, switchpacks, modules and relays, signal heads, poles, and pedestrian push buttons used to maintain proper operation shall meet the applicable requirements of §680-2 materials. Parts and materials which are to continue in operation beyond the contract duration shall be new.
§619

619-2.08 Flashing Arrow Board. The Flashing Arrow Boards shall be trailer mounted self contained units or, with permission of the Engineer, truck mounted self-contained units. Flashing Arrow Boards shall display a flashing symbol consisting of flashing yellow lights arranged on a panel to form an arrow.

The arrow panel shall consist of 1200 X 2400 mm rectangular solid panel finished in non-reflective black, and shall be mounted so that the bottom of the panel is a minimum of 2.1 m above the roadway. The arrow indication shall cover the entire area of the panel, and shall be composed of lamp units with five lamps in the arrowhead and five lamps in the shaft.

Lamps shall be arranged and controlled to provide the following mode selections: Left Arrow, Right Arrow, Left and Right Arrow, and Caution. In the three directional modes, the lamps in the shaft next to the arrow point shall not illuminate. The caution mode shall consist of either two pairs of alternately flashing lamps arranged in a pattern that does not indicate direction, or four lamps simultaneously flashing in each of the four corners of the board. The rear face of the arrow panel shall contain one or more clear lamps to indicate that the arrow board is operating properly. Arrow panel operation controls shall be mounted in a lockable enclosure.

The lamps shall flash at a rate of not less than 25 nor more than 40 flashes per minute with a minimum lamp “on time” of at least 50 percent of the cycle. The lamps shall be recess mounted or alternatively equipped with an upper hood of not less than 180 degrees. The lamps shall be equipped with an automatic solar cell controlled dimming switch activated at a level of approximately five candelas. The solar cell dimming switch shall be equipped with a delay to prevent undesirable actuation from car lights. The dimming voltage to the lamps shall be manually controllable over a five to twelve volts effective range.

Flashing Arrow Boards shall be powered by line voltage, diesel motor generator system, or by a solar charged battery system. Boards powered by diesel motor generator system shall be capable of sustained operation for 72 continuous hours at normal operating voltage. Solar charged arrow boards shall be capable of continuous operation on battery power only for the same period at normal operating voltage.

The flashing arrows of diesel or line powered boards shall be legible at a minimum distance of 1600 meters on a bright sunny day or a clear night. The flashing arrows of solar charged boards shall be clearly legible continuously from any point on the traveled way or shoulder from the beginning of the lane closure taper to an upstream distance of 500 meters on a bright sunny day or a clear night.

619-2.09 Plastic Drums. Plastic Drums may be used for channelization devices, provided they are of the proper size and reflectorized as indicated in the M.U.T.C.D. Plastic drums purchased after October 1, 1998 must be certified by their manufacturers or vendors as complying with NCHRP 350 testing requirements. The basis for such certifications shall be full or simplified crash testing or satisfactory in-service performance of identical or similar devices. The plastic drums shall have provisions for the installation of ballast (weights) or retainer rings to prevent the drums from blowing over due to wind loading. The ballast or retainer rings must be designed to separate from the drum on impact. The ballast shall be located at or near ground level and consist of bagged sand, or other material approved by the Engineer, weighing no more than 22 kilograms. The sand shall be contained in waterproof closed bags or in a waterproof compartment of the device specifically designed for the purpose. For two-piece drums, only the base shall be detachable no more than 100 mm above the pavement. For one-piece drums, the base shall be elongated to accept ballast on one or more sides. No open or top metal drums will be permitted.

619-2.10 Construction Zone Pavement Markings. These markings shall consist of reflectorized pavement marking paints, removable reflectorized pavement marking tape, or removable raised reflectorized pavement markers. Pavement marking paints shall meet the material requirements of §640-2. Removable reflectorized pavement marking tape and raised reflectorized pavement markers shall meet the requirements of §727-02 and shall be selected from the Department's Approved list of "Removable Reflectorized Pavement Markings." All longitudinal line segments shall be not less than 100 mm nor more than 150 mm in width and colors shall be as specified in the MUTCD and shown on the plans.

The type of pavement marking material to be supplied shall be as required by the pay item. In the case of the "Optional Construction Zone Pavement Markings" pay items, the Contractor may select the type of material to be used from the choices permitted in the preceding paragraph, except that reflectorized pavement marking paint shall not be used on any top pavement course that is to remain
place without overlaying at the completion of the project, except where the location of those markings coincide with final painted pavement markings. Raised reflectorized pavement markers shall not be used to simulate marking letters or symbols.

§619-2.11 High-Visibility Apparel.

A. Protective Helmets. Protective helmets shall meet current OSHA standards for impact, electrical shock, and burn protection. Protective helmets used during nighttime operations shall be equipped with a minimum of 7500 mm² of reflective tape on all four sides (i.e., 25 mm by 75mm strip - 1875 mm² per side). Protective helmets for flaggers shall be orange.

B. Construction Apparel. Construction Apparel shall consist of a vest, shirt, or jacket; orange, fluorescent orange, yellow, fluorescent yellow, yellow-green, fluorescent yellow-green or combination of these colors meeting the requirements of the MUTCD.

C. Nighttime Apparel. Nighttime Apparel shall consist of a vest, shirt, or jacket; orange, fluorescent orange, yellow, fluorescent yellow, yellow-green, fluorescent yellow-green or combination of these colors meeting the requirements of ANSI 107 Class 2.

D. Traffic Control Apparel. Traffic Control Apparel shall consist of a vest, shirt, or jacket; fluorescent orange with fluorescent yellow-green striping bands or fluorescent yellow-green with fluorescent orange striping bands, placed both horizontal and vertical, meeting the requirements of ANSI 107 Class 2. The striping bands shall be approximately 120 mm wide with retroreflective strips. Retroreflective strips shall consist of two 25 mm wide retroreflective strips being 50 mm apart in the center of the fluorescent striping band material or a single 50 mm wide in the center of the fluorescent striping band material.

§619-2.12 (Vacant)

§619-2.13 (Vacant)

§619-2.14 (Vacant)

§619-2.15 (Vacant)

§619-2.16 (Vacant)

§619-2.17 Temporary Rumble Strips.

A. Raised Asphalt Rumble Strips. Raised asphalt rumble strips shall be formed from Type 5 (Shim Course) or Type 7 (Top Course) hot mix asphalt (HMA) meeting the requirements of Section 403, Hot Mix Asphalt (HMA) Pavements for Municipalities or a 9.5 mm hot mix asphalt meeting the requirements of Section 402, Hot Mix Asphalt (HMA) Pavements. Asphalt Emulsion Tack Coat shall be used to adhere the rumble strip to the existing pavement. Raised asphalt rumble strips shall have a width measured in the direction of traffic of between 150 mm and 225 mm and have a final compacted thickness of 10 mm ± 3 mm.

B. Raised, Removable-Tape Rumble Strips. Removable-tape rumble strips shall be formed from black, nonreflectorized, removable pavement-marking tape. Raised, removable-tape rumble strips shall have a minimum width measured in the direction of traffic of 150 mm, with sufficient layers of tape such that each finished rumble strip has a thickness of 10 mm ± 3 mm.

C. Raised, Preformed Rumble Strips. Raised, preformed rumble strips shall be manufactured specifically as temporary rumble strips. Raised, preformed rumble strips shall have a minimum width measured in the direction of traffic of 100 mm, with a thickness of between 6 mm and 13 mm.
D. Saw-cut Rumble Strips. Saw-cut rumble strips shall have a width measured in the direction of traffic of 100 mm ± 13 mm. The depressions shall have a rectangular cross section with a depth of 10 mm ± 3 mm.

E. Milled-in Rumble Strips. Milled-in rumble strips shall have a nominal width measured in the direction of traffic of 150 mm. The depressions shall have a semicircular, concave cross section with a depth of 10 mm ± 3 mm.

F. Removing Temporary Rumble Strips. Rumble strip depressions shall be filled in with Type 5 (Shim Course) or Type 7 (Top Course) hot mix asphalt (HMA) meeting the requirements of Section 403, Hot Mix Asphalt (HMA) Pavements for Municipalities or a 9.5 mm hot mix asphalt meeting the requirements of Section 402, Hot Mix Asphalt (HMA) Pavements.

619-3 CONSTRUCTION DETAILS

619-3.01 Basic Maintenance and Protection of Traffic. Under this work, the Contractor shall maintain and protect traffic in accordance with the following:

A. General. The Contractor shall generally provide a traveled way suitable for two lanes of moving traffic, or more lanes if shown on the plans, or in the proposal. The traveled way shall be kept reasonably smooth and hard at all times, and shall be well drained and free of potholes, bumps, irregularities and depressions that hold or retain water. Construction operations shall be conducted to insure a minimum of delay to traffic. Stopping traffic for more than five minutes shall not be permitted unless specifically authorized in writing by the Engineer. The necessary equipment and personnel to attain and maintain a satisfactory riding surface shall be available and used as needed at all times when work is under way and when work is temporarily suspended for any period of time. Special attention to maintenance of a satisfactory traveled way shall be given during weekends, holidays and the winter season.

B. Cleaning of Highways. The Contractor shall keep the traveled way free of foreign objects such as spilled earth, rock, timber and other items that may fall from transporting vehicles. Materials spilled by or dropped from the undercarriage of any carrying vehicle used in the Contractor's hauling operations along or across any public traveled way both within and outside the contract limits shall be removed immediately.

C. Dust Control. Dusty conditions resulting from the Contractor's operations shall be corrected by the use of calcium chloride and/or water. Water used as a dust palliative shall be distributed uniformly over a minimum width of 2400 mm by the use of suitable spray heads or spray bar. Nothing in these specifications shall preclude the use of a dust palliative which has been evaluated and found to be environmentally compatible and is used in conformance with any conditions placed on its use. This use shall be at no additional cost to the State and as approved by the Engineer. A list of acceptable dust palliatives is available from the Director, Geotechnical Engineering Bureau or a Departmental Soils Engineer.

D. Traffic Control. Whenever it becomes necessary to maintain traffic on one lane, the Contractor shall provide adequate traffic controls. The Contractor shall employ a sufficient number of competent flaggers and/or temporary traffic signals to control one lane traffic and areas where construction equipment is operating in potential conflict with public traffic, regardless of the volume of traffic or the sight distance. Flaggers shall wear orange protective helmets and Traffic Control Apparel. Flaggers shall direct traffic in conformance with the MUTCD. Stop/Slow Paddles meeting the requirements of the MUTCD shall be used as the standard signaling device for flagging operations where one or more flaggers are controlling a single stream of traffic, or two alternating streams of traffic proceeding in opposite directions. Signal flags may be substituted where display of the STOP and SLOW faces may be inappropriate or misleading, or in other situations, with the approval of the Engineer.
§619

E. Drainage. The Contractor shall devote particular attention to all drainage facilities, keeping them fully operative at all times. Ditches shall be provided at all times, even during grading operations and periods of accumulated plowed snow, to adequately drain the traveled way and the remainder of the right-of-way areas.

F. Ingress and Egress. The Contractor shall provide and maintain, at all times, safe and adequate ingress and egress to and from intersecting highways, homes, business and commercial establishments at existing or at new access points, consistent with the work, unless otherwise authorized by the Engineer. The Contractor will not be responsible for snow removal from driveways or entrances. On highways on which motor bus service is maintained, the Contractor shall provide suitable areas or locations for the loading and unloading of passengers. The existing pavement, at improved intersecting streets, shall not be disturbed without prior consent of the Engineer.

G. Channelization, Delineation, Pavement Edge Drop-off Protection. The Contractor shall furnish, erect, move, maintain and remove delineators, channelizing devices, and traffic barrier as required by the contract documents and as directed by the Engineer. In areas where grading is being done, a safe and easily traveled roadway shall be properly marked at all times either by the use of delineation and channelizing devices or flaggers. Where private driveways, pedestrian or handicapped facilities exist, the entire access area shall be kept safe and smooth for convenient ingress and egress. Any area determined by the Engineer to be particularly hazardous shall be marked by the use of flashing warning lights conforming to the requirements of the MUTCD in addition to the channelizing or delineation devices.

1. Channelization. Channelizing devices shall be provided as shown in the plans and proposal, or as required by the Engineer, to physically separate traffic from the portion of roadway not available for travel, and to mark the limits of the roadway that is available for travel. Channelizing devices shall consist of cones, plastic drums, tubular markers, Type III Barricades, or vertical panels. The design and usage of these devices shall conform to the requirements of the MUTCD.

   The placement and spacing of these devices in tapers shall not exceed the values given in the MUTCD. Along pavement edge drop-offs, placement and spacing shall be in accordance with Table 619-1 of these specifications. At locations other than tapers and pavement edge drop-offs, unless specific placement and spacing of devices is shown in the contract documents, the placement and spacing between devices shall be selected by the Contractor subject to the Engineer's approval. The spacing shall be sufficiently close to clearly indicate the intended path through the work zone and the portions of the roadway not available for use. If, after deployment of the selected devices, the Engineer is not satisfied that the spacing and placement is sufficient, the Engineer may direct that a different spacing be used.

   All channelizing devices shall be maintained upright, in proper alignment and orientation, and kept clean at all times. If ballast is used to maintain alignment and position of the devices, it shall consist of dry sand or other material approved by the Engineer, and placed at ground level. The sand shall be contained in waterproof closed bags or in a waterproof compartment of the device specifically designed for the purpose. Under no circumstances shall ballast be placed on top of a drum or at any point above ground level on any of these devices. If plastic drums are used, they shall be two-piece devices with detachable bases or one-piece devices with elongated bases provided to hold the ballast. In the case of one-piece devices, the ballast shall be placed on the side from which traffic approaches. In no case will the use of steel drums or open-top plastic drums be permitted. Where warning lights are attached to the channelization devices, a bolt, nut and washer shall be used for the attachment as recommended by the manufacturer, and the battery should be located at ground level.

2. Delineation. If post-mounted delineators are used, they shall be securely mounted and placed in accordance with the requirements of the MUTCD. They shall be placed only behind curbing or to mark the outside limits of usable shoulders. Post-mounted delineators are not required to be installed behind channelizing devices, but such an installation is not prohibited. Other delineators for mounting on traffic barriers or other purposes may be circular or rectangular in shape and
shall be constructed of reflective sheeting having a minimum area of 12,900 square millimeters or a reflective button having a minimum diameter of 75 mm.

3. Drop-off Protection. For drop-offs within three meters of the travel lanes, except bridge drop-offs or other drop-offs in excess of 1.8 m deep, the Contractor shall provide traffic protection in accordance with the provisions of Table 619-1, “Required Protection for Pavement-edge Drop-offs” and its accompanying notes, unless otherwise shown in the Contract documents. In all cases, construction operations shall be conducted so as to minimize to the extent practicable the time, depth, and length of drop-offs to which motorists are exposed. At the close of work each day, the Contractor shall provide the treatment shown in Table 619-1. At the time a drop-off condition first occurs, the protection treatment shall be installed based on the anticipated number of days the traffic will be exposed to the drop-off. The anticipated exposure time shall be determined by the Contractor, subject to verification by the Engineer. If at any time subsequent to installation of the protection treatment, the Engineer determines that the anticipated exposure time is likely to increase such that additional protection is required, that increased protection shall be installed as soon as practicable, and it shall be based on the revised anticipated exposure time measured from the first day the drop-off condition existed. In addition, “LOW SHOULDER” or “NO SHOULDER” signs, as appropriate, shall be used for all drop-offs within 1.5 m of the shoulder edge. For long drop-offs, these signs shall be placed beyond intersections and at spacing not exceeding 300 meters. For drop-offs less than 50 mm deep, the “LOW SHOULDER” sign will not be necessary after edge lines are installed.

If a ramp is required by Table 619-1, it shall be constructed from the pavement surface to the surface of the excavated area using a slope not steeper than the slope shown in the table. Ramp material shall be erosion resistant, fully compacted, and compatible with the material in the excavated area. At the Contractor’s option, a preformed ramp may be used provided it is adequately anchored to the underlying course. Unless indicated otherwise in the plans or permitted in writing by the Engineer, channelizing devices or positive barrier used to protect drop-offs shall not intrude into the travel way to the extent that they reduce available lane width to less than 3 meters on roadways with actual operating speeds of 70 km/h or less or 3.35 m on all other roadways. Channelizing devices may be placed in the drop-off area only for depths of up to 150 mm if their placement on the roadway would reduce lane widths below the values specified above. For drop-offs deeper than 150 mm, the channelizing devices must be placed entirely on the pavement.

If the Contractor’s operations are scheduled or delayed such that positive barrier is required by Table 619-1, or if the Contractor chooses, with written approval from the Engineer, to provide a positive barrier in lieu of the treatment shown in Table 619-1, the barrier shall be installed at no additional cost to the State. The positive barrier shall meet all the requirements of the Standard Specifications and Standard Sheets for temporary concrete barrier. (Box Beam Guide Railing or Heavy Post Blocked-Out Corrugated Beam Guide Rail may be used if approved in writing by the Engineer and the distance from the back of the rail to the drop off is at least 1.2 m for the corrugated beam rail and 1.5 m for the box beam.) Any anticipated or proposed use of positive barrier by the contractor shall require submittal of a plan for approval by the Regional Director. The plan shall include barrier type, location, terminal and end treatment, and any necessary traffic control devices such as signing, barricades, channelizing devices etc in accordance with the MUTCD. The contractor shall construct his plan under the following guidelines.

Approach ends of positive barrier shall be flared at the taper rate shown in Table 619-2. When operating speeds are over 65 km/h, an approved safety terminal or sand barrel array will be required on approach ends of temporary concrete barrier when the offset from the edge of traveled way to end of the full section barrier is less than 3.7 m. In traversable medians, gores and other areas where impacts on a tapered concrete end section could allow vehicles to penetrate into opposing or adjacent lanes of traffic, the use of the tapered concrete end section is prohibited. Box beam and heavy post blocked-out corrugated beam guide rail shall be anchored with the appropriate end assemblies and anchorage units shown on the standard sheets for these systems. Alternate methods of terminating positive barrier such as connecting to existing barrier or shielding behind other barrier will be considered for approval. If a work zone crash cushion is used, any work zone crash cushion purchased after 10/1/98 must comply with NCHRP 350. The
test level shall be as indicated in §712-06. Work zone crash cushions purchased before 10/1/98 may be phased out as they complete their normal service life.

H. Signs

1. Control and Authority. All existing highway signs, markers, delineators and their supports (authorized by the Department of Transportation) within the contract limits shall remain under the control and jurisdiction of the Engineer and shall be maintained for the duration of the contract by the Contractor if directed by the Engineer. Any signs not authorized by the Department of Transportation, shall be removed from the right-of-way if ordered by the Engineer.

2. Maintenance of Route Marker Signs. Route marker signs shall be maintained by the Contractor during construction. Should relocations be necessary at various stages of construction, they shall be in conformance with the M.U.T.C.D. and the directions of the Engineer to locations visible to traffic. Appropriate directional signing shall also be used in conjunction with route marker signs.

3. Storage of Existing Signs, Markers and Delineators. The Contractor, when ordered, shall remove existing signs, markers and delineators and their supports which interfere with the construction operations; store, protect, clean and replace them on the contract as directed to locations approved by the Engineer. Signs, markers and delineators not to be replaced, shall be cleaned and delivered to the Engineer as directed. Signs, markers and delineators lost or damaged because of negligence on the part of the Contractor, shall be replaced at the Contractor’s expense.

<table>
<thead>
<tr>
<th>TABLE 619-1 REQUIRED TREATMENT FOR PAVEMENT EDGE DROP-OFFS</th>
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<tbody>
<tr>
<td>Depth of Drop-off (mm.)</td>
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<td>600+</td>
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</tbody>
</table>

NOTES:
1. The table shows spacing for drums or Type III barricades. The spacing shall be halved if other channelizing devices are used. Type III barricades may be used instead of drums, if space permits, but no separate payment will be made unless otherwise shown on the plans.
2. For drop-off lengths shorter than the maximum devices spacing shown in Table 619-1, or for drop-offs at intersections, the device spacing shall be shortened to provide adequate channelizing as directed by the Engineer.
3. Two flashing warning lights shall be used at the beginning of each work zone drop-off.
4. The ramp from the pavement surface to the excavated area shall not exceed the slope shown in the Table. Cases where no slope is shown, no sloped ramp is required.
5. Whenever it is not practicable in the opinion of the Engineer to achieve the desired ramp slope shown in the Table, the flattest practicable ramp shall be constructed and the device spacing shall match the 7 day spacing, except positive barrier shall be required for drop-offs exceeding 600 mm on roadways with traffic volumes exceeding 7500 vehicles per day.
6. At the Contractor's option, required 1:3 ramps may be flattened to 1:4 and device spacing increased to 60 meters.
7. For drop-offs located more than 3 meters from the edge of the travel lane, ramping shall not be required and the minimum required spacing for drums and Type III barricades shall be 30 meters. (15 meters for alternate devices). Drums or Type III Barricades spaced at 15 meters or other approved devices spaced at 15 meters may be substituted for positive barrier. Signs and flashing warning lights shall be provided as required in this Section for drop-offs greater than 150 mm.

8. For winter shutdown periods, the Contractor shall restore the roadway to the normal operating condition whenever possible. If this cannot be achieved, a compacted 1:4 ramp shall be provided at all pavement edge drop-offs. If a 1:4 ramp cannot be provided, a positive barrier shall be required, unless otherwise directed by the Regional Construction Engineer, at no additional cost to the State.

9. For drop-offs exceeding 600 mm in depth for exposure times of 7 days or less, and when an offset of at least 600 mm cannot be provided from the edge of travel lane to the drop-off, alternate traffic control plans may be required by the Engineer.

<table>
<thead>
<tr>
<th>TABLE 619-2 TAPER RATES FOR POSITIVE BARRIER</th>
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</thead>
<tbody>
<tr>
<td>OPERATING SPEED (km/h)</td>
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<tr>
<td>TAPER RATE FOR TEMPORARY CONCRETE BARRIER</td>
</tr>
<tr>
<td>TAPER RATE FOR BOX BEAM OR HEAVY POST CORRUGATED BEAM</td>
</tr>
</tbody>
</table>

I. Existing Pavement Markings. The Contractor shall remove, as soon as practicable, existing pavement markings where indicated on the plans, in the proposal or where ordered by the Engineer. This shall include any pavement markings that are added during the course of the work. If darkness or inclement weather interferes with removal operations, such operations should be accomplished during the next daylight period or as soon thereafter as weather conditions permit.

The method of removal is subject to the approval of the Engineer. Obliterated markings shall be unidentifiable as pavement markings under day or night, wet or dry conditions. Overlaying existing stripes with black paint or asphalt does not meet the requirements of covering, removal or obliteration; however, the use of removable, nonreflective, preformed tape is permitted where markings need to be covered temporarily. Grinding, sandblasting, etc., must be conducted in such a manner that the finished pavement surface is not damaged or left in a pattern that will mislead or misdirect the motorist.

J. Exposed Guide Railing, Median Barrier, and Bridge Railing Ends. During non-work hours, when traffic is being maintained on the facility, all exposed approach ends (free ends) of guide railing, median barrier, and bridge railing shall be marked with a reflectorized drum and temporarily terminated. Corrugated beam guide railing and median barrier, and heavy post blocked out corrugated beam guide railing and median barrier shall be temporarily terminated by having the exposed approach ends (free ends) dropped to the ground and pinned in a manner approved by the Engineer. The approach ends of box beam guide railing, median barrier and bridge railing shall be temporarily terminated with box beam guide railing end assemblies utilizing two splice plates and the proper number of bolts per connection. No posts for anchorages will be required. Special temporary splice plates will be needed to adapt box beam guide railing end assemblies to box beam median barriers.

619-3.02 Construction Signs, Reflectorized Signs, and Sign Covers. The Contractor shall furnish and erect appropriate construction signs to adequately and safely inform and direct the motorist and to satisfy legal requirements. All signs shall indicate actual conditions, and shall be removed and/or relocated, or changed immediately as required in the contract documents and as directed by the Engineer. All signs shall be the property of the Contractor and shall be maintained in good condition for the duration of the contract. All signs shall be removed from the work site when the contract is accepted.

Sign sizes and details shall conform to the standard sheets, MUTCD, and the contract documents. The number of signs indicated on the standard sheets, in the MUTCD, and in the contract documents are a minimum number and the contractor shall have an adequate quantity of these signs available for immediate use, as required. The Engineer may order that additional signs be used.

All wood supports, and backs of plywood sign panels shall be painted with two coats of white paint.

All signs shall be kept clean, mounted at the required height on adequate supports, and placed in the proper position and alignment so as to give maximum visibility. In general, sign orientation shall
conform to the MUTCD, Section 201.5, subdivision (g). All sign supports shall display the sign panel in as vertical an orientation as possible. The deviation angle from vertical shall not exceed ±5 degrees.

Signs that are erected and removed or relocated on a daily basis, or that must be frequently relocated to adjust to the location of construction operations, may be mounted on portable sign supports. Signs that are to remain at a fixed location may be supported on posts mounted in the ground. The type of sign supports used shall be selected by the contractor, subject to the approval of the Engineer. If rigid diagonal bracing is used, the high end of the bracing shall face away from approaching traffic. All supports, except those located beyond the deflection distances of guiderail or temporary barrier, or otherwise protected against impact by errant vehicles, shall meet the following safety requirements for portable and fixed supports.

A. Portable Supports. Ballast used to stabilize supports shall be bagged sand or other suitable material approved by the Engineer, and shall be located at ground level. Portable supports shall comply with one of the following:

1. Manufactured portable supports designed for the display of signs in temporary traffic area. For manufactured supports purchased after October 1, 2000, the Contractor shall obtain from the supplier, and provide to the Engineer upon request, a certification that the support meets the requirements of NCHRP 350 Test Level 2 or Test Level 3. The use of devices certified as meeting Test Level 2 shall be limited to roadways with a posted speed limit of 40 mph or less. Test Level 3 devices may be used on all roadways.
2. Wood supports of a configuration which has been satisfactorily crash tested as indicated in #1 above.
3. Metal supports fabricated in accordance with the details shown on the standard sheet entitled “Type III Construction Barricades.”

Fabricated wood or metal supports shall not be placed on their sides unless they are placed behind a barrier or removed a safe distance from the roadway, as determined by the Engineer.

B. Fixed Supports. If stakes are used to attach the lower end of diagonal braces to the ground, they shall not protrude more than 100 mm above the ground surface. Fixed supports shall comply with one of the following:

1. Type A Sign Supports meeting the requirements of §730-24 and the applicable Materials Details may be used for sign sizes appropriate for those supports.
2. Sign posts and footings meeting the requirements of §730-20 and the applicable Standard Sheets may be used for sign sizes appropriate for those supports.
3. Wood posts, excluding any synthetic or composite wood product, may be used as follows:
   a. Wood posts up to 89 mm by 89 mm with no holes drilled.
   b. Wood posts up to 89 mm by 140 mm having 2 holes of 38 mm diameter, drilled in the direction perpendicular to the flow of traffic and located 100 mm and 450 mm above ground level. These holes shall be filled with flexible caulking.
      No more than two posts of acceptable sizes as listed above shall be located within a single 2.1 meter width, and no more than one post of acceptable size as listed below shall be located within a single 2.1 meter width.
   c. Wood posts up to 89 mm by 140 mm with no holes drilled.
   d. Wood posts up to 140 mm by 184 mm having 2 holes of 75 mm diameter, drilled in the direction perpendicular to the flow of traffic and located 100 mm and 450 mm above ground level. These holes shall be filled with flexible caulking.
      Wood posts larger than 140 mm by 184 mm shall not be used.
4. Any other support that the Contractor may select, upon submission of documentation to the Engineer demonstrating that the post selected meets the current AASHTO and NCHRP criteria for impact performance of Highway Sign Supports.
Supports for construction signs shielded by barrier or guiderail, and located beyond the deflection distance described below, do not have to conform to the above safety requirements.

<table>
<thead>
<tr>
<th>TABLE 619-3 GUIDERAIL &amp; CONCRETE BARRIER DEFLECTION DISTANCES</th>
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<tbody>
<tr>
<td>Guide Rail Type</td>
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<tr>
<td>Cable</td>
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<tr>
<td>Corrugated Beam (Weak Post)</td>
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<tr>
<td>Corrugated Beam (Heavy Post)</td>
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<td></td>
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<tr>
<td>Box Beam</td>
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<td></td>
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<tr>
<td>Concrete Barrier</td>
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</tbody>
</table>

Flexible signs will only be allowed for short-term, daytime use, for portable type signs that are deployed for use on a daily basis. They may not be used overnight, or for signs mounted on supports installed in the ground, or on portable supports that are left in place continuously for more than one work day. All flexible sign panels shall be mounted on supports with adequate bracing, so as to minimize flutter and to support the intended shape of the sign.

Intermixing reflective fluorescent orange colored signs with non-fluorescent orange colored flexible signs within the same series of signs shall not be allowed.

All construction signs shall be mounted in accordance with the MUTCD. Signs on rigid panels, except rigid lightweight plastic sign panels, shall be mounted at a minimum height of 1.5 m. Flexible sign panels, including rigid lightweight plastic sign panels, shall be mounted at a minimum height of 1.5 m, or optionally as low as 0.3 m when the following conditions are met:

A. On two lane, two-way roadways and four lane divided highways, when signs are placed on the left and the right sides of the roadway.
B. Where there will be no parked vehicles to obstruct the view.
C. When at least one advance work zone warning sign, mounted at a height of 1.5 m is located upstream of any flexible signs to alert motorists that they are entering a construction zone.
D. When the Engineer determines that the lower mounting height does not adversely affect the motorists' visibility of the sign.

If signs are temporarily covered, the cover shall be attached in a manner that completely covers the face of the sign. No adhesive shall be applied to the face of the sign, and the method of attaching the cover shall not damage the sign face. Sign covers shall be secured firmly to prevent dislodging and shall be maintained in good condition to present a neat appearance and minimize distraction to motorists traveling through the work zone. Sign covers shall contain no wording or images. Damaged covers which are determined by the Engineer to be no longer effective shall be replaced.

On limited access highways, when the normal legal speed limit is 50 MPH and higher, the Contractor shall have available at the project site, sufficient warning signs as described below, to inform oncoming traffic of a stopped, or very slow traffic condition. These signs shall be placed, moved, covered, maintained and removed in a manner directed by the Engineer.

The sign shall measure 1.2 m x 1.2 m, and letters shall be 175 mm Series D, similar to a W8-10, except it shall read "BE PREPARED TO STOP." The background color shall be fluorescent orange (Materials Designation 730-05.04, Class D). Each sign shall be mounted on a suitable portable support, and each shall be equipped with a pair of warning flags conforming to the requirements of the MUTCD, Section 294.2. Both sides of the approach shall be signed unless the median is too narrow, or if there are fewer than three lanes in the approach.
The sign shall be posted approximately 460 m upstream of the end of the queue, and when the end of the queue moves, the sign shall also be moved to maintain that spacing. If the resulting location places the sign upstream of the first warning sign for the project, the contractor shall also furnish and place an appropriate general work zone sign. The work zone sign shall be placed approximately 300 m in advance of the "BE PREPARED TO STOP" sign.

Whenever a reduced regulatory speed limit for a highway work area has been legally established by any means, the R-2 speed limit signs and, if used, the R2-10 speed zone ahead signs for the reduced speed shall be supplemented by a work zone warning panel as described below.

The work zone warning panels shall be the same width as the speed limit sign they are supplementing. They shall be 150 mm high with 75 mm Series B lettering when used with size B speed limit signs; 200 mm high with 100 mm Series B lettering when used with size C speed limit signs; 300 mm high with 150 mm Series B lettering when used with size D speed limit signs and 400 mm high with 200 mm Series B lettering when used with size E speed limit signs. The panel shall read “WORK ZONE” with black legend and fluorescent orange background (Materials Designation 730-05.04, Class D). These panels shall be placed on the same posts and immediately above the speed limit signs.

Signing advising motorists of increased fines for speeding within a highway work zone shall be installed in accordance with the contract documents on the mainline of any highway construction or maintenance work zone, or near the project limits on projects with multiple work zones, where a travel lane is closed to vehicular traffic or the speed limit within the work zone is reduced below the normally posted speed limit. If the signing is not detailed in the contract documents, it shall be installed as follows.

The “FINES DOUBLED FOR SPEEDING IN WORK ZONES” sign shall be installed upstream of the first advance warning sign. It shall not be placed between a warning sign and the condition to which it relates, or within a warning sign countdown series. To avoid the aforementioned conditions, install the sign approximately 300 m upstream of the first warning sign on highways with normally posted speed limits equal to or greater than 45 mph and 100 m-150 m upstream where normally posted speed limits are under 45 mph. For long projects with multiple work zones, the sign should be installed above distances upstream of the G11-1 “ROAD WORK NEXT XX MILES” sign or at the project limits and need not be installed at each work zone. The sign shall have black legend and border on a white background (Materials Designation 730-05.01, Class A) except for the top of the sign which has black background and white “STATE LAW” legend. If not otherwise detailed in the plans, the sign shall be a minimum of 600 mm wide by 900 mm high with “STATE LAW” in 75 mm Series D white lettering on a black background and “FINES DOUBLED FOR SPEEDING IN WORK ZONES” in 75 mm Series C black lettering. A double sized sign 1200 mm wide by 1800 mm high with “STATE LAW” in 150 mm Series D white lettering on a black background and “FINES DOUBLED FOR SPEEDING IN WORK ZONES” in 150 mm Series C black lettering shall be used in freeway and multilane applications where the normally posted speed limit equals or exceeds 55 mph.

If indicated in the contract documents as a supplement to the “FINES DOUBLED FOR SPEEDING IN WORK ZONES” sign, where a reduced work area speed limit is posted, the “FINES DOUBLED” panel shall be installed on the indicated R2-1 “SPEED LIMIT”, R2-10 SPEED ZONE AHEAD, and/or R2-12 “REDUCED SPEED AHEAD” signs used to post the reduced work area speed limit. The “FINES DOUBLE” panels shall be the same width as the speed limit sign they are supplementing. They shall be 300 mm high with 75 mm Series D lettering when used with size B speed limit signs; 450 mm high with 100 mm Series D lettering when used with size C speed limit signs; 600 mm high with 150 mm Series D lettering when used with size D speed limit signs and 900 mm high with 200 mm Series D lettering when used with size E speed limit signs. The panel shall read “FINES DOUBLE” with black legend and borders and white background (Materials Designation 730-05.02, Class B). These panels shall be placed on the same posts and immediately below the speed limit signs.

Both the work zone warning and the fines double panels shall be completely covered or otherwise removed from view when the R-2 speed limit sign is covered or removed.

Where traffic will be riding on a milled pavement, GROOVED PAVEMENT (W4-5) signs shall be installed on the approaches. On multilane highways where only one lane in a direction is milled and both lanes are open to traffic, supplement the GROOVED PAVEMENT sign with a LEFT LANE or RIGHT LANE panel below the sign. Where only an entrance or exit ramp is milled, sign the mainline with a GROOVED PAVEMENT sign and a supplemental RAMP panel. Sign all side streets approaching the milled section.
Milling operations shall be conducted to preclude the possibility of pavement runoff collecting along milled joints and creating a traffic hazard. Milling rebates resulting in longitudinal or transverse vertical faces exceeding 25 mm in height that would be exposed to traffic during nonwork hours shall be sloped or tapered by temporary patches or shims to avoid creating a traffic hazard. Where such vertical transverse faces cannot be adequately sloped or tapered, BUMP (W4-1) signs shall be installed in advance of milling rebates in accordance with the MUTCD. A W7-10 object marker shall be installed on the right side of the roadway at the rebate. On divided highways, an object marker shall be installed on both sides of the roadway. A drum with a Type B, flashing warning light may be used instead of an object marker.

Where both BUMP and GROOVED PAVEMENT signs are warranted, in nonurban areas the GROOVED PAVEMENT sign shall be installed 150 m (100 m in urban areas) upstream of the BUMP sign.

If not indicated in the contract documents, the size of the GROOVED PAVEMENT and BUMP signs shall be consistent with that of other signs within the contract limits.

619-3.03 Temporary Box Beam Barrier, Temporary Concrete Barrier, Construction Barricades, and Lighting for Construction Barricades. The Contractor shall furnish, erect, move and remove, temporary concrete barrier, construction barricades and lighting for construction barricades where and as indicated on the plans, on the standard sheets, in the M.U.T.C.D., or as directed by the Engineer. Posts and painted members or bands used to delineate drop-offs will not be considered barricades. The contractor shall provide and maintain delineation on temporary barriers. This delineation shall make the barrier visible to approaching traffic as well as traffic which is adjacent to the barrier. The contractor shall have the choice of using one, or more, of the following: Warning lights, delineators, pavement marking, reflectorized tape placed on the barrier, reflective paint, or any other device subject to the approval of the Engineer. The delineation devices shall be maintained dirt and snow free and visible throughout the term of the contract including shutdown periods.

Where indicated on the plans or in the proposal, construction barricades shall be supplemented by approved flashing or steady burning lights, as indicated.

Temporary box beam barrier shall be erected in accordance with the requirements for box beam median barrier specified in §606-3.01 and §606-3.03.

Each run, or bay, of temporary concrete barrier units shall be fastened together to form a continuous chain. After placement each successive unit shall be moved longitudinally to remove the slack in the joint between units. The units at each end of a run or bay shall be anchored as shown on the standard sheet. In order to reduce movement of the barrier on structures, areas where limited deflection is desired, or where directed by the Engineer, one of the methods shown on the standard sheet shall be used. Where shown on the plans or directed by the Engineer, the ends of the barrier run shall be fitted with an impact attenuation device or fitted with a tapered end section and flared back as directed.

Steady burning or flashing barricade lights have a minimum nominal diameter of 175 mm and shall emit yellow light. Steady burning lights may be used to supplement other channelizing devices to delineate the traveled way. Flashing lights shall not be used for delineation or channelizing purposes.

Flashing barricade lights shall be either Type A, Low Intensity, or Type B, High Intensity conforming to the requirements of section 294.3 of the M.U.T.C.D. High intensity lights shall be used where barricade lights are required to operate 24 hours per day. Low intensity lights shall be used where barricade lights are required only at night. In that event, the hours for operation of the low intensity lights shall be dusk to dawn.

Steady burning lights shall have a minimum beam intensity of 2 candelas maintained within a solid angle of 9° on each side of the vertical axis, and 5° above and 5° below the horizontal axis. The hours for operation of steady burning barricade lights shall be dusk to dawn.

619-3.04 Temporary Structures and Approaches. Temporary structures and their approaches or existing structures that are moved to provide temporary structures along with their temporary approaches shall be constructed in such a manner and sequence that interference with and inconvenience to the traveling public and the abutting owners is kept to a minimum. The Contractor shall be responsible for the workmanship, upkeep and safety of all temporary structures and approaches. All fabrication shall conform to the current AASHTO Specifications for Highway Bridges, Division II except as modified herein. Fabrication shall be performed by an AISC Category III Certified Fabricator.
§619

When specific details are not indicated on the plans, the Contractor shall design all elements of the temporary structure and approaches including the railing system. Design shall be done in conformance with the AASHTO standard specifications for Highway Bridges which is current on the date of advertisement for bids. Design live load shall be MS 18 unless otherwise noted on the plans. Plans and design computations shall bear the stamp and signature of a Professional Engineer licensed to practice in the State of New York.

Prior to beginning construction of any structure designed by the Contractor or the Contractor's agents the Contractor shall submit detailed plans to the DCES for review and approval in accordance with §585-3.02. Such review, however, shall not relieve the Contractor of the responsibility for the adequacy and design of such temporary structures and approaches. If the Contractor proposes to construct with used materials, the Contractor's Engineer shall submit with the plans the method for documenting that all primary member material meets the design. In the absence of Mill Certification Reports, physical testing shall be performed. Excluded from this provision are proprietary structures. All welding required for the fabrication of temporary steel structures shall be performed in accordance with the provisions of the New York State Steel Construction Manual. Complete joint penetration groove welds in main material shall be radiographed as described therein. The DCES reserves the right to perform in-process fabrication inspection. The Contractor shall notify the DCES of the fabrication Schedule 10 days prior to commencement of work.

619-3.05 Tubular Markers. Tubular markers shall be installed according to the manufacturer’s instructions on asphalt or concrete pavement that has been properly cleaned with a wire brush to remove all paints, dirt, oil or any substance which will interfere with the proper bond. Bonding agents shall be of sufficient amount or size to ensure proper bonding of the base to the pavement. When epoxy is used the epoxy shall be applied evenly to the bottom of the base of the marker and the base shall be pressed firmly on the pavement surface until a bead of epoxy appears around the edge. When installing the marker with a butyl pad, the pad shall cover the entire bottom of the base of the marker. Tubular markers not installed properly along the required line, as determined by the Engineer, shall be removed and reset.

Tubular markers damaged by the Contractor’s operation or by traffic shall be replaced within 24 hours or as directed by the Engineer. The Engineer shall direct the Contractor to replace damaged reflective sheeting as required. This sheeting shall be removed and disposed of in an approved manner at the time as directed by the Engineer.

619-3.06 Short-Term Pavement Markings. The Contractor shall furnish, apply, maintain, and when so ordered, remove short-term pavement markings, where shown in the contract documents or where directed by the Engineer. Any pavement upon which traffic will be maintained shall be properly marked before nightfall or the end of the working day, whichever comes sooner, in accordance with this subsection.

Short-term pavement markings shall be installed and maintained in accordance with the patterns and colors indicated for pavement marking, Parts 260 to 263 of the M.U.T.C.D. or as directed by the Engineer. Where the limits of passing and no-passing zone have not been determined prior to construction, the Contractor shall allow the Engineer one week after the placement of binder or top course to determine these limits. If the Engineer codes these limits right on the pavement surface, this coding shall be preserved, by the Contractor, offset from the roadway.

Alternately, if the pay item ‘Determination of No-Passing Zones and Pavement Coding’ is included in the contract, this determination shall be made by the Contractor either on binder course or top course.

The following pavement marking patterns shall be installed as short-term pavement markings:

1. Yellow broken lines, partial barrier lines and full barrier lines used to separate opposing traffic flows on two-way roadways.
2. White broken lane lines to separate traffic flows in the same direction on multi-lane highways.

Stop bars, hatch lines and edge lines will not normally be required under short-term pavement markings but may be ordered by the Engineer. Broken lines may be as short as 1200 mm. Short-term pavement markings as described above, will be considered acceptable as the only pavement markings in place for periods normally not longer than fourteen (14) days, unless otherwise extended by the Engineer.
Within 14 days after paving, or the time period as extended by the Engineer, if the Contractor fails to install either the succeeding pavement course, or the final pavement markings on contracts with pay items for such, the short-term pavement markings shall be supplemented (at no additional expense to the State) with edge lines, 3 meter broken lines, stop bars, cross walks and arrows. In the event the project is to remain uncompleted over the winter, other than for staged construction when indicated, the short-term pavement markings shall be supplemented (at no additional expense to the State) by full pavement markings in accordance with the pattern indicated in the plans. If no full pavement marking pattern is given in the plans, the short-term pavement markings shall be supplemented as directed by the Engineer. The pavement markings used to supplement the minimum short-term pavement markings shall be designated as 'Temporary Pavement Markings' and use the materials as described below.

Removable tape and raised markers can be used as short-term pavement markings for solid and broken lines on any pavement course. However, on the final pavement surface, these shall be offset, if possible, from the location of the final mark in order to prevent interference with the adhesion of the final mark.

Pavement marking paint can be used as short-term pavement markings for solid and broken lines on all underlying pavement courses (ie base, binder, leveling and shim). On top course, or final pavement surface, paint may only be used if the final marking pattern is known prior to paving, and the contract does not contain durable markings (ie thermoplastic or epoxy marks). Where paint is used on the final pavement surface, it shall be applied before nightfall in the final location. If the Contractor is unable to place the final pavement marking paint before nightfall on contracts with pay items for Reflectorized Pavement Marking Paints (Section 640), then removable short-term pavement markings shall be installed before nightfall offset from the final location at no additional cost to the State.

Non-removable tape may be used as short-term pavement markings only for broken lines on underlying pavement courses. Non-removable tape will not be allowed to mark barrier lines on any pavement course.

If paint is used for short-term pavement markings, it shall be applied in accordance with the requirements of Section 640, Reflectorized Pavement Marking Paints. If tape is used, it shall be applied to a clean, dry pavement in accordance with the manufacturer's recommendations. Tape shall conform to the shape of, and adhere to the surface upon which it is applied. If raised marker units are used, they shall be of a color in accordance with the M.U.T.C.D. A raised marker unit spaced every 1500 mm may be used as a substitute for a solid line. Three raised marker units, evenly spaced 600 mm apart, may be used as a substitute for a 1200 mm long broken line. Four raised marker units, evenly spaced one meter apart, may be used as a substitute for a three meter long broken line.

Any markings, including raised markers, that fail to adhere to the pavement, become abraded, dislodged by snowplowing, or in the opinion of the Engineer become ineffective in any manner during the "period of use" shall be replaced by the Contractor at no additional expense to the State. The "period of use" shall be defined as the time from when the short-term pavement markings are first applied to the time when the markings are either paved over, the project's final markings are applied, or contract acceptance, whichever is first. After their period of use, short-term pavement markings, and temporary markings added to supplement short-term pavement markings shall be removed from the pavement by the Contractor, if ordered by the Engineer, as described in Section 635 Cleaning and Preparation of Pavement Surfaces.

In the event of sudden, unforeseen precipitation or other extraordinary situations, Do Not Pass signs may be used in lieu of short-term pavement markings for up to three consecutive calendar days on two or three lane, two-way, roadways under the following conditions:

1. The signs meet the requirements of Section 214.2 of the NYSDOT MUTCD and spaced not more than 300 meters apart.
2. The signs shall be supplemented with delineators and/or plastic drums spaced as directed by the Engineer, but not more than 60 meters apart and meeting the requirements of Section 291.2 of the NYSDOT MUTCD and §619-3.01G. of the Standard Specifications, respectively.
3. No payment will be made for the installation of Do Not Pass signs, delineators and plastic drums when necessitated by the Contractor's failure to place short-term pavement markings.

619-3.07 Temporary Traffic Signals. The traffic signal system shall be constructed in such a manner that interference with and inconvenience to the traveling public is kept to a minimum. The Contractor
shall maintain in proper operation, all temporary signals used for Maintenance and Protection of Traffic until approved removal. The Contractor shall be responsible for their continuous 24-hour operation except for reasonable shutdown during relocation and transfer operations.

If for any reason a signal is not functioning as required, the Contractor shall commence repair work on this signal within two hours after notification of a malfunction. The Contractor shall provide a flagger at each malfunctioning traffic signal during repair work. The flagger control shall be provided until the temporary traffic signal is restored to proper operation.

On each approach, one signal face shall be at the right side of the roadway or over the right half of the roadway. One signal face shall also be installed at the left side of the roadway or over the left half of the roadway.

The lateral distance between signal faces for each approach shall be a minimum of 2400 mm and a maximum of 8230 mm.

In the event flashing operation occurs, all signal faces shall show flashing red indications. Flashing operation of signal is considered a malfunction.

In the event the Contractor elects to use temporary traffic signals to control traffic in lieu of flaggers, the Contractor shall submit complete plans of the proposed work to the Engineer for approval at least 30 days before signals are required for the maintenance of traffic. Plans shall show type of proposed equipment, details of construction, and table of operation of the temporary signal system.

619-3.08 Mailboxes. The Contractor shall not move any mailbox which contains mail. The Contractor will advise the owner to remove such mail before the box is moved. Before acceptance of the work, any mailbox which has been disturbed or removed, shall be replaced by the Contractor in a location approved by the Engineer.

In the event the original mounting post has been lost, damaged, or is unusable, the Contractor shall furnish a similar device or mounting acceptable to the Engineer, or when directed shall furnish a galvanized pipe mounting post of 25 mm (minimum) diameter with flanged top fitting and will firmly install the new mounting and mailbox at the designated location and at the proper height in accordance with the requirements of the U.S. Postal Service and to the satisfaction of the Engineer.

619-3.09 Opening Highway to Traffic Prior to Contract Acceptance. The construction details specified in §619-3.01 through §619-3.08 shall apply when required.

619-3.10 Maintain Traffic Signal Equipment. General. Existing, relocated, modified or newly installed traffic signals identified in the contract documents or by the Engineer shall be maintained in proper operation as specified in Requirement A, B or C of this subsection as called for in the contract documents.

Proper operation shall include the maintenance of all features of the traffic signal operation in effect and operating at the time any work begins on the contract as defined in §619-1.11, Duration of Contract. Traffic actuated phases shall be maintained actuated and signals operating within signal systems shall remain in step with the remainder of the system unless otherwise approved by the Engineer. Except for emergencies, no changes in the signal operation or timing shall be made without prior approval by the Engineer. If emergency conditions dictate a change in the operation, the Engineer shall be notified accordingly by the start of the next work day. Unless otherwise approved by the Engineer, an altered signal operation must be returned to the original signal operation within 24 hours.

The Contractor shall maintain in operation all equipment including signal heads, supports, cable, wiring, existing and new span wire mounted signing, controllers, master controllers, detector systems, conflict and current monitors, relays, switch packs, and all other accessory and necessary equipment. Maintenance shall also include the repair and replacement of existing detector loops, under separate items. All parts, supplies, equipment and labor shall be furnished by the Contractor.

The Contractor shall have capable traffic signal repair personnel on call 24 hours a day, seven days a week, and shall provide to the Engineer a single telephone number for contacting them. If for any reason, a signal is not functioning properly, the Contractor shall commence work on the signal within two hours notification. If directed by the Engineer, the Contractor shall notify the appropriate police agency for traffic control operations. If the police agency cannot or will not provide traffic control, the Contractor shall provide flaggers at locations specified by the Engineer within the two hour time period. The Contractor shall continue the flagger services until the signal is in proper operation. Reflectorized
“Flagger Ahead” signs shall be used in conformance with the M.U.T.C.D. on all approaches to an intersection controlled by flaggers.

The Contractor shall, on a daily basis, provide the Engineer with a record of all maintenance calls received and responded to, as well as a record of all corrective action taken by the Contractor.

Where the Contractor is required to temporarily relocate existing traffic signals because of his construction operations, all existing equipment, fittings, wire, cable, conduit, and related materials shall be reinstalled and extended where necessary. Temporary timber poles (Class 2), guys and related material shall be furnished and installed where necessary. Temporary timber poles shall be treated with an appropriate wood preservative in accordance with the American Wood Preserver's Association Standard C2. Preservative retentions shall be appropriate for the specie when used in ground contact application.

**Requirement A.** The contractor shall maintain in proper operation, for the duration of the contract, the indicated existing, relocated, modified and newly installed signals as required by the contract documents. If such signals are to be removed, the Contractor shall be responsible for the operation and maintenance of them until their approved removal. The Contractor shall be responsible for their continuous operation except for reasonable shutdown periods authorized by the Engineer during relocation and transfer operations. All of the requirements in the “General” subsection of this specification shall apply.

**Requirement B.** All requirements of the “General” subsection shall apply except that the State shall assume operation and maintenance responsibility for the signal from the Contractor following successful completion by the Contractor of the installation/modification testing as required by §680-3.32, Tests. Assumption of operation and maintenance responsibility by the State shall not relieve the Contractor of the responsibility to provide a Manufacturer’s Warranty for the correction of defects in material or labor provided by the Contractor. However, the six month period shall be measured from the day the State assumes maintenance responsibility. The State assumption of maintenance responsibilities will not relieve the Contractor of any responsibilities for damage prior to contract final acceptance.

**Requirement C.** All the requirements of the “General” subsection shall apply except that at relocated, modified or newly installed signals, the State will assume responsibility for the following four items after successful testing as required by §680-3.32, Tests, has been completed. At existing microcomputer traffic signals, the State shall be responsible for those four items for the duration of the contract.

1. Supply and maintenance of the microcomputer assembly and software.
2. Programming of the microcomputer furnished by the State.
3. Operation or timing changes directed by the Engineer.
4. Normal (no abuse, or vandalism) equipment failures of existing, relocated, modified or new traffic signal equipment furnished by the State.

All other operational features and signal equipment shall be maintained by the Contractor in accordance with the “General” provisions of this subsection for the duration of the contract. Prior to the assumption by the State of maintenance responsibility for relocated, modified or newly installed signals, the Contractor shall maintain such signals under the “General” provisions of this specification. It shall be the Contractor's responsibility to investigate all maintenance calls as outlined in the “General” provisions. If the malfunction is in the equipment supplied by the State, the Contractor shall notify Regional Traffic and Safety personnel and, if directed by the Engineer, provide flaggers until the arrival of State maintenance personnel. Such flagging operations in excess of four hours per maintenance call shall be paid for as extra work.

Assumption of the above listed responsibilities by the State shall not relieve the Contractor of the responsibility for operation and maintenance of the signal as required by this section. Further, the Contractor will not be relieved of the responsibility to provide a manufacturer’s warranty for the correction of defects in material or workmanship provided by the Contractor. The State assumption of maintenance responsibilities will not relieve the Contractor of responsibilities for damage prior to contract final acceptance.

**619-3.11 Flashing Arrow Boards.** The Contractor shall provide Flashing Arrow Boards on multilane highways with preconstruction posted speed limits of 45 mph and higher whenever a lane is closed to
traffic and vehicles are required to merge with traffic in adjacent lanes. One Flashing Arrow Board is required for each lane closed to traffic, regardless of the duration. Flashing Arrow Boards shall also be provided at locations where posted speeds are below 45 mph when shown on the plans or when indicated in the proposal.

Flashing Arrow Boards will not be required where they would interfere with the operation of a 3 color signal or flasher or where there is an operation controlled by a signal or flagger. Flashing Arrow Boards will not be required for alignment changes or lane diversions where the number of through traffic lanes is not reduced unless specifically indicated on the plans.

Flashing Arrow Boards shall be placed in accordance with the Manual of Uniform Traffic Control Devices. They shall be used as a substitute for the W1-11B; W1-11C; W1-12B; or W1-12C large arrow sign located nearest the beginning of the taper. The arrow boards shall be mounted so that the base of the panel is at least 2.1 m above the pavement surface and properly aligned to provide optimum viewing by approaching motorists. Flashing Arrow Boards may be relocated or reoriented on a daily basis or more frequently as ordered by the Engineer.

Where the posted preconstruction speed limit on the highway is 45 mph or greater within 2.0 km upstream of the board, only diesel or line powered arrow boards shall be used, unless indicated or directed otherwise. Where the posted preconstruction speed limit is below 45 mph for at least 2.0 km upstream of the taper, diesel powered, line powered or solar charged boards shall be used as approved or as directed by the Engineer.

The Contractor shall be responsible for maintenance, repair and continuous operation of the Flashing Arrow Board until progress of work no longer requires its use, as directed by the Engineer.

619-3.12 Construction Zone Pavement Markings. All pavement markings and patterns shall be placed as shown on the plans, or directed by the Engineer, and in accordance with the MUTCD.

Except when other spacings are permitted by the plans or proposal, raised reflectorized pavement markings shall be spaced as required in this paragraph. When raised reflectorized pavement markers are used to simulate a solid line, they shall be spaced 1500 mm apart; and when these markers are used to simulate a 3 m broken line, 4 equally spaced markers shall be used, with a marker at beginning and end of each line segment. Other line patterns shall be as specified in the MUTCD. When used to supplement a solid or broken line, markers shall be spaced a maximum of 24 m on tangents and a maximum of 12 m for curves with a radius less than 860 m.

The application of pavement markings on roadways open to traffic shall be done in the direction of traffic.

When required by the Engineer, the Contractor shall establish marking line points at 9 m intervals as necessary to control the lateral position of the line.

A. Application. All pavement marking materials shall be installed in accordance with the manufacturer's instructions. In addition, pavement marking paints shall be installed according to the provisions of §640-3.

B. Maintenance of Pavement Markings. The Contractor shall be responsible for maintaining the construction zone pavement markings for the duration of the temporary traffic pattern or detour. Any marking material that fails to provide for any reason, both satisfactory daytime and nighttime delineation, in the opinion of the Engineer, shall be replaced immediately by the Contractor at no additional cost to the State. Replacement shall, as a minimum, be required for the following degrees of material loss:

1. Removable Tape. Any gap exceeding 15 m in length in a solid line, or loss of shorter segments exceeding 10 percent of the total length in any 250 m segment of solid line, or more than two consecutive segments of broken line.

2. Raised Markers. Loss of more than 2 markers used to simulate a 3 m broken line; loss of more than 3 consecutive markers used to simulate a solid line, or more than 5 percent of the markers within a 250 m segment of solid line; when used to supplement a line, loss of 2 or more consecutive markers or more than 5 percent of the markers within a 1000 m segment of solid or broken line.
3. Traffic Paint. Abrasion of the line such that more than 10 percent of the underlying pavement is visible within any segment of broken line or within any 100 m section of solid line; failure of any line to be clearly visible at night under low-beam headlamp illumination when viewed from a distance of 60 m.

If the Contractor elects to use raised pavement markers as the marking material under the optional construction zone pavement markings items, the Contractor shall be responsible for maintaining these markings in acceptable condition during winter months, including loss of markers by snow plows. The Contractor shall either replace lost markers between storms, or place an alternate marking material as allowed by this specification to maintain all markings in acceptable condition, subject to the approval of the Engineer. No additional payment shall be provided for such replacement of lost markers.

The Contractor shall not be responsible for snowplow damage or loss of raised markers provided under pay items requiring the use of these markers. In the event that such markers are damaged or lost, the Engineer shall decide whether to replace the lost markers in kind or with other marking materials at the time the loss occurs. Payment shall be provided under the appropriate item for any markers replaced, or for alternate marking materials installed.

C. Removal of Pavement Markings. Construction zone pavement markings used to delineate temporary traffic patterns shall be removed at the completion of that phase of the work and prior to the installation of the next temporary pattern, or return to the permanent pattern.

Traffic paint shall be removed by mechanical means subject to their ability to achieve satisfactory results. After removal, there shall be no paint residue or pavement scarring that conflicts with successive pavement markings under any viewing conditions - wet or dry, day or night.

Marking tapes and raised markers shall be removed, intact or in large pieces, using manual methods or a mechanical roll-up device. The use of heat, solvents or other chemicals, grinders, or blasters will not be allowed on top-course pavement that is to remain in place without overlaying, or on other pavement surfaces where subsequent temporary traffic patterns are to be placed. After removal, there shall be no resultant damage to or permanent marks or scars on the pavement surface.

Temporary adhesive residues that will eventually be worn from the pavement will be allowed to remain, providing that they are not left in a pattern that will mislead or misdirect motorists. The Engineer will be the sole determiner of misleading temporary marks.

The removal of construction zone pavement markings shall not be required from detours or other areas directed by the Engineer where they do not conflict with permanent markings at the completion of the work. Removal shall be required where it is necessary to transition pavement marking patterns on the detour into permanent markings at the completion of the detour phase.

D. Damage to Pavement Surfaces. Any damage to the finished pavement surface, any permanent marks or scars on the finished pavement surface (including remaining pavement marking material), or any adhesive residues left in a pattern that may mislead or misdirect traffic, that results from the removal of pavement markings shall be removed or repaired as directed by and to the satisfaction of the Engineer at no expense to the State, including complete removal and/or replacement of the damaged pavement section if necessary. The Engineer shall be the sole determiner of satisfactory repair.

619-3.13 Maintenance and Protection of Traffic During Nighttime Operations. In addition to the requirements of basic maintenance and protection of traffic, additional requirements for maintenance and protection of traffic during nighttime operations shall be as follows:

A. Worker Apparel. All contractors' employees involved in nighttime operations shall wear at all times protective helmets and Nighttime Apparel. All Nighttime Apparel shall be closed front and rear and in clean condition to maintain color, visibility, reflectivity, and conspicuity. Truck drivers and equipment operators shall wear Nighttime Apparel when out of an enclosed cab.
§619

**B. Vehicle Protection.** All vehicles and equipment in the traffic control zone shall be equipped with rotating amber beacons which shall be visible from all directions for a minimum of 300 m during daylight. Beacons shall be mounted in a manner which does not cause glare for the driver or operator.

Vehicles operating or parked on the pavement of a closed roadway or travel lane shall display 4-way flashers or beacons at all times.

Rollers shall display a 50 mm band of reflective tape on the front and rear (60 000 mm² per end minimum).

All trucks shall display a minimum of 60 000 mm² of reflective tape on the rear.

Haul trucks shall display a 600 mm by 1200 mm orange reflective sign with the legend “Construction Vehicle - Do Not Follow” in black lettering on the tailgate.

All construction equipment when moving at a speed below the operating speed of traffic in an open travel lane or on a shoulder adjacent to an open travel lane shall be equipped with an amber rotating beacon and shall be followed by a chase vehicle equipped with an amber rotating beacon and 4-way flashers.

Vehicles (except for rollers) shall travel facing in the same direction as adjacent traffic in order to avoid glare and confusion to drivers.

**C. Signs, Delineation and Guiding Devices.** All signs, delineators and guiding devices for nighttime operations shall be kept clean and visible with good reflectivity.

Type III construction barricades shall be used whenever an entire roadway or ramp is closed to traffic.

Plastic drums or 300 mm by 600 mm vertical panels shall be used for channelizing and delineating lane closures. Oversize (900 mm) cones may be used on tangent runs beyond the completion of the lane closure tapers. Spacing shall be in accordance with the following:

<table>
<thead>
<tr>
<th>Estimated Operating Speed (km/h)</th>
<th>Maximum Spacing (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>6.0</td>
</tr>
<tr>
<td>50</td>
<td>9.0</td>
</tr>
<tr>
<td>≥70</td>
<td>12.0</td>
</tr>
</tbody>
</table>

Delineation at gores or intersections shall be spaced at intervals equal to one-half of the above table values and shall consist of plastic drums or 300 mm by 600 mm vertical panels except that every other device may be an oversize (900 mm) cone at the Contractor's option.

When traffic will be traveling adjacent to closed travel lanes; two plastic drums, two 300 mm by 600 mm vertical panels or two oversize (900 mm) cones shall be placed transversely in each closed lane at 225 m maximum intervals (unless a lesser spacing is shown on the plans) except where it would interfere with paving, rolling or other ongoing operations. A Type III construction barricade may be substituted at the Contractor's option. No additional payment for Type III construction barricades will be made when used for this purpose.

**619-3.14** (Vacant)

**619-3.15** (Vacant)

**619-3.16** (Vacant)

**619-3.17 Temporary Rumble Strips.** Due to difficulties in patching shallow voids in hot mix asphalt pavement surfaces, saw-cut and milled-in rumble strips shall only be installed in locations where hot mix asphalt pavement will subsequently be overlaid or reconstructed.

**A. Raised Asphalt Rumble Strips.** The roadway surface on which the rumble strips are to be attached shall be dry, free of surface contaminants such as dust or oil, and thoroughly swept with a stiff broom. The surface temperature of the pavement shall be 8°C or greater unless otherwise authorized by the Engineer. The pavement surface shall be cleaned with compressed air just prior to tack coating and subsequent installation of the rumble strips. The strips shall be formed using a
rumble strip paver (drag box) pulled transversely across the pavement, or by hand placement between forms fixed to the pavement. If forms are used, they shall be removed prior to compaction of the asphalt mixture. Compaction shall be accomplished using a plate tamper or a static roller.

**B. Raised, Removable-Tape Rumble Strips.** Raised removable tape rumble strips shall be formed by applying one or more layers of removable preformed pavement-marking tape. The tape shall be applied to a clean, dry pavement surface in accordance with the Manufacturer’s recommendations. The pavement surface shall be swept or cleaned with compressed air just prior to application of the tape.

**C. Raised, Preformed Rumble Strips.** Raised preformed rumble strips shall be applied to a clean, dry pavement surface in accordance with the Manufacturer’s recommendations. The pavement surface shall be swept or cleaned with compressed air just prior to application of the tape.

**D. Saw-cut Rumble Strips.** Saw-cut rumble strips shall be saw cut into existing pavement using wet cutting methods. The blade or blades shall be of such configuration that the desired dimensions of the saw cut can be made with one pass. No spacers between blades will be allowed.

Before a work area is reopened to traffic, the pavement shall be cleaned by sweeping, flushing, or with a stream of compressed air. Sawing slurry from the wet-sawing process shall be flushed from the pavement surface immediately.

**E. Milled-In Rumble Strips.** Milled-in rumble strips shall be milled into existing pavement using a rotary-type cutting head with a maximum nominal outside diameter of 600 mm. The cutting head shall be on its own suspension system, independent from that of the power unit, to allow the head to align itself with the slope of the pavement and/or any irregularities in the pavement surface. The pattern of cutting tips on the head shall be arranged to produce a relatively smooth cut with no more than 2 mm between peaks and valleys. Prior to beginning work, the Contractor shall demonstrate to the Engineer the ability to achieve the desired surface without tearing or snagging the pavement.

Before a work area is reopened to traffic, the pavement shall be cleaned by sweeping, flushing, or with a stream of compressed air.

**F. Removing Temporary Rumble Strips.** The Contractor shall either completely remove raised rumble strips from the pavement or fill in the depressions from saw-cut or milled-in rumble strips prior to the start of the winter plowing season, prior to the placement of successive pavement courses, or as directed by the Engineer. Any damage to the pavement surface that results from the removal of raised rumble strips shall be repaired at no additional cost to the State.

Rumble strip depressions shall be filled in with hot mix asphalt. Before they are filled, the depressions shall be cleaned by sweeping, flushing, or with a stream of compressed air, and coated with Asphalt Emulsion Tack Coat. The rumble strips shall be overfilled slightly and compacted using a plate tamper or static roller so that the final compacted surface is flush with the existing pavement.

### §619-4 METHOD OF MEASUREMENT

**619-4.01 Basic Maintenance and Protection of Traffic.** Payment for Basic Maintenance and Protection of Traffic will be made on a lump sum basis.

**619-4.02 Construction Signs.** Payment for signs will be made on a lump sum basis.

**619-4.03 Temporary Box Beam Barrier, and Temporary Concrete Barriers.** The quantity of temporary box beam barrier, and temporary concrete barrier shall be computed by the number of meters, measured to the nearest meter, placed in accordance with the contract documents and/or direction of the Engineer. Temporary box beam barrier shall be measured in accordance with the requirements of §606-4.01. Temporary concrete barrier shall be measured along the centerline of the uppermost surface.

Temporary concrete barrier installed at the option of the Contractor, or required solely by a delay in the Contractor’s operations, shall not be included in the measurement or payment for temporary concrete barrier.
§619

619-4.04 Construction Barricades. Barricades will be computed for payment by the number of meters measured to the one tenth, along the face of each barricade unit installed. No payment will be made for spaces between individual barricade units. Type III Construction Barricades used at the option of the Contractor in lieu of drums or other channelizing devices shall not be included in the measurement or payment for Type III Construction Barricades.

Whenever barricades are moved to a new location or the diagonal stripes are changed to allow traffic to pass on the other side of the barricade, measurement will be made in the same manner as if it were a new barricade. Minor movements of the barricade from one side of the roadway to the other side, daily replacement to the same location or rearrangement within a work area, not requiring any change in the diagonal stripes, will not be considered as movement to a new location and will not be measured as additional barricades.

619-4.05 Lighting for Construction Barricades. Lighting for construction barricades (powered from electrical power line or self-powered flashers) will be computed for payment by the number of meters of barricade actually lighted. Measurement shall be made to the nearest one-tenth meter along the face of each barricade unit. No payment will be made for spaces between individual barricade units. No separate measurement will be made for the two flashing warning lights used at the beginning of each work zone drop-off, as required by these specifications.

619-4.06 Temporary Structures and Approaches. Temporary structures and their respective approaches will be computed for payment on a unit price basis for each structure including its approaches.

619-4.07 Flashing Arrow Board. When this work is specified to be measured as lump sum, it shall be measured on a lump sum basis, for the Flashing Arrow Boards of the required type satisfactorily furnished, installed, maintained, and removed in accordance with these specifications.

619-4.08 Short Term Pavement Markings. Short Term Pavement Markings will be measured in meters along the center line of the pavement stripe and shall be based on a 100 mm wide stripe.

Measurement for striping with a plan width greater or less than the basic 100 mm, as shown on the plans or as directed by the Engineer, will be made by the following method:

\[
\text{Plan Width of Striping (millimeters) x Number of Meters} \div 100 \text{ millimeters}
\]

No payment will be made for the length of skips in the dashed line.

If raised marker units are used, reimbursement will be made as if the substituted line were in place. For example, for three raised marker units substituted for a 1200 mm long broken line, reimbursement will be made for 1.2 meters.

619-4.09 Temporary Traffic Signals. Payment for Temporary Traffic Signals will be made on a lump sum basis.

619-4.10 Mailboxes. Mailboxes will be computed for payment on the basis of each mailbox moved or replaced. Where multiple mailboxes are installed on a single post, payment shall be based upon the number of mailboxes so installed.

619-4.11 Opening Highway to Traffic Prior to Contract Acceptance. The additional basic maintenance and protection of traffic required for the highway opened to traffic in accordance with §619-1.09 will be computed by the lane kilometers, measured to the nearest tenth, per calendar day. The lane-kilometer per calendar days to be paid for shall not include the length of temporary connections, length of ramps, or any pavement opened for the convenience of or at the request of the Contractor.

619-4.12 Maintain Traffic Signal Equipment. Maintenance of existing and new traffic signal equipment will be computed for payment on a monthly basis for each signalized intersection being maintained. Payment will be made to the nearest 1/4 month increment.
619-4.13 Tubular Markers. This work shall be measured as the number of tubular markers furnished and installed to the satisfaction of the Engineer.

619-4.14 Construction Zone Pavement Markings. Pavement striping will be measured by meter along the centerline of the pavement stripe, and will be based on a 100 mm wide stripe. When raised pavement markers are used to simulate or to supplement a pavement marking, they shall be measured as the number of linear meters of simulated or supplemented pavement stripe (e.g. a 3 meter longitudinal line segment is simulated by four, or more, individual marker units; the pavement striping will be measured as 3 meters, regardless of the number of markers installed).

Measurement for striping with a plan width greater than the basic 100 mm as shown on the plans or as directed by the Engineer, will be made by the following method:

\[
\text{Plan Width of Striping (millimeters) \times Number of Meters} \\
\frac{100 \text{ (millimeters)}}{}
\]

No measurement will be made for the number of meters of gaps between broken and dotted line segments. All payments for longitudinal lines shall be made on the basis of the theoretical required plan quantity.

Letters and symbols will be measured by each unit applied. A unit will consist of one letter or one symbol. Example: "SCHOOL" would be measured as six units. Double and triple headed arrows will be measured as a single unit, each "R" in a railroad grade crossing marking will be measured as a single unit, but the "X" in railroad grade crossing markings (MUTCD figure 263-33) will be measured by the number of meters of 100 mm stripe.

When raised pavement markers are used to supplement a pavement marking stripe, the supplemental raised pavement markers will be measured and paid separately from the appropriate pavement marking stripe.

619-4.15 (Vacant)

619-4.16 (Vacant)

619-4.17 Temporary Rumble Strips. The work will be measured for payment as the number of meters of individual rumble strip, measured transverse to the direction of traffic flow, satisfactorily installed.

619-5 BASIS OF PAYMENT

No payment will be made under Basic Maintenance and Protection of Traffic for each calendar day during which there are substantial deficiencies in compliance with the specification requirements of any subsection of this section, as determined by the Engineer, including but not limited to Basic Maintenance and Protection of Traffic, Construction Signs, Construction Barricades, Barriers, Lighting for Construction Barricades, Temporary Structures and Approaches, Short-Term Pavement Marking, Construction Zone Pavement Markings, Temporary Traffic Signals, Mailboxes, Maintain Traffic Signal Equipment and Opening Highway to Traffic Prior to Contract Acceptance, as well as Temporary Impact Attenuators, Impact Attenuators, Crash Cushions, Crash Terminals found elsewhere in the contract documents.

The amount of such calendar day non-payment will be determined by dividing the lump sum amount bid for Basic Maintenance and Protection of Traffic by the number of calendar days between the date the Contractor commences work and the date of completion as designated in the proposal, without regard to any extension of time.

Liquidated damages will be assessed for each subsequent calendar day or part thereof that a cited deficiency resulting in non-payment is not corrected or is permitted to recur.

If the Contractor fails to adequately conform to the provisions required under Construction Signs, Barriers, Temporary Impact Attenuators, Impact Attenuators, Crash Cushions, Crash Terminals, Construction Barricades, Lighting for Construction Barricades, Temporary Structures and Approaches,
§619

Short-Term Pavement Marking, Construction Zone Pavement Markings, Temporary Traffic Signals, Mailboxes, Maintain Traffic Signal Equipment and Opening Highway to Traffic Prior to Contract Acceptance, to the degree that such failure is deemed by the Engineer to adversely affect the maintenance and protection of traffic, the above liquidated damages will be assessed in addition to any payment deductions from Basic Maintenance and Protection of Traffic for inadequate work as specified herein.

The assessment of liquidated damages will not exceed the above amount per calendar day regardless of the number of violations.

If the Contractor fails to maintain and protect traffic adequately and safely for a period of 24 hours, the Engineer shall correct the adverse conditions by any means deemed appropriate, and shall deduct the cost of the corrective work from any monies due the Contractor. The cost of this work shall be in addition to the liquidated damages and non-payment for Basic Maintenance and Protection of Traffic listed above.

However, where major nonconformance with the requirements of this specification is noted by the Engineer, and prompt Contractor compliance is deemed not to be obtainable, all contract work may be stopped by direct order of the Engineer, regardless of whether corrections are made by the Engineer as stated in the paragraph above.

619-5.01 Basic Maintenance and Protection of Traffic. The lump sum price bid for Basic Maintenance and Protection of Traffic shall include all equipment, materials and labor necessary to adequately and safely maintain and protect traffic, except as provided for in separate payment items in the proposal. However, if the Contractor elects to utilize temporary traffic signals to control traffic in lieu of flaggers, the cost of such signals together with all costs of installation, operation and removal shall be included in the price bid for Basic Maintenance and Protection of Traffic.

The cost of temporarily terminating guide railing, median barrier, or bridge rail during non-work hours shall be included in the lump sum price bid for this item.

In the event the proposal does not include a separate item of payment for Opening Highway to Traffic Prior to Contract Acceptance and the Regional Director directs, in writing, any portion of pavement, structure or ramp to be opened to traffic prior to contract acceptance and on which traffic was not specified to be maintained and protected during construction, the price bid for Basic Maintenance and Protection of Traffic shall include any and all costs for opening said portion or portions to traffic prior to contract acceptance.

In the event the contract completion date is extended, no additional payment will be made for Basic Maintenance and Protection of Traffic.

Progress payments will be made for this item in proportion to the total amount of contract work completed less any deductions for unsatisfactory maintenance and protection of traffic.

619-5.02 Construction Signs. The lump sum price bid shall include the cost of labor, equipment and material, necessary to erect, remove, relocate, protect, maintain, store or replace any construction signs required to properly sign the contract. The lump sum price bid shall also include the cost of repairing or replacing reflectorized signs, when the Engineer determines that the reflective sheeting material no longer meets the specifications.

No payment will be made under Section 619 Basic Maintenance and Protection of Traffic for each calendar day during which there are substantial deficiencies in compliance with the requirements of this specification, as determined by the Engineer. The amount of each calendar day non-payment will be determined by dividing the lump sum bid by the number of calendar days between the date the Contractor commences work and the date of contract completion, as designated in the contract proposal, without regard to any extension of time.

Liquidated damages will be assessed for each calendar day or part thereof that a cited deficiency resulting in non-payment is not corrected or is permitted to recur.

Partial payments will be made. Fifty (50) percent of the lump sum price will be paid when ten (10) percent of the contract work has been completed. The remaining fifty (50) percent will be paid proportionally in accordance with the total contract work completed, beginning with the estimate following the initial payment on this item.

619-5.03 Temporary Box Beam Barrier, and Temporary Concrete Barrier. The unit price bid per meter of temporary box beam barrier, and temporary concrete barrier shall include all material, equipment, and labor necessary to erect, maintain, and remove the required barrier, including any required
connection devices, end treatments, delineation or guiding devices, repair of pavement after removal of box beam barriers, and devices for pinning and connecting temporary precast concrete barrier units. Any movement of temporary box beam barrier or temporary concrete barrier, except movements of the concrete barrier necessary to maintain, realign, or replace damaged units will be considered as a movement to a new location and the Contractor will be entitled to payment for the movement.

After placement, payment will be made for ninety (90) percent of the quantity of temporary box beam barrier, or temporary concrete barrier furnished and erected in accordance with the contract requirements. The remaining ten (10) percent will be paid upon removal. Temporary concrete barrier installed at the option of the Contractor, or required solely by a delay in the Contractor's operations, shall not be included in the measurement or payment for temporary concrete barrier.

619-5.04 Construction Barricades. The unit price bid per meter of barricade shall include all material, equipment and labor necessary to erect, maintain and remove required barricades. Whenever barricades are moved to a new location or the diagonal stripes are changed to allow traffic to pass on the other side of the barricade, payment will be made in the same manner as if it were a new barricade. Minor movements of the barricade from one side of the roadway to the other side, daily replacement to the same location or rearrangement within a work area, not requiring any change in the diagonal stripes, will not be considered as movement to a new location and will not be paid for as additional barricades.

After placement, payment will be made for ninety (90) percent of the quantity of barricade furnished and erected in accordance with the contract requirements. The remaining ten (10) percent will be paid upon removal. Type III Construction Barricades used at the option of the Contractor in lieu of drums or other channelizing devices shall not be included in the measurement or payment for Type III Construction Barricades.

619-5.05 Lighting for Construction Barricades. The unit price bid shall include the cost of furnishing all labor, materials, equipment, and power necessary to provide, maintain, and remove Lighting for Construction Barricades. Should a barricade that is lighted be moved to a new location or the diagonal stripes be changed to allow traffic to pass on the other side of the barricade, payment shall be made in the same manner as if it were a new installation of lighting for barricades. Minor movements of barricades that are lighted, such as a movement from one side of the road to the other side or rearrangements within the same work area not requiring any change in the diagonal stripes, will not be considered as a movement to a new location. This will be true, regardless of the source of power.

After installation and demonstration of satisfactory operation, payment will be made for seventy-five (75) percent of the quantity of barricade lighting furnished and installed in accordance with the contract requirements. The remaining twenty-five (25) percent will be paid for upon removal. No separate payment will be made for the two flashing warning lights used at the beginning of each work zone drop-off, as required by this specification.

619-5.06 Temporary Structures and Approaches. The unit price bid shall include all labor, material and equipment necessary to build, move, remove, dismantle and/or store the structure specified together with all work related to construction, removing and restoring approaches.

Payment will be made at the unit price bid for each temporary structure and its approaches as follows:

- Seventy-five (75) percent when the temporary structures and approaches are complete and operable.
- Twenty-five (25) percent when the temporary structures and approaches or appurtenances are permanently removed.

619-5.07 Tubular Markers. The unit price bid for tubular markers shall include the cost of furnishing all labor, materials, equipment, and all incidentals necessary to complete the work in accordance with this specification and as directed by the Engineer. The unit price bid shall include the cost of replacing damaged reflective sheeting. The cost to remove and reset tubular markers due to contractor error shall be borne by the Contractor. Removal at the completion of the work or when no longer needed shall also be included in the unit bid price. Tubular markers that are in good condition may be relocated as directed by the Engineer. Whenever tubular markers are moved to a new location, payment will be made as if it were a new tubular marker.
§619-5.08 Short-Term Pavement Markings. The unit price bid shall include the cost of furnishing all labor, material and equipment necessary to apply, maintain and remove short-term pavement markings in compliance with the requirements of §619-3.06. A separate payment will be made each time short-term pavement markings are first applied on a pavement course in accordance with the contract requirements. No payment will be made for the application, maintenance and removal of “temporary pavement markings” required after 14 days, or for short-term pavement marking necessitated by the Contractor's failure to place the final pavement marking paint before nightfall.

No payment will be made for the installation of Do Not Pass signs, delineators and plastic drums when necessitated by the Contractor's failure to place short-term pavement markings.

§619-5.09 Temporary Traffic Signal. The lump sum price bid for this item shall include the cost of all labor, materials, and equipment necessary to furnish, install, operate, maintain, move, and remove the signals for the required duration of the work. The bid price shall include the cost of electric power necessary to operate the signals until their removal is approved or ordered by the Engineer. Permanent signal control equipment will be paid for under separate contract items.

For the purposes of progress payment, the lump sum bid for the item shall be apportioned equally between the number of signals called for in the plans and proposal. If it becomes evident that a different number of temporary signals will be used, the lump sum bid should be apportioned equally between the revised number of signals and progress payments adjusted accordingly.

Payments will be made on each individual signal as follows:
Sixty (60) percent when the signal is installed and is in proper operation.
Forty (40) percent when all necessary work for this item is completed.

§619-5.10 Mailboxes. The unit price for each mailbox shall include all equipment, material and labor necessary to move, maintain or replace rural route mailboxes in their final position or location. Only one payment for each mailbox will be made regardless of the number of times it is moved or replaced and shall be made when the mailbox has been placed in its final location.

§619-5.11 Opening Highway to Traffic Prior to Contract Acceptance. Payment will be made for additional basic maintenance and protection of traffic as indicated in §619-1.09. The unit price bid shall include the cost of all materials, equipment and labor to provide the basic maintenance and protection of traffic.

In the event that additional signs, barricades, or other items are required to supplement the work under this item, payment shall be made upon erection as follows:

A. Where contract unit bid items, exclusive of lump sum items, cover the supplementary work ordered, payment will be made at the contract unit bid prices.
B. Where lump sum items, exclusive of the Basic Maintenance and Protection of Traffic item, or no contract unit bid items cover the supplementary work ordered, payment will be made at agreed prices or by force account.

No payment will be made under this item during any period for which the Contractor has been granted an extension of time with engineering charges and/or for which the Contractor has been assessed liquidated damages.

§619-5.12 Other Work. The work required for Clearing and Grubbing, Furnishing and Applying Water, and Furnishing and Applying Calcium Chloride for dust control, and for placing bituminous plant mixed material for patching existing pavement, or where specifically ordered by the Engineer or as shown on the plans shall be paid for under their respective pay items. During the winter period when plant mixed bituminous material is unavailable the material used for patching shall be a suitable “winter mix” approved by the Materials Bureau. Payment for the bituminous patching material used, regardless of the type, will be made under the top course roadway paving item.

No payment will be made for any bituminous concrete determined by the Engineer to be necessary as a result of the Contractor's failure to complete paving operations prior to the weather and seasonal limitations, pursuant to §402-3.01. Also, no separate payment will be made for interim pavement markings, applied, maintained, or removed pursuant to §619-3.06 Short Term Pavement Markings.
Whenever any of the above items do not appear in the contract, payment for the work equivalent to such item will be included in the lump sum price bid for Basic Maintenance and Protection of Traffic.

**619-5.13 (Vacant).**

**619-5.14 Maintain Traffic Signal Equipment.** The unit bid price per signalized intersection per month shall include the cost of all labor, materials and equipment necessary to perform the work with the exception of inductance loop replacement which will be paid for separately. The cost of the electric power shall be the responsibility of the original maintaining agency. No payment will be made during any period for which the contractor has been granted an extension of time with engineering charges.

**619-5.15 Flashing Arrow Board.** The lump sum amount bid for this work shall include the cost of all material, equipment, labor, maintenance, and electrical power necessary to complete this work in a manner approved by the Engineer.

Progress payments will be made for this work in proportion to the total amount of contract work completed.

**619-5.16 Construction Zone Pavement Markings.** The unit price bid shall include the cost of furnishing all labor, materials, and equipment necessary to install, maintain, and remove pavement markings as required by §619-3.12. No payment shall be made under these items for short term pavement markings installed to meet the requirements of §619-3.06. When raised pavement markers are used to supplement a pavement marking stripe, payment shall be made for each item.

The non-payment and Liquidated Damage provisions of §619-5 Basis of Payment - General shall apply to these items of work.

Progress payments will be made. Quantities will be measured for payment when the pavement striping is satisfactorily installed and payment will be 75%. The remaining 25% will be measured for payment following satisfactory removal of the pavement striping.

**619-5.17 Temporary Rumble Strips.** The unit price bid for temporary rumble strips shall include the cost of all labor, materials and equipment necessary to complete the work. Payment will include the cost of pavement cleaning, hot mix asphalt, or other materials used to form or fill in the rumble strips, and tack coat. Progress payments will be made at the unit price bid for 75 percent of the quantity after installation. The remaining 25 percent will be paid upon removal.

**Payment will be made under:**

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>619.01</td>
<td>Basic Maintenance and Protection of Traffic</td>
<td>Lump Sum</td>
</tr>
<tr>
<td>619.02</td>
<td>Construction Signs</td>
<td>Lump Sum</td>
</tr>
<tr>
<td>619.0303</td>
<td>Flashing Arrow Boards</td>
<td>Lump Sum</td>
</tr>
<tr>
<td>619.0413</td>
<td>Type III Construction Barricades</td>
<td>Meter</td>
</tr>
<tr>
<td>619.0502</td>
<td>Lighting for Construction Barricades</td>
<td>Meter</td>
</tr>
<tr>
<td>619.06*</td>
<td>Temporary Structures and Approaches</td>
<td>Each</td>
</tr>
<tr>
<td>619.10</td>
<td>Mailboxes</td>
<td>Each</td>
</tr>
<tr>
<td>619.1101</td>
<td>Opening Highway to Traffic Prior to Contract Acceptance</td>
<td>Lane Kilometer-Calender Day</td>
</tr>
<tr>
<td>619.13</td>
<td>Temporary Traffic Signals</td>
<td>Lump Sum</td>
</tr>
<tr>
<td>619.1611</td>
<td>Maintain Traffic Signal Equipment (Requirement A)</td>
<td>Intersection Month</td>
</tr>
<tr>
<td>619.1612</td>
<td>Maintain Traffic Signal Equipment (Requirement B)</td>
<td>Intersection Month</td>
</tr>
<tr>
<td>619.1613</td>
<td>Maintain Traffic Signal Equipment (Requirement C)</td>
<td>Intersection Month</td>
</tr>
<tr>
<td>619.17</td>
<td>Temporary Concrete Barrier</td>
<td>Meter</td>
</tr>
<tr>
<td>619.18</td>
<td>Temporary Box Beam Barrier</td>
<td>Meter</td>
</tr>
<tr>
<td>619.2001</td>
<td>Tubular Markers White Tape</td>
<td>Each</td>
</tr>
<tr>
<td>619.2101</td>
<td>Construction Zone Pavement Marking Stripes(Optional)</td>
<td>Meters</td>
</tr>
<tr>
<td>619.2102</td>
<td>Construction Zone Pavement Marking Letters(Optional)</td>
<td>Each</td>
</tr>
<tr>
<td>619.2103</td>
<td>Construction Zone Pavement Marking Symbols(Optional)</td>
<td>Each</td>
</tr>
<tr>
<td>619.2104</td>
<td>Construction Zone Pavement Marking Stripes</td>
<td></td>
</tr>
</tbody>
</table>
SECTION 619 - REMOVABLE TAPE

619.2105 Construction Zone Pavement Marking Letters
- Each

619.2106 Construction Zone Pavement Marking Symbols
- Each

619.2107 Construction Zone Pavement Marking Stripes
- Simulated by Raised Markers
- Meters

619.2108 Construction Zone Pavement Marking Stripes
- Supplemented by Raised Markers
- Meters

619.22 Temporary Rumble Strips
- Meter

* Refer to the Standard Contract Pay Item Catalog for full Item Number and full description.

SECTION 620 - BANK AND CHANNEL PROTECTION

620-1 DESCRIPTION. This work shall consist of furnishing all plant, labor, equipment, and materials to place a protective covering of erosion-resistant material on embankment slopes, streambanks, at culvert inlets or outlets on bottoms and side slopes of channels, at structure foundations, and at other locations shown on the plans or as directed by the Engineer. The work shall be done in accordance with these specifications and in conformity with the lines, grades, thicknesses, and typical sections shown on the plans or established by the Engineer.

620-1.01 Stone Filling. Stone filling shall consist of well graded stone placed as protective material on stream-banks, in channels and elsewhere, as required.

620-1.02 Dry Rip-Rap. Dry rip-rap shall consist of stone fitted and placed on streambanks or in channels in order to provide protection against erosion.

620-1.03 Grouted Rip-Rap. Grouted rip-rap shall consist of stone similar to dry rip-rap but with all spaces between the stones filled with cement grout.

620-1.04 Bedding Material. Bedding material shall consist of granular material placed in a layer, where required, on the ground surface prior to placing stone filling or rip-rap. The purpose of the bedding material is to prevent underlying finer materials from passing into and through the stone filling or rip-rap.

620-1.05 Concrete Block Paving. Concrete block paving shall consist of concrete blocks placed on embankment slopes under structures as protection against erosion.

620-1.06 Gabions. Gabions shall consist of open wire mesh baskets, filled with stones.

620-2 MATERIALS

620-2.01 Soundness Approval. The soundness of all material used for stone filling or rip-rap shall be approved on the basis of a geologic evaluation in accordance with the control procedure in effect on the date of advertisement for bids. Prior to the evaluation, the Contractor shall stockpile the material. Where the State elects to conduct soundness tests, stone filling or rip-rap will be rejected if it exceeds 10% loss, by weight, after 10 cycles of the magnesium sulfate soundness test.

620-2.02 Stone Filling. The gradation of materials furnished for use as stone filling shall be as specified in Figure 620-1, and will be accepted or rejected based on a visual examination of the material by the Engineer.

620-2.03 Dry Rip-Rap. In addition to meeting the requirements set forth in §620-2.01, dry rip-rap shall consist of stones shaped as nearly as practicable in the form of right rectangular prisms. At least fifty
percent, by weight, of the stones shall weigh in excess of 150 kg each, and the remainder of the stones shall weigh from 50 to 150 kg each. One dimension of each of the stones furnished shall be at least equal to the thickness of the rip-rap as shown on the plans.

The gradation of materials furnished for use as dry rip-rap will be accepted or rejected based on a visual examination of the material by the Engineer.

620-2.04 Grouted Rip-Rap. The requirements for the stone used for grouted rip-rap shall be the same as stated in §620-2.03.

The grout shall consist of one part cement conforming to the requirements for Portland Cement Type 2, §701-01 and three parts fine aggregate, conforming to the requirements for Concrete Sand in §703-07.

620-2.05 Bedding Material. Bedding material shall be composed of crushed stone, crushed air-cooled blast furnace slag, or gravel, free of soft, nondurable particles, organic material, and thin or elongated particles. Bedding material shall be stockpiled.

Bedding material shall meet the following gradation requirements:

<table>
<thead>
<tr>
<th>Sieve Designation</th>
<th>Percent by Weight Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 mm</td>
<td>100</td>
</tr>
<tr>
<td>25.0 mm</td>
<td>15 to 60</td>
</tr>
<tr>
<td>6.3 mm</td>
<td>0 to 25</td>
</tr>
<tr>
<td>425 µm</td>
<td>0 to 10</td>
</tr>
</tbody>
</table>

The procedure for acceptance or rejection of these materials shall be as described in the appropriate Soil Control Procedure (SCP) Manual.

![FIGURE 620-1 STONE FILLING GRADATION REQUIREMENTS](image-url)

**NOTES:**
1. Stone sizes, other than weights, refer to the average of the maximum and minimum dimensions of a stone particle as estimated by the engineer.
2. Materials shall contain less than 20 percent of stones with a ratio of maximum to minimum dimension greater than three.
3. Air-cooled blast furnace slag, cobbles or gravel having at least one fractured face per particle are acceptable substitutes for stone under these items, provided that the soundness and gradation requirements are met.
4. Materials shall contain a sufficient amount of stones smaller than the average stone size to fill in the spaces between the larger stones.
5. Heavier gradings of this item may be required on some projects, in which case the requirements will be stated on the plans or in the proposal.
**620-2.06 Concrete Block Paving.** The concrete block shall comply with the requirements for Concrete Block (Slope Paving), §704-04. The block shall have the following nominal dimensions:

<table>
<thead>
<tr>
<th>Specified Masses and Sizes</th>
<th>APPROXIMATE SHAPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>300 kg</td>
<td>![Block Image]</td>
</tr>
<tr>
<td>150 kg</td>
<td>![Block Image]</td>
</tr>
<tr>
<td>75 kg</td>
<td>![Block Image]</td>
</tr>
<tr>
<td>50 kg</td>
<td>![Block Image]</td>
</tr>
<tr>
<td>200 mm</td>
<td>![Block Image]</td>
</tr>
<tr>
<td>150 mm</td>
<td>![Block Image]</td>
</tr>
</tbody>
</table>

- Length: 400 to 500 mm
- Thickness: 150 mm (solid)
- Width: 200 mm

The standard dimensions of the block shall be the specified nominal dimension minus 10 mm. The maximum permissible variation in dimensions of individual units from standard dimensions shall be not more than 3 mm. The size of block used shall be consistent throughout any continuously paved area, and only one nominal length shall be used in any contract. All units shall be sound and free from cracks or other defects that would interfere with the proper placing of the blocks or impair the strength, permanence and appearance of the construction.

Cushion sand for concrete block paving shall conform to the requirements for cushion sand set forth in §703-06. Grout, where used, shall consist of one part Portland Cement Type 2, conforming to the requirements of §701-01, and two parts Mortar Sand, conforming to the requirements of §703-03.

**620-2.07 Gabions.** The materials used in this work shall conform to the requirements of the following subsection of Section 700 - Materials.

Gabions 712-15

**620-3 CONSTRUCTION DETAILS**

**620-3.01 General.** The ground surface on which bank or channel protection is to be placed shall be free of brush, trees, stumps, and other objectionable material and shall be dressed to a smooth surface. All soft or spongy material shall be removed to the depth shown on the plans or as directed by the Engineer and replaced with approved material. Filled areas shall be compacted in accordance with applicable provisions of §203-3.12, Compaction. Protection for structure foundations shall be provided as early as the foundation construction permits. The type of protection shall be placed in accordance with these specifications and the contract documents.

**620-3.02 Stone Filling.** Stone filling shall be placed in a manner that will produce a reasonable well-graded mass of stone with smaller stone fragments filling the space between the larger ones, so as to result in the minimum practicable percentage of voids. The final section of stone filling shall be in conformance with the lines, grades, and thicknesses shown on the plans. Stone filling used for bank or channel protection shall be placed to its full course thickness in one operation, unless otherwise directed by the Engineer or specified in the special provisions, and in such a manner that the underlying material will not be displaced or worked into the layer of stone filling. Placement of stone upon finished bedding material, when used, shall be carefully controlled to avoid disruption and damage to the layer of bedding.
material. The stone shall be so placed and distributed that there will be no pockets of uniform size material.

The desired distribution of the various sizes of stone throughout the mass shall be obtained by selective loading of the material at the quarry or other source; by controlled dumping of successive loads during final placing; or by other methods of placement which will produce the specified results. Rearranging of individual stones by mechanical equipment or by hand will be required to the extent necessary to secure the specified results. When stone filling is dumped under water, methods shall be used that will minimize segregation.

620-3.03 Dry Rip-Rap. The stones shall be placed so that the dimension approximately equal to the layer thickness is perpendicular to the slope surface and that the weight of the stone is carried by the underlying material and not by the adjacent stones. On slopes, the largest stones shall be placed at the bottom of the slope. The dry rip-rap shall be properly aligned and placed so as to minimize void spaces between the adjacent stones. The spaces between the stones shall be filled with spalls of suitable size.

620-3.04 Grouted Rip-Rap. The procedure of placing the stones shall be the same as described in §620-3.03, Dry Rip-Rap, except that the space between stones shall be filled with grout rather than spalls. Material upon which the grouted rip-rap is laid shall not be allowed to occupy the space between the stones.

When the stones are in place, the spaces between them shall be completely filled with grout and the surface of the stones cleaned to remove accumulation of grout. Rip-rap shall not be grouted in freezing weather. The grouted rip-rap shall be kept moist for seven days after grouting. A suitable curing compound may be employed, if approved by the Engineer.

The Engineer may direct that occasional spaces be left ungrouted for relief of hydrostatic pressure. The ungrouted spaces shall be chinked with spalls of suitable size.

620-3.05 Bedding Material. Where called for on the plans or directed by the Engineer, stone filling and dry rip-rap shall be placed on bedding material. The bedding material shall be placed on the prepared area to the full specified thickness of each layer in one operation, using methods which will not cause segregation of particle sizes. Contamination of bedding material by natural soils or other materials shall be prevented at all times. Bedding material that becomes contaminated shall be removed and replaced with uncontaminated bedding material at no expense to the State.

620-3.06 Concrete Block Paving. Blocks shall be laid on a 75 mm bed of cushion sand in running bond with the long dimension transverse to the slope and all joints tight. Blocks shall be thoroughly rammed in place to provide a uniformly even surface and solid bedding under each block.

In the areas where grouting is called for, the concrete block shall be laid in running bond with the length parallel to the slope and with 6 mm joints. Following the laying of blocks, in the area to be grouted, sufficient mortar sand shall be spread over the surface and swept into the joints to fill the latter to 100 mm from the surface. The block shall be wetted to the satisfaction of the Engineer before any grout is placed. The joints shall be filled with grout from the bottom flush with the top of the block.

After grouting has been completed and the grout has sufficiently hardened, the blocks shall be wetted, covered and cured with curing covers for the first seven days after grouting. Grout shall not be poured during freezing water.

620-3.07 Gabions. Each gabion unit shall be assembled by binding together all vertical edges with wire ties on approximately 150 mm spacing or by a continuous piece of connecting wire stitched around the vertical edges with a coil about every 100 mm. Empty gabion units shall be set to line and grade as shown on the plans. For structural integrity wire ties or connecting wire shall be used to join the gabions together along the perimeter of all contact surfaces according to the manufacturer's instructions. Internal tie wires shall be uniformly spaced and securely fastened in each outside cell of the structure in accordance with the manufacturer's instructions or where ordered by the Engineer. When gabions are being placed as slope protection the cross-connecting wire may be deleted if order by the Engineer.

A standard fence stretcher, chain fall, or iron rod may be used to stretch the wire baskets and hold alignment.
The gabions shall be filled with stone carefully placed by hand or machine to assure alignment and avoid bulges with a minimum of voids. After a gabion has been filled, the lid shall be bent over until it meets the side and edges. The lid shall then be secured to the sides, ends, and diaphragms with the wire ties or connective wire in the same manner described above for assembling.

620-4 METHOD OF MEASUREMENT

620-4.01 Stone Filling, Dry Rip-Rap, Gabions, Grouted Rip-Rap and Bedding Material. The quantity to be paid for under each of these items shall be the number of cubic meters computed from the payment lines shown on the plans, or as directed by the Engineer.

620-4.02 Concrete Block Paving. The quantity to be paid for under this item shall be the number of square meters computed from the payment lines shown on the plans, or as directed by the Engineer.

620-5 BASIS OF PAYMENT

620-5.01 Stone Filling, Dry Rip-Rap, Gabions, Grouted Rip-Rap and Bedding Material. The unit price bid per cubic meter for each of these items shall include the costs of furnishing all materials, labor and equipment necessary to satisfactorily complete the work, except that any necessary excavation will be paid for under its appropriate pay item.

620-5.02 Concrete Block Paving. The unit price bid per square meter for this item shall include the costs of furnishing all materials, labor and equipment necessary to satisfactorily complete the work, except that any necessary excavation will be paid for under its appropriate pay item.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
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SECTIONS 621 AND 622 (VACANT)

SECTION 623 - SCREENED GRAVEL, CRUSHED GRAVEL, CRUSHED STONE, CRUSHED SLAG

623-1 DESCRIPTION. This work shall consist of furnishing and placing, as shown on the plans or directed by the Engineer, screened gravel, crushed gravel, crushed stone, or crushed slag.

623-2 MATERIALS. The materials shall meet the requirements of §703-02, Coarse Aggregates, unless otherwise indicated, and shall be furnished in the sizes or combination of sizes indicated on the plans or ordered by the Engineer.

623-3 CONSTRUCTION DETAILS. Screened gravel, crushed gravel, crushed stone or crushed slag shall be placed on the plans or as directed by the Engineer.

623-4 METHOD OF MEASUREMENT
§623-4.01 Measurement by Weight. The quantity to be paid for shall be the number of metric tons, loose measure, incorporated into the work conforming to the requirements of these specifications and in accordance with the lines, grades, and cross-sections shown on the plans or as directed by the Engineer.

§623-4.02 In-Place Measure. The quantity to be paid for shall be the number of cubic meters of material placed, measured in the completed work, within the payment lines, as shown on the plans or as ordered by the Engineer.

§623-5 BASIS OF PAYMENT. The unit price bid shall include costs of all labor, material and equipment necessary to properly complete the work.

Payment will be made under:

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<th>Item No.</th>
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<td>Crushed Stone (By Weight)</td>
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SECTION 624 - PAVED GUTTERS

§624-1 DESCRIPTION. This work shall consist of the construction of asphalt concrete, precast, conventionally formed or machine formed Portland Cement concrete, or cobblestone gutters in accordance with these specifications and in reasonably close conformity with the lines and grades shown on the plans or established by the Engineer.

§624-2 MATERIALS

§624-2.01 Asphalt Concrete Gutters. The materials for hot mix asphalt gutters shall meet the requirements specified for a 9.5 mm mixture designed for <0.3 million ESALs using coarse aggregate Type F9.

§624-2.02 Conventionally Formed Concrete Gutters. The materials and manufacture of concrete for this work shall meet the requirements for Class A concrete specified in Section 501 Portland Cement Concrete--General.

§624-2.03 Precast Concrete Gutters. Precast concrete gutters shall comply with the requirements of §714-07, Precast Concrete Gutters.

§624-2.04 Cobble Gutters. Cobble gutters shall be made of rounded “Hardheads,” 150 mm to 255 mm in diameter.

§624-2.05 Machine Formed Concrete Gutter. The material requirements, mix preparation and manufacturing of concrete shall comply with the requirements for Class I concrete, as specified in Section 501 Portland Cement Concrete-General.

§624-3 CONSTRUCTION DETAILS

§624-3.01 Asphalt Concrete Gutters. Except as provided below, the construction requirements shall meet those of §402-3, Construction Details for Hot Mix Asphalt (HMA) Pavements.
A. Preparation of Bed. The location of the gutter shall be properly excavated and graded to conform with the gutter cross-section and line and grade. The excavated area shall be firm and dry before laying the gutter.

B. Placing. The asphalt concrete may be placed by handwork or by a paving machine approved by the Engineer. The gutter shall be uniform in texture, shape and density. The asphalt may be placed in a single layer providing that the section, line and grade after compaction are determined satisfactory by the Engineer.

C. Sealing. After compaction, the finished surface of the gutter shall be sealed by an application of bituminous material, 702-3001, in the quantity and manner directed by the Engineer.

624-3.02 Conventionally Formed or Machine Formed Concrete Gutters. Concrete gutters shall be either conventionally formed or machine formed to the size and shape shown on the standard sheets.

A. Conventionally Formed Gutters.

1. General. Unless otherwise indicated, concrete gutters shall be constructed in 2.4 m sections of the shapes and types shown on the plans and/or standard sheet. A steel separation plate 3 mm thick and cut to fit the section shall be used in each joint and removed as the concrete hardens, or the gutter may be constructed in alternate sections. 24 hours to elapse before the construction of the intermediate sections. Excess concrete shall be screeded off perpendicular to the line of the gutter.

   All construction joints shall be poured full with material meeting the requirements of 702-0700. Miscellaneous Asphalt Cement.

2. Curing. Curing of the gutters shall comply with the requirements of §502-3.11, Curing. Minimum curing periods for the various types of curing materials shall comply with the requirements of Table 502-3. A clear membrane curing compound may be used in lieu of a white-pigmented membrane.

B. Machine Formed Gutter. The machine forming requirements of concrete curb as specified under §609-3.03 shall apply except that contraction joints shall be formed or scored every 2440 mm to depths sufficient to produce weakened planes in the concrete.

624-3.03 Precast Concrete Gutters. The location of the gutter shall be excavated and graded to conform with the gutter cross-section and line and grade. Gutter sections shall be placed to line and grade on a firm and dry subgrade.

   All joints shall be poured full with material meeting the requirements of 702-0700, Asphalt Filler.

624-3.04 Cobble Gutters. The largest stones shall be selected and set along the inner edge and the center of the gutter. All stones shall be embedded in mortar composed of one part Type 1 or 2 cement, §701-01, and two parts of §703-07, Concrete Sand. All stone shall be laid to line and grade, with close joints, by skilled workmen using regular paving tools. The stones shall then be thoroughly rammed in place and brought to a uniform surface.

   The joints shall be made of the same mortar as described above. The mortar shall completely fill the joints after being tamped.

624-4 METHOD OF MEASUREMENT

624-4.01 Asphalt Concrete Gutters. The quantity of asphalt gutters to be paid for will be measured by the number of metric tons of asphalt concrete furnished and placed in accordance with the plans, specifications and requirements of the Engineer. Quality payment adjustments will be measured as outlined in §402-4, Method of Measurement.
§624

624-4.02 Conventionally Formed or Machine Formed Concrete Gutters. The quantity to be paid for under this work will be the number of square meters of exposed surface of concrete gutters placed in accordance with the plans and as specified by the Engineer. No reduction in the number of square meters will be made to account for drainage structure frames and grates, or any other obstruction placed within the gutter section.

624-4.03 Precast Concrete Gutters. The quantity to be paid for under this item will be the number of meters of gutter (laying length) placed in the work in accordance with the plans and specifications.

624-4.04 Cobble Gutters. The quantity of cobble gutters to be paid for under this work will be the number of square meters of exposed surface laid in accordance with the plans or as directed by the Engineer.

624-5 BASIS OF PAYMENT

624-5.01 Asphalt Concrete Gutters. The unit price bid per metric ton of asphalt concrete shall include the cost of furnishing all materials including the asphalt cement, the mixing, transporting, grading, placing, rolling and all equipment and labor necessary to complete the work including all necessary excavation below the finished surface, exclusive of any undercutting or excavation for special bedding materials. Payment of Quality Units will be made based on the Index Price listed in the contract documents. The index price shown in the itemized proposal for each Quality Unit shall be considered the price bid. The unit (index) price is not to be altered in any manner by the bidder. Should the bidder alter the amount shown, the altered figure will be disregarded and the original price will be used to determine the total amount bid for the Contract.

624-5.02 Conventionally Formed or Machine Formed Concrete Gutters. The unit price bid shall include the cost of furnishing all labor, materials and equipment necessary to complete the work including all necessary excavation below the finished surface exclusive of any undercutting or excavation for special bedding materials.

624-5.03 Precast Concrete Gutters. The provisions of §624-5.02 shall apply.

624-5.04 Cobble Gutters. The provisions of §624-5.02 shall apply.

Payment will be made under:

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<td>624.0401</td>
<td>Cobble Gutters</td>
<td>Square Meter</td>
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Refer to the Standard Contract Pay Item Catalog for full Item Number and full Description.

SECTION 625 - SURVEY OPERATIONS, ROW MARKERS, & PERMANENT SURVEY MARKERS

625-1 DESCRIPTION

625-1.01 Project Survey and Stakeout. Under this work the Contractor shall do all necessary surveying required to construct all elements of the project as shown on the plans and specified in the proposal and specifications, and to protect all boundary and survey markers which are either shown on the plans or discovered on the project site. This work shall include but not be limited to stakeout, layout, and
§625 elevations for the highway, structures, forms, pile layouts and appurtenances as shown and required, consistent with the current practices of the Department, and shall be performed by competently qualified personnel acceptable to the Engineer. This shall also include all work necessary to preserve the location of all existing boundary or right of way and survey markers which should not be in direct conflict with the work to be performed under the contract, as well as all private property monumentation which is in direct conflict with the work to be performed under the contract. Where railroad relocation or alteration is done by force account by the railroad or by the Contractor, all necessary surveying is to be done as part of this work as directed by the Engineer. All survey stake-out shall proceed immediately following the award of the contract and shall be expeditiously progressed to completion in a manner and at a rate satisfactory to the Engineer. The Contractor shall keep the Engineer fully informed as to the progress of the stakeout survey. All survey control work shall be done in accordance with the Department’s “Surveying Standards & Procedures Manual”.

625-1.02 Right of Way Markers. Under this work, the Contractor shall locate, furnish, place and certify right-of-way markers at the locations indicated on the plans or where shown on right-of-way maps or where directed by the Engineer, in accordance with the details shown on the appropriate Standard Sheet, these specifications, and the directions of the Engineer. The Contractor shall verify with the Engineer, their use of the most current Right of Way Acquisition Maps to determine the appropriate locations of the proposed markers.

625-1.03 Permanent Survey Markers. Under this work the Contractor shall furnish and place permanent survey markers at locations indicated on the plans or as directed by the Engineer, and in accordance with the details shown on the appropriate standard sheet.

625-2 MATERIALS

625-2.01 Project Survey and Stakeout. All stakes, reinforcing steel, and any other material necessary to perform the work satisfactorily, shall be provided by the Contractor.

   All stakes used shall be of a type approved by the Engineer. All reinforcing steel shall be a minimum diameter 16 mm bar, 1 meter length, and Grade 300 or 420. It shall be the Contractor's responsibility to maintain stakes in their proper position and location at all times.

625-2.02 Concrete Right of Way Markers. Concrete right-of-way markers shall conform to the requirements of §712-05, Precast Concrete Right-of-Way Markers.

625-2.03 Steel Pin and Cap Right-of-Way Markers. Reinforcing steel used for the shank shall conform to ASTM A615, Grade 300 or Grade 420. It shall be epoxy coated for its entire length in accordance with the coating application requirements of §705-14 Longitudinal Joint Ties or §709-04 Epoxy Coated Bar Reinforcement, Grade 420.

   The cap shall be aluminum or a corrosion resistant aluminum alloy. The cap shall weigh a minimum of fifty grams and fasten to the shank by means of threading or force fitting.

   A commercial grade Silicone Sealant shall be used between the cap and the shank. Zinc Chromate Primer, §708-04 shall be applied to all aluminum or aluminum alloy surfaces to be in contact with cement concrete.

   Concrete Grouting Material §701-05 shall be used to anchor the Steel Pin and Cap Type Markers into rock.

625-2.04 Permanent Survey Markers. The concrete shall meet the requirements of Class A Concrete in Section 501, Portland Cement Concrete-General, except that the requirements for inspection facilities, automated batching controls and recordation do not apply. The batching, mixing and curing methods, and the inspection facilities shall meet the approval of the Department or its representative. The Contractor may submit, for approval by Director, Materials Bureau, a mix at least equivalent to the specified Class A Concrete. The cap shall be provided by the Contractor as specified by the standard sheet.
625-3.01 Project Survey and Stakeout. The Contractor shall trim trees, brush and other interfering objects, not inconsistent with the plans, from survey lines in advance of all survey work to permit accurate and unimpeded work by its own stake-out survey crews and the Department's survey crews.

The location and length shown on the plans for pipe and structural plate culverts shall be considered to be approximate. The ordered length of culverts will be determined by the Engineer after the Contractor accurately stakes the proposed culvert in the planned location as approved by the Engineer and after appropriate and necessary engineering study.

The exact position of all work shall be established from survey control points which are shown on the plans and/or modified by the Engineer. Any error, apparent discrepancy or absence in or of data shown or required for accurately accomplishing the stake-out survey shall be referred to the Engineer for interpretation or furnishing when such is observed or required.

The Contractor shall place two offset stakes or references at each center line station and at such intermediate locations as the Engineer may direct. From computations and measurements made by the Contractor, these stakes shall be clearly and legibly marked with the correct center line station number, offset and cut or fill so as to permit the establishment of the exact centerline location and elevation during construction. If markings become faded or blurred for any reason the markings shall be restored by the Contractor and at the request of the Engineer. The Contractor shall locate and place all cut, fill, slope, fine grade or other stakes and points, as the Engineer may direct for the proper progress of the work. All control points shall be properly guarded and flagged for easy identification.

Drainage structures shall be staked out by the Contractor at the locations and elevations shown on the plans or specified by the Engineer.

The Contractor shall also accurately establish the center line of bearings for bridge abutments and piers, by setting special hubs or reference points as directed by the Engineer, so located and protected to insure their remaining undisturbed until such time as they are no longer needed. The Contractor shall accurately mark the location of anchor bolts to be installed, establish the elevation of bearing surfaces and check bearing plates to insure installation at their exact elevation. Before the erection of structural steel is started the Contractor shall verify by accurate field measurements the locations, both vertically and horizontally, of all bearings and shall assume full responsibility for the fabricated structural steel fitting the substructure as constructed.

All required Rights-of-Way and easement limits shall be established, staked and referenced by the Contractor concurrent with the construction stake-out survey, and prior to any construction work beginning on the affected properties. Rights of way and easement limits shall only be set, and property lines reset, by or under the direction of a Licensed Land Surveyor or exempt Professional Engineer (as permitted under Section 7209(m) of the NYS Education Law), who is licensed and registered to practice in New York State. The Contractor shall supply proof to the Engineer that such work is being performed by or supervised by a Licensed Land Surveyor or exempt Professional Engineer and all control has been established in accordance with the Department’s “Surveying Standards & Procedures Manual”.

Reference points, base lines, stakes and bench marks for borrow pits shall be established by the Contractor.

The Contractor shall ensure that prior to beginning work, all existing property and survey monuments (including right of way markers) which are adjacent to work areas and may be disturbed during construction shall be properly tied into fixed reference points or located from prime project control, before beginning work in that area. Reference ties (3 or 4 minimum) or field location notes shall be neatly recorded and made available to the Engineer upon request. If any property line and/or survey monuments are disturbed by the Contractor, they shall be reset under this item prior to the conclusion of the contract by either reuse of the original marker or by use of reinforcing steel, as directed by the Engineer. All work connected with tying off monuments and/or resetting them shall be performed by or under the direction of a Professional Land Surveyor or exempt Professional Engineer, who is licensed and registered to practice in New York State.

Information on installed right-of-way markers and permanent survey markers shall be neatly recorded on certification forms provided by the Engineer. The permanent survey marker forms include project information, as-built State Plane Coordinate values, control line and centerline station and offset to marker, distance and direction to adjacent markers, the elevation of the marker, and a sketch which shows the relative positions to the control line points, 3 or 4 physical ties to the markers, and a north arrow. The
right of way marker forms include project information and control line (proposed and as-built) station and offset to the marker. The as-built location of all markers shall be recorded to the nearest millimeter and located from prime project control to a minimum accuracy of one part in twenty thousand. These locations shall be certified by a Professional Land Surveyor or exempt Professional Engineer who is licensed to practice in New York State. The certification forms shall be delivered to the Engineer within 30 calendar days of setting the markers, which then will be forwarded to the Regional Land Surveyor.

The Contractor shall be responsible for the accuracy of the work and shall maintain all reference points, stakes, etc. throughout the life of the contract. Damaged or destroyed points, bench marks or stakes, or any reference points made inaccessible by the progress of the construction shall be replaced or transferred by the Contractor. Any of the above points, which may be destroyed or damaged shall be transferred by the Contractor before they are damaged or destroyed. All control points shall be referenced by ties (3 or 4 minimum) to acceptable objects and recorded. Any alterations or revisions in the ties shall be so noted and the information furnished to the Engineer immediately. All stake-out survey work related to highway control shall be referenced to the center line shown on the plans. All computations necessary to establish the exact position of the work from control points, shall be made and preserved by the Contractor. All computations, survey notes and other records necessary to accomplish the work shall be neatly made available to the Engineer upon request and shall become the property of the State and delivered to the Engineer not later than the date of acceptance of the contract.

The Engineer may check all or any portion of the stake-out survey work or notes made by the Contractor. Any necessary correction to the work shall be made immediately by the Contractor. Such checking by the Engineer shall not relieve the Contractor of any responsibilities for the accuracy or completeness of the work.

Prior to the final cross-section survey of the project by the Engineer, the Contractor shall reestablish center line or base line points and stationing as required by the Engineer.

Prior to the final cross-section survey of any borrow pits by the Engineer, the Contractor shall reestablish base line points and stationing, as well as any necessary bench marks as required by the Engineer.

The Contractor will not be required or permitted to take the preconstruction or final cross-sections that are used for payment purposes.

During the progress of the construction work the Contractor will be required to furnish all of the surveying and stake-out incidental to the proper location by line and grade for each phase of the work. For paving and any other operation requiring extreme accuracy, the Contractor will re-stake with pins or other acceptable hubs located directly adjacent to the work at a spacing directed by the Engineer.

Just prior to completion of the contract, the Contractor shall reestablish if necessary and retie all control points as permanently as possible and to the satisfaction of the Engineer.

625-3.02 Right of Way Markers. The Contractor shall set right-of-way markers at the time the Engineer directs them to be placed. Placement shall be made from a closed traverse within Second-Order, Class II (1 part in 20,000) accuracy, and in accordance with the Department’s “Surveying Standards & Procedures Manual”. The right-of-way markers shall be set at the locations specified by the Engineer and as shown on the appropriate Right of Way Acquisition Maps. This work shall be performed by, or under the direction of, a Professional Land Surveyor or an exempt Professional Engineer who is licensed and registered to practice in New York State. The Licensed Land Surveyor or exempt Professional Engineer shall certify the as-built position of each marker on the appropriate form provided by the Engineer. The scheduling for installation of Right of Way Markers shall be approved by the Engineer prior to their installation.

Right-of-Way markers shall be installed in accordance with the Standard Sheets, these specifications, and in accordance with the directions of the Engineer. If the Steel Pin ROW Marker is used, prior to placing the cap on the bar, the cap shall be filled 2/3 full of silicone sealant and then fastened to the bar by threading or by force fit. During the driving operation for the Steel Pin Right-of-Way Marker, the lettering on the cap shall be protected by the use of a metal sleeve or cushion block. The marker shall be driven so that the cap is flush with the ground surface.

When located in rock, right-of-way markers shall be installed as shown on the Standard Sheet. For Steel Pin Right-of-Way Markers, the surface of the aluminum cap to be in contact with the concrete grout shall be thoroughly coated with §708-04 Zinc Chromate Primer or an alternate material approved by the Materials Bureau.
All right-of-way markers shall be properly guarded and flagged for easy identification during construction. The Contractor shall be responsible for maintaining and protecting right-of-way markers during construction. Any new or existing markers disturbed or damaged prior to contract acceptance shall be replaced by the Contractor at no expense to the State.

625-3.03 Permanent Survey Markers. The markers shall be constructed as shown on the applicable standard sheet and placed where directed by the Engineer. Upon completion of installation, the survey markers shall be located from a closed traverse within Second-Order, Class II (1 part in 20,000) accuracy, which has been established in accordance with the NYSDOT “Surveying Standards & Procedures Manual”. This work shall be performed by, or under the direction of, a Professional Land Surveyor or an exempt Professional Engineer licensed and registered in New York State. The Contractor shall provide the Engineer with completed forms which are certified by a Licensed Land Surveyor or exempt Professional Engineer and which lists the precise as-built location of each survey markers. Certification forms are available from the Engineer. The scheduling for installation of Survey Markers shall be approved by the Engineer prior to their installation. The sequential numbering required on the permanent survey marker caps is to coordinate with the Engineer and the Regional Land Surveyor.

625-4 METHOD OF MEASUREMENT

625-4.01 Project Survey and Stakeout. Payment will be made at the lump sum price bid for this work. Monthly payments will be made under this work in proportion to the amount of work done as determined by the Engineer.

625-4.02 Right of Way Markers. The number of right-of-way markers to be paid for under this work shall be the number placed and certified in accordance with the plans, right-of-way maps, or directions of the Engineer. Payment will be made upon proper installation of the marker, receipt of the certification form by the Engineer, and approval of the certification by the Regional Land Surveyor.

625-4.03 Permanent Survey Markers. The number of permanent survey markers to be paid for under this work shall be the number placed and certified, in accordance with the plans or as directed by the Engineer. Payment will be made upon proper installation of the marker, receipt of the certification form by the Engineer, and approval of the certification by the Regional Land Surveyor.

625-5 BASIS OF PAYMENT

625-5.01 Project Survey and Stakeout. The price bid shall include the cost of furnishing all labor, instruments, materials and equipment necessary to satisfactorily complete the work.

625-5.02 Right of Way Markers. The unit price bid per each shall include the cost of furnishing all labor, materials and equipment necessary to satisfactorily complete the work, except that all survey control necessary for stakeout and certification shall be included under the contract item for Survey and Stakeout.

625-5.03 Permanent Survey Markers. The unit price bid per each shall include the cost of furnishing all labor, materials, and equipment necessary to satisfactorily complete the work, except that all survey control necessary for stakeout and certification shall be included under the contract item for Survey and Stakeout.

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<td>Steel Pin and Cap Right-of-Way Markers</td>
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<td>625.06</td>
<td>Permanent Survey Markers</td>
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SECTION 630 - BARRICADES

630-1 DESCRIPTION. This work shall consist of furnishing and erecting in accordance with the appropriate standard sheet, permanent type barricades for highway or highway-railroad installations at the locations indicated on the plans or as directed by the Engineer.

630-2 MATERIALS. Materials shall meet the requirements of the following subsections of Section 700 - Materials.

Wood Posts 710-13
Galvanized Steel Barrier Posts 710-14
Corrugated Beam Guide Railing and Median Barrier 710-20

630-2.01 Barricades (All Permanent Types). Rails shall conform to §710-20 Corrugated Beam Guide Railing and Median Barrier, and to the details indicated on the appropriate standard sheet.

Posts shall be steel W150 x 22 or wood 150 mm x 205 mm (nominal) as indicated in the proposal and in accordance with the details shown on the appropriate standard sheet for Highway Barrier and Highway Railroad Barricade. All metal posts shall conform to §710-14 Galvanized Steel Barrier Posts.

630-3 CONSTRUCTION DETAILS

630-3.01 Barricades (All Permanent Types). Posts shall be set as shown on the plans, the applicable standard sheet, or as directed by the Engineer, and shall be set true to the line and grade and on a firmly tamped base.

Rails shall be erected in such a manner as to produce a smooth appearance, and approximately parallel with the grade of the ground surface. Bolts shall be drawn tight and shall extend 6 mm to 12 mm beyond the nuts unless otherwise permitted by the Engineer.

630-4 METHOD OF MEASUREMENT

630-4.01 Barricades (All Permanent Types). The quantity to be measured for payment under this work will be the number of meters of barricade outside to outside of end posts plus an allowance of 1.2 m for each complete terminal assembly including all rails as specified on the plans.

630-5 BASIS OF PAYMENT

630-5.01 Barricades (All Permanent Types). The unit price bid per meter shall include the cost of all labor, equipment and material necessary to complete the work including inspection and testing information required as well as painting, excavating and backfilling. Any required signs will be paid for separately under the appropriate payment item.

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SECTION 631 (VACANT)

SECTION 632 - CRIBBING

632-1 DESCRIPTION

632-1.01 General. This work shall consist of all the work required for furnishing and placing precast concrete cribbing or metal bin-type retaining walls including all excavation and filling in the manner
specified by the contract documents or by the Engineer. Other types of cribbing not shown on the
standard sheets may be furnished and placed, if approved by the DCES.

632-1.02 Definitions. The following general definitions shall be used in conjunction with this section:

A. Unit. Any single piece used to construct precast concrete cribbing or metal bin-type retaining
walls. For precast concrete cribbing the work unit shall include but not be limited to, stretchers,
headers (both closed and open face), coping, bearing blocks, full sections, half sections, end sections,
and leveling footings. For metal bin-type retaining walls the work unit shall include, but not be
limited to, stringers, spacers, columns, column caps, stringer stiffeners and base plates.

B. Bin. Any volumetric space which is designated to be filled with backfilling material, as defined in
this section, and is enclosed on all four sides by precast concrete cribbing units, or metal bin-type
retaining wall units.

C. Wall. A series of units to form bins connected in unbroken sequence so that, when filled with
backfill material, they will act as a single entity (i.e., a retaining wall).

632-2 MATERIALS

632-2.01 Unit Materials. Materials shall meet the requirements specified in the following subsections
of Section 700 - Materials:

<table>
<thead>
<tr>
<th>Material</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precast Concrete Cribbing</td>
<td>704-06</td>
</tr>
<tr>
<td>Premoulded Resilient Joint Filler</td>
<td>705-07</td>
</tr>
<tr>
<td>Metal Bin-Type Retaining Wall</td>
<td>715-11</td>
</tr>
</tbody>
</table>

632-2.02 Backfill. Backfill Material shall conform to the material requirements for either Stone Filling
(Fine), as specified in §620-2.01 and 620-2.02, or Select Granular Fill and Select Structure Fill as
specified in §203-2.01 and 203-2.02C.

632-3 CONSTRUCTION DETAILS

632-3.01 Precast Concrete Cribbing.

A. Excavation. Excavation shall be conducted in accordance with the applicable requirements of
Section 206, Trench, Culvert and Structure Excavation, and the details specified in the contract
documents.
Prior to erection of the cribbing, the foundation shall be inspected and approved by the Engineer.

B. Erection. All units shall be assembled and handled in accordance with the manufacturer's
instructions and the contract documents. In the event of a conflict between the contract documents
and the manufacturer's instructions, the Engineer shall decide which course to follow. During
erection, any units damaged beyond repair shall be removed and replaced, by the Contractor, with
approved units. The Contractor shall use precast leveling footings. Cast-in-place leveling footings
will not be permitted.

C. Backfill. Immediately prior to backfilling, the Engineer shall inspect units for damage. Units,
which are determined by the Engineer to be damaged beyond repair, shall be rejected. Rejected units
shall be replaced by the Contractor.
Filling the interior of the bins and behind the walls shall progress simultaneously with the
erection of the units and the material shall be placed as specified in §203-3.15, Fill and Backfill at
Structures, Culverts, Pipes, Conduits and Direct Burial Cables.

D. Contractor Responsibility. Movement of construction equipment and all other vehicles and
loads over and adjacent to walls shall be done at the Contractor's risk. Any damage to bins and units
§632 from any cause whatsoever shall be repaired or replaced by the Contractor in a manner satisfactory to the Engineer.

632-3.02 Metal Bin-Type Retaining Walls. The provisions specified in §632-3.01, Precast Concrete Cribbing, shall apply with the following additions and modifications:

The ends of all stringers and spacer units shall be bolted to corner columns by means of connecting channels.

In the construction of a wall on a curve, the proper curvature for the face shall be obtained by the use of shorter stringers in the front or rear units of walls as designed on the plans or by the Engineer.

The wall height and depth may be varied, but not to exceed the maximum dimension shown for the design selected. Two or more wall designs may be incorporated in the same wall by the use of standard split columns to make the connections on the step-back.

632-4 METHOD OF MEASUREMENT

632-4.01 Cribbing or Retaining Wall. Cribbing or retaining wall shall be measured by the number of square meters of the front wall face computed between the payment lines shown on the plans or between payment lines established, in writing, by the Engineer.

632-4.02 Excavation and Disposal of Excavated Material for the Installation of Cribbing or Retaining Wall. Excavation and disposal of excavated material shall be measured by the number of cubic meters of material measured in its original position between the payment lines shown on the plans or between payment lines established, in writing, by the Engineer.

632-4.03 Backfill for the Installation of Cribbing or Retaining Wall. Backfill shall be measured by the number of cubic meters of material, computed between the payment lines shown on the plans or between payment lines established in writing by the Engineer. Deductions for the volume of units of precast concrete cribbing will be made. No deduction will be made for the volume of a metal-bin unit.

632-5 BASIS OF PAYMENT

632-5.01 Cribbing or Retaining Wall. The unit price bid shall cover the cost of furnishing all materials, labor, and equipment necessary to complete the work including leveling footings required for precast concrete wall units, and the replacement or repair of any materials damaged by the Contractor's operations.

632-5.02 Excavation and Disposal of Excavated Material for the Installation of Cribbing or Retaining Wall. The unit price bid shall include the cost of all labor, material and equipment necessary to complete the work.

632-5.03 Backfill for the Installation of Cribbing or Retaining Wall. The unit price bid shall include the cost of all materials, labor, and equipment necessary to complete the work. No direct payment will be made for any loss of material which may result from compaction, foundation settlement, erosion, or any other cause; the cost of such losses shall be included in the price bid for this work. The cost of adding water for compaction of backfill shall be included in the price bid unless the item “Applying Water” is included in the proposal.

Payment will be made under:

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<thead>
<tr>
<th>Item No.</th>
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<th>Pay Unit</th>
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</thead>
<tbody>
<tr>
<td>632.0101</td>
<td>Concrete Cribbing (Stretcher and Header Type)</td>
<td>Square Meter</td>
</tr>
<tr>
<td>632.0102</td>
<td>Concrete Cribbing (Precast Concrete Wall Unit Type)</td>
<td>Square Meter</td>
</tr>
<tr>
<td>632.02</td>
<td>Metal Bin-Type Retaining Wall</td>
<td>Square Meter</td>
</tr>
<tr>
<td>632.0501</td>
<td>Excavation for Concrete Cribbing (Stretcher and Header Type)</td>
<td>Cubic Meter</td>
</tr>
<tr>
<td>632.0502</td>
<td>Excavation for Concrete Cribbing(Precast Concrete Wall Unit Type)</td>
<td>Cubic Meter</td>
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<td>632.0503</td>
<td>Excavation for Metal Bin-Type Retaining Wall</td>
<td>Cubic Meter</td>
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<td>632.0601</td>
<td>Backfill for Concrete Cribbing (Stretcher and Header Type)</td>
<td>Cubic Meter</td>
</tr>
</tbody>
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SECTION 633 - CONDITIONING EXISTING PAVEMENT PRIOR TO HOT MIX ASPHALT (HMA) OVERLAY

633-1 DESCRIPTION. Cleaning, sealing, and filling joints and cracks in the existing pavement, removal and repair of deteriorated pavement sections, stress-relieving pavement repairs, and cleaning the existing pavement and shoulders prior to the application of a new HMA course.

633-2 MATERIALS. Use materials conforming to the requirements of the specifications listed below:

- Hot Mix Asphalt True & Leveling 401 and 402
- Hot Mix Asphalt Shim 401
- Asphalt Filler 702-0700 (Table 702-2, Miscellaneous Asphalt Cements)
- Asphalt Emulsions Tables 702-5 and 702-6
- Fine Aggregate 703-01

633-3 CONSTRUCTION DETAILS

633-3.01 Cleaning Existing Pavement and/or Shoulders. Clean existing pavement and shoulder surfaces to be overlaid, including ruts and depressions, by the use of mechanical sweepers, hand brooms, or other means until the surfaces are free of all material which might interfere with the bond between the overlay material and the existing surfaces. All cleaning equipment shall be approved by the Engineer prior to use.

Remove all debris from the pavement and shoulders surfaces and dispose of in an appropriate manner. Keep the pavement and shoulders clean until the overlay operations are completed. Cleaning of shoulders is required only when the shoulder surface is constructed of Portland Cement Concrete (PCC), Hot Mix Asphalt (HMA) or a surface treatment thereon.

633-3.02 Cleaning, Sealing and/or Filling Joints and Cracks. If the existing pavement requires stress relieving repairs, complete these repairs in accordance with §633-3.05, Stress Relieving Pavement Repairs, prior to joint and crack repair work.

Use a compressed air stream of at least 550 kPa measured at the source, to clean all unsealed and inadequately sealed joints and cracks. Clean all joints and cracks in the pavement of all dirt and loose material to a depth equal to a minimum of twice the crack or joint width, by holding the cleaning jet 25 mm above the pavement surface. Old joint and crack sealer remaining after such cleaning operation need not be removed. Keep the joint and cracks clean until the sealing, filling, and paving operations are completed.

Joints and cracks less than 6 mm are not required to be cleaned or sealed. Seal joints and cracks in the existing pavement from 6 mm to 25 mm wide with an asphalt filler. To ensure that space will be available for expansion of the asphalt filler when the HMA is paved over the joint or crack, do not fill the joint or crack completely to the surface. Blot with fine aggregate, if required, to prevent tracking the bituminous material over the pavement surface.

Fill joints and cracks greater than 25 mm wide with HMA Shim or an approved cold, plant-mixed stockpile patching material.

633-3.03 Removal and Repair of Deteriorated HMA Pavement Sections. Remove and dispose of deteriorated HMA pavements to sound material, such that all excavated sides are vertical. Use a chipping hammer meeting the requirements of §580-3.02, Removal of Structural Concrete, a milling machine equipped with a means to suppress airborne particles, or by other appropriate means. If a chipping hammer is used, first sawcut the pavement around the perimeter of the designated repair area to the anticipated repair depth.

Clean and dry all surfaces exposed from removal operation such that they are clean and free of dust and debris. Uniformly apply asphalt emulsion to these surfaces and place the HMA in the repair areas.
only when the ambient temperature is 7°C or greater. The minimum HMA placement temperature shall be 120°C.

If the total depth of the patch is greater than 75 mm, compact the HMA in multiple lifts of approximately equal thickness with a maximum lift of 75 mm. When placing HMA in multiple lifts, thoroughly compact the lower lifts with a mechanical tamper. For the top lift, thoroughly compact with a roller meeting the requirements of §402-3.04, Rollers, or a small vibratory roller approved by the Engineer. Slightly overfill the patch with HMA such that the resulting patch is dense, smooth, and no more than 6 mm above the existing surface.

633-3.04 Removal and Repair of Loose, Broken, or Spalled PCC Pavement Sections.
Remove loose, broken, or spalled PCC pavements to sound material, but not exceeding a depth of 75 mm. Use a chipping hammer meeting the requirements of §580-3.02, Removal of Structural Concrete, a milling machine equipped with a means to suppress airborne particles, or by other appropriate means. If a chipping hammer is used, first sawcut the pavement around the perimeter of the designated repair area to the anticipated repair depth not to exceed 75 mm. Dispose of all the removed PCC material in an appropriate manner.

Clean and dry all surfaces exposed from removal operation such that they are clean and free of dust and debris. Uniformly apply asphalt emulsion to these surfaces and place the HMA in the repair areas only when the ambient temperature is 7°C or greater. The minimum HMA placement temperature shall be 120°C.

If the total depth of the patch is greater than 75 mm, compact the HMA in multiple lifts of approximately equal thickness with a maximum lift of 75 mm. When placing HMA in multiple lifts, thoroughly compact the lower lifts with a mechanical tamper. For the top lift, thoroughly compact with a roller meeting the requirements of §402-3.04, Rollers, or a small vibratory roller approved by the Engineer. Slightly overfill the patch with HMA such that the resulting patch is dense, smooth, and no more than 6 mm above the existing surface.

633-3.05 Stress Relieving Pavement Repairs.
Unless indicated otherwise in the contract documents, the pressure relief joint shall be a minimum of 5.0 meters longitudinally and the full width of the pavement, including the curb, and gutter, if any. If an existing transverse joint is within the pressure relief joint repair, remove the existing transverse joint by a minimum of 300 mm. Saw cut the transverse lines of the designated repair area full depth to produce a neat cut. Remove the PCC pavements with minimum disturbance to the subbase. Dispose of all the removed PCC material in an appropriate manner.

Level and recompact the subbase, prior to the placement of the HMA.

Clean and dry all surfaces exposed from removal operation such that they are clean and free of dust and debris. Uniformly apply asphalt emulsion to these surfaces and place the HMA in the repair areas only when the ambient temperature is 7°C or greater. The minimum HMA placement temperature shall be 120°C.

Compact the HMA in multiple lifts of approximately equal thickness with a maximum lift of 75 mm. Thoroughly compact each lift with a roller meeting the requirements of §402-3.04, Rollers, or a small vibratory roller approved by the Engineer. Slightly overfill the patch with HMA such that the resulting patch is dense, smooth, and no more than 6 mm above the existing surface.

633-4 METHOD OF MEASUREMENT

633-4.01 Cleaning Existing Pavement and/or Shoulders. The quantity measured will be the number of square meters of existing pavement and/or shoulder surfaces cleaned.

633-4.02 Cleaning, Sealing, and/or Filling Cracks. The quantity measured will be on a lump-sum basis for work satisfactorily completed.

633-4.03 Cleaning, Sealing, and/or Filling Joints. The quantity measured will be on a linear meter basis for work satisfactorily completed.

633-4.04 Removal and Repair of Deteriorated HMA Pavement Sections. The quantity measured will be the number of square meters of existing pavement surface removed and repaired.
633-4.05 Removal and Repair of Loose, Broken, or Spalled PCC Pavement Sections. The quantity measured will be the number of square meters of existing pavement surface removed and repaired.

633-4.06 Stress Relieving Pavement Repairs. The quantity measured will be the number of square meters of existing pavement surface removed and repaired.

633-5 BASIS OF PAYMENT

633-5.01 Cleaning Existing Pavement and/or Shoulders. The unit price bid for this work shall include the cost of all labor, materials, and equipment necessary to complete the work.

633-5.02 Cleaning, Sealing, and/or Filling Cracks. The lump sum price bid for this item shall include the cost of all labor, materials, and equipment necessary to complete the work.

633-5.03 Cleaning, Sealing and/or Filling Joints. The unit price bid for this item shall include the cost of all labor, materials, and equipment necessary to complete the work.

633-5.04 Removal and Repair of Deteriorated HMA Pavement Sections. The unit price bid for this work shall include the cost of all labor, materials, and equipment necessary to complete the work.

633-5.05 Removal and Repair of Loose, Broken, or Spalled PCC Pavement Sections. The unit price bid for this work shall include the cost of all labor, materials, and equipment necessary to complete the work.

633-5.06 Stress Relieving Pavement Repairs. The unit price bid for this work shall include the cost of all labor, materials, and equipment necessary to complete the work.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>633.11</td>
<td>Cleaning Existing Pavement and/or Shoulder</td>
<td>Square Meter</td>
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<tr>
<td>633.12</td>
<td>Cleaning, Sealing and/or Filling Cracks</td>
<td>Lump Sum</td>
</tr>
<tr>
<td>633.13</td>
<td>Cleaning, Sealing and/or Filling Joints</td>
<td>Linear Meter</td>
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<td>633.14</td>
<td>Removal and Repair of Deteriorated HMA Pavement</td>
<td>Square Meter</td>
</tr>
<tr>
<td>633.15</td>
<td>Removal and Repair of Loose, Broken, or Spalled PCC Pavement</td>
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<tr>
<td>633.16</td>
<td>Stress Relieving Pavement Repairs</td>
<td>Square Meter</td>
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SECTION 634 (VACANT)

SECTION 635 - CLEANING AND PREPARATION OF PAVEMENT SURFACES FOR PAVEMENT MARKINGS

635-1 DESCRIPTION. This work shall consist of cleaning and preparing portland cement and bituminous pavement surfaces for the application of reflectorized pavement marking materials. Examples of pavement markings requiring this item include, but are not limited to, reflectorized thermoplastic, preformed, and epoxy type marking materials.

635-2 MATERIALS. Materials and equipment for cleaning and preparing pavement surfaces may be selected by the Contractor, except that they will be approved by the Engineer and shall conform to all applicable Local, State or Federal law, regulation or codes.

635-3 CONSTRUCTION DETAILS

635-3.01 General. The work required to clean and prepare pavement surfaces shall be performed in accordance with these specifications, the contract documents and to the satisfaction of the Engineer.
Before any work is begun, a schedule of operations shall be submitted for the approval of the Engineer. When the work is conducted under traffic, the Contractor shall supply all necessary flags, markers, signs, and other devices to maintain and protect traffic.

Whenever grinding, waterblasting, dry sandblasting or other operations are performed, the work shall be conducted in such a manner that the finished pavement surface is not damaged or left in a pattern that will mislead or misdirect the motorist. When these operations are completed the pavement surface shall first be power broomed and then blown off with compressed air to remove residue and debris resulting from the cleaning work. All such debris that remains on the roadway, including broken parts from cleaning equipment, shall be removed and disposed of in a manner satisfactory to the Engineer.

The Contractor shall conduct removal and cleaning work in such a manner as to minimize airborne dust, and similar debris so as to prevent a hazard to motor vehicle operation or nuisance to property.

Care shall be taken on bituminous and portland cement concrete surfaces when performing removal and cleaning work to prevent damage to transverse and longitudinal joint sealers.

Unless otherwise specified in the contract documents the area(s) and quantity of cleaning work will be determined by the Engineer at the job site when the contract is in progress. In addition the Engineer will have the authority of increasing the work area as the project continues.

**635-3.02 Limits of Work.** Cleaning and surface preparation work shall be confined to the surface area specified for the application of pavement marking materials; or the surface area of existing pavement markings that are specified for removal on the plans, or as directed by the Engineer.

Surface preparation work includes cleaning for lines or cleaning for letters and symbols. Lines will be meant to include: broken line; dotted line; channelizing line; barrier lines; stop lines; crosswalk line and crossbars.

When lines are cleaned, the area of preparation will be the width of the new pavement marking, or existing line, plus twenty five (25) millimeter on each side. When letters and symbols are cleaned the area of preparation will be sufficiently large to accommodate the new marking, or to remove the existing marking.

**635-3.03 Cleaning Concrete Curing Compounds.** On new portland cement concrete pavements, cleaning operations shall not begin until a minimum of 30 days after the placement of concrete. All new concrete pavements shall be cleaned by either sandblasting or water blasting. When water blasting is performed, pavement markings shall be applied no sooner than 24 hours after the blasting has been completed.

The extent of the blasting work shall be to clean and prepare the concrete surface such that:

A. There is no visible evidence of curing compound on the peaks of the textured concrete surface.
B. There are no heavy puddled deposits of curing compound in the valleys of the textured concrete surface.
C. All remaining curing compound is intact; all loose and flaking material is removed.
D. The peaks of the textured pavement surface are rounded in profile and free of sharp edges and irregularities.

**635-3.04 Cleaning Existing Pavement Markings.** Existing pavement markings shall be cleaned for the purpose of:

A. Preparing the pavement surface for the application of new pavement markings in the same location as the existing markings.
B. To remove existing markings that are in good condition which, if allowed to remain, will interfere with or otherwise conflict with newly applied marking patterns.

It shall be understood that in this context cleaning means the removal of an existing marking. It is not intended that all deteriorated existing pavement markings be removed. Example: If a new marking is applied to an unmarked “gap” in a broken line and the existing broken line pattern is worn or deteriorated, as determined by the Engineer, to the extent that it is not misleading or confusing to the motorist, the existing markings do not require removal.
Pavement markings shall be cleaned to the extent that 95% to 100% of the existing marking is removed. Removal operations shall be conducted in such a manner that no more than moderate color and/or surface texture change results on the surrounding pavement surface. When waterblasting is performed, pavement markings shall be applied no sooner than 24 hours after the blasting has been completed. Waterblasting shall not be allowed for cleaning markings requiring replacement within the same day as removal as specified under §635-3.05.

The determination of acceptable removal will be made by judgement of the Engineer and will be guided by the Department's pictorial standards of acceptable marking removal. Pictorial standards are available from the Materials Bureau.

635-3.05 Replacement of Pavement Markings. The Contractor shall not remove existing pavement markings and leave the highway unmarked overnight.

If traffic is to be maintained overnight on highways where the existing markings have been removed either the permanent type marking(s) as called for in the contract documents, or short-term pavement markings, shall be applied before the end of the working day for the following conditions.

1. Yellow broken lines, partial barrier lines and full lines used to separate opposing traffic flows on two-way roadways.
2. White broken lane lines to separate traffic flows in the same direction on multi-lane highways.

In the event of sudden, unforeseen precipitation or other extraordinary situations, Do Not Pass signs shall be used on two or three lane, two-way roadways, in accordance with §619–3.06 Short-Term Pavement Markings.

All other pavement marking patterns on both two way and multi-lane highways shall be applied within 14 calendar days using the project's permanent markings.

The Contractor may apply the permanent white and yellow broken line in the gaps between the existing broken line, before the existing broken line is removed, when the Engineer determines that the existing broken line will not be misleading to traffic.

If short-term pavement markings are placed, they shall be applied and conform to the requirements of §619–3.06. Short-term Pavement Markings will be considered acceptable for periods not longer than fourteen (14) days.

If within 14 days after removal the Contractor fails to install the project's permanent pavement markings, temporary pavement markings shall be applied and maintained in accordance with §619–3.06 Short-Term Pavement Markings.

All short-term and temporary pavement markings shall be cleaned from the pavement in accordance with this specification, at the time that the project's permanent markings are installed, or as directed by the Engineer. Signs shall be removed as ordered by the Engineer.

The work of furnishing, applying, maintaining and cleaning short-term and temporary markings shall be performed by the Contractor at no additional expense to the State.

635-4 METHOD OF MEASUREMENT. Surface cleaning and preparation of pavement surfaces for lines will be measured in meters along the centerline of the prepared surface and will be based on a nominal 100 mm wide line. Measurement for cleaning surfaces for line widths greater than the nominal 100 mm will be made by the following method:

\[
\text{Nominal Existing Width of Line (millimeters) x Length (meters)} \div 100 \text{ (millimeters)}
\]

No payment will be made for the additional 25 mm of cleaning on each side of the line required by §635-3.02.

No payment will be made for cleaning the number of meters of unmarked gaps between broken or dotted line segments.

Cleaning and preparation of letters and symbols on pavement surfaces will be measured by each unit cleaned. A unit will consist of one letter or one symbol. Example: “STOP” would be measured as four units.
§635

The Engineer will adjust the quantities of these items as required to meet field conditions. This may result in substantial increases or decreases of the proposal quantities.

635-5 BASIS OF PAYMENT. The accepted quantities of cleaned pavement surface will be paid for at the contract unit price, which shall include the cost of furnishing all labor, materials and equipment to satisfactorily complete the work. The cost of maintaining and protecting traffic during the cleaning work will be included in the price bid. No payment will be made under this item for the removal of pavement markings required under §635-3.05.

Payment will be made under:

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<th>Pay Unit</th>
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<td>Meter</td>
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<td>Cleaning and Preparation of Pavement Surfaces-Letters</td>
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<tr>
<td>635.0303</td>
<td>Cleaning and Preparation of Pavement Surfaces-Symbols</td>
<td>Each</td>
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</table>

SECTION 636 (VACANT)

SECTION 637 - ENGINEER'S OFFICE AND LABORATORY BUILDING

637-1 DESCRIPTION. This work shall consist of providing, furnishing and maintaining an Engineer's Office and a Field Laboratory Building for the exclusive use of and occupancy by the Department and Consultant field engineers. It shall be the responsibility of the Contractor to install and maintain the Engineer's Office in compliance with all applicable building, safety, and health regulations and/or laws. The Contractor shall maintain all facilities and furnished equipment in good working condition. The office shall be cleaned weekly, or as required by the Engineer.

637-1.01 Engineer's Office (Type A, B, C, D or E). The Contractor shall supply for the Engineer's use a building or mobile trailer, (specified at Type A, B, C, D or E), which shall be erected at a location selected by the Engineer and shall be separate from any building used by the Contractor.

637-1.02 Laboratory Building. The Contractor shall supply mobile building(s) or trailer(s) for use as field laboratories for soils and materials testing. As work progresses on the contract, the laboratory shall be moved by the Contractor to follow the work, at such times and to the locations approved or designated by the Engineer.

637-1.03 Furnishing Existing Facilities and Buildings. The Contractor may furnish equivalent facilities in existing buildings provided such facilities and building(s) are located to provide convenient service and provided that the building location(s) and facilities are approved by the Regional Director in writing.

637-1.04 Concrete Cylinder Curing Box. This work shall consist of furnishing, prior to placement of any structural concrete, an approved concrete cylinder curing box.

637-1.05 CHAMP® Management System. This work consists of software purchase and training of Contractor personnel in the use of the CHAMP® software. CHAMP® is specifically designed to monitor conformity with Federal and State Disadvantaged/Minority/Women's Business Enterprise (D/M/WBE), Equal Employment Opportunity (EEO), and training laws, rules and regulations.

637-2 MATERIALS

637-2.01 General Construction. Each Engineer's Office or Field Laboratory shall be an approved and weatherproof building or mobile trailer of the type specified in the contract documents. The structure shall have a minimum ceiling height of 2.13 meters and shall be provided with weatherproof windows and weatherproof doors each equipped with adequate locking devices. Each window shall have a minimum area of 0.75 square meters, shall be screened and of a type that will open and close to provide adequate ventilation.
637-2.02 General Requirements for all Engineer's Offices.

A. **Lighting.** Electric light, non-glare type luminaires to provide a minimum illumination level of 1000 lux at desk height level.

B. **Heating and Cooling.** Adequate equipment to maintain an ambient air temperature of 21°C ± 3°.

C. **35mm Camera.** Autofocus operation with “red-eye reduction” and “easy film loading” features. A soft storage/carry case shall be provided. The camera functions shall include the following.

- Automatic and motorized film advance and rewind
- Built in flash with automatic sensor
- Automatic adjustment for DX coded films
- Date stamp on each picture
- Film speeds ISO 100 through 400

The supply of batteries shall be replenished by the Contractor as required by the Engineer. Film and film processing will be the responsibility of the State.

D. **Typewriter with stand.** A standard electric office size with pica type and a stand with casters.

E. **Telephone.** A separate phone for the exclusive use of Department and Consultant personnel. The phone shall have modular jacks at the wall and phone and be adaptable to electronic communications. An extension telephone, of a type and location as required by the Engineer, with a minimum 7 meter cord shall also be provided. The number of telephones, each with an extension, to be provided is specified for each type of office.

F. **Potable Water.** From a local municipal water line and/or bottled water with refrigerator unit - hot/cold water.

G. **Adding Machine.** Tape type registering to at least ten digits, four function. The number of adding machines to be provided is specified for each type of office.

H. **First Aid Kit.** The Contractor shall keep the kit properly stocked with appropriate first aid supplies at all times.

I. **Toilet.** A separately enclosed room, properly ventilated and complying with applicable sanitary codes. The Contractor shall provide all lavatory amenities, necessary paper and soap products, hot and cold running water and a flush-type toilet. Any other toilet will not be acceptable unless as ordered by the Engineer (A.O.B.E.).

J. **Locker.** A metal or wood locker, with lock, of sufficient size for storage of surveying instruments and testing equipment.

K. **Refrigerator.** A standard electric cold storage type providing a minimum storage space of approximately 0.09 m³.

L. **Fire Extinguisher.** Non-toxic dry chemical, fire extinguisher meeting Underwriters Laboratories, Inc., approval for Class A, Class B and Class C fires with a minimum rating of 2A: 10B: 10C. 1 per room.

M. **Fire Resistant Cabinet.** Fire resistant, 4 drawer, legal size file cabinet with lock and 2 keys, meeting the requirements for “Insulating Filing Devices, Class 350-1 Hour (D)” of ANSI/UL 72 or the Class D rating of the original Underwriters Laboratories specification for insulated filing devices. The number of cabinets to be provided is specified for each type of office.
N. Thermometer. A minimum -- maximum celsius thermometer.


P. Photocopying Machine. Desk top, heavy duty, electric, dry process photocopying machine. The machine shall be capable of copying 216 mm x 279 mm, 216 mm x 355 mm, 279 mm x 432 mm sheets. An adequate supply of 75 gram per square meter copy paper in the three (3) sizes shall be provided. The supply of copy paper shall be replenished by the Contractor as required by the Engineer.

Q. Signs/Bulletin Board. The Contractor shall furnish and install necessary signs to locate and identify the Project Engineers Office.

The sign shall be installed at the location or locations directed by the Engineer. The panel material may be of any material permitted under §619-2.02, Construction Signs. The panel shall be 900 mm high by 1200 mm wide with white legend on green background with the phrases as positioned and described below.

The letters in the phrase “FIELD OFFICE” shall be 150 mm C series with the top of the letters 150 mm below the top of the panel. The letters in the phrase “PROJECT ENGINEER” shall be 150 mm B series with the top of the letters 450 below the top of the panel. The letters in the phrase “N.Y.S. DEPT. OF TRANSPORTATION” shall be 38 mm E series with the top of the letters 750 mm below the top of the panel. All phrases shall be centered horizontally on the panel.

If erected at a location where the sign might be struck by passing traffic, as determined by the Engineer, the sign support shall be a breakaway type. Payment for the sign and its supports shall be included in the price for the Engineer's Office.

The Contractor shall also furnish and install a 1.2 m x 2.4 m weatherproof Bulletin Board in front of or adjacent to the Project Engineers Office. This Board may also be attached to the Office on an outside wall which is easily accessible and clearly visible.

R. Stove. The Contractor shall furnish an electric, propane or bottle gas stove adequate for rapid drying of soil samples, including all necessary fuel or electrical supply and all maintenance necessary for continued operation. Size of the stove shall be approved by the Engineer.

Stove will be necessary when excavation, embankment, and/or culverts and storm drains are included in a project and a laboratory building is not included.

S. Tack Board. Cork Tack Boards (0.6 m x 1.2 m) mounted on a wall of each room.

T. Bookcase. A self-standing 3 shelf metal bookcase. 1 per room. (Approximate size 1.2 m high, 1.2 m wide, 0.3 m deep.)


V. Parking Area. The Contractor shall provide/furnish a paved or hard surfaced (gravel or bankrun material) parking area adjacent to the building where the Engineers Office is located. The number of spaces to be provided is specified for each type of office. Each space shall measure 2.75m by 5.50m.

W. Mailbox. Standard mailbox (with post if necessary) or post office box shall be provided.

X. Coat Rack. A metal or wooden coat rack capable of holding at least 4 coats. 1 per room.

Y. Telephone Answering Device. A FCC approved automatic answering device capable of recording outgoing messages of 60 seconds long and receiving a minimum of 40 incoming messages of 60 seconds duration. The unit shall include a message mark so you can hear new messages without erasing old messages. The unit shall include remote programming of playback, backspace, and outgoing message re-record. The unit shall include computer generated voice marking of time and day of each message received. The unit shall allow for the retrieval of messages without a remote beeper unit or shall include a number of remote control units as ordered by the Engineer (A.O.B.E.).
Z. Telephone FAX Machine, with a dedicated telephone line (in addition to the telephone line(s) specified in Table 637-1 and meeting the following requirements:

| DOCUMENT SIZE | 216 mm X 279 mm both transmit and receive with transmit speed less than 20 seconds per page |
| COMPATIBILITY | Group G3 |
| RESOLUTION | Standard, with 16-Shade Gray Scale |
| RECEIVING | Automatic |
| DOC FEEDER | Automatic 5 Sheets |
| AUTO DIALER | 10 Phone Number Memory with automatic redial and on-hook dialing |
| TRANSMIT TERMINAL IDENTIFICATION | Page number, Sender's Phone Number and Name |
| OUTPUT DOCUMENT SEPARATOR | Automatic Cutter |

An adequate supply of fax paper shall be provided. The supply of fax paper shall be replenished by the Contractor as required by the Engineer.

§637-2.03 General Requirements for Engineer's Offices, Types B, C, D and E only (Not Type A)

1. Freestanding Microcomputer System Workstation with a 1.50 m long by 0.75 m wide work surface and height of 0.70 m. The workstation shall include an adjustable shelf approximately 0.30 m wide and no less than 0.75 m long. This workstation shall be fully assembled.
2. Ergonomic Microcomputer Workstation Chair w/arms, five (5) legs w/casters and adjustable from approximately 0.4 m to 0.6 m height by pneumatic gas cylinder. This chair shall be fully assembled.
3. Antistatic Tabletop Mat for the Microcomputer System Workstation with an approximate size of 0.75 m long by 0.60 m wide.
4. Ergonomic and height adjustable “wrist rest” keyboarding support
5. Calculator. The device shall be capable of executing normal engineering/surveying calculations and have sufficient memory to accept and execute programs of at least 200 lines or steps. The device shall also be capable of printing the results of calculations and programs, storing programs resident in the device on a magnetic medium for later use, and accepting preprogrammed software. The Contractor shall supply the preprogrammed software capable of performing normal surveying computations and the printing paper. The supply of printing paper shall be replenished by the Contractor as required by the Engineer. Instruction manuals for the calculator and software shall also be provided.

§637-2.04 Specific Requirements for all Engineer’s Offices (Type A, B, C, D, and E).

A. Engineer’s Office Type A. In addition to the general requirements, Type A shall provide a minimum of 18 square meters of floor space with one outside door and four windows. The office shall be partitioned to provide two rooms with an adjoining door. The smaller room shall not be less than 6 square meters in floor area and shall contain at least one of the four windows. The furnishings shall be as indicated in Table 637-1 of this Section.

B. Engineer’s Office Type B. In addition to the general requirements, Type B office shall provide a minimum 30 square meters of floor space with two outside doors and six windows. The office shall be partitioned to provide two rooms with an adjoining door. The smaller room shall be not less than 9 square meters in floor area and shall contain two of the six windows. The furnishings shall be as indicated in Table 637-1 of this Section.

C. Engineer’s Office Type C. In addition to the general requirements, Type C office shall provide a minimum 42 square meters of floor space with two outside doors and six windows. The office shall be partitioned to provide three rooms with adjoining doors. The smaller rooms shall be
not less than 9 square meters in floor area and shall contain two of the six windows. The furnishings shall be as indicated in Table 637-1 of this Section.

D. Engineer’s Office Type D. In addition to the general requirements, Type D office shall provide a minimum of 66 square meters of floor space and shall be partitioned to provide four rooms: three small rooms and one large room with adjoining doors. The smaller rooms shall be not less than 9 square meters in area, and shall each contain two windows. Two outside doors and at least eight windows will be the total required. The furnishings shall be as indicated in Table 637-1 of this Section.

If two mobile trailer units are provided, they shall be joined in parallel fashion and shall have two weatherproof doorways or archways between units A.O.B.E. A minimum of two (2) outside doors shall still be required, and arranged so as to facilitate emergency access.

<table>
<thead>
<tr>
<th>TABLE 637-1 SPECIFIC REQUIREMENTS FOR OFFICES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Office Type</strong></td>
</tr>
<tr>
<td><strong>Item Description</strong></td>
</tr>
<tr>
<td>Office Desks not less than 0.75 m X 1.5 m each with Drawers and Locks</td>
</tr>
<tr>
<td>Office Chairs</td>
</tr>
<tr>
<td>Fire Resistant Cabinet, 4-Drawer as specified in §637-2.02M</td>
</tr>
<tr>
<td>Drafting-type Tables, approximately 0.9 m by 1.8 m and supported by brackets and legs</td>
</tr>
<tr>
<td>Drafting stools</td>
</tr>
<tr>
<td>Vertical filing plan rack for 6 sets of plans each</td>
</tr>
<tr>
<td>Vertical filing plan rack for 12 sets of plans each</td>
</tr>
<tr>
<td>Roll File Unit each with twelve 0.15 m X 0.15 m compartments for twelve cross-section rolls each 0.60 meters long</td>
</tr>
<tr>
<td>Office table, not less than 0.9 m X 1.8 m each</td>
</tr>
<tr>
<td>Metal storage cabinet with four adjustable shelves, tumbler lock and two keys (approx. size 1.80 m high, 0.90 m wide, 0.45 m deep)</td>
</tr>
<tr>
<td>Adding Machine as specified in §637-2.02G</td>
</tr>
<tr>
<td>Telephone lines with extensions as specified in §637-2.02E</td>
</tr>
<tr>
<td>Parking lot spaces as specified in §637-2.02V</td>
</tr>
</tbody>
</table>

E. Engineer’s Office Type E. In addition to the general requirements, Type E office shall provide a minimum of 85 square meters of floor space, a maximum of 130 square meters of floor space, and shall be partitioned to provide four rooms: two small rooms and two large rooms each with adjoining doors. The smaller rooms shall be not less than 11 square meters in area and shall each contain two windows. Two outside doors and at least twelve windows will be required. The furnishings shall be as indicated in Table 637-1 of this Section.

If two mobile trailer units are provided, they shall be joined in parallel fashion and shall have two weatherproof doorways or archways between units A.O.B.E. A minimum of two (2) outside doors shall still be required, and arranged so as to facilitate emergency access.

637-2.05 Minimum requirements for Field Laboratories.

A. Area. Floor space of 9 square meters.

B. Windows. Three windows.

C. Doors. One door with lock and two sets of keys.

D. Floor Covering. Linoleum, tile or other serviceable finish.

E. Sink. A sink at least 0.90 meters long by 0.60 meters wide by 0.45 meters deep, equipped with water faucet and drain line.
§637

F. Counter. A work counter next to sink at least 0.6 meters long by 0.6 meters wide.

G. Table. A heavy duty work table not less than 2.50 meters long by 0.75 meters wide by 0.90 meters high.

H. Cabinet. A storage cabinet or locker at least 0.6 meters square by 1.8 meters high, equipped with at least four shelves, lock and two keys.

I. Fire Resistant Cabinet. Two drawer as specified in §637-2.02M.

J. Desk. A desk or writing table with chair.

K. Pedestal. A heavy wooden block for soil compaction tests, nominally 0.25 meters square by 0.30 meters high. (Soils Lab. only.)

L. Stove. As specified in §637-2.02R.

M. Lighting. Electric lighting and not less than three convenient outlets. Electric service shall be for not less than 20 amperes, 115 VAC. Where an electric hotplate or stove is provided under (L) above, service shall be increased over 20 amperes by an amount equal to the rating of the device listed on the nameplate.

N. Potable Water. Potable water supplied from an existing system or from an external 200 liter (minimum) gravity-feed storage tank connected to the sink faucet.

O. Heater. A space heater with the necessary fuel and outside vent, if required.

P. Fire Extinguisher. As specified in §637-2.02L.

637-2.06 Concrete Cylinder Curing Box. The materials shall meet the requirements of §735-01, Concrete Cylinder Curing Box.

637-2.07 CHAMP® Management System. The CHAMP® management system is comprised of software products marketed under the trademark of CHAMP®. The Contractor is responsible for having computer equipment meeting the minimum requirements for operating the software as specified by an approved vendor. The Contractor shall install vendor issued upgrades and maintain the software to ensure data submissions are made using the most recent approved version of the software.

637-3 CONSTRUCTION DETAILS

637-3.01 General Requirements. The buildings shall be fully equipped and made available for use and occupancy by the Department personnel as well as comparable personnel employed by a Consultant prior to the start of any contract work. Such use and occupancy shall be made available after the work has been accepted by the Department as directed in writing by the Regional Director.

All buildings shall be maintained in good condition and appearance by the Contractor for the designated period after which all portable buildings or trailers, fencing, surfacing and utilities shall be removed from the location, the areas cleaned, loamed and seeded if required and left in a neat and acceptable condition.

The Contractor shall be responsible, until use and occupancy of the Engineer's office and Laboratory building is relinquished by the State, for any and all damage, direct or indirect, of whatever nature, occurring to the property of the State of New York, property of the Department's personnel, property of the Department's Consultant representative, including other employees of the Consultant assigned to this office, which is kept in the Engineer's Office and Laboratory Building. Non-State owned or employee property shall only be those items used by appropriate personnel in the performance of project-related
work activities. Such property shall be replaced within 30 days of the reported damages and would include any loss caused by, but not limited to, fire, theft, vandalism or malicious mischief.

The Engineer shall provide the Contractor a detailed list of items, with corresponding dollar values, belonging to the State of New York, the Department's personnel, the Department's Consultant representative, and the Consultant's employees at least once every three months but not more than once a month. The Contractor shall not be responsible for items kept in the Engineer's office that are not on this list.

**637-3.02 Concrete Cylinder Curing Box.** The Contractor shall furnish the Engineer a concrete cylinder curing box and two locks with two keys for each lock. The locks shall fit each securing latch of the curing box. This concrete cylinder curing box shall remain exclusively available to the Engineer at the location selected by the Engineer. The Contractor shall relocate to any new location directed by the Engineer, repair or replace, if necessary, paint, clean and otherwise maintain the concrete cylinder curing box for the duration of the contract. The Contractor shall also provide and maintain all necessary utility connections to operate the curing box.

The concrete cylinder curing box will remain the property of the Contractor and shall be removed from the site of the work upon completion of the contract.

**637-3.03 CHAMP® Management System.** After contract award and prior to notice to proceed, the contractor shall, if necessary, purchase CHAMP® software and become proficient in its use. The vendor(s) approved to market the software and provide or coordinate training are listed on the Department website at www.dot.state.ny.us/oecd/champ.html or are available from the Office of Equal Opportunity Development & Compliance. Training costs will only be reimbursed for training obtained from an approved vendor. There is a NYSDOT CHAMP® user guide available for download at www.dot.state.ny.us/oecd/ceieb.html. The Contractor and subcontractors shall retain the CHAMP® software upon completion of the contract with the understanding that the Contractor and subcontractors will employ this copy of the CHAMP® software on all subsequent contracts with the Department.

**A. Software.** From an approved marketing vendor, the Contractor shall, if necessary:
- Purchase one copy of the CHAMP® Contractor Module (CM) to support the contractor's import of contractor and subcontractor payroll data, compliance monitoring and creation of required CHAMP® reports;
- Purchase copies of the CHAMP® Subcontractor Module (SM) to support the manual data entry of payroll data by subcontractors in instances where subcontractors do not own CHAMP® CM or SM and cannot create a CHAMP® compatible import file from their company payroll system;
- Copies shall be distributed to and retained by the subcontractor.

**B. Training.** From an approved vendor of CHAMP® training, the Contractor shall, if necessary:
- Obtain CHAMP® training.

**637-4 METHOD OF MEASUREMENT**

**637-4.01 Engineer's Office (Type A, B, C, D and E).** Payment will be made for each month (to the nearest 0.25 month increment), of availability for occupancy by the field engineers during the period of the contract. Payment will begin the first month that the office is fully equipped, serviced as specified, and made available for occupancy. Monthly payments will continue until the date of acceptance of the contract. When directed in writing by the Regional Director, payment for each month's occupancy after the date of acceptance will be made as part of the final estimate. Failure of the Contractor to supply all documents required to complete the final estimate may result in a non-payment during this delaying period. This non-payment will be in the form of a charge to the Contractor as further stated in §637-5 of this Specification. Monthly payments may be terminated on a specified date prior to acceptance of the contract by written notification by the Regional Director that such office will no longer be required on the contract.

No payment will be made for occupancy and services during the periods of contract extension of time where Engineering Charges are assessed, except that, in such cases, payment for each month's occupancy
after the date of acceptance will be made as part of the final estimate when directed in writing by the Regional Director.

637-4.02 Laboratory.  Payment will be made for each building or trailer furnished under this work as follows: Seventy-five (75%) of the amount bid will be paid when the building or trailer equipped as specified has been placed on the work site and fully operative. The remaining twenty-five percent (25%) will be paid when the Engineer estimates the contract to be ninety percent (90%) complete, on a dollar basis.

637-4.03 Concrete Cylinder Curing Box.  Concrete cylinder curing boxes will be measured by the number of units furnished and installed and actually used in accordance with these specifications.

637-4.04 CHAMP® Management System.  The work will be measured for payment on a Dollars-Cents basis. The unit price shown in the proposal for this item will be considered as the price bid, and shall not be altered in any manner. Should the amount shown be altered, the new figure will be disregarded and the original price will be used to determine the total amount bid for the contract.

637-5 BASIS OF PAYMENT

637-5.01 Engineer's Office (Type A, B, C, D, and E). The unit price bid per month shall include the cost of all labor, material, equipment, ground rental and utility charges necessary to complete the work.

No payment will be made under Engineer's Office for each calendar day during which there are deficiencies in compliance with the requirements of any subsection of this specification. The first calendar day shall commence 24 hours after notice to the Contractor of such a deficiency. This non-payment shall be deducted from the Contractor's next estimate as a charge to Contractor on the item. The amount of such calendar day non-payment will be determined by dividing the unit price bid per month by 30.

If the cited deficiencies exceeds 72 hours or are permitted to recur, liquidated damages will be assessed at twenty percent (20%) of the daily liquidated damages rate for each subsequent calendar day or part thereof that a cited deficiency resulting in non-payment, as prescribed herein, is not corrected.

637-5.02 Laboratory.  The price bid for each building or trailer shall include the cost of furnishing all labor, materials and equipment necessary to erect, relocate and remove the building or trailer as directed by the Engineer, together with all fuel, water, ground rental, or other expenses incidental thereto.

637-5.03 Concrete Cylinder Curing Box.  The unit price bid for each box shall include the cost of all labor, material, equipment, ground rental, relocation, repair or replacement, painting, cleaning, maintenance, and utility charges necessary for operation.

637-5.04 CHAMP® Management System.  The Department will reimburse the Contractor for the purchase of CHAMP® software and fifty percent (50%) of the training cost at an approved vendor for Contractor employees upon submission of original receipts. No payment will be made for computer hardware required to run the CHAMP® software. No payment will be made for software, training and/or fees paid or reimbursed by another source (i.e., another Department contract or another state/municipality that requires CHAMP® use). No payment will be made for software maintenance fees subsequent to initial purchase.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>637.01</td>
<td>Laboratory Building</td>
<td>Each</td>
</tr>
<tr>
<td>637.03</td>
<td>Concrete Cylinder Curing Box</td>
<td>Each</td>
</tr>
<tr>
<td>637.0502</td>
<td>Engineer's Office-Type A</td>
<td>Month</td>
</tr>
<tr>
<td>637.0602</td>
<td>Engineer's Office-Type B</td>
<td>Month</td>
</tr>
<tr>
<td>637.0702</td>
<td>Engineer's Office-Type C</td>
<td>Month</td>
</tr>
</tbody>
</table>
SECTION 638 - WHITE SYNTHETIC RESIN BINDER CONCRETE

638-1 DESCRIPTION. This work shall consist of the construction of white synthetic resin binder concrete pavement in accordance with these specifications and in reasonably close conformity with lines and grades shown on the plans or established by the Engineer.

638-2 MATERIALS. The materials shall meet the requirements of §402-2, Materials, except as modified below.

638-2.01 Aggregates. The requirements of §703-05, Fine Aggregate for White Portland Cement Concrete, shall apply except that the gradation shall meet the general limits described in §638-2.05, Mix Design. A sample of the white aggregate will be obtained by the Department from the stockpile located at the mixing plant and submitted to the Materials Bureau at least 10 days prior to the production of the mix for color approval by the Director, Materials Bureau. Unless otherwise approved by the Regional Director, the material shall be stockpiled in advance and in sufficient quantity to complete the work. Any additions to the stockpile or apparent contamination of the aggregate, as determined by the Engineer, will require submission of samples to the Materials Bureau for evaluation and approval by the Director, Materials Bureau.

638-2.02 Mineral Filler. Mineral Filler, if required in the mix to meet gradation requirements shall be hydrated lime.

638-2.03 Binder. The binder shall conform to the requirements of §702-70. The synthetic resin binder shall be supplied by a manufacturer appearing on the Department's Approved List of Synthetic Resins. When the one component binder is used, the binder shall be available 10 days prior to production of the mix so representative samples of the binder can be obtained by the Engineer and tested by the Materials Bureau for conformance to §702-70.

638-2.04 Pigment. The pigment shall conform to the requirements of §712-16, Pigment for Colored Synthetic Resin Binder Concrete.

638-2.05 Mix Design. The job mix formula stating the proposed aggregate gradation, binder and pigment contents shall be prepared by the synthetic resin binder concrete producer according to the requirements of §401-2.01, Hot Mix Asphalt Designs, except for the modifications in this specification.

The general limits for the mix are as follows:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>General Limits (1)</th>
<th>Job Mix</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% Passing</td>
<td>% Tolerance</td>
</tr>
<tr>
<td>6.3 mm</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>3.2 mm</td>
<td>90–100</td>
<td>±5</td>
</tr>
<tr>
<td>850 µm</td>
<td>42–68</td>
<td>±7</td>
</tr>
<tr>
<td>425 µm</td>
<td>20–50</td>
<td>±6</td>
</tr>
<tr>
<td>180 µm</td>
<td>10–22</td>
<td>±3</td>
</tr>
<tr>
<td>75 µm</td>
<td>6–12</td>
<td>±2</td>
</tr>
<tr>
<td>Synthetic Binder Content (2)</td>
<td>7.0–8.0</td>
<td></td>
</tr>
<tr>
<td>Pigment (1,3)</td>
<td>2.3–2.7</td>
<td></td>
</tr>
<tr>
<td>Mix and Placing Temperature</td>
<td>120°C–160°C</td>
<td></td>
</tr>
</tbody>
</table>

NOTES:
1. Based on total aggregate weight.
2. Based on total mix weight.
3. The pigment shall be considered as mineral filler passing the 75 µm sieve.
638-2.06 Tack Coat. The tack coat shall be supplied by a manufacturer appearing on the Department's Approved List of Synthetic Resins. The tack coat shall conform to the requirements of §702-71. The tack coat material shall be available 10 days prior to production of the mix so representative samples of the tack coat can be obtained by the Engineer and tested by the Materials Bureau for conformance of §702-71.

638-3 CONSTRUCTION DETAILS. Except as provided in this specification, the construction requirements shall meet those of §402-3, Hot Mix Asphalt (HMA) Pavements - Construction Details.

638-3.01 Weather Limitations. The requirements for top course mixes in §402-3.01, Weather and Seasonal Limitations, shall apply.

638-3.02 Preparation of Mixture. The mixing plant shall meet the requirements of §401-3.08 unless otherwise approved by the Director, Materials Bureau. Before the pugmill is allowed to produce white synthetic resin binder concrete, it shall be thoroughly cleaned by charging a minimum of two (2) successive batches of hot dry aggregate into the pugmill and mixing each batch for a minimum of four (4) minutes. In addition, the first batch of white synthetic resin binder concrete produced, after a change from normal asphalt concrete production, shall not be incorporated into the work. Such batches shall be at least fifty (50) percent of the rated pugmill capacity. This batch may also be used for the first material passed through the paver as described in §638-3.04, Paving. The white aggregate shall be introduced into the pugmill, between the limits of 120°C to 180°C and the temperature of the synthetic resin binder (one component) shall be maintained between the limits of 130°C and 150°C. When the binder is added directly into the pugmill in cold, prepackaged units (two components), the temperature of the aggregate may be increased accordingly to meet the specified mix temperature, but shall not exceed 220°C. For either method of binder addition, the resulting mix temperature shall be in the range of 120°C to 160°C.

The pigment, resin chips, plasticizing oil and hydrated lime shall be added to the pugmill in whole bag units. If the pigment and/or hydrated lime is not delivered from the manufacturers as whole units, the Contractor may weigh and repackage in a manner approved by the Engineer so that the pigment and/or hydrated lime may be added as whole units. The hydrated lime may be added in a manner approved by the Engineer, if difficulties are encountered in maintaining the specified mix temperature when adding the hydrated lime directly to the pugmill.

Batching and mixing requirements for the White Synthetic Resin Binder Concrete are as follows:

A. One Component Binder. After the hot aggregate is discharged into the pugmill, add the pigment and hydrated lime in whole bag units as required and dry mix for a minimum of 15 seconds. After the dry mix the synthetic resin binder should be added and wet mixed for a minimum of 45 seconds.

B. Two Component Binder. After the hot aggregate is discharged into the pugmill add resin chips in whole bag units as required. This should be immediately followed by the addition of the hydrated lime in whole bag units and dry mixed for 30 seconds. Following the dry mix add the plasticizing oil and pigment in whole bag units in that order and wet mix for 30 seconds after all components are in the pugmill.

Any increase in pigment content above that specified on the job mix formula for the convenience of mixing shall be made at no additional cost to the Department. The pigment content may be increased within the general limits, as directed by the Engineer, to obtain a satisfactory color during production.

638-3.03 Preparation of Surface. All surfaces to be paved shall be thoroughly cleaned of all foreign material, including membrane curing compound of Portland Cement concrete pavement, prior to the placing of the pavement. A tack coat, consisting of a uniform application of rapid curing synthetic resin liquid, §702-71, shall be applied at a uniform rate between 0.15 to 0.25 liters per square meter over the areas to be paved. The tack coat shall be applied with either a paint roller or spray unit to assure uniform application. The tack coat shall not be poured onto the pavement surface for application. After the tack
coat application, curing time shall be sufficient to permit the coating to become tacky before paving. No traffic shall be permitted on the tack coated surface.

**§638-3.04 Paving.** The mix shall be laid between the temperatures of 120° to 160°C as specified by the Engineer. All areas of uniform width of 1.2 meters or more shall be paved with an approved paving machine. Areas of narrow or variable width may be placed without a paver but in a manner approved by the Engineer. All paving edges shall be formed in a manner approved by the Engineer to obtain a true edge. The equipment including trucks, paving machine rollers and tools which come in contact with the white synthetic resin binder concrete shall be thoroughly cleaned before use. In addition, the paving machine shall be cleaned of excess asphalt by spraying with solvent. This shall be directly followed by the passage and subsequent wastage of at least one (1) metric ton of the white material. The material may be from the same batch used to clean the pugmill.

**§638-3.05 Compaction.** Provisions of §402-3.07 Compaction shall apply except that a minimum of two passes of a nominal 9 metric ton steel wheel tandem roller shall be used for compaction. The edge forms shall be removed prior to applying the second roller pass. This shall be done as expeditiously as possible so that the second roller pass is completed while the mat is still hot. Forms used for the formation of transverse drainage troughs shall be kept in place until the completion of all rolling operations. Narrow areas which are subject to overstressing with a 9 metric ton roller may be rolled with a small roller as approved by the Engineer. The paving edge forms shall be removed prior to applying the final roller pass with the small roller as previously described for the 9 metric ton rollers. The use of a pneumatic tire roller will not be required for this item.

**§638-4 METHOD OF MEASUREMENT.** The quantity of white synthetic resin binder concrete shall be measured by the number of metric tons of compacted material in place.

**§638-5 BASIS OF PAYMENT.** The unit price bid per metric ton of white synthetic resin binder concrete shall include the cost of all materials, equipment and labor necessary to complete the work including the synthetic resin binder, pigment and tack coat.

*Payment will be made under:*

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>638.0104</td>
<td>White Synthetic Resin Binder Concrete</td>
<td>Metric Ton</td>
</tr>
</tbody>
</table>

**SECTION 639 (VACANT)**

**SECTION 640 - REFLECTORIZED PAVEMENT MARKING PAINTS**

**640-1 DESCRIPTION.** Under this work, the Contractor shall furnish and apply painted reflectorized pavement marking paint at the locations and in accordance with the patterns indicated on the plans or as directed by the Engineer, and in accordance with the NYSMUTCD and these specifications.

**640-2 MATERIALS.** Reflectorized pavement marking paints shall be selected from the Department’s Approved List of White and Yellow ReflectORIZED Pavement Marking Paints. Project acceptance will be based on the appearance of an approved brand name on the container label.

All paints shall conform to Federal, State, and local air pollution regulations, including those for the control (emission) of volatile organic compounds (VOC) as established by the U.S. Environmental Protection Agency, and the New York State Department of Environmental Conservation.

Reflective glass beads shall conform to §727-05 Glass Beads for ReflectORIZED Pavement Marking Paints.

Details for obtaining Approved List status are available from the Materials Bureau.

**640-3 CONSTRUCTION DETAILS**

**640-3.01 General.** All pavement markings and patterns shall be placed as shown in the contract documents and in accordance with the New York State Manual of Uniform Traffic Control Devices.
Before any pavement marking work is begun a schedule of operations shall be submitted to and approved by the Engineer.

When pavement markings are applied under traffic, the Contractor shall provide all the necessary flags, signs, cones, shadow vehicles, flashing arrow boards, etc. to maintain and protect traffic, to protect the work operation, and to protect the painted pavement markings until thoroughly dry and serviceable. No additional payment will be made for these items. The application of pavement markings shall be done in the general direction of traffic. Striping against the direction of normal flow of traffic shall not be allowed.

The Contractor shall be responsible for cleaning the pavement, to the satisfaction of the Engineer, of dust, dirt, and other foreign material which may be detrimental to the adhesion of the paint film.

When necessary, the Contractor shall establish marking line points at nine (9) meter intervals throughout the length of the pavement or as directed by the Engineer.

The Contractor shall be responsible for removing, to the satisfaction of the Engineer, all tracking marks, spilled paint, and paint applied in unauthorized areas.

**640-3.02 Application of Pavement Markings.** Painted pavement markings shall be applied with either atomizing or airless type striping equipment. The striping equipment may be either truck mounted or hand operated, and shall be equipped with glass bead dispensing equipment. The striping equipment shall be compatible with and suitable for the application of the type of paint being used.

At the time of paint application, the pavement surface and ambient temperature shall not be less than 10°C, the relative humidity shall not exceed 85%, and the pavement surface shall be dry. Painted pavement markings shall not be applied during periods of rain or if rain is imminent. Waterborne type paints shall not be applied if rain is expected within 4 hours after the paint application.

Paint shall be applied in strict accordance with the manufacturer’s recommendations for use. In no case shall the paint be heated above 65°C.

The painted pavement markings shall be uniformly applied to the pavement surface at the minimum specified wet film thickness. Immediately following paint application reflective glass beads shall be uniformly applied to the wet paint film at the rate of 0.75 kg/L of paint. The applied pavement markings shall have clean-cut edges, and true and smooth alignment.

On pavements where traffic is to be maintained and the final marking pattern is known, reflectorized pavement marking paint shall be applied before nightfall or before the end of the working day, whichever comes sooner. If the Contractor is unable to apply these final pavement markings, where traffic is to be maintained, then Short-Term Pavement Markings meeting the requirements of §619-3.06 shall be installed using removable reflectorized pavement markings, offset from the location of the project’s final pavement markings, at no additional cost to the State.

**640-4 METHOD OF MEASUREMENT.** Pavement striping will be measured in linear meters along the centerline of the pavement stripe and shall be based on a 100 mm wide stripe. Measurement for striping with a plan width greater or less than the basic 100 mm as shown in the contract documents or as directed by the Engineer, will be made by the following method:

\[
\text{Plan Width of Striping (Millimeters) x Meters} \div 100 \text{ Millimeters}
\]

No payment will be made for the number of meters of gaps in between the dashed lines. Letters and symbols will be measured by each unit applied. A unit will consist of one letter or one symbol. Examples: “SCHOOL” will be measured as six units. Double and triple headed arrows will each be measured as a single unit. The “X” in railroad grade crossing markings (MUTCD figure 263-33) will be measured by meter of 100 mm stripe.

**640-5 BASIS OF PAYMENT.** The accepted quantities of pavement markings will be paid for at the contract unit price bid, which shall include the cost of furnishing all labor, materials, and equipment to satisfactorily complete the work. The cost for maintaining and protecting traffic during the painting operations shall be included in the price bid. The application of Short-Term Pavement Markings, necessitated by the Contractor’s failure to apply the required Reflectorized Pavement Marking Paints, shall be at no additional cost to the State.
§640

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>640.10</td>
<td>White Paint Reflectorized Pavement Stripes - 0.38 mm</td>
<td>Meter</td>
</tr>
<tr>
<td>640.11</td>
<td>White Paint Reflectorized Pavement Stripes - 0.38 mm</td>
<td>Meter</td>
</tr>
<tr>
<td>640.12</td>
<td>White Paint Reflectorized Pavement Letters - 0.38 mm</td>
<td>Each</td>
</tr>
<tr>
<td>640.13</td>
<td>White Paint Reflectorized Pavement Symbols - 0.38 mm</td>
<td>Each</td>
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<tr>
<td>640.20</td>
<td>White Paint Reflectorized Pavement Stripes - 0.51 mm</td>
<td>Meter</td>
</tr>
<tr>
<td>640.21</td>
<td>White Paint Reflectorized Pavement Stripes - 0.51 mm</td>
<td>Meter</td>
</tr>
<tr>
<td>640.22</td>
<td>White Paint Reflectorized Pavement Letters - 0.51 mm</td>
<td>Each</td>
</tr>
<tr>
<td>640.23</td>
<td>White Paint Reflectorized Pavement Symbols - 0.51 mm</td>
<td>Each</td>
</tr>
</tbody>
</table>

SECTION 641, 642 AND 643 (VACANT)

SECTION 644 - OVERHEAD SIGN STRUCTURES

644-1 DESCRIPTION

644-1.01 General. Under this work the Contractor shall fabricate, furnish and erect sign structures for overhead signs in accordance with the contract documents.

The Contractor shall notify the Deputy Chief Engineer, Structures (DCES) of the name and address of the fabricator of all overhead sign structures in accordance with §106-01 Sources of Supply.

644-1.02 Definitions. Overhead Sign Structures (OSS) are structures with vertical supports and horizontal arms or chords used to support signs over any portion of the roadway, including the shoulders. Span Wire Assemblies supporting overhead signs, and structures supporting both traffic signal equipment and overhead signs are covered under Section 680, Traffic Signals. Bridge fascia mounted signs, where the signage is intended for the under roadway, are also not covered in this Section.

OSS are classified into the following three standard types (See Figure 644-1).

A. Single Arm Cantilever. Single (horizontal) arm supported by a single (vertical) post.
B. Trussed Arm Cantilever. Two trussed arms supported by a single post. (If the arms are not trussed, the structure shall be classified as Non-Standard).
C. Span. Single span, four-chord (quad-chord) superstructure supported by trussed end posts.

OSS that fall outside these categories are Non-Standard. This includes butterfly structures, multi-span structures, structures that are a combination of span and cantilevers, and all other overhead sign structures not included in §644-1.02.

644-2 MATERIALS

644-2.01 Steel for Sign Structures. Steel for component parts of sign structures shall meet the requirements of the New York State Steel Construction Manual and the following:

All material greater than 13 mm thick shall meet the Charpy V-Notch toughness requirements of §715-01, Structural Steel. Chords, cantilevered arms, end posts, base plates, end and face plates for cantilever arm to post connections, and flange splice plates shall be considered main members. Diagonals, struts and gusset or tab plates shall be considered secondary members. Upon receipt at the fabrication plant, all main member material shall be traceable to a mill test report and traceability shall be maintained throughout the duration of the fabrication.

All main member material thickness shall be a minimum of 6 mm.
Single-Arm Cantilever Structure

Single-Arm Butterfly Structure

Trussed-Arm Cantilever Structure

Trussed-Arm Butterfly Structure

Single Span Structure
§644

NEW YORK STATE DEPARTMENT OF TRANSPORTATION
STANDARD SPECIFICATIONS of May 4, 2006

A. **Pipe.** Pipe shall meet the requirements of one of the following specifications:

- ASTM A 53, Welded and Seamless Steel Pipe, Grade B, Type E or S.
- ASTM A 500, Welded and Seamless Steel Pipe, Grade B (Rounds Only)
- ASTM A 252, Welded and Seamless Steel Pipe, Grade 2 or 3, provided that the chemical certifications meet the requirements for ASTM A 53, Grade B, Type E or S.
- API 5L American Petroleum Institute Specification 5L, Grade B

In addition to the above material requirements, all pipe used for welded applications shall have a maximum Carbon Equivalency (CE) of 0.40 using the following equation:

\[
CE = \%C + \%Mn/6 + \%Cu/40 + \%Ni/20 + \%Cr/10 - \%Mo/50 - \%V/10
\]

B. **Structural Steel.** Structural steel for structural shapes, plates, and bars shall meet the requirements of §715-01, Structural Steel, and the ASTM Specification noted on the contract documents. Cutting and drilling shall be done in such a manner that the resulting surfaces are free from any gouges or burrs.

C. **Anchor Bolts, Nuts and Washers.** Anchor bolts, nuts and washers shall meet the requirements of the following:

- ASTM F 1554, Grade 55 with Supplementary Requirement S4, Charpy Impact Requirement
Anchor bolts, nuts, and washers shall be galvanized in accordance with the requirements of Materials Detail 719-01 Type II, Galvanized Coatings and Repair Methods - Zinc Coating (Hot Dip) on Iron and Steel Hardware. Anchor bolts shall be the Unified Course Thread Series with Class 2A threads, and shall be galvanized full length. Nuts shall be Grade A, Heavy Hex.

**D. High Strength Steel Bolts, Nuts and Washers.** Bolted steel connections shall be made with bolts, nuts and washers meeting the material requirements of §715-14, High Strength Bolts, Nuts and Washers, and the galvanizing requirements of §719-01, Galvanized Coatings and Repair Methods. Additionally, the Contractor shall provide documentation that the zinc coated fastener assemblies have satisfied the requirements of ASTM A 325M Section 6.2, R.C. testing.

Fasteners in main members shall be sampled and tested in accordance with Section 1001.5 of the New York State Steel Construction Manual, with the exception that the waiver for lot sizes less than 20 bolts shall not apply.

**E. U-Bolts.** U-Bolts shall conform to material specification ASTM F 1554, Grade 36, and shall be galvanized in accordance with the requirements of Type II of §719-01, Galvanized Coatings and Repair Methods.

**F. Galvanizing.** All steel shall be galvanized in accordance with §719-01 Type I, except as noted above in §644-2.01 C, D & E. Galvanizing shall provide a minimum coating of 127 µm. All welding, cutting and drilling shall be done prior to galvanization, and all bolting shall be done after galvanization, except as approved by the Engineer.

**G. Acceptance.** All steel furnished shall be documented in accordance with the requirements of §715-01 Basis of Acceptance.

**644-2.02 Concrete.** All overhead sign structure foundations shall meet the requirements of Class A concrete in Section 501, Portland Cement Concrete - General. The Contractor may submit, for approval by Director, Materials Bureau, a mix at least equivalent to the specified Class A Concrete.

All precast concrete overhead sign structure foundations shall meet the requirements of §704-03, Precast Concrete - General.

**644-3 CONSTRUCTION DETAILS**

**644-3.01 Drawings.** Shop drawings shall be required for all OSS in the contract documents. The Contractor must submit shop drawings in accordance with the requirements of Section 2 in the New York State Steel Construction Manual.

**644-3.02 Fabrication.** All fabrication, inspection, transportation and erection shall be performed in accordance with the requirements of the New York State Steel Construction Manual.

**A. Storage of Materials.** Structural material shall be stored in a manner that will protect the materials from deformation, surface deterioration and accumulations of dirt, oil, or other foreign matter.

**B. Straightening Materials.** Prior to fabrication in the shop, all deformed structural materials shall be properly straightened by methods which are non-injurious. Sharp kinks and bends, and deep dents shall be cause for rejection.

**C. Anchor Bolts.** Where anchor bolts have been or are being set under a separate contract, the Contractor shall check the size, location, and spacing of anchor bolts before fabricating the structure.

**D. Pole Markings.** A Sign Structure Identification Number (SIN) shall be attached to the post using white numbers on a green background. The background shall be Green, Class A, Engineer Grade reflective sheeting as described in §730-05, Reflective Sheeting, and shall be 300 mm wide by 150 mm high, with the corners cut to a 40 mm radius. The numbers shall be cut out from White,
§644

Class A, Engineer Grade reflective sheeting and shall be 75 mm high. The sheeting and numbers shall be applied in accordance with the manufacturer’s recommendations. The numbers shall be placed on the right near post, 45 degrees from the viewing direction of traffic, approximately 1.8 m above the base plate, so as to be visible to the traveling public. For structures spanning more than one direction of traffic, or structures that span non-contiguous travel lanes, two posts shall be marked to facilitate identification by inspectors.

The following information shall be stamped into the base plate in 12 mm letters to such a depth as to be clearly visible through subsequent galvanizing:

<table>
<thead>
<tr>
<th>Required Information</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturer’s name or logo</td>
<td>ABC Fabricating</td>
</tr>
<tr>
<td>Month and year of manufacture</td>
<td>06/2003</td>
</tr>
<tr>
<td>D Number</td>
<td>D123456</td>
</tr>
<tr>
<td>SIN Number</td>
<td>SIN 12345</td>
</tr>
</tbody>
</table>

For span type structures the marked base plate shall correspond to the marked posts, except that only one end of the span must be marked.

**E. High Strength Bolts.** Each bolt shall be furnished with a galvanized flat washer installed under the turned element. All connections shall be made by first tightening all nuts and bolts sufficiently to bring all components into full contact with each other. After full contact has been achieved, all connections shall be brought to a condition beyond snug tight as required by Table 1001.3b of the New York State Steel Construction Manual.

Fasteners shall be inspected after installation in accordance with Section 1001.4 of the New York State Steel Construction Manual. The inspection shall apply to a minimum of 10% of the connections randomly throughout the entire span of the structure.

All holes for high strength bolts in main members shall be made in accordance with Section 613 of the New York State Steel Construction Manual. This requirement also includes all secondary members that are welded to main members.

**F. Quality.** Fabricators shall be certified in accordance with the American Institute of Steel Construction’s Quality Certification Program in the Simple Steel Bridge Structures Category, or an equivalent program acceptable to the DCES.

**G. Inspection.** Provisions for shop inspection shall be in accordance with the New York State Steel Construction Manual.

**H. Assembly.** All OSS shall be fully assembled in the fabrication shop to ensure proper fitup.

**I. Acceptance For Shipping.** Each section of a sign structure shall bear the QA inspector’s mark of acceptance prior to shipping.

**644-3.03 Transportation.** Sign structures (including posts and post assemblies) shall be shipped by flat bed trailer or other similar means. Structures shall be shimmed, braced, blocked, and tied down to prevent distortion or other damage from occurring during transportation. The use of any device which does not support the member for its entire length, as described below, shall not be permitted. This prohibition includes, but is not limited to, dolly wheels and pole trailers.

Sections less than 15.0 m in length shall be, at a minimum, supported at the midspan and end points. Sections 15.0 m and longer shall be, at a minimum, supported at the ends and at the quarter points.

Adhering to these requirements does not relieve the Contractor of the responsibility for damage to the structure en route.

**644-3.04 Excavation.** All excavation shall conform to Section 206, Trench, Culvert and Structure Excavation.
Excavation shall not be performed until immediately before installation of the footings, or any other appurtenances. The excavated material shall be placed in a location or locations selected by the Contractor so as to cause the least inconvenience to vehicular and pedestrian traffic and to avoid interference with surface drainage. All surplus excavated material shall be removed and disposed of by the Contractor as specified in §203-3.08, Disposal of Surplus Excavated Materials.

Excavation shall be backfilled as specified in §203-3.15, Fill and Backfill at Structures, Culverts, Pipes, Conduits and Direct Burial Cables.

The outline of all areas to be removed in sidewalks, driveways, and pavement shall be saw cut to a depth of at least 75 mm prior to removal. Cuts shall be neat and true along score lines with no shatter outside the removal area. Damaged saw cut areas shall be recut.

Pavement, shoulder, sidewalks, curbs, driveways, lawns, plants and other such features shall be replaced in kind with material of equal quality or as shown in the contract documents. For transverse sidewalk, curb or gutter cuts in concrete the entire square or section shall be removed and replaced with the same kind and quality of material. For longitudinal cuts in concrete sidewalks only the area removed between sawcuts shall be replaced unless specified otherwise in the contract documents.

Whenever a part of a square or slab of existing concrete sidewalk, curb or driveway is broken or damaged by this work, the entire square, section or slab shall be removed and replaced with the same kind and quality of material, at no additional cost to the State.

644-3.05 Concrete Foundations. Foundations shall be constructed as shown in the contract documents. The Contractor shall establish the location and elevation of foundation, prior to the start of construction, based on the information shown in the contract documents and data derived from field surveys. Locations and elevations will be verified by the Engineer prior to the start of construction.

The Contractor has the option, unless specifically disallowed in the contract documents, to use either Drilled Shafts or Rectangular Footings for Overhead Sign Structures, if both types are detailed in the contract plans. When both foundation types are detailed and permitted, the Department has prepared the contract documents based on the presumed less expensive foundation type. If the Contractor elects to change from one type of foundation to the other under this option, it shall be done at no additional cost to the State. The Contractor shall notify the Engineer of the decision to change foundation type.

Excavation for these items shall be as specified in §644-3.04. All concreting operations shall conform to Section 555, Structural Concrete. Reinforcing steel shall conform to Section 556, Reinforcing Steel for Concrete Structures.

The allowable tolerance from verticality for the drilled shaft or pedestal shall be 2.5%. The allowable tolerance for the top of shaft elevation or pedestal elevation shall be +6 mm, -0 mm.

Stripping of forms and subsequent loading of foundations shall be in accordance with §555-3, in Table 555-1, under “Pier Columns”. Placing the sign panels on an overhead sign structure is assumed to be equivalent to placing superstructure loads on a bridge.

A. Drilled Shafts for Overhead Sign Structures. Work under this item shall consist of the layout and construction of Drilled Shaft foundations for Overhead Sign Structures. This work may require rock drilling, installing rock sockets, dewatering, the use of temporary casing, slurry, or other means necessary to keep the hole open. Formwork shall be required for the portion of the shaft above finished grade.

Holes for drilled shafts shall be pre-augered. Precaution shall be taken to protect the holes from collapse. Holes shall contain no free water, nor any loose material at the time of concrete placement. The holes shall be filled with Class A concrete placed in direct contact with the soil. Casing, if used, shall be removed prior to concrete placement. Precast shafts shall not be permitted.

B. Rectangular Footings for Overhead Sign Structures. Work under this item shall consist of the layout and construction of conventional rectangular spread footings, either cast-in-place or precast. This work may require the use of protective sheeting.

644-3.06 Erection of Sign Structures

A. Methods and Equipment. Before starting work, the Contractor shall submit details of the method of erection and types of equipment he proposes to use, to the Engineer for review and
approval. Approval shall not relieve the Contractor of the responsibility for the safety of the methods or equipment, or for damage to the structures due to overloading.

**B. Handling and Storage.** Structural members shall be loaded, moved, and unloaded in a manner that prevents stresses in excess of those provided for by the structure design. Permanent distortion, or other damage attributable to the Contractor's operations, shall be cause for rejection.

Members stored either in the fabricator's storage area, or at the work site, or at other storage areas, shall be supported off the ground in a manner that will not allow distortion, or other damage to occur.

**C. Lifting.** Erection of overhead sign structures shall be done in accordance with §107-05P. Lifting. Lift Plans are required, and shall be provided in accordance with §107-05P.3. Nylon slings, or an equivalent approved by the Engineer, shall be used for all lift operations. Picking points for the superstructure portion of span type OSS shall be made at the panel points that are closest to the third points of the span, in order to ensure that no members are overstressed during lift operations. Two picking points, one at each end, shall be used for the superstructure portion of cantilever OSS. Picking shall be made by wrapping the entire cross section of the structure. When alternate pick points are used, supporting calculations shall be submitted in accordance with §107-05P.5. Lift Operations. However, lifting by chains or by individual members shall not be permitted.

**D. Field Inspection.** All sign structures shall be visibly inspected, and components shall be clean prior to erection. Damage that is attributable to the Contractor's operations shall be cause for rejection. Damage includes, but is not limited to, bends, kinks, dents, cracks and pits. Rejected structures, or components, shall be removed from the work site and repaired, or replaced as required by the DCES. All work relating to the repair or replacement, of defective structures, or components, shall be done at no additional cost to the State.

**E. Anchor Bolts.** The following procedure shall be used for placing and tightening anchor bolts:

1. Anchor bolts shall be carefully set to the proper location, alignment, and elevation by using templates. Templates shall be as detailed in the contract documents, and shall be used at both the top and bottom of the anchor bolt pattern. Bottom templates shall be cast into the footing. Top templates shall be placed near the top of the anchor bolts so as not to interfere with concrete operations, and shall be left in place for 24 hours after concrete placement. Undamaged top templates may be reused.
2. Anchor bolts shall be set vertical, within 2.5%, and shall not be realigned by bending to fit the base plate. Anchor bolts that do not fit the base plate, or anchor bolts that are more than 2.5% out of plumb, shall be rejected. The Contractor may propose a remediation method for rejected anchor bolts, subject to the approval of the Engineer. Rejected anchor bolts, and the concrete they are embedded in shall be replaced by new materials at no cost to the State.
3. The exposed portion of the anchor bolts shall be cleaned with a wire brush. The leveling nuts and washers under the base plate shall be threaded onto the anchor bolts, leaving a gap between the top of concrete and the bottom of the leveling nuts of no more than one anchor bolt diameter, and no less than 10 mm.
4. The post(s) alone, without the arms attached, shall be placed on the leveled anchor bolts and washers. Posts shall not be raked back to account for camber. The base plate shall bear directly and evenly on the washers and leveling nuts.
5. Beeswax, or the equivalent, shall be applied to the bearing face and the threads inside the top nut. The top anchor bolt nuts and washers shall then be placed and tightened by hand. All cleaning and lubricating shall be done immediately prior to nut placement and tightening. Top nuts and leveling nuts shall be checked for full bearing against the base plate, and any loose nuts shall be tightened by hand. The top nuts shall then be snug tightened using 20 - 30% of the torque values listed in Table 644-1. The snugging sequence shall be as shown in Figure 644-2. The leveling nuts shall then be similarly checked for snug tightness, using 20 - 30% of the values listed in Table 644-1.
6. Fully tighten all top nuts according to the torques listed in Table 644-1. The tightening sequence shall be as shown in Figure 644-2. There shall be no rotation of the leveling nut during this procedure.
7. An additional nut shall be installed and tightened against the top nut to lock the installation. This lock nut shall be prepared and tightened as defined in 5.) and 6.) above. There shall be no rotation of the lower top nut during this procedure.

<table>
<thead>
<tr>
<th>Anchor Bolt Size (Metric)</th>
<th>Required Torque (±5%) (N•m)</th>
<th>Anchor Bolt Size (English)</th>
<th>Required Torque (±5%) (ft•lbs)</th>
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<tr>
<td>M36</td>
<td>850</td>
<td>1 ½</td>
<td>650</td>
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<tr>
<td>M42</td>
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</tr>
<tr>
<td>M56</td>
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</tr>
<tr>
<td>M64</td>
<td>4,000</td>
<td>2 ½</td>
<td>3,000</td>
</tr>
</tbody>
</table>

**F. Bolting.** Bolted steel connections shall be made with bolts, nuts and washers meeting the material requirements of §715-14, High Strength Bolts, Nuts and Washers, and the galvanizing requirements of §719-01, Galvanized Coatings and Repair Methods. Each bolt shall be furnished with a galvanized flat washer installed under the turned element. All connections shall be made by first tightening all nuts and bolts sufficiently to bring all components into full contact with each other. Any gaps between the faying surfaces after snug tightening that exceed 1 mm shall not be considered in full contact and shall be cause for rejection. The Contractor may propose remediation measures subject to approval by the DCES. Rejected components shall be replaced or repaired at no cost to the State. Bolts shall not be fully tightened before said tolerances are checked. After full contact has been achieved, all connections shall be brought to a condition beyond snug tight as required by Table 1001.3b of the New York State Steel Construction Manual.

Fasteners shall be inspected after installation in accordance with Section 1001.4 of the New York State Steel Construction Manual.

**G. Welding.** Field welding shall not be permitted on any part of the structure, except as approved by the DCES.
§644

H. Galvanized Metal Repair. The Contractor shall repair any damage to galvanized surfaces in conformance with the field repair requirements specified in §719-01, Galvanized Coatings and Repair Methods, except that zinc paint applied by the spray method shall not be permitted.

644-4 METHOD OF MEASUREMENT

644-4.01 Sign Structure. The work will be measured as the number of sign structures installed without sign panels.

644-4.02 Drilled Shafts for Overhead Sign Structures. The payment quantity shall be the concrete volume shown for the shaft in the table in the contract documents, multiplied by the number of drilled shafts in the contract, unless the Engineer orders a modification to the details shown in the contract documents. If the Engineer orders a modification to the details shown in the contract documents, the payment quantity shall be the volume of concrete ordered by the Engineer. If the Engineer orders a change from a drilled shaft to a rectangular footing, an order-on-contract shall be negotiated. No adjustment shall be made for the Contractor’s election to use a rectangular footing, unless the Engineer orders a change to the details shown in the contract documents.

644-4.03 Rectangular Footing for Overhead Sign Structures. The payment quantity shall be the concrete volume shown for the footing and pedestal in the table in the contract documents, multiplied by the number of footings in the contract, unless the Engineer orders a modification to the details shown in the contract documents. If the Engineer orders a modification to the details shown in the contract documents, the payment quantity shall be the volume of concrete ordered by the Engineer. If the Engineer orders a change from a rectangular footing to a drilled shaft, an order-on-contract shall be negotiated. No adjustment shall be made for the Contractor’s election to use a drilled shaft, unless the Engineer orders a change to the details shown in the contract documents.

644-4.04 Anchor Bolts. The payment quantity shall be the mass shown in the anchor bolt table in the contract documents times the number of bolts installed.

644-5 BASIS OF PAYMENT

644-5.01 Sign Structure. The unit price bid for each structure for supporting sign panels shall be compensation in full for fabricating, furnishing and erecting the structure complete as specified including upright support(s), span and/or cantilever arm or truss assemblies, diagonal bracing, all necessary hardware, nuts, bolts, and washers, and all other material, equipment and labor necessary to properly complete the work as shown in the contract documents and called for in the specifications. Footings and anchor bolts shall be paid for under separate items or will be furnished by others.

The cost of all shop drawings, prints and reproducible prints required by the New York State Steel Construction Manual shall be included in the unit price bid for this item.

644-5.02 Foundations for Overhead Sign Structures. The unit price bid per cubic meter shall include the excavation, any protective system(s) required to ensure the safety of the workers and the public, dewatering, backfill (select granular backfill or concrete), formwork, concrete, bar reinforcement for concrete, excavation and backfilling of test holes, conduit and fittings, restoration of surfaces in kind, disposal of excess excavated material, and saw cutting.

644-5.03 Anchor Bolts. The unit price bid per kilogram shall include the furnishing and installing the anchor bolts and all necessary hardware, including galvanizing, as shown in the contract documents and called for in the specifications. This includes the anchor bolts, all templates used to ensure the proper alignment of the anchor bolt system, all nuts, and all washers necessary to complete the work as shown in the contract documents.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>644.11</td>
<td>Anchor Bolts</td>
<td>Kilogram</td>
</tr>
</tbody>
</table>
644.20 Drilled Shaft for Overhead Sign Structures Cubic Meter
644.30 Rectangular Footing for Overhead Sign Structures Cubic Meter
644.41xxxy Single Arm Cantilever Sign Structure Each
644.42xxxy Trussed Arm Cantilever Sign Structure Each
644.43xxxy Single Span Sign Structure Each
644.44nn Non-Standard Sign Structure Each

NOTE:
1. xx, yy and nn denote serialized pay items. See §101-02, Definition of Terms, under “Specifications”.
2. xx denotes span or arm length in meters. For Single Arm and Trussed Arm Cantilever Sign Structures, xx varies from 04 to 16 in whole number increments. For Single Span Sign Structures, xx varies from 15 to 65 in 5 meter increments.
3. yy denotes sign area in square meters. For Single Arm Cantilever Sign Structures, yy is 03, 05 or 08 square meters. For Trussed Arm Cantilever Sign Structures, yy varies from 05 to 30 in 5 square meter increments. For Single Span Sign Structures, yy varies from 30 to 90 in 30 square meter increments.

SECTION 645 - SIGNS

645-1 DESCRIPTION. This work shall consist of fabricating, installing and covering traffic sign panels, sign support systems, sign posts, and illuminated sign panels in accordance with the contract documents, standard sheets, the MUTCD and as directed by the Engineer.

645-2 MATERIALS.

645-2.01 General. Materials shall meet the requirements of the following subsections of Section 700 Materials and Manufacturing:

Wood Preservative - Water Borne 708-31
Stress Graded Timber and Lumber 712-14
Stainless Steel Connecting Products 715-16
Rubber Impregnated Woven Cotton-Polyester Fabric 728-01
Rubber Impregnated Random Fiber Pad 728-02
Aluminum Sign Panels 730-01
Reflective Sheeting 730-05
Reactorized Sheeting Sign Characters (Type IV) 730-12
Reactorized Sheeting Sign Characters (Type V) 730-13
Stiffeners, Overhead Brackets, and Miscellaneous Hardware 730-22
Fiberglass Reinforced Plastic Sign Panels 730-23
Type A Sign Supports 730-24
Type B Sign Posts 730-25
Breakaway Bases and Hinge Assemblies 730-26
U-Bolts ASTM F1554, Grade 36

645-2.02 Sign Panels. Fabrication of all components shall produce a finished sign panel. Holes may be punched or drilled. Edges shall be smooth and true and free from burrs or ragged breaks. Sign panels shall be fabricated as shown on the standard sheets. Details for signs that are not shown on the standard sheets shall be similar to the closest shown sign blank size. All sign panels shall be clearly marked in the lower right corner on the back of the sign panel to show the Contract Number and the installation date (month/year). Markings shall be a minimum of 25 mm high and shall be permanently engraved, labels attached with pressure-sensitive adhesives, marked with an indelible ink or paint, or established by another method approved by the Engineer. U-Bolts used to attach sign panels to overhead sign structures shall be Type II galvanized in accordance with §719-01 Galvanized Coatings and Repair Methods.

A. Ground-Mounted Sign Panels (MUTCD Codes R, P, W and M). Panels for Ground-Mounted MUTCD Codes R, P, W and M signs shall be aluminum alloy 2.5 mm thick meeting the requirements of §730-01, Aluminum Sign Panels. Fiberglass Reinforced Plastic Sign Panels, 3.5
mm thick, meeting the requirements of §730-23 Fiberglass Reinforced Plastic Sign Panels, may be used for sign panels up to 1.2 m X 1.2 m.

**B. Ground-Mounted Sign Panels (MUTCD Codes G and I) and Overhead-Mounted Sign Panels.** Sign panels for ground mounted MUTCD Codes G and I signs and Overhead-Mounted Sign Panels shall be aluminum alloy 3 mm thick meeting the requirements of §730-01, Aluminum Sign Panels.

**C. Reflective Sheeting.** Reflective sheeting materials used on sign panels shall conform to the requirements of §730-05 Reflective Sheeting. Type I (Class A) sheeting may be used on tourist and motorist services signs. Type III (Class B) sheeting shall be used on regulatory, warning, route marker, and guidance signs unless specified otherwise below.

Type I (Class A) sheeting shall be used whenever brown reflective sheeting is specified, and may be processed by a sign fabricator in its shop. The legend for a sign with brown background shall be made by applying cut-out letters or symbols of Type I (Class A) yellow sheeting.

1. **High-Visibility Sheeting.** Signs with the following MUTCD codes shall be fabricated using Type IX (Class E) sheeting: R1-1, R1-2, R1-3, R3-1, R3-2, R3-3, R3-15, and R3-16.

2. **High-Visibility Fluorescent Yellow Sheeting.** Signs with the following MUTCD codes shall be fabricated using Type IX (Class E) fluorescent yellow sheeting for the yellow portion of the sign face, and the appropriate nonfluorescent Type IX (Class E) color for the remainder of the sign face:

3. **High-Visibility Fluorescent Yellow-Green Sheeting.** Signs with the following MUTCD codes shall be fabricated using Type IX (Class E) fluorescent yellow-green sheeting for the yellow portion of the sign face, and the appropriate nonfluorescent Type IX (Class E) color for the remainder of the sign face:
   - R2-7, R2-8, W5-1, W5-3, W5-6, W6-1, W6-3, and W6-4.

   Signs with the following National MUTCD codes shall also be fabricated using Type IX (Class E) fluorescent yellow-green sheeting for the yellow portion of the sign face, and the appropriate nonfluorescent Type IX (Class E) color for the remainder of the sign face:
   - W16-1, W16-2a, W16-7P, and W16-9P.

**D. Sheeting Sign Characters.** Characters include letters, numerals, route shields, symbols, and borders. Characters shall be the size, series and color specified in the MUTCD and as specified in the contract documents. Only Type IV or Type V Characters, as appropriate, shall be used. White legends and borders shall be formed with directly-applied Type IV Characters. Interstate shields for signs shall be either demountable panels or directly-applied panels with Type V reverse-screened characters. Sign face characters and background shall be reflective, but black portions of a sign face shall not be reflective.

**E. Sign Face Layouts.** Sign face shape, color, dimensions, and characters shall be in accordance with:

1. MUTCD.
2. National MUTCD.
3. Standard Highway Signs Book - FHWA.
4. Standard Alphabets for Highway Signs and Pavement Markings (Metric Edition) - FHWA.

Standard sign face layouts for MUTCD Codes R, P, W and M sign panels are shown in the MUTCD. Sign face layouts for MUTCD Codes G and I sign panels will be available as Supplemental Information Available to Bidders. After contract award, two copies of the sign face layouts will be provided to the Contractor. The Contractor shall verify dimensions on the sign face layouts prior to fabrication.
F. **Sign Structure Bearing Pads.** Type A Sign Structure Bearing Pads shall be made from Rubber Impregnated Woven Cotton-Polyester Fabric. Type B Sign Structure Bearing Pads shall be made from Rubber Impregnated Random Fiber Pad.

645-2.03 **Type A Sign Posts.** Type A sign posts shall be selected from the Department's Approved List of Type A Sign Supports. The standard strength (i.e., moment capacity) of a Type A sign post shall be 2800 N.m, although weaker or stronger posts may be substituted.

A. **Type A Sign Posts With Extra Embedment.** Type A sign posts with extra embedment (more than 1 m) shall meet the requirements of the Materials Details for Type A Sign Supports.

B. **Soil Plates for Type A Sign Posts.** Type A sign posts with soil plates shall meet the requirements of the Materials Details for Type A Sign Supports.

C. **High-Capacity Type A Sign Posts.** High-Capacity Type A sign posts are defined as any Type A sign post system shown in the Materials Details for Type A Sign Supports that has a total combined capacity for the entire two- or three-post system higher than 10600 N.m. The Contractor shall calculate the design moment of the sign panel, and select an appropriate High-Capacity Type A sign post system capable of resisting that moment, subject to the Engineer's approval.

645-2.04 **Type B Sign Posts.** Type B sign posts shall be fabricated in accordance with the requirements of §730-25 Type B Sign Posts.

A. **Rustic Type B Sign Posts.** Rustic Type B sign posts shall be ungalvanized weathering steel meeting the requirements of ASTM A588M or A242M.

B. **Breakaway Bases and Hinge Assemblies.** Breakaway bases and hinge assemblies shall be fabricated in accordance with the requirements of §730-26 Breakaway Bases and Hinge Assemblies.

645-2.05 **Concrete Foundations.** Cast-in-place concrete for foundations shall meet the requirements of Class A concrete in Section 501, *Portland Cement Concrete-General*. Precast concrete foundations shall meet the requirements of §704-06 Precast Concrete Cribbing. The batching, mixing and curing methods, and the inspection facilities shall meet the approval of the Department. The Contractor may submit a mix at least equivalent to Class A Concrete for approval by the Engineer.

645-2.06 **Breakaway Wooden Sign Posts.** Breakaway wooden sign posts shall be either Grade 2 Southern Yellow Pine or Grade 2 Douglas Fir-Larch, surfaced four side (S4S) as designated by the National Design Specification (NDS) for Wood Construction, and meeting the requirements of §712-14 Stress Graded Timber and Lumber. The bending stress (Modulus of Rupture) shall not be less than 27000 kPa using the clear wood properties of ASTM D2555. Posts shall be pressure treated in accordance with §708-31 Wood Preservative - Water Borne, dried to a maximum moisture content of 15% before and after pressure treating. The embedded portion of each post shall be sealed to 50 mm above the ground surface or above the steel tube insert, with a heavy coat (0.3 mm dry film thickness) of an emulsified asphalt conforming to AASHTO M140.

All 89 mm x 140 mm posts shall have two 38 mm diameter breakaway holes drilled through the center of the post parallel to the sign face 100 mm and 450 mm above grade and filled with flexible caulk. All 140 mm x 190 mm posts shall have two 75 mm diameter breakaway holes drilled through the center of the post parallel to the sign face 100 mm and 450 mm above grade and filled with flexible caulk. Nails and fasteners shall be stainless steel meeting the requirements of §715-16. Cuts and holes made at the contract site shall be field treated with copper naphthenate having a minimum 2% metallic solution, in accordance with AWPA Standard M4. Breakaway holes shall be field treated with copper naphthenate before filling with flexible caulk.

645-2.07 **Pole-Mounted Sign Support Systems.** Bands, brackets, hardware, and fasteners necessary to mount signs on traffic signal poles, street lighting poles or other poles shall be stainless steel.
Bands shall be a minimum of 20 mm x 0.5 mm. Other methods of attachment may be substituted with prior approval of the Engineer.

645-2.08 Illuminated Signs. Illuminated Sign Panels shall be aluminum alloy 3 mm thick meeting the requirements of §730-01, Aluminum Sign Panels. All materials necessary to illuminate the sign panels shall be as shown in the contract documents.

645-2.09 Sign Covering Material. Material used to cover sign panels shall be of an opaque, porous, and windproof fabric. Plastic, mesh, translucent or transparent materials will not be allowed. The covering material shall be a single neutral color, except orange or yellow, and shall not contain any wording or images.

645-3 CONSTRUCTION DETAILS

645-3.01 General. Sign panels, overhead panels, overhead vertical brackets, vertical and horizontal Z-bars, sign support systems, sign posts, breakaway bases and hinge assemblies, and foundations for Type B sign posts shall be constructed in accordance with the contract documents, standard sheets, MUTCD and materials details. Sign locations shown in the contract documents are approximate, and the exact location for each sign will be approved by the Engineer in the field.

The Contractor shall erect new signs and remove existing signs in such a manner that the traveling public is provided all necessary regulatory, warning, and guidance information at all times. Certain items may be designated to be performed prior to other items of work.

An inspection installed signs will be made in the daylight for color, reflectivity, location, vertical post alignment, visibility, and appearance. The installed signs will also be inspected at night for color, orientation and reflectivity, traits which will be more conspicuous at night.

A. Wind Loads. The wind pressures given on the standard sheets have been calculated according to the procedure in the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals (1994). All wind loading shall be adjusted for height, drag, and gusting in accordance with AASHTO's Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals (1994). Allowable sign areas shall be reduced when the sign centroid height is at an elevated site condition (e.g., an overpass) where the influence of the ground on the wind is reduced. For example, a sign centroid between 8.84 m and 14.94 m above the existing ground would result in a 37.5% increase in wind pressure (refer to the section "Loads" in aforementioned AASHTO Specifications).

<table>
<thead>
<tr>
<th>TABLE 645-1 WIND LOAD CRITERIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Region</td>
</tr>
<tr>
<td>--------</td>
</tr>
<tr>
<td>Type A Post</td>
</tr>
<tr>
<td>Type B Post</td>
</tr>
<tr>
<td>Type A Post</td>
</tr>
<tr>
<td>Type B Post</td>
</tr>
</tbody>
</table>

NOTE: Panel centroid height measured above the surrounding terrain.

645-3.02 Sign Panels. Sign panels shall be installed as shown on the standard sheets or as shown in the contract documents. Nominal widths are based on a conversion factor of 25 mm per inch in accordance with §200.8 of the MUTCD. Layout of sign panels and assemblies shall be as shown in the contract documents. Aluminum Overhead Mounted Sign Panels shall be separated from steel overhead sign structures in order to prevent corrosion by a Type A Sign Structure Bearing Pad or a Type B Sign Structure Bearing Pad as shown in the contract documents.
§645

645-3.03 Type A Sign Posts. The Contractor shall install Type A sign posts individually or in groups to provide the required moment resistance. Type A sign posts with Extra Embedment, and Soil Plates for Type A sign post, shall be installed where extra embedment depth and/or soil plates are required. High-Capacity Type A sign posts shall also be installed where extra moment capacity is required.

The number of Type A sign posts indicated in the contract documents is based on the information available during design. The number and strength of Type A sign posts installed shall be based on conditions at the final sign location approved by the Engineer. The Contractor shall determine the required moment resistance for the Type A sign post(s) due to the wind loads indicated in §645-3.01A. Wind Loads, and propose an appropriate number and strength of Type A sign posts for the approval of the Engineer. The Contractor shall submit the approved Materials Details, and any computations, to the Engineer, and install the required number of Type A sign posts subject to the following criteria:

1. For signs with a nominal width greater than 750 mm, at least two posts are required, except that the nominal 750 mm x 750 mm diamond panel and the nominal 900 mm wide "YIELD" panel require only one post.
2. The maximum number of posts installed within a 2.13 m path shall be as described on the approved Materials Details.
3. For single flanged channel post installations only, the required moment resistance for the post shall be increased by 25% to account for torsional shear. The Materials Details include this adjustment.

645-3.04 Type B Sign Posts. The Contractor shall install Type B sign posts, breakaway bases, hinge assemblies and foundations in accordance with the details shown on the standard sheets or the manufacturer's approved materials details.

The Type B sign post type, size and number shown in the contract documents are based on the information available during design. The sign post type, size and number to be installed by the Contractor shall be based on conditions at the final location approved by the Engineer. The Contractor shall determine the required moment resistance for the Type B sign post(s) based on the wind loads indicated in §645-3.01A. Wind Loads and verify the sign post type, size, number, hinge capacity and 2.13 m wheel path criteria for the approval of the Engineer. The Contractor shall submit any computations to the Engineer.

The Contractor may install breakaway type bases under the contract pay item for nonbreakaway type posts provided that nonslotted hinge plates are used on both flanges and the installation is outside the clear zone or otherwise protected.

A. Rustic Type B Sign Posts. Rustic Type B sign posts shall be installed in the same manner as Type B sign posts.

B. Breakaway Bases and Hinge Assemblies. Breakaway bases and hinge assemblies shall be installed in accordance with the standard sheets or the manufacturer's approved materials details.

When breakaway bases and hinge assemblies are used with rustic Type B sign posts, the breakaway bases and hinge assemblies shall be installed as follows:

1. The front (approach) flange hinge plate of rustic Type B sign posts shall be installed as shown on the contract drawings, except that an additional galvanized steel flat washer shall be installed on all four bolts between each post and the slotted hinge plate to assure proper slippage.
2. All miscellaneous visible galvanized steel hardware, except in the vicinity of the hinge plate slots, shall be painted with Weathered Brown Guide Rail Paint.

645-3.05 Concrete Foundations. Concrete foundations shall be constructed in accordance with the Materials Detail Sheets and contract documents. Upon completion of the sign installation the Contractor shall restore the area to its original state.
### TABLE 645-2 ALLOWABLE SIGN AREAS ON 2 BREAKAWAY WOODEN POSTS

<table>
<thead>
<tr>
<th>Wooden Post Section (mm)</th>
<th>Embedment (m)</th>
<th>97 km/h Wind Velocity Height to Panel Centroid (m)</th>
<th>113 km/h Wind Velocity Height to Panel Centroid (m)</th>
</tr>
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<tbody>
<tr>
<td>89 x 89</td>
<td>1.5</td>
<td>1.36</td>
<td>0.81</td>
</tr>
<tr>
<td>1.8</td>
<td>1.02</td>
<td>0.81</td>
<td>0.68</td>
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<tr>
<td>3.0</td>
<td>0.81</td>
<td>0.68</td>
<td>0.57</td>
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<tr>
<td>3.6</td>
<td>0.68</td>
<td>0.57</td>
<td>0.48</td>
</tr>
<tr>
<td>89 x 140</td>
<td>1.8</td>
<td>3.26</td>
<td>2.44</td>
</tr>
<tr>
<td>1.8</td>
<td>2.44</td>
<td>1.96</td>
<td>1.63</td>
</tr>
<tr>
<td>3.0</td>
<td>1.96</td>
<td>1.63</td>
<td>1.38</td>
</tr>
<tr>
<td>3.6</td>
<td>1.63</td>
<td>1.38</td>
<td>1.15</td>
</tr>
<tr>
<td>140 x 190</td>
<td>2.1</td>
<td>8.65</td>
<td>6.48</td>
</tr>
<tr>
<td>1.8</td>
<td>6.48</td>
<td>5.19</td>
<td>3.66</td>
</tr>
<tr>
<td>3.0</td>
<td>5.19</td>
<td>3.66</td>
<td>3.05</td>
</tr>
</tbody>
</table>

**NOTE:**
- For 1 post, reduce allowable sign areas by 60%.
- For 3 posts, increase allowable sign areas by 50%.
- For 3 posts, outer posts shall be separated by more than 2.4 m.

### 645-3.06 Breakaway Wooden Sign Posts

Breakaway wooden sign posts shall be installed in accordance with Table 645-2, *Allowable Sign Areas on 2 Breakaway Wooden Posts* and Materials Details. Each sign stringer to post attachment shall be bolted completely through the post using two 10 mm diameter stainless steel bolts with nuts and washers. Posts shall use a concrete foundation as noted in Subsection 645-2.05 in this specification, with a steel tube insert or be backfilled with compacted cushion sand or stone screening, as noted in the Materials Detail Sheets and contract documents.

### 645-3.07 Pole-Mounted Sign Support Systems

Pole-Mounted Sign Support Systems shall consist of stainless steel bands and brackets which shall be firmly attached to the pole in accordance with the standard sheets and/or manufacturer's instructions. Each horizontal Z-Bar stiffener shall be banded to the pole. Sign panels without Z-Bars shall be attached to the pole with two bands.

Where ground-mounted signs are to be mounted on traffic signal or street lighting poles, they and their mountings shall be designed to withstand the wind loadings shown in Table 645-1. Each horizontal Z-Bar stiffener (stringer) shall be firmly attached to the pole.

### 645-3.08 Illuminated Signs

Illuminated sign panels shall be installed as shown in the contract documents. All work on the illumination system shall be performed in accordance with the National Electrical Code and the requirements of the local utility. Electrical circuits shall be tested by the Contractor for insulation resistance and ground resistance in accordance with the requirements below.

Testing equipment shall be supplied by the Contractor and the tests shall be performed in the presence of the Engineer.

#### A. Insulation Resistance Test

Each circuit including ballasts and protective devices shall be insulation tested using an insulation tester according to manufacturers instructions. The Contractor shall compute a polarization index by dividing a ten-minute reading by a one-minute reading. The polarization index shall be greater than 4.0 for acceptance of new circuits, and greater than 2.0 for acceptance of existing circuits. The lighting system shall be properly grounded and disconnected while this test is conducted.

#### B. Ground Resistance Test

A ground test shall be performed by the Contractor using an earth tester with resolution to a minimum of 0.1 ohm. The test shall be performed, and the results interpreted, according to manufacturer's instructions. Readings of 5.0 ohms or less will be required for acceptance.

#### C. Functional Test

After satisfactory completion of all other tests, a functional test shall be performed consisting of not less than ten consecutive days of satisfactory operation. If unsatisfactory performance of any component of the lighting system is discovered during this time, the condition shall be corrected and the Engineer may require the test repeated until ten days of continuous satisfactory operation is obtained.

Temporary shutdowns caused by power interruption or vehicle impact will not constitute discontinuity of the functional test.
645-3.09 Covering Signs. Signs shall be covered to eliminate noncurrent, conflicting, or unneeded information. The cover shall be held in place and positioned so that none of the sign face shows. More than one layer of fabric may be required to prevent legibility of the sign legend to be covered.

The cover shall be folded over the top and bottom of panel edges, but not on the sides, and secured to the back of the sign panel. Tape shall not be attached to the face of the sign panel nor shall holes be drilled in the sign panel or posts. Coverings that work loose shall be resecured by the Contractor at no additional expense to the State. The cover shall remain in place until the sign is no longer in conflict with current conditions.

645-4 METHOD OF MEASUREMENT

645-4.01 General. (VACANT)

645-4.02 Sign Panels. The work will be measured as the number of square meters measured to the nearest 0.01 square meter of sign panel satisfactorily covered or installed.

The area of each panel will be measured as the area shown on the standard sheets. For sign panels not shown on the standard sheets, the area will be measured as the product of length and width, with no reduction for rounded corners. When sign panels are mounted back-to-back, each panel face will be measured separately.

645-4.03 Type A Sign Posts. The work will be measured as the number of Type A sign posts required, which is the greater of either:

1) the number of posts required based on the width of the sign; or,
2) the number of posts of standard strength (2800 N•m moment capacity) required to resist the moment due to wind load.

A. Type A Sign Posts With Extra Embedment. The work will be measured as the number of Type A sign posts with extra embedment satisfactorily installed with these modified bases.

B. Soil Plates for Type A Sign Posts. The work will be measured as the number of soil plates for Type A sign posts satisfactorily installed on either standard Type A sign posts, or on Type A sign posts with extra embedment.

C. High-Capacity Type A Sign Posts. The work will be measured as the number of high-capacity Type A sign posts satisfactorily installed. Post systems in which two posts are combined to function as a single post, such as the back-to-back flanged channel or the telescoping square tube, are measured as one post.

645-4.04 Type B Sign Posts and Rustic Type B Sign Posts. The work will be measured as the number of Type B sign posts or rustic Type B sign posts satisfactorily installed. When the Engineer directs that a different size Type B sign post be installed at a location that is called for in the contract documents, and there is no contract pay item in the contract for the directed post, the original quantity shall be multiplied by the following factor: kg/m of directed post divided by kg/m of original post.

645-4.05 Concrete Foundations. The work will be measured as the number of concrete foundations for Type A Sign Posts, High-Capacity Type A Sign Posts, or Breakaway Wooden Sign Posts with steel tube inserts satisfactorily installed.

645-4.06 Breakaway Wooden Sign Posts. The work will be measured as the number of breakaway wooden sign posts satisfactorily installed.

645-4.07 Pole-Mounted Sign Support System. The work will be measured as the number of pole-mounted sign support systems satisfactorily installed. A pole-mounted sign support system is defined as the hardware necessary to mount a single sign panel on an existing pole, regardless of the number of bands used.
§645

645-4.08 Illuminated Sign Panels. The work will be measured as the number of square meters measured to the nearest 0.01 square meter of illuminated sign panel satisfactorily installed.

645-4.09 Covering Sign Panels. (Vacant).

645-5 BASIS OF PAYMENT

645-5.01 General. The unit price bid for all items shall include the cost of furnishing all labor, materials, and equipment necessary to complete the work.

645-5.02 Sign Panels. The unit price bid for sign panels shall include the panels, horizontal and vertical stiffeners (Z-Bars), vertical overhead brackets to mount sign panels to overhead structures, and fasteners and miscellaneous hardware necessary to complete the work. The cost of sign panels that are to become part of larger signs (e.g., route shields on large guide signs) shall be included in the unit price bid for the main panel.

645-5.03 Type A Sign Posts. The unit price bid for Type A sign posts, Type A sign posts with extra embedment, soil plates for Type A sign posts, and high-capacity Type A sign posts shall include the cost of furnishing all labor, materials and equipment necessary to complete the work.

645-5.04 Type B Sign Posts. The unit price bid for Type B sign posts shall include the posts, breakaway base and hinge assemblies, and concrete footings. Breakaway bases provided in lieu of nonbreakaway posts at the Contractor's option will be paid for at the bid price for nonbreakaway bases.

645-5.05 Concrete Foundations. The unit price bid for Concrete Footing for Type A, High-Capacity Type A or Breakaway Wooden Sign Posts with steel tube inserts shall include the cost of furnishing all labor, materials and equipment necessary to install the footing and hardware.

645-5.06 Breakaway Wooden Sign Posts. The unit price bid for breakaway wooden sign posts shall include the posts and backfill if required.

645-5.07 Pole-Mounted Sign Support Systems. The unit price bid for pole-mounted sign support systems shall include the cost of furnishing all labor, materials and equipment necessary to install the sign panel on an existing pole, regardless of the number of bands used.

645-5.08 Illuminated Sign Panels. The unit price bid for illuminated sign panels shall include the work required under §645-5.02 Sign Panels, and all luminaires, bulbs, ballasts, wiring, conduit, and fittings from a point just above the footing to the most extreme luminaire. The unit price bid for illuminated sign panels shall also include the cost to energize and test the illuminated sign panel. The cost of energy necessary to illuminate sign panels before final contract acceptance shall be borne by the Contractor. The cost of controllers will be paid separately.

645-5.09 Covering Sign Panels. The unit price for covering sign panels shall include the work required for covering permanent signs: covering construction signs will be paid under Construction Signs.

Payment will be made under:

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<thead>
<tr>
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<th>Item</th>
<th>Pay Unit</th>
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<tbody>
<tr>
<td>645.71XX</td>
<td>Ground-Mounted Sign Panel MUTCD Codes R, P, W, and M</td>
<td>Square Meter</td>
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<td>I/III</td>
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<td>Greater than 1625 mm</td>
<td>14</td>
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</table>
§645

645.72 Overhead-Mounted Sign Panels, MUTCD Codes R, P, W and M Square Meter
645.73 Ground-Mounted Sign Panels, MUTCD Codes G and I Square Meter
645.74 Overhead-Mounted Sign Panels, MUTCD Codes G and I Square Meter
645.75 Tourist and Motorist Service Sign Panels Square Meter
645.76 Illuminated Sign Panels Square Meter
645.77 Covering Sign Panels Square Meter
645.78 High-Visibility Overhead-Mounted Sign Panel MUTCD Codes R, P, W, and M Square Meter

645.81 Type A Sign Posts Each
645.8104 Type A Sign Posts with Extra Embedment Each
645.8105 Soil Plate for Type A Sign Post Each
645.8106 High-Capacity Type A Sign Posts Each
645.8107 Concrete Footing for Type A, High-Capacity Type A or Breakaway Wooden Sign Posts With Steel Tube Inserts Each
645.82 Breakaway Wooden Sign Posts Each
645.8XYZZ Type B Sign Posts Each

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<td>Galvanized</td>
<td>01 S75X8</td>
<td>01 Nonbreakaway</td>
</tr>
<tr>
<td>4</td>
<td>Rustic</td>
<td>02 W150X14</td>
<td>02 Bidirectional Breakaway</td>
</tr>
<tr>
<td></td>
<td></td>
<td>03 W150X18</td>
<td>03 Omnidirectional Breakaway</td>
</tr>
<tr>
<td></td>
<td></td>
<td>04 W200X22</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>05 W250X28</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>06 W250X33</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>07 W310X39</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>08 W360X51</td>
<td></td>
</tr>
</tbody>
</table>

645.85 Pole-Mounted Sign Support System (Band Mounting) Each

SECTION 646 - DELINEATORS, REFERENCE MARKERS AND SNOWPLOWING MARKERS

646-1 DESCRIPTION. This work shall consist of furnishing and installing delineators, reference markers and snowplowing markers in accordance with the N.Y.S.M.U.T.C.D., Reference Marker Manual, standard sheets, plans or as ordered by the Engineer.

646-1.01 Delineators. Delineators are reflective units placed on supports along the highway to serve as driving aids.

646-1.02 Reference Markers. Reference markers are panels with a legend, placed at approximately 161 meter intervals along the highway, to provide a numerical location reference.

646-1.03 Snowplowing Markers. Snowplowing markers are reflective units installed along the highway to identify guardrail sections for snowplow operators.

646-2 MATERIALS. Materials for delineators, reference markers and snowplowing markers shall meet the requirements of the following subsection of Section 700 Materials except as provided for below:

Galvanized Coating and Repair Methods 719-01
Aluminum Sign Panels 730-01
Reflective Sheeting 730-05
(Materials Designations 730-05.02 and 730-05.03)
Acrylic Plastic Reflex Reflectors for Delineators 730-10
Sign Posts and Footings 730-20
Flexible Delineator Posts 730-21
Stiffeners, Overhead Brackets and Miscellaneous Hardware 730-22.
§646-2.01 Posts. Posts shall be fabricated from galvanized steel as shown on the standard sheets and/or plans, or an approved flexible post meeting the requirements of §730-21 Flexible Delineator Posts.

§646-2.02 Reflective Material. Delineators and snowplowing markers shall be fabricated from either Reflective Sheeting, Material Designations 730-05.02 (Class B) or 730-05.03 (Class C), or from Acrylic Plastic Reflex Reflectors. On any one contract all of the delineators must be fabricated from the same material and all of the snowplowing markers must be fabricated from the same material, but the material may differ between the delineators and the snowplowing markers.

Reference markers shall be fabricated from Reflective Sheeting, Materials Designation 730-05.02 (Class B).

§646-2.03 Aluminum Panels. Aluminum panels for delineators, reference markers and snowplowing markers shall be of aluminum alloy 6061-T6 in accordance with the standard sheets.

§646-2.04 Fasteners. Fasteners shall be fabricated from stainless steel, galvanized steel or aluminum as shown on the standard sheets.

§646-2.05 Brackets. Mounting brackets shall be fabricated from either aluminum alloy 6061-T6 or galvanized steel or polycarbonate (0.080) as shown on the standard sheets.

§646-2.06 Corrosion Protection. All steel surfaces shall be prevented from coming in direct contact with the aluminum brackets by means of either an approved mastic or 3 mm thick pad placed between the dissimilar metals.

§646-3 CONSTRUCTION DETAILS

§646-3.01 Fabrication. Delineators and snowplowing markers shall be fabricated as shown on the standard sheets. Reference markers shall be fabricated as shown on the standard sheets from reflective sheeting with the legends applied by reverse silk screening and/or directly applied reflective characters using green background and white letters. Legend content shall be as shown on the plans.

§646-3.02 Location. Delineators shall be installed at the locations and spacing as shown on the plans or as ordered by the Engineer. Directional orientation, arrangement, number and color of reflector units, at any given location shall be as shown on the plans.

Reference markers shall be installed at approximately 161 meter intervals along the highway. The Contractor will be given the location of each marker.

Snowplowing markers and supplementary snowplowing markers shall be installed at the locations shown on the plans or as ordered by the Engineer.

§646-3.03 Erection. Delineators, reference markers and snowplowing markers are to be erected on posts, brackets, existing posts and structures in the manner shown on the standard sheets.

§646-3.04 Inspection. After the installation of delineators, reference markers and snowplowing markers, an inspection by the Engineer shall be made in the day time for proper location, line and grade, vertical post alignment and visibility. They shall also be inspected at night for improper orientation, specular reflection and other defects more conspicuous at night. All apparent defects disclosed after the day and night inspections shall be corrected by the Contractor to the satisfaction of the Engineer and the cost thereof shall be included in the Contractor's unit price bid.

§646-3.05 Damage. When delineators and markers are installed on walls, bridges, existing posts, poles or structures, care shall be taken so as not to damage the appearance or structural features of the existing facilities. All damaged features shall be repaired or replaced, at no additional cost, to the satisfaction of the Engineer.
§646

646-3.06 Marker Relocation. The existing markers shall be carefully removed and stockpiled above ground in a neat and skilled manner, to the satisfaction of the Engineer, by the Contractor at the site or sites within the R.O.W. limits as designated by the Engineer. Care shall be exercised in removing the markers to prevent damage to any part of the reflectorized panels. All markers so damaged shall be replaced at the Contractor's expense.

The contractor shall remove and dispose of all existing posts or hardware used only for the support of the existing markers.

Markers removed shall be re-erected on new posts, brackets, or bands at the locations called for on the plans or specified by the Engineer.

646-4 METHOD OF MEASUREMENT. Delineators, reference markers and snowplowing markers shall be measured as the number of complete markers and/or delineators furnished and installed. In the event a section of highway is under construction by others and reference markers cannot be installed, they will be measured as the number of marker panels furnished only.

Relocated markers shall be measured as the number of markers relocated in accordance with these specifications and in a manner approved by the Engineer.

646-5 BASIS OF PAYMENT. The unit price bid shall include the cost of all materials, equipment and labor necessary to satisfactorily complete the work.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>646.0601</td>
<td>Delineator, Single Unit, One Way on Post</td>
<td>Each</td>
</tr>
<tr>
<td>646.0602</td>
<td>Delineator, Single Unit, Back to Back on Post</td>
<td>Each</td>
</tr>
<tr>
<td>646.0603</td>
<td>Delineator, Single Unit, Two Way on Post</td>
<td>Each</td>
</tr>
<tr>
<td>646.0604</td>
<td>Delineator, Single Unit, Three Way on Post</td>
<td>Each</td>
</tr>
<tr>
<td>646.0605</td>
<td>Delineator, Single Unit, Four Way on Post</td>
<td>Each</td>
</tr>
<tr>
<td>646.0606</td>
<td>Delineator, Double Unit on Post</td>
<td>Each</td>
</tr>
<tr>
<td>646.0607</td>
<td>Delineator, Single Unit, Band or Bracket Mounted</td>
<td>Each</td>
</tr>
<tr>
<td>646.0608</td>
<td>Delineator, Double Unit, Band or Bracket Mounted</td>
<td>Each</td>
</tr>
<tr>
<td>646.0609</td>
<td>Delineator, Single Unit, Back to Back, Band or Bracket Mounted</td>
<td>Each</td>
</tr>
<tr>
<td>646.0610</td>
<td>Delineator, Single Unit, Two Way, Band or Bracket Mounted</td>
<td>Each</td>
</tr>
<tr>
<td>646.0611</td>
<td>Delineator, Single Unit, Three Way, Band or Bracket Mounted</td>
<td>Each</td>
</tr>
<tr>
<td>646.0612</td>
<td>Delineator, Single Unit, Four Way, Band or Bracket Mounted</td>
<td>Each</td>
</tr>
<tr>
<td>646.0623</td>
<td>Delineator, White, Single Unit, One Way on Flexible Post</td>
<td>Each</td>
</tr>
<tr>
<td>646.0624</td>
<td>Delineator, White, Single Unit, Back to Back, on Flexible Post</td>
<td>Each</td>
</tr>
<tr>
<td>646.0625</td>
<td>Delineator, White, Double Unit on Flexible Post</td>
<td>Each</td>
</tr>
<tr>
<td>646.0633</td>
<td>Delineator, Yellow, Single Unit, One Way on Flexible Post</td>
<td>Each</td>
</tr>
<tr>
<td>646.0634</td>
<td>Delineator, Yellow, Single Unit, Back to Back, on Flexible Post</td>
<td>Each</td>
</tr>
<tr>
<td>646.0635</td>
<td>Delineator, Yellow, Double Unit on Flexible Post</td>
<td>Each</td>
</tr>
<tr>
<td>646.0701</td>
<td>Reference Marker, 1.2 m Mounting Height</td>
<td>Each</td>
</tr>
<tr>
<td>646.0702</td>
<td>Reference Marker, 2.1 m Mounting Height</td>
<td>Each</td>
</tr>
<tr>
<td>646.0703</td>
<td>Reference Marker, Band or Bracket Mounted</td>
<td>Each</td>
</tr>
<tr>
<td>646.0704</td>
<td>Reference Marker, On Existing Post</td>
<td>Each</td>
</tr>
<tr>
<td>646.0705</td>
<td>Reference Marker, Furnish Panel Only</td>
<td>Each</td>
</tr>
<tr>
<td>646.0801</td>
<td>Snowplowing Marker, Single Unit</td>
<td>Each</td>
</tr>
<tr>
<td>646.0802</td>
<td>Snowplowing Marker, Double Unit</td>
<td>Each</td>
</tr>
<tr>
<td>646.0803</td>
<td>Supplementary Snowplowing Marker</td>
<td>Each</td>
</tr>
<tr>
<td>646.09</td>
<td>Marker-Relocation</td>
<td>Each</td>
</tr>
</tbody>
</table>

SECTION 647 - REMOVING, STORING AND RELOCATING SIGNS

647-1 DESCRIPTION. This work shall include the removal, or removal and storage, or relocation of existing State signs and/or sign structures designated on the plans or specified by the Engineer. The sign components shall include sign panels, stringers, vertical brackets, miscellaneous hardware used solely for the support of the designated sign panels, upright supports, bracing and structures.
**§647**

**647-2 MATERIALS.** All materials used in this work shall meet the requirements of §645-2.

**647-3 CONSTRUCTION DETAILS**

**647-3.01 Removal of Signs.** Existing traffic signs requiring removal, but not storage, shall become the property of the Contractor and shall be removed from the work site in a neat and skillful manner to the satisfaction of the Engineer.

**647-3.02 Removal and Storage of Signs.** Existing traffic signs shall be removed and stockpiled off the ground in a neat and skillful manner, to the satisfaction of the Engineer, by the Contractor at the site or sites within the R.O.W. limits as approved by the Engineer.

**647-3.03 Removal of Concrete Sign Footings.** All concrete sign footings shall be completely removed, or if allowed by the Engineer, shall be cut to a depth of 0.3 meters below existing ground and be replaced with suitable material as specified by the Engineer.

**647-3.04 Relocation of Signs.** Existing sign panels shall be removed and stockpiled off the ground in a neat and skillful manner by the Contractor to the satisfaction of the Engineer, at the site or sites within the R.O.W. limits as designated by the Engineer. Care shall be exercised in removing the sign panels to prevent damage to any part of the reflectorized sign face or characters, or the existing stringers or stiffeners. Any damage shall be repaired or the damaged part replaced to the satisfaction of the Engineer at the Contractor's expense.

Existing sign posts shall become the property of the Contractor and shall be removed from the work site in a neat and skillful manner.

The Contractor shall erect new sign posts and mount the existing sign panels at the locations shown on the plans or specified by the Engineer. The requirements of §645-3, Construction Details, shall apply to this work.

**647-4 METHOD OF MEASUREMENT.** The quantity to be paid for will be the number of completely removed or relocated installations having sign areas of the following sizes:

<table>
<thead>
<tr>
<th>Size A: 0.0 to 1.0 Square Meters</th>
<th>Size B: 1.1 to 2.0 Square Meters</th>
<th>Size C: 2.1 to 4.0 Square Meters</th>
<th>Size D: 4.1 to 10.0 Square Meters</th>
<th>Size E: Over 10.0 Square Meters</th>
<th>All Overhead Sign Panels (Any Size)</th>
</tr>
</thead>
</table>

**647-5 BASIS OF PAYMENT.** The unit price bid for removing or removing and storing or relocating an existing installation shall be compensation in full for the furnishing of all labor, equipment, and materials necessary described in this section.

**Payment will be made under:**

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>647.01</td>
<td>Removal of Signs - Size A (0.0 to 1.0 S.M.)</td>
<td>Each</td>
</tr>
<tr>
<td>647.02</td>
<td>Removal of Signs - Size B (1.1 to 2.0 S.M.)</td>
<td>Each</td>
</tr>
<tr>
<td>647.03</td>
<td>Removal of Signs - Size C (2.1 to 4.0 S.M.)</td>
<td>Each</td>
</tr>
<tr>
<td>647.04</td>
<td>Removal of Signs - Size D (4.1 to 10.0 S.M.)</td>
<td>Each</td>
</tr>
<tr>
<td>647.05</td>
<td>Removal of Signs - Size E (Over 10.0 S.M.)</td>
<td>Each</td>
</tr>
<tr>
<td>647.06</td>
<td>Removal and Storage of Signs Size A (0.0 to 1.0 S.M.)</td>
<td>Each</td>
</tr>
<tr>
<td>647.07</td>
<td>Removal and Storage of Signs Size B (1.1 to 2.0 S.M.)</td>
<td>Each</td>
</tr>
<tr>
<td>647.08</td>
<td>Removal and Storage of Signs Size C (2.1 to 4.0 S.M.)</td>
<td>Each</td>
</tr>
<tr>
<td>647.09</td>
<td>Removal and Storage of Signs Size D (4.1 to 10.0 S.M.)</td>
<td>Each</td>
</tr>
<tr>
<td>647.10</td>
<td>Removal and Storage of Signs Size E (Over 10.0 S.M.)</td>
<td>Each</td>
</tr>
<tr>
<td>647.11</td>
<td>Relocating Signs Size A (0.0 to 1.0 S.M.)</td>
<td>Each</td>
</tr>
<tr>
<td>647.12</td>
<td>Relocating Signs Size B (1.1 to 2.0 S.M.)</td>
<td>Each</td>
</tr>
<tr>
<td>647.13</td>
<td>Relocating Signs Size C (2.1 to 4.0 S.M.)</td>
<td>Each</td>
</tr>
<tr>
<td>647.14</td>
<td>Relocating Signs Size D (4.1 to 10.0 S.M.)</td>
<td>Each</td>
</tr>
</tbody>
</table>
SECTION 648 - SUBSURFACE EXPLORATIONS

648-1 DESCRIPTION. This work shall consist of furnishing equipment, drilling for soil and rock samples, and preparing a driller's log in accordance with these specifications and the direction of the Engineer.

648-2 MATERIALS. Materials for this work shall meet the requirements of the following Subsections of Section 700 - Materials Details:

- Drill Rigs 732-01
- Drive Pipe 732-02
- Casing 732-03
- Samplers 732-04
- Thin-Walled Sample Tubes 732-05
- Coring Bits 732-06
- Sample Storage Bags 732-07
- Sample Jars 732-08
- Jar Cartons 732-09
- Boulder and Rock Core Boxes 732-10
- Open Well Piezometers 732-11
- Grout 732-12

648-3 CONSTRUCTION DETAILS

648-3.01 General. This work shall consist of furnishing equipment, clearing of all drill holes in accordance with New York State Department of Public Service Rule 753, drilling for soil and rock samples, back filling all drill holes to the satisfaction of the Engineer, and preparing a driller's log in accordance with these specifications. Any proposed variation from the methods and techniques in the specifications shall be submitted in writing by the Contractor to the Engineer who shall forward the proposal to the Director of the Geotechnical Engineering Bureau for review. Approval, if granted, will be based on the decision of the Director of the Geotechnical Engineering Bureau as to the capabilities of the proposed variation to provide satisfactory samples and subsurface information. If granted, this approval will remain in force only so long as all conditions set forth in the approval are met and satisfactory results are obtained. In the event unsatisfactory results are obtained, the approval will be withdrawn and all remaining work shall be completed in accordance with this specification. Boring work shall not commence until all equipment stated in the proposal is on the project and approved. In addition, the following shall apply:

A. Furnishing equipment for Making Borings. The Contractor shall furnish the number of drill rigs, conforming to §732-01, stated in the proposal or work order, maintain this equipment, and remove it from the site at the time indicated by the Engineer. All equipment shall be acceptable to the Engineer.

B. Driller's Logs. The forms for the driller's logs, Form 282e, will be furnished by the State and shall have the following information legibly printed on them by the Contractor:

Region
County
Contractor Name
<table>
<thead>
<tr>
<th>Contract Number</th>
<th>Project Identification Number (PIN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Name</td>
<td>Date Started and Finished</td>
</tr>
<tr>
<td>Hole Number</td>
<td>Weight and Fall of Hammer (Casing)</td>
</tr>
<tr>
<td></td>
<td>Weight and Fall of Hammer (Sampler)</td>
</tr>
<tr>
<td>Casing and Sampler Size</td>
<td>Inspector Name (Regional Geotechnical Engineer on Log)</td>
</tr>
<tr>
<td>Structure Name/Number</td>
<td>Penetration Records (Blows on Casing, Drive Pipe and Sampler)</td>
</tr>
<tr>
<td>Sample numbers</td>
<td></td>
</tr>
</tbody>
</table>

**Groundwater Data**

- Depth at which drill water was first used
- Depth at which groundwater was first encountered
- Depth to groundwater at the beginning and end of each day's operation

**Rock Core**

- Length of Run
- Percent Recovery
- Number of Pieces
- Depth Core Obtained
- Size of Core Obtained
- Type of Core Barrel

**All pertinent remarks and comments**

The hole designation on the final log and sample containers should reflect the actual method of progressing the hole. Any change in hole designation (due to an alternate hole progression method) shall be forwarded to the Engineer in writing in a timely manner.

Provide all measurements and dimensions in metric units on the final log.

Ensure that the completed driller's log is signed by the drill rig operator, the drill rig inspector, and the Chief Inspector.

Deliver the samples and a copy of the completed driller's log to the location indicated in the Contract documents, between the hours of 8:00 A.M. and 3:00 P.M., within five working days following completion of the hole, except holidays. In addition, deliver another copy of the completed driller's log to the Departmental Geotechnical Engineer. Submit the original copy of the completed driller's log to the Engineer.

**C. Groundwater Determinations.** The level at which groundwater is first encountered in the borings shall be noted. Water level readings shall be taken at the end of each day after the last sample has been taken and the sample and rods have been removed. No soil shall be left in the casing at the end of the day. Do not fill the casing with water unless there is a need to compensate for a condition such as running sand. Measure and record the change in water level when resuming work. Capped borings shall be vented. Groundwater levels shall be measured before and after the casing or drive pipe is pulled. Each water level reading shall be recorded showing the date and time the reading was made, the depth of the drive pipe or casing, and the depth to water. Any loss or gain of water in the boring, except that caused by deliberately introducing water and/or inserting or removing tools, shall be recorded. This record shall show the date and time the loss or gain is noted, the depth of the casing and the depth to water. The height of artesian rise shall be recorded.

All water level readings and related data shall be recorded on the boring logs under “Remarks”. If necessary, additional forms shall be used for recording groundwater data.

Artesian pressures shall be permanently sealed at the elevation at which they were encountered. This seal shall be satisfactory to the Engineer before casing is removed from the hole.
648-3.02 Split Barrel Samples

**A. Progressing the Hole.** The hole shall be progressed by advancing flush-joint casing, flush-coupled casing, or extra-strength drive pipe by driving or drilling, or where permitted, by a drilling mud process or by using a hollow flight auger. When driven casing is used a 136.3 kg (± 3 percent) hammer falling freely 450 mm shall be used. Actuate the hammer by means of a rope and cathead, or by automatic hammer, when casing or drive pipe is driven.

Casing refusal shall be considered as 300 blows for less than 300 mm of penetration. When refusal is encountered, the casing shall be cleaned and a sample shall be attempted, if no sample is recovered, coring will commence.

Prior to sampling, the drill hole shall be cleaned to the sampling elevation by using equipment that will not disturb the material to be sampled. Bottom discharge bits, including samplers, will not be allowed. A roller bit may be used as a clean out tool if it is of a type that deflects water to the sides rather than downward into the material to be sampled. The Engineer may order a new roller bit at any time he deems the one in use to be unacceptable. “N” size drill rods or larger shall be used in 76.2 mm or larger inside diameter casing.

The Engineer shall be advised of the time of the last sampling operation so he may be present when the hole is measured for payment purposes.

**B. Sampling.** Samples shall be taken at every change in stratum but in no case at intervals greater than 1.5 m. Continuous sampling may be directed by the Engineer. The sampler shall be placed on the bottom of the cleaned out hole and then driven 450 mm with a 136.3 kg (±3 percent) hammer falling freely 450 mm. Actuate the hammer by means of a rope and cathead, or by automatic hammer. When the Standard Penetration Test (SPT) is required, use equipment and procedures conforming to ASTM D1586-84, except as modified by this specification.

The number of blows required to drive the sampler each increment of 150 mm shall be recorded. If refusal is encountered before the desired sample length is attained, and the sampler proves to have no recovery, the sampler shall be removed from the hole and core drilling started; however, if refusal is encountered and the material retained represents the best obtainable sample as determined by the Engineer, the hole may be progressed to the next sample elevation or change in soil strata. Refusal shall be 50 hammer blows for less than 150 mm of penetration for the 136.3 kg hammer. When the SPT is used, refusal shall be as defined in ASTM D1586-84.

When a recovery of less than 150 mm of sample in a split barrel sampler is retrieved, the sampler shall be re-driven at the same elevation in an attempt to obtain more material. Only the first set of blows shall be recorded on the boring log, but a note shall be included under “Remarks” indicating that a second sampling attempt was made. The Engineer may direct that a basket or other spring type retainer be used on any or all sampling attempts. Flap or trap valves will only be used when specifically directed by the Engineer. When sampling material below the water table, the hole shall be kept full of fluid during the removal of tools to prevent flowback, unless otherwise directed by the Engineer.

All samples, regardless of the amount of recovery, shall become the property of the State and shall be packaged, transported and delivered in accordance with this specification.

**C. Marking, Packaging and Transporting Sample.** Samples shall be placed in tied plastic storage bags placed in jars conforming to §732-08 in such a manner so as to maintain the natural structure of the sample. The jar shall be labeled to show the project name, PIN, sample number, hole number, and the depths from which the sample was taken. Jars shall be placed in cartons conforming to §732-09. Samples must be protected from freezing or extreme heat. The samples shall be delivered by the Contractor to the location indicated in the Contract documents between the hours of 8:00 A.M. and 3:00 P.M., within five working days following completion of the hole, excepting holidays.

If samples are not delivered in a timely manner, work will be suspended until the samples have been delivered as required by the contract.
§648

**D. Acceptance.** Samples having less than 150 mm of recovery or more than 50 mm of wash material will be considered unacceptable unless, in the judgment of the Engineer, the actual recovery represents the best sample obtainable. All samples shall become the property of the State.

648-3.03 Thin-Walled Tube Samples

**A. Progressing the Hole.** The hole shall be a minimum of 100 mm in diameter. Drilling mud may be used if permitted in writing by the Engineer. Hollow stem augers will not be allowed. The hole shall be cleaned using methods and equipment which will not disturb the soil to be sampled. Bottom discharge bits, including samplers, will not be allowed.

The 50 mm of soil directly above the sampling elevation shall be removed with a clean-out jet auger without the use of water. “N” size drill rod or larger shall be used.

**B. Sampling.** Thin-walled tube samples shall be taken in the strata designated by the Engineer. Samples shall be recovered with a stationary piston type sampler or a hydraulically operated piston sampler, modified to accept the thin-walled tubes specified in §732-05. Samplers with piston rods extending to the ground surface must be provided with clamps which positively lock the piston against upward travel during lowering of the sampler until the sampling depth is reached. During the press the piston rods shall be locked in a stationary position to eliminate any movements either up or down. In addition, the sampler shall also be provided with positive locks to secure the piston rods prior to removal of the sampler after penetration.

At the elevation to be sampled, the tube shall be pressed into the soil with a continuous motion a distance of 450 mm. Care must be taken to allow air and water to flow freely through the vent thus preventing compression of the soil sample. After pressing to the required depth and waiting for 5 minutes, the sampler shall be carefully rotated and removed from the hole.

During the removal of the sampler the hole shall be kept full of fluid. Before the thin-walled tube is removed from the piston, the piston rod shall be backed off to admit air past the flattened threads to break the vacuum. For other approved types of equipment, the necessary vacuum breaking measures shall be taken. The length of sample in the tube and also the distance pressed, shall be measured and recorded.

Should a thin-walled sample not be retained, a 50 mm driven sample shall be taken.

The bottom of the sample shall be carefully squared off at least 25 mm back from the end of the tube and a wax seal, approximately 25 mm thick, shall be poured in the bottom end of the tube. The soil at the top of the tube shall be carefully squared off and a wax seal, approximately 15 mm thick, shall be poured. Any space remaining between the top or bottom of the sample tube and the wax seal shall be filled with sawdust or paper after the wax has hardened. Wax will be furnished by the Geotechnical Engineering Bureau. The ends of the tubes shall be sealed with snugly fitting plastic caps which shall be secured in place with friction tape. Wax shall not be placed on the outside of the tube. Labels shall be placed on the tube below center and secured with strips of tape.

**C. Marking, Packaging and Transporting Samples.** Thin-walled tubes shall be labeled to show the Project Identification Number, Location, hole number, sample number, and depths from which the sample was taken. The samples shall be handled, stored and transported using care to prevent the samples from being subjected to freezing, drying, jarring and any other disturbance. The tubes properly packaged shall be stored and transported in an upright position at all times. The tubes shall be delivered by the Contractor to:

New York State Department of Transportation
Geotechnical Engineering Bureau
State Campus, Building 7
1220 Washington Avenue
Albany, New York 12232

between the hours of 8:00 A.M. and 3:00 P.M., within five working days after obtaining the tubes, excepting holidays.
648-3.04 Rock Core Samples

A. Progressing the Hole. The hole shall be progressed through the overburden in accordance with §648-3.02A until refusal is encountered. Continuous core drilling shall then be progressed in boulders and ledge rock at locations and to depths determined by the Engineer.

B. Sampling. Core shall be drilled using a double tube, swivel type core barrel. If at any time the core barrel is withdrawn more than 30 mm, the core barrel shall be removed from the hole and the core removed from the barrel.

C. Marking, Packaging and Transporting Samples. Rock cores shall be labeled in accordance with the current Geotechnical Engineering Bureau Drawing entitled “Proper Labeling of Rock Cores.” They shall be placed in core boxes constructed in accordance with the current Geotechnical Engineering Bureau Drawing entitled “Core Box - AX, BX, HX, NX Sizes” and delivered to the Department's Regional Office or to a location designated in the proposal within 2 weeks after completion of the hole.

D. Acceptance. Rock core recoveries of less than 85 percent of each run will be considered unacceptable unless, in the judgment of the Engineer, all obtainable state-of-the-art equipment and methods have been used and actual recovery represents the best obtainable.

648-3.05 Open Well Piezometer

A. Progressing the Hole. A 100 mm nominal diameter cased drill hole shall be progressed to the depth specified on the contract documents. Equipment conforming to the requirements contained in §732-01 shall be used.

B. Installing the Well Pipe. The open well piezometer shall be assembled to form a continuous pipe as recommended by the manufacturer or as directed by the Engineer. The open well piezometer shall be placed in the hole as shown in the Open Well Piezometer drawing to the elevation or depth specified in the contract documents or as directed by the Engineer. No grout, debris or other foreign material shall enter the PVC pipe during the installation.

C. (Vacant).

D. Placing the Bentonite Seal. After the final sand placement the steel casing shall be withdrawn an additional 300 mm. and the bentonite pellets placed to form a 300 mm thick seal.

E. Grouting and Casing Removal. The hole shall be grouted from the bottom using the mix found at the end of this subsection or in proportions approved by the Engineer. The contractor shall withdraw the casing. As the casing is being withdrawn, the level of grout shall be maintained within 1.5 m of the top of the hole at all times. The PVC pipe shall not be allowed to move vertically while withdrawing the casing.

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>NYSDOT SPECIFICATION REQ.</th>
<th>PROPORTION BY VOL.</th>
</tr>
</thead>
<tbody>
<tr>
<td>PORTLAND CEMENT TYPE 1 OR 2</td>
<td>§701-01</td>
<td>2 PARTS</td>
</tr>
<tr>
<td>WATER</td>
<td>§712-01</td>
<td>12 PARTS</td>
</tr>
<tr>
<td>BENTONITE (ground to pass a 75 µm mesh sieve)</td>
<td>N/A</td>
<td>1 PART</td>
</tr>
</tbody>
</table>
F. Finishing. Wait 18 hours for the grout to cure. If the grout bleeds or shrinks, the hole shall be backfilled with sand to within 300 mm of the top of the hole. The manhole shall be mortared over the top of the open well piezometer as shown in Open Well Piezometer drawing.

648-3.06 Bore Hole Grouting. Prior to placing the grout, the sides of the boring shall be supported to the satisfaction of the Engineer using casing or some other positive means. The Contractor shall mix the grout in the following proportions, by volume:

<table>
<thead>
<tr>
<th>Component</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bentonite</td>
<td>1 part</td>
</tr>
<tr>
<td>Dry Cement</td>
<td>12 parts</td>
</tr>
<tr>
<td>Water</td>
<td>18 parts</td>
</tr>
</tbody>
</table>

or in proportions approved by the Engineer. After the boring is cleaned out, a grout pipe shall be placed to the bottom of the hole and grout pumped through the pipe to completely fill the boring for the full depth of the boring. After grouting, the casing shall be removed, and the boring topped off with grout. All mixing and placing operations shall be performed to the satisfaction of the Engineer.

648-4 METHOD OF MEASUREMENT

648-4.01 Furnishing Equipment for Making Borings. The quantities to be paid for will be the number of drill rigs, including barges, platforms and support vessels where required on water, specified in the proposal or work order, and for additional drill rigs ordered on the project by the Engineer. Payment will not be made for any drill rig that does not work at least 75 percent of the total working time computed from the date of actual commencement of the work to the final completion date, except for additional drill rigs ordered to the project by the Engineer.

648-4.02 Split Barrel Sample. The quantity to be paid for will be the number of acceptable samples obtained.

648-4.03 Thin-Walled Tube Sample. The quantity to be paid for will be the number of acceptable samples obtained.

648-4.04 Rock Core Drilling. The quantity to be paid for will be the number of linear meters drilled from which acceptable core was obtained. Measurement for payment shall be made in the presence of the Engineer.

648-4.05 Drill Hole (65 mm and 100 mm diameter). The quantity to be paid for will be the number of linear meters of boring progressed in overburden, less a deduction equal to the specified sampling interval for each unacceptable sample. Measurement shall be made from the surface elevation where the boring starts (including top of bridge deck or the water surface if working from a floating platform) at each hole. Measurement for payment shall be made in the presence of the Engineer.

648-4.06 Open Well Piezometer. The quantity to be paid for will be the number of linear meters of PVC pipe satisfactorily installed in accordance with this specification, measured from the top of the pipe to the bottom of the slotted screen.

648-4.07 Bore Hole Grouting (65 mm and 100 mm diameter). The quantity to be paid for will be the number of linear meters of drill hole grouted in accordance with these specifications.

648-5 BASIS OF PAYMENT

648-5.01 Furnishing Equipment for Making Borings (on land or water). The unit price bid for each drill rig shall include the cost of all labor, materials and equipment including barges, platforms and
support vessels necessary to furnish, transport and maintain the drill rig, and dismantling and removing the equipment.

648-5.02 **Split Barrel Sample.** The unit price bid per sample shall include the cost of all labor, material and equipment necessary to obtain, mark, package and deliver the sample. The jars, cartons and samples shall become the property of the State.

648-5.03 **Thin-Walled Tube Sample.** The unit price bid per sample shall include the cost of all labor, materials and equipment necessary to obtain, mark, package and deliver the sample. The tubes and samples shall become the property of the State.

648-5.04 **Rock Core Drilling.** The unit price bid per meter shall include the cost of all labor, material and equipment necessary to obtain, mark, package and deliver the samples. The core boxes shall become the property of the State.

648-5.05 **Drill Hole (65 mm and 100 mm diameter).** The unit price bid per meter shall include the cost of all labor, clearing of all drill holes in accordance to New York State Department of Public Service Rule 753, and material and equipment used to progress the hole from which an acceptable sample or samples were obtained and acceptably recorded on a driller's log. The unit price bid shall be based on 15 meter incremental depths as follows:

- 0 - 15 meters
- 15 - 30 meters
- 30 - 45 meters
- 45 - 60 meters
- over 60 meters

648-5.06 **Open Well Piezometer.** The unit price bid for this item shall include the cost of all labor, materials and equipment necessary to satisfactorily install and protect the open well piezometer. The Contractor will receive full payment after the open well piezometer has been approved by the Engineer.

648-5.07 **Bore Hole Grouting (65 mm and 100 mm diameter).** The unit price bid for grouting borings shall include the cost of furnishing all labor, materials and equipment necessary to complete the work as required by these specifications. The cost for progressing the boring will be paid under its appropriate item.

### Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>648.01</td>
<td>Drill Hole, 65 mm diameter 0 to 15 m Depth Range</td>
<td>Meter</td>
</tr>
<tr>
<td>648.02</td>
<td>Drill Hole, 65 mm diameter 15 to 30 m Depth Range</td>
<td>Meter</td>
</tr>
<tr>
<td>648.03</td>
<td>Drill Hole, 65 mm diameter 30 to 45 m Depth Range</td>
<td>Meter</td>
</tr>
<tr>
<td>648.04</td>
<td>Drill Hole, 65 mm diameter 45 to 60 m Depth Range</td>
<td>Meter</td>
</tr>
<tr>
<td>648.05</td>
<td>Drill Hole, 65 mm diameter greater than 60 m Depth Range</td>
<td>Meter</td>
</tr>
<tr>
<td>648.06</td>
<td>Drill Hole, 100 mm diameter 0 to 15 m Depth Range</td>
<td>Meter</td>
</tr>
<tr>
<td>648.07</td>
<td>Drill Hole, 100 mm diameter 15 to 30 m Depth Range</td>
<td>Meter</td>
</tr>
<tr>
<td>648.08</td>
<td>Drill Hole, 100 mm diameter 30 to 45 m Depth Range</td>
<td>Meter</td>
</tr>
<tr>
<td>648.09</td>
<td>Drill Hole, 100 mm diameter 45 to 60 m Depth Range</td>
<td>Meter</td>
</tr>
<tr>
<td>648.10</td>
<td>Drill Hole, 100 mm diameter greater than 60 m Depth Range</td>
<td>Meter</td>
</tr>
<tr>
<td>648.11</td>
<td>Split Barrel Sample</td>
<td>Each</td>
</tr>
<tr>
<td>648.12</td>
<td>Thin-Walled Tube Sample</td>
<td>Each</td>
</tr>
<tr>
<td>648.13</td>
<td>Rock Core Drilling AX</td>
<td>Meter</td>
</tr>
<tr>
<td>648.14</td>
<td>Rock Core Drilling BX</td>
<td>Meter</td>
</tr>
<tr>
<td>648.15</td>
<td>Rock Core Drilling NX</td>
<td>Meter</td>
</tr>
<tr>
<td>648.16</td>
<td>Rock Core Drilling HX</td>
<td>Meter</td>
</tr>
<tr>
<td>648.17</td>
<td>Furnishing Equipment for making Borings</td>
<td>Each</td>
</tr>
<tr>
<td>648.18</td>
<td>Furnishing Equipment for making Borings on water</td>
<td>Each</td>
</tr>
<tr>
<td>648.19</td>
<td>Furn. Equip. for making Borings on water using stationary platform</td>
<td>Each</td>
</tr>
<tr>
<td>648.20</td>
<td>Open Well Piezometer</td>
<td>Meter</td>
</tr>
<tr>
<td>648.21</td>
<td>Grouting 65 mm Bore Hole</td>
<td>Meter</td>
</tr>
<tr>
<td>648.22</td>
<td>Grouting 100mm Bore Hole</td>
<td>Meter</td>
</tr>
</tbody>
</table>
SECTION 650 - JACKING REINFORCED CONCRETE PIPE

650-1 DESCRIPTION. Under this work the Contractor shall install by jacking, an extra strength, reinforced concrete, tongue and groove, culvert pipe of the size and at the location shown on the plans or as specified by the Engineer.

650-2 MATERIALS. Pipe shall meet all the requirements of §706-02, Reinforced Concrete Pipe for Class V, except that the exterior barrel shall be smooth.

650-3 CONSTRUCTION DETAILS

650-3.01 Approval

A. General. Construction drawings, showing the proposed method and procedure of jacking the pipe and construction of jacking and receiving pits shall be submitted to the Engineer for approval before work on the jacking operation is started. Approval of construction drawings shall not relieve the Contractor of his responsibility to perform the work without damage to existing construction. Field conditions may require changes in the approved drawings and such changes shall be subject to the approval of the Engineer.

B. Jacking Under Railroad. Construction drawings, methods, work and necessary precautions related to jacking pipe under a railroad shall be submitted to, meet the requirements of, and have the approval of the Chief Engineer of the railroad company. No work shall be commenced until such approval has been received from the railroad company.

650-3.02 Jacking Procedures

A. General. The pipe shall be jacked with jacks of sufficient capacity to shove the pipe through the embankment into position true to required line and grade and with tongue downstream. When jacking the pipe, a minimum 13 mm thick steel cutting shield at least 600 mm long with an arc length equal to 1/3 of the pipe circumference shall be required to abut the upper 1/3 circumference and extend beyond the forward end of the pipe being jacked. The outside radius of this shield shall not exceed the outside radius of the pipe. Excavation ahead of the pipe shall not be permitted to progress beyond the end of the shield being used.

B. Jacking Under Railroad. Rail hangers shall be installed by railroad company forces prior to the jacking operations, unless the Engineer is advised otherwise by the railroad company. The rail hangers will not be removed by railroad forces until all voids in the embankment as a result of the jacking operation, have been filled by the Contractor to the satisfaction of the railroad company.

650-3.03 Contractor Responsibility. The Contractor shall be held responsible for surface subsidence and damage or disturbance to adjacent property and facilities that may result from his construction methods. In case loose material is encountered and cave-ins occur or are anticipated, all jacking will be discontinued, approved shoring shall be provided and all voids filled either by pressure grouting or other approved methods before jacking is continued.

Field conditions may require that the actual jacking operations be continued without interruption in order to prevent undermining the roadway or the railroad roadbed and tracks. Should the Engineer permit interruption of jacking operations, the Contractor shall provide bulkheads and dewatering measures as approved by the Engineer.

650-3.04 Railroad Responsibility. Any settlement or upheaval of the railroad tracks resulting from the pipe installation and occurring within one year from the date the work is completed, will be corrected by the railroad company.
§650

650-4 METHOD OF MEASUREMENT. The quantity to be paid for under this work will be the number of linear meters of extra strength reinforced concrete culvert pipe jacked into place and measured in its final position.

650-5 BASIS OF PAYMENT

650-5.01 General. The unit price bid per linear meter shall include the cost of jacking the pipe; sheeting, bracing and flooring the jacking and receiving pits; excavation and backfill; pressure grouting; construction drawings; and all labor, materials and equipment (including dewatering if required) necessary to complete the work in accordance with the plans and specifications or directions of the Engineer; except the pipe which will be paid for separately under the contract item for Reinforced Concrete Pipe Class V. Rail hangers (if required) shall be installed and removed by railroad company forces at no cost to the Contractor.

No extra payment of any sort will be made for premium time which may be required under this work, but the cost thereof shall be included in the unit price bid.

No partial or final payment for jacking pipe under a railroad will be made until the work has been approved by the respective railroad company.

Costs incurred by the railroad company to correct settlement or upheaval of the railroad tracks resulting from the pipe installation and occurring within one year from the date of work is completed, will be reimbursed to the railroad company directly by the State at no cost to the Contractor.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>650.01nn</td>
<td>Jacking Reinforced Concrete Pipe Under Railroad</td>
<td>Meter</td>
</tr>
<tr>
<td>650.02nn</td>
<td>Jacking Reinforced Concrete Pipe Under Highway</td>
<td>Meter</td>
</tr>
</tbody>
</table>

Refer to the Contract Proposal for full item number and full description.

SECTION 651 - COMMUNICATION FACILITIES

651-1 DESCRIPTION. The work in this section shall include special construction of communication facilities which are required for outside agencies such as police and fire departments. The construction details for this work will be covered by special provisions in the contract documents.

SECTION 652 - FURNISHING AND APPLYING SALTS

652-1 DESCRIPTION. Under this work the Contractor shall furnish and apply salt for soil stabilization, as a dust palliative or for other purposes as specified.

652-2 MATERIALS. Materials for this work shall conform to the requirements of the following subsections of Section 700 - Materials:

- Calcium Chloride 712-02
- Sodium Chloride 712-03

652-3 CONSTRUCTION DETAILS

652-3.01 Stabilized Gravel Surface Course. The Contractor shall apply salt for stabilization in accordance with the construction details specified in §411-3.

652-3.02 Dust Control. The Contractor shall apply salt on the highway to control dust at the locations and during periods as the Engineer may direct. The salt shall be applied on the dampened road surface by means of approved line spreader or equal equipment. An approved sprinkler or other approved method
may be used to dampen the road surface. The recommended application rates for calcium chloride are as follows:

0.8 kg/m² per application
2.2 kg/m² per year

**652-4 METHOD OF MEASUREMENT.** Salt shall be measured by the number of the metric tons furnished and applied.

**652-5 BASIS OF PAYMENT.** The unit price bid per metric ton shall include all labor, material and equipment necessary to complete the work including necessary water to dampen the road surface.

*Payment will be made under:*

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>652.01</td>
<td>Furnishing and Applying Calcium Chloride</td>
<td>Metric Ton</td>
</tr>
<tr>
<td>652.02</td>
<td>Furnishing and Applying Sodium Chloride</td>
<td>Metric Ton</td>
</tr>
</tbody>
</table>

**SECTION 653 (VACANT)**

**SECTION 654 - IMPACT ATTENUATORS**

**654-1 DESCRIPTION.** The Contractor shall furnish and install, remove and dispose, remove and store, relocate, or refurbish impact attenuators of the indicated types and sizes at or from the locations indicated in the Contract Documents or those directed in accordance with these specifications, the Contract Documents, materials details, manufacturer’s directions and drawings, and the directions of the Engineer.

**654-2 MATERIALS.** Materials shall conform to the following subsections of these specifications:

- Class A Concrete
- White Pavement Marking Paints
- Concrete Grouting Material
- Anchoring Material- Chemically Curing
- Epoxy Coated Bar Reinforcement, Grade 420
- Sodium Chloride
- Inertial Barrier Modules
- Impact Attenuator, Reusable, HDPE Cylinders and Cables
- Impact Attenuator, Quad Beam Type with Expendable Modules
- Impact Attenuator, Corrugated Beam Type with Metal Tearing Strips
- Impact Attenuator, Thrie Beam Type with Expendable Modules
- Impact Attenuator, HDPE Cylinders with Monorail and Diaphragms
- Galvanized Coating and Repair Methods
- Aluminum Sign Panels
- Reflective Sheeting

**654-3 CONSTRUCTION DETAILS.**

**654-3.01 General.** The following shall apply to all impact attenuators to be installed under this section.

* A Drawings. Prior to installing any materials required under this section, the Contractor shall submit three (3) copies of the manufacturer’s drawings, modified as necessary to reflect site conditions, to the Engineer. The submission shall include certification that modifications made to reflect site conditions will not impair the satisfactory performance of the impact attenuator. Manufacturer’s drawings, modified as necessary to reflect site conditions, will be referred to in this section as “working drawings.” Working drawings will take precedence over manufacturer’s drawings.
Working drawings shall show supports, transition pieces, connections, miscellaneous parts, concrete or steel back-up structure, and anchorages not detailed in the plans, but which are necessary to develop the full performance of the impact attenuator. The Contractor shall not commence installation of the impact attenuator earlier than five (5) days following submission of the above mentioned working or manufacturer’s drawings unless authorized by the Engineer to do so.

**B Manuals.** In addition to the drawings mentioned above, the Contractor shall deliver to the Engineer three (3) copies of design manuals, installation manuals, parts lists, and maintenance manuals prepared for each type impact attenuator being installed. The Contractor shall not commence installation of the impact attenuator earlier than five (5) days following submission of the above mentioned manuals, unless authorized by the Engineer to do so.

**C Coordination with Other Work.** The work under this section shall be coordinated with the removal or installation of shielded objects, guide rail and median barriers, impact attenuators or end terminals so as to minimize the time that motorists are exposed to unnecessary hazard. Also, the Contractor shall minimize exposure of vehicular traffic to the possibility of impact on the back-up structure. Unless modified in the contract documents, minimize shall mean seven (7) or fewer calendar days.

**D Traffic Protection.** Traffic control devices, such as cones, drums, lights, signs, barricades, or other articles directed by the Engineer shall be provided and maintained under their respective pay items. These devices shall not be removed until the impact attenuator, including required transition pieces, is fully operational. If the impact attenuator is to be installed in lighted areas, or in areas to be lighted, the mentioned traffic control devices shall not be removed unless the lighting system is operational.

**654-3.02 Impact Attenuators Requiring Foundations.** If the work of furnishing and installing impact attenuators requires the provision of a foundation slab, the following shall apply:

**A Excavation.** Necessary excavation shall be performed in accordance with Section 203 of the Standard Specifications. If the foundation slab is to be installed in a pavement that is to remain in place in the completed project, the limits of excavation in such pavement shall be saw cut full depth prior to removal of the pavement and performance of the excavation work. Unless indicated otherwise, the limits of pavement excavation shall be 600 mm outside the perimeter of the foundation slab.

**B Foundation Slab.** The Contractor shall construct the reinforced concrete foundation slab and back-up structure to the dimensions indicated in the working or manufacturer’s drawings. The foundation slab shall be not less than the thickness indicated on the working drawings, manufacturer’s drawings, or 200 mm, whichever is greatest.

The concrete shall be Class A concrete batched in accordance with §501-3 Portland Cement Concrete, Construction Details. If accelerators are needed, the Contractor shall submit the concrete mix design to the Materials Bureau for prior approval. The concrete shall be formed, placed, finished, and cured in accordance with §502-3 Portland Cement Concrete Pavement, Construction Details.

The reinforcing bars shall be in conformance to §709-04 Epoxy Coated Bar Reinforcement, Grade 420. The size, length, and bending details of reinforcement shall be as shown in the foundation slab details in the manufacturer’s drawings or in the working drawings. The minimum allowable reinforcing shall be #16 longitudinal bars, spacing 400 mm on centers, and #16 cross bars, spacing 2 meters on centers. Longitudinal bars shall be placed such that they will not be cut during anchorage installation.

**C Pavement Restoration.** The excavated section of pavement between the new foundation slab and the limits of excavation shall be restored to the full height of the surrounding sound pavement in accordance with §402-3.05 Conditioning of Existing Surface, or in the manner directed by the Engineer.
§654-3.03 Anchorages. The impact attenuator shall be anchored to the new foundation slab or existing concrete foundation as shown on the manufacturer’s drawings or the working drawings. Anchor bolts and studs not cast integrally into the new foundation slab shall be anchored with approved concrete expansion anchors, concrete grouting material conforming to §701-05, or approved chemically curing anchoring material conforming to §701-07. Such anchor bolts or studs shall be set into holes drilled with rotary impact drills of the size recommended by the manufacturer of the anchor. Core drills will not be acceptable. Care shall be taken that anchor studs projecting from the surface and exposed to foot or wheeled traffic be well marked by barricades, plastic drums, or protected by other means as approved by the Engineer.

§654-3.04 Inertial Barrier Modules. The Contractor shall furnish and install Inertial Barrier Modules of the size and number required at the locations and to the configurations indicated on the contract plans, or at the locations and to the configurations directed by the Engineer. In addition to the requirements indicated in §654-3.01 General, the Contractor shall also paint and label the layout pattern and weights on paved surfaces using traffic or other durable paint. Glass beads will not be required. Either the metric weight or the U.S. customary weight, as directed by the Engineer, shall be marked.

The 90 kg units shall be restrained from movement by mechanical means, or by other means as approved by the Engineer.

§654-3.05 Impact Attenuator, Thrie Beam Type or Quadbeam Type with Expendable Modules. In addition to the requirements indicated in §654-3.01 General, §654-3.02 Impact Attenuators Requiring Foundation (if applicable,) and §654-3.03 Anchorages, the Contractor shall furnish and install Impact Attenuators, Thrie Beam Type or Quadbeam Type with Expendable Modules on existing or new foundations, as indicated, of the indicated width and length and at the locations indicated on the contract plans, in accordance with these specifications, the manufacturer’s directions and drawings, the working drawings, and the directions of the Engineer.

The manufacturer’s steel backup assemblies shall be used, except when protecting concrete piers, concrete parapets, concrete walls, or other rigid objects. In these excepted cases, either the manufacturer’s steel backup assembly or the manufacturer’s recommended concrete backup assembly may be used at the option of the Contractor, unless directed otherwise on the plans or by the Engineer. The Contractor shall furnish and install the appropriate standard transition piece. If there is no appropriate standard transition piece available, a manufacturer’s approved special transition piece shall be furnished and installed.

§654-3.06 Impact Attenuator, HDPE Cylinder Types.

A. General. In addition to the requirements indicated in §654-3.01 General, §654-3.02 Impact Attenuators Requiring Foundation , and 654-3.03 Anchorages, the Contractor shall furnish and install Impact Attenuator, HDPE Cylinders and Cable Type or Impact Attenuator, HDPE Cylinders with Monorail and Diaphragm Type on existing or new foundations, as indicated, of the indicated number of cylinders of the required thicknesses and dimensions in accordance with these specifications, the manufacturer’s directions, and the working drawings.

B. Impact Attenuator, HDPE Cylinders and Cable Type. In addition to the above in A. General, the following shall also apply. The base of concrete barriers and other similar solid objects shall be cut back at a 45° angle, and transition pieces shall be provided on both sides between the backup structure and the concrete barrier or other similar object.

C. Impact Attenuator, HDPE Cylinders with Monorail and Diaphragm. In addition to the above in A. General, the following shall also apply. Unless indicated otherwise, the Contractor shall select, furnish, and install either a metal backup structure or concrete backup structure. In bidirectional situations, a transition piece shall be installed to shield the back of the backup structure from impact by traffic.
§654-3.07 Impact Attenuator, Corrugated Beam Type with Metal Tearing Strips. The Contractor shall furnish and install Impact Attenuators, Corrugated Beam Type with Metal Tearing Strips on new or existing foundations, as indicated, of the indicated number of bays at the locations indicated in the contract documents in accordance with these specifications, the manufacturer’s instructions and drawings, the working drawings, and the directions of the Engineer.

§654-3.08 Impact Attenuators, All Types, Remove and Dispose. The Contractor shall remove impact attenuators of the indicated type and associated foundation slabs, if required, from their existing locations. Upon removal, the impact attenuators and foundation slabs shall become the property of the Contractor, and the Contractor shall dispose of them in a manner and at a location approved by the Engineer.

Holes in and other damage to the surfaces underlying the impact attenuator shall be repaired to the satisfaction of the engineer. Anchor bolts or studs that are no longer required or usable shall be removed or cut off flush with the surface. Voids resulting from the removal of foundation slabs shall be filled with compacted suitable material or compacted granular material, or other designated material as directed.

§654-3.09 Impact Attenuators, All Types, Remove and Store. The Contractor shall remove impact attenuators of the indicated type from their existing locations with reasonable skill and care in a manner that preserves their condition. The impact attenuators shall remain the property of the State, and the Contractor shall store and protect them in a manner and at locations satisfactory to the Engineer. Damaged parts shall be replaced with like parts in satisfactory condition or repaired in a manner approved by the Engineer.

If required, pavement slabs shall be removed and disposed in a manner and at locations satisfactory to the Engineer. Voids resulting from the removal of foundation slabs shall be filled with compacted suitable material or compacted granular material, or other designated material as directed.

Holes and other damage to the surfaces underlying the impact attenuator shall be repaired to the satisfaction of the engineer. Anchor bolts or studs that are no longer required or usable shall be removed, or cut off flush with the surface.

§654-3.10 Impact Attenuators, All Types, Relocate. The Contractor shall remove impact attenuators of the indicated type from their existing locations with reasonable skill and care in a manner that preserves their condition, and reinstall them at the same location or install them at another designated location. If required, the Contractor shall construct a new foundation slab. The impact attenuators shall remain the property of the State during the course of the work. If intermediate storage is required during the relocation, the Contractor shall store and protect impact attenuators in a manner and at locations approved by the Engineer. Damaged parts shall be replaced with like parts in satisfactory condition or repaired in a manner approved by the Engineer.

If required, pavement slabs shall be removed and disposed of in a manner and at locations satisfactory to the Engineer. Voids resulting from the removal of foundation slabs shall be filled with compacted suitable material, compacted granular material, or other designated material, as directed.

Holes and other damage to the surfaces underlying the impact attenuator shall be repaired to the satisfaction of the Engineer. Anchor bolts or studs that are no longer required or usable shall be removed, or cut off flush with the surface.

§654-3.01C Coordination with Other Work, §654-3.01D Traffic Protection, and §654-3.09 Impact Attenuators, All Types, Remove and Store shall apply. If required, a new foundation slab shall be constructed in accordance with the requirements of §654-3.02, Impact Attenuators Requiring Foundations.

§654-3.11 Impact Attenuators, All Types, Refurbish. The contractor shall refurbish bays of designated impact attenuators of the indicated type in accordance with these specifications, the directions of the manufacturer, and as approved by the Engineer. Damaged parts shall be replaced with like parts in satisfactory condition or repaired to the satisfaction of the Engineer. §654-3.01C Coordination with Other Work, and §654-3.01D Traffic Protection shall apply. In addition, the Contractor shall repair the anchorages in accordance with §654-3.03 Anchorages, if they are damaged.

§654-4 METHOD OF MEASUREMENT.
§654

654-4.01 General. Measurement will be taken as the number of impact attenuators of the indicated type and size satisfactorily furnished and installed on existing foundations; as the number of impact attenuators of the indicated type and size satisfactorily furnished and installed on new foundation slabs; as the number of impact attenuators of the indicated type satisfactorily removed and disposed; as the number of impact attenuators of the indicated type satisfactorily removed and stored; as the number of impact attenuators of the indicated type and size satisfactorily relocated to existing foundation; as the number of impact attenuators of the indicated type and size satisfactorily relocated to a new foundation slab, including construction of the new foundation slab; or as the number of individual bays of impact attenuators of the indicated type satisfactorily refurbished, all in accordance with these specifications, the directions of the Engineer, and the manufacturer’s or working drawings and manufacture’s directions.

654-4.02 Number of Bays. Under the contract items for furnishing and installing Impact Attenuators, Quad Beam Type with Expendable Modules and the contract items for furnishing and installing Impact Attenuators, Corrugated Beam Type with Metal Tearing Strip, the nose will not be counted as a bay. Under the contract items for refurbishing Impact Attenuators, Quad Beam Type with Expendable Modules the nose will be counted as a bay.

654-5 BASIS OF PAYMENT.

654-5.01 General. Except as modified below, the following shall apply to contract items under this section. The unit prices bid for furnishing and installing, removing and disposing, removing and storing, relocating, or refurbishing Inertial Barrier Modules and Impact Attenuators of the various types shall include the cost of all labor, materials, and equipment necessary to satisfactorily perform the work.

A. Site preparation. Site preparation, if any, shall be paid for separately under appropriate contract items.

B. Pavement sawing. Pavement sawing in pavement to remain as finished surface, or that directed by the Engineer shall be separately paid. That conducted for the convenience of the contractor shall be at no additional expense to the State.

C. Excavation, and removal of existing foundation slabs. Excavation for new foundation slabs and for the removal of existing foundation slabs will be separately paid for under the contract item for unclassified excavation and disposal.

D. Pavement restoration. Pavement restoration shall be separately paid under the contract items for Truing and Leveling. If there are no contract pay items for Truing and Leveling, then pavement restoration shall be paid under the contract item for the top course of hot mix asphalt. If no contract items exist in the contract for paving items, then no separate payment for pavement restoration will be made.

E. Parts. The cost of replacing or repairing parts damaged during the course of the work shall be at no additional expense to the State. The cost of replacing or repairing parts having pre-existing damage shall be separately paid for under the provisions of Extra Work.

F. Maintenance and protection of Traffic. Maintenance and protection of traffic will be measured and paid for under appropriate items.

654-5.02 Progress Payments. The contract items under this section are eligible for progress payments as indicated below. The balance of payment will be made upon satisfactory completion of the work.

A Working Drawings. Contract items requiring working drawings will be eligible for progress payment of ten (10) percent upon submission of the working drawings and certification that the modifications thereon will not impair the satisfactory performance of the impact attenuator.
Submission of manufacturer’s drawings that are not working drawings, as determined by the Engineer, will not entitle the Contractor to a progress payment.

**B Impact Attenuators with New Foundation Slabs.** Contract items requiring the construction of new foundation slabs will be eligible for progress payments of ten (10) percent upon satisfactory finishing and initiation of curing of the foundation slab.

**Payment will be made under:**

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>654.01xx</td>
<td>Inertial Barrier Module, ___ Kilograms</td>
<td>Each</td>
</tr>
<tr>
<td>654.02xx</td>
<td>Inertial Barrier Module, ___ Kilograms, Remove and Dispose</td>
<td>Each</td>
</tr>
<tr>
<td>654.03xx</td>
<td>Inertial Barrier Module, ___ Kilograms, Remove and Store</td>
<td>Each</td>
</tr>
<tr>
<td>654.04xx</td>
<td>Inertial Barrier Module, ___ Kilograms, Relocate</td>
<td>Each</td>
</tr>
</tbody>
</table>

\(xx = 01\) for 90 kg units; \(02\) for 180 kg units; \(03\) for 320 kg units; \(04\) for 640 kg units; \(05\) for 960 kg units.

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>654.10xxyy</td>
<td>Impact Attenuator, Quad Beam Type with Expendable Modules Including new Foundation Slab, xx Width Class, yy Bays</td>
<td>Each</td>
</tr>
<tr>
<td>654.11xxyy</td>
<td>Impact Attenuator, Quad Beam Type with Expendable Modules Existing Foundation, xx Width Class, yy Bays</td>
<td>Each</td>
</tr>
</tbody>
</table>

\(xx = width\) class: 24, 30, 36, 69, 90 (inches)  
\(yy = number\) of bays: 03, 04, 05, 06, 07, 08, 09

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>654.12</td>
<td>Impact Attenuator, Quad Beam Type with Expendable Modules, Remove and Dispose</td>
<td>Each</td>
</tr>
<tr>
<td>654.13</td>
<td>Impact Attenuator, Quad Beam Type with Expendable Modules, Remove and Store</td>
<td>Each</td>
</tr>
<tr>
<td>654.14</td>
<td>Impact Attenuator, Quad Beam Type with Expendable Modules, Refurbish Bay</td>
<td>Each</td>
</tr>
<tr>
<td>654.15xxyy</td>
<td>Impact Attenuator, Quad Beam Type with Expendable Modules, Relocate to and Construct New Foundation Slab, xx Width Class, yy Bays</td>
<td>Each</td>
</tr>
</tbody>
</table>

\(xx = width\) class: 24, 30, 36, 69, 90 (inches)  
\(yy = number\) of bays: 03, 04, 05, 06, 07, 08, 09

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>654.16</td>
<td>Impact Attenuator, Quad Beam Type with Expendable Modules, Relocate to Existing Foundation</td>
<td>Each</td>
</tr>
<tr>
<td>654.20xx</td>
<td>Impact Attenuator, Reusable, HDPE Cylinders and Cable Type, Including New Foundation Slab, xx Cylinders</td>
<td>Each</td>
</tr>
<tr>
<td>654.201527</td>
<td>Impact Attenuator, HDPE Cylinders, Diaphragms, New Foundation Slab, 1.5 m Wide, 27 Cylinders</td>
<td>Each</td>
</tr>
<tr>
<td>654.202429</td>
<td>Impact Attenuator, HDPE Cylinders, Diaphragms, New Foundation Slab, 2.4 m Wide, 29 Cylinders</td>
<td>Each</td>
</tr>
<tr>
<td>654.203029</td>
<td>Impact Attenuator, HDPE Cylinders, Diaphragms, New Foundation Slab, 3.0 m Wide, 29 Cylinders</td>
<td>Each</td>
</tr>
<tr>
<td>654.211527</td>
<td>Impact Attenuator, HDPE Cylinders, Diaphragms, on Existing Foundation, 1.5 m Wide, 27 Cylinders</td>
<td>Each</td>
</tr>
<tr>
<td>654.212429</td>
<td>Impact Attenuator, HDPE Cylinders, Diaphragms, Existing Foundation, 2.4 m Wide, 29 Cylinders</td>
<td>Each</td>
</tr>
<tr>
<td>654.213029</td>
<td>Impact Attenuator, HDPE Cylinders, Diaphragms, Existing Foundation, 3.0 m Wide, 29 Cylinders</td>
<td>Each</td>
</tr>
<tr>
<td>654.2215</td>
<td>Impact Attenuator, HDPE Cylinders, Diaphragms, 1.5 m Wide, 27 Cylinders Remove and Dispose</td>
<td>Each</td>
</tr>
<tr>
<td>654.2224</td>
<td>Impact Attenuator, HDPE Cylinders, Diaphragms, 2.4 m Wide, 29 Cylinders Remove and Dispose</td>
<td>Each</td>
</tr>
<tr>
<td>654.2230</td>
<td>Impact Attenuator, HDPE Cylinders, Diaphragms, 3.0 m Wide, 29 Cylinders Remove and Dispose</td>
<td>Each</td>
</tr>
<tr>
<td>654.2315</td>
<td>Impact Attenuator, HDPE Cylinders, Diaphragms,</td>
<td>Each</td>
</tr>
</tbody>
</table>
§654

1.5 m Wide, 27 Cylinders Remove and Store Each

654.2324 Impact Attenuator, HDPE Cylinders, Diaphragms, 2.4 m Wide, 29 Cylinders Remove and Store Each

654.2330 Impact Attenuator, HDPE Cylinders, Diaphragms, 3.0 m Wide, 29 Cylinders Remove and Store Each

654.241527 Impact Attenuator, HDPE Cylinders, Diaphragms, 1.5 m Wide, 27 Cylinders Relocate to and Construct New Foundation Slab Each

654.242429 Impact Attenuator, HDPE Cylinders, Diaphragms, 2.4 m Wide, 29 Cylinders, Relocate to and Construct New Foundation Slab Each

654.243029 Impact Attenuator, HDPE Cylinders, Diaphragms, 3.0 m Wide, 29 Cylinders, Relocate to and Construct New Foundation Slab Each

654.2515 Impact Attenuator, HDPE Cylinders, Diaphragms, 1.5 m Wide, 27 Cylinders, Relocate to Existing Foundation Each

654.2524 Impact Attenuator, HDPE Cylinders, Diaphragms, 2.4 m Wide, 29 Cylinders, Relocate to Existing Foundation Each

654.2530 Impact Attenuator, HDPE Cylinders, Diaphragms, 3.0 m Wide, 29 Cylinders, Relocate to Existing Foundation Each

654.2615 Impact Attenuator, HDPE Cylinders, Diaphragms, 1.5 m Wide, 27 Cylinders Refurbish Diaphragm Each

654.2624 Impact Attenuator, HDPE Cylinders, Diaphragms, 2.4 m Wide, 29 Cylinders, Refurbish Diaphragm Each

654.2630 Impact Attenuator, HDPE Cylinders, Diaphragms, 3.0 m Wide, 29 Cylinders, Refurbish Diaphragm Each

654.2715 Impact Attenuator, HDPE Cylinders, Diaphragms, 1.5 m Wide, 27 Cylinders, Refurbish Monorail Meter

654.2724 Impact Attenuator, HDPE Cylinders, Diaphragms, 2.4 m Wide, 29 Cylinders, Refurbish Monorail Meter

654.2730 Impact Attenuator, HDPE Cylinders, Diaphragms, 3.0 m Wide, 29 Cylinders, Refurbish Monorail Meter

654.21xx Impact Attenuator, Reusable, HDPE Cylinders and Cable Type, On Existing Foundation, xx Cylinders Each

xx = number of cylinders ; 04, 06, 09

654.22 Impact Attenuator, Reusable, HDPE Cylinders and Cable Type, Remove and Dispose Each

654.23 Impact Attenuator, Reusable, HDPE Cylinders and Cable Type, Remove and Store Each

654.24xx Impact Attenuator, Reusable, HDPE Cylinders and Cable Type, Relocate to and Construct New Foundation Slab, xx Cylinders Each

xx = number of cylinders ; 04, 06, 09

654.25 Impact Attenuator, Reusable, HDPE Cylinders and Cable Type, Relocate to Existing Foundation Each

654.26 Impact Attenuator, Reusable, HDPE Cylinders and Cable Type, Refurbish Cylinder Each

654.30XXYR Impact Attenuator, Beam Type, Metal Tearing Strips, New Foundation, XX Bays, Y Sides Widening Each

654.31XXYR Impact Attenuator, Beam Type, Metal Tearing Strips, Existing Foundation, XX Bays, Y Sides Widening Each

654.32 Impact Attenuator, Corrugated Beam Type with Metal Tearing Strips, Remove and Dispose Each

654.33 Impact Attenuator, Corrugated Beam Type with Metal Tearing Strips, Remove and Store Each

654.34XXYR Impact Attenuator, Beam Type, Metal Tearing Strips, Relocate to and Construct New Foundation, XX Bays, Y Sides Widening Each

654.35 Impact Attenuator, Corrugated Beam Type with Metal Tearing Strips,
RELOCATE TO EXISTING FOUNDATION

Each

Where XX = 06, or 09-19 bays

Y = 0, no flaring. Available only when XX = 06 or 09.

= 1, flared on only one side

= 2, flared on two sides

R = major revision number

654.40xxyy Impact Attenuator, Thrie Beam Type w/Expendable Modules,

New Foundation Slab Each

654.41xxyy Impact Attenuator, Thrie Beam Type w/Expendable Modules,

Existing Foundation Each

654.42 Impact Attenuator, Thrie Beam Type w/Expendable Modules,

Remove and Dispose Each

654.43 Impact Attenuator, Thrie Beam Type w/Expendable Modules,

Remove and Store Each

654.44xxyy Impact Attenuator, Thrie Beam Type w/Expendable Modules,

Relocate to & Construct New Foundation Slab Each

654.45xxyy Impact Attenuator, Thrie Beam Type w/Expendable Modules,

Relocate to Existing Foundation Each

654.46xxyy Impact Attenuator, Thrie Beam Type w/Expendable Modules, Refurbish Each

xx = width class; 36, 42, 48, 54, 60, 66, 72, 78, 84, 90, 96

yy = number of bays; 03-12

SECTION 655 - FRAMES, GRATES AND COVERS

655-1 DESCRIPTION. This work shall consist of furnishing and placing frames, graters, covers and curb boxes for drainage structures as shown on the plans or as directed by the Engineer.

655-2 MATERIALS

655-2.01 Castings. All cast graters, covers, frames and curb boxes manufactured in conformance to the Standard Sheets “Cast Manhole Frames, Grates and Covers”, or “Cast Frames and Curb Boxes and Welded Frames”, or “Telescoping Manhole Casting & Ring” shall meet the requirements of §715-05 Iron Castings, Class No. 30B or Class No. 35B. All other graters, covers, frames and curb boxes shall meet the requirements of §715-02, Steel Castings, Grade N-1; or §715-07, Proof Loaded Iron Castings, Class No. 30B or Class No. 35B; or §715-09, Malleable Iron Castings, Grade 22010, at the Contractor’s option. No substitutions will be allowed.

655-2.02 Fabricated Articles. All frames, graters and appurtenant parts shall be fabricated from steel conforming to ASTM A36M, AISI Grade 1020 Steel, AISI Grade 1025 Steel, or ASTM A529M Gr. 345, except that the longitudinal bars for graters G1, G2, G3, 10 PCB, 11 PCB and 12 PCB shall meet the requirements of ASTM A529M, Gr. 345. The Contractor shall submit mill certifications, to the Engineer, for ASTM A529M, Gr.345. Welding or splicing by welding of any member of the frame or grater, other than the welds shown on the standard sheets, plans, approved shop drawings, approved Materials Details, or in the proposal will not be permitted. Galvanizing shall be in accordance with §719-01 Type I, unless indicated otherwise.

Welding shall comply with the requirements specified in the New York State Steel Construction Manual, except that radiographic inspection will not be required.

655-3 CONSTRUCTION DETAILS

655-3.01 Frames and Grates. Frames, covers and graters shall be placed true to line and grade. Covers, graters and frames shall make firm, full and even bearing on their respective underlying surfaces and shall be non-rocking under the influence of traffic or other loads. On all frames, the Contractor shall
have the option of drilling and tapping holes or drilling holes in and welding nuts to the bottom of the frame to facilitate the stud bolts used to hold down the grate.

Unless otherwise specified, the hole shall be drilled and tapped or the nut welded to the frame before galvanizing. The threads shall be tapped sufficiently oversize to conform to ANSI B1.13M Class 6h after galvanizing.

655-3.02 Field Repairs for Improperly Fitting Systems. The Contractor may propose to the Engineer reasonable field repair procedures for improperly fitting castings. No field repairs of improperly fitting fabricated frames and grates shall be allowed. Field repairs may include grinding and/or proper welding techniques for the materials involved. Repairs that involve welding shall be allowed only on steel castings, and not on iron, and only with prior approval of the DCES. Implemented repairs must result in systems whose constituent parts have full, uniform and even bearing contact on their respective underlying surfaces and that do not rock or move under the influence of traffic and other loads. All such repairs must be completely satisfactory to the Engineer or the work shall be rejected and replaced with satisfactory systems. All repairs shall be done at no cost to the State.

655-4 METHOD OF MEASUREMENT

655-4.01 Frames and Grates. The quantity to be measured under this work will be the number of square meters measured inside the frame containing the grate and computed to the nearest 1/100 square meter. The payment areas shown on the standard sheets need not be computed.

655-5 BASIS OF PAYMENT

655-5.01 Frames and Grates. The unit price bid per square meter for cast or prefabricated frames and grates shall included the cost of furnishing all labor, materials and equipment necessary to satisfactorily complete the work, including the cost of any field repair work for improperly fitting castings or to render the frame and grate non-rocking.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>655.0101</td>
<td>Frames and Grates (Castings)</td>
<td>Square Meter</td>
</tr>
<tr>
<td>655.0201</td>
<td>Frames and Grates (Fabricated)</td>
<td>Square Meter</td>
</tr>
<tr>
<td>655.0301</td>
<td>Frames and Grates (Parallel Bar Type)</td>
<td>Square Meter</td>
</tr>
<tr>
<td>655.0401</td>
<td>Frames and Grates (Parallel Bar Type with Cast Frames)</td>
<td>Square Meter</td>
</tr>
<tr>
<td>655.0501</td>
<td>Steel Fabricated Grates In Cast Frames</td>
<td>Square Meter</td>
</tr>
<tr>
<td>655.0601</td>
<td>Telescoping Manhole Frames and Covers</td>
<td>Square Meter</td>
</tr>
</tbody>
</table>

SECTION 656 - MISCELLANEOUS METALS

656-1 DESCRIPTION. This work shall consist of furnishing and placing all metal component parts in accordance with the specifications which are not included in other items of work and which are specifically identified on the plans to be reimbursed at the unit bid price for Miscellaneous Metals.

656-2 MATERIALS. Metals required for this work shall meet the requirements of the following Subsections of Section 700 - Materials:

- Castings, Forgings, and Metals (As Specified) 715
- Miscellaneous Metals and Plastics (As Specified) 725

656-3 CONSTRUCTION DETAILS

656-3.01 Drawings. Shop drawings shall be prepared, approved and distributed in accordance with the provisions of the SCM. When applicable, the manufacturer's specification date sheet (catalog clip) may be furnished in lieu of shop drawings. The Engineer may waive the shop drawing requirement for any non-welded component part that can be fabricated directly from the details shown on the plans.
656-3.02 Welding. Welding shall comply with the requirements specified in the New York State Steel Construction Manual.

656-3.03 Galvanizing. When materials for this work are to be galvanized, the process and spelter coating shall conform to the requirements of §719-01, Galvanized Coatings and Repair Methods.

656-3.04 Painting. All unembedded metal except castings shall be painted in accordance with Section 574, Localized Painting of Structural Steel. Galvanized material shall be painted in accordance with Section 657.

656-4 METHOD OF MEASUREMENT. Payment for this work shall be measured by the number of kilograms of metal furnished and placed in accordance with the plans and specifications.

656-5 BASIS OF PAYMENT. The unit price bid per kilogram shall include all labor, materials and equipment necessary to complete the work.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>656.01</td>
<td>Miscellaneous Metals</td>
<td>Kilogram</td>
</tr>
</tbody>
</table>

SECTION 657 - PAINTING GALVANIZED AND ALUMINUM SURFACES

657-1 DESCRIPTION. This work shall consist of painting galvanized and aluminum surfaces. The surfaces will not have been painted previously. See special note entitled “Galvanized and Aluminum Surface to be Painted” for the description of serialized items.

657-2 MATERIALS

657-2.01 Paint For Use On Galvanized Surfaces. Material for this work shall meet the requirements of:

708-06 Paint for Galvanized Surfaces

657-2.02 Paint for Use On Aluminum Surfaces. The portions of aluminum or aluminum alloys that will be in contact with cast or projected concrete shall meet the requirements of:

708-04 Zinc Chromate Primer

Substitutions for this material will be considered, provided the material is specifically formulated for use over aluminum and to reduce alkali attack. Aluminum surfaces not in contact with concrete shall be painted as described in the contract documents with;

708-07 Paint for Aluminum Surfaces

657-2.03 Paints.

A. Data Sheets. At least five work days prior to the start of work, the Contractor shall supply the Engineer with one copy of the paint manufacturer's current technical data and materials safety data sheets for each coat to be applied. If manufacturer’s recommendations are more restrictive or require additional effort not defined in this specification, then the manufacturer’s recommendations shall be followed.
§657  

**B. Storage.** Paint in storage shall be protected from damage and maintained in accordance with manufacturer’s recommendations. Paint will be considered in storage if it is onsite for more than 8 hours prior to application.

**C. Color.** The color of the primer will be the Contractor's option; however, it shall contrast with the underlying substrate. The color of the topcoat shall be in accordance with the contract documents or defined by §708-05. A ‘Rustic’ color shall be Weathered Brown.

**D. Labeling.** Paint arriving at the work site in new, unopened containers and labeled with the manufacturer's name, product name, component part, batch number, color, and shelf life date shall be used. Paint in containers having expired shelf life dates shall not be used. They shall be immediately removed from the work site.

**657-2.04 Water for Pressure Washing.** Water shall be clean, fresh potable water.

**657-2.05 Abrasive for Sweep Blasting Galvanizing Surfaces.** Abrasive size shall range between 200 and 500 microns, and shall have a Mohr’s hardness of 5 or less. Use of steel grit or shot is prohibited.

**657-2.05 Paint Inspection Equipment.** Prior to the start of and throughout the duration of the work, the Contractor shall ensure that the Engineer or Inspector is supplied with the following equipment in good working order:

- One bound copy of the Steel Structures Painting Council surface preparation specification, SSPC - SP COM “Surface Preparation Commentary for Steel and Concrete Substrates”.
- One bound copy of the Steel Structures Painting Council surface preparation specification, SSPC SP-1 “Solvent Cleaning”.
- One bound copy of the Steel Structures Painting Council surface preparation specification, SSPC-SP7, “Brush-Off Blast Cleaning”.
- One bound copy of the Steel Structures Painting Council method SSPC-PA2, Paint Application Specification No. 2 – “Measurement of Dry Film Thickness With Magnetic Gages”.
- ASTM D 4417 Test Method for Field Measurement of Surface Profile of Blast Cleaned Steel.
- ASTM D 4285 Test Method for Indicating Oil or Water in Compressed Air.
- One Air Thermometer, pocket type, -10°C to +40°C.
- One Magnetic Dry-Film Thickness Gage, Type 2 (fixed probe).
- Two Wet-Film Thickness Gages, Prong-Type, capable of measuring 25 µm to 250 µm in 25 µm increments.
- Sling Psychrometer and US Weather Bureau Psychrometric Tables.

**657-3 CONSTRUCTION DETAILS**

**657-3.01 Classification and Surface Preparation of Surfaces.** For the purposes of this specification, a surface will be considered weathered if the galvanizing has been uncoated and exposed to a well-ventilated environment for a minimum of two years. A surface will be considered new if it was galvanized less than two years ago.

**A. Weathered Galvanized Surfaces.** All surfaces to be painted shall be pressure washed using equipment operating at a minimum pressure of 12.5 MPa, a water temperature of 85°C to 93°C, and a minimum flow of 15 L/minute. The nozzle shall be held at a distance of 150 mm to 300 mm from the surface.

When the washing is completed, the cleaned surfaces shall be free of dust, dirt, oil and grease, animal waste, salts, and other debris. Oil and grease shall be removed by solvent cleaning as described in SSPC SP1. The areas shall be pressure washed again following this cleaning.
B. Newly Galvanized Surfaces. All surfaces to be painted shall be pressure washed, using equipment operating at a minimum pressure of 21 MPa, and a minimum flow of 15 L/minute. The nozzle shall be held at a distance of 150 mm to 300 mm from the surface.

When the washing is completed, the cleaned surfaces shall be free of dust, dirt, oil and grease, animal waste, salts, and other debris. Oil and grease shall be removed by solvent cleaning as described in SSPC SP1. The areas shall be pressure washed again following this cleaning.

Once cleaned, all galvanized surfaces shall receive a light sweep blast using abrasive blasting equipment. All compressed air used to satisfy the requirements of this specification shall be clean. The cleanliness shall be verified with a white blotter test according to ASTM D 4285 at least once per shift.

The light blast shall remove zinc oxides from the galvanizing as well as etch the surface. The light sweep blast shall not remove excessive amounts of zinc from the galvanized surface. The sweep blast shall impart to the galvanized surface an anchor profile of 25 to 40 microns as measured using profile tape and a spring-loaded micrometer according to ASTM D 4417.

The initial thickness of the galvanizing prior to sweep blasting shall be established using a magnetic thickness gage in a manner as described under ASTM A123. If the sweep blast results in a 15% or greater loss of galvanized coating, the article shall be rejected. The sweep blast shall be performed in a manner that does not result in disbondment and flaking of the galvanizing.

After sweep blasting, the galvanized surfaces shall be thoroughly blown down with clean compressed air to remove all blast residue. Any sharp, protruding defects in the galvanized surface such as that commonly found on edges and holes shall be removed by hand tools.

Application of the primer shall be performed within 12 hours of sweep blasting the galvanized surface. If more than 12 hours elapse prior to priming, the galvanized surfaces shall be reblasted according to this specification at no additional cost to the State. If re-blasted, the item shall not have lost 15% or more of its original galvanized coating thickness.

C. Aluminum Surfaces. Aluminum surfaces shall be prepared using methods and technologies as described in the latest version of SSPC-SP COM, Surface Preparation Commentary for Steel and Concrete Substrates. Chemical stripping and water jetting methods for surface preparation are prohibited. The effectiveness of the method chosen shall be verified prior to production work for its ability to remove aluminum oxides and provide a surface profile as required by the paint manufacturer.

657-3.02 Painting.

A. Atmospheric Conditions. No paint shall be applied when the receiving surface and ambient temperatures are less than 5°C or greater than 38°C. If the manufacturer’s recommendations for temperature are more restrictive than those listed in this specification, the manufacturer’s temperature limits shall be used for application requirements. No paint shall be applied unless the receiving surface is absolutely dry.

Paint shall not be applied when the relative humidity is more than 85% unless the coating manufacturer’s requirements are more stringent. No paint shall be applied during rain.

Manufacturer’s recommended humidity and dew point restrictions shall be observed.

B. Mixing Paint. All paint shall be thoroughly mixed with mechanical mixers in accordance with the manufacturer's recommendations. After mixing, the bottom of the container shall be free of any unmixed pigment prior to use.

C. Solvents and Thinners. Paint may be thinned if recommended by the manufacturer and approved by the Engineer. Under no circumstance should the paint be thinned where the resulting VOC level exceeds 340 g/L. The manufacturer shall be able to advise the Contractor and Engineer as to the maximum amount of thinner allowed.

Use of unauthorized solvents and thinners or using excess amounts of solvents and thinners is prohibited. Paint thinned excessively or incorrectly shall be removed at no additional cost.
D. Paint Application. Painting shall not begin until cleaned surfaces have been inspected. The Contractor shall also provide sufficient time for the work to be inspected at various stages of completion. The item(s) shall cure in an environment that is free of airborne dust and dirt until the paint is dry to the touch. Paint may be applied using brush or roller, unless otherwise indicated by the contract documents. All paint shall be applied to produce a uniform, even coating free of runs, sags, drips, ridges or other defects. Areas exhibiting these defects shall be re-cleaned at no additional cost to the State.

Brushes and rollers used to apply the paint must be of a quality to produce a smooth uniform coating and not leave fibers in the coating. The roller nap length shall be limited in accordance with the paint manufacturer’s recommendation.

If the surface becomes contaminated before paint is applied, the surface shall be cleaned as described in this specification at no additional cost.

E. Paint Film Thickness. Paint shall be applied to produce the specified dry-film thickness as directed by the paint manufacturer’s data sheets.

The actual dry-film thickness over galvanizing shall be determined in accordance with SSPC-PA 2, Paint Application Specification No. 2 - Measurement of Dry-Film Thickness with Magnetic Gages, using a Type 2 fixed-probe magnetic gages. The gage(s) shall be properly calibrated over the galvanized surface according to their manufacturer’s recommendation prior to paint application.

The actual dry-film thickness over aluminum surfaces will be estimated using a wet-film thickness gauge.

Areas failing to meet the specified minimum dry film thickness shall be overcoated with the same type of paint to produce the total dry film thickness required. The overcoating must be performed within the paint manufacturer’s specified recoat window.

657-4 METHOD OF MEASUREMENT. The unit measurement for this work is lump sum.

657-5 BASIS OF PAYMENT. The unit price bid shall include the cost of all labor, materials, and equipment necessary to complete the work.

657-5.01 Progress Payments. Progress payments will be made based on the ratio of area cleaned and painted to the total area to be painted as described in the contract documents.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>657.01nmnnn</td>
<td>Painting Weathered Galvanized Surfaces</td>
<td>Lump Sum</td>
</tr>
<tr>
<td>657.02nmnnn</td>
<td>Painting Newly Galvanized Surfaces</td>
<td>Lump Sum</td>
</tr>
<tr>
<td>657.03nmnnn</td>
<td>Painting Aluminum Surfaces</td>
<td>Lump Sum</td>
</tr>
</tbody>
</table>

*nnnn Serialized number identified structure detailed in contract documents.

SECTION 658 (VACANT)

SECTION 659 - TELECOMMUNICATION UTILITIES

659-1 DESCRIPTION. The work in this section shall include special construction required for telecommunications service utilities, including telephone, cellular telephone and cable television that are publicly, privately or cooperatively owned. The extent of work and construction specifications will be covered by special provisions in the contract documents.

659-2 MATERIALS. Materials shall meet the requirements specified by the respective utility company.

659-3 CONSTRUCTION DETAILS

659-3.01 General. The installation and testing procedures shall conform to the requirements specified by the utility company.
§659-3.02 Schedule of Work. Work shall be scheduled for minimum interruption of service and must meet the approval of the utility company and the Engineer. A specified advance notice period must be given to the utility company and Engineer prior to interruption of services for construction.

659-3.03 Excavation. The requirements specified in Section 206, Trench, Culvert and Structure Excavation, shall apply.

659-3.04 Backfill. The requirements specified in §203-3.15, Fill and Backfill at Structures, Culverts, Pipes and Conduits and Direct Burial Cables, shall apply.

659-4 METHOD OF MEASUREMENT. As specified in the special specifications.

659-5 BASIS OF PAYMENT. As specified in the special specifications.

SECTION 660 - UTILITIES

660-1 DESCRIPTION. The work in this section shall include special construction required for service utilities that are publicly, privately or cooperatively owned. The extent of work, and construction specifications will be covered by special provisions in the contract documents.

660-2 MATERIALS. Materials shall meet the requirements specified by the respective utility company.

660-3 CONSTRUCTION DETAILS

660-3.01 General. The installation and testing procedures shall conform to the requirements specified by the utility company.

660-3.02 Schedule of Work. Work shall be scheduled for minimum interruption of service and must meet the approval of the utility company and the Engineer. A specified, advance notice, period must be given to the utility company and Engineer prior to interruption of services for construction.

660-3.03 Excavation. The requirements specified in Section 206, Trench, Culvert and Structure Excavation, shall apply.

660-3.04 Backfilling. The requirements specified in §203-3.15, Fill and Backfill at Structures, Culverts, Pipes and Conduits and Direct Burial Cables, shall apply.

660-4 METHOD OF MEASUREMENT. As specified in the special specifications.

660-5 BASIS OF PAYMENT. As specified in the special specifications.

SECTION 661 - ELECTRIC UTILITIES

661-1 DESCRIPTION. The work in this section shall include special construction required for electric service utilities that are publicly, privately or cooperatively owned. The extent of work and construction specifications will be covered by special provisions in the contract documents.

661-2 MATERIALS. Materials shall meet the requirements specified by the respective electric utility company.

661-3 CONSTRUCTION DETAILS

661-3.01 General. The installation and testing procedures shall conform to the requirements specified by the electric utility company.
§661-3.02 Schedule of Work. Work shall be scheduled for minimum interruption of service and must meet the approval of the utility company and the Engineer. A specified advance notice period must be given to the utility company and Engineer prior to interruption of services for construction.

§661-3.03 Excavation. The requirements specified in Section 206, Trench, Culvert and Structure Excavation, shall apply.

§661-3.04 Backfill. The requirements specified in §203-3.15, Fill and Backfill at Structures, Culverts, Pipes and Conduits and Direct Burial Cables, shall apply.

§661-4 METHOD OF MEASUREMENT. As specified in the special specifications.

§661-5 BASIS OF PAYMENT. As specified in the special specifications.

SECTION 662 - GAS, OIL & STEAM UTILITIES

662-1 DESCRIPTION. The work in this section shall include special construction required for gas, oil and steam service utilities that are publicly, privately or cooperatively owned. The extent of work and construction specifications will be covered by special provisions in the contract documents.

662-2 MATERIALS. Materials shall meet the requirements specified by the respective utility company.

662-3 CONSTRUCTION DETAILS

662-3.01 General. The installation and testing procedures shall conform to the requirements specified by the utility company.

662-3.02 Schedule of Work. Work shall be scheduled for minimum interruption of service and must meet the approval of the utility company and the Engineer. A specified, advance notice period must be given to the utility company and Engineer prior to interruption of services for construction.

662-3.03 Excavation. The requirements specified in Section 206, Trench, Culvert and Structure Excavation, shall apply.

662-3.04 Backfill. The requirements specified in §203-3.15, Fill and Backfill at Structures, Culverts, Pipes and Conduits and Direct Burial Cables, shall apply.

662-4 METHOD OF MEASUREMENT. As specified in the special specifications.

662-5 BASIS OF PAYMENT. As specified in the special specifications.

SECTION 663 - WATER SUPPLY UTILITIES

663-1 DESCRIPTION. This work shall consist of the construction or reconstruction of water supply utilities in accordance with these specifications, the contract documents and the standard sheets.

663-2 MATERIALS

663-2.01 General. Materials requirements are specified in the following subsections:

<table>
<thead>
<tr>
<th>Material</th>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portland Cement Concrete</td>
<td>501</td>
</tr>
<tr>
<td>Reinforced Concrete Pipe Classes II, III, IV, V</td>
<td>706-02</td>
</tr>
<tr>
<td>Prefabricated Adjustment Rings, Frames and Utility</td>
<td>715-13</td>
</tr>
<tr>
<td>Valve Risers for Drainage Units, Manholes and Utilities</td>
<td>715-14</td>
</tr>
<tr>
<td>High Strength Bolts, Nuts and Washers</td>
<td>715-14</td>
</tr>
<tr>
<td>Pins and Rollers</td>
<td>715-15</td>
</tr>
</tbody>
</table>
Materials for water systems shall meet the appropriate American Water Works Association (AWWA) standards and American National Standards Institute (ANSI) specifications, except as modified by these specifications. Asbestos cement pipe or lead tipped gaskets shall not be used. The materials provided shall meet the requirements specified in the “Owner Requirements for Water Mains and Appurtenances”.

663-2.02 Concrete. All concrete for thrust blocks and cradles for water mains shall meet the requirements of Class A Concrete in Section 501, Portland Cement Concrete General, except that the requirements for inspection facilities, automated batching controls and recordation will not apply. Class A concrete for thrust blocks and cradles, or other concrete that comes into contact with ductile iron or cast iron materials for water mains, including pipe, fittings, hydrants, valves and valve boxes shall not contain fly ash. The batching, mixing and curing methods and the inspection facilities shall meet the approval of the Department, or its representative. The Contractor may submit, for approval by Director, Materials Bureau, a mix at least equivalent to the specified Class A Concrete.

663-3 CONSTRUCTION DETAILS

663-3.01 General. All work shall be done in accordance with applicable AWWA standards, the plans and specifications, and shall be completed to the satisfaction of the Engineer. Owner requirements will be specified in the contract documents under the special notes “Owner Requirements for Water Mains and Appurtenances”. The Contractor shall make all necessary arrangements, obtain all local permits, and pay all charges as required to satisfy the requirements and regulations of the system Owner. Any required health agency permits will be obtained by the system Owner. The local fire department shall be notified by the Contractor a minimum of forty-eight (48) hours prior to interruption of service to any existing hydrant and within twenty-four (24) hours after a hydrant is placed into service. The Contractor shall notify the Owner, in writing, of any hydrant installed with the drain hole plugged.

The locations of the existing mains as shown on the contract plans are often approximate, as indicated by the underground utility quality level designation. Where new water main connections, not including service connections of 2 NPS and smaller, to existing facilities are proposed, existing utility type, size and/or condition shall be determined by excavating test pits prior to the start of installation. The Contractor shall submit details for connecting existing pipe(s) to the proposed main(s) and drawings or catalog cuts of water pipes and appurtenances comprising the work to the Engineer, with sufficient time to allow for local approval, prior to ordering materials. At any time pipe laying is not in progress, the open ends of the working pipe shall be kept plugged and watertight with plugs, stoppers or other means acceptable to the Engineer.

The Engineer shall be notified immediately of the discovery of any suspected asbestos-containing water supply utilities not identified in the contract documents. Any asbestos-containing water supply utility not identified in the contract documents and encountered during the work shall not be disturbed. No cutting, grinding or any disturbance of asbestos-containing utility shall be performed under the items in this section.

663-3.02 Removals. Removal of existing water main shall include the removal of all appurtenances and fittings within the trench excavation width for that size pipe as shown on the standard sheets, except that an existing concrete thrust block need not be removed unless its presence will interfere with proposed work. Existing items requiring removal and disposal shall become the property of the Contractor and
shall be removed from the work site to the satisfaction of the Engineer. Existing items requiring removal and storage shall be removed and stored by the Contractor for pick up by the Owner. The Contractor shall exercise care in removing items to be stored to prevent damage. Unusable or unwanted material shall be disposed of by the Contractor. Removal of an existing water service connection shall include the removal of the service pipe from the main to the highway boundary or other location(s) shown in the contract documents and the removal of the curb stop and curb box. Unless otherwise noted in the Owner requirements, corporation stops shall be removed and the hole plugged with a solid brass or iron plug.

Disturbance of asbestos-containing water supply utility requires use of a New York State Department of Labor (NYSDOL) licensed contractor using NYSDOL certified asbestos handlers. Removal of asbestos-containing water supply utility encountered during excavation or exploration shall not be performed under the removal items contained in this section.

663-3.03 Shutdowns. A shutdown of any portion of a water system to make connections to existing mains shall be made with the consent of the system Owner. Approvals for shutting off a water service shall be obtained from the Engineer. The Contractor shall give a minimum of forty-eight (48) hours notice to each customer prior to interruption of service, unless the system Owner requires a longer notification period. Such notice may be provided by posting a written notice at the entrance to the building from the street. When a residential service is to be interrupted for more than 60 minutes during the establishment’s normal business hours, the Contractor shall, when directed by the Engineer, provide a temporary water service. When a commercial service is to be interrupted for more than 60 minutes during the establishment’s normal business hours, the Contractor shall, when directed by the Engineer, provide a temporary water service. A temporary water service shall be required only when specified in the plans, or when directed by the Engineer, and will then be paid for under the Temporary Water Service item.

663-3.04 Excavation and Backfill. The Contractor shall meet the requirements specified in Section 206, Trench, Culvert and Structure Excavation, except as modified by the contract documents. The payment width of trench excavation shall be as shown on the standard sheet for this section. Bell holes shall be excavated no larger than required to allow joint assembly and to allow the pipe to lay flat in the trench. Trenches for pipe sizes from 3 NPS to 24 NPS shall provide a minimum of 150mm clearance to rocks or boulders and trenches for pipe sizes from 30 NPS to 64 NPS shall provide a minimum of 225mm clearance to rocks or boulders. Longitudinal excavation and backfill limits shall be 1.0 m beyond the connection or termination point with an existing main, and 0.6 m beyond the barrel of a hydrant.

The Contractor shall meet the requirements of §203-3.15, Fill and Backfill at Structures, Culverts, Pipes, Conduits, and Direct Burial Cables. Materials containing fly ash or slag, including Controlled Low Strength Material that contains flyash, shall not be used as backfill or allowed to come into contact with ductile iron or cast iron materials for water mains, including pipe, fittings, hydrants, valves and valve boxes. Bedding and embedment material used for backfill around plastic pipe shall have a maximum particle size of 19mm.

663-3.05 Thrust Restraint. Thrust forces produced in water mains at changes in direction or size shall be restrained in order to keep the main intact. Thrust restraint may be provided by restrained joints, retainer glands, thrust blocks or tie rods, as required by the Owner. The minimum required thrust block areas and volumes shown on the standard sheet are for a standard water system test pressure, soil bearing capacity and soil unit weight. These values shall be adjusted for higher water system test pressure requirements or different soil conditions in the field. The Contractor shall be responsible for providing the proper size and type of thrust restraint, based on the standard sheets, the Owner requirements and the contract plans. Thrust restraint for sizes larger than 24 NPS will be designed on a case by case basis, and will be shown in the contract documents.

663-3.06 Pipe.

A. General. Pipe shall be laid in close conformity to line and grade having a full, firm and even bearing at each joint and along the entire length of pipe. Pressurized pipe need not be laid with the bells upstream. Only gaskets certified by the Manufacturer for use with the type of pipe or fitting installed shall be used. Existing gray iron pipe shall be cut with an abrasive pipe saw, rotary wheel
cutter, guillotine pipe saw, milling wheel saw or a hydraulic squeeze cutter. The Contractor shall repair, realign or replace pipe that is damaged or disturbed through any cause occurring prior to acceptance of the contract. Pipe which is defective from any cause, including damage caused by handling and determined by the Engineer to not be repairable, will be unacceptable for installation and shall be replaced as directed by the Engineer at no cost to the State.

**B. Ductile Iron Cement Lined Water Pipe.** Ductile iron water mains shall be installed in accordance with AWWA Standard C600. Unless otherwise noted in the Owners requirements, ductile iron pipe up to 12 NPS shall be pressure class 350 or thicker, and the cement lining shall be 1.6 mm thick. Unless otherwise noted in the Owners requirements, ductile iron pipe from 14 NPS to 24 NPS shall be pressure class 250 or thicker, and the cement lining shall be 2.4 mm thick. Unless otherwise noted in the Owners requirements, ductile iron pipe from 30 NPS to 64 NPS shall be pressure class 250 or thicker and the cement lining shall be 3.2 mm thick. Ductile iron pipe joints shall be installed with deflections not exceeding that listed in the table on the standard sheet. Ductile iron pipe selected for cutting shall be field gauged in order to ensure that after smoothing and beveling (if required), the cut end will provide a sound joint. Ductile iron pipe shall be cut with an abrasive pipe saw, rotary wheel cutter, guillotine pipe saw or milling wheel saw. Ductile iron pipe shall be cut with an oxyacetylene torch only when recommended by the Manufacturer and approved by the Engineer. Cut ends and rough edges shall be ground smooth. Cut ends shall be beveled if using push-on joints. The Contractor shall ensure that the cement mortar lining of ductile iron pipe is not damaged during cutting operations.

**C. Steel Water Pipe.** Steel water pipe shall be installed in accordance with the contract documents and the Owner requirements. Steel pipe may be cut with an abrasive pipe saw, rotary wheel cutter, guillotine pipe saw or milling wheel saw. Steel pipe shall be welded in accordance with AWWA Standards and with the provisions of the “NYS Steel Construction Manual”. Fittings for steel pipe shall be shop fabricated in accordance with AWWA Standard C208. Linings and coatings shall be installed in accordance with the appropriate AWWA Standard for the specified material.

**D. Concrete Water Pipe.** Concrete water pipe shall be installed in accordance with the contract documents and the Owner requirements.

**E. Plastic Water Pipe.** Plastic water mains shall be installed in accordance with AWWA Standard C605. Unless otherwise noted in the Owners requirements, plastic water pipe shall be pressure class 150. Plastic water pipe may be cut with a hand saw, circular saw or similar equipment. After cutting plastic water pipe, ends shall be smoothed or beveled similar to factory ends to provide sound joint connections.

Plastic water pipe shall be re-marked with an insertion line to allow proper joint make-up. Unless otherwise noted in the Owners requirements, plastic water pipe shall be installed with a coated tracing wire above the pipe to facilitate location. A portion of the wire shall be stripped and firmly connected to valves, hydrants, corporation stop and curb stops to provide electrical connectivity.

**F. Bridge Mounted Water Pipe.** Water pipe shall be installed on a bridge in accordance with the contract plans. This shall include, but is not limited to, expansion devices, rollers, chairs, connectors, insulation, insulation covering and sleeves.

**G. Handling and Assembly of Pipe.** Pipe and fittings shall be inspected prior to placement. The inside of pipe, fittings and existing water mains shall be kept free of dirt and foreign material. If dirt or potentially contaminated water has entered the inside of a water main, the main shall be cleaned and disinfected prior to placement to facilitate the disinfection process on the completed installation. Pipe and fittings shall be lowered into place, and shall not be rolled, dropped or allowed to fall into a trench or pit.
663-3.07 Polyethylene Encasement and Insulation.

A. Polyethylene Encasement. When called for in the contract documents, ductile-iron pipe shall be polyethylene encased in accordance with the methods outlined in AWWA Standard C105.

B. Insulation for Buried Water Pipe. When called for in the contract documents, insulation shall be installed in accordance with the contract plans and the Manufacturer’s recommendations. Insulation for underground installation shall use appropriate material or be covered with an appropriate waterproof jacket or insulator, as specified in the Owner requirements.

663-3.08 Valves & Valve Boxes.

A. General. Valves shall have an asphaltic or epoxy coating as required under AWWA Standard C509 or C515. Valves shall open in the direction specified in the Owner requirements. Valves shall be lowered into place, and shall not be rolled, dropped or allowed to fall into a trench or pit. Valves shall not be lifted or moved by the valve stem.

B. Valve Installation. Valves shall be installed where shown on the contract plan during the progress of the pipe laying. Valves shall be laid with full, firm and even bearing. Bearing shall be provided by concrete blocks, or a minimum of 150mm of well-compacted granular fill or crushed stone, as required in the Owner requirements or as shown on the plans.

C. Handling of Removed or Relocated Valves. All valves shown on the plans to be removed or relocated shall be carefully detached, cleaned and stored in locations acceptable to the Engineer within the job site. The Contractor shall take special precautions to prevent damage to the valve during disconnection, movement and reinstallation.

D. Valve Relocation. Valves shall be removed from the existing location, checked, all foreign material removed from the interior and placed in operating condition before reinstallation. Exterior rust and corrosion shall be removed and the valve exterior recoated with an asphaltic coating prior to installation.

E. Valve Boxes. Unless otherwise noted in the Owner requirements, valve boxes shall be slide type adjustable, set plumb over the center of the valve and to the proper grade. Any valve box which has moved sufficiently from the original position so as to prevent the application of the valve key shall be reset by the Contractor at no additional cost to the State. New valve box covers shall be cast with the word “WATER” on the top as a means of identification.

663-3.09 Hydrants.

A. General. Each hydrant shall include bonnet, upper barrel, lower barrel and shoe with all internal operating parts. Hydrants shall be dry-barrel, traffic type, incorporating a frangible connection on the hydrant barrel or at the groundline joint and on the operating rod. The outside of the hydrant upper barrel shall be painted with a minimum of one coat of primer and one finish coat of industrial enamel in the color noted in the Owner requirements or to match existing hydrants if not noted. Unless otherwise noted in the Owner requirements, all hydrants shall have a 5 NPS main valve and be equipped with a 4½ NST steamer nozzle and two 2½ NST hose nozzles. Non-operational hydrants shall be bagged or covered, in a manner acceptable to the Engineer, until they are tested and placed in service.

B. Hydrant Installation. Hydrants shall be installed during the laying of pipe. Hydrants shall be restrained, typically from the main to the hydrant shoe, using one of the methods outlined under §663-3.05 “Thrust Restraint”. Hydrants shall be set plumb at the proposed locations. The groundline marked on the hydrant, or identified by the manufacturer using an offset from a point on the hydrant, shall be within 25 mm above or below finished grade. The hydrant shall be installed so that no portion of the lower barrel, (that portion remaining if the hydrant top is broken off) extends more than
100 mm above grade. The measurement will be taken over a 1.5 m horizontal span when a change in grade occurs within 1.5 m of the hydrant. Hydrant drainage material meeting the specifications of §703-02, Table 703-4, Size Designation 1 or 2, shall be placed around the hydrant at the drip location (0.2 m’ minimum) to drain the barrel, except as noted on the standard sheets or the contract plans. Hydrant barrels shall be rotated so that the steamer nozzle is facing the roadway, unless otherwise noted in the contract documents.

C. Handling of Removed or Relocated Hydrants. All hydrants shown on the plans to be removed or relocated shall be carefully detached, cleaned and stored in locations designated by the Engineer within the job site. The Contractor shall take special precautions to prevent damage to the hydrant assembly during disconnection, movement and reinstallation.

D. Hydrant Relocation. Hydrants shall be removed from the existing location, checked, all foreign material removed from the interior of the barrel and placed in operating condition before reinstallation. Exterior rust and corrosion shall be removed and the hydrant repainted the color specified by the Owner prior to reinstallation. When the hydrant is ready for service, the hydrant shall be opened and closed to verify that all parts are in working condition. The barrel interior shall be inspected for proper drainage after reinstallation is completed.

663-3.10 Hydrant Fenders. Fenders shall be installed where shown on the contract plans, in accordance with the standard sheets.

663-3.11 Dry Hydrants. Dry hydrants shall be furnished and installed in accordance with the contract documents.

663-3.12 Tapping Sleeve, Valve & Valve Boxes and Line Stop & Tapping Fittings. Fittings shall be installed in accordance with the Manufacturers recommendations. All valves shall be installed in accordance with the requirements of §663-3.08.

663-3.13 Bolted, Sleeve Type Couplings. All couplings shall meet the requirements of AWWA Standard C219.

663-3.14 Iron Water Main Fittings. All fittings shall be compact ductile iron (AWWA C153) unless specifically required otherwise in the Owner requirements. When approved by the Owner, the Contractor may provide a comparable full body fitting (AWWA C110) when not specifically required.

663-3.15 Wedge Type Mechanical Restraint Glands. Glands shall be installed in accordance with the Manufacturer’s recommendations, using break away wedge bolts. If a gland needs to be moved or adjusted, the Contractor shall reinstall the wedges using a torque indicating wrench to within the torque range recommended by the Manufacturer.

663-3.16 High Deflection Restrained Joint Fittings. All fittings shall be compact ductile iron (AWWA C153) unless specifically required otherwise in the Owner requirements.

663-3.17 Water Service Connections. A water service connection shall include the installation of everything, except water service pipe, required to provide a connection from a main to a customer at the highway boundary, including corporation stop, curb stop, curb box, tapping sleeve or saddle, if required, and all necessary fittings.

Taps should be a minimum of 600mm from a pipe end. Multiple taps should be a minimum of 450mm apart, measured along the axis of the main. If taps are made at the 2 or 10 o’clock positions, the Contractor shall ensure that the high point in the water service pipe meets the minimum cover requirement. Taps greater than 2 NPS shall be made using a tapping sleeve and valve.

For ductile iron pipe, unless otherwise noted in the Owner requirements, maximum allowable direct tap sizes shall be as shown in Table 663-1. For plastic pipe, unless otherwise noted in the Owner requirements, taps up to NPS 1 may be direct tapped into a main, and taps from 1-1/4 NPS to 2 NPS shall be tapped using a tapping saddle.
TABLE 663-1  MAXIMUM ALLOWABLE DIRECT TAP SIZE FOR DUCTILE IRON PIPE (NPS)

<table>
<thead>
<tr>
<th>Pipe Size (NPS)</th>
<th>Pressure Class 250</th>
<th>Pressure Class 300</th>
<th>Pressure Class 350</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>--</td>
<td>--</td>
<td>3/4</td>
</tr>
<tr>
<td>6</td>
<td>--</td>
<td>--</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
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<td>--</td>
<td>1</td>
</tr>
<tr>
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<tr>
<td>12</td>
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<td>2</td>
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<td>20</td>
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<td>2</td>
<td>2</td>
</tr>
<tr>
<td>24</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

NOTE: All thickness class sizes of ductile iron pipe may be direct tapped.

Unless otherwise noted in the Owner requirements, water service pipe shall be Type K copper. Unless otherwise noted in the Owner requirements, polyethylene water service pipe shall be installed with a coated tracing wire to facilitate location. A portion of the wire shall be stripped and firmly connected to the corporation stop and the curb stop to provide electrical connectivity.

The Contractor will have the option to install water service pipe using boring, drilling or other trenchless method. Trenchless installation shall be performed in a manner acceptable to the Engineer. Water service pipe installed using a trenchless method shall be installed in a single length free of couplings or other fittings over that length.

663-3.18 Water Meter Pits, Type A. All pits shall be furnished in accordance with details in the contract documents and the Owner requirements. Type A pits are concrete or masonry structures capable of holding water meters and valves, and allow personnel entry for service and repair. Unless otherwise noted in the Owner requirements, meters to be installed in water meter pits will be supplied by the Owner at no cost to the Contractor or to the State.

663-3.19 Water Meter Pits, Type B. All pits shall be furnished and installed in accordance with the standard sheets and the Owner requirements. Unless otherwise noted in the Owner requirements, meters to be installed in water meter pits will be supplied by the Owner at no cost to the Contractor or to the State.

663-3.20 Temporary Water Service for Water Main Installation. The Contractor shall, when called for in the contract documents or directed by the Engineer, provide temporary water service to customers during interruptions caused by water main work. The service may be provided by temporary piping or other method approved by the Engineer.

663-3.21 Adjust Valve Box Elevation. Prior to the placement of the top course and after the placement of the binder course, when required, the Contractor shall install adjustment rings or frames for valve boxes. The Contractor shall be responsible for ensuring that the adjustment rings or frames are compatible with the existing valve boxes. The adjustment ring or frame shall be placed so the valve box cover will not protrude above the finished surface of the pavement, and is no more than 5 mm below finished grade. The Contractor shall have the option of resetting the existing valve box to the required grade.

To ensure a firm and secure fit with the adjustment ring or frame, the seat of the existing valve box shall be free of all foreign material at the time of installation. The entire assembly shall be set on the seat of the existing valve box and secured. The valve box cover shall then be set upon the seat of the
adjustment ring or frame. All rings or frames shall be protected from displacement caused by traffic maintained on the roadway or equipment used in the paving operation.

663-3.22 Disconnect and Cap Existing Water Main. Existing water main shall be disconnected and capped in accordance with the contract documents.

663-3.23 Hydrostatic Testing. Hydrostatic pressure and leakage tests shall be performed in accordance with AWWA C600. Prior to formal testing, the mains shall be thoroughly flushed. Hydrostatic pressure and leakage tests shall be made on installations (water mains, valves, fittings, etc.) having diameters larger than 2 NPS. The testing shall include any filling points, sampling points or other appurtenances required to conduct the tests. The total leakage per day shall not exceed the amounts allowable under AWWA C600. Unless otherwise noted in the Owner requirements, the system shall be subjected to the pressure/leakage test with water under a hydrostatic pressure of 1035 kPa for two (2) hours.

663-3.24 Disinfection. Upon completion of all water supply related construction, all mains, valves, hydrants and other appurtenances built under this contract shall be flushed, disinfected and tested for bacteriological quality in accordance with AWWA C651. Tablets shall not be used for chlorination of solvent welded plastic or screwed-joint steel pipe due to danger of fire or explosion from the reaction of joint compounds with calcium hypochlorite.

663-4 METHOD OF MEASUREMENT

663-4.01 Water Pipe. The quantity to be measured for payment will be in meters of laying length to the nearest 0.1 m. The measurement for pipe will not include the length of fittings.

663-4.02 Water Service Pipe. The quantity to be measured for payment will be in meters of laying length to the nearest whole meter. The measurement for pipe will not include the length of fittings.

663-4.03 Steel Pipe Bends and Fittings. Steel pipe bends and fittings will be measured in meters of equivalent lengths of steel pipe, to the nearest 0.1 m. The length of bends will be the length of the circular arc using the angle of the bend and the radius of bend used to make the desired connection. The length of special fittings for steel pipe will be the length along the centerline from an intersecting centerline, as in a tee or wye. The lengths may be measured for different diameters on a tee or wye having legs of unequal diameter. Refer to AWWA Standard C208, Figure 1 and Table 1 for lengths.

663-4.04 Bridge Mounted Water Pipe. The quantity to be measured for payment will be in meters to the nearest 0.1 m from a point 1.5 m behind the back surface of each structure abutment or backwall, or to points indicated in the contract documents for installations that do not pass through an abutment or backwall.

663-4.05 Valve & Valve Boxes. The quantity to be measured for payment will be the number of units of each size furnished and incorporated into the work in accordance with the contract documents.

663-4.06 Hydrants. The quantity to be measured for payment will be the number of units furnished and incorporated into the work in accordance with the contract documents.

663-4.07 Hydrant Fenders. The quantity to be measured for payment will be the number of fenders furnished and incorporated into the work in accordance with the contract documents.

663-4.08 Dry Hydrants. The quantity to be measured for payment will be the number of dry hydrants, including all necessary pipe and fittings furnished and incorporated into the work in accordance with the contract documents.
663-4.09 Tapping Sleeve, Valve & Valve Boxes; Line Stop and Tapping Fittings; and Bolted, Sleeve Type Couplings.  The quantity to be measured for payment will be the number of units of each size furnished and incorporated into the work in accordance with the contract documents.

663-4.10 Iron Water Main Fittings.  The quantity to be measured for payment will be the bare weight of fittings installed, as listed in AWWA Standard C110 or C153, as applicable.  Total contract quantity will be measured to the nearest whole kilogram.  No measurement will be made for the weight of gaskets, other appurtenant hardware, retainer glands provided solely for thrust restraint or thrust restraints rods.  The quantity measured for payment for fittings not listed in the AWWA Standards will be based upon Manufacturer certifications.

663-4.11 Wedge Type Mechanical Restraint Glands and High Deflection Restrained Joint Fittings.  The quantity to be measured for payment will be the number of units furnished and incorporated into the work in accordance with the contract documents.

663-4.12 Polyethylene Encasement for Water Mains and Insulation for Water Mains.  The quantity to be measured for payment will be the number of meters along the pipe axis measured to the nearest whole meter furnished and incorporated into the work in accordance with the contract documents.

663-4.13 Water Service Connections and Curb Stop & Curb Box.  The quantity to be measured for payment will be the number of complete units furnished and incorporated into the work in accordance with the contract documents.

663-4.14 Water Meter Pits, Type A and Water Meter Pits, Type B.  The quantity to be measured for payment will be the number of complete units furnished and incorporated into the work in accordance with the contract documents.

663-4.15 Temporary Water Service for Water Main Installation.  Payment for Temporary Water Service for Water Main Installation will be made on a lump sum basis.

663-4.16 Relocate Existing Water Valve & Valve Box, Relocate Existing Hydrant Assembly and Relocate Existing Curb Stop & Curb Box.  The quantity to be measured for payment will be the number of units of each relocated in accordance with the contract documents.

663-4.17 Adjust Existing Valve Box Elevation, Adjust Existing Hydrant Elevation and Adjust Existing Curb Box Elevation.  The quantity to be measured for payment will be the number of units of each adjusted in accordance with the contract documents.

663-4.18 Disconnect and Cap Existing Water Main.  The quantity to be measured for payment will be the number of mains disconnected and capped in accordance with the contract documents.

663-4.19 Remove and Dispose of Existing Water Main.  The quantity to be measured for payment will be in meters along the pipe axis measured to the nearest whole meter in accordance with the contract documents.

663-4.20 Remove and Dispose of Existing Water Valve & Valve Box and Remove and Dispose of Existing Hydrant.  The quantity to be measured for payment will be the number of units removed and disposed of in accordance with the contract documents.

663-4.21 Remove and Dispose of Existing Water Service Connection.  The quantity to be measured for payment will be the number of units removed and disposed of in accordance with the contract documents.

663-4.22 Remove and Store Existing Water Valve & Valve Box and Remove and Store Existing Hydrant.  The quantity to be measured for payment will be the number of units removed and stored in accordance with the contract documents.
663-5 BASIS OF PAYMENT

663-5.01 General. The unit price bid shall include the cost of all materials, labor and equipment necessary to complete the work, except that test pits, excavation and backfill will be paid for separately. Unless otherwise noted in the contract documents, payment for thrust restraint shall be included in the price bid for pipe and appurtenances. No additional payment will be made for permits, cutting existing mains, thrust restraint, disinfection or testing. Progress payments for installed or relocated items will be made at the unit bid price for 80 percent of the quantity installed, when the installation is completed and backfilled to a minimum of 600mm over the top of the pipe plus additional cover required to protect the installation from vehicular and construction traffic. The remaining 20 percent will be paid for when required testing and disinfection of the system has been satisfactorily completed.

663-5.02 Steel Pipe Bends and Fittings. The payment for steel pipe bends and fittings will be made under the steel water pipe item for equivalent lengths of steel pipe. The payment item for a reducer will be based on the larger diameter.

663-5.03 Bridge Mounted Water Pipe. The unit price bid shall include the cost of all labor, materials and equipment necessary to complete the work, including, but not limited to, expansion devices, rollers, chairs, connectors, insulation, insulation covering and sleeves, except that structural utility support members will be paid for under a structural steel item.

663-5.04 Water Service Pipe. The unit price bid for plastic pipe and polyethylene water service pipe will include the installation of tracing wire, if required. If the Contractor opts to install water service pipe using a trenchless method, excavation and backfill will be paid for as if the standard installation method had been used. No additional payment will be made for surface restoration not required due to use of trenchless installation.

663-5.05 Hydrants. The unit price bid for each hydrant shall include a length or lengths of anchor pipe, installed at any point between the main and the hydrant up to 2.0 m long at no additional cost to the State. Hydrant drainage material will be included in the payment for each hydrant at no additional cost to the State.

663-5.06 Hydrant Fenders. The unit price bid shall include the cost of all labor, materials and equipment necessary to complete the work. The work shall include excavation for the fenders, installation and backfill. The excavation for the concrete collars and slabs and the concrete required will be paid for separately.

663-5.07 Bolted, Sleeve Type Couplings. If a bolted coupling is used to join two different diameters of pipe, the payment item will be based on the larger size.

663-5.08 Iron Water Main Fittings. Payment for a full body (AWWA C110) fitting provided but not required will be the weight of a similar compact (AWWA C153) fitting. The payment item for a fitting with different size connections will be based on the largest NPS size on that fitting (i.e. a 12 NPS x 4 NPS Tee will be in the 10 NPS - 16 NPS range).

663-5.09 Water Service Connections. Payment for a water service connection will include the cost of all labor, materials and equipment necessary to complete the installation of everything required to provide a connection from a main to a customer at the highway boundary, including corporation stop, curb stop, curb box, tapping sleeve or saddle, if required, and all necessary fittings, except the service pipe, which will be paid for separately.

663-5.10 Water Meter Pits. The unit price bid shall include the cost of all labor, materials, including meter pit lids, covers and steps, and equipment necessary to complete the work.
§663

663-5.11 Relocate Existing Hydrant. The unit price bid for each hydrant relocation shall include a length of lateral pipe up to 2.0 m long, installed at any point between the main and the hydrant and hydrant drainage material at no additional cost to the State.

663-5.12 Adjust Existing Valve Box Elevation and Adjust Existing Curb Box Elevation. If the Contractor elects to reset the existing valve box, the costs of the work involved in the removal and replacement of existing disturbed pavement shall be included in the bid price for adjustment of the valve box.

663-5.13 Adjust Existing Hydrant Elevation. The unit price bid for each hydrant elevation adjustment shall include the cost of any barrel extensions required to complete the work at no additional cost to the State.

663-5.14 Disconnect and Cap Existing Water Main. Any fittings required to complete the work will be paid for separately.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>663.01xx</td>
<td>Ductile Iron Cement Lined Water Pipe</td>
<td>Meter</td>
</tr>
<tr>
<td>663.02xx</td>
<td>Steel Water Pipe</td>
<td>Meter</td>
</tr>
<tr>
<td>663.03xx</td>
<td>Concrete Water Pipe</td>
<td>Meter</td>
</tr>
<tr>
<td>663.04xx</td>
<td>Plastic Water Pipe</td>
<td>Meter</td>
</tr>
<tr>
<td>663.05xx</td>
<td>Bridge Mounted Water Pipe</td>
<td>Meter</td>
</tr>
<tr>
<td>663.06zz</td>
<td>Copper Water Service Pipe</td>
<td>Meter</td>
</tr>
<tr>
<td>663.07zz</td>
<td>Polyethylene Water Service Pipe</td>
<td>Meter</td>
</tr>
<tr>
<td>663.08zz</td>
<td>Steel Water Service Pipe</td>
<td>Meter</td>
</tr>
<tr>
<td>663.10xx</td>
<td>Resilient Wedge Valve &amp; Valve Box</td>
<td>Each</td>
</tr>
<tr>
<td>663.11xx</td>
<td>Butterfly Valve &amp; Valve Box</td>
<td>Each</td>
</tr>
<tr>
<td>663.12xx</td>
<td>Double Disk Gate Valve &amp; Valve Box</td>
<td>Each</td>
</tr>
<tr>
<td>663.13nn</td>
<td>Hydrant</td>
<td>Each</td>
</tr>
<tr>
<td>663.14</td>
<td>Hydrant Fender</td>
<td>Each</td>
</tr>
<tr>
<td>663.15nn</td>
<td>Dry Hydrant</td>
<td>Each</td>
</tr>
<tr>
<td>663.16xxxy</td>
<td>Tapping Sleeve, Valve &amp; Valve Box Assembly</td>
<td>Each</td>
</tr>
<tr>
<td>663.17xx</td>
<td>Line Stop Fitting</td>
<td>Each</td>
</tr>
<tr>
<td>663.18xx</td>
<td>Bolted, Sleeve Type Coupling</td>
<td>Each</td>
</tr>
<tr>
<td>663.2001</td>
<td>Iron Water Main Fittings (3 NPS - 8 NPS)</td>
<td>Kilogram</td>
</tr>
<tr>
<td>663.2002</td>
<td>Iron Water Main Fittings (10 NPS - 16 NPS)</td>
<td>Kilogram</td>
</tr>
<tr>
<td>663.2003</td>
<td>Iron Water Main Fittings (18 NPS and larger)</td>
<td>Kilogram</td>
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<tr>
<td>663.21xx</td>
<td>Wedge Type Mechanical Restraint Glands (xx NPS)</td>
<td>Each</td>
</tr>
<tr>
<td>663.22xx</td>
<td>High Deflection Restrained Joint Fitting (xx NPS)</td>
<td>Each</td>
</tr>
<tr>
<td>663.23xx</td>
<td>Polyethylene Encasement for Water Pipe</td>
<td>Meter</td>
</tr>
<tr>
<td>663.24xxgg</td>
<td>Insulation for Buried Water Pipe (xx NPS with gg Thick Insulation)</td>
<td>Meter</td>
</tr>
<tr>
<td>663.25zz</td>
<td>Water Service Connection</td>
<td>Each</td>
</tr>
<tr>
<td>663.26zz</td>
<td>Curb Stop &amp; Curb Box</td>
<td>Each</td>
</tr>
<tr>
<td>663.27nn</td>
<td>Water Meter Pit, Type A</td>
<td>Each</td>
</tr>
<tr>
<td>663.28nn</td>
<td>Water Meter Pit, Type B</td>
<td>Each</td>
</tr>
<tr>
<td>663.29nn</td>
<td>Temporary Water Service for Water Main Installation</td>
<td>Lump Sum</td>
</tr>
<tr>
<td>663.30</td>
<td>Relocate Existing Water Valve &amp; Valve Box</td>
<td>Each</td>
</tr>
<tr>
<td>663.31</td>
<td>Relocate Existing Hydrant</td>
<td>Each</td>
</tr>
<tr>
<td>663.32</td>
<td>Relocate Existing Curb Stop &amp; Curb Box</td>
<td>Each</td>
</tr>
<tr>
<td>663.33</td>
<td>Adjust Existing Valve Box Elevation</td>
<td>Each</td>
</tr>
<tr>
<td>663.34</td>
<td>Adjust Existing Hydrant Elevation</td>
<td>Each</td>
</tr>
<tr>
<td>663.35</td>
<td>Adjust Existing Curb Box Elevation</td>
<td>Each</td>
</tr>
<tr>
<td>663.40</td>
<td>Disconnect and Cap Existing Water Main</td>
<td>Each</td>
</tr>
<tr>
<td>663.41xx</td>
<td>Remove and Dispose of Existing Water Main</td>
<td>Meter</td>
</tr>
<tr>
<td>663.42</td>
<td>Remove and Dispose of Existing Water Valve &amp; Valve Box</td>
<td>Each</td>
</tr>
</tbody>
</table>
663.43    Remove and Dispose of Existing Hydrant        Each
663.44    Remove and Dispose of Existing Water Service Connection    Each
663.45    Remove and Store Existing Water Valve & Valve Box     Each
663.46    Remove and Store Existing Hydrant          Each
663.47    Remove and Store Existing Curb Stop & Curb Box    Each

\[ gg = \text{Insulation Thickness Code} \]
\[ (gg \times 25 = \text{mm of thickness}) \]
\[ nn = \text{Serialized item} \]
\[ xx = \text{NPS} \]
\[ yy = \text{NPS} \]
\[ zz = \text{Water Service Size,} \ 01 = \frac{1}{2}, \ 02 = 5/8 \ (\text{not available in steel}), \ 03 = 3/4, \ 04 = 1, \ 05 = 1-1/4, \ 06 = 1-1/2, \ 07 = 2 \]

SECTION 664 - SANITARY SEWER UTILITIES

664-1 DESCRIPTION. The work in this section shall include special construction required for sanitary sewer utilities that are publicly, privately or cooperatively owned. The extent of work and construction specifications will be covered by special provisions in the contract documents.

664-2 MATERIALS. Materials shall meet the requirements specified by the respective utility company.

664-3 CONSTRUCTION DETAILS

664-3.01 General. The installation and testing procedures shall conform to the requirements specified by the utility company.

664-3.02 Schedule of Work. Work shall be scheduled for minimum interruption of service and must meet the approval of the utility company and the Engineer. A specified advance notice period must be given to the utility company and Engineer prior to interruption of services for construction.

664-3.03 Excavation. The requirements specified in Section 206, Trench, Culvert and Structure Excavation, shall apply.

664-3.04 Backfill. The requirements specified in §203-3.15, Fill and Backfill at Structures, Culverts, Pipes and Conduits and Direct Burial Cables, shall apply.

664-4 METHOD OF MEASUREMENT. As specified in the special specifications.

664-5 BASIS OF PAYMENT. As specified in the special specifications.

SECTION 665 - WATERWAYS

665-1 DESCRIPTION. The work in this section shall include special construction required for the New York State Canal Corporation.

The extent of work, material required, construction details, method of measurement and basis of payment will be covered by special provisions in the contract documents.

SECTION 666 (VACANT)

SECTION 667 - LOCAL ROAD GRAVEL SURFACE, BASE, AND SUBBASE COURSES

667-1 DESCRIPTION.
§667

667-1.01 General. The work consists of furnishing, placing and compacting gravel surface, base and subbase courses in conformity with the lines, grades, thicknesses and typical sections shown on the plans, or as determined by field conditions and ordered in writing by the municipality.

667-1.02 Material Types. Provide materials as specified by the following options.

Type A. Surface quality material with a maximum particle size of 25 mm.

Type B. Base quality material with a maximum particle size of 50 mm.

Type C. Subbase quality material with a maximum particle size of 75 mm.

667-2 MATERIALS.

667-2.01 Test and Control Methods. All tests shall be performed by laboratories accredited under the AASHTO accreditation program. Materials tests and quality control methods pertaining to the work of this section will be performed in conformance with the procedures contained in the appropriate New York State Department of Transportation (NYSDOT) and/or American Association of State Highway and Transportation Officials (AASHTO) publications which are current on the date of advertisement of bids.

667-2.02 Materials Requirements. Provide materials for road gravel surface, base, and subbase courses that consist of Sand and Gravel, approved Blast Furnace Slag or Stone that meet the requirements contained herein. Provide materials well graded from coarse to fine, and free from organic or other deleterious materials. Any gravel material will be rejected if it is determined to contain any unsound or deleterious materials.

A. Gradation. Perform sieve analysis in accordance with the AASHTO procedures T 27, T 88 or T 311. Report the following sieves for all tests: 75µm, 425µm, 6.3 mm, 12.5 mm, 19 mm, 25 mm, 37.5 mm, 50 mm, 75 mm.

Provide material meeting the gradation limits from Table 667-1.

B. Soundness. Material for local road gravel surface, base, and subbase courses will be accepted on the basis of Magnesium sulfate Soundness Loss after four (4) cycles performed according to NYSDOT procedures and Table 667-2.

C. Plasticity. Determine plasticity using either of the following methods:

1. Plasticity Index. The Plasticity Index of the material passing the #40 mesh sieve shall meet the values in Table 667-2. Determine plasticity using AASHTO tests T 89 and T 90.

2. Sand Equivalent. The sand equivalence of the granular material shall meet the values in Table 667-2. Determine sand equivalence using AASHTO test T 176.

<table>
<thead>
<tr>
<th>Table 667-1 PERCENT PASSING BY WEIGHT OF GRAVEL MATERIALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sieve (U.S. sieve)</td>
</tr>
<tr>
<td>---------------------</td>
</tr>
<tr>
<td>75 mm (3&quot;)</td>
</tr>
<tr>
<td>50 mm (2&quot;)</td>
</tr>
<tr>
<td>37.5 mm (1.5&quot;)</td>
</tr>
<tr>
<td>25 mm (1&quot;)</td>
</tr>
<tr>
<td>19 mm (3/4&quot;)</td>
</tr>
<tr>
<td>6.3 mm (1/4&quot;)</td>
</tr>
<tr>
<td>425 µm (#40)</td>
</tr>
<tr>
<td>75 µm (#200)</td>
</tr>
</tbody>
</table>
TABLE 667-2  TEST AND CONTROL LIMITS OF GRAVEL MATERIALS

<table>
<thead>
<tr>
<th>Material Properties</th>
<th>Material Type</th>
<th>A (Surface)</th>
<th>B (Base)</th>
<th>C (Subbase)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Soundness loss (%)</td>
<td>20</td>
<td>20</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Plasticity Index</td>
<td>2-9</td>
<td>0-5</td>
<td>0-8</td>
<td></td>
</tr>
<tr>
<td>Sand Equivalent</td>
<td>&gt;25</td>
<td>&gt;40</td>
<td>&gt;35</td>
<td></td>
</tr>
</tbody>
</table>

D. **Elongated Particles.** Not more than 30 percent, by weight, of the particles retained on a 12.5 mm sieve shall consist of flat or elongated particles. A flat or elongated particle is defined herein as one which has its greatest dimension more than 3 times its least dimension. Acceptance for this requirement will normally be based on a visual inspection. When the municipality elects to test for this requirement, material with a percentage greater than 30 will be rejected.

E. **Fractured Faces.** When the municipality elects to test for this requirement, Type A material shall have at least two fractured faces on 50 percent of the stone particles larger than 12.5 mm or at least one fractured face on 75 percent of the particles larger than 12.5 mm. Type B material shall have at least one fractured face on 50 percent of the stone particles larger than 12.5 mm.

667-2.03 **Stockpiling.** Stockpile all material, except that material furnished under Type C will not be required to be stockpiled if the total project quantity is more than 500 tons, unless otherwise stated in the contract documents. Follow stockpile construction requirements, sampling, testing and acceptance/rejection procedures as stipulated by applicable NYS DOT procedures.

667-3 **CONSTRUCTION DETAILS.**

667-3.01 **General.** Use uniform gravel types and materials between the roadbed limits.

667-3.02 **Placement.**

A. Place the upper course material on the grade in a manner to minimize segregation, using equipment and procedures approved by the Municipality. Do not perform uncontrolled spreading from piles dumped on the grade.

B. The maximum compacted layer thickness is 380 mm, or as shown on the plans. In confined areas as defined by the Municipality the maximum compacted layer thickness is 150 mm. The minimum loose lift thickness is 1.5 times the maximum particle size.

667-3.03 **Compaction.** When the moisture content is within the limits for proper compaction, compact the material in accordance with the requirements of §203-3.12, Compaction. Density tests are not required for the acceptance of these courses. If a subbase course has been disturbed by frost action prior to paving, recompact the layer.

667-3.04 **Traffic and Contamination.** The movement of highway traffic over the final surface of the base or subbase may be permitted at locations designated by, and under such restrictions as directed by the Municipality, provided such movements take place prior to the final finishing of this course to the specified tolerance. The movement of construction equipment on this course may be permitted at locations designated by and under such restrictions as directed by the Municipality.

No payment will be made for furnishing, placing, maintaining, removing and disposing any protective layer. Include the cost thereof in the price bid.

If a layer is damaged or mixed with the subgrade or any other material due to the Contractor’s operation, remove such material and replace it with the appropriate material at no additional cost to the Municipality.
§667

667-3.05 Tolerance.

**A. Surface and Base Course.** Place material so that after compaction the top surface of the course does not extend more than six (6) mm above nor more than six (6) mm below true grade for the course at any location.

**B. Subbase Course.** Place material so that after compaction the top surface of the course does not extend more than twelve (12) mm above nor more than twelve (12) mm below true grade for the course at any location.

667-4 METHOD OF MEASUREMENT. The quantity is the number of cubic meters of material, computed from payment lines shown on the plans or, where changes has been ordered, from payment lines established by the Municipality.

667-5 BASIS OF PAYMENT. The unit price bid for this work includes the cost of furnishing all labor, material and equipment necessary to complete the work. Include the cost of adding water in the price bid unless the items for furnishing and applying water are included in the contract. No direct payment will be made for losses of material resulting from compaction, foundation settlement, erosion, or any other cause. Include the cost of such losses in the price bid for this item. No deductions will be made for the volumes occupied by manholes, catch basins and other such objects.

Progress payments will be made after each Type course has been properly placed and compacted. Payment will be made at the unit price bid for seventy-five (75) percent of the quantity. The balance of the quantity will be paid after the final finishing to the required tolerance and just prior to the placing of the next course or Type.

**Payment will be made under:**

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>667.01</td>
<td>Local Road Gravel Surface Course, Type A</td>
<td>Cubic Meter</td>
</tr>
<tr>
<td>667.02</td>
<td>Local Road Gravel Base Course, Type B</td>
<td>Cubic Meter</td>
</tr>
<tr>
<td>667.03</td>
<td>Local Road Gravel Subbase Course, Type C</td>
<td>Cubic Meter</td>
</tr>
</tbody>
</table>

SECTION 668 AND 669 (VACANT)

SECTION 670 - HIGHWAY LIGHTING SYSTEM

670-1 DESCRIPTION. This work shall consist of furnishing and installing an operating highway lighting system in accordance with the plans, standard sheets, and specifications or as directed by the Engineer.

Where not specifically covered on the plans, specifications, or special provisions, all equipment shall be installed according to the manufacturer's published recommendations.

Included in this work is the furnishing and installing of metal light standards, breakaway transformer bases, arms, luminaires, lamps, electrical conductors, fittings, minor miscellaneous components (pole line hardware, insulators, etc.), concrete foundations, pull boxes and all other materials necessary for operating and controlling the highway lighting system. Also included is the removal, relocation, storage, and/or disposal of the above materials.

670-2 MATERIALS. All electrical equipment shall conform to the EEI, NEMA, ANSI and ASTM Standards. All material shall conform to the latest requirements of the “National Electrical Code”, herein referred to as the “Code”; the rules of the New York State Public Service Commission; local power company requirements and any local ordinances which may apply. Differences in standards or code requirements shall be resolved as determined by the Engineer.

The materials used in the construction of lighting systems shall meet the requirements of the following subsections of Section 700-Materials:

- Aluminum Light Standards and Arms 723-01
- High Mast Pole, Head Frame Assembly

NEW YORK STATE DEPARTMENT OF TRANSPORTATION
STANDARD SPECIFICATIONS of May 4, 2006
§670

NEW YORK STATE DEPARTMENT OF TRANSPORTATION
STANDARD SPECIFICATIONS of May 4, 2006

All cast-in-place concrete base, foundations and pullboxes shall conform to the requirements of Section 501, Portland Cement Concrete - General, except that the requirements for inspection facilities, automated batching control and recordation do not apply. The concrete shall be Class A concrete for structures unless otherwise specified. The batching, mixing and curing methods, and the inspection facilities shall meet the approval of the Department or its representative. The Contractor may submit for approval by Director, Materials Bureau, a mix at least equivalent to the specified Class A Concrete.

All precast concrete bases and foundations shall meet the requirements of §723-45 Precast Reinforced Concrete Foundations and Pullboxes. Anchor bolts encased in concrete foundations shall meet the requirements of §723-60, and shall be set by template.

All concrete bases, foundations and pullboxes shall conform to the dimensions and details shown on the plans, standard sheets and specifications.

Materials will be subject to inspection at any time during the contract. Failure of the Engineer to note faulty material or faulty installation during construction will not relieve the Contractor of responsibility for removing or replacing such materials or redoing work which may fail to pass any of the Engineer's inspections of this work.

670-2.01 Conduit. Couplings, condulets, adaptors and bends shall be made from the same material as the conduit, unless otherwise indicated on the plans or directed by the Engineer.

670-2.02 Pullboxes. Pullboxes shall be cast-in-place or precast concrete units. Precast concrete units shown on the contract drawings for rectangular or circular pullboxes will be acceptable if they are of sufficient interior volume required under the pay item. If no drawings are given, the details shown on the Standard Sheet “Pullbox, Conduit and Ground Rod Installation Details” shall apply.

670-2.03 Luminaires. Luminaires shall be suitable for severe vibrations up to 3 G's, and lamp supports shall be provided if the lamp is horizontally mounted.

670-3 CONSTRUCTION DETAILS

670-3.01 Plans. The Contractor shall study the plans and details and use them as a guide in determining the location of the highway lighting equipment. Any discrepancies in the contract documents shall be resolved with the Engineer before any materials are ordered. Additionally, the manufacturer or
supplier of the lighting equipment shall also use the plans to clearly label what each component part is or where it is to be installed.

All installation shall conform to the latest EEI, NEMA, ANSI and ASTM standards. In addition, workmanship shall conform to the latest requirements of the Code; the rules of the New York State Public Service Commission; local power company requirements and any local ordinances which may apply.

Any work performed within the boundaries of New York City shall also be in accordance with the “General Specifications for Street Lighting Facilities” contained in the latest publication of “City of New York SPECIFICATIONS For Use With State of New York Department of Transportation Construction Contracts.” Differences in standards or code requirements shall be resolved as determined by the Engineer.

**670-3.02 Shop Drawings.** The Contractor shall submit six copies of the Manufacturer's Shop Drawings to the Engineer for approval. These drawings shall cover the following items and be submitted at least ten working days prior to the date the Contractor orders the light standards, breakaway transformer base, arms, precast concrete foundations and high mast poles, head assemblies and lowering devices. These items shall not be shipped to the job site until the shop drawings are approved. The shop drawings shall be neatly drawn and clearly legible.

For luminaires and photoelectric controls catalog cuts may be submitted instead of shop drawings.

**670-3.03 Excavation and Miscellaneous Work.** All excavation shall be performed in accordance with Section 206 Trench, Culvert and Structure Excavation, including the protection of workers and the public. Cuts in roadways, sidewalk surfaces and driveways shall be done in a neat manner, so as to cause the least possible damage. Sawcutting will be required unless otherwise shown on the plans or directed by the Engineer.

Excavation shall not be performed until immediately before installation of the conduit, direct burial cable or any other appurtenances.

The excavated material will be placed in a location or locations approved by the Engineer. These locations shall be selected by the Contractor so as to cause the least inconvenience to vehicular and pedestrian traffic and to cause the minimum interference with the surface drainage.

All surplus excavated material shall be removed and disposed of by the Contractor as specified in §203-3.08, Disposal of Surplus Excavated Materials. Excavations shall be backfilled as specified in §203-3.15, Fill and Backfill at Structures, Culverts, Pipes, Conduits and Direct Burial Cables. After backfilling, the location shall be maintained to the satisfaction of the Engineer until permanent repairs are made.

Pavement or structure courses shall be replaced as specified in §206-3.02, Replacement of Pavement Structure Courses, except that in concrete sidewalks, the complete sidewalk panel shall be removed and replaced.

**670-3.04 Foundations.** Locations of concrete foundations for light standards shown on the plans are approximate only and the exact location will be determined in the field. The Contractor has the option to use precast foundations in place of cast-in-place foundations for light standards. However, precast foundations shall not be allowed for high mast systems.

All excavation necessary for constructing or installing a lamppost foundation shall be performed in conformance to §670-3.03.

When cast-in-place concrete foundations can be constructed in undisturbed soil, as determined by the Engineer, the concrete shall be poured in direct contact with the earth. Forms shall not be used unless the excavation is oversize or where neat limits must be maintained. The top 0.3 to 0.5 meters shall be formed as specified on the plans or as directed by the Engineer. Care shall be taken to construct the tops of all foundations so they are level and true to line and grade. Anchor bolts shall be set by template, as ordered by the Engineer.

When cast-in-place concrete foundations are to be constructed in soil that will not support a vertical cut, the foundations shall be formed. When forms are used, the foundations shall be backfilled and compacted allowing sufficient room for the compaction equipment selected.

Where unstable soil is encountered, permanent support shall be used. This can include driving sheeting, augering in a pipe section, or any other method acceptable to the engineer.
§670

When precast foundations are used, the size of the precast foundation shall not be less than that shown on the plans or standard sheet for cast-in-place foundations. They are only to be used in conjunction with one of the following special excavation and backfill methods to insure foundation stability:

**Method A.** The excavation shall allow a minimum clearance of 0.15 meters around the precast foundation to be backfilled with concrete meeting the requirements of §501-2.02, Class A. For backfill purposes, small construction mixers will be permitted.

**Method B.** The excavation shall allow a minimum clearance around the precast unit compatible with the compaction equipment used. The clear area shall be backfilled with Select Granular Fill in accordance with §203-2.02 of the Standard Specifications, and compacted in accordance with §203-3.15.

Method A or Method B can be used in undisturbed areas. Only Method B is to be used in disturbed areas.

670-3.05 **Grounding.** A 3 meter by 16 millimeter diameter, copperclad ground rod shall be driven near each foundation, maintaining at least 600 mm of cover, or through selected pullboxes where metal conduit is used. The ground rod shall be electrically connected to the base of the pole with a No. 6 soft drawn bare stranded copper ground wire. A copperclad groundwire clamp shall be used to attach the ground wire to the ground rod.

Where a 3 meter ground rod cannot be driven, or is insufficient to provide adequate grounding (see §670-3.16), alternate methods shall be used as shown on the plans or ordered by the Engineer. Such alternate methods can include changing the ground rod length or location, or connecting the ground wire to some other grounded object.

670-3.06 **Light Standards, Breakaway Transformer Bases and Arms.** Each metal light standard shall be set vertically (within 1° of plumb) on a foundation or anchorage, employing approved shims when necessary, either with or without a transformer base as shown on the plans or in the proposal. The transformer base, or the anchor base when a transformer base is not used, shall be securely bolted to the anchorage by the anchor bolts previously set.

The individual light standards shall be identified as required by the responsible maintenance agency and as shown on the plans.

Each arm shall be mounted on the shaft so the luminaire will be at the proper mounting height as shown on the plans. The mounting height shall be measured from the center of the light source to the pavement. The arms shall be in a plane perpendicular to the roadway. The Contractor, in conjunction with the Engineer, shall determine the necessary elevation data for fabricating the light standard with the correct mounting height.

A Number 8 Gauge galvanized steel or 6 millimeter nylon rope drag line shall be furnished and installed running from the terminal strip area in the luminaire to the anchor base or box where the power distribution cable is or will be installed. This drag line shall be securely anchored at each end, and removed only after the cables are installed.

The protective wrapping shall not be removed from any of the shafts or arms until the Engineer instructs the Contractor to do so.

670-3.07 **Conduit.** Underground conduit shall be either zinc coated metal steel conduit, PVC coated galvanized steel, rigid plastic, or flexible liquid-tight steel conduit, as indicated on the plans, and shall be carefully laid in trenches prepared to receive them. Unless indicated otherwise, conduits in exposed areas, when attached to the outside of structures, such as underdeck installations, shall be PVC coated galvanized steel conduit installed as shown on the plans or in a manner approved by the Engineer. Hot dipped, galvanized or non-rusting alloy steel clamps shall be provided to support the conduit at intervals not exceeding 1 m or as directed by the Engineer.

Underground conduit installations shall have a minimum cover of 0.45 meters except under roadways, where the minimum cover shall be 0.6 meters. The conduit shall be laid on a uniform grade to allow any condensation to drain to pull boxes or “T” drains, as detailed on the Standard Sheet “Pullbox,
Conduit and Ground Rod Installation Details”. Where uniform grades cannot be maintained, “T” drains shall be installed where directed by the Engineer. Conduit shall be backfilled in accordance with §203-3.15 Fill and Backfill at Structures, Culverts, Pipes, Conduits, and Direct Burial Cables. However, in rock excavations, a bedding of selected backfill must be placed and tamped before laying the conduit.

All bends in the conduit shall be made without kinking, flattening or appreciably reducing the internal diameter of the conduit. A hydraulic or power pipe bender shall be employed, unless a template is used, for all bends in steel conduit. No bends will be accepted for exposed conduit which shows any evidence of destruction of the protective coating.

Where conduits terminate at pullboxes, the Contractor shall break into the pullbox and seal, usually with mortar, the remainder of the hole(s) in a manner acceptable to the Engineer. Sealed bonding bushings shall be provided at each conduit outlet in boxes. Bushing caps, to prevent entry of dirt and refuse prior to pulling cables, shall be placed on all conduit ends. Outlet boxes with conduits properly connected shall be accurately located according to the plans and securely fastened.

All conduits installed shall be tested for clear bore and correct installation by the Contractor using a ball mandrel, brush and snake before the installation will be accepted. Two short wire brushes shall be included in the mandrel assembly. Snaking of conduits shall be done by the Contractor in the presence of the Engineer. Any conduit which rejects the mandrel shall be cleared and the Contractor shall bear all costs to replace defective conduit and restore surface to original condition.

Numbers or letters shall be assigned to the various conduit runs, and as they test clear, they shall be identified by a brass tag, no less than 31 mm in diameter, attached by means of No. 20 AWG brass wire. All conduit terminations in pole bases or pull boxes shall be tagged.

As the conduit runs test clear, a record shall be kept under the heading of “Empty Conduits Tested, Left Clear, Tagged and Capped,” showing conduit designation, diameter, location, date tested and by whom. When completed, this record shall be signed by the Electrical Inspector and submitted in triplicate for approval. This record shall be entered on the Record Drawings.

All empty conduit and duct openings after test, shall be capped or plugged by the Contractor as directed. After a conduit is properly installed and cleaned, the Contractor shall furnish and install in each conduit run a No. 10 AWG galvanized steel drag line or nylon or polypropylene rope, with a tensile strength of at least 2222 newtons, leaving at least 1 meter of extra line in each pull box, transformer base, or other terminus. If cable is not pulled through the conduit within thirty days, the steel drag shall be grounded to a suitable grounding device at each end of the circuit.

All metallic connections shall be tight to assure continuity of ground bondings.

Conduit shall be placed under existing pavement by approved jacking or boring methods and as directed by the Engineer. The jacking or boring pit shall be located beyond the outside shoulder keeping at least 0.6 meters clear of the edge of shoulder. Jacking pits will not be permitted in the median, but receiving pits may be dug in grass medians after the jacking is completed if permitted on the plans or by the Engineer.

670-3.08 Pullboxes. Cast-in-place or precast concrete pullboxes shall be constructed at the locations and to the dimensions shown in the plans, standard sheets, specifications, or proposal.

Excavations for pullboxes shall be performed in accordance with the requirements of §206-3, Construction Details for Trench, Culvert and Structure Excavation, and included in this item. Frames and covers shall be furnished and placed on each pullbox. They shall be placed true to line and grade and make full and even bearing on the pullbox.

The frames and covers shall be of the design and detail shown in the plans, standard sheets, specifications or proposal. Frames and covers which do not fit together properly, are warped or rock, will be rejected by the Engineer. Any material rejected by the Engineer, will be removed from the site by the Contractor.

No pullbox shall be backfilled until all cement concrete has sufficiently hardened and forms, if any, have been removed.

The requirements of §203-3.15, Fill and Backfill at Structures, Culverts, Pipes, Conduits and Direct Burial Cables, shall apply.

670-3.09 Junction Boxes. Cast iron junction boxes shall be installed at the locations shown on the plans. For surface mounting, the boxes shall be securely bolted to brackets as detailed on the plans. For
installation where boxes are embedded in cement concrete, the boxes shall be set with the covers flush with the surface.

All hardware used in conjunction with mounting of these boxes shall be rust and corrosion resistant.

670-3.10 Luminaires. Luminaires of the type and wattage specified, complete with all components shall be installed where shown on the plans standard sheets, or proposal or where directed by the Engineer. All necessary field adjustments required to achieve the specified light distribution shall be performed as directed by the Engineer.

A. Standard Mounting. Luminaires shall be installed on light standard mast arms with the vertical axis perpendicular to the roadway and the longitudinal axis parallel to the roadway centerline. The luminaires shall be installed, though not necessarily powered, immediately after the mast arms are connected to the shaft. Otherwise, vibration dampeners shall be used until the luminaires are installed.

B. Underbridge Mounting. Luminaires of the type and wattage specified shall be installed on wall mounts or outlet box studs.

Self-contained underbridge luminaires complete with all specified ballasts, and any other appurtenances necessary shall be installed according to manufacturers written instructions, as shown on the plans, as specified in the proposal or as directed by the Engineer.

670-3.11 Photoelectric Control. Photoelectric controls shall be installed at the locations shown on the plans, preferably facing north, and properly adjusted to energize the luminaires at the specified illumination levels.

670-3.12 Single Conductor Cable and Single Conductor Direct Burial Cable. Wire installation shall not start until raceways and boxes have been cleared of all foreign matter and all other operations of the work which are likely to damage the conductors have been completed. The National Electric Code Rules shall be observed regarding installation of wire and cable.

Unless otherwise specified, splices will be permitted only in pullboxes, junction boxes, utility manholes, luminaires, transformer bases, and lamppost hand holes. All conductor runs between units of equipment shall be without splices. Conductors in control cabinets shall not be spliced.

All splices shall be capable of satisfactory operation under continuous submersion in water. Multiple conductors shall be spliced and insulated to provide a watertight joint and to prevent absorption of moisture by the conductors.

Moisture shall be excluded from the joint during the splicing operation and the work shall be done in dry weather or under shelter. Perspiration from the splicer's hand should be wiped off with dry material. All materials and tools involved in the splicing process shall be kept dry.

One of the following methods shall be used for making a watertight and electrically insulated splice:

Method No. 1. The outer covering and insulation shall be removed from each conductor for a minimum length necessary for the use of a pressure release crimping tool. The conductor ends shall be bared and jointed with a seamless, solderless type sleeve connector of the same AWG size as the conductor being spliced, using a pressure release crimping tool designed for the size connector being used. After crimping the sleeve connector shall maintain proper contact with both conductors around the circumferences of the splice and along the length of the sleeve.

The portion of each conductor where insulation has been removed, and the sleeve connector, shall be reinsulated using a coat of fast drying sealing agent of electrical grade, wrapped tightly with overlapping layers of rubber tape, a second coat of the sealing agent applied, and then wrapped tightly with overlapping layers of polyvinylchloride tape.

The sealing agent and tape shall extend at least 25 mm onto the undisturbed insulation of each conductor. Sufficient layers of tape shall be applied to equal 1.5 times the thickness of the original insulation.

Rejacketing the cable shall be accomplished in a similar manner as described above except that the sealing agent and tape shall extend at least 0.1 meters onto the undisturbed outer covering of each cable.
§670  Individual splices in each conductor shall be staggered to minimize the outside diameter of the splice.

**Method No. 2.** All of the requirements for splicing, specified in Method No. 1, shall apply, except that the completed splice including sleeve connector and the portion of each conductor where the insulation has been removed, shall be reinsulated and the conductor rejacketed by using an acceptable mold poured full with a two component dielectric epoxy resin. The resin shall not require external heating to produce satisfactory pouring consistency.

670-3.13 Ground Cable.  Ground cable shall be installed where and as detailed on the plans or as directed by the Engineer.

670-3.14 Regulations.  All work shall be done in accordance with latest edition of the national electrical safety codes, rules and regulations of the State authorities having jurisdiction over such work, and regulations of the utility companies where the work is being installed. Where differences or discrepancies occur, the most stringent requirements shall apply.

670-3.15 Prosecution of Work.  All work shall be done by qualified and experienced mechanics of each labor class, as determined by the Engineer. All work shall be inspected and approved by the Engineer before concealment.

670-3.16 Tests.  The Contractor shall conduct all tests, in the presence of the Engineer. The equipment required for each test shall be supplied by the Contractor, along with the equipment manufacturer's written instructions describing how to perform the test. The following tests shall be performed by the Contractor, at the time directed by the Engineer, prior to acceptance of the work:

**A. Insulation Test.** Each circuit with associated ballasts and protective devices shall be insulation tested using an insulation tester connected according to manufacturers instructions. A polarization index shall be computed by dividing a ten minute reading by a one minute reading. The polarization index shall be greater than four (4) for acceptance of new circuits, and greater than two (2) for acceptance of existing circuits. The lighting system shall be properly grounded and disconnected while this test is taking place.

**B. Ground Test.** A ground test shall be performed by the Contractor using an earth tester with resolution to at least a tenth of an ohm. The test shall be performed, and the results interpreted, according to manufacturer's instructions. Readings of five ohms or less will be required for acceptance. Additional grounding methods satisfactory to the Engineer may be necessary until the installation can pass the ground test.

**C. Functional Test.** After satisfactory completion of all other tests, a functional test shall be performed consisting of not less than ten consecutive days of satisfactory operation. If unsatisfactory performance of any component of the lighting system is discovered during this time, the condition shall be corrected and the Engineer may require the test repeated until ten days of continuous satisfactory operation is obtained. Temporary shut downs caused by power interruption or vehicle impact shall not constitute discontinuity of the functional test.

670-3.17 Coordination with Utility Company.  The Contractor shall be responsible for all coordination with and between the utility company. The Contractor shall make all necessary arrangements with the utility company for the required electrical services necessary for the energizing of a temporary lighting installation and barricade lighting. The Contractor shall comply with the utility company regulations. The utility company will connect and disconnect the power as required. When an entry into a service manhole or attachment to any utility company pole is required, the Contractor shall notify the utility company sufficiently in advance, and under no condition shall the Contractor enter any utility company owned manhole or place an attachment to a utility company owned pole without an agreement with the utility company.
The service points shown on the plans are approximate only and the Contractor shall determine the exact location from the serving utility company.

When called for in the contract documents the Contractor shall make arrangements with the local utility company to complete the service connections.

670-3.18 Removal and Disposal, or Storage, of Lighting Equipment. Existing lighting equipment designated for storage shall be carefully removed from their present locations by disconnecting the conductors, unbolting the mast arm(s) and luminaire(s) and detaching the shaft (and transformer base) from the anchor bolts. The work shall be performed in a manner acceptable to the Engineer. Component parts designated for storage shall be neatly stored and protected during storage at locations and in a manner as approved by the Engineer. Standards designated for removal and disposal shall be disposed of by the contractor in a manner approved by the Engineer within the directed time period after removal from their original location. The concrete lamppost foundations shall be cut free of the attached trenched conduits and shall be removed by the Contractor from the job site. The hole resulting from removing the foundation shall be filled with an approved material and compacted as directed by the Engineer.

670-3.19 Relocation of Lighting Equipment. Lighting equipment designated for relocation shall be detached and stored as per §670-3.18, reinstalled and successfully retested at the new location. The complete relocation shall take place in one work shift unless otherwise shown on the plans or ordered by the Engineer.

Where bracket arms and luminaires are to be relocated onto other utility poles, the down leads shall also be relocated, or replaced in kind if necessary, AOBE. (Down leads include small sections of conduit or wood molding, wires and fuses connecting the secondary power supply line to the luminaire.) The bracket arm shall be attached to the pole with hardware similar to existing. The Contractor shall also relocate the epoxied strap used where the bracket arm is located above telephone lines.

Any part of the bracket arm, luminaire, or down lead damaged during removal or reinstallation shall be replaced or repaired to the satisfaction of the Engineer.

670-3.20 High Mast Pole, Head Frame Assembly and Lowering System. The high mast steel pole, head frame assembly and lowering system shall be installed in accordance with the manufacturer's recommendations, or as directed by the Engineer. With each installation a Manufacturer's instructional manual shall be furnished in each pole base. This manual shall include, but not be limited to the following details:

1. Raise and lower assembly instructions
2. Operating instructions
3. Maintenance instructions
4. Attachments

Additionally, the luminaire ring with all luminaires installed shall be lowered and raised five (5) times, at least twice in the coldest part of the winter and twice in the hottest part of the summer, if possible, to test functionality. These test dates shall be determined by the Engineer. Failure to lower or rise properly will be means for rejection of the assembly.

670-3.21 Portable Power Drive for High Mast Luminaire Lowering System. The portable power drive shall be used to raise and lower the luminaire ring as described above, and be delivered in good condition to the location shown on the plans upon acceptance of the high mast system.

670-4 METHOD OF MEASUREMENT

670-4.01 Foundations. Lighting standard foundations will be measured as the number of complete units installed in accordance with the plans, specifications or as directed by the Engineer.

670-4.02 Light Standards. Light standards will be measured as each standard of the type specified, complete, in place, in accordance with plans, specifications or as directed by the Engineer.
§670

670-4.03 Arms. Arms of the type and length specified will be measured by the number of units furnished and installed on the respective light standards (or wood poles) according to the plans, specifications or as directed by the Engineer.

670-4.04 Breakaway Transformer Base. Breakaway transformer bases will be measured as the number furnished and installed in accordance with the plans, specifications or as directed by the Engineer.

670-4.05 Conduit. Conduit will be measured by the linear meters along the axis of the conduit, of the type and size specified, installed according to the plans, proposal, or as directed by the Engineer. Measurement shall include all couplings, condulets, adaptors and bends.

670-4.06 Pullboxes. Pullboxes, including frames and covers, will be measured as the number furnished and installed in accordance with the plans, specifications or as directed by the Engineer.

670-4.07 Junction Box. Cast iron junction boxes will be measured as the number of each size furnished and installed in accordance with the plans, specifications or as directed by the Engineer.

670-4.08 Luminaires. Luminaires of the type and wattage specified will be measured by the number of units furnished and installed according to the plans, specifications or as directed by the Engineer.

670-4.09 Photoelectric Controls. Photoelectric controls will be measured as each control furnished and installed in accordance with the plans, specifications or as directed by the Engineer.

670-4.10 Single Conductor Cable and Direct Burial Cable. Single Conductor Cable wire will be measured for payment by the number of linear meters of single conductor of each size actually installed in accordance with the plans and specifications or as directed by the Engineer.

670-4.11 Ground Wire. Ground wire will be measured for payment by the number of linear meters of ground wire installed in accordance with the plans and specifications or as directed by the Engineer.

670-4.12 Removal of Lighting Equipment. The removal of lighting equipment will be measured by the number of light standards (including bracket arms and luminaires), or foundations, removed from the site and stored or disposed of as ordered by the Engineer.

670-4.13 Relocation of Lighting Equipment. The relocation of lighting equipment will be measured by the number of specified units removed and reinstalled at the new location.

670-4.14 High Mast Pole, Head Frame and Lowering Assembly. High mast steel pole, head frame assembly and lowering system will be measured by the number of complete units furnished and installed in accordance with the contact documents.

670-4.15 Portable Power Drive for High Mast Luminaire Lowering System. The portable power drive for high mast luminaire lowering system will be measured by the number of complete units delivered.

670-5 BASIS OF PAYMENT

670-5.01 General. The Contractor shall pay all fees and expenses for testing, service connections, licenses, electrical energy and any other cost he may incur in constructing the highway illumination system, except that the cost of electrical energy used for public benefit prior to the completion of the contract will be borne by the State, when such operation is directed by the Engineer in writing. The cost of all minor miscellaneous components shall be included in the price bid for the various lighting items.

670-5.02 Foundations. The unit price for each lighting standard foundation shall include the cost of all labor and materials necessary to complete the work, including conduit elbows, grounding system,
anchor bolts, all appurtenances, excavation, special fill, and any protective system(s) required to ensure the safety of the workers and the public.

**670-5.03 Light Standards.** The unit bid for each light standard shall include the cost of all labor and other materials necessary to complete the work.

**670-5.04 Arms.** The unit price bid for each arm of the type and length specified shall include the cost of the arm, appropriate down leads and all labor and other materials necessary to install it on the designated light standard or wood pole shown on the plans.

**670-5.05 Breakaway Transformer Bases.** The unit price bid for each breakaway transformer base shall include the cost of the breakaway transformer base and all labor and other materials necessary to install it where shown on the plans.

**670-5.06 Conduit.** The unit price bid per linear meter shall include the conduit and all labor and other materials necessary to complete the work, including couplings, condulets, adaptors or bends. Excavation and backfill for conduit shall be paid for separately under the item for Conduit Excavation and Backfill or as indicated.

**670-5.07 Pullbox.** The unit price bid for each pullbox shall include the cost of all excavation, backfill, frames, covers, labor, equipment, and other materials necessary to complete the work.

**670-5.08 Junction Box.** The unit price bid per each junction box shall include the cost of furnishing and installing cast iron junction boxes, and all labor, equipment and any other material necessary to complete the work.

**670-5.09 Luminaires**

  **A. Standard Mount.** The unit price bid for each standard mount luminaire shall include the cost of the luminaire of the type specified, labor and other material necessary to complete the work.

  **B. Underbridge Mount.** The unit price bid for each underbridge luminaire shall include the cost of the underbridge luminaire of the type specified, complete with mounting hardware, and all labor and other materials necessary to complete the work.

**670-5.10 Photoelectric Controls.** The unit price bid for each control shall include the cost of all labor, equipment and any materials necessary to complete the work.

**670-5.11 Single Conductor Cable and Direct Burial Cable.** The unit price bid per linear meter shall include the cost of furnishing all labor, materials, and equipment to satisfactorily complete the work. Cable from the pole base to the luminaire, or from the overhead power source to the luminaire, will be included in the light standard item or bracket arm item.

**670-5.12 Ground Wire.** The unit price bid per linear meter shall include the cost of furnishing all labor, materials, and equipment to satisfactorily complete the work.

**670-5.13 Remove and Store Lighting Equipment.** The unit price bid for removing and storing lighting equipment shall include the cost of all labor, materials and equipment necessary to complete the work. Removing concrete foundations will be paid for under its appropriate item.

**670-5.14 Remove and Dispose of Lighting Equipment.** The unit price bid for removing and disposing lighting equipment shall include the cost of all labor, materials and equipment necessary to complete the work. Removing concrete foundations will be paid for under its appropriate item.

**670-5.15 Relocate Lighting Equipment.** The unit price bid for relocating the lighting equipment shall include the cost of all labor, materials and equipment necessary to complete the work. Installing
new concrete foundations will be paid for under their appropriate items. New conductors and conduit, where necessary, will also be paid for separately.

670-5.16 High Mast Pole, Head Frame Assembly, and Lowering System. The price bid shall include the furnishing of all labor, materials, and equipment necessary to complete the work. The luminaires will be paid for separately.

670-5.17 Portable Power Drive for High Mast Luminaire Lowering System. The price bid shall include the entire power drive assembly, and winch if necessary, delivered to the location indicated on the plans or directed by the Engineer.

Payment will be made under:

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<tr>
<td>XX =</td>
<td>Mounting height in whole meters (09, 11, 13, 14, 16)</td>
<td></td>
</tr>
<tr>
<td>670.17XX</td>
<td>Aluminum Davit Arm</td>
<td>Each</td>
</tr>
<tr>
<td>XX =</td>
<td>Arm Length in meters and tenths (1.8, 3.6, 4.5, 5.4, 6.0)</td>
<td></td>
</tr>
<tr>
<td>670.18XXZZ</td>
<td>High Mast Pole, Head Frame Assembly with Luminaire Ring and Lowering Device</td>
<td>Each</td>
</tr>
<tr>
<td>XX =</td>
<td>Height of pole in whole meters (30, 36, 45)</td>
<td></td>
</tr>
<tr>
<td>ZZ =</td>
<td>Number of luminaire tenons (04, 05, 06, 08, 10, 12)</td>
<td></td>
</tr>
<tr>
<td>670.1801</td>
<td>Portable Power Drive for High Mast Luminaire Lowering System</td>
<td>Each</td>
</tr>
<tr>
<td>670.19 M</td>
<td>Breakaway Transformer Base (Aluminum)</td>
<td>Each</td>
</tr>
<tr>
<td>670.20XX</td>
<td>Galvanized Steel Conduit</td>
<td>Meter</td>
</tr>
<tr>
<td>XX=</td>
<td>01 02 03 04 05 06</td>
<td></td>
</tr>
<tr>
<td>NPS=</td>
<td>¾ 1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>670.23XX</td>
<td>Galvanized Steel Plastic Coated Conduit</td>
<td>Meter</td>
</tr>
<tr>
<td>XX=</td>
<td>01 02 03 04 05 06 07 08 09 10 11 12</td>
<td></td>
</tr>
<tr>
<td>NPS=</td>
<td>1/2 3/4 1 1¼ 1½ 2 2½ 3 3½ 4 5 6</td>
<td></td>
</tr>
<tr>
<td>670.25XX</td>
<td>Flexible Conduit</td>
<td>Meter</td>
</tr>
<tr>
<td>XX=</td>
<td>01 02 03 04 05 06 07</td>
<td></td>
</tr>
<tr>
<td>NPS=</td>
<td>3/4 1 1¼ 1½ 2 3 4</td>
<td></td>
</tr>
</tbody>
</table>
§670

670.26XX   Rigid Plastic Conduit             Meter
   \(XX= 01 \ 02 \ 03 \ 04 \ 05 \ 06\)
   \(NPS= 1 \ 2 \ 3 \ 4 \ 5 \ 6\)

670.3001   Pullboxes less than 0.14 m\(^3\), inside volume (Lighting) Each
670.3006   Pullboxes 0.14 m\(^3\) to 0.21 m\(^3\), inside volume (Lighting) Each
670.3010   Pullboxes 0.22 m\(^3\) to 0.28 m\(^3\), inside volume (Lighting) Each
670.3020   Pullboxes 0.29 m\(^3\) to 0.42 m\(^3\), inside volume (Lighting) Each
670.3030   Pullboxes over 0.42 m\(^3\), inside volume (Lighting) Each
670.40    Cast Iron Junction Boxes Each
670.50TCWW Luminaire Each
   \(T= Type \ of \ Lamp \ and \ Mounting:\)
   \(1=High \ Pressure \ Sodium \ Vapor, \ Std. \ Mount; \ 2=High \ Pressure \ Sodium \ Vapor, \ Underbridge \ Mt.; \)
   \(3=Low \ Pressure \ Sodium \ Vapor, \ Underbridge \ Mt.; \ 4=Mercury \ Vapor, \ Std \ Mount; \)
   \(5=Mercury \ Vapor, \ Underbridge \ Mount\)
   \(C= Cutoff \ Characteristics\)
   \(1=Short, \ Cutoff; \ 2=Medium, \ Semi-cutoff; \ 3=Long, \ Non-cutoff; \)
   \(4=Medium, \ Cutoff; \ 5=Long, \ Semi-cutoff; \ 6=Medium, \ Non-cutoff; \ 7=Short, \ Non-cutoff\)
   \(8=Short, \ Full \ Cutoff; \ 9=Medium, \ Full \ Cutoff\)
   \(WW= Wattages\)
   \(03=35 \ watts; \ 05=50 \ watts; \ 07=70 \ watts; \ 15=150 \ watts; \)
   \(20=200 \ watts \ 25=250 \ watts; \ 40=400 \ watts; \ 01=1000 \ watts; \)
   \(55=55 \ watts; \ 09=90 \ watts; \ 10=100 \ watts; \ 13=135 \ watts; \ 17=175 \ watts; \ 70=700 \ watts\)

670.60    Photoelectric Controls Each
670.70XX   Single Conductor Cable             Meter
   \(XX= 02 \ 03 \ 04 \ 05 \ 06 \ 07 \ 10 \ 20 \ 30 \ 40\)
   \(Gage = 2 \ 4 \ 6 \ 8 \ 10 \ 12 \ 1/0 \ 2/0 \ 3/0 \ 4/0\)

670.71XX   Single Conductor Direct Burial Cable Meter
   \(XX= 01 \ 02 \ 03 \ 04 \ 05 \ 06 \ 07\)
   \(Gage = 4/0 \ 2/0 \ 1/0 \ 2 \ 6 \ 10 \ 12\)

670.7501   Ground Wire No. 6 AWG. Meter
670.80    Remove and Store Lamppost Assembly Each
670.81    Remove and Dispose of Lamppost Assembly Each
670.82    Remove Lamppost Foundation Each
670.90    Relocate Lamppost Assembly Each
670.91    Relocate Bracket Arm With Luminaire Each

SECTIONS 671 THRU 679 (VACANT)

SECTION 680 - TRAFFIC SIGNALS

680-1 DESCRIPTION

680-1.01 Work. This work shall consist of furnishing and installing new traffic signal equipment, in accordance with the plans, specifications, standard sheets, or directions of the Engineer.

680-1.02 Definitions. The following definitions shall apply to all work, equipment, and materials included under this section:

1. Actuation - The operation of any type of detector.
2. Controller - That part of a controller assembly which performs the basic timing and logic functions.
3. Controller Assembly - The complete assembly for controlling the operation of a traffic signal, consisting of a controller together with all auxiliary equipment, housed in a weatherproof cabinet or cabinets.

4. Cycle Length - The time in seconds required for one complete signal cycle.

5. Detector - A device for indicating the passage or presence of vehicles or pedestrians.

6. Inductance Loop Detector - A detector consisting of a wire loop embedded in the roadway surface connected to an electronic device that is capable of sensing the passage or presence of either moving or stationary vehicles by a change in the electrical inductance characteristics of the wire loop.

7. Interval - That part or parts of a signal cycle during which signal indications do not change.

8. Phase - That part of a signal cycle allocated to any traffic movement receiving the right of way or to any combination of traffic movement receiving the right of way simultaneously during one or more intervals. Each phase shall consist of at least one green interval and one yellow clearance interval.


10. Signal Face - That part of a signal head provided for controlling traffic in a single direction and consisting of one or more signal sections. Turning indications may be included in a signal face.

11. Signal Head - An assembly containing one or more signal faces which may be designated accordingly as one-way, two-way, etc.

12. Signal Indication - The illumination of a traffic signal lens or equivalent device, or a combination of several lenses or equivalent devices at the same time.

13. Signal Section - A complete unit for illuminating a lens consisting of a housing, lens, reflector, lamp receptacle, and lamp.

14. Type I Traffic Signal Section. A Type I Traffic Signal Section is a standard or polycarbonate traffic signal section without reflector, reflector ring, lens, and lamp receptacle.

15. Type I Pedestrian Signal Section. A Type I Pedestrian Signal Section is a standard or polycarbonate pedestrian signal section without reflector, lens, and lamp receptacle.

680-2 MATERIALS

680-2.01 Traffic Signal Equipment. The specific components used in the construction of new traffic signal systems shall meet the requirements of the following subsections included under section 700, MATERIALS DETAILS:

<table>
<thead>
<tr>
<th>Description</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bar Reinforcement, Grade 420</td>
<td>709-01</td>
</tr>
<tr>
<td>Iron Castings</td>
<td>715-05</td>
</tr>
<tr>
<td>Breakaway Transformer Base</td>
<td>723-15</td>
</tr>
<tr>
<td>Rigid Plastic Conduit</td>
<td>723-19</td>
</tr>
<tr>
<td>Metal Steel Conduit, Zinc Coated</td>
<td>723-20</td>
</tr>
<tr>
<td>P.V.C. Coated Galvanized Steel Conduit</td>
<td>723-23</td>
</tr>
<tr>
<td>Flexible Liquid-Tight Steel Conduit</td>
<td>723-24</td>
</tr>
<tr>
<td>Cast Iron Junction Boxes</td>
<td>723-40</td>
</tr>
<tr>
<td>Precast Reinforced Concrete Pullboxes</td>
<td>723-45</td>
</tr>
<tr>
<td>Signal Cable</td>
<td>724-01</td>
</tr>
<tr>
<td>Span Wire</td>
<td>724-02</td>
</tr>
<tr>
<td>Traffic Signal Poles</td>
<td>724-03</td>
</tr>
<tr>
<td>Traffic Signal Heads</td>
<td>724-04</td>
</tr>
<tr>
<td>Shielded Communication Cable</td>
<td>724-08</td>
</tr>
<tr>
<td>Signal Cable with Integral Messenger</td>
<td>724-09</td>
</tr>
<tr>
<td>Shielded Communication Cable with Integral Messenger</td>
<td>724-10</td>
</tr>
<tr>
<td>Fire Pre-emption Tell Tale Light</td>
<td>724-15</td>
</tr>
<tr>
<td>Inductance Loop Wire</td>
<td>724-20</td>
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<tr>
<td>Shielded Lead-in Cable</td>
<td>724-21</td>
</tr>
<tr>
<td>Roadway Loop Embedding Sealer</td>
<td>724-22</td>
</tr>
<tr>
<td>Pedestrian Push Button and Sign</td>
<td>724-23</td>
</tr>
<tr>
<td>Fiberoptic Pedestrian Signal Heads</td>
<td>724-04</td>
</tr>
<tr>
<td>Fiberoptic Dual Indication Arrow</td>
<td>724-04</td>
</tr>
<tr>
<td>Strobing Signal Indication</td>
<td>724-04</td>
</tr>
</tbody>
</table>
§680

LED Traffic Signal Modules 724-04
LED Pedestrian Signal Modules 724-04

680-2.02 Concrete. All cast-in-place pullboxes, signal pole foundations and controller cabinet bases shall meet the requirements of Class A concrete in section 501, Portland Cement Concrete General, except that the requirements for inspection facilities, automated batching controls and recordation do not apply. The batching, mixing and curing methods and the inspection facilities shall meet the approval of the Department or its representative. The Contractor may submit, for approval by Director, Materials Bureau, a mix at least equivalent to the specified Class A Concrete.

All precast concrete pullboxes, signal pole foundations and controller cabinet bases shall meet the requirements of §723-45 Precast Reinforced Concrete Pullboxes.

680-2.03 Messenger Wire. Messenger wire shall meet the requirements of §724-02 Span Wire.

680-2.04 Guy Wire. Guy wire shall meet the requirements of §724-02 Span Wire.

680-2.05 Pullbox Frames and Covers. Frames and covers shall meet the requirements of §715-05 Iron Castings.

680-3 CONSTRUCTION DETAILS

680-3.01 Equipment List and Drawings. Unless otherwise waived, the Contractor shall submit to the Regional Director within 30 days following the award of contract, detailed specifications, catalog cuts, parts list, instruction sheets, and shop drawings of equipment and materials which he proposes to install.

680-3.02 (Vacant).

680-3.03 Negotiations with Utility Company. The Contractor shall be responsible for all negotiations involving utility companies.

The Contractor shall comply with utility company regulations.

When a entry into a service manhole or attachment to any utility company pole is required, the Contractor shall notify the utility company sufficiently in advance. Entry into a service manhole or attachment to any pole shall not be made without the presence of a utility company representative if the utility company so requires. The service points shown on the plans are approximate only and the Contractor shall determine the exact location from the serving utility company.

The Contractor shall make arrangements with the local utility company to complete the service connection.

680-3.04 Underground Facilities. The Contractor shall locate all existing underground facilities in accordance with the provisions of Industrial Code Rule 753. It shall be the Contractors responsibility to satisfy himself as to existing conditions and to protect and support in a suitable manner all underground facilities encountered during the trenching and excavating operations. The Contractor shall repair any damage to these lines caused by his operations, and if the nature of the damage is such as to endanger the operations of these services and utilities and the necessary repairs are not immediately made by the Contractor, the work may be performed by the State or other Contractor and the cost thereof charged against the Contractor.

680-3.05 Test Holes. Prior to excavating for pole placement and after locating all existing underground facilities, the Contractor shall dig a test hole or holes at the proposed location of each pole. If obstructions are encountered the Contractor shall properly backfill the test hole and move to a new location as directed by the Engineer.

680-3.06 Work Sites. The Contractor shall perform all work within the work site in a workmanlike manner and in accordance with U.S. Department of Labor's Occupational Safety and Health Standards.
The sites of the work and adjacent premises shall be kept as free from material, debris and rubbish as is practicable. All such material or debris that accumulates during the work shall be removed by the Contractor as the work progresses.

Neither the materials excavated, nor the materials used, shall be placed so as to prevent access to any fire hydrants, water valves, manholes, police call boxes or fire alarm boxes.

680-3.07 Schedule of Work. The Contractor shall notify the local power company at least 72 hours (or as required by the company) in advance of the time that the individual installation is complete and ready for operation in order that taps may be made by the power company to distribution lines.

Upon completion of a signal installation the signal may be placed in operation prior to the completion of other installations or the signal head may be covered. The Contractor shall place the signal in operation or cover the head as directed by the Engineer.

When the traffic signal is placed in operation, it shall be operated in accordance with timing schedules to be supplied by the Department.

680-3.08 Contractor Responsibility with Utilities. All attachments to utility company poles shall be made in accordance with the specifications and subject to the inspection of the utility companies owning the poles. The height of all proposed attachments above the ground and their locations on the poles shall be in accordance with the plans, standard sheets or as directed by the Engineer and shall meet the approval of the utility companies owning the poles.

The Contractor shall protect all property and materials of the utility companies and shall be responsible for the repair or replacement of any damaged material or property. In the event that the point of attachment or location of the risers is such that the risers interfere with or do not provide proper clearance with existing utility company attachments, the Engineer, in consultation with the utility companies owning the poles, shall make the necessary adjustments in heights and location to eliminate such interference.

680-3.09 Excavation. All excavation shall be performed in accordance with Section 206 Trench, Culvert and Structure Excavation, including the protection of workers and the public.

Excavation shall not be performed until immediately before installation of the conduit, direct burial cable, footings, pullboxes or any other appurtenances. The excavated material shall be placed in a location or locations approved by the Engineer. These locations shall be selected by the Contractor so as to cause the least inconvenience to vehicular and pedestrian traffic and to cause the minimum interference with the surface drainage. All surplus excavated material shall be removed and disposed of by the Contractor as specified in §203-3.08 Disposal of Surplus Excavated Materials.

Excavation shall be backfilled as specified in §203-3.15, Fill and Backfill at Structures, Culverts, Pipes, Conduits and Direct Burial Cables. After backfilling, the excavation shall be kept well filled and maintained in a smooth and well drained condition until permanent repairs are made.

The outline of all areas to be removed in sidewalks, driveways, and pavement shall be saw cut to a depth of at least 75 mm prior to removing the sidewalk, driveway or pavement. Cuts shall be neat and true along score lines with no shatter outside the removal area. Damaged saw cut areas shall be recut.

Pavement, shoulder, sidewalks, curbs, driveways, lawns, plants and other such features shall be replaced in kind with material of equal quality or as shown on the plans, standard sheets or as directed by the Engineer.

Whenever a part of a square or slab of existing concrete sidewalk, curb, gutter or driveway is broken or damaged, the entire square, section or slab shall be removed and replaced with the same kind and quality of material.

For transverse sidewalk, curb or gutter cuts in concrete the entire square or section shall be removed and replaced with the same kind and quality of material. For longitudinal cuts in concrete sidewalks only the area removed between sawcuts shall be replaced unless specified otherwise on the plans.

680-3.10 Pole Excavation and Concrete Foundation. Foundations shall be constructed as shown in the contract documents or as directed by the Engineer. However, the Contractor has the option to use either Cast-in-Place or Precast Concrete foundations for the signal poles.

If the Contractor elects to install a cast-in-place foundation, the signal pole may be installed on the foundation three (3) days after concrete placement. However, the span wire and signal heads may not be...
installed until the concrete cylinder strength reaches at least 15 MPa. Therefore, the Contractor shall assist the Engineer in making a sufficient number of test cylinders of the foundation concrete, store these cylinders at the location directed by the Engineer, and transport these cylinders to the State testing facility in order to install the traffic signal as soon as possible.

If the Engineer requests the submittal of design computations for one or more signal poles, the Contractor shall not start construction of the foundations for those signal poles until the Engineer's review of the submittal is completed. The Engineer will have twenty (20) working days to review the design computation for one signal pole, and an additional two (2) working days for each additional signal pole.

For those poles on which a traffic signal cabinet will be mounted, the Contractor shall orient the pole foundation to align the signal cabinet and cabinet wiring access hole as specified on the plans. If no orientation is specified on the plans, the Contractor shall orient the signal cabinet and cabinet wiring access hole 180° from the span wire or load attachment to the pole, unless otherwise directed by the Engineer. The Contractor shall notify the Engineer three (3) working days in advance of doing any pole foundation work and provide the intended pole orientation.

680-3.11 Poles. Poles shall be erected as specified on the plans, standard sheets and as directed by the Engineer.

Pole and signal locations shown on the contract plans shall be field checked for any condition that may affect their placement, where changes are necessary the exact location will be determined by the Engineer.

When field conditions require a change in pole position from that shown in the contract plans, the pole length requirements may vary. It shall be the Contractor’s responsibility to verify pole length before ordering poles.

Pole erection shall include installation of mast arms and lighting arms and attachment of fittings as specified on the plans and standard sheets as follows:

1. Anchor bolt covers if specified.
2. Weatherheads and couplings as required.
3. Service bracket.
4. Pole cap and mast arm end caps.
5. Cabinet mounting fittings, plates, brackets as needed for the cabinet being installed.
6. Reinforced couplings for wire entrances to cabinets.
7. Galvanized eyebolt, nuts and washers for attaching span wire assembly.
8. Galvanized pole clamps with eyes for attaching tether wires.

In addition, the Engineer may require the contractor to submit, at any time, design computations for any or all of the traffic signal poles in the contract. The design computations must be approved, stamped and signed by a professional engineer licensed in New York State. The Engineer shall have twenty (20) working days to review the design computations for one traffic signal pole, and an additional two (2) days for each additional signal pole.

If the Engineer’s review of a pole's design indicates a problem(s) exists, the Contractor will be notified within the time allotted for the review. In these cases a meeting will be held between the Engineer and the Contractor to resolve the Engineer's concerns.

680-3.12 Grounding. A copper clad ground rod, ground wire and fittings shall be installed as shown on the plans, standard sheets or as directed by the Engineer. The ground system shall be electrically connected to the grounding terminal on the pole or controller cabinet.

The ground system when completed shall be tested in accordance with §680-3.32. If the requirements of this test are not met, additional ground rods, ground rod extensions, electrical bonding of metallic conduit or other grounding measures may be required as directed by the Engineer.

680-3.13 Conduit and Direct Burial Cable. Conduit and direct burial cable shall be installed as specified on the plans, standard sheets or as directed by the Engineer. Underground conduit and direct burial cable installations shall have a minimum cover of 0.45 m except under roadways, where the minimum cover shall be 0.6 m unless specified otherwise on the plans, or standard sheets. The conduit shall be laid on a uniform grade to allow any condensation to drain to pull boxes or “T” drains. Conduit
shall be backfilled in accordance with §203-3.15 Fill and Backfill at Structures, Culverts, Pipes, Conduits and Direct Burial Cables. In rock excavations a bedding of select backfill must be placed and tamped before laying the conduit.

Conduit may be placed under pavement by jacking or boring methods approved by the Engineer. Pavement may not be disturbed without permission of the Engineer. In the event obstructions are encountered, small test holes may be cut in the pavement upon approval of the Engineer. Jacking or boring pits shall be kept 0.6 m clear of the edge of pavement and shoulder whenever possible. Excavation for jacking or boring pits shall be in accordance with §680-3.09 Excavation.

Conduit or direct burial cable may be placed by machine methods approved by the Engineer. All bends in conduit shall be made without kinking, flattening or appreciably reducing the internal diameter of the conduit. A hydraulic or power pipe bender shall be employed for all bends in steel conduit. Any evidence of destruction of the protective coating will be cause for rejection. All connections in metallic conduit shall be tight. Ends of conduit shall be reamed to remove burrs and rough edges.

Conduit ends in pullboxes, junction boxes, cabinet, etc. shall be equipped with insulating bushings.

All conduits installed shall be tested for clear bore and correct installation by the Contractor in the presence of the Engineer.

All empty conduit after testing shall be immediately sealed by the Contractor.

After a conduit is properly installed, the Contractor shall furnish and install in each conduit run a No. 10AWG galvanized steel drag wire or nylon or polypropylene rope with a tensile strength of at least 2.2 kN. At least one meter of extra wire or rope shall be left at each end.

680-3.14 Pullboxes. Pulboxes shall be constructed and installed in accordance with the details specified on the standard sheets or as directed by the Engineer.

Cast iron frames and covers shall be furnished and placed on each pullbox. They shall be set in mortar and placed true to line and grade and make full and even bearing on the underlying construction surface. The frame and cover shall be as shown on the standard sheet. Frames and covers which do not fit together properly, will be rejected by the Engineer and shall be removed from the site.

680-3.15 Signal Control Cable and Shielded Communication Cable. Cable shall be installed to form a continuous circuit between the proper equipment terminals. All terminal connections shall be made with approved solderless lugs of the proper size using a crimping tool that is self-releasing when proper compression has been applied. Only connectors that provide continuity and physical contact around the circumference of the connector and conductor shall be used.

During installation of the cable, the Contractor shall take care not to damage conductors, insulation, or outer covering. The length of cable installed shall not cause excessive stress on the conductors or any part of the cable.

An insert lubricant approved by the Engineer shall be used in placing cable in conduit. Cable shall be pulled into conduit by hand and the use of winches or other power actuated pulling equipment will not be permitted.

At least one meter but not more than one and one half meter of slack shall be left for each cable at each pullbox or junction box. Short bends of cable shall be avoided inside pullboxes. Cable in pullboxes or junction boxes shall not cross over any other cables already in place nor block any conduit. All cable shall be identified as to function in each pullbox, junction box or cabinet by the use of aluminum or brass cable markers. If a wire numbering system is used for identification, the key to the system shall be placed along with the wiring diagram in the controller cabinet.

Conductors in controller cabinets shall be dressed neatly with tie wraps. Spare conductors shall be taped and coiled neatly in the bottom of the cabinet. Ends of spare conductors shall be taped. Field wiring entering controller cabinets shall be identified as to function.

Splices in shielded communication cable will not be allowed between equipment terminals. Where cable is installed on span wire, or messengers, it shall be supported at intervals not greater than 380 mm by messenger rings, stainless steel cable straps or other non-corrosive metal lashing approved by the Engineer. Taping and plastic cable ties will not be permitted.

Integral messenger cable shall be installed in accordance with the details specified on the standard sheets or as directed by the Engineer.

When integral messenger cable is installed on utility company poles, the Contractor shall make all arrangements with the utility company for the installation. The Contractor shall observe all utility...
company requirements for attachments to poles and clearances with utility wires. The Contractor shall notify the utility company prior to start of the work and observe the utility company requirements for accomplishment of the work.

All necessary hardware used with integral messenger cable shall develop the full breaking strength of the integral messenger wire. Poles at each end and at each change of direction shall be guyed as specified on the plans or directed by the Engineer. When installed on utility company poles, guys shall be installed as directed by the utility company.

680-3.16 Cable Splices. Unless otherwise specified, cable splices will be permitted only in pullboxes, junction boxes, utility manholes, and at traffic signal heads. All cable runs between units of equipment shall be without splices unless shown on the plans or authorized by the Engineer. Conductors in controller cabinets shall not be spliced. Splices in overhead cable, when necessary, shall be made with the approval of, and as specified by the Engineer.

All splices shall be capable of satisfactory operation under continuous submersion in water. Multi-conductor cables shall be spliced and insulated to provide a watertight joint and to prevent absorption of moisture by the cable.

Moisture shall be excluded from the joint during the splicing operation and the work shall be done in dry weather or under shelter. Perspiration from the splicer's hand should be wiped off with dry material. All materials and tools involved in the splicing process shall be kept dry.

One of the following methods shall be used for making a watertight and electrically insulated splice:

**Method No. 1.** The outer covering and insulation shall be removed from each conductor for a minimum length necessary for the use of a pressure release crimping tool. The conductor ends shall be bare and joined with a seamless, solderless type sleeve connector of the same AWG size as the conductor being spliced, using a pressure release crimping tool designed for the size connector being used. After crimping the sleeve connector shall maintain proper contact with both conductors around the circumference of the splice and along the length of the sleeve.

The portion of each conductor where insulation has been removed, and the sleeve connector, shall be reinsulated using a coat of fast drying sealing agent of electrical grade, wrapped tightly with overlapping layers of rubber tape, a second coat of the sealing agent applied, and then wrapped tightly with overlapping layers of polyvinylchloride tape.

The sealing agent and tape shall extend at least 25 mm onto the undisturbed insulation of each conductor. Sufficient layers of tape shall be applied to equal 1.5 times the thickness of the original insulation.

Rejacketing the cable shall be accomplished in a similar manner as described above except that the sealing agent and tape shall extend at least 100 mm onto the undisturbed outer covering of each cable.

Individual splices in each conductor shall be staggered to minimize the outside diameter of the spliced cable.

**Method No. 2.** All of the requirements for splicing, specified in Method No. 1, shall apply, except that the completed splice including sleeve connector and the portion of each conductor where the insulation has been removed, shall be reinsulated and the cable rejacketed by using an acceptable mold poured full with a two component electrical insulating resin approved by the Engineer. The resin shall not require external heating to produce satisfactory pouring consistency.

680-3.17 Span Wire Assembly. Span wire assemblies including necessary hardware shall be installed and constructed in accordance with the details on the standard sheets or as directed by the Engineer.

Span wire assemblies shall be either single span wire, dual span wire with upper tether or dual span wire with lower tether as specified on the plans.

The Contractor shall determine the span and tether wire diameter based upon pole design load using the table on the standard sheets. All necessary hardware for attaching span and tether wires to the poles shall develop the full breaking strength of the span or tether wire with which it is used, except that breakaway links for lower tether wires shall develop the strength specified on the standard sheets.
Sag shall be adjusted so that it is a minimum of 5 percent of the span when the traffic signal system, including overhead signs, is complete.

The Contractor shall determine the length of suspension and tether wire required to span the distance between poles, allow sufficient length for fastening and sag and after adjustments, make the whole assembly consistent with the plans, standard sheets or as directed by the Engineer.

680-3.18 Messenger Assembly. The messenger shall be installed in accordance with the details on the standard sheets or as directed by the Engineer.

When a messenger is installed on utility company poles the Contractor shall make all arrangements with the utility company for the installation. The Contractor shall observe all utility company requirements for attachments to poles and clearance with utility wires. The Contractor shall notify the utility company prior to the start of the work and observe the utility company requirements for accomplishment of the work.

All necessary hardware used with the messenger assembly shall develop the full breaking strength of the messenger strand. Poles at each end and at each change of direction along the run of messenger shall be guyed as specified on the plans or directed by the Engineer. When installed on utility company poles, guys shall be installed where required by the utility company. The signal control cable shall be fastened to the messenger at intervals not greater than 0.4 m by messenger rings, stainless steel cable straps or other non-corrosive metal lashings approved by the Engineer. Taping and plastic cable bands will not be permitted.

680-3.19 Guy Assembly. Guys shall be installed and constructed in accordance with the details on the standard sheets or as directed by the Engineer. Guys on utility company poles shall meet the utility company requirements.

Excavation for the anchor shall be of the minimum width possible to accept the unexpanded anchor. All backfill shall be compacted.

680-3.20 Riser Assembly. Risers and weatherheads shall be installed and constructed in accordance with the details on the standard sheets or as directed by the Engineer. Risers on utility company poles shall meet the utility company requirements.

680-3.21 Signal Heads. Signal heads shall be installed as specified on the plans, standard sheets or as directed by the Engineer. Each signal head shall be assembled from signal sections and brackets in the configuration specified on the plans. Signal heads shall be properly aligned to the satisfaction of the Engineer. All mounting hardware shall be securely tightened to prevent loosening by the wind.

Until signal heads are placed in operation they shall be bagged with opaque or other material, as approved by the Engineer, that is adequately secured in a neat and orderly manner.

Optically programmed signal heads shall be installed, directed and veiled in accordance with the manufacturer's instructions, plans, standard sheets and the Engineer's visibility requirements. Each section of the signal shall be masked with prescribed materials in an acceptable and skillful manner.

LED Traffic or Pedestrian Signal Modules, which are supplied by the State, shall be installed in new or existing traffic or pedestrian signal heads as shown on the plans or as ordered by the Engineer. When the Contractor is required to furnish the LED module, unless otherwise waived, the Contractor shall submit to the Regional Director within 30 days following the award of contract, detailed specifications and catalog cuts of the equipment he/she proposes to install. In either case, the Contractor shall first remove any existing components necessary to install the LED modules, and the removed components shall remain the property of the State.

680-3.22 Wiring Color Code. The following wire color code system, unless otherwise shown on the plans, shall be used for wiring signal heads:

A. Through C. (Vacant)
**D. 1 Through 8 Phases**

1. Priority of assigning signal phases, overlaps and double clearances to Groupings of Color - Coded Wire for Signal Heads:

<table>
<thead>
<tr>
<th>PRIORITY FUNCTION</th>
<th>PRIORITY FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 5</td>
<td>Phase 4</td>
</tr>
<tr>
<td>Phase 1</td>
<td>Overlap No. 1</td>
</tr>
<tr>
<td>Phase 6</td>
<td>Overlap No. 2</td>
</tr>
<tr>
<td>Phase 2</td>
<td>Overlap No. 3</td>
</tr>
<tr>
<td>Phase 7</td>
<td>Overlap No. 4</td>
</tr>
<tr>
<td>Phase 3</td>
<td>Double Clearance No. 1</td>
</tr>
<tr>
<td>Phase 8</td>
<td>Double Clearance No. 2</td>
</tr>
</tbody>
</table>

2. Groupings of color coded wire for signal heads:

<table>
<thead>
<tr>
<th>GROUP NUMBER</th>
<th>INDICATION</th>
<th>WIRE COLOR CODE*</th>
<th>GROUP NUMBER</th>
<th>INDICATION</th>
<th>WIRE COLOR CODE*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Red</td>
<td>14/19C-1-R</td>
<td>4</td>
<td>Red</td>
<td>14/19C-1-B/R</td>
</tr>
<tr>
<td></td>
<td>Yellow</td>
<td>14/19C-1-0</td>
<td>4</td>
<td>Yellow</td>
<td>14/19C-1-O/R</td>
</tr>
<tr>
<td></td>
<td>Green</td>
<td>14/19C-1-G</td>
<td>4</td>
<td>Green</td>
<td>14/19C-1-BL/R</td>
</tr>
<tr>
<td></td>
<td>Ground Wire</td>
<td>14/19C-1-W/B</td>
<td>4</td>
<td>Ground Wire</td>
<td>14/19C-1-W/B</td>
</tr>
<tr>
<td>2</td>
<td>Red</td>
<td>14/19C-2-B</td>
<td>5</td>
<td>Red</td>
<td>14/19C-2-B</td>
</tr>
<tr>
<td></td>
<td>Yellow</td>
<td>14/19C-2-BL</td>
<td>5</td>
<td>Yellow</td>
<td>14/19C-2-O/B</td>
</tr>
<tr>
<td></td>
<td>Green</td>
<td>14/19C-2-G</td>
<td>5</td>
<td>Green</td>
<td>14/19C-2-G/B</td>
</tr>
<tr>
<td></td>
<td>Ground Wire</td>
<td>14/19C-2-B/W</td>
<td>5</td>
<td>Ground Wire</td>
<td>14/19C-2-B/W</td>
</tr>
<tr>
<td>3</td>
<td>Red</td>
<td>14/19C-1-0/R</td>
<td>6</td>
<td>Red</td>
<td>14/19C-1-B/R</td>
</tr>
<tr>
<td></td>
<td>Yellow</td>
<td>14/19C-1-0/</td>
<td>6</td>
<td>Yellow</td>
<td>14/19C-1-O/R</td>
</tr>
<tr>
<td></td>
<td>Green</td>
<td>14/19C-1-0/</td>
<td>6</td>
<td>Green</td>
<td>14/19C-1-BL/R</td>
</tr>
<tr>
<td></td>
<td>Ground Wire</td>
<td>14/19C-1-0/B</td>
<td>6</td>
<td>Ground Wire</td>
<td>14/19C-1-0/B</td>
</tr>
<tr>
<td>7</td>
<td>Red</td>
<td>14/19C-2-B/R</td>
<td>11</td>
<td>Red</td>
<td>14/19C-3-B/R</td>
</tr>
<tr>
<td></td>
<td>Yellow</td>
<td>14/19C-2-BL/R</td>
<td>11</td>
<td>Yellow</td>
<td>14/19C-3-BL/R</td>
</tr>
<tr>
<td></td>
<td>Green</td>
<td>14/19C-2-G/R</td>
<td>11</td>
<td>Green</td>
<td>14/19C-3-G/R</td>
</tr>
<tr>
<td></td>
<td>Ground Wire</td>
<td>14/19C-2-G/R</td>
<td>11</td>
<td>Ground Wire</td>
<td>14/19C-3-G/R</td>
</tr>
<tr>
<td>8</td>
<td>Red</td>
<td>14/19C-2-3-R</td>
<td>12</td>
<td>Red</td>
<td>14/10C-1-R</td>
</tr>
<tr>
<td></td>
<td>Yellow</td>
<td>14/19C-2-3-O</td>
<td>12</td>
<td>Yellow</td>
<td>14/10C-1-O</td>
</tr>
<tr>
<td></td>
<td>Green</td>
<td>14/19C-2-3-G</td>
<td>12</td>
<td>Green</td>
<td>14/10C-1-G</td>
</tr>
<tr>
<td></td>
<td>Ground Wire</td>
<td>14/19C-2-3-G/R</td>
<td>12</td>
<td>Ground Wire</td>
<td>14/10C-1-G/R</td>
</tr>
<tr>
<td>9</td>
<td>Red</td>
<td>14/19C-3-3-R</td>
<td>13</td>
<td>Red</td>
<td>14/10C-1-B/R</td>
</tr>
<tr>
<td></td>
<td>Yellow</td>
<td>14/19C-3-3-O</td>
<td>13</td>
<td>Yellow</td>
<td>14/10C-1-B/R</td>
</tr>
<tr>
<td></td>
<td>Green</td>
<td>14/19C-3-3-G</td>
<td>13</td>
<td>Green</td>
<td>14/10C-1-B/R</td>
</tr>
<tr>
<td></td>
<td>Ground Wire</td>
<td>14/19C-3-3-G/R</td>
<td>13</td>
<td>Ground Wire</td>
<td>14/10C-1-B/R</td>
</tr>
<tr>
<td>10</td>
<td>Red</td>
<td>14/19C-3-3-R/B</td>
<td>14</td>
<td>Red</td>
<td>14/10C-1-B/R</td>
</tr>
<tr>
<td></td>
<td>Yellow</td>
<td>14/19C-3-3-O/B</td>
<td>14</td>
<td>Yellow</td>
<td>14/10C-1-B/R</td>
</tr>
<tr>
<td></td>
<td>Green</td>
<td>14/19C-3-3-G/B</td>
<td>14</td>
<td>Green</td>
<td>14/10C-1-B/R</td>
</tr>
<tr>
<td></td>
<td>Ground Wire</td>
<td>14/19C-3-3-G/R</td>
<td>14</td>
<td>Ground Wire</td>
<td>14/10C-1-B/R</td>
</tr>
</tbody>
</table>
E. Groupings of Color Coded Wire for Preempts (Blue Light) and Pedestrian Signals:

1. Preempts (Blue Light).

<table>
<thead>
<tr>
<th>WIRE COLOR CODE</th>
<th>INDICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>14/2C-1-B</td>
<td>Blue Light</td>
</tr>
<tr>
<td>14/2C-1-W</td>
<td>Ground Wire</td>
</tr>
</tbody>
</table>

2. Pedestrians Signals.

<table>
<thead>
<tr>
<th>PED NUMBER</th>
<th>WIRE COLOR CODE*</th>
<th>INDICATION</th>
<th>PED NUMBER</th>
<th>WIRE COLOR CODE*</th>
<th>INDICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>14/5C-1-P/R</td>
<td>DONT WALK</td>
<td>3</td>
<td>14/5C-3-P/R</td>
<td>DONT WALK</td>
</tr>
<tr>
<td>1</td>
<td>14/5C-1-P/G</td>
<td>WALK</td>
<td>1</td>
<td>14/5C-3-P/G</td>
<td>WALK</td>
</tr>
<tr>
<td>1</td>
<td>14/5C-1-P/B</td>
<td>Switch Wire</td>
<td>2</td>
<td>14/5C-3-P/B</td>
<td>Switch Wire</td>
</tr>
<tr>
<td>1</td>
<td>14/5C-1-P/O</td>
<td>Switch Wire</td>
<td>3</td>
<td>14/5C-3-P/O</td>
<td>Switch Wire</td>
</tr>
<tr>
<td>1</td>
<td>14/5C-1-P/W</td>
<td>Ground Wire</td>
<td>4</td>
<td>14/5C-3-P/W</td>
<td>Ground Wire</td>
</tr>
<tr>
<td>1</td>
<td>14/5C-2-P/R</td>
<td>DONT WALK</td>
<td>5</td>
<td>14/5C-4-P/R</td>
<td>DONT WALK</td>
</tr>
<tr>
<td>1</td>
<td>14/5C-2-P/G</td>
<td>WALK</td>
<td>6</td>
<td>14/5C-4-P/G</td>
<td>WALK</td>
</tr>
<tr>
<td>1</td>
<td>14/5C-2-P/B</td>
<td>Switch Wire</td>
<td>7</td>
<td>14/5C-4-P/B</td>
<td>Switch Wire</td>
</tr>
<tr>
<td>1</td>
<td>14/5C-2-P/O</td>
<td>Switch Wire</td>
<td>8</td>
<td>14/5C-4-P/O</td>
<td>Switch Wire</td>
</tr>
<tr>
<td>1</td>
<td>14/5C-2-P/W</td>
<td>Ground Wire</td>
<td>9</td>
<td>14/5C-4-P/W</td>
<td>Ground Wire</td>
</tr>
</tbody>
</table>

* Key for Wire Color Code:

<table>
<thead>
<tr>
<th>XX</th>
<th>X</th>
<th>X</th>
<th>/</th>
<th>X</th>
<th>X</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWG</td>
<td>No. of Conductors</td>
<td>Cable No.</td>
<td>Color</td>
<td>Tracer</td>
<td>Conductor Size For the Given Wire Color</td>
</tr>
</tbody>
</table>

Colors: R-Red, O-Orange, G-Green, BL-Blue, W-White, B-Black.

F. Notes:

The following steps should be used to determine the appropriate color coded wiring for a given signal installation:

1. Determine which functions are used in the signal operation.
2. Assign the color coded wire to the functions used in numerical order according to the priority given to the function.
3. Use the minimum number of conductors required to maintain the color code.

EXAMPLE: Signal X is a four phase signal

Step No.1 -- Phase 1, 5, 6, 4, and an overlap of Phase 6 + 4 is used in the Signal operation.

<table>
<thead>
<tr>
<th>Step No.2</th>
<th>Priority</th>
<th>Function</th>
<th>Color Coded Group No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>6</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Overlap No. 1</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

Step No.3 -- Use one 19 conductor cable and one five conductor cable
§680

680-3.23 Pedestrian Push Button and Sign. The push button and sign shall be installed and constructed in accordance with the details specified on the standard sheets. Push button and sign shall be installed on either an existing pole, a newly installed signal pole or on its own post and footing as specified on the plans.

The orientation shall be convenient to pedestrians intending to cross the street controlled by the push button at the marked or obvious crosswalk.

680-3.24 Fire Pre-Emption Tell Tale Light. The Tell Tale Light shall be installed in accordance with details on the standard sheets or as directed by the Engineer.

The light shall be wired in such a manner as to simultaneously display a blue light during the emergency pre-emption interval and at other times remain unlighted. It shall be oriented in the position which provides the best view to the emergency equipment approach roadway.

680-3.25 Flashing Beacon Sign Assembly. The flashing beacon sign assembly shall be constructed as shown on the plans, and standard sheets. It shall be installed on either an existing sign and post or a new pole as specified on the plans.

The sign panel shall be constructed in accordance with the appropriate subsections of Section 645, Guide Signs, Traffic Signs and Special Devices. The flashing beacon signal heads and solid state flasher and cabinet shall be installed as shown on the standard sheets.

When not mounted behind guiderail, the pole shall be equipped with an approved breakaway base or transformer base fabricated in accordance with §723-15.01--Breakaway Transformer Base (Aluminum).

680-3.26 Inductance Loop Installation. Loops shall be installed in accordance with the details specified on the plans, Standard Sheets or as directed by the Engineer. Loop dimensions shall be as specified on the plans.

Pullboxes, conduits and curb cuts shall be completed before beginning the loop installation.

The loop shall be outlined on the pavement to conform to the specified configuration. A power saw and wet cutting techniques shall be used to cut a slot in the pavement. Dry cutting techniques shall be used if directed by the Engineer and with appropriate measures to safeguard nearby vehicle and pedestrian traffic. The cut shall be 9.5 mm in width and the depth specified on the standard sheets. The corners shall be cored, drilled or chipped out as shown on the standard sheets. Sharp edges in the corners shall be smoothed. All saw cuts and corners shall be of the same depth.

Immediately after sawing by either wet or dry methods, the slot and pavement shall be flushed with pressurized clean water to remove the saw slurry, dust or other cutting debris. Filtered compressed air shall be used to remove all dust and moisture from the slot. If the slot is damp, do not proceed with the installation until it is dry. Hot air may be used to dry the saw slot.

At the edge of pavement or curb a 25 mm minimum diameter, Metal Steel Conduit, Zinc Coated, Flexible Liquid-Tight Steel Conduit or Rigid Plastic Conduit shall be installed between the pavement and pullbox in accordance with details specified on the standard sheets. The curb or pavement shall be cut or scored to leave a permanent mark to show where the conduit runs under the curb or pavement.

The loop wire shall be installed starting at the roadside pullbox, passed around the loop for the specified number of turns and brought back to the pullbox. Splices shall not be permitted outside the pullbox. The wire shall be depressed in the slot without the use of sharp objects which might damage the wire insulation.

The loop shall be held in place every 0.6 m with 25 mm (approximate) strips of rubber, neoprene, flexible tubing or foam backer rod as approved by the Engineer. These hold down strips shall be left in place when the slot is filled with Roadway Loop Embedding Sealer.

The pair of loop wires between the edge of pavement and the splice to the shielded lead-in cable in the pullbox shall be twisted together with at least five turns per 0.3 m.

The splice between the loop wires (twisted pair) and the shielded lead-in cable shall be moisture proof and shall have a dielectric strength at least equal to that of the original insulation.

The bared conductor ends shall be either twisted and soldered or joined using an uninsulated, size coded solderless type connector of the correct size using an appropriate crimping tool. The splice shall be reinsulated in accordance with §680-3.16 Cable Splices, Method No. I except that heat shrinkage polyolefin tubing may be used as an alternate to the rubber tape; also, the first layer of PVC tape and sealing agent shall be extended as needed to cover a minimum of 25 mm of the inductance loop wire tube.
The polyolefin tubing shall be at least as thick as the original insulation. Upon completion of the reinsulating, a final waterproof coating shall be applied over the entire splice.

The loop wires (twisted pair) and the splice to the shielded lead-in cable with the pullbox shall be held by wire hangers as near as possible to the top of the box in order to prevent their immersion in water. The shielded lead-in cable shall be continuous (no splices) from the splice to the loop wires to the controller cabinet terminals. The drain or ground wire in the shielded cable shall be grounded at the controller cabinet terminals only.

The completed loop installation including the shielded lead-in to the controller cabinet shall have a minimum of 50 megohms leakage resistance to ground. This resistance shall be tested before the loop is sealed in the pavement and after the splice is made between the loop wires (twisted pair) and shielded lead-in. Resistance to ground shall be tested in accordance with the Insulation Resistance Test in §680-3.32.

When it is determined that the resistance to ground requirements are met, the slot shall be filled with Roadway Loop Embedding Sealer. The pavement temperature shall be at least 4.4°C and rising before the sealer is placed. All work involving the sealer shall be done in compliance with the manufacturer's specifications. When the loop embedding sealer has set sufficiently to open the loop to traffic, but the surface remains tacky, the loop may be dusted with cement dust to facilitate opening the loop to traffic.

680-3.27 Concrete Base for Controller Cabinet. Bases shall be installed and constructed in accordance with the details specified on the standard sheets. Bases shall be either pre-cast or cast-in-place. Anchor bolts shall be placed in the footing at the proper location. Conduits shall be installed in the footing as required by the plans.

Where the base is installed in unpaved areas a work pad shall be constructed in front of the cabinet door.

Excavation shall be in accordance with §680-3.09, Excavation.

680-3.28 Power Meter Base. At each power source, the Contractor shall provide two meters of slack in the traffic signal cable used for power supply and neatly coil this slack within the controller cabinet.

The Contractor shall install a meter base as shown on the standard sheets or as ordered by the Engineer. The meter base will be furnished by the utility company. The additional length of power cable in the controller cabinet shall be extended through the cabinet wall into the meter base and back to the controller circuit breaker. All meter base fittings shall be weather tight.

680-3.29 Overhead Traffic Signs. Sign and mounting brackets shall be installed as shown on the plans and standard sheets. Signs shall be aligned to the satisfaction of the Engineer.

Sign Panels shall be aluminum and constructed in accordance with the appropriate subsections of section 645-Guide Signs, Traffic Signs and Special Devices.

680-3.30 Field Galvanizing. All abrasions of galvanized steel due to handling equipment, erection, etc., and all points of attachment, shall be field repaired as specified in §719-01--Galvanized Coatings and Repair Methods.

680-3.31 Cast Iron Junction Boxes. Junction boxes shall be installed at the locations and according to the details on the plans or as directed by the Engineer. Dimensions shall be as shown on the plans.

680-3.32 Tests. The Contractor shall perform all tests described herein in the presence of the Engineer or his representative. Testing equipment shall be supplied by the Contractor.

Prior to placing a signal in operation, the Contractor shall perform the following tests:

A. Continuity Test. Each circuit shall be tested for continuity.

B. Ground Test. All traffic signal grounding systems when completed in place shall have a resistance to ground of not more than that shown in the table below as determined in the following manner:
1. Temporarily connect a 10 ampere load between the AC + side of the equipment cabinet fuse and the ground system. It should be assured that the power company applied voltage is 120 volts AC at the time of the test.
2. Disconnect the power company AC neutral from the ground system.
3. Connect a voltmeter between the power company AC neutral and the ground system.

<table>
<thead>
<tr>
<th>Controller Installed</th>
<th>Voltmeter Reading (Volts)</th>
<th>Equivalent Resistance (Ohms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Phase</td>
<td>20</td>
<td>2.0</td>
</tr>
<tr>
<td>Model 170 Microcomputer</td>
<td>20</td>
<td>2.0</td>
</tr>
<tr>
<td>All others</td>
<td>10</td>
<td>1.0</td>
</tr>
</tbody>
</table>

If the voltmeter reading is higher than the appropriate voltage shown in the above table under the 10 ampere load, the grounding system has an unacceptable resistance to ground. Additional grounding, including electrical bonding of underground metallic conduit, may be necessary in order to meet the requirements of this test.

**C. Insulation Resistance Test.** An insulation resistance test at 500 volts DC shall be made on each circuit between the circuit and ground. The insulation resistance shall not be less than 10 megohms on each circuit except that inductive loop detector circuits shall have an insulation resistance of not less than 50 megohms.

The insulation resistance test shall not be performed on magnetometer sensing elements. Splices in the pullbox adjacent to the magnetometer sensing elements shall not be made prior to performing an insulation resistance test on the lead-in conductors between the pullbox and the controller cabinet field terminals.

**D. Functional Test.** After satisfactory completion of all other tests, a functional test of the traffic signal control equipment shall be performed to demonstrate that every part of the signal system operates in accordance with the plans, specifications and to the satisfaction of the Engineer. The functional test for each signal system shall consist of not less than ten days of continuous satisfactory operation. If unsatisfactory performance of the system components is discovered during this time, the condition shall be corrected and the test repeated until ten days of continuous satisfactory operation is obtained.

Functional tests shall not begin on a Friday or on the day before a legal holiday. On the day the functional test begins, initial turn-on shall be made between the hours of 9:00 am and 2:00 pm unless otherwise ordered by the Engineer. Prior to turn-on all signal control equipment required for signal system shall be installed and ready for operation including pedestrian signal indications, pedestrian signs and push buttons, and vehicle detectors. All louvers, visors, and signal heads shall be directed to provide maximum visibility.

Temporary shut downs caused by power interruption or traffic accidents shall not constitute discontinuity of the functional test.

**680-3.33 Fiberoptic Pedestrian Signal Heads.** Fiberoptic pedestrian signal heads shall be installed according to the requirements of §680-3.21 Signal Heads.

**680-3.34 Fiberoptic Dual Indication Arrow.** Fiberoptic dual indication arrows shall be installed according to the requirements of §680-3.21 Signal Heads.

**680-3.35 Strobing Signal Section.** Strobing Signal Sections shall be installed according to the requirements of §680-3.21 Signal Heads.

**680-3.36 LED Traffic Signal Module.** LED Traffic Signal Modules shall be installed in Type I Traffic Signal Sections according to the requirements of §680-3.21 Signal Heads.

**680-3.37 LED Pedestrian Signal Module.** LED Pedestrian Signal Modules shall be installed in Type I Pedestrian Signal Section according to the requirements of §680-3.21 Signal Heads.
§680

680-4 METHOD OF MEASUREMENT

680-4.01 Each Unit. The following items will be measured for payment as the number of each unit furnished and installed in accordance with the contract documents or as directed by the Engineer:


680-4.02 Linear Meter Measurements. The following items will be measured for payment as the number of meters actually installed in accordance with the contract documents or as directed by the Engineer:

Inductance Loop Wire, Shielded Lead-In Cable, Inductance Loop Installation, Messenger Assembly, Signal Cable, Shielded Communication Cable, Signal Cable with Integral Messenger, Shielded Communication Cable w/ Integral Messenger, Conduit.

Inductance loop wire shall be the actual number of meters of wire used and left in place. Measurement of inductance loop installation shall be the number of meters of pavement sawcut.

680-4.03 Pole Excavation and Concrete Foundation. The payment quantity of pole excavation and concrete foundation shall be the number of cubic meters of concrete shown in the table on the standard sheet for Traffic Signal Pole Foundations for the specified footing size. No adjustment will be made when the Contractor elects to install a square footing. When a square footing is specified on the plans, the payment quantity shown in the table will be multiplied by a factor of 1.3.

680-4.04 Conduit Jacking or Boring. The quantity of conduit jacking or boring shall be the number of linear meters as computed from the payment limits specified in the contract documents.

680-5 BASIS OF PAYMENT

680-5.01 General. The unit price bid for all items of work encompassed by this Section shall include the furnishing of all labor, materials, tools, equipment, safety requirements as determined by U.S. Department of Labor's Occupational Safety and Health Standards, and incidentals as necessary to complete the work of the item installed in place and performing all tests to the satisfaction of the Engineer. No direct payment will be made for the installation of the power service connection and meter base but the cost shall be covered in the various traffic signal items. Items with additional provisions are as follows:

680-5.02 Pedestrian Signal Section. The unit price bid for each section shall include one “WALK” and one “DONT WALK” indication, and all necessary internal wiring, visor(s) and lamp(s).

680-5.03 Pedestrian Signal Bracket Assembly. The unit price bid for each bracket assembly shall include the bracket, fittings, wiring of the head assembly and installation.
680-5.04 Pole Excavation and Concrete Foundation. The unit price bid per cubic meter shall include the excavation, any protective system(s) required to ensure the safety of the workers and the public, backfill (select granular backfill or concrete), form work, concrete, bar reinforcement for concrete, excavation and backfilling of test holes, conduit bends and fittings, restoration of surfaces in kind, and sawcutting.

Progress payments will be made at the unit price bid for 80 percent of the quantity for each foundation properly installed except for the mortar cap and restoration. The remaining 20 percent will be paid for upon satisfactory completion of each footing.

680-5.05 Pullbox. The unit price bid for each pullbox shall include all concrete, reinforcing steel, crushed stone or gravel, extensions, sawcutting, excavation, backfill, frames, covers, restoration of surfaces and incidentals as required.

680-5.06 Conduit. The unit price bid shall include all handling, cutting, bending, fitting, capping, painting, testing, furnishing and placing pull lines, condulets and concrete inserts, expansion and incidental fittings as required. Conduit bends and fittings in concrete footings will be paid for under the respective footing item. Conduit excavation and backfill and jacking or boring will be paid for under their respective items.

680-5.07 Inductance Loop Installation. The unit price bid per linear meter shall include the cost of all pavement sawing and drilling, loop embedding sealer, and pavement cut-outs. Inductance Loop Wire, pullboxes, Shielded lead-in Cable, Vehicle Detector Inductance Loop, Conduit, and Conduit Excavation and Backfill shall be paid under their respective items.

680-5.08 Controller Assembly. The unit price bid for each component of the Controller Assembly shall include all labor, material and equipment necessary to complete the work. The cost of the necessary grounding system shall be included in the unit price bid for the controller assembly components.

Progress payments will be made in the following manner:

Sixty-five percent of the bid price of each component will be paid after it is installed and ready for testing.

Twenty-five percent of the bid price will be paid after satisfactory completion of all tests required by these specifications, including the function test for ten days of continuous satisfactory operation of the traffic signal system at each signalized location.

The remaining ten percent will be paid when all the traffic signals in the contract are functioning to the satisfaction of the Engineer.

680-5.09 Fire Pre-Emption Tell Tale Light. The unit price bid shall include the light fixture, bulb, nipple, guard, and all attachments and fittings as required.

680-5.10 Concrete Base for Controller Cabinet. The unit price bid for each base shall include the cost of all sawcutting, excavation, backfill, form work, restoration of surfaces, concrete, test holes, conduit bends and fittings, and concrete work pad.

680-5.11 Pedestrian Push Button and Sign. The unit price bid shall include the push button, sign, mounting hardware, pole drilling, and necessary fittings as required. Where the push button and sign is installed on its own post the unit price shall also include the cost of the post, sawcutting, excavation, backfill, concrete, restoration of surfaces, and conduit bend and fittings.

680-5.12 Jacking or Boring. The unit price bid per meter shall include excavation, backfilling for jacking or boring pits; test holes; and restoration of surfaces in kind.

680-5.13 Signal Cable and Shielded Communication Cable. The unit price bid per meter shall include the connectors, lashing or messenger rings or plastic cable bands, splices when permitted, testing, cable markers, and incidental fittings for the cable connected in place.
§680

**680-5.14 Signal Cable with Integral Messenger and Shielded Communication Cable with Integral Messenger.** The unit price bid per meter shall include connectors, splices when permitted, testing, cable markers, hardware and fittings to attach the cable to the pole and other incidentals for the cable connected in place.

**680-5.15 Traffic Signal Sections.** The unit price bid shall include housing, visors, lamps, lenses and incidentals to make an individual signal head section.

**680-5.16 Traffic Signal Bracket Assembly.** The unit price bid shall include all brackets, elbows, arms and fittings to attach the signal to span wire, pole and mast arm. It shall include all labor and materials to assemble the individual signal sections and brackets to form a complete signal head including internal wiring and installation on the span wire, pole and mast arm.

**680-5.17 Traffic Signal Disconnect Hanger.** The unit price bid shall include the disconnect hanger, wiring to the signal head and signal cable and installation on the signal head.

**680-5.18 Traffic Signal Poles.** The unit price bid for each pole shall include all the items specified in §680-3.11 and the necessary grounding system, anchor bolts, mast arms, lighting arms, pole assembly and erections, and field galvanizing as required. Breakaway transformer bases when specified shall be included in the price bid for each pole.

**680-5.19 Overhead Sign Assembly.** The unit price bid shall include the mounting brackets attaching the sign to signal head, span wire, pole, and mast arm, sign panel and incidental hardware and fittings.

**680-5.20 Flashing Beacon Sign Assembly.** The unit price bid shall include the flashing beacon signal head, two circuit flasher and cabinet, sign panel and mounting brackets and all other necessary hardware. The cost of the pole and pole excavation and concrete foundation will be paid for under their respective items. The cost of any necessary breakaway base shall be included in the cost of the pole.

**680-5.21 LED Traffic Signal Module.** The unit price bid shall include the LED module, the removal of existing components if necessary, and installation of the LED module on the signal head.

**680-5.22 LED Pedestrian Signal Module.** The unit price bid shall include the LED module, the removal of existing components if necessary, and installation of the LED module on the pedestrian signal head.

**680-5.23 Type I Traffic Signal Section.** The unit price bid shall include housing, door, visor and incidentals to make an individual Type I Signal Head Section.

**680-5.24 Type I Pedestrian Signal Section.** The unit price bid shall include housing, door, visor and incidentals to make an individual Type I Pedestrian Signal Section.

**680-5.25 LED Traffic Signal Module Installation.** The unit price bid shall include the cost of labor, materials, and equipment required to remove existing components if necessary, and install the State supplied Traffic Signal Modules as shown on the plans or as ordered by the Engineer.

**680-5.26 LED Pedestrian Signal Module Installation.** The unit price bid shall include the cost of labor, materials, and equipment required to remove existing components if necessary, and install the State supplied Pedestrian Signal Modules as shown on the plans or as ordered by the Engineer.

*Payment will be made under:*

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
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<tbody>
<tr>
<td>680.5001</td>
<td>Pole Excavation and Concrete Foundation</td>
<td>Cubic Meter</td>
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<tr>
<td>680.5002</td>
<td>Concrete Base for Controller Cabinet</td>
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</table>
680.51XXYY Pullbox Each
   \( XX = \text{Size} \quad YY = \text{Type} \)
   01 - 375 mm 01 - Reinforced Concrete
   02 - 450 mm 02 - Optional Reinforced
   03 - 600 mm Concrete/Bituminous
   04 - 750 mm Fiber
   05 - Rectangular 650 x 450
   06 - Rectangular 650 x 450/600 mm Diameter
   07 - Rectangular 650 x 450/750 mm Diameter

680.5120 Cast Iron Junction Box Each

680.52XXYY Conduit Meter
   \( XX = \text{Type} \quad YY = \text{Diameter} \)

680.53 Conduit Jacking or Boring Meter
680.54 Inductance Loop Installation Meter
680.56 Emergency Pre-emption System Each

680.60XXYY Traffic Signal Pole--Span Wire Each
680.61XXYY Traffic Signal Pole--Span Wire with Lighting Arm Each
   \( XX = \text{Load in kilonewtons (10, 20, 30, 40, ...)} \)
   \( YY = \text{Length in whole meters} \)

680.62XXYY Traffic Signal Pole--Mast Arm Each
680.63XXYY Traffic Signal Pole--Dual Mast Arm** Each
680.64XXYY Traffic Signal Pole--Mast Arm with Lighting Arm Each
680.65XXYY Traffic Signal Pole--Dual Mast Arm** with Lighting Arm Each
   \( XX = \text{Mast arm mounting height in meters and tenths of a meter} \)
   \( YY = \text{Mast arm length in whole meters} \)

680.66XX Traffic Signal Pole--Post Top Mount Each
680.68XX Traffic Signal Pole--Bracket Mount Each
680.69XX Traffic Signal Pole Bracket Mount with Lighting Arm Each
   \( XX = \text{Mounting height in meters and tenths of a meter} \)

680.7001 Single Span Wire Assembly Each
680.7002 Dual Span Wire Assembly with Upper Tether Wire Each
680.7003 Dual Span Wire Assembly with Lower Tether Wire Each
680.7004 Messenger Assembly Meter
680.7005 Guy Assembly Each
680.700602 Riser Assembly, ½ NPS Diameter Each
680.700603 Riser Assembly, 1 NPS Diameter Each
680.700604 Riser Assembly, 1½ NPS Diameter Each
680.700606 Riser Assembly, 2 NPS Diameter Each
680.700607 Riser Assembly, 2½ NPS Diameter Each
680.700608 Riser Assembly, 3 NPS Diameter Each
680.700609 Riser Assembly, 3½ NPS Diameter Each
680.700610 Riser Assembly, 4 NPS Diameter Each
680.700612 Riser Assembly, 5 NPS Diameter Each
680.700613 Riser Assembly, 6 NPS Diameter Each

680.71 Shielded Lead-in Cable Meter
680.72 Inductance Loop Wire Meter
680.73XXYY Signal Cable Meter
680.74XXYY Signal Cable with Integral Messenger Meter
   \( XX = \text{Number of Conductors} \quad YY = \text{Wire Gauge} \)
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<td>680.75XXYY</td>
<td>Shielded Communication Cable</td>
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<tr>
<td>680.76XXYY</td>
<td>Shielded Communication Cable with Integral Messenger</td>
<td>Meter</td>
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$XX = \text{Number of Pairs}$

$YY = \text{Wire Gauge}$

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<th>Quantity</th>
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<td>Traffic Signal Section - 300 mm</td>
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<tr>
<td>680.810101</td>
<td>Traffic Signal Module - 300 mm, Red Ball, LED</td>
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<tr>
<td>680.810102</td>
<td>Traffic Signal Module - 300 mm, Red Arrow, LED</td>
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<td>680.810103</td>
<td>Traffic Signal Module - 300 mm Yellow Ball, LED</td>
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<td>680.810105</td>
<td>Traffic Signal Module - 300 mm, Green Ball, LED</td>
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<td>680.810106</td>
<td>Traffic Signal Module - 300 mm, Green Arrow, LED</td>
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<td>Traffic Signal Section - Type I, 300 mm</td>
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<tr>
<td>680.810108</td>
<td>Traffic Signal Module - 300 mm, Bi-Modal Yellow/Green Arrows, LED</td>
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<td>680.8102</td>
<td>Traffic Signal Section, Optically Programmed - 300 mm</td>
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<td>680.8103</td>
<td>Traffic Signal Section - 200 mm</td>
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<td>680.810306</td>
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<td>680.810307</td>
<td>Traffic Signal Section - Type I, 200 mm</td>
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<td>Install Ball/Arrow LED Traffic Signal Module</td>
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<td>Traffic Signal Section - Fiberoptic Dual Indication Arrow</td>
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<td>Traffic Signal Section - Polycarbonate, Fiberoptic Dual Indication Arrow</td>
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<td>680.8105</td>
<td>Traffic Signal Section - Strobing Signal Indication</td>
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<td>680.8113</td>
<td>Traffic Signal Bracket Assembly - 3 Way</td>
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<td>Traffic Signal Bracket Assembly - 4 Way</td>
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<td>680.8115</td>
<td>Traffic Signal Bracket Assembly - 5 Way</td>
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<td>Traffic Signal Disconnect Hanger</td>
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<td>Pedestrian Signal Section - 114 mm Letters</td>
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<td>Pedestrian Signal Module - 300 mm, Hand Symbol, LED</td>
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<td>Pedestrian Signal Module - 300 mm by 300 mm MAN LED</td>
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<td>Install LED Pedestrian Signal Module</td>
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<td>Pedestrian Signal Module - 300 mm, Bi-Modal Hand/Man Symbols, LED</td>
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<td>Pedestrian Signal Section - Polycarbonate, Type I, 300 mm</td>
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<td>680.813108</td>
<td>Pedestrian Signal Section, Type I - for 410 mm by 450 mm LED module</td>
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<td>680.813109</td>
<td>Pedestrian Signal Section - Polycarbonate, Type I - for 410 mm by 450 mm LED module</td>
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680.8132 Pedestrian Signal Section - 76 mm Letters Each
680.8133 Pedestrian Signal Section - Fiberoptic Each
680.8141 Pedestrian Signal Bracket Mount Assembly Each
680.8142 Pedestrian Signal Post Top Mount Assembly Each
680.82XX Overhead Sign Assembly Each
   \(XX = Type\)
   680.8220 Flashing Beacon Sign Assembly Each
   680.8225 Pedestrian Push Button and Sign - without Post Each
   680.8226 Pedestrian Push Button and Sign - with Post Each
   680.8230 Fire Pre-Emption Tell Tale Light Each

\textbf{NOTE:} SEE STANDARD CONTRACT PAY ITEM CATALOGUE FOR ITEM NUMBERS CONTAINING VARIABLES.
* Mast arm mounting heights, and span wire pole length and load, are as defined on the `Standard Traffic Signal Poles' standard sheets and in §724-03, Traffic Signal Poles. The nominal luminaire mounting height and span shall be as indicated on the plans.
** The mast arm length and mounting height indicated by the item number is for only one of the mast arms. The other mast arm length and mounting height shall be as indicated on the plans.

\textbf{SECTION 681 THRU SECTION 684 (VACANT)}

\textbf{SECTION 685 - EPOXY REFLECTORIZED PAVEMENT MARKINGS}

\textbf{685-1 DESCRIPTION.} Under this work, the Contractor shall furnish and apply epoxy reflectorized pavement markings at the location and in accordance with patterns indicated on the plans or as ordered by the Engineer, and in conformance with the NYSMUTCD and these specifications.

The epoxy marking material should be hot–applied by spray methods onto bituminous and portland cement concrete pavement surfaces at the thickness and width shown on the Contract Documents. Following an application of glass beads, the cured epoxy marking shall be an adherent reflectorized stripe.

\textbf{685-2 MATERIALS.} Materials shall conform to the requirements of §727-03 White and Yellow Epoxy Reflectorized Pavement Markings.

\textbf{685-3 CONSTRUCTION DETAILS}

\textbf{685-3.01 General.} All pavement markings and patterns shall be placed as shown on the Contract Documents and in accordance with the New York State, Manual of Uniform Traffic Control Devices (MUTCD).

Before any pavement marking work is begun, a schedule of operations shall be submitted for the approval of the Regional Director and his/her authorized representative.

At least five (5) days prior to starting striping, the Contractor shall provide the Engineer with the epoxy manufacturer's written instructions for use. These instructions shall include, but not be limited to, material mixing ratios and application temperatures.

When pavement markings are applied under traffic, the Contractor shall provide all necessary flags, markers, signs, etc. in accordance with the MUTCD to maintain and protect traffic, and to protect marking operations and the markings until thoroughly set.

The application of pavement markings shall be done in the general direction of traffic. Striping against the direction of traffic flow shall not be allowed.

The Contractor shall be responsible for removing, to the satisfaction of the Engineer, all tracking marks, spilled epoxy, and epoxy markings applied in unauthorized areas.

When necessary the Contractor shall establish marking line points at nine (9) meter intervals throughout the length of the pavement or as directed by the Engineer.

\textbf{685-3.02 Atmospheric Conditions.} Epoxy pavement markings shall only be applied during conditions of dry weather and on substantially dry pavement surfaces. At the time of installation the
pavement surface temperature shall be minimum of 10°C and the ambient temperature shall be a minimum of 10°C and rising. The Engineer shall be the sole determiner as to when atmospheric conditions and pavement surface conditions are such to produce satisfactory results.

685-3.03 Surface Preparation. The Contractor shall clean the pavement and existing durable markings to the satisfaction of the Engineer.

Surface cleaning and preparation work shall be performed only in the area of the epoxy markings application.

At the time of application, all pavement surfaces and existing durable markings shall be free of oil, dirt, dust, grease and similar foreign materials. The cost of cleaning these contaminants shall be included in the bid price of this item.

In addition, concrete curing compounds on new portland cement concrete surfaces and existing painted pavement markings on both concrete and bituminous pavement surfaces shall be cleaned and paid for in accordance with Section 635, Cleaning and Preparation of Pavement Surfaces for Pavement Markings.

685-3.04 Epoxy Applicating Equipment. Mobile applicating equipment for the placement of epoxy reflectorized pavement markings shall be approved by the Director (Materials Bureau) prior to the start of work.

In general, a mobile applicator shall be a truck mounted, self-contained pavement marking machine, specifically designed to apply epoxy resin materials and reflective glass spheres in continuous and skip-line patterns. The applicating equipment shall be maneuverable to the extent that straight lines can be followed and normal curves can be made in true arc. In addition, the truck mounted unit shall be provided with accessories to allow for the marking of legends, symbols, crosswalks, and other special patterns.

At any time throughout the duration of the project, the Contractor shall provide free access to his epoxy applicating equipment for inspection by the Engineer or his authorized representative.

The Engineer may approve the use of a portable applicator in lieu of mobile truck mounted accessories for use in applying special markings only, provided such equipment can demonstrate satisfactory application of reflectorized epoxy markings in accordance with these specifications. The applicating equipment shall be capable of installing a minimum of 30,000 m of epoxy reflectorized pavement markings in an eight hour day and shall include the following features:

1. Individual tanks for the storage of Part A and Part B of the epoxy resin and for the storage of reflective glass spheres.
2. Heating equipment of sufficient capacity to maintain the individual epoxy resin components at the manufacturer's recommended temperature for spray application.
3. Glass bead dispensing equipment and the capacity of applying the spheres a minimum rate of 2.4 kg/L of epoxy resin composition.
4. Metering devices or pressure gauges on the proportioning pumps, positioned to be readily visible to the Engineer.
5. All necessary spray equipment, mixers, compressors, and other appurtenances for the placement of epoxy reflectorized pavement markings in a simultaneous sequence of operations as described in §685-3.05 Application of Epoxy Reflectorized Pavement Markings.

685-3.05 Application of Epoxy Reflectorized Pavement Markings. Epoxy reflectorized pavement markings shall be placed at the width, thickness, and pattern designated by the Contract Documents.

Marking operations shall not begin until applicable surface preparation work is completed and approved by the Engineer, and the atmospheric conditions and pavement surface temperature are acceptable to the Engineer.

Pavement markings shall be applied by the following simultaneous operation:

1. The pavement surface is air-blasted to remove dirt and residues.
2. The epoxy resin, mixed and heated in accordance with the manufacturer's recommendations, is uniformly hot-sprayed onto the pavement surface at the minimum specified thickness.
3. Reflective glass spheres are injected into, or dropped onto, the liquid epoxy marking at a minimum rate of 2.4 kg/L of epoxy resin.

685-3.06 Defective Epoxy Pavement Markings. Epoxy reflectorized pavement markings, which after application and curing are determined by the Engineer to be defective and not in conformance with this specification, shall be repaired. Repair of defective markings shall be the responsibility of the Contractor and shall be performed to the satisfaction of the Engineer as follows:

1. Insufficient film thickness and line width; insufficient glass bead coverage or inadequate glass bead retention.

   Repair Method. Prepare the surface of the defective epoxy marking by grinding or blast cleaning. No other cleaning methods will be allowed. Surface preparation shall be performed to the extent that a substantial amount of the reflective glass spheres are removed and a roughened epoxy marking surface remains. Immediately after surface preparation remove loose particles and foreign debris by brooming or blasting with compressed air. Repair shall be made by restriping over the cleaned surface in accordance with the requirements of this specification and at the full thickness indicated on the Contract Documents.

2. Uncured or discolored epoxy*; insufficient bond (to pavement surface or existing durable marking).

   Repair Method. The defective epoxy marking shall be completely removed and cleaned to the underlying pavement surface in accordance with the requirements of Section 635 - Cleaning and Preparation of Pavement Surfaces, at the Contractor's expense. The extent of removal shall be the defective area plus any adjacent epoxy pavement marking material extending one meter in any direction. After surface preparation work is complete, repair shall be made by reapplying epoxy over the cleaned pavement surface in accordance with the requirements of this specification.

*Uncured epoxy shall be defined as applied material that fails to cure (dry) in accordance with requirements of §727–03 MATERIAL REQUIREMENTS, A., 2.0 paragraph d. Drying Time (Field); or applied material that fails to cure (dry) within a reasonable time period under actual field conditions, as defined by the Engineer.

Discoloration shall be defined as localized areas or patches of brown, grayish or black colored epoxy marking material. These areas often occur in a cyclic pattern and often are not visible until several days or weeks after markings are applied.

Other defects not noted above, but determined by the Engineer to need repair, shall be repaired or replaced as directed by and to the satisfaction of the Engineer.

All work in conjunction with the repair or replacement of defective epoxy reflectorized pavement markings shall be performed by the Contractor at no additional cost to the State.

685-4 METHOD OF MEASUREMENT. Pavement striping will be measured in linear meters along the centerline of the pavement stripe and will be based on a 100 mm wide stripe. Measurement for striping with a plan width greater or less than the basic 100 mm as shown on the plans or directed by the Engineer, will be made by the following method:

Plan Width of Striping (millimeters) x Linear Meters

100 mm

Letters and symbols will be measured by each unit applied. A unit will consist of one letter or one symbol. Example: “SCHOOL” would be paid as six units. Double and triple headed arrows will be measured as a single unit, but the “X” in railroad grade crossing markings (M.U.T.C.D. figure 263-33) will be measured by linear meters of 100 mm stripe.

685-5 BASIS OF PAYMENT. The accepted quantities of markings will be paid for at the contract unit price, which shall include the cost of furnishing labor, materials and equipment to satisfactorily complete the work. The cost for maintaining and protecting traffic during the marking operations shall be included in the price bid. The cost of removal of concrete curing compounds and existing pavement markings will be paid under separate items and are not included in this item.

No payment will be made for the repair or replacement of defective epoxy reflectorized pavement markings.

No payment will be made for the number of linear meters of skips in the dashed line.
SECTION 687 - THERMOPLASTIC REFLECTORIZED PAVEMENT MARKINGS

687-1 DESCRIPTION. Under this work, the Contractor shall furnish and apply thermoplastic reflectorized pavement markings at the location and in accordance with patterns indicated on the plans or as ordered by the Engineer, and in conformance with the NYSMUTCD and these specifications.

The thermoplastic pavement marking compound shall be extruded in a molten state onto the pavement surface. Following surface application of glass beads and upon cooling to normal pavement temperatures, the resultant marking shall be an adherent reflectorized stripe of the specified thickness and width that is capable of resisting deformation by traffic.

687-2 MATERIALS. Materials shall conform to the requirements of §727-01 White and Yellow Thermoplastic Reflectorized Pavement Markings.

687-3 CONSTRUCTION DETAILS

687-3.01 Equipment General. Thermoplastic applying equipment shall be approved by the Engineer prior to the start of work.

Unless otherwise approved by the D.C.E.C., all projects specifying quantities greater than 20,000 m of longitudinal pavement marking lines will be striped using only mobile applying equipment for the longitudinal lines, Longitudinal pavement marking lines are Broken Lines (skipline), Edge Lines, Barrier Lines, and Solid Lines as defined by the M.U.T.C.D. Portable applying equipment will be acceptable for placing all other markings on these projects.

Thermoplastic material shall be applied to the pavement surface by the extrusion method, wherein one side of the shaping die is the pavement and the other three sides are contained by, or are part of, suitable equipment for maintaining the temperature and controlling the flow of material (Note 1.)

Note 1. Alternate types of extrusion devices may be considered acceptable for use upon prior approval by the Materials Bureau. Requests for approval of alternate extrusion applying equipment shall be made to the Materials Bureau by the Contractor/Manufacturer at least 90 days prior to its date of intended use. Detailed requirements and procedures for the acceptance of alternate equipment are available from the Materials Bureau.

For heating the thermoplastic composition, the application equipment shall include a melting kettle(s) of such capacity as to allow for continuous marking operations. The melting kettle(s) may be mounted on a separate “supply” vehicle or included as part of the mobile applying equipment. The kettle(s) shall be capable of heating the thermoplastic composition temperatures greater than 204.5°C. The heating mechanism shall be by means of a thermostatically controlled heat transfer medium. Heating of the composition by direct flame will not be allowed. Material temperature gauges shall be visible at both ends of the kettle(s).

Application equipment shall be constructed to provide continuous mixing and agitation of the material. Conveying parts of the equipment between the main material reservoir and the extrusion shoe(s) shall be so constructed as to prevent accumulation and clogging. All parts of the equipment which come into contact with the material shall be so constructed so as to be easily accessible and exposable for
cleaning and maintenance. The equipment shall be constructed so that all mixing and conveying parts up
to and including the extrusion shoe(s), maintain the material at the required plastic temperature.

The applicating equipment shall be so constructed as to insure continuous uniformity in the
dimensions of the stripe. The applicator shall provide a means for cleanly cutting off stripe ends squarely
and shall provide a method of applying “skip” lines. The equipment shall be capable of applying varying
widths of traffic markings.

The applicator shall be equipped with a drop-on type bead dispenser capable of uniformly dispensing
reflective glass spheres at controlled rates of flow.

The bead dispenser shall be automatically operated in such a manner that it will only dispense beads
while the composition is being applied.

Applicating equipment shall be mobile and maneuverable to the extent that straight lines can be
followed and normal curves can be made in a true arc.

Applicators shall be equipped and constructed in such a manner as to satisfy the requirements of the
National Board of Fire Underwriters and the appropriate agencies of the State of New York.

The equipment used for the placement of thermoplastic pavement markings shall be two general
types: mobile applicator and portable applicator.

687-3.02 Mobile Applicating Equipment. The mobile applicator shall be defined as a truck
mounted, self-contained pavement marking machine that is capable of hot applying thermoplastic by the
extrusion method. The unit shall be equipped to apply the thermoplastic material at temperatures
exceeding 204.5°C, and at the widths and thicknesses specified herein. The mobile unit shall be capable
of operating continuously and of installing a minimum of 6000 m of longitudinal markings in an 8-hour
day.

The mobile unit shall be equipped with a melting kettle(s) or materials storage reservoir(s) of such
capacity as to allow for continuous marking operations. The kettle(s) or reservoirs shall be capable of
heating or holding the thermoplastic composition at temperatures greater than 204.5°C.

The mobile unit shall be equipped with an extrusion shoe(s), and shall be capable of marking edgeline
and centerline stripes. The extrusion shoe(s) shall be closed, heat jacketed or suitably insulated unit; shall
hold the molten thermoplastic at a temperature greater than 204.5°C; and shall be capable of extruding a
line between 75 to 200 mm in width; and at a thickness of not less than 3.2 mm nor more than 4.8 mm,
and of generally uniform cross section. Material temperature gauges shall be affixed or incorporated in
the extrusion shoe in such a manner as to be visible, and capable of monitoring the composition
temperature throughout the marking operation.

The mobile unit shall be equipped with an electronic and programmable line pattern control system,
or mechanical control system, so as to be capable of applying skip or solid lines in any sequence, and
through any extrusion shoe in any cycle length.

687-3.03 Portable Applicating Equipment. The portable applicator shall be defined as hand
operated equipment, specifically designed for placing thermoplastic installations such as crosswalks; stop
bars; legends; arrows; and short lengths of lane, edge, and centerlines. The portable applicator shall be
capable of applying thermoplastic pavement markings by the extrusion method. It is intended that the
portable applicator will be loaded with hot thermoplastic composition from the melting kettle(s). The
portable applicator shall be equipped with all the necessary components, including a materials storage
reservoir, bead dispenser, extrusion shoe, and heating accessories, so as to be capable of holding the
molten thermoplastic at temperatures greater than 204.5°C, of extruding a line of from 75 to 200 mm in
width, and in thickness of not less than 3.2 mm nor more than 4.8 mm and of generally uniform cross–
section. Material temperature gauges shall be affixed or incorporated in the extrusion shoe in such a
manner as to be visible, and capable of monitoring the composition temperature throughout the marking
operation.

687-3.04 Application General. All pavement markings shall be placed as shown on the plans and in
accordance with the New York State Manual of Uniform Traffic Control Devices.

Before any pavement marking work is begun, a schedule of operations shall be submitted for the
approval of the Regional Director or his authorized representative.
When pavement markings are applied under traffic the Contractor shall provide all necessary flags, markers, signs, etc. to maintain and protect traffic; and to protect marking operations and the markings until thoroughly set.

The application of pavement markings shall be done in the general direction of traffic. Striping against the direction of traffic flow shall not be allowed.

The Contractor shall be responsible for removing, to the satisfaction of the Engineer, tracking marks, spilled thermoplastic or thermoplastic applied in unauthorized areas.

When necessary, the Contractor shall establish marking line points at nine (9) meter intervals throughout the length of pavement or as directed by the Engineer.

687-3.05 Atmospheric Conditions. Thermoplastic pavement markings shall be placed upon dry pavement surfaces. At the time of installation the pavement surface temperature shall be a minimum of 12.5°C and the ambient temperatures shall be a minimum of 9.5°C and rising. The Engineer will determine when atmospheric conditions are such to produce satisfactory results (Note 2).

Note 2. To comply with the 12.5°C pavement surface temperature requirement, it will benefit the Contractor to schedule striping work for seasons of warm weather when possible. In cooler conditions, striping operations may be coordinated with bituminous paving work to take advantage of residual heat, providing that the ambient temperature requirements of §687-3.05 are still met.

687-3.06 Materials Application Requirements

A. Thermoplastic Primer. All pavement surfaces shall be primed except that on new bituminous pavements, when the thermoplastic pavement markings are applied within the same calendar year as the completion of paving operations, primer shall not be required.

The primer shall be either a one-component or a two-component, cold or hot applied material of the type recommended by the manufacturer of the thermoplastic pavement marking material. At least five working days prior to the start of thermoplastic application, the Contractor shall provide the Engineer with the manufacturer's written instructions for primer application. The application of the primer shall be performed in accordance with the manufacturer's written recommendations which shall include the method of application, the application rate, and the drying time.

B. Thermoplastic Composition.

1. Application Temperature - thermoplastic composition shall be applied at temperatures no lower than 204.5°C at the point of deposition. For purposes of these specifications, the point of deposition shall be defined as within the extrusion shoe.

2. Extruded Markings - all extruded markings shall be applied at the specified width, and at a thickness of not less than 3.2 mm nor more than 4.8 mm.

C. Reflective Glass Spheres (for Drop-On). Immediately following application, reflective glass spheres shall be dropped onto the molten thermoplastic marking at the rate of 1 kg per 4 m² of composition.

687-3.07 Surface Cleaning and Preparation of Pavement. The Contractor shall be responsible for cleaning the pavement surface to the satisfaction of the Engineer.

Surface cleaning and preparation work shall be performed only in the area of the thermoplastic markings application.

At the time of application all pavement surfaces shall be free of oil dirt, dust, grease and similar foreign materials. The cost of cleaning these contaminants shall be included in the bid price of this item.

In addition, concrete curing compounds on new Portland Cement concrete surfaces; and existing pavement markings on both concrete and bituminous pavement surfaces shall be cleaned and paid for under separate items.
687-3.08 Application of Thermoplastic Pavement Markings. All special markings, cross walks, stop bars, legends, arrows, and similar patterns shall be placed with a portable applicator. Unless otherwise specified in the contract documents all center line, skip line, edge line and other longitudinal type markings may be applied with either a portable or a mobile applicator.

When the surface preparation work has been completed, if applicable, the bituminous and/or concrete pavement surface shall be primed according to the manufacturer's written instructions. Primer shall not be required on new bituminous pavement surfaces that are completed within the same calendar year as the thermoplastic marking application. The primer shall be spray applied onto the pavement surface and allowed to dry according to the manufacturer's written instructions. Pavement surfaces that are primed and not striped with thermoplastic within the required drying time or within the same work day shall be re-primed.

After the primer has dried, the thermoplastic shall be applied at composition temperatures no lower than 204°C at the point of deposition. Immediately after installation of the thermoplastic, drop-on reflective glass spheres shall be mechanically applied such that the spheres are held by and embedded in the surface of the molten composition.

687-4 METHOD OF MEASUREMENT. Pavement striping will be measured by linear meter along the centerline of the pavement stripe, and will be based on a 100 mm wide stripe. Measurement for striping with a plan width greater or less than the basic 100 mm as shown on the plans or as directed by the Engineer, will be made by the following method:

\[
\text{Plan Width of Striping (millimeters) \times Linear Meters}
\]

\[100 \text{ mm}\]

No payment will be made for the number of linear meters of skips in the dashed line.
Letters and symbols will be measured by each unit applied. A unit will consist of one letter or symbol. Example: “SCHOOL” would be measured as six units. Double and triple headed arrows will be measured as a single unit, but the “X” in railroad grade crossing markings (M.U.T.C.D. figure 263-33) will be measured by linear meters of 100 mm stripe.

687-5 BASIS OF PAYMENT. The accepted quantities of markings will be paid for at the contract unit price, which shall include the cost of furnishing all labor, materials and equipment to satisfactorily complete the work. The cost for maintaining and protecting traffic during the marking operations shall be included in the price bid. The cost of removal of concrete curing compounds and existing pavement markings will be paid under separate items and are not included in this item.

\[
\text{Payment will be made under:}
\]

<table>
<thead>
<tr>
<th>Item No.</th>
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<th>Pay Unit</th>
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</thead>
<tbody>
<tr>
<td>687.0101</td>
<td>White Thermoplastic Reflectorized Pavement Stripes</td>
<td>Meter</td>
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<tr>
<td>687.0201</td>
<td>Yellow Thermoplastic Reflectorized Pavement Stripes</td>
<td>Meter</td>
</tr>
<tr>
<td>687.0301</td>
<td>White Thermoplastic Reflectorized Pavement Letters</td>
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</tr>
<tr>
<td>687.0401</td>
<td>White Thermoplastic Reflectorized Pavement Symbols</td>
<td>Each</td>
</tr>
</tbody>
</table>

SECTION 688 - PREFORMED REFLECTORIZED PAVEMENT MARKINGS

688-1 DESCRIPTION. Under this work, the Contractor shall furnish and apply preformed reflectorized pavement markings at the location and in accordance with patterns indicated on the plans or as ordered by the Engineer, and in conformance with the NYSMUTCD and these specifications.

The preformed reflectorized pavement marking shall be applied on new and existing bituminous and portland cement concrete surfaces by hand and mechanical methods. The resultant marking shall be an adherent reflectorized stripe that is capable of molding itself to the contours of the pavement surface and of resisting deformation by traffic.

688-2 MATERIALS. Materials shall conform to the requirements of §727-04 White and Yellow Reflectorized Pavement Markings.
§688-3 CONSTRUCTION DETAILS

688-3.01 General. All pavement markings and patterns shall be placed as shown on the plans and in accordance with the New York State Manual of Uniform Traffic Control Devices.

Before any pavement marking work is begun, a schedule of operations shall be submitted for the approval of the Regional Director or his authorized representative.

At least five (5) days prior to the start of work, the Contractor shall provide the Engineer with the manufacturer's written instructions for the application of preformed marking and primer materials.

When pavement markings are applied under traffic, the Contractor shall supply all necessary flags, markers, signs, and other devices, to maintain traffic and to protect the markings until set.

The application of pavement markings shall be done in the general direction of traffic. Striping against the direction of traffic flow will not be allowed without prior approval of the Engineer.

The Contractor shall be responsible for removing, to the satisfaction of the Engineer, preformed markings applied in unauthorized areas.

When required by the Engineer, the Contractor shall establish marking line points at nine (9) meter intervals throughout the length of the pavement or as directed by the Engineer.

688-3.02 Application Methods. Preformed pavement markings shall be applied by the following methods. The installation of markings on the project may be performed simultaneously by more than one method.

A. During Bituminous Paving Operations. Preformed markings shall be applied on newly paved bituminous surfaces after finish rolling is complete.

B. On Completed Pavements. Preformed markings shall be applied on new and existing bituminous and portland cement concrete pavement surfaces as prescribed in §688–3.03 Weather and Seasonal Limitations.

688-3.03 Weather and Seasonal Limitations. The Engineer shall determine as to when temperature and pavement surface conditions are such as to produce satisfactory results.

Preformed pavement markings shall be placed upon dry pavement surfaces; pavements exposed to rain or wet conditions shall be allowed to thoroughly dry before marking application.

Preformed markings applied in conjunction with §688–3.02A, During Bituminous Paving Operations, shall only be placed within the seasonal limitations of Standard Specification §402-3.01. The bituminous pavement surface temperature shall, at all times, be the controlling temperature at which preformed markings are placed, and shall be between 37.5°C and 76.5°C.

Preformed markings applied in conjunction with §688–3.02B, on completed pavements, shall be applied within the seasonal limitations of Table 688-1, Temperature and Seasonal Requirements. The pavement surface and ambient air temperatures in Table 688-1 shall, in all cases, be the controlling temperatures at which preformed markings are placed. Marking application work shall be discontinued when temperatures fall below the specified requirements.

<table>
<thead>
<tr>
<th>Geographic Location</th>
<th>Pavement Surface Temperature</th>
<th>Ambient Air Temperature</th>
<th>Allowable Installation Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regions 1, 2, 3, 4, 5, 6, 7 &amp; 9 (All Counties)</td>
<td>21°C, Min.</td>
<td>15.5°C, Min.</td>
<td>May 15 to September 1</td>
</tr>
<tr>
<td>Region 8 (Ulster County only)</td>
<td>21°C, Min.</td>
<td>15.5°C, Min.</td>
<td>May 15 to September 15</td>
</tr>
<tr>
<td>Regions 8 &amp; 10 (except Ulster County)</td>
<td>21°C, Min.</td>
<td>15.5°C, Min.</td>
<td>May 1 to September 30</td>
</tr>
<tr>
<td>Region 11</td>
<td>21°C, Min.</td>
<td>15.5°C, Min.</td>
<td>May 1 to September 15</td>
</tr>
</tbody>
</table>

NOTES:
1. Surface temperatures shall be measured on the pavement surface where the preformed markings are to be placed. The controlling temperature shall be the average of three temperature readings taken at locations 30± meter apart.
2. Ambient air temperatures shall be measured in the shade.
688-3.04 Mechanical Applicating Equipment. Mechanical applicating equipment for the placement of preformed pavement marking stripes shall be of the type recommended by the manufacturer of the preformed material. All applicating equipment shall be approved by the Engineer prior to the start of work.

688-3.05 Rollers. Preformed markings applied in conjunction with §688-3.02a, during bituminous paving operations, shall be rolled into place with compaction equipment meeting the requirements of Standard Specification §402-3.04. Vibratory roller models shall operate in a ‘static’ mode.

Preformed markings applied in conjunction with §688-3.02B., On Completed Pavements, shall be rolled into place using steel shell or pneumatic rubber–tired roller equipment approved by the Engineer. Steel wheel rollers shall weigh a minimum of 90 kg on each axle. Pneumatic rubber–tired rollers shall exert a minimum tire compression on the pavement of 195 Kpa. Hand rollers or rubber tired vehicles (e.g. pick–up truck) meeting the above requirements may be suitable for use.

688-3.06 Primer Requirements. When required, primer or adhesive shall be used for marking applications in accordance with the written recommendations of the manufacturer of the preformed marking material.

Primer materials shall be placed at the application rate and by the application methods recommended by the manufacturer.

When primer is applied, the area of application shall be at least the width or dimension, of the new preformed marking, plus twenty-five (25) millimeter on each side.

688-3.07 Surface Cleaning and Preparation of Pavement Surfaces. The Contractor shall be responsible for cleaning the pavement surface to the satisfaction of the Engineer.

Surface cleaning and preparation work shall be performed only in the area of the preformed markings application.

At the time of application, all pavement surfaces shall be free of oil, dirt, dust, grease and similar foreign materials. The cost of cleaning these contaminants shall be included in the bid price of this item.

In addition, concrete curing compounds on new portland cement concrete surfaces and existing pavement markings on both concrete and bituminous pavement surfaces shall be removed and paid for under separate items.

688-3.08 Application of Preformed Reflectorized Pavement Markings. Unless otherwise approved by the Engineer, all longitudinal lines shall be applied using mechanical applicating equipment. Transverse and special marking patterns may be applied by hand or mechanical methods.

Preformed marking operations shall not begin until after the pavement surface has been cleaned and prepared.

Preformed stripes shall not be applied over longitudinal paving joints or over the point of transition between the pavement surface and adjoining shoulder. The placement of stripes in the area of transition shall be either on the pavement or on the shoulder, as directed by the Engineer.

No roller shall operate in excess of 4.5 km/h. One roller pass shall be defined as one movement of the roller over any point of the preformed marking, in the direction of the marking application.

A. Application During Bituminous Paving Operations. The application of preformed markings shall not begin until finish rolling of the new bituminous pavement is complete.

At the time of marking application, the surface temperature of the new bituminous pavement shall be between 37.5°C and 76.5°C. The Contractor shall coordinate paving and preformed marking operations to conform with surface temperature requirements.

Immediately after finish rolling is complete, the preformed marking shall be applied on the new bituminous surface. Traces of water or other residue from finish rolling operations shall first be removed. Immediately after its placement, the preformed marking shall be adhered to the warm pavement surface by rolling. Rollers shall make a minimum one pass, and operate in the same direction that the marking was applied. Diagonal, reverse or crosswise rolling will not be allowed. The minimum one pass may be increased by the Engineer if, in his opinion, the desired adherence is not obtained.
§688

B. Application on Completed Pavements. The application of preformed markings shall only be performed within the limitations of §688–3.03 Weather and Seasonal Limitations.

If required by the manufacturer, primer and adhesive activators shall be applied and allowed to dry in accordance with the instructions of the manufacturer of the preformed material.

The preformed marking shall be placed on the pavement surface and adhered by rolling. Rollers shall make a minimum of one pass, and operate in the same direction that the marking was applied. Diagonal, reverse or crosswise rolling will not be allowed. The minimum one pass may be increased by the Engineer if, in his opinion, the desired adherence is not obtained.

688-4 METHOD OF MEASUREMENT. Pavement striping will be measured by meters along the centerline of the pavement stripe and will be based on a 100 mm wide stripe.

The preformed pavement markings will be inspected during and following installation to determine conformance with this specification. In addition, they will be inspected following a performance period that will extend for 180 calendar days following both their installation and opening of the roadway to traffic.

Within 15 consecutive calendar days after the end of the 180 day performance period, a final performance inspection will be made by the Engineer. If this inspection discloses any work, in whole or in part, as not being visibly intact and serviceable to the following extent, the Contractor shall completely repair or replace such work:

A. Broken Line. 90 percent measured longitudinally of the total length of all broken lines in any 150 meter long pavement section.

B. Dotted Line. 50 percent measured longitudinally of the total length of all dotted lines in any 30 meter long pavement section.

C. Solid Line and Edge Line. 90 percent measured longitudinally of the total length of solid line or edge line in any 150 meter long pavement section.

D. Channelizing Line, Stop Line, Crosswalk Lines, Clearance Line and Crossbars, Hatch Lines, Letters and Symbols. 90 percent by area of any individual line, letter or symbol.

When required all repair or replacement work shall be performed in accordance with this specification and completed within 60 calendar days of the earliest allowable installation date as specified in Table 1, for that location. The Engineer shall determine the limits or quantity of preformed to be repaired or replaced.

Upon completion of the final performance inspection, or after satisfactory completion of any necessary corrections, the Engineer will, within 10 calendar days, notify the Contractor in writing, of the date of such final performance inspection and release the Contractor from further performance responsibility.

Pavement striping on–going projects will be measured as the total of the striping applied, if after the final 180 day performance period, damage to the striping is not in excess of that specified (e.g. If 95% of the edgeline striping is intact in a 150 meter pavement section, the edgeline will be measured as the full 150 meters of applied marking. No deduction will be made for the damaged 5% (7.5 m) of striping).

Measurement for striping with a plan width greater or less than the basic 100 mm as shown on the plans or as directed by the Engineer, will be made by the following method:

\[
\text{Plan Width of Striping (millimeters) x Meters} \\
100 \text{ (millimeters)}
\]

No payment will be made for the number of meters of gaps between broken or dotted line segments. Letters and symbols will be measured by each unit applied. A unit will consist of one letter or one symbol. Example: “SCHOOL” would be measured as six units.

Double and triple headed arrows will be measured as a single unit, but the “X” in railroad grade crossing markings (M.U.T.C.D. figure 263-33) will be measured by linear meter of 100 mm stripe.
§688

688-5 BASIS OF PAYMENT. The accepted quantities of markings will be paid for at the contract unit price, which shall include the cost of furnishing all labor, materials and equipment to satisfactorily complete the work. The cost of cleaning pavement surfaces of oil, dirt, dust, grease and similar foreign materials shall be included in the price bid. The cost of removal of concrete curing compounds and existing pavement markings will be paid under separate items and are not included in this item.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
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</tr>
<tr>
<td>688.04</td>
<td>White Preformed Reflectorized Pavement Symbols</td>
<td>Each</td>
</tr>
</tbody>
</table>

SECTIONS 689 THRU 696 (VACANT)

SECTION 697 - FIELD CHANGE ORDER

697-1 DESCRIPTION

697-1.01 General. The Field Change Order (FCO) provides a contract contingency allowance for the timely payment of authorized additional work that is necessary to fulfill the intent of the plans and specifications.

697-1.02 Eligible Work. FCO payments shall be limited to work that is: (1) within the scope of the contract, (2) a quantity variation of existing contract pay items, or (3) a new contract pay item introduced as a result of minor field adjustments in the details of the project. All eligible items of work shall have a known unit price, either through use of a contract bid price or through an Agreed Price.

697-2 MATERIALS. None Specified.

697-3 CONSTRUCTION DETAILS. None Specified.

697-4 METHOD OF MEASUREMENT.

697-4.01 Bid Price. The unit price shown in the proposal for this item will be considered as the price bid, and shall not be altered in any manner. Should the amount shown be altered, the new figure will be disregarded and the original bid price will be used to determine the total amount bid for the contract.

697-4.02 Payments. Work for which FCO payments are processed will be measured in accordance with the specifications governing the work.

697-5 BASIS OF PAYMENT. All work to be paid under the FCO item must be authorized in advance of the work. Disputed work, force account work, work associated with Value Engineering Change Proposals, or payments for time related provisions are not eligible for FCO payment. FCO payments will be determined from the quantities and unit prices of eligible work that has been completed in conformance with applicable Specifications. Work for which FCO payments are processed will be paid in accordance with the specifications governing the work.

Prior to processing the final agreement, the FCO payments will be reconciled through a final Order-on-Contract, such that the amount of FCO payments are converted to the corresponding quantities of the pertinent contract pay items. When payments are transferred to the appropriate items, the remaining amount of FCO funds will be deleted.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
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</thead>
<tbody>
<tr>
<td>697.0201</td>
<td>Field Change Order (FCO)</td>
<td>Dollars-Cents</td>
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</tbody>
</table>
SECTION 698 PRICE ADJUSTMENTS

698-1 DESCRIPTION. This section will provide for additional compensation to the Contractor for increases, or repayment by the Contractor for decreases, in the price of asphalt, fuel, or steel/iron products.

No adjustment will be provided for any new or additional work paid for by force account. Additional quantities of existing contract pay items at original bid prices will be considered eligible work. Additional work added by agreed price will be considered eligible work. Work performed by the Contractor at its own expense will not be eligible for price adjustment.

698-1.01 Asphalt Price Adjustment. This item will enable the Department to make price adjustments to account for changes in asphalt prices. Price adjustments will be made for eligible work listed in the proposal.

698-1.02 Fuel Price Adjustment. This item will enable the Department to make price adjustments to account for changes in fuel prices. Price adjustments will be made for eligible work listed in the proposal.

698-1.03 Steel/Iron Price Adjustment. This item will enable the Department to make price adjustments to account for changes in steel/iron product prices for materials which will be permanently incorporated into the work.

698-2 MATERIALS. None specified.

698-3 CONSTRUCTION DETAILS.

698-3.01 Asphalt Price Adjustment. The asphalt price adjustment will be based solely on the price changes for asphalt as determined by the formulas below. No consideration will be given to the situation where an individual supplier's price exceeds the monthly average posted price, nor will any adjustment be made if the monthly average posted price is within $10.00 of the Performance Graded Binder (PGB) index price.

A. Quantity. The quantity of asphalt (metric tons) considered for adjustment will be determined by multiplying the quantity of eligible work completed by the conversion factors which are listed in the proposal note entitled Asphalt Price Adjustment.

B. Prices. The PGB index price and the monthly average posted price are defined as follows:

1. Asphalt Index Price. A fixed price per metric ton of PGB used solely as a basis from which to compute asphalt price adjustments. The PGB index price will be the monthly average posted price for the month of the bid letting, as listed in the Engineering Bulletin entitled Fuel, Asphalt and Steel Price Adjustments. The PGB index price for additional work at the original contract bid price will be the monthly average posted price for the month the agreed price was submitted to the Engineer.

2. Monthly Average Posted Price. The average FOB terminal price for unmodified PG 64-22 binder, without anti stripping agent, will be determined by the Department, based on prices of approved primary sources of PGB. Prices will be posted in a monthly Engineering Bulletin entitled Fuel, Asphalt and Steel Price Adjustments.

C. Adjustment. Asphalt price adjustment will be based on the following formulas:

1. When price increases:
   \[ \text{Price Adjustment} = (\text{Quantity of Asphalt}) \times (\text{Average Posted Price} - \text{PGB Index Price} - \$10.00) \]
2. When price decreases:
   Price Adjustment = (Quantity of Asphalt) x (Average Posted Price - PGB Index Price + $10.00)

698-3.02 Fuel Price Adjustment. The fuel price adjustment will be based solely on the price changes for fuel as determined by the formulas below. No consideration will be given to the situation where an individual supplier's price exceeds the monthly average posted price, nor shall any adjustment be made if the monthly average posted price is within $0.03 of the fuel index price.

   A. Quantity. The quantity of fuel (liters) considered for adjustment will be determined by multiplying the quantity of eligible work completed by the fuel usage factor which are listed on the proposal note entitled Fuel Price Adjustment.

   B. Prices. The Fuel Index Price and the monthly average posted price are defined as follows:

   1. Fuel Index Price. A fixed price per liter of fuel used solely as a basis from which to compute fuel price adjustments. The fuel index price will be the monthly average posted price for the month of the bid letting, as listed in the Engineering Bulletin entitled Fuel, Asphalt and Steel Price Adjustments. The fuel index price for additional work at the original contract bid price will be the monthly average posted price for the month of the bid letting. The fuel index price for additional work at agreed price will be the monthly average posted price for the month the agreed price was submitted to the Engineer.

   2. Monthly Average Posted Price. An average FOB refinery or terminal price per liter determined by the Department based on prices for No. 2 fuel oil and unleaded gasoline in the cities of New York, Philadelphia, Detroit, and Boston. Prices will be posted in a monthly Engineering Bulletin entitled Fuel, Asphalt and Steel Price Adjustments.

   C. Adjustment. Fuel price adjustment will be based on the following formulas:

   1. When price increases:
      Price Adjustment = (Quantity of Fuel) x (Average Posted Price - Fuel Index Price - $0.03)

   2. When price decreases:
      Price Adjustment = (Quantity of Fuel) x (Average Posted Price - Fuel Index Price + $0.03)

698-3.03 Steel/Iron Price Adjustment. If the percentage change does not exceed 5%, no adjustments will be made for materials invoiced that month. For lump sum or each items, such as overhead sign structures, that are assembled from numerous components, the percentage change will be determined for the assembled contract pay item using the month that the largest value of materials were invoiced. To allow for multiple adjustments of various quantities at different times, for unit price items such as guiderail that are assembled from numerous components, the percentage change will be determined for a given quantity of the contract pay item using the month that the largest value of component materials for that quantity of the contract pay item were invoiced.

The weight of the steel and/or iron shall be determined from manufacturer’s/supplier’s data or shipping weights, and exclude minor appurtenances individually weighing less than 2 kg (i.e., nuts, bolts, washers, etc.). Eligible precast or prestressed concrete items shall have total reinforcing steel weight listed on the approved shop drawings. The following sources shall be used, in declining order of precedence, to determine the weight of steel/iron: approved shop drawings, contract documents, Department Standard Sheets, industry standards (i.e., AISC Manual of Steel Construction, AWWA Standards, etc.) and manufacturer’s data. Materials will be considered invoiced when invoiced from a Manufacturer or Material Supplier to the Contractor, to a Subcontractor or to a Fabricator.

   A. Quantity. The quantity of steel and/or iron considered for adjustment for each core (3-digit) contract pay item number (e.g., 564 – Structural Steel) will be measured to the nearest 0.1 Metric Tons.
1. **Percent Change Greater Than 5%**. If the percentage change calculated by the Engineer is greater than 5%, Price Adjustments will be made for materials invoiced that month. The Contractor shall provide the Engineer a detailed list of the weight of eligible materials, including: the contract pay item, the weight of steel/iron, the month(s) of invoice, the source used to determine the weight, and if requested by the Engineer, copies of invoices to verify the month of invoice.

2. **Percent Change -5% to +5%**. If the percentage change calculated by the Engineer is 5% or less, no adjustments will be made for materials invoiced that month. The Contractor shall provide the Engineer with a list of the materials invoiced that month, including the contract pay item, the quantity invoiced, and if requested by the Engineer, copies of invoices to verify the month of invoice. The list shall be provided not later than the 15th of the following month.

3. **Percent Change -5% and Lower**. If the percentage change calculated by the Engineer is -5% or lower, a Price Rebate will be charged to the Contractor for materials invoiced that month. The Contractor shall provide the Engineer a detailed list of the weight of eligible materials, including: the contract pay item, the weight of steel/iron, the month(s) of invoice, the source used to determine the weight, and if requested by the Engineer, copies of invoices to verify the month of invoice. If the Contractor fails to provide the information required to determine the Price Rebate within 60 calendar days after the end of the month, the percentage change will be applied to the entire unit price, until such time as the Contractor provides the required information.

**B. Prices.** The Benchmark Steel Index and the Monthly Index are defined as follows:

1. **Producer Price Index (PPI)**. Producer Price Index (PPI) values are published by the US Department of Labor (USDOL), Bureau of Labor Statistics (BLS). Recent PPI values are posted on the Construction Division website at www.dot.state.ny.us. A complete listing of PPI values can be found on the BLS website at http://data.bls.gov/PDQ/outside.jsp?survey=wp.

2. **Benchmark Steel Index (BI)**. Value of the PPI for *Semifinished Steel Mill Products* (WPU 101702) for the month of contract bid letting. The benchmark steel index for additional work at the original contract bid price will be the value of the PPI for the month of the bid letting. The benchmark steel index for additional work at agreed price will be the value of the PPI for the month the agreed price was submitted to the Engineer.

3. **Monthly Steel Index (MI)**. Value of the PPI for *Semifinished Steel Mill Products* (WPU 101702) for the month the material is invoiced.

4. **Cost Basis (CB)**. Cost Basis defined in dollars per metric ton listed in the monthly Engineering Bulletin *Fuel, Asphalt and Steel Price Adjustments* for the month of bid letting. The cost basis for additional work at the original contract bid price will be the cost basis listed for the month of the bid letting. The cost basis for additional work at agreed price will be the value of the cost basis for the month the agreed price was submitted to the Engineer.

**C. Adjustment.** Steel/Iron price adjustment will be based on the following formulas:

1. The percent change in any given month will be determined as follows:

   \[
   \text{Percentage Change} = \left( \frac{\text{MI} - \text{BI}}{\text{BI}} \right) \times 100
   \]

2. When price increases:

   \[
   \text{Price Adjustment} = \left[ \left( \frac{\text{MI} - \text{BI}}{\text{BI}} \right) - 0.05 \right] (\text{CB}) \text{Qty}
   \]
3. When price decreases:

$$\text{Price Rebate} = \left[ \left( \frac{MI - BI}{BI} \right) + 0.05 \right] (CB) Qty$$

### §698-4 METHOD OF MEASUREMENT

The unit price shown in the itemized proposal will be considered the unit price bid, although actual payment will be calculated based on changes in posted material prices. Should the amount shown be altered, the altered figures will be disregarded and the original price will be used to determine the total contract bid amount.

**698-4.01 Asphalt Price Adjustment.** Asphalt price adjustments will be measured on a Dollar Cents basis.

**698-4.02 Fuel Price Adjustment.** Fuel price adjustments will be measured on a Dollar Cents basis.

**698-4.03 Steel/Iron Price Adjustment.** Steel/Iron price adjustments will be measured on a Dollar Cents basis.

### §698-5 BASIS OF PAYMENT

Price adjustments will be based on the computations described above. Adjustments, either positive or negative, will be made when the accumulated amount for a price adjustment contract pay item exceeds $5,000, or at such additional times as the Engineer deems appropriate. Adjustments not meeting this criteria will be made in the final contract payment.

If price adjustments are based on estimated material quantities for that time, and a revision to the total material quantity is made in a subsequent or final estimate, an appropriate addition or deduction will be made to the price adjustment previously calculated. The addition or deduction will be based on the same adjustment factors used to calculate the price adjustment which is being revised. If the installation dates of the revised material quantity cannot be determined, the addition or deduction will be based on the adjustment factors in effect during the last month in which any portion of the material quantity was installed.

If eligible items are installed after the original contract completion date and during which time an extension of time without the assessment of engineering charges is approved, the monthly average posted price or monthly index value used to compute price adjustments will be the appropriate monthly average posted price or monthly index value.

If eligible items are installed after the scheduled contract completion date and during which time there are assessed engineering charges and/or liquidated damages, the monthly average posted price or monthly index value used to compute price adjustments will not exceed, but may be less than the monthly average posted price or monthly index value in effect on the last contract completion date without assessed engineering charges.

**698-5.01 Asphalt Price Adjustment.** The adjustment will be based on the monthly average posted price in effect at the time the work is completed. The monthly average posted price will be updated about the twentieth of each month and will apply to eligible work performed during the following month.

**698-5.02 Fuel Price Adjustment.** The adjustment will be based on the monthly average posted price in effect at the time the work is completed. The monthly average posted price will be updated about the twentieth of each month and will apply to eligible work performed during the following month.

**698-5.03 Steel/Iron Price Adjustment.** The minimum price adjustment for a contract is $5,000. The minimum price adjustment for any group of contract pay items sharing the same core (3-digit) contract pay item number (e.g., 564 – Structural Steel) is $1,000. The adjustment will be based on the index in effect at the time of purchase or invoice.

The monthly index is listed as preliminary for 4 months after initial publication. At contract final acceptance, the Engineer will make final revisions to the adjustment based on revised data. If all contract work is complete, preliminary index values as posted by the BLS may be used in place of final values. If a preliminary value is not posted for a given month or months, the preliminary value will be the average of the preceding and following months that are posted. If a final value is not posted for a given month or
months, the final value will be determined from the average annual value, if possible, or will be the average of the preceding and following months that are posted.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>698.04</td>
<td>Asphalt Price Adjustment</td>
<td>Dollars Cents</td>
</tr>
<tr>
<td>698.05</td>
<td>Fuel Price Adjustment</td>
<td>Dollars Cents</td>
</tr>
<tr>
<td>698.06</td>
<td>Steel/Iron Price Adjustment</td>
<td>Dollars Cents</td>
</tr>
</tbody>
</table>

SECTION 699 - MOBILIZATION

699-1 DESCRIPTION. Under this work the Contractor shall provide necessary bonds, insurance, and prefinancing and shall set up his necessary general plant, including shops, storage areas, office and such sanitary and other facilities as are required by local or state law or regulation.

699-2 MATERIALS. Such materials as required for mobilization and that are not to be part of the completed contract shall be as determined by the Contractor, except that they shall conform to any pertinent local or State Law, regulation or code.

699-3 CONSTRUCTION DETAILS. The work required to provide the above facilities and service for mobilization shall be done in a safe and workmanlike manner and shall conform with any pertinent local or State Law, regulation or code. Good housekeeping consistent with safety shall be maintained.

699-4 METHOD OF MEASUREMENT. Payment for mobilization will be made on a lump sum basis.

699-5 BASIS OF PAYMENT. The amount bid for mobilization shall not exceed four percent (4%) of the total contract bid price excluding the bid price for mobilization. Should the bidder exceed the foregoing four percent (4%), the Department will make the necessary adjustment to determine the total amount bid based on the arithmetically correct proposal.

The amount bid shall include the furnishing and maintaining of services and facilities noted under §699-1 DESCRIPTION, to the extent and at the time the Contractor deems them necessary for his operations, consistent with the requirements of this work and the respective contract.

The amount bid shall be payable to the Contractor with the first contract payment made for other contract work.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>699.0400001</td>
<td>Mobilization</td>
<td>Lump Sum</td>
</tr>
</tbody>
</table>
Section 700
MATERIALS and MANUFACTURING

SECTION 701 - HYDRAULIC CEMENTS

701-01 PORTLAND CEMENT

SCOPE. This Specification covers five types of portland cement as follows:

Type 1. For use in general concrete construction where low heat of hydration is not required and where no sulfate action is anticipated.

Type 2. For use in general concrete construction.

Type 3. For use when high early strength is required.

Type 5. For use when high sulfate resistance is required.

Type 6. For use in white concrete or white mortar.

For uniformity with recognized industry terminology, Types 1, 2, 3 and 5 may also be designated as Types I, II, III and V respectively. Type I/II is defined as a cement that meets the requirements of both Types I and II cement.

Type of cement to be used will be as shown in the plans or specifications for each contract.

MATERIAL REQUIREMENTS. Portland cement, Types 1, 2, 3 and 5 shall conform to the chemical and physical requirements of those respective types as contained in AASHTO M 85 with the following:

Type 6 cement shall meet the requirements for Type 1 cement except the color shall be white

Any cement with an alkali content in excess of 0.70% is restricted for use as per the requirements of §501.

The Department reserves the right to impose the “Optional Chemical and Physical Requirements" of AASHTO M 85 when, in the Department's opinion, a cement contains undesirable constituents.

The temperature of the cement, measured immediately prior to entering the mixing unit at a batching facility, shall not exceed 76°C.

Manufacturer. The gypsum shall be added to the clinker by means of an approved automatic mechanical device. At the option of the manufacturer, additions of those commercial products known as “grinding aids" will be permitted as provided for by AASHTO M 85. The manufacturer shall declare the commercial name of the product used and the amount thereof in writing to the Materials Bureau.

Storage. The cement shall be stored at its source of supply in approved weather-tight silos. Facilities shall be provided for maintaining such silos under Department seal control when and as directed by the Materials Bureau.

All silos shall be completely empty and clean before cement is deposited therein unless the silo contains Department specification cement of the same type.

Cement remaining in bulk storage at the mill and/or distribution terminal for a period greater than one year after completion of tests shall be resampled and retested before shipment. However, cement which has been in bulk storage at mills and/or distribution terminals more than two years from the time of original manufacture shall not be used. No cement stored by the Contractor over the winter shall be used until retested by the Materials Bureau.

Bagged cement shall not be stored at mill or terminal locations for a period longer than that time considered reasonable by the Department for preparing an order for shipment.
Shipment. All shipments of cement shall be made in accordance with procedural directives issued by the Materials Bureau. Conveyances for bulk cement shipment shall be of a type approved by the Department. The compartments of all such conveyances shall be completely empty and clean before any cement is loaded therein. Cement may be shipped in paper bags which conform to industry standards and which have the brand name, type of cement, and the name of the manufacturer plainly marked thereon.

Inspection and Testing. All inspection and testing shall be in accordance with procedural directives issued by the Materials Bureau. When required by the Materials Bureau, cement shall be sampled by means of an automatic sampling device constructed so as to obtain continuous samples across the full stream of cement and deliver such samples into a sealed container approved by the Materials Bureau. Tests for chemical and physical properties shall be in accordance with test methods stipulated by AASHTO M 85.

BASIS OF ACCEPTANCE. Portland cement will be considered for acceptance at mill or terminal locations in accordance with procedural directives issued by the Materials Bureau.

701-02 MASONRY AND MORTAR CEMENT

SCOPE. Masonry and mortar cement, used to make masonry mortar.

MATERIALS
Masonry Cement ASTM C91
Mortar Cement ASTM C1329

BASIS OF ACCEPTANCE. The Engineer will base acceptance on each package being labeled to show ASTM conformance and its contents being in good condition.

701-03 BLENDED PORTLAND CEMENT

SCOPE. This specification covers blended portland cement, for use in portland cement concrete, using Class F fly ash, microsilica, ground granulated blast furnace slag or a combination of fly ash and microsilica. The cement, and percent of each material in the blended cement, shall be at an appropriate quantity to achieve the desired percentage in the concrete mix as shown in the plans or specifications without further addition of any cementitious component.

GENERAL. Blended portland cements, as described in AASHTO M 240 shall conform to the chemical and physical requirements described herein, or as modified in the concrete mix as shown in the plans or specifications of each contract. Acceptable blended portland cements are defined as follows:

Portland/ fly ash cement (IP). A product consisting of portland cement and fly ash in which the fly ash content does not exceed 22 percent by mass.

Portland/ microsilica cement (SF). A product consisting of portland cement and microsilica in which the microsilica content does not exceed 10 percent by mass.

Portland/ ground granulated slag cement (SM). A product consisting of portland cement and finely ground, granulated blast furnace slag in which the slag content does not exceed 22 percent by mass.

Ternary blend cement. A product consisting of portland cement, fly ash, and microsilica in which the total supplementary cementitious content does not exceed 30 percent by mass. The fly ash portion shall range from 15 -20 percent of the total mass. The microsilica portion shall range from 6-10 percent of the total mass.

Blending may be completed by means of intergrinding or by mechanical means. The blended cement shall remain homogeneous from the point of blending to the point of use at a portland cement concrete.
batching facility. The ability and means of maintaining homogeneity shall be demonstrated to the satisfaction of the Department.

**MATERIAL REQUIREMENTS.** The individual components, before blending, shall meet the following requirements:

- Portland Cement: 701-01 Type I, II or I/II only
- Fly ash: 711-10
- Microsilica: 711-11
- Ground, Granulated Blast Furnace Slag: 711-12

Blended portland cements shall meet the chemical requirements specified in Table 701-1 and the physical requirements specified in Table 701-2.

**STORAGE.** The blended cement shall be stored at its source of supply in approved weather-tight silos. Facilities must be provided for maintaining such silos under Department seal control when and as directed by the Materials Bureau.

### TABLE 701-1 CHEMICAL REQUIREMENTS - BLENDED PORTLAND CEMENTS (ASTM C114)

<table>
<thead>
<tr>
<th>Component</th>
<th>Portland/flyash (IP)</th>
<th>Portland/microsilica (SF)</th>
<th>Ternary Blend</th>
<th>Portland /slag (SM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss on Ignition</td>
<td>5.0 % max.¹</td>
<td>3.4 % max.</td>
<td>3.6 % max.</td>
<td>3.0 % max.²</td>
</tr>
<tr>
<td>SiO₂</td>
<td>---</td>
<td>22.0 % min.</td>
<td>31.5 % min.</td>
<td>---</td>
</tr>
<tr>
<td>MgO</td>
<td>6.0 % max.¹</td>
<td>6.0 % max.</td>
<td>6.0 % max.</td>
<td>---</td>
</tr>
<tr>
<td>SO₃</td>
<td>4.0 % max.¹,³</td>
<td>3.1 % max.³</td>
<td>3.5 % max.³</td>
<td>3.0 % max.²,³</td>
</tr>
<tr>
<td>Total Alkalinity</td>
<td>0.85 % max.⁴</td>
<td>0.80 % max.⁴</td>
<td>0.95 % max.⁴</td>
<td>0.75 % max.⁴</td>
</tr>
</tbody>
</table>

Note 1- As per chemical requirements of AASHTO M 240 for Type IP blended cement.
Note 2- As per chemical requirements of AASHTO M 240 for Type I(SM) blended cement.
Note 3- There are cases where the optimum SO₃ (using ASTM test method C563) for a particular cement is close to or in excess of the limit in this specification. In such cases where the properties of a cement can be improved by exceeding the SO₃ limits stated in this table, it is permissible to exceed the values in the table, provided it has been demonstrated by ASTM test method C1038 that the cement with the increased SO₃ will not develop expansion under water exceeding 0.020 % at 14 days. When the manufacturer supplies cement under this provision, the supporting data will be supplied, on request, to the Materials Bureau.
Note 4- Any blended cement where the portland cement portion contains an alkali content in excess of 0.70% may be either rejected, accepted, or have use limitations imposed as directed by the Materials Bureau.

### TABLE 701-2 PHYSICAL REQUIREMENTS - BLENDED PORTLAND CEMENTS

<table>
<thead>
<tr>
<th>Test Requirement</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passing 45μm (ASTM C430)</td>
<td>70% minimum</td>
</tr>
<tr>
<td>Time of setting, Vicat test (ASTM C191)</td>
<td>45 minimum, 420 maximum</td>
</tr>
<tr>
<td>Autoclave contraction (ASTM C151)</td>
<td>0.2% maximum</td>
</tr>
<tr>
<td>Autoclave expansion</td>
<td>0.8% maximum</td>
</tr>
<tr>
<td>Compressive strength (AASHTO T 106)</td>
<td></td>
</tr>
<tr>
<td>3 days</td>
<td>10.0 minimum</td>
</tr>
<tr>
<td>7 days</td>
<td>20.0 minimum</td>
</tr>
<tr>
<td>28 days</td>
<td>25.0 minimum</td>
</tr>
</tbody>
</table>

All silos shall be completely empty and clean before blended cement is deposited therein unless the silo contains Department specification blended cement of the same type.

Blended cement remaining in bulk storage at the mill and/or distribution terminal for a period greater than one year after completion of tests must be resampled and retested before shipment. However, blended cement which has been in bulk storage at mills and/or distribution terminals more than two years...
from the time of original manufacture shall not be used. No blended cement stored by the Supplier over
the winter may be used until retested by the Materials Bureau.

Bagged blended cement shall not be stored at mill or terminal locations for a period longer than that
time considered reasonable by the Department for preparing an order for shipment.

**SHIPMENT.** All shipments of blended cement shall be in accordance with procedural directives issued
by the Materials Bureau. Conveyances for bulk shipment must be of a type approved by the Department.

The compartments of all such conveyances must be completely empty and clean before any blended
cement is loaded therein. Blended cement may be shipped in paper bags which conform to industry
standards and which have the brand name, type of blended cement, and the name of the manufacturer
plainly marked thereon.

**INSPECTION AND TESTING.** All inspection and testing shall be in accordance with procedural
directives issued by the Materials Bureau. When required by the Materials Bureau, blended cement shall
be sampled by means of an automatic sampling device constructed so as to obtain continuous samples
across the full stream of blended cement and deliver such samples into a sealed container approved by the
Materials Bureau. Tests for chemical and physical properties will be in accordance with test methods
stipulated herein.

**BASIS OF ACCEPTANCE.** Blended portland cement will be considered for acceptance at mill or
terminal locations in accordance with procedural directives issued by the Materials Bureau.

### 701-04 CONCRETE REPAIR MATERIAL

**SCOPE.** This specification covers a portland cement based concrete mix generally used in the repair of
precast concrete products such as pipe, cribbing, manholes, etc.

**MATERIAL REQUIREMENTS.** This material shall have a maximum initial setting time of 1 hour.
Compressive strength shall be a minimum of 14 MPa after 1 day and 35 MPa after 28 days. The material
shall be able to withstand 25 cycles of freeze-thaw (10% NaCl) with a maximum loss of 4%. The
material may exhibit expansion at no more than 0.40% and shrinkage of no more than 0.05% such that no
 cracks are produced. The bond strength shall be a minimum of 1.5 MPa after 5 days air cure without the
use of a special bonding agent. The material shall exhibit no appreciable heat of hydration. The color of
the repair after it cures will be of substantially the same color as the item being repaired.

**BASIS OF ACCEPTANCE.** Application for approval of concrete repair material shall be submitted to
the Materials Bureau accompanied by a labeled 23 kg standard production sample. Upon approval, the
name of the product will be placed on an approved list. Such product will then be accepted on the basis
of the brand name labeled on the containers. The manufacturer is required to print the date of
manufacture on the container in the following format “month, year.” Inclusion of the day of manufacture
in the date is optional. The expiration date of acceptance for this material shall be one calendar year from
the date of manufacture or as stated in the Approved List, whichever is less. If in the opinion of the
Engineer the material is determined to be unsuitable for Department work, the material will be rejected.

### 701-05 CONCRETE GROUTING MATERIAL

**SCOPE.** This specification covers a grouting material for use in grouting anchor bolts, dowels and other
miscellaneous items in concrete.

**GENERAL.** The material shall be a non-metallic, non-shrink grout which, when mixed with water, will
harden rapidly to produce a permanent anchoring bond. It shall contain no metals nor rust or corrosion
promoting agents. The color shall be light gray matching approximately the color of hardened concrete.

**MATERIAL REQUIREMENTS.** The material when prepared in accordance with the manufacturers
instructions, shall be of a trowelable consistency. It shall also have the following properties.
A. **Shrinkage.** The material shall exhibit no shrinkage on setting but may exhibit slight expansion of no more than 0.40%.

B. **Compressive Strength.** Cubes cast in accordance with AASHTO T 106 shall be cured as shown and have a minimum three cube compressive strength average as follows:

<table>
<thead>
<tr>
<th>Cure</th>
<th>Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 hour air cure @ 24°C</td>
<td>28 MPa Min.</td>
</tr>
<tr>
<td>7 day air cure @ 24°C</td>
<td>42 MPa Min.</td>
</tr>
<tr>
<td>7 day air, 10-day water submersion</td>
<td>42 MPa Min.</td>
</tr>
<tr>
<td>7 day air, 24 hour, 10% NaCl solution submersion, 25 cycles freeze-thaw</td>
<td>42 MPa Min.</td>
</tr>
</tbody>
</table>

C. **Initial Set.** The material shall have a minimum initial set of 30 minutes.

D. **Pull-out Strength.** A No. 15 reinforcement bar grouted 152 mm deep in a 22 mm diameter hole in saturated, surface-dried concrete shall have a pull-out strength of 45 kN.

E. **Impurities.** The material shall contain not more than 0.05% chlorides or 5% sulfates.

F. **Durability.** The material shall withstand 25 cycles of freeze-thaw (10% NaCl) with a maximum loss of 4%.

**BASIS OF ACCEPTANCE.** Application for approval of a Concrete Grouting Material by the producer shall be submitted to the Materials Bureau accompanied by a labeled 23 kg standard production sample of the product. Upon approval by the Materials Bureau, the name of the product will be placed on an approved list. Such product shall then be accepted on the basis of the brand name labeled on the container. The manufacturer is required to print the date of manufacture on the container in the following format “month, year.” Inclusion of the day of manufacture in the date is optional. The expiration date of acceptance for this material shall be one calendar year from the date of manufacture or as stated in the Approved List, whichever is less. If in the opinion of the Engineer the material is determined to be unsuitable for Department work, the material will be rejected.

701-06 CEMENT BASED GROUT MATERIALS FOR SHEAR KEYS

**SCOPE.** This specification covers the requirements for cement based grouts for placement in shear keys between prestressed concrete box beam and hollow slab units.

**GENERAL.** The material shall be cement-based, non-metallic, non-shrink and pre-packaged which when mixed with water will become a grout that hardens and develops strength rapidly. The material shall contain no rust, or corrosion promoting agents and shall require only the addition of water in the field. No additional aggregate will be allowed when field mixing. The Department's approved products list titled: Cement Based Grout Materials for Shear Keys will state the precise water-cement (w/c) ratio by weight. This ratio shall not be altered.

**MATERIAL REQUIREMENTS.** Following the manufacturer's instructions, the Department will test all cement based grout materials to ensure that the following properties are attainable. If the material attains these properties, the Department will place the material on its approved list together with the precise water cement ratio (by weight) required to attain the properties. The properties are:

A. **Compressive Strength.** Three cubes shall be cast and cured in accordance with AASHTO T 106. The average strength of the 3 cubes at 7 days age shall be a minimum of 42 MPa.

B. **Freeze-Thaw (FT) Resistance.** Three cubes shall be molded and cured for 7 days in accordance with AASHTO T 106. Upon completion of cure, they will be subjected to 25 FT cycles
in accordance with test method NY 502-3P. Material shall not exhibit a weight loss greater than 3.0%, based on the average loss of the 3 cubes.

C. Expansion-Contraction. The grout shall be tested in accordance with CRD C621. Measurements shall be made at 4 hours, 1, 2, 3 and 4 days age after molding. The tolerance for the measurement ages shall be ±15 minutes. The material shall exhibit a 4-day expansion between 0 - 5% inclusive, with no subsequent contraction.

D. Pourability. The grout shall be thoroughly mixed and immediately poured into a container with the approximate shape of a standard shear key. To be considered pourable, the grout shall completely fill the container without excess air entrapment.

BASIS OF ACCEPTANCE. Application for material approval shall be submitted to the Materials Bureau by the manufacturer. The application shall be accompanied by a labeled 23 kg standard production sample of the product. Upon approval, the name, and manufacturer, of the product will be placed on the Department's approved list. Products so listed will be accepted at the work site on the basis of the brand name labeled on the container. The manufacturer is required to print the date of manufacture on the container in the following format “month, year.” Inclusion of the day of manufacture in the date is optional. The expiration date of acceptance for this material shall be one calendar year from the date of manufacture or as stated in the Approved List, whichever is less. If in the opinion of the Engineer the material is determined to be unsuitable for Department work, the material will be rejected.

701-07 ANCHORING MATERIALS - CHEMICALLY CURING

SCOPE. This specification covers polymer anchoring materials for installing anchor bolts and other miscellaneous items in concrete.

GENERAL. The material shall be a non-metallic, non-shrink polymer resin supplied in prepackaged and/or premeasured containers. It shall contain no rust or corrosion promoting agents and shall be moisture insensitive. Packaged stability of each component in original unopened containers stored in temperatures between 5°C and 32°C shall be a minimum of six months. The mixing instructions, setting time and expiration date of the material shall appear on each container.

CHEMICAL RESISTANCE. Cured sealer shall be resistant to most chemicals and solvents. The manufacturer shall certify that the sealant meets the following chemical resistances when tested in accordance with ASTM D471 (22°C for 24 hours):

<table>
<thead>
<tr>
<th>Chemical Resistance</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gasoline</td>
<td>Slight Swell</td>
</tr>
<tr>
<td>Hydraulic Brake Fluid</td>
<td>No Effect</td>
</tr>
<tr>
<td>Motor Oil</td>
<td>No Effect</td>
</tr>
<tr>
<td>Sodium Chloride (5%)</td>
<td>No Effect</td>
</tr>
<tr>
<td>Calcium Chloride (5%)</td>
<td>No Effect</td>
</tr>
</tbody>
</table>

MATERIAL REQUIREMENTS. Manufacturers must supply test results performed in accordance with the procedural directives of the Materials Bureau, using 24 mm diameter fully threaded rods embedded 250 mm deep in unreinforced concrete. Results from testing using lesser embedment depths will be accepted provided they achieve the pullout strength required for the 250 mm embedment. Testing must be performed by an independent testing agency and approved by the Materials Bureau. A minimum of three tests shall be performed and each test result must meet the minimum required pullout value. Concrete with a compressive strength greater than 28 MPa is recommended. The minimum required pullout values for various concrete strengths are shown below:

<table>
<thead>
<tr>
<th>Concrete Strength (MPa)</th>
<th>Minimum Pullout Load (kN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤28</td>
<td>221  31  35  38  247  258</td>
</tr>
<tr>
<td>&gt;28</td>
<td>233  35  38  247  258</td>
</tr>
</tbody>
</table>
The Materials Bureau will inform the Manufacturer when the test results are accepted. The Manufacturer shall then supply six 16 mm diameter fully threaded rods, a minimum of 18 mm long, and sufficient material for testing by the Materials Bureau. Tensile pullout testing will be performed on the 16 mm diameter rods embedded 100 mm deep in unreinforced concrete. Two sets of three tests shall be performed and each test shall meet the minimum required load. The minimum required pullout values for various concrete strengths are shown below:

<table>
<thead>
<tr>
<th>Concrete Strength (MPa)</th>
<th>28</th>
<th>31</th>
<th>35</th>
<th>38</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Pullout Load (kN)</td>
<td>37</td>
<td>39</td>
<td>42</td>
<td>44</td>
</tr>
</tbody>
</table>

Copies of Procedural Directives may be obtained from the Materials Bureau upon request.

**BASIS OF ACCEPTANCE.** Application for approval of Anchoring Materials - Chemically Curing shall be made by the manufacturer or supplier to the Materials Bureau and shall include the material safety data sheets and independent test data. The manufacturer or supplier shall prepare and submit the appropriate material in accordance with the procedural directives of the Materials Bureau and the requirements of this specification. Upon approval by the Materials Bureau, the name of the product will be placed on the Approved List. Such product will then be accepted on the basis of the brand name labeled on the container.

**701-08 VERTICAL AND OVERHEAD PATCHING MATERIAL**

**SCOPE.** This specification covers the requirements for Vertical and Overhead Patching Material for placement in structural concrete repairs.

**GENERAL.** The material shall consist of a cementitious material to which water or an emulsified component is added. The material shall be pre-packaged with the product name, manufacturer and mixing instructions printed clearly on the package.

**MATERIAL REQUIREMENTS.** Following the manufacturer’s instructions, the Department will test the patching materials to ensure that the following properties are attainable. If the material attains these properties, the Department will place the material on its Approved List. The properties are:

- **A. Compressive Strength.** The material shall exhibit a minimum 7 day compressive strength of 14 MPa and a minimum 28 day strength of 21 MPa when tested under NYSDOT Test Method 701-13F.

- **B. Flexural Bond Strength.** The material shall exhibit a minimum bond strength of 1.5 MPa when tested under NYSDOT Test Method 701-13F.

- **C. Freeze-Thaw Resistance.** Three cubes shall be molded of the material and cured for 7 days in accordance with AASHTO T 106. Upon completion of cure, they shall be subject to 50 Freeze-Thaw cycles in accordance with NYSDOT Test Method 502-3P. Materials shall not exhibit a weight loss greater than 3.0% based on the average loss of the 3 cubes.

- **D. Expansion-Contraction.** The material may exhibit expansion of no more than 0.40% and shrinkage of no more than 0.01% when tested in accordance with NYSDOT Test Method 701-13F.

- **E. Material Consistency.** The material shall be placeable in layers of at least 25 millimeters on overhead applications without the use of formwork or anchoring devices.

- **F. Color.** The material shall produce a finished patch, concrete grey in color.

**BASIS OF ACCEPTANCE.** Application for material approval shall be submitted to the Materials Bureau by the manufacturer. The application shall be accompanied by a labeled 23 kg standard production sample of the product. Upon approval, the product name and manufacturer will be placed on
§701

NEW YORK STATE DEPARTMENT OF TRANSPORTATION
STANDARD SPECIFICATIONS of May 4, 2006

the Department's Approved List. Products so listed will be accepted at the worksite on the basis of the
brand name labeled on the container. The manufacturer is required to print the date of manufacture on the
container in the following format “month, year.” Inclusion of the day of manufacture in the date is
optional. The expiration date of acceptance for this material shall be one calendar year from the date of
manufacture or as stated in the Approved List, whichever is less. If in the opinion of the Engineer the
material is determined to be unsuitable for Department work, the material will be rejected.

701-09 RAPID HARDENING CONCRETE REPAIR MATERIAL (Normal Weather)

SCOPE. This specification covers a rapid hardening concrete mix, consisting of a dry component made
up of the cementing medium and fine aggregate to which water or an emulsified component is added.
The resulting mixture is generally used in the repair of portland cement concrete pavements.

GENERAL. The rapid hardening concrete shall be of a high strength, have rapid strength gain
characteristics in normal weather (above 10°C ambient temperature), bond to the existing concrete, and
be durable. The rapid hardening concrete shall be able to accept coarse aggregate to extend the yield and
result in a workable mixture.

MATERIAL REQUIREMENTS. The material, as delivered without additional coarse aggregate, and
mixed in accordance with the manufacturer's instructions, shall have the following properties when tested
under NYSDOT Test Method 701-13F:

- A minimum one hour compressive strength of 18 MPa, a 24 hour strength of 25 MPa and a 28 day
  strength of 35 MPa.
- A minimum bond strength of 1.5 MPa after 24 hours.
- A minimum initial setting time of 5 minutes at 24 ± 1°C.
- The ability to withstand 50 cycles of freeze-thaw (10% NaCl solution) with a maximum loss of 6%.
- Expansion of no more than 0.40% and contraction of no more than 0.05%.
- A workable mixture when extended with a minimum 60% CA1 coarse aggregate by weight of dry
  R.S.C. component.

The material delivered from the manufacturer in moisture proof bags shall weigh within ±3% of the
labeled bag weight, the manufacturer's name, address, mixing instructions, and manufacturing date shall
be printed on each bag.

BASIS OF ACCEPTANCE. Application for material approval shall be submitted to the Materials
Bureau by the manufacturer. The application shall be accompanied by a labeled 45 kg standard
production sample of the product. Upon approval, the name and manufacturer of the product will be
placed on the Department's Approved List. Products so listed will be accepted at the worksite on the
basis of the brand name labeled on the container. The manufacturer is required to print the date of
manufacture on the container in the following format “month, year.” Inclusion of the day of manufacture
is optional. The expiration date of acceptance for this material shall be one calendar year from the date of
manufacture or as stated in the Approved List, whichever is less. If in the opinion of the Engineer the
material is determined to be unsuitable for Department work, the material will be rejected.

701-10 (VACANT)

701-11 ELASTOMERIC CONCRETE

SCOPE. This specification covers the material requirements for elastomeric concrete.

GENERAL. Supply elastomeric concrete components and primer materials in prepackaged and/or
premeasured containers with the product name, manufacturer, VOC content, and mixing instructions
clearly marked on each container.
MATERIAL REQUIREMENTS.

Physical Test Requirements. Elastomeric concrete will conform to the following physical test requirements:

<table>
<thead>
<tr>
<th>TESTS</th>
<th>PROCEDURE</th>
<th>MINIMUM REQUIREMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resilience</td>
<td>ASTM C579-01</td>
<td>70%</td>
</tr>
<tr>
<td>5-Hr. Compressive Strength</td>
<td>ASTM C579-01 (modified)</td>
<td>3.45 MPa</td>
</tr>
<tr>
<td>24-Hr. Compressive Strength</td>
<td>ASTM C579-01 (modified)</td>
<td>14 MPa</td>
</tr>
<tr>
<td>7-Day Tensile</td>
<td>ASTM D638</td>
<td>1 MPa</td>
</tr>
<tr>
<td>7-Day Tear</td>
<td>ASTM D624</td>
<td>7 kN/m</td>
</tr>
<tr>
<td>Pot Life</td>
<td>Gardco GT-S Gel Timer</td>
<td>5 minutes</td>
</tr>
</tbody>
</table>

Materials Details. The manufacturer will submit Material Detail Sheets to the Materials Bureau for approval. Upon approval, the manufacturer, product name, and the Material Detail Number will be placed on the Department’s Approved List.

Field Evaluation. To maintain Approved List status, the elastomeric concrete will be evaluated by the Materials Bureau or a designated representative at six-month intervals for a period of two years from the date of installation. If the material is performing as designed at the end of the two-year evaluation approved status will continue.

BASIS OF ACCEPTANCE. Acceptance of this material will be based on the manufacturer's name appearing on the Department’s Approved List for Materials and Equipment. The supplier shall provide two copies of the Approved Material Detail Sheets and Material Safety Data Sheets through the Contractor to the Engineer as part of the evidence of acceptability for the material at least 14 days prior to shipment of the product to the job site.

SECTION 702 - BITUMINOUS MATERIALS

SCOPE. These specifications cover the material requirements and methods of testing bituminous materials used in highway construction and classified into the following five groups:

1. Asphalt Cements.
2. Liquid Asphalts (Rapid Curing, Medium Curing)
3. Asphalt Emulsions (Anionic, Cationic, Polymer Modified Cationic).
4. Synthetic Resins.
5. Asphalt Emulsion Tack Coat.

GENERAL. The bituminous material volume shall be measured at 16°C. Information as to the specific gravity at 16°C shall be included with each shipment of bituminous material to a plant or project.

MATERIAL REQUIREMENTS. The bituminous materials furnished shall meet the requirements

A. Performance Graded Binders For Paving. A Performance Graded Binder (PGB), designated PG XX-YY, is defined as the range of pavement temperatures expressed in degrees Celsius, maximum to minimum, over which the PGB can be expected to provide acceptable performance. PGBs shall meet the requirements of AASHTO Designation MP1 - Standard Specification For Performance Graded Asphalt Binder and Table 702-1, Performance Graded Binders for Paving. The PGB shall be prepared from refining crude petroleum by suitable methods with the addition of a modifier, if necessary, to meet the required Performance Grade. The PGB Supplier shall certify that the PGB meets NYSDOT quality requirements for a Primary Source appearing on the Department's Approved List of Performance Graded Binders for Paving. The PGB Supplier shall provide the design mixing and compaction temperatures on a NYSDOT BR-320. Also, provide MP1 test data and all necessary shipping documents in accordance with Department written instructions.
### TABLE 702-1 PERFORMANCE GRADED BINDERS FOR PAVING

<table>
<thead>
<tr>
<th>MATERIAL DESIGNATION</th>
<th>702-5828</th>
<th>702-5834</th>
<th>702-6422</th>
<th>702-6428</th>
<th>702-7022</th>
<th>702-7622</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERFORMANCE GRADE</td>
<td>PG 58</td>
<td>PG 64</td>
<td>PG 70</td>
<td>PG 76</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-28</td>
<td>-22</td>
<td>-22</td>
<td>-22</td>
<td>-22</td>
<td>-22</td>
</tr>
</tbody>
</table>

**Original Binder**

- Flash Point Temp, T48: Min °C
  - Performance Grade PG 58
  - 230
- Viscosity, ASTM D 4402: 1
  - Performance Grade PG 64
  - 135
- Maximum, 3 Pa*s (3000 cP) Test Temp, °C
  - Performance Grade PG 70
  - 22
- Dynamic Shear, TP5: 2
  - Performance Grade PG 76
  - 22

**Rolling Thin Film Oven (T240) or Thin Film Oven (T179) Residue**

- G*sin α, Min., 1.00 kPa Test Temp @ 10 rad/s, °C
  - Performance Grade PG 58
  - 58
  - Performance Grade PG 64
  - 64
  - Performance Grade PG 70
  - 70
  - Performance Grade PG 76
  - 76

**Pressure Aging Vessel Residue (PP1)**

- PAV Aging Temp, °C
  - Performance Grade PG 58
  - 100
  - Performance Grade PG 64
  - 100
  - Performance Grade PG 70
  - 100
  - Performance Grade PG 76
  - 100
- Dynamic Shear, TP5:
  - G*sin α, Min., 2.20 kPa Test Temp @ 10 rad/s, °C
    - Performance Grade PG 58
    - 58
    - Performance Grade PG 64
    - 64
    - Performance Grade PG 70
    - 70
    - Performance Grade PG 76
    - 76

**Physical Hardening 3 Report**

- Creep Stiffness, TP1: 4
  - S, Maximum, 300 MPa
    - Performance Grade PG 58
    - -18
    - Performance Grade PG 64
    - -24
    - Performance Grade PG 70
    - -12
    - Performance Grade PG 76
    - -12
- m-value, Minimum, 0.300 Test Temp, @ 60 sec, °C
  - Performance Grade PG 58
  - -18
  - Performance Grade PG 64
  - -24
  - Performance Grade PG 70
  - -12
  - Performance Grade PG 76
  - -12
- Direct Tension, TP3: 4
  - Failure Strain, Min, 1.0%
    - Performance Grade PG 58
    - -18
    - Performance Grade PG 64
    - -24
    - Performance Grade PG 70
    - -12
    - Performance Grade PG 76
    - -12
- Test Temp @ 1.0 mm/min, °C
  - Performance Grade PG 58
  - -18
  - Performance Grade PG 64
  - -24
  - Performance Grade PG 70
  - -12
  - Performance Grade PG 76
  - -12

**NOTES:**

1. This requirement may be waived by the Director, Materials Bureau if the supplier warrants that the PGB can be adequately pumped and mixed at temperatures that meet all applicable safety standards.
2. For quality control of unmodified PGB production, measurement of the viscosity of the original PGB may be substituted for dynamic shear measurements of G* / Sin * at test temperatures where the PGB is a Newtonian fluid. Any suitable standard means of viscosity measurement may be used, including capillary or rational viscometry (AASHTO T 201 or T 202).
3. Physical Hardening - TP 1 is performed on a set of PGB beams according to Section 13.1, except the conditioning time is extended to 24 hours ± 10 minutes at 10 °C above the minimum performance temperature. The 24-hour stiffness and m-value are reported for information purposes.
4. If the creep stiffness is below 300 MPa, the direct tension test is not required. If the creep stiffness between 300 and 600 MPa the direct tension failure strain requirement can be used in lieu of the creep stiffness requirement. The m-value requirement must be satisfied in both cases.

Silicone additives will be permitted in paving binders. Silicone may be introduced into the PGB in accordance with the manufacturer’s recommendations either at the refinery, terminal or at a mixing plant storage tank. PGB treated with silicone shall conform to the specifications for untreated PGB. Any previously approved PGB that has been stored in the mixing plant tank over the winter shall be resampled and accepted by the Department before it is used.

**B. Miscellaneous Asphalt Cements.** Asphalt cements shall meet the requirements of Table 702-2 Miscellaneous Asphalt Cements. The asphalt shall be prepared by refining crude petroleum using suitable methods. The asphalt cement shall be homogenous, free from water and shall not foam when heated to 175 °C. The supplier shall maintain the identity of the asphalts in accordance with the Department's written instructions from the point of refining to the point where the asphalt is incorporated into the work. Test data and shipping documents shall be provided by the supplier in accordance with the Department’s written instructions.


**TABLE 702-2 MISCELLANEOUS ASPHALT CEMENTS**

<table>
<thead>
<tr>
<th>MATERIAL DESIGNATION</th>
<th>702-0700</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRADE</td>
<td>18-60</td>
</tr>
</tbody>
</table>

**Test Requirements**

<table>
<thead>
<tr>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Penetration, 25°C, 100g, 5s (AASHTO T49)</td>
<td>18</td>
</tr>
<tr>
<td>Flash Point, COC, °C (AASHTO T48)</td>
<td>200</td>
</tr>
<tr>
<td>Solubility in Trichlorethylene, % (AASHTO T44)</td>
<td>99.5</td>
</tr>
<tr>
<td>Softening Point, °C (AASHTO T53)</td>
<td>55</td>
</tr>
<tr>
<td>Loss on Heating, 163°C, 5h, % (AASHTO T47)</td>
<td>-</td>
</tr>
<tr>
<td>Penetration of Residue, % of Original (AASHTO T49)</td>
<td>60</td>
</tr>
<tr>
<td>Ductility, 25°C, 5 cm/min, cm (AASHTO T51)</td>
<td>5</td>
</tr>
</tbody>
</table>

**Typical Uses**

- Joint and Crack Filler

**C. Liquid Asphalts (Rapid Curing, Medium Curing).** Rapid Curing and Medium Curing liquid asphalts shall meet the requirements of Table 702-3 and Table 702-4, respectively.

**TABLE 702-3 RAPID CURING LIQUID ASPHALTS**

<table>
<thead>
<tr>
<th>MATERIAL DESIGNATION</th>
<th>702-11</th>
<th>702-12</th>
<th>702-13</th>
<th>702-14</th>
<th>702-15</th>
<th>702-16</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRADE</td>
<td>RC-70</td>
<td>RC-250</td>
<td>RC-800</td>
<td>RC-300</td>
<td></td>
<td></td>
</tr>
<tr>
<td>REQUIREMENTS</td>
<td>ASTM D-2028 or AASHTO M 81</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(1) The Materials 702-13 and 702-15 shall contain an anti-stripping additive and shall meet the stone coating requirements.

**TABLE 702-4 MEDIUM CURING LIQUID ASPHALTS**

<table>
<thead>
<tr>
<th>MATERIAL DESIGNATION</th>
<th>702-20</th>
<th>702-21</th>
<th>702-22</th>
<th>702-24</th>
<th>702-25</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRADE</td>
<td>MC-30</td>
<td>MC-70</td>
<td>MC-250</td>
<td>MC-800</td>
<td>MC-3000</td>
</tr>
<tr>
<td>REQUIREMENTS</td>
<td>ASTM D-2027 or AASHTO M 82</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(1) The Materials 702-23 shall contain an anti-stripping additive and shall meet the stone coating requirements.

The liquid asphalts shall show no separation or curdling prior to use and shall not foam when heated to the application temperature.

When required on the plans or in the specifications, an additive shall be added to the bituminous material which will cause the bituminous material to coat and adhere more effectively to wet and unheated aggregates. The additive shall have no deleterious effect upon the bituminous material and shall be completely miscible and thoroughly blended throughout the bituminous materials. The anti-stripping additive shall be added to the bituminous material only during the process when the asphalt cement and the solvent materials are blended to make the liquid asphalt. Material containing an anti-stripping additive shall conform to the specifications for untreated material.

**D. Asphalt Emulsions (Anionic, Cationic, Polymer Modified Cationic).** The emulsion shall be homogeneous and show no separation of asphalt, after thorough mixing, within 30 days after delivery. Provided separation has not been caused by freezing. Material that is separated due to freezing is unacceptable at any time. During production of polymer modified emulsions, mill or blend the polymer modifier into the base asphalt or emulsifying agent prior to the emulsification process.

Anionic asphalt emulsions (702-3001, 702-3101, 702-3102, 702-3201, 702-3301, 702-3401, 702-3402, 702-3501, and 702-3601) shall meet the requirements shown in Table 702-5, Asphalt Emulsions. Cationic asphalt emulsions (702-4001, 702-4101, 702-4201, 702-4301, 702-4401, 702-4501, and 702-4601) shall meet the requirements shown in Table 702-6, Cationic Asphalt Emulsions.
Polymer modified cationic emulsions (702-4701 and 702-4801) shall meet the requirements shown in Table 702-6, Cationic Asphalt Emulsions.

E. Synthetic Resins. The synthetic resins covered under these specifications are two types: synthetic resin binder, §702-70, and rapid curing synthetic resin liquid, §702-71. The synthetic resin binder §702-70, is a light insensitive liquid used in the colored synthetic resin binder concrete. The rapid curing synthetic resin liquid, §702-71, is a tack coat for the resin binder concrete and shall be light colored and compatible with the resin binder concrete placed over it.

The synthetic resin shall be homogeneous and shall meet requirements specified in Table 702-8.

<table>
<thead>
<tr>
<th>TABLE 702-5 ASPHALT EMULSIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATERIAL DESIGNATION</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>GRADE</td>
</tr>
<tr>
<td>Tests on Emulsion</td>
</tr>
<tr>
<td>Viscosity, Saybolt Furol, 25°C, Sec.</td>
</tr>
<tr>
<td>20</td>
</tr>
<tr>
<td>Storage Stability Test, 1 Day (Difference in % Residue)</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>Demulsibility, 35ml. 0.02N CaCl₂, %</td>
</tr>
<tr>
<td>60</td>
</tr>
<tr>
<td>Cement Mixing Test</td>
</tr>
<tr>
<td>-</td>
</tr>
<tr>
<td>Sieve Test, percent</td>
</tr>
<tr>
<td>-</td>
</tr>
<tr>
<td>Residue by distillation, %</td>
</tr>
<tr>
<td>55</td>
</tr>
<tr>
<td>Oil Distillate, Volume Total Emulsion, %</td>
</tr>
<tr>
<td>-</td>
</tr>
<tr>
<td>Tests on Residue from Distillation Test</td>
</tr>
<tr>
<td>Penetration, 25°C, 100g, 5 Sec.</td>
</tr>
<tr>
<td>100</td>
</tr>
<tr>
<td>Float Test, 60°C Note (2), Sec.</td>
</tr>
<tr>
<td>-</td>
</tr>
<tr>
<td>Tests on Asphalt Base for Emulsion</td>
</tr>
<tr>
<td>Penetration 25°C, 100g, 5 Sec.</td>
</tr>
<tr>
<td>100</td>
</tr>
<tr>
<td>Solubility or trichlorethylene, %</td>
</tr>
<tr>
<td>99.0</td>
</tr>
<tr>
<td>Ductility, 25°C, 5cm/min, cm</td>
</tr>
<tr>
<td>100</td>
</tr>
<tr>
<td>Flash Point, °C</td>
</tr>
<tr>
<td>177</td>
</tr>
<tr>
<td>Typical Applications: Note (3)</td>
</tr>
<tr>
<td>Spray Patch, Penetration Macadam</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Suggested Temperature Range</td>
</tr>
<tr>
<td>Mixing, °C</td>
</tr>
<tr>
<td>25-60</td>
</tr>
<tr>
<td>Spraying, °C</td>
</tr>
<tr>
<td>25-60</td>
</tr>
</tbody>
</table>

NOTES:
1. This viscosity requirement at 50°C applies to emulsion used for shoulder sealing.
2. Float Test AASHTO T-50, except that the residue from distillation shall be poured immediately into the float collar at 260°C.
3. These typical applications are intended only as a guide for selecting the proper emulsion grade.

F. Asphalt Emulsion Tack Coat. The asphalt emulsion tack coat shall be homogeneous at the time of application. Homogeneity of the tack coat may be maintained by agitation providing that separation is not caused by freezing. The consistency of the tack coat shall be appropriate for pumping and uniform spraying.

The asphalt emulsion tack coat shall meet the requirements in Table 702-9.
TESTS. When anti-stripping additives are added to the bituminous material, a stone coating test performed on a mixture of stone and bituminous material shall have at least 95 percent of the stone area coated.

Details of all test methods may be obtained from the Materials Bureau.

BASIS OF ACCEPTANCE. Acceptance of the bituminous material is based on the name of the primary source appearing on the Department's Approved List for the specific group of bituminous materials; and acceptance of the bituminous material is contingent upon satisfactory test results from samples taken, as required by the Department's procedural directives, at the location where the material is incorporated into the work. A primary source is defined as a firm that samples, tests, and certifies that the samples taken, as required by the Department's procedural directives, at the location where the material is made available from the Materials Bureau.

### TABLE 702-6 CATIONIC ASPHALT EMULSIONS

<table>
<thead>
<tr>
<th>MATERIAL DESIGNATION</th>
<th>702-4001</th>
<th>702-4101</th>
<th>702-4201</th>
<th>702-4301</th>
<th>702-4401</th>
<th>702-4501</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEST on Emulsion: Viscosity, Saybolt Furol, 50° C, second</td>
<td>20 100</td>
<td>100 400</td>
<td>50 450</td>
<td>50 450</td>
<td>- -</td>
<td>20 100</td>
</tr>
<tr>
<td>Storage Stability Test, 1 Day (in % Residue)</td>
<td>- 1 - 1 1 1 - 1 - 1</td>
<td>Positive</td>
<td>Passes</td>
<td>- -</td>
<td>- -</td>
<td>- -</td>
</tr>
<tr>
<td>Particle Charge Test</td>
<td>Positive</td>
<td>Positive</td>
<td>Positive</td>
<td>Positive</td>
<td>Positive</td>
<td>Positive</td>
</tr>
<tr>
<td>Sieve Test, %</td>
<td>- 0.10</td>
<td>- 0.10</td>
<td>- 0.10</td>
<td>- 0.10</td>
<td>- 0.10</td>
<td>- 0.10</td>
</tr>
<tr>
<td>Cement Mixing</td>
<td>- 2.0</td>
<td>- 2.0</td>
<td>- 2.0</td>
<td>- 2.0</td>
<td>- 2.0</td>
<td>- 2.0</td>
</tr>
<tr>
<td>Demulsibility (ASTM D 244)</td>
<td>40</td>
<td>-</td>
<td>-</td>
<td>40</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Ring &amp; Ball Softening Point°C</td>
<td>57</td>
<td>-</td>
<td>-</td>
<td>57</td>
<td>-</td>
<td>57</td>
</tr>
<tr>
<td>Polymer Content, %</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>Residue by Distillation, %</td>
<td>60</td>
<td>65</td>
<td>65</td>
<td>65</td>
<td>57</td>
<td>57</td>
</tr>
<tr>
<td>Oil Distillate, Vol. Total Emulsion, %</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Penetration, 25° C,100 g, 5 sec on Asphalt Base for Emulsion</td>
<td>100 200</td>
<td>100 200</td>
<td>100 200</td>
<td>100 200</td>
<td>100 200</td>
<td>100 200</td>
</tr>
<tr>
<td>Penetration, 25° C,100 g, 5 sec on Residue from Distillation</td>
<td>100 200</td>
<td>100 200</td>
<td>100 200</td>
<td>100 200</td>
<td>100 200</td>
<td>100 200</td>
</tr>
<tr>
<td>Solubility or Trichloroethylene, %</td>
<td>99.9</td>
<td>99.9</td>
<td>99.9</td>
<td>99.9</td>
<td>99.9</td>
<td>99.9</td>
</tr>
<tr>
<td>Ductility, 25° C, 5 cm/ min., cm</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Flash Point, °C</td>
<td>177</td>
<td>177</td>
<td>177</td>
<td>177</td>
<td>177</td>
<td>177</td>
</tr>
<tr>
<td>Typical Application:</td>
<td>Spray, P.M., S.T., Cold Mixes,</td>
<td>Cold Mixes, B.&amp; S. S., Quick-Set Slurry</td>
<td>Paver-Placed Micro-Surfacing Treatment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suggested Temp. Range: Mixing, °C</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Spraying, °C</td>
<td>25-60</td>
<td>55-75</td>
<td>55-75</td>
<td>55-75</td>
<td>25-65</td>
<td>25-65</td>
</tr>
</tbody>
</table>

(1) If the Particle Charge Test result is inconclusive, material having a maximum pH value of 6.7 will be acceptable.
(2) According to AASHTO T 53
(3) According to AASHTO T 59
(4) These typical applications are intended only as a guide for selecting the proper emulsion grade.
Abbreviations: B.& S. S.- base and shoulder stabilization;  P.M.- penetration macadam;  S.T.- surface treatment.

### TABLE 702-7 (VACANT)
## TABLE 702-8 SYNTHETIC RESINS

<table>
<thead>
<tr>
<th>Material Designation</th>
<th>702-70</th>
<th>702-71</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Test Requirements</strong></td>
<td>Min.</td>
<td>Max.</td>
</tr>
<tr>
<td>Penetration, 25°C, 100g 5s</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td>Viscosity, 60°C, m²/s (x10-6)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Flash Point, COC, °C</td>
<td>204</td>
<td>-</td>
</tr>
<tr>
<td>Solubility in trichlorethylene, %</td>
<td>99.5</td>
<td>-</td>
</tr>
<tr>
<td>Loss of Heating, 163°C, 5 hr., (AASHTO T47) %</td>
<td>-</td>
<td>1.0</td>
</tr>
<tr>
<td>Water, %</td>
<td>-</td>
<td>0.0</td>
</tr>
<tr>
<td>Color, (30% binder/70% toluene)</td>
<td>-</td>
<td>16</td>
</tr>
<tr>
<td>Gardner Standard Color Scale, ASTM D1544</td>
<td>-</td>
<td>16</td>
</tr>
<tr>
<td>Test on residue from Thin-film Oven Test (AASHTO T179) Penetration, % of original</td>
<td>47</td>
<td>-</td>
</tr>
<tr>
<td>Residue from evaporation, 105°C</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Typical Uses</td>
<td>Hot Plant Mix Tack Coat</td>
<td></td>
</tr>
<tr>
<td>Suggested Spraying Temperature, °C</td>
<td>-</td>
<td>10-50</td>
</tr>
</tbody>
</table>

## TABLE 702-9 ASPHALT EMULSION TACK COAT

<table>
<thead>
<tr>
<th>Material Designation</th>
<th>702-90</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Test Requirements</strong></td>
<td>Minimum</td>
</tr>
<tr>
<td>Sieve Test, %</td>
<td>-</td>
</tr>
<tr>
<td>Residue by Distillation, %</td>
<td>28</td>
</tr>
<tr>
<td>Oil Distillate, Volume of Total Emulsion, %</td>
<td>-</td>
</tr>
<tr>
<td>Test on residue from Distillation: Penetration, 25°C, 100g, 5s</td>
<td>40</td>
</tr>
<tr>
<td>The asphalt emulsion tack coat shall be produced by diluting one of the following bituminous materials with a suitable emulsifier solution and thoroughly mixing into a homogeneous liquid:</td>
<td></td>
</tr>
<tr>
<td>Asphalt Emulsion</td>
<td>HFMS-2h</td>
</tr>
<tr>
<td>Asphalt Emulsion</td>
<td>SS-1h</td>
</tr>
<tr>
<td>Cationic Asphalt Emulsion</td>
<td>CSS-1h</td>
</tr>
<tr>
<td>Suggested Spraying Temperature, °C</td>
<td>25-65</td>
</tr>
</tbody>
</table>

## SECTION 703 - AGGREGATES

### 703-01 FINE AGGREGATE

**SCOPE.** The specification covers the material details, quality requirements and methods for sampling and testing fine aggregate generally used in portland cement concrete and bituminous concrete.

**SAMPLING.** Samples of fine aggregates shall be obtained by and submitted to the Materials Bureau by a representative of the Department under the following conditions:

**A. Sampling Approved Operating Sources.** All approved operating sources shall be sampled when:
- The latest test for a source is two (2) years old.
- A change in the character of processed fine aggregate occurs.
- The location of the course of raw material is shifted, or a change in the character of raw material occurs.
- Considered necessary by the Department.
B. Sampling Non-approved or Rejected Operating Sources. Non-approved or rejected operating sources, equipped with adequate processing facilities, may be sampled upon favorable recommendation by a Regional Director and approved by the Director, Materials Bureau. Approval action on such sources may be conditioned on the results obtained by periodic sampling and testing as prescribed by the Materials Bureau.

C. Sampling Proposed Unopened Sources of Material. Proposed unopened sources of material may be sampled upon the favorable recommendation of a Regional Director and approved by the Director, Materials Bureau. The results of tests on such samples shall be for information only and shall be indicative of the potential quality of the source. Action in regard to acceptance or rejection of a source will be taken only after processing facilities have been installed and approved.

Stripping. All sources of fine aggregate shall be thoroughly stripped of all inferior and objectionable material before processing operations are started and shall be kept stripped far enough from the working face to insure against undesirable material becoming mixed with the output. If undesirable material is furnished from accepted sources through faulty operations or any other cause whatsoever, the source and any objectionable material therefrom may be rejected by the Regional Director.

Annual Reports. As part of the acceptance requirements, the following information shall be submitted to the Department annually for each operating source:

A. Geologic Source Report. A geologic source report that describes the characteristics of the material to be processed during the coming year.

B. Plant Flow Information. Plant flow information describing the processing equipment and the products to be furnished for Departmental use.

The details of these requirements may be obtained from the Materials Bureau. These annual reports shall be received and approved by the Department before the start of the year's operations. Approval of the reports by the Department does not relieve the supplier of its responsibility to provide a uniform and acceptable product.

MATERIAL REQUIREMENTS. Fine aggregate shall consist of natural sand or manufactured sand, conforming to the requirements of these specifications. All fine aggregate shall consist of hard, strong, durable particles which are free from a coating or any injurious material and injurious amounts of clay, loam, or other deleterious substances. In addition, the fine aggregate shall not contain substances, which, when mixed in portland cement concrete, produce an unacceptable level of chloride ions in the final product. Substances that produce chloride ions shall be considered deleterious material. Any fine aggregate may be rejected if it is determined by the Department to contain sufficient amounts of unsound or deleterious material to be harmful.

Fine aggregates from more than one source or of more than one type of material may be blended. Blending procedures shall be approved by the Department.

Fine aggregates meeting the requirements of Table 703-1, “Fine Aggregate Requirements (Testing)” shall be accepted unless service records indicate that it is unsound, or that the material is otherwise determined to be unsatisfactory by the Director, Materials Bureau.

<table>
<thead>
<tr>
<th>TABLE 703-1 FINE AGGREGATE REQUIREMENTS (TESTING)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Test Method</strong></td>
</tr>
<tr>
<td>Magnesium Sulfates (NYSDOT 207)</td>
</tr>
<tr>
<td>Max. percent loss by weight at 5 cycles</td>
</tr>
<tr>
<td>Organic Impurities (NYSDOT 202, AASHTO T-21)</td>
</tr>
<tr>
<td>Organic Plate, Lighter Than</td>
</tr>
<tr>
<td>Gardner Color, Lighter Than</td>
</tr>
<tr>
<td><strong>Portland Cement Concrete</strong></td>
</tr>
<tr>
<td>30</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>11</td>
</tr>
<tr>
<td><strong>Bituminous Concrete</strong></td>
</tr>
<tr>
<td>45</td>
</tr>
<tr>
<td>-</td>
</tr>
<tr>
<td>-</td>
</tr>
</tbody>
</table>
Fine aggregate not meeting the requirement of Table 703-1 may be further evaluated by additional testing, petrographic examination, geologic studies, review of performance history and plant flow information. If the results of the evaluation indicate that the aggregate should perform satisfactorily, the source may be accepted by the Director, Materials Bureau.

If fine aggregate is found unsatisfactory when examined for organic impurities, it shall be rejected unless it passes the mortar strength test for compression. Fine aggregates so tested shall achieve a compressive strength of at least one hundred percent when tested according to methods prescribed by the Material Bureau (NYSDOT 204).

TESTS. The details of all test methods for fine aggregates may be obtained from the Materials Bureau.

BASIS OF ACCEPTANCE. Acceptance of the source is determined on the basis of tests performed by the Materials Bureau on samples representing the sources; review of Geologic Source Reports and Plant Flow Information; petrographic examination and other geologic studies; and performance histories where applicable. The material is incorporated into the work on the basis that it is from an approved source conforming to procedural directives of the Department and the aggregate shall meet the gradation requirement at the point of use.

Aggregate for use in the manufacture of precast concrete units may be accepted on the basis of stockpile approval at a location acceptable to the Department on a per job basis. Requests for stockpile approval shall be made in writing to the Materials Bureau. The manufacturer shall allow at least ninety (90) days for the testing and evaluation of the aggregate.

703-02 COARSE AGGREGATE

SCOPE. This specification covers the material details, requirements and methods for sampling and testing coarse aggregate generally used in portland cement concrete, bituminous concrete and surface treatments.

SAMPLING. Samples of coarse aggregates shall be obtained by and submitted to the Materials Bureau by a representative of the Department under the following conditions:

A. Sampling Approved Operating Sources. All approved operating sources shall be sampled when:
   • The latest test for a source is two (2) years old.
   • A change in the character of processed coarse aggregate occurs.
   • The location of the source of raw material is shifted or a change in the character of raw material occurs.
   • Considered necessary by the Department.

B. Sampling Non-approved or Rejected Operating Sources. Non-approved or rejected operating sources, equipped with adequate processing facilities, may be sampled upon favorable recommendation by a Regional Director and approval by the Director, Materials Bureau. Approval action on such sources may be conditioned on the results obtained by periodic sampling and testing as prescribed by the Materials Bureau.

C. Sampling Proposed Unopened Sources of Material. Proposed unopened sources of material may be sampled upon the favorable recommendation of a Regional Director and approval by the Director, Materials Bureau. The results of tests on such samples shall be for information only and shall be interpreted as indicative of the potential quality of the source. Action in regard to acceptance or rejection of a source will be taken only after processing facilities have been installed and approved.

Stripping. All sources of coarse aggregate shall be thoroughly stripped of all inferior and objectionable material before processing operations are started and shall be kept stripped far enough from the working face to insure against undesirable material becoming mixed with the output. If undesirable material is furnished from accepted sources through faulty operation or any other cause whatsoever, the source and any objectionable material therefrom may be rejected by the Regional Director.
Annual Reports. As part of the acceptance requirements, the following information shall be submitted to the Department annually for each operating source:

A. Gravel Operations

1. A Geologic Source Report that describes the characteristics of the material to be processed during the coming year.
2. Plant Flow Information describing the processing equipment and the products to be furnished for Departmental use.

B. Quarry Operations. A Quarry Report describing the characteristics and uniformity of rock to be quarried during the coming year.

All details of these report requirements may be obtained from the Materials Bureau. The annual reports shall be received and approved by the Department before the start of the year's operations. The approval of a report does not relieve the supplier of its responsibility to provide a uniform and acceptable product.

MATERIAL REQUIREMENTS. Coarse aggregates shall consist of crushed stone, crushed gravel, screened gravel or crushed air-cooled blast furnace slag, conforming to the requirements of these specifications. All coarse aggregates shall meet the requirements for these materials as outlined in Tables 703-2, “Physical Requirements (Testing),” 703-3, “Physical Requirements (Deleterious Materials),” and 703-4, “Size of Stone, Gravel and Slag.”

A coarse aggregate meeting the requirements of Tables 703-2, and 703-3 shall be accepted unless service records indicate that it is unsound or that the material is otherwise determined to be unsatisfactory by the Director, Materials Bureau. Coarse aggregate not meeting the requirements of these tables may be further evaluated by additional testing, petrographic examination, geologic studies, review of Plant Flow Information and performance history. If the results of the evaluation indicate that the aggregate should perform satisfactorily, the source may be accepted by the Director, Materials Bureau.

<table>
<thead>
<tr>
<th>TABLE 703-2 PHYSICAL REQUIREMENTS (TESTING)</th>
<th>Crushed Stone 703-0201</th>
<th>Crushed Gravel 703-0202</th>
<th>Screened Gravel 703-0203</th>
<th>Crushed Slag 703-0204</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material Designation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Magnesium Sulfate Test (703-07 P,G)</td>
<td>18</td>
<td>18</td>
<td>18</td>
<td>6</td>
</tr>
<tr>
<td>Max. percent loss by weight at 10 cycles</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freezing and Thawing Test (703-08 P,G)</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Max. percent loss by weight at 25 cycles</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Los Angeles Abrasion Test (703-11 P,G)</td>
<td>35&lt;sup&gt;(4)&lt;/sup&gt;</td>
<td>35</td>
<td>35</td>
<td>40</td>
</tr>
<tr>
<td>Max. percent loss by weight (Grading A or B)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flat Particles, Elongated Particles, or Flat and Elongated Particles (ASTM D 4791)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum percent by weight</td>
<td></td>
<td>10&lt;sup&gt;(6)&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flat and Elongated to the Degree of 5:1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crushed Particles in any primary size(ASTMD 5821)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum percent by weight</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Larger than 12.5mm (1 fractured face)</td>
<td>-</td>
<td>75&lt;sup&gt;(7)&lt;/sup&gt;</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Smaller than 12.5mm (2 fractured faces)</td>
<td>-</td>
<td>85&lt;sup&gt;(7)&lt;/sup&gt;</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Minimum unit weight (703-10 P,G) kg/m3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>70</td>
</tr>
</tbody>
</table>

1. To determine its conformance to specification limits, processed coarse aggregate may be tested at any point after completion of processing. The manufactured material shall be separated into the primary sizes indicated in Table 703-5, “Primary Size.” Each size fraction shall conform to the requirements of §703-02 Coarse Aggregate.
2. Loss applies to No. 2 size fraction.
3. The freeze-thaw requirement applies only to aggregate used in Portland cement concrete. The loss applies to the No. 2 size fraction.
4. Loss applies to all materials excepting marble, granite, and other similar materials.
5. Loss applies to marble, granite, and other similar materials.
6. Requirement applies to coarse aggregate for use in hot mix asphalt with design ESALs of 0.3 million or greater.
7. Gravel which has not been processed through a crusher shall not be combined with crushed gravel.

**A. Crushed Stone.** Crushed stone shall be Material Designation 703-0201 and shall consist of clean, durable, sharp-angled fragments of rock of uniform quality. The crushed stone used as coarse aggregate for all items shall be obtained from sources conforming to the requirements of the Department as to sampling, testing methods, Quarry Reports and any other required procedures.

**B. Crushed Gravel.** Crushed Gravel shall be Material Designation 703-0202 and shall consist of clean, durable, sharp-angled fragments of gravel free from coatings. A crushed particle shall be defined as one in which the total area of face fracture exceeds 25% of the maximum cross-sectional area of the particle. When two fractured faces are designated, the total area of each fractured face shall exceed 25% of the maximum cross-sectional area of the particle.

A naturally fractured face shall be acceptable providing that the sharp angular portion of the particle consists of sound material and is free from unsound or injurious coatings.

### TABLE 703-3 PHYSICAL REQUIREMENTS - DELETERIOUS MATERIALS

<table>
<thead>
<tr>
<th>Material Designation</th>
<th>Crushed Stone 703-0201</th>
<th>Crushed Gravel 703-0202</th>
<th>Screened Gravel 703-0203</th>
<th>Crushed Slag 703-0204</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shale and shale-like materials(2)</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>-</td>
</tr>
<tr>
<td>Coal/Lignite/Sulfides(3)</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>-</td>
</tr>
<tr>
<td>Clay lumps or Wood</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>-</td>
</tr>
<tr>
<td>Metal Ore(4)</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Other Deleterious Materials(5)</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Total Deleterious Materials</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
</tr>
</tbody>
</table>

(1) Coarse aggregates containing more than the specified maximum amounts of deleterious materials may be washed or otherwise processed until such specifications are satisfied.

(2) Shale, slate, phyllite, argillite, schist, and similar shale-like fissile rocks that have been identified by performance or by test to be unsound and deleterious. Such shale-like fissile rocks may be tested separately from the rest of the aggregate by freezing and thawing according to NYSDOT Test Method 703-08 P.G. If the loss is 20% or greater, that material will be designated as deleterious shale or shale-like material.

(3) Pyrite, marcasite, pyrrhotite, bog iron, and similar material.

(4) Magnetite, ilmenite, etc. Percentages above 3.0% may be accepted by the Director, Materials Bureau, when appropriate adjustments to yield have been made.

(5) Cemented clusters, weathered particles, and similar material.
TABLE 703-4 SIZES OF STONE, GRAVEL AND SLAG

<table>
<thead>
<tr>
<th>Screen Sizes</th>
<th>100</th>
<th>75</th>
<th>63</th>
<th>50</th>
<th>37.5</th>
<th>25</th>
<th>12.5</th>
<th>6.3</th>
<th>3.2</th>
<th>180</th>
<th>75</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screenings</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td>90-100</td>
<td>-</td>
<td>-</td>
<td>0-1.0</td>
<td></td>
</tr>
<tr>
<td>1B</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td>90-100</td>
<td>0-15</td>
<td>0-1.0</td>
<td></td>
</tr>
<tr>
<td>1A</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td>90-100</td>
<td>0-15</td>
<td>0-1.0</td>
<td></td>
</tr>
<tr>
<td>1ST</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td>0-15</td>
<td>-</td>
<td>0-1.0</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td>90-100</td>
<td>0-15</td>
<td>-</td>
<td>0-1.0</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td>90-100</td>
<td>0-15</td>
<td>-</td>
<td>0-1.0</td>
<td></td>
</tr>
<tr>
<td>3A</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td>90-100</td>
<td>0-15</td>
<td>-</td>
<td>-</td>
<td>0-0.7</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>-</td>
<td>100</td>
<td>90-100</td>
<td>0-15</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0-0.7</td>
<td></td>
</tr>
<tr>
<td>4A</td>
<td>-</td>
<td>100</td>
<td>90-100</td>
<td>0-15</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0-0.7</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>100</td>
<td>90-100</td>
<td>0.15</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0-0.7</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>90-100</td>
<td>0-15</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0-0.7</td>
<td></td>
</tr>
</tbody>
</table>

(1)Percentage by weight passing the following square openings.
(2)Screenings shall include all of the fine material passing a 6.3 mm screen.
(3)The minus 75 μm material requirements apply only to aggregate for use in portland cement concrete, surface treatment, cold mix bituminous pavements and underdrain filter material. The test (NYSDOT 201) will be performed on the entire sample of the designated size aggregate. Primary size does not apply in the determination of the minus 75 μm material.

TABLE 703-5 SIZES OF CRUSHED GRAVEL, STONE, AND SLAG FOR SLURRY

<table>
<thead>
<tr>
<th>Screen Sizes</th>
<th>9.5 mm</th>
<th>4.75 mm</th>
<th>2.36 mm</th>
<th>1.18 mm</th>
<th>600 μm</th>
<th>300 μm</th>
<th>150 μm</th>
<th>75 μm(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2MS</td>
<td>100</td>
<td>90-100</td>
<td>65-90</td>
<td>45-70</td>
<td>30-50</td>
<td>18-30</td>
<td>10-21</td>
<td>5-20.0</td>
</tr>
<tr>
<td>3MS</td>
<td>100</td>
<td>70-90</td>
<td>45-70</td>
<td>28-50</td>
<td>19-34</td>
<td>12-25</td>
<td>7-20</td>
<td>5-20.0</td>
</tr>
</tbody>
</table>

(1)Percentage by weight passing the following square openings.
(2)Determine percent passing 75 μm sieve according to AASHTO T 11, Materials Finer than 75 μm Sieve in Mineral Aggregates by Washing.

The crushed gravel used as coarse aggregate for all items shall be obtained from sources conforming to the requirements of the Department as to sampling, testing methods, Geologic Source Reports, Plant Flow Information, and any other required procedures.

C. Screened Gravel. Screened gravel shall be Material Designation 703-0203 and shall consist of clean, durable gravel free from coatings. Screened gravel may consist of all uncrushed particles and shall be obtained from sources conforming to the requirements for crushed gravel.

D. Crushed Slag. Crushed slag particles shall be Material Designation 703-0204 and shall consist of hard, durable, angular fragments which are reasonably uniform in density and quality; free from
injurious amounts of sulphur; and reasonably free from thin, elongated pieces, dirt, or other objectional matter. All crushed slag shall be obtained from approved sources conforming to the requirements of the Department as to sampling, test methods and any other required procedures.

**Gradation.** The sizes of all stone, gravel or slag used under these specifications shall conform to the gradation requirements for the various sizes tabulated in Table 703-4. All crushing plants shall be fitted with tailing chutes so that no aggregate will reach the bins other than that which passes through the proper screens.

**Primary Size.** For the purposes of this specification, the term “Primary Size” shall be defined for each size designation as all of the material passing and retained on the screens specified in Table 703-5 “Primary Sizes.”

**TESTS.** The details of test methods for coarse aggregate may be obtained from the Materials Bureau.

**BASIS OF ACCEPTANCE.** Acceptance of the source is determined on the basis of tests performed by the Materials Bureau on samples representing the source; review of Quarry Reports; Geologic Source Reports and Plant Flow Information; petrographic examination and other geologic studies; and performance history where applicable. The material is incorporated into the work on the basis that it is from an approved source conforming to procedural requirements of Department and that the aggregate shall meet gradation at the point of use.

Aggregate for use in the manufacture of precast concrete units may be accepted on the basis of stockpile approval at a location acceptable to the Department on a per job basis. Requests for stockpile approval shall be made in writing to the Materials Bureau. The manufacturer shall allow at least ninety (90) days for the testing and evaluation of the aggregate.

### 703-03 MORTAR SAND

**SCOPE.** This specification contains the requirements for sand used in mortar.

**GENERAL.** §703-01, Fine Aggregate shall apply except as modified herein.

**MATERIAL REQUIREMENTS.** When dry, mortar sand shall meet the following gradation requirements:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>4.75 mm</th>
<th>2.36 mm</th>
<th>300 µm</th>
<th>150 µm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent Passing by Weight</td>
<td>100</td>
<td>95-100</td>
<td>10-40</td>
<td>0-15</td>
</tr>
</tbody>
</table>

Concrete sand, §703-07, will be permitted as an alternative to mortar sand.

**TEST.** Test methods may be obtained from the Materials Bureau.

**BASIS OF ACCEPTANCE.** The provisions of §703-01, Fine Aggregate, shall apply.

### 703-04 GROUT SAND

**SCOPE.** This specification contains the requirements for sand used in grout.

**GENERAL.** §703-01, Fine Aggregate, shall apply except as modified herein.

**MATERIAL REQUIREMENTS.** When dry, the grout sand shall meet the following gradation requirements:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.18 mm</td>
<td>100</td>
</tr>
<tr>
<td>150 µm</td>
<td>0-10</td>
</tr>
</tbody>
</table>
The sand may be determined to be unacceptable for grout sand if it contains more than 6 percent by volume of loam and silt.

**TEST.** Test methods may be obtained from the Materials Bureau.

**BASIS OF ACCEPTANCE.** The provisions of §703-01, Fine Aggregate, shall apply.

**703-05 FINE AGGREGATE FOR WHITE PORTLAND CEMENT CONCRETE**

**SCOPE.** This specification contains the requirements for white fine aggregate used in the white portland cement concrete.

**MATERIALS REQUIREMENT.** Material Specification 703-01, Fine Aggregate, shall apply except as modified herein. The aggregate shall be white, having a Munsell color with a value of 8 or greater and a chroma saturation of 2 or less, when compared to a set of standard color chips. Gradation shall conform to the specification requirement under § 703-07, Concrete Sand.

**TEST.** The details of the test methods may be obtained from the Materials Bureau.

**BASIS OF ACCEPTANCE.** The provisions of §703-01 Fine Aggregate, shall apply except that the color will be accepted on a per stockpile basis by the Director, Materials Bureau.

**703-06 CUSHION SAND**

**SCOPE.** This specification contains the requirements for cushion sand used for concrete block slope paving.

**GENERAL.** Material for cushion sand shall meet the requirements specified herein.

**MATERIAL REQUIREMENTS.** Cushion sand shall consist of clean, hard, durable, uncoated particles, free from lumps of clay and all deleterious substances. When dry, the cushion sand shall meet the following gradation requirements:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>6.3 mm</th>
<th>300 µm</th>
<th>150 µm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent Passing by Weight</td>
<td>100</td>
<td>0-35</td>
<td>0-10</td>
</tr>
</tbody>
</table>

The sand may be determined to be unacceptable for cushion sand if it contains more than 10 percent by volume of loam or silt.

**TEST.** Test methods may be obtained from the Materials Bureau.

**BASIS OF ACCEPTANCE.** The cushion sand is accepted on the basis of gradation tests and visual inspection, unless otherwise specified, at the point of use.

**703-07 CONCRETE SAND**

**SCOPE.** This specification contains the requirements for sand used in portland cement concrete.

**GENERAL.** §703-01, Fine Aggregate, shall apply except as modified herein.

**MATERIAL REQUIREMENTS.** When dry, the fine aggregate for portland cement concrete shall conform to the following gradation requirements:
NEW YORK STATE DEPARTMENT OF TRANSPORTATION
STANDARD SPECIFICATIONS of May 4, 2006

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing By Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Minimum</td>
</tr>
<tr>
<td>9.5 mm</td>
<td>100</td>
</tr>
<tr>
<td>4.75 mm</td>
<td>90</td>
</tr>
<tr>
<td>2.36 mm</td>
<td>75</td>
</tr>
<tr>
<td>1.18 mm</td>
<td>50</td>
</tr>
<tr>
<td>600 µm</td>
<td>25</td>
</tr>
<tr>
<td>300 µm</td>
<td>10</td>
</tr>
<tr>
<td>150 µm</td>
<td>1</td>
</tr>
<tr>
<td>75 µm (Wet)</td>
<td>0</td>
</tr>
</tbody>
</table>

TEST. Test methods may be obtained from the Materials Bureau.

BASIS OF ACCEPTANCE. The provision of §703-01, Fine Aggregates, shall apply.

703-08 MINERAL FILLER

SCOPE. This specification contains the requirements for mineral filler used in bituminous concrete mixtures.

MATERIAL REQUIREMENTS. Mineral filler shall conform to the requirements of the standard specification for Mineral Filler for Bituminous Paving Mixture, ASTM D242.

When dry, the mineral filler shall meet the following gradation requirements:

<table>
<thead>
<tr>
<th>Percent Passing by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>600 µm</td>
</tr>
</tbody>
</table>

BASIS OF ACCEPTANCE. Acceptance of this material will be based on the producer's certification of compliance with these specification requirements.

703-09 RECLAIMED ASPHALT PAVEMENT (RAP)

SCOPE. This specification covers the material requirements for reclaimed asphalt pavement (RAP) for use in asphalt pavement recycling.

The provisions of Section 403 - Hot Mix Asphalt Concrete Pavement shall apply except that the Contractor has the option of recycling reclaimed asphalt pavement (RAP). RAP may be recycled in any of the following mixes or applications:

- Asphalt Concrete - Type 1 Base
- Asphalt Concrete - Type 3 Binder
- Asphalt Concrete - Type 6 Top (for shoulders)
- Asphalt Concrete - Truing and Leveling

If the contractor chooses the recycling option, the following modifications to the specification requirements shall apply:

MATERIAL REQUIREMENTS. RAP shall consist of asphalt pavement recovered from an asbestos free pavement by cold milling or other removal techniques approved by the Regional Director or his/her representative.

The aggregate component of the RAP shall meet the requirements of Section 703, Aggregates. The bitumen component of the RAP shall be asphalt cement and shall be free of significant contents of solvents, tars or other contaminating substances that will make the RAP unacceptable for recycling as determined by the Department. The RAP shall be separated according to specific pavement source by the Contractor unless otherwise permitted by the Regional Director or his/her representative.

The Department will use one of the following procedures to approve the RAP quality:
A. RAP obtained from an asbestos-free pavement which was constructed with asphalt cement, and with aggregates that meet the current requirements of Section 703, Aggregates, will be approved by the Regional Director or his/her representative.

B. If the source of the RAP or its quality is not known, the Contractor shall submit the following to the Department at least 30 calendar days prior to the start of paving:

1. Designated use of the RAP and approximate proportions.
2. A 2.5 kilogram (minimum) sample representing the RAP to be incorporated into the recycled mixture.
3. A 2.5 kilogram (minimum) sample of the aggregate extracted from the RAP for petrographic examination.
4. The penetration test result (25°C, 100 g, 5 s) of the bituminous material recovered from the RAP. The Department will determine the acceptability of the RAP for the designated use. Details for sampling and testing the RAP are available from the Materials Bureau.

Composition of Mixtures. The blend percentage of RAP shall be selected within the limits shown in Table 703-09A:

<table>
<thead>
<tr>
<th>Plant Type</th>
<th>% Reclaimed Material, Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drum Mixer</td>
<td>70 G</td>
</tr>
<tr>
<td>Batch</td>
<td>50 G</td>
</tr>
</tbody>
</table>

The recycled mixture of RAP, new aggregate and added asphalt cement shall meet the requirements specified in Table 401-1, Composition of Bituminous Plant Mixtures for aggregate gradation, asphalt cement content and temperature range.

Mix Design for bituminous mixtures containing RAP shall be submitted in accordance with the procedures outlined by Department written instructions. The mix design shall be submitted to the Regional Director or his/her representative a minimum of fourteen (14) calendar days prior to the scheduled start of work.

Bituminous Materials. The added asphalt cement may be AC 20, AC 15, AC 10, AC 5, AC 2.5 or other asphalt cement grades approved by the Director, Materials Bureau. The resultant penetration of the combined asphalt cement (reclaimed bitumen and added asphalt cement) prior to plant mixing shall be between 70 and 105. The grade of asphalt cement selected by the Contractor shall be in accordance with Department written instructions.

Stockpile Materials. RAP from each pavement source shall be stockpiled on a free draining base separately from other aggregate or RAP sources. Department accepted RAP stockpiles shall be positively identified. The RAP shall be reclaimed from the stockpiles without contamination by foreign materials. Prior to entry into the RAP feed bin, the RAP shall have a reasonably uniform gradation from coarse to fine with 100 percent passing the 50 mm sieve.

The maximum allowable RAP blend percentages for given RAP stockpile moisture contents are given in Table 703-9B. These limits shall apply to all plants as indicated.

Plant Equipment. RAP shall be fed into the plant by equipment specifically designed for recycling and shall be approved by the Director of the Materials Bureau. Scalping screens, grizzlies or similar devices shall be installed on the RAP feed bin(s) to remove any debris or other foreign material in excess of 100 mm.
### TABLE 703-9B ALLOWABLE RAP BLENDING PERCENTAGES

<table>
<thead>
<tr>
<th>RAP MOISTURE CONTENT (%)</th>
<th>MAXIMUM RAP (%) (Batch Plant)</th>
<th>MAXIMUM RAP (%) (Drum Mixer)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0 - 0.9</td>
<td>50</td>
<td>70</td>
</tr>
<tr>
<td>1.0 - 1.9</td>
<td>45</td>
<td>50</td>
</tr>
<tr>
<td>2.0 - 2.9</td>
<td>40</td>
<td>45</td>
</tr>
<tr>
<td>3.0 - 3.9</td>
<td>35</td>
<td>40</td>
</tr>
<tr>
<td>4.0 - 4.9</td>
<td>30</td>
<td>35</td>
</tr>
<tr>
<td>5.0 - 5.9</td>
<td>25</td>
<td>30</td>
</tr>
<tr>
<td>6.0 and over</td>
<td>20</td>
<td>25</td>
</tr>
</tbody>
</table>

**Batch Plants.** RAP shall be last in the aggregate weighing sequence. RAP draw weight(s) shall be increased to compensate for the moisture content. Total mix time shall be 60 seconds minimum. In addition, all requirements pertaining to aggregates shall apply to RAP including the equipment requirements for automatic proportioning and recordation stipulated for aggregates in §401-3.02.

**Drum Mix Plants.** The RAP shall be fed into the drum so that it will not come in direct contact with the burner flame. Mixing of RAP with new aggregate shall occur before the bituminous material introduction point. All requirements pertaining to aggregates shall apply to RAP. The equipment for automatic proportioning and recordation of RAP shall meet the requirements for aggregates in §401-3.02. In addition, RAP shall be added with a maximum variation of 0.5 percent of the total weight of bituminous mixture per interval of time. The recordation shall also record accumulated dry RAP weights separately from aggregates.

**Retained Moisture in Mixture.** The moisture content of the mixture upon discharge from the mixer shall not exceed 0.5 percent when tested in accordance with Department written instructions.

**METHOD OF MEASUREMENT.** The provisions of subsection 401-4, Method of Measurement shall apply except that recorded batch weights will not be permitted for determination of the metric tons of mixture being delivered to the work site.

**BASIS OF ACCEPTANCE.** The RAP will be accepted on the basis of one of the following:

1. Certification from the Contractor that the RAP from a specific pavement which was constructed with asphalt cement and aggregates that meet current specification requirements.
2. Analysis of RAP and its components by the Department.

### §703 LIGHTWEIGHT AGGREGATES

**SCOPE.** This specification covers the material details and quality requirements for lightweight aggregates generally used in structural portland cement concrete.

**GENERAL.** The provisions of Sampling, Stripping and Annual Reports under §703-02 Coarse Aggregate shall apply, except that in addition under 2. Quarry Operations, plant flow information describing the processing equipment shall be provided.

**MATERIAL REQUIREMENTS.** The lightweight aggregates shall be prepared by expanding or sintering materials such as shale, slate, clay, fly ash or blast furnace slag. The requirements of ASTM C330 shall apply except as modified in these specifications. In addition to ASTM C330, the lightweight aggregates shall meet the requirements given in Table 703-10, Lightweight Aggregate Requirements (Testing). The Durability Factor of concrete made from lightweight aggregates shall not be less than 80 percent.

A lightweight aggregate meeting the requirements of this specification shall be accepted unless service records indicate that the aggregate is unsound or that the material is otherwise determined to be
unsatisfactory by the Director, Materials Bureau. Lightweight aggregates not meeting these requirements may be further evaluated by additional testing, petrographic examination, geologic studies, a review of the lightweight aggregate processing and the performance history. If the results of the evaluation indicate that the lightweight aggregate should perform satisfactorily, the material may be accepted by the Director, Materials Bureau.

Test. Sampling procedure instructions and test methods may be obtained from the Materials Bureau.

BASIS OF ACCEPTANCE. Acceptance of lightweight aggregates is determined by the Director, Materials Bureau on the basis of tests performed by the Materials Bureau on representative samples of the materials; review of Quarry Reports and Plant Flow Information; petrographic examination and other geologic studies; and performance histories where applicable. The material is incorporated into the work on the basis that it is accepted and conforms to procedural directives of the Department and the aggregate shall meet the gradation requirement at the point of use.

<table>
<thead>
<tr>
<th>Test Method</th>
<th>Fine Aggregate</th>
<th>Coarse Aggregate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnesium Sulfate (NYSDOT 207).</td>
<td>30</td>
<td>18</td>
</tr>
<tr>
<td>Loss by Weight 5 cycles, % Max.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Los Angeles Abrasion Test (ASTM C131).</td>
<td></td>
<td>50</td>
</tr>
<tr>
<td>Loss by Weight (Grading B or C), % Max.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SECTION 704 - MASONRY UNITS

704-01 COMMON BRICK

SCOPE. This specification covers the material and quality requirements for common brick, made from clay or shale, used in the construction of drainage structures and manholes.

MATERIAL REQUIREMENTS. Brick shall conform to the requirements of ASTM C32, Grade MS, including the requirement for saturation coefficient. Common brick may be furnished in any of the designated standard sizes that will produce the required dimensions in the completed structure, and the bricks shall be solid.

SAMPLING AND TESTING. Samples, when requested by the Department, shall be randomly selected from production-run material. A minimum of 10 full-size bricks of the same size and style will be required. Samples will be tested for the physical properties identified in ASTM C32. Tests will be performed in accordance with ASTM 67.

BASIS OF ACCEPTANCE. Common brick will be accepted on the basis of a material certification that specifies the product conforms to this specification.

704-02 CONCRETE BRICK

SCOPE. This specification covers the material and quality requirements for concrete brick used in brick masonry construction.

MATERIAL REQUIREMENTS. Concrete brick shall conform to the requirements of ASTM C55 Grade N, except as noted herein. Materials used in the manufacture of concrete brick shall meet the requirements of the following subsections:

Portland Cement  701-01
Coarse Aggregate  703-02
Mortar Sand  703-03
Grout Sand  703-04
Concrete Sand  703-07
Fly ash or ground, granulated blast-furnace slag may be substituted up to a maximum of 20% by weight of the total amount of cement plus pozzolan in the mix. Pigments used for integral coloring shall meet the requirements of ASTM C979. Other materials may be used in the manufacture as approved by the Director, Materials Bureau.

The nominal dimensions of the brick shall be 205 mm long, 100 mm wide, and 70 mm in height.

**SAMPLING AND TESTING.** Samples, when requested by the Department, shall be randomly selected from production-run material. A total of 10 full-size bricks of the same size and style will be required. Five samples will be tested for compressive strength and five for absorption, in accordance with ASTM C140.

The manufacturer shall be responsible for having brick tested for linear drying shrinkage in accordance with ASTM C55. A copy of the test report shall be included with the samples submitted to the Department for compression and absorption testing.

**BASIS OF ACCEPTANCE.** Concrete brick will be accepted on the basis of the manufacturer's name and location appearing on the Department’s Approved List and a material certification that specifies the product conforms to this specification.

### 704-03 PRECAST CONCRETE - GENERAL

**SCOPE.** This specification covers the general material and quality requirements for precast concrete items produced in accordance with the current Materials Procedure for precast concrete QC/QA titled “Procedures For Achieving And Maintaining Precast Concrete Manufacturer’s Approved List Status”. It is intended for use in conjunction with the individual item specifications.

**MATERIAL REQUIREMENTS.** The Portland Cement Concrete shall meet the requirements in §501, Portland Cement Concrete - General; §501-2.02, §501-2.03 and §501-3.02 except as noted herein.

Type 1, 2 or 3 cement may be used. The manufacturer may substitute pozzolans up to a maximum of 20% by weight of the total amount of cement plus pozzolan in the mix. Certain aggregates appear in the Approved List of Sources of Fine & Coarse Aggregates that have use limitations with a high alkali portland cement. When requested, the Materials Bureau may approve this combination when 15-20% by mass of the cement in the mix is replaced with fly ash.

The concrete shall have an air content of 5.0 to 9.0%. Unless noted otherwise in the contract documents, approved fabrication drawings or item specification, the minimum compressive strength of concrete used in precast units shall be 25 MPa @ 28 days.

Threaded inserts used to connect reinforcing steel to precast concrete shall be non-corrosive and shall have a tensile capacity of at least 50% of the yield strength of the reinforcing steel.

Additional materials, listed below, shall meet the requirements of the following subsections:

- Concrete Repair Material 701-04
- Bar Reinforcement, Grade 420 709-01
- Wire Fabric For Concrete Reinforcement 709-02
- Epoxy Coated Bar Reinforcement, Grade 420 709-04
- Epoxy Coated Wire Fabric Reinforcement 709-08
- Cold-Drawn Wire For Concrete Reinforcement 709-09
- Mechanical Connectors for Reinforcing Bar Splices (Epoxy Coated) 709-10
- Quilted Covers (for curing) 711-02
- Plastic Coated Fiber Blankets (for curing) 711-03
- Polyethylene Curing Covers (White Opaque) 711-04
- Membrane Curing Compound (Clear w/Fugitive Dye) 711-05
- Burlap 711-06
- Corrosion Inhibitor 711-13
DRAWINGS. Precast concrete units shall be fabricated to conform to the details contained in the plans and contract documents. Fabrication Drawings shall be one of the following:

A. Contract Plan Sheets. When the contract plans contain enough detail to properly fabricate and inspect the precast element they may be used as the fabrication drawings. The Materials Bureau will determine whether or not the contract plans contain enough detail.

B. Department Standard Sheets. When Department Standard Sheets are referenced in, and are in compliance with the contract plans, the Standard Sheet shall be used as the fabrication drawing.

C. Fabricator Working Drawings. When the contract plans do not contain enough detail to be used as fabrication drawings and there is no Department Standard Sheet for the precast element or the Standard Sheet is not in compliance with the contract plans, Fabricator Working Drawings shall be used as the fabrication drawings.

D. Fabricator Standard Drawing. Fabricator Standard Drawings, previously approved by the Director, Materials Bureau, which meet the requirements of the contract plans, may be used as the fabrication drawings in place of Contract Plan Sheets, Department Standard Sheets or Fabricator Working Drawings.

Fabrication Drawings shall be prepared and processed in accordance with the current Materials Procedure for Preparing and Processing Fabrication Drawings for Precast Concrete Products.

FABRICATION. The manufacturer shall produce precast units that conform to the details of the approved fabrication drawings. The precast units shall be uniform in appearance. All concrete surfaces which will be exposed to view after installation shall be flat and smooth, free from irregularities and uniform in color and texture. The Department, and its representatives, shall have free access to the manufacturing facility and all products produced for the Department.

Formwork. Concrete shall be cast in rigidly constructed forms which will maintain the units within specified tolerances to the shapes, lines and dimensions shown on the approved fabrication drawings. Forms shall be constructed from flat, smooth, non-absorbent material and shall be sufficiently tight to prevent the leakage of mortar. When wood forms are used all faces in contact with the concrete shall be laminated with a non-absorbent material. All worn or damaged forms which cause irregularities on the concrete surface or damage to the concrete during form removal shall be repaired or replaced before being reused. Form coatings, appearing on the Department's Approved List, shall be applied to all forms.

Lifting Devices. Lifting devices shall be a recessed type designed for use in precast concrete. The precast manufacturer shall ensure that the lifting devices selected for use have an adequate capacity to safely handle the precast product. Reinforcing steel shall not be used as a lifting device. Lifting devices that are used for turning or rotating a unit at the precast facility but are not necessary for further handling or installation shall be filled with concrete repair material before the unit is shipped. All other lifting devices shall be filled with concrete repair material after the unit is installed.

Reinforcing. Unless noted otherwise in the contract documents, approved fabrication drawings or item specification, the minimum concrete cover over reinforcing steel shall be 38 mm. Reinforcing steel shall be tied and supported to keep it in position during the concrete placement. The ends of chairs or spacers, used to support or locate reinforcing steel, that bear on the faces of forms, shall be made of, or coated with, non-corrosive material so that no discoloration will show on the face of the units. Chairs, tie wires and other devices used to support, position or fasten epoxy coated reinforcement shall be made of or coated with a dielectric material. Tack welding or any other welding of specified steel reinforcement will not be allowed. Welding for cage stability will be permitted provided that redundant steel is added in each direction and tied to the cage. The redundant steel shall be thirty (30) bar diameters, minimum, in length and shall be positioned so that the midpoint is located at the weld. All welds to epoxy coated steel shall be repaired with an epoxy repair material meeting the requirements of §709-04 or §709-08.
Corrosion Inhibitor. When allowed by the individual item specification, corrosion inhibitor may be used in lieu of epoxy coated reinforcing. When corrosion inhibitor is selected for use it shall be clearly noted on the fabricator working drawing or in the fabrication request when standard sheets, contract plan sheets, etc are used as the fabrication drawings. When selected for use, corrosion inhibitor shall be used in all units produced to the referenced fabrication drawings. The corrosion inhibitor shall be added to the concrete as an aqueous solution at a dosage rate of 20.0 liters per cubic meter.

The calcium nitrite, which acts as an accelerator, may be used in conjunction with compatible retarding admixtures to control setting time and workability of the concrete, however the use of a formulation of calcium nitrite solution which includes a set control ingredient may be used if setting times and increased water demands are of concern, consult the manufacturer of the product. The corrosion inhibitor must be added to the mix immediately after air entraining and retarding admixtures have been introduced into the batch.

When a batching problem exists or is perceived the Department reserves the right to test the hardened concrete at any time to verify the quantity of calcium nitrite present. Units with less than the specified amount of calcium nitrite shall be subject to rejection. If hardened concrete is tested, 100 mm diameter cores shall be drilled by the manufacturer under the supervision of a Department representative. Cores shall be a minimum of 100 mm in length unless otherwise approved by the Materials Bureau. Cores shall be plugged and repaired in accordance with the requirements of repair indicated below.

Concrete Placement And Consolidation. Suitable means shall be used for placing concrete to prevent segregation. The concrete shall be thoroughly consolidated by external or internal vibrators or a combination of both, unless otherwise approved by the Materials Bureau. Vibrators shall not be used to move concrete within the forms. Concrete shall be placed and consolidated in a way that minimizes the presence of surface voids or bug holes on the formed surfaces.

Cold Weather. When concrete is cast in ambient temperatures less than 10°C the following requirements shall apply:

A. Immediately before concrete placement the minimum temperature inside the forms shall be 5°C.
B. Immediately following completion of the placement the requirements of the chosen curing method shall be followed.
C. Concrete temperatures required by the chosen curing method shall be maintained by means of an external indirect heat supply or by utilizing the heat of hydration. Curing temperatures shall not exceed 30°C unless units are steam cured in accordance with this specification. When an external heat supply is used the enclosure shall be properly vented to prevent surface disintegration of the fresh concrete due to an accumulation of carbon dioxide gas.
D. The plastic concrete shall not be exposed to freezing temperatures after it has been placed into the forms or during the curing period.

Dimensional Tolerances

A. Unit dimensions shall not vary by more than 5 mm from those shown on the approved fabrication drawings unless noted otherwise in the contract documents, approved fabrication drawings or item specification.
B. Variations in the required spacing of reinforcing steel shall not be more than 50 mm and are not cumulative. Concrete cover over reinforcing steel shall not be more than 10 mm greater than, and in no case be less than, the amount specified in the contract documents, approved fabrication drawings, or item specification.

Architectural Treatments

A. Architectural Patterned And Textured Precast Concrete. The architectural pattern or textured effect called for in the contract plans shall be obtained by using form liners, stamping equipment or other texturing tools recommended by the manufacturer. Details of the architectural pattern or texture and the fabrication method used shall be shown on the fabrication drawings for the precast item. Concrete surfaces treated with form liners or by stamping shall have a repeatable,
seamless pattern such that when installed the units will form a continuous, natural looking, matching and repeatable pattern. Surfaces treated with texturing tools shall be uniform in appearance. When form liners are used, a high quality release agent compatible with the form liner material shall be used. Form liners which are worn or damaged resulting in a non-uniform appearance or damage to the concrete during form removal shall be replaced. Fabrication drawings shall clearly show the design thickness of the precast element and the thickness being added by the architectural pattern or texturing. The architectural pattern or texturing shall not penetrate into the required concrete cover over the reinforcing steel at any point.

B. Exposed Aggregate Precast Concrete. Coarse aggregate shall meet the color and size requirements in the plans. When no size is specified a Type CA1 gradation, or equal approved by the Director, Materials Bureau, shall be used. A set retarder designed for use in exposed aggregate applications shall be used. Surfaces requiring an exposed aggregate finish shall be uniform in appearance with the surface completely covered with exposed aggregate. A set retarder shall be applied, in accordance with the manufacturers recommendations, to the surfaces receiving the exposed aggregate finish. Alternate methods of obtaining the exposed aggregate finish require prior approval of the Director, Materials Bureau. Unless otherwise shown in the contract plans, the depth of exposure shall be 30% of the primary size of the coarse aggregate. The depth of exposure shall be measured by laying a straight edge across the plane of the concrete face and measuring back to the concrete matrix.

C. Integral Coloring. Integrally colored concrete shall be produced by use of a pigment coloring system meeting the requirements of ASTM C979. For each color used the pigment shall be from the same batch or lot unless otherwise approved by the Director, Materials Bureau. Pigment will be approved based on a manufacturers certification of compliance with these requirements. Type 6 white cement, meeting the requirements of §701-01, may be used to achieve the desired color. Coloring pigment shall be added to the concrete mix per manufacturer’s recommendations, at a dosage rate to achieve the desired color as specified in the contract documents. The manufacturer’s recommended maximum dosage rate shall not be exceeded.

D. Visual Standards. The Contractor shall construct visual samples that are the same general size and shape as the production units they represent. The samples must be submitted to the Regional Landscape Architect for written approval. Each of the patterns, textures and colors identified in the plans shall be represented by the samples. Only one pattern or texture shall be used per sample face. When multiple patterns or textures are called for, additional samples will be required. Materials and fabrication techniques used in the samples, including curing, concrete pigment and sealers, shall be the actual materials and techniques to be used in the construction of the final product. If the samples are rejected by the Landscape Architect, the Contractor shall construct additional samples as required to obtain the Landscape Architect’s approval. The approved samples shall be made available at the precast plant, for use by the inspector as visual standards, throughout production of the units. When surface coatings are to be field applied additional samples, without the surface coatings, shall be prepared and retained at the precast plant for use as visual standards. The fabrication of precast concrete units shall not begin until written approval of the visual standards has been received from the Department.

E. Visual Evaluation. When comparing production units against the visual standards there shall be minimal color and texture variations, from the standard, when viewed in good typical lighting at a 6m distance. When viewed alone, production units shall show no obvious imperfections or evidence of repairs other than minimal color and texture variations when viewed in good typical lighting at a 6m distance.

Curing. All precast concrete units shall be subjected to curing by any one of the methods described in the following paragraphs. The manufacturer shall provide minimum/maximum temperature thermometers to monitor curing temperatures unless otherwise specified. If, at any time, curing temperatures fall below the specified minimum for the chosen curing procedure, the curing period shall be increased accordingly.
Except as noted under D. Moisture Retention Curing, no unit shall be subjected to freezing temperatures until the following two conditions are met:

- The chosen curing cycle has been completed.
- The specified 28 day compressive strength or 21 MPa, whichever is less, has been reached.

Cylinders shall be cured in the same manner and maintained in the same temperature and environmental conditions as the units they represent until being tested.

**A. Steam Curing.** The units shall be cured in a suitable enclosure. The enclosure shall be designed to minimize the loss of heat and moisture while allowing for the uniform circulation of steam around the entire unit. The interior surfaces of the enclosure and the surface of the unit shall be moist at all times. Steps shall be taken to prevent localized "hot spots" caused by the steam lines. The enclosure shall be free from outside drafts.

Steam curing shall not begin until a preset period has been completed. The preset period begins when the last concrete has been placed and continues until the concrete obtains initial set. Prior written approval from the Director, Materials Bureau is required when preset periods of less than two hours are to be used. During the preset period, moderate heat may be applied to the enclosure to maintain the initial temperature of the concrete. The maximum temperature inside the enclosure during the preset period shall be the initial temperature of the concrete +5°C.

After the preset period is complete, steam shall be injected into the curing enclosure. The temperature inside the enclosure shall not be increased at a rate greater than 20°C per hour. A moist atmosphere shall be maintained at a temperature between 40°C and 85°C for a period of not less than 12 hours. The temperature inside the enclosure shall then be decreased at a rate not exceeding 20°C per hour until the ambient temperature outside the enclosure is reached. The manufacturer shall provide automatic temperature recorders to continuously record the curing temperature inside the enclosure.

**B. Water Spray Curing.** Curing shall begin as soon as the concrete has hardened sufficiently to prevent surface damage from the water spray but not more than 2 hours after the completion of finishing. All exposed surfaces of the precast unit shall be kept wet with a continuous fine spray of water in an enclosure maintained at a temperature of not less than 20°C for a period of not less than 72 hours. Additional curing time may be necessary to meet the 28 day strength requirements.

**C. Saturated Cover Curing.** The saturated covers used under this method shall be burlap. Curing shall begin as soon as the concrete has hardened sufficiently to prevent surface damage from the saturated burlap but not more than 2 hours after the completion of finishing. All exposed concrete surfaces on the precast unit shall be covered with burlap, saturated with water before applying. The burlap shall be kept saturated and the units kept at a temperature of not less than 20°C for a period of not less than 72 hours. Additional curing time may be necessary to meet the 28 day strength requirements.

**D. Moisture Retention Curing.** Units cured in accordance with these methods shall be maintained at a temperature of not less than 10°C for a period of not less than 7 days except as noted below. Additional curing time may be necessary to meet the 28 day strength requirements. When the specified 28 day compressive strength or 21 MPa, whichever is less, has been reached the unit may be exposed to freezing temperatures however the membrane curing compound or curing covers must still be maintained for a minimum of 7 days.

1. **Membrane Curing Compound.** The membrane curing compounds used under this method must appear on the Department's current Approved List of Membrane Curing Compounds under B. Clear (with fugitive dye). The compound shall be properly agitated immediately before each use. A minimum coverage rate of one liter per 3.5 square meters shall be used.

The membrane curing compound shall be applied to the concrete surface after finishing as soon as the free water on the surface has disappeared and no water sheen is visible, but not so late that the liquid curing compound will be absorbed into the concrete. When curing compound
cannot be applied within the above requirements, the manufacturer shall instead immediately begin curing the unit in accordance with one of the other curing methods contained in this specification, until curing compound can be applied.

If the forms are left on for a minimum of 7 days, curing compound is not required on any formed surfaces. When the forms are removed prior to 7 days, the exposed concrete surfaces shall be wet with water within one half hour of form removal and shall be kept moist until the curing compound is applied. Before application, the concrete shall be allowed to reach a uniformly damp appearance with no free water on the surface and then the compound shall be applied immediately.

This method of curing shall not be used on any concrete surface which is to have plastic concrete, grout or mortar bonded to it or on any concrete surface that will have a penetrating or coating type treatment such as a sealer or stain applied to it. Another approved method of curing shall be used when this condition exists.

2. Curing Covers. The curing covers used under this method shall be either Plastic Coated Fiber Blankets, §711-03, appearing on the Department's Approved List or Polyethylene Curing Covers meeting the requirements of §711-04. Curing covers shall be placed immediately following the finishing operation or form removal, whichever is applicable. Care shall be taken not to damage any exposed concrete surfaces during cover placement. Curing covers shall be placed and secured and be of such condition as to minimize the loss of moisture and temperature. When it is necessary to use more than one curing cover the edges shall be lapped a minimum of 300 mm.

E. Other Methods. Other Methods of curing are subject to approval by the Director, Materials Bureau.

Repair. Precast concrete units that contain minor defects caused by manufacture or mishandling shall be repaired at the manufacturing site. In addition, units that contain minor defects caused by mishandling during shipment or installation shall be repaired at the project site. When repairs are made to a unit that has been sprayed with curing compound, the compound must be removed from the repair area before making the repair as it will act as a bond breaker between the precast concrete and the repair material. Major defects and non repairable defects in a unit will be cause for rejection of the unit. Defects are defined as follows:

A. Surface Defects. Surface voids or bugholes which are less than 15 mm in diameter and less than 5 mm deep are acceptable, except as noted under D. of this section. Surface defects need not be repaired.

B. Minor Defects. Minor defects are defined as: spalls, honeycombing and surface voids which have no dimension greater than 300 mm, when measured along a straight line, and do not expose the reinforcing steel. Minor defects shall be repaired by removing all unsound concrete from the defect, square cutting the edges of the defect to prevent feather edging of the repair and then filling the void with concrete repair material meeting the requirements of §701-04. Concrete repair material shall have a color similar to that of the precast unit. The repair shall be finished to the proper shape and cured in accordance with the repair material manufacturer's recommendations. It shall withstand a moderate blow with a 450 g hammer. The blow shall produce a sharp ring indicating proper bonding of the repair.

C. Major Defects. Major defects are defined as: spalls, honeycombing and surface voids which have any dimension greater than 300 mm, when measured along a straight line, or expose the reinforcing steel. Cracks which go through the section or are greater than 0.25 mm in width are also major defects.

No major defect shall be repaired without prior approval of the Department. Requests to repair major defects shall be made in accordance with the requirements contained in the current Materials Procedure for precast concrete.
D. Non Repairable Defects. Non repairable defects are defined as: cracks in a concrete surface, which will be exposed to view after installation, that are visible when viewed in good typical lighting with the naked eye at a 3 m distance; minor defects which in total make up more than 5% of the surface area of the unit and excessive surface defects on more than 5% of the surface area which will be exposed to view after installation.

SAMPLING AND TESTING. Sampling and testing shall be done by the precast manufacturer in accordance with Materials Bureau requirements contained in the current Materials Procedure for precast concrete.

MARKING. All precast units shall be clearly marked with permanent waterproof paint. Unless noted otherwise in the item specification, units shall be marked on an inside or back surface which will not be exposed to view after installation. The following information shall be included:

Name or trademark of the manufacturer.
Date of manufacture.
Unique piece identification number.
NYS DOT Contract number.

FINAL PRODUCTION INSPECTION. A final production inspection shall be performed by the precast manufacturer on every precast unit produced for the Department. An inspection will be considered satisfactory when it verifies that the precast unit is in compliance with the appropriate Department specifications. The specific requirements and procedures for the inspection are contained in the precast manufacturer’s Department approved Quality Control Plan.

SHIPPING. Upon completion of a satisfactory final production inspection the precast unit may be shipped from the manufacturing location except that units produced between the dates of October 31st and April 1st shall not be shipped for a minimum of 72 hours following the completion of casting.

BASIS OF ACCEPTANCE. Precast units will be accepted at the job site based on the following:
The manufacturer’s name must appear on the Department’s Approved List for the item being supplied.
A manufacturer’s certification.
An acceptable product evaluation made by the Engineer.

704-04 CONCRETE BLOCK (SLOPE PAVING)

SCOPE. This specification covers the material and quality requirements for solid concrete block for use in concrete block slope paving.

MATERIAL REQUIREMENTS. Materials used in the manufacture of concrete block shall meet the requirements of the following subsections:

Portland Cement 701-01
Coarse Aggregate 703-02
Mortar Sand 703-03
Grout Sand 703-04
Concrete Sand 703-07
Fly Ash 711-10
Ground, Granulated Blast-Furnace Slag 711-12
Water 712-01

Fly ash or ground granulated blast furnace slag may be substituted for up to a maximum of 20% by weight of the total amount of cement plus pozzolan in the mix. Pigments used for integral coloring shall meet the requirements of ASTM C979. Other materials may be used in the manufacture as approved by the Director, Materials Bureau.
**Physical Properties.** The average compressive strength of five full-size blocks shall be not less than 20 MPa, with no individual block less than 15 MPa. The average freeze/thaw loss of five block samples, subjected to 42 freeze/thaw cycles in a 3% NaCl solution, shall not exceed 1.0%, with no individual sample exceeding 1.5%.

Block dimensions shall be as required in the contract documents. Dimensions shall not vary by more than 5 mm from those specified. Blocks shall be sound and free from cracks or other defects that would interfere with their proper placement or performance.

**SAMPLING AND TESTING.** Samples, when requested by the Department, shall be randomly selected from production-run material. A minimum of 5 full-size blocks of the same size and style will be required for compression testing. A minimum of five samples, prepared by the manufacturer in accordance with ASTM C1262, will be required for freeze/thaw testing.

Samples will be tested for compressive strength in accordance with ASTM C140. Samples will be tested for freeze/thaw durability in accordance with ASTM C1262.

**BASIS OF ACCEPTANCE.** Concrete block will be accepted on the basis of the manufacturer’s name and location appearing on the Department’s Approved List and a material certification that specifies the product conforms to this specification.

**704-05 PRECAST CONCRETE BARRIER**

**SCOPE.** This specification covers the material and quality requirements for precast concrete barrier used in highway applications and precast concrete barrier for structures.

**MATERIAL REQUIREMENTS.** The Material Requirements contained in §704-03 shall apply except as noted herein.

Unless noted otherwise in the contract documents or approved fabrication drawings the compressive strength of concrete used in precast concrete barrier shall be as follows:

<table>
<thead>
<tr>
<th>Concrete Barrier</th>
<th>25 MPa (minimum) @ 28 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete Barrier for Structures</td>
<td>35 MPa (minimum) @ 28 days</td>
</tr>
</tbody>
</table>

Concrete mixtures used under this specification shall have a maximum cement content of 445 kg per cubic meter.

Reinforcing steel shall be epoxy coated meeting the requirements of §709-04.

**DRAWINGS.** The drawing requirements contained in §704-03 shall apply except as noted herein.

**Concrete Barrier For Structures.** Units shall be fabricated to conform to the details shown on DCES approved Fabricator Standard Drawings for the barrier system. When site conditions require modification of the approved Fabricator Standard Drawings, job specific Fabricator Working Drawings are required.

**FABRICATION.** The Fabrication requirements contained in §704-03, along with the following shall apply.

**Dimensional Tolerances.** The requirements of §606-3.05 A. Precast Concrete Barrier shall apply.

**SAMPLING AND TESTING.** The Sampling and Testing requirements contained in §704-03 shall apply.

**MARKING.** The Marking requirements contained in §704-03 shall apply except as noted herein.

Markings shall be placed on one end of each barrier unit such that they will not be exposed to view after installation.
§704

FINAL PRODUCTION INSPECTION. The Final Production Inspection requirements contained in §704-03 shall apply.

SHIPPING. The Shipping requirements contained in §704-03 shall apply.

BASIS OF ACCEPTANCE. The Basis of Acceptance requirements contained in §704-03 shall apply.

704-06 PRECAST CONCRETE CRIBBING

SCOPE. This specification covers the material and fabrication requirements for precast concrete cribbing.

MATERIAL REQUIREMENTS. The Material Requirements contained in §704-03 shall apply.

DRAWINGS. The Drawing requirements contained in §704-03 shall apply.

FABRICATION. The Fabrication requirements contained in §704-03 shall apply.

SAMPLING AND TESTING. The Sampling And Testing requirements contained in §704-03 shall apply.

MARKING. The Marking requirements contained in §704-03 shall apply.

FINAL PRODUCTION INSPECTION. The Final Production Inspection requirements contained in §704-03 shall apply.

SHIPPING. The Shipping requirements contained in §704-03 shall apply.

BASIS OF ACCEPTANCE. The Basis Of Acceptance requirements contained in §704-03 shall apply.

704-07 SEGMENTAL RETAINING WALL BLOCKS

SCOPE. This specification covers the material details and quality requirements for segmental retaining wall blocks.

MATERIAL REQUIREMENTS. Provide segmental retaining wall block meeting the style and color requirements in the contract documents. Use materials, meeting the following requirements, in the manufacture of segmental retaining wall blocks:

- Portland Cement 701-01
- Coarse Aggregate 703-02
- Mortar Sand 703-03
- Grout Sand 703-04
- Concrete Sand 703-07
- Fly Ash 711-10
- Ground, Granulated Blast-Furnace Slag 711-12
- Water 712-01

Fly ash or ground, granulated blast-furnace slag may be substituted for up to a maximum of 20% by weight of the total amount of cement plus pozzolan in the mix. Use integral coloring pigments, when required, meeting the requirements of ASTM C979. Other materials may be used in the manufacture as approved by the Director, Materials Bureau.

Physical Properties. The minimum acceptable average compressive strength of five-block samples is 28 MPa, with no individual block sample less than 24 MPa. The maximum acceptable average
freeze/thaw loss of five-block samples, subjected to 42 freeze/thaw cycles in a 3% NaCl solution, is 1.0%, with no individual sample exceeding 1.5%.

The formed dimensions of concrete retaining wall block units will not differ more than 5 mm from the nominal dimensions shown on the approved Materials Detail Drawing. Provide sound blocks, free from cracks or other defects that would interfere with the proper placing, performance, or appearance of the blocks.

**Materials Details.** At the time of application to the Approved List, submit Materials Details Drawings to the Director, Materials Bureau for approval. Prepare and submit drawings in accordance with Departmental procedural directives. Submit a unique drawing(s) for each block style under consideration.

**SAMPLING AND TESTING.** When samples are requested by the Department, randomly select them from production-run material. A minimum of 5 samples, prepared by the manufacturer in accordance with ASTM C140, will be required for compression testing. A minimum of five samples, prepared by the manufacturer in accordance with ASTM C1262, will be required for freeze/thaw testing.

Samples will be tested for compressive strength in accordance with ASTM C140. Samples will be tested for freeze/thaw durability in accordance with ASTM C1262.

**BASIS OF ACCEPTANCE.** Segmental retaining wall blocks will be accepted on the basis of the manufacturer’s name and block style appearing on the Department’s Approved List, a material certification that specifies the product conforms to this specification, and conformance to the approved materials detail drawing(s).

### 704-08 BRICK SIDEWALK AND DRIVEWAY PAVERS

**SCOPE.** This specification covers the material and quality requirements for brick pavers made from extruded fire clay or shale for use in brick paving.

**MATERIAL REQUIREMENTS.** Brick pavers shall conform to the requirements of ASTM C902, Class SX, Type I. Brick pavers shall be the shape, size, and color shown in the contract documents.

**SAMPLING AND TESTING.** Samples, when requested by the Department, shall be randomly selected from production-run material. A minimum of 10 full-size bricks of the same size and style will be required. Samples will be tested for the physical properties identified in ASTM C902. Tests will be performed in accordance with ASTM C67.

**BASIS OF ACCEPTANCE.** Brick sidewalk and driveway pavers will be accepted on the basis of a material certification that specifies the product conforms to this specification.

### 704-09 STONE BLOCKS

**SCOPE.** This specification covers the material and quality requirements for stone blocks for use in Grouted Stone Block Paved Sidewalks and Driveways.

**MATERIAL REQUIREMENTS.** Stone blocks shall be new or used granite or other stone as specified.

The blocks shall be sound and durable, reasonably uniform in quality and texture throughout, free from shale, excess mica, seams, scaling or evidence of disintegration. Color shall be as specified.

Samples of stone blocks shall be submitted to and be approved by the Engineer prior to beginning of work.

The blocks shall be rectangular in shape, with the following approximate dimensions: 200 mm - 300 mm in length, 75 mm - 125 mm in depth, unless otherwise specified or approved, and so dressed that they may be laid with a maximum of 30 mm joints or as specified. All blocks shall have one reasonably smooth split face with no projections or depressions over 5 mm. Cutting of blocks to meet the pattern requirements will be permitted subject to the approval of the Engineer.
BASIS OF ACCEPTANCE. Stone blocks shall be inspected, by the Engineer, for dimensional and color compliance upon arrival at the project location. Blocks not in compliance with the contract documents may be rejected by the Engineer.

704-10 SPLIT-FACED CONCRETE BRICK

SCOPE. This specification covers the material and quality requirements for split-faced concrete brick for use in facing structural walls.

MATERIAL REQUIREMENTS. Split-faced concrete brick shall conform to the requirements of ASTM C55, Grade N, except as noted herein. The shape, size, and color of split-faced concrete brick shall be as shown in the contract documents. The splitting operation shall leave relatively sharp, straight, and parallel edges. Materials used in the manufacture of split-faced concrete brick shall meet the requirements of the following subsections:

- Portland Cement 701-01
- Coarse Aggregate 703-02
- Mortar Sand 703-03
- Grout Sand 703-04
- Concrete Sand 703-07
- Fly Ash 711-10
- Ground, Granulated Blast-Furnace Slag 711-12
- Water 712-01

Fly ash or ground, granulated blast-furnace slag may be substituted for up to a maximum of 20% by weight of the total amount of cement plus pozzolan in the mix. Pigments used for integral coloring shall meet the requirements of ASTM C979. Other materials may be used in the manufacture as approved by the Director, Materials Bureau.

SAMPLING AND TESTING. Samples, when requested by the Department, shall be randomly selected from production-run material. A minimum of 10 full-size, split-faced bricks of the same size and style will be required. Five samples will be tested for compressive strength and five for absorption, in accordance with ASTM C140.

The manufacturer shall be responsible for having brick tested for linear drying shrinkage in accordance with ASTM C55. A copy of the test report shall be included with the samples submitted to the Department for compression and absorption testing.

BASIS OF ACCEPTANCE. Split-faced concrete brick will be accepted on the basis of a material certification that specifies the product conforms to this specification.

704-11 PRECAST CONCRETE COPING

SCOPE. This specification covers the material and quality requirements for precast concrete coping.

MATERIAL REQUIREMENTS. The Material Requirements contained in §704-03 shall apply.

DRAWINGS. The Drawing requirements contained in §704-03 shall apply.

FABRICATION. The Fabrication requirements contained in §704-03 shall apply except as noted herein. Coping shall be produced with a dense, smooth, uniform finished surface without rubbing or additional treatment. Corners shall have a maximum radius of 3 mm and grinding will not be allowed. Coping shall be removed from the forms and handled in a manner that will prevent chipping of the edges and faces of the concrete.

Repair. Surface defects, regardless of size, shall be repaired by wetting the surface to achieve a damp condition with no standing water in the holes and then filling the holes with a mortar composed of an
appropriate proportion of sand and cement having the same color and physical characteristics of the original mix. The mortar shall be allowed to partially harden and then be rubbed until a clean, uniform appearance, with no visible coating of mortar on the concrete, is obtained. The mortar repair shall be cured in the same manner as the coping unit.

**SAMPLING AND TESTING.** The Sampling and Testing requirements contained in §704-03 shall apply.

**MARKING.** The Marking requirements contained in §704-03 shall apply except as noted herein. Markings shall be placed on one end of each unit such that they won’t be exposed to view after installation.

**FINAL PRODUCTION INSPECTION.** The Final Production Inspection requirements contained in §704-03 shall apply.

**SHIPPING.** The Shipping requirements contained in §704-03 shall apply

**BASIS OF ACCEPTANCE.** The Basis Of Acceptance requirements contained in §704-03 shall apply.

**704-12 DECORATIVE CONCRETE BLOCK**

**SCOPE.** This specification covers the material and quality requirements for decorative concrete block for use in facing structural walls.

**MATERIAL REQUIREMENTS.** Decorative concrete block shall conform to the requirements of ASTM C90 except as noted herein. The shape, size, and color of decorative concrete block shall be as shown in the contract documents. Materials used in the manufacture of decorative concrete block shall meet the requirements of the following subsections:

- Portland Cement 701-01
- Coarse Aggregate 703-02
- Mortar Sand 703-03
- Grout Sand 703-04
- Concrete Sand 703-07
- Fly Ash 711-10
- Ground, Granulated Blast-Furnace Slag 711-12
- Water 712-01

Fly ash or ground, granulated blast-furnace slag may be substituted for up to a maximum of 20% by weight of the total amount of cement plus pozzolan in the mix. Pigments used for integral coloring shall meet the requirements of ASTM C979. Other materials may be used in the manufacture as approved by the Director, Materials Bureau.

**SAMPLING AND TESTING.** Samples, when requested by the Department, shall be randomly selected from production-run material. A minimum of 10 full-size decorative concrete blocks of the same size and style will be required. Five samples will be tested for compressive strength and five for absorption, in accordance with ASTM C140.

The manufacturer shall be responsible for having block tested for linear drying shrinkage in accordance with ASTM C90. A copy of the test report shall be included with the samples submitted to the Department for compression and absorption testing.

**BASIS OF ACCEPTANCE.** Decorative concrete block will be accepted on the basis of a material certification that specifies the product conforms to this specification.
704-13 PRECAST CONCRETE DRIVEWAY AND SIDEWALK PAVERS

SCOPE. This specification covers the material and quality requirements for precast concrete pavers used for driveway and sidewalk paving.

MATERIAL REQUIREMENTS. Precast concrete pavers shall meet the requirements of ASTM C936 except as noted herein. The shape, size, and color of precast concrete pavers shall be as shown in the contract documents. Materials used in the manufacture of precast concrete pavers shall meet the requirements of the following subsections:

<table>
<thead>
<tr>
<th>Material</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portland Cement</td>
<td>701-01</td>
</tr>
<tr>
<td>Coarse Aggregate</td>
<td>703-02</td>
</tr>
<tr>
<td>Mortar Sand</td>
<td>703-03</td>
</tr>
<tr>
<td>Grout Sand</td>
<td>703-04</td>
</tr>
<tr>
<td>Concrete Sand</td>
<td>703-07</td>
</tr>
<tr>
<td>Fly Ash</td>
<td>711-10</td>
</tr>
<tr>
<td>Ground, Granulated Blast-Furnace Slag</td>
<td>711-12</td>
</tr>
<tr>
<td>Water</td>
<td>712-01</td>
</tr>
</tbody>
</table>

Fly ash or ground, granulated blast-furnace slag may be substituted for up to a maximum of 20% by weight of the total amount of cement plus pozzolan in the mix. Pigments used for integral coloring shall meet the requirements of ASTM C979. Other materials may be used in the manufacture as approved by the Director, Materials Bureau.

Physical Properties. Precast concrete pavers shall meet the compressive strength and absorption requirements in ASTM C936. In addition, the maximum acceptable average freeze/thaw loss of five paver samples, subjected to 25 freeze/thaw cycles in a 10% NaCl solution, is 1.0%, with no individual sample exceeding 1.5%.

SAMPLING AND TESTING. Samples, when requested by the Department, shall be randomly selected from production-run material. A total of 15 precast concrete pavers of the same size and style will be required. Five samples will be tested for compressive strength and five for absorption, in accordance with ASTM C140. Five samples will be tested for freeze/thaw durability in accordance with NYSDOT test methods.

BASIS OF ACCEPTANCE. Precast concrete driveway and sidewalk pavers will be accepted on the basis of the manufacturer's name and location appearing on the Department’s Approved List and a material certification that specifies the product conforms to this specification.

704-14 PRECAST CONCRETE PANEL UNITS (Mechanically Stabilized Earth System)

SCOPE. This specification covers the material and quality requirements for precast concrete panel units used to construct a mechanically stabilized earth system.

MATERIAL REQUIREMENTS. The Material Requirements contained in §704-03 shall apply except as noted herein.

- Unless noted otherwise in the contract documents or approved fabrication drawings the concrete used to fabricate panel units shall have a minimum compressive strength of 35 MPa @ 28 days.
- Reinforcing steel shall be epoxy coated meeting the requirements of §709-04 or §709-08.
- Embedded items shall be as detailed on the fabrication drawings. Acceptance of embedded items will be based on manufacturer’s certification, unless otherwise directed by the Materials Bureau. When steel embeddments are required, they shall be galvanized to §719-01.

DRAWINGS. The drawing requirements contained in §704-03 shall apply.
FABRICATION. The Fabrication requirements contained in §704-03, along with the following, shall apply.

A. Corrosion Inhibitor. When required in the contract plans the concrete used shall contain a corrosion inhibitor. The use of corrosion inhibitor does not replace the requirement for epoxy coated reinforcing.

B. Dimensional Tolerances

- Panel dimensions (edge-to-edge of concrete). ±5 mm
- Panel thickness. ±5 mm
- Length difference between two diagonals (squareness). ±10 mm
- Distance between the centerline of dowel and dowel sleeve. ±5 mm
- Dimension from the face of panel to centerline of dowel and dowel sleeve, and to centerline of reinforcing steel. ±5 mm.
- Warping of the exposed panel face 5 mm in 1.5 m.
- Location of tie strips. ± 25 mm
- Location of coil embeds. ±5 mm
- Location of connection slots. ±25 mm
- Contact surfaces of each fabricated embedment assembly. ±2 mm from a straight line.
- Miscellaneous tolerances. as detailed on the fabrication drawings.

C. Coating of Concrete Units. When required in the contract plans, panel units shall be coated on all surfaces with a penetrating sealer meeting the requirements of §717-03 Penetrating Type Protective Sealers. Surfaces to be coated must be prepared by blast cleaning, removing all laitance, loose particles, etc. The surface shall be allowed to dry for 24 hours after wetting for any reason. All surface preparation work shall be completed before sealer application can commence. The coating of units shall take place prior to shipping unless otherwise approved by the Engineer.

Sealer materials shall not be applied during wet weather conditions. Any unit exposed to wetting within 12 hours of being sealed shall be recoated. Ambient and surface temperatures shall be a minimum of 4°C during application and until the sealed concrete is dry to the touch. Application by spray methods shall not be used during windy conditions.

The sealer shall be used as supplied by the manufacturer without thinning or alterations, unless specifically required in the manufacturer’s instructions. Thorough mixing of the sealer before and during use shall be accomplished as recommended by the manufacturer. Equipment for sealer application shall be clean of foreign materials. A minimum of two coats of sealer shall be applied. The total quantity of sealer applied by each coat shall be equal to the quantity required at the application rate specified in the Approved List. Each coat shall be allowed to dry before the next coat is applied. On sloping and vertical surfaces, sealer application shall progress from the bottom to the top. Care shall be taken to ensure that the entire surface of the concrete is covered and all pores filled.

SAMPLING AND TESTING. The Sampling and Testing requirements contained in §704-03 shall apply.

MARKING. The Marking requirements contained in §704-03 shall apply.

FINAL PRODUCTION INSPECTION. The Final Production Inspection requirements contained in §704-03 shall apply.

SHIPPING. The Shipping requirements contained in §704-03 shall apply.

BASIS OF ACCEPTANCE. The Basis Of Acceptance requirements contained in §704-03 shall apply.

704-15 THRU 704-22 (VACANT)
704-23 PRECAST CONCRETE STREET PAVERS

SCOPE. This specification covers the material and quality requirements for precast concrete pavers used for street paving.

MATERIAL REQUIREMENTS. Precast concrete pavers shall meet the requirements of ASTM C936 except as noted herein. The shape, size, and color of precast concrete pavers shall be as shown in the contract documents. Materials used in the manufacture of precast concrete pavers shall meet the requirements of the following subsections:

- Portland Cement 701-01
- Coarse Aggregate* 703-02
- Mortar Sand* 703-03
- Grout Sand* 703-04
- Concrete Sand* 703-07
- Fly Ash 711-10
- Ground, Granulated Blast-Furnace Slag 711-12
- Water 712-01

*Aggregates used in precast concrete street pavers shall meet the friction requirements of §501-2.02 B. 2.

Fly ash or ground, granulated blast-furnace slag may be substituted up to a maximum of 20% by weight of the total amount of cement plus pozzolan in the mix. Pigments used for integral coloring shall meet the requirements of ASTM C979. Other materials may be used in the manufacture as approved by the Director, Materials Bureau.

Physical Properties. Precast concrete pavers shall meet the compressive strength and absorption requirements in ASTM C936. In addition, the maximum acceptable average freeze/thaw loss of five paver samples, subjected to 25 freeze/thaw cycles in a 10% NaCl solution, is 1.0%, with no individual sample exceeding 1.5%.

SAMPLING AND TESTING. Samples, when requested by the Department, shall be randomly selected from production-run material. A total of 15 precast concrete pavers of the same size and style will be required. Five samples will be tested for compressive strength and five for absorption, in accordance with ASTM C140. Five samples will be tested for freeze/thaw durability in accordance with NYSDOT test methods.

BASIS OF ACCEPTANCE. Precast Concrete Street pavers will be accepted on the basis of the manufacturer's name and location appearing on the Department’s Approved List and a material certification that specifies the product conforms to this specification.

SECTION 705 - JOINT MATERIALS

705-01 PREFORMED CORK JOINT FILLER

SCOPE. This specification contains the material requirements pertaining to preformed cork joint filler.

GENERAL. The Joint Filler shall be of the dimensions shown on the plans or listed in the specifications. Each piece shall be plainly marked with the manufacturer's name.

MATERIAL REQUIREMENTS. Preformed Cork Joint Filler shall conform to the requirements of ASTM D1752, Type III (Self-expanding Cork).

BASIS OF ACCEPTANCE. Acceptance of this material will be based on the manufacturer's certification of compliance with these specification requirements.
705-02 HIGHWAY JOINT SEALANTS

SCOPE. Material requirements for hot-applied joint and crack sealants.

MATERIAL REQUIREMENTS. ASTM D 6690, Types II and/or IV, except the bond, non-immersed requirement for Type IV is 3 cycles at 100% extension at -29°C.

SAMPLING AND TESTING. Deliver sealant sampled, packaged, and marked in accordance with ASTM D 6690, to:

The New York State DOT Laboratories
1220 Washington Avenue
Albany, NY, 12206

Include the following information along with the sample:

- Manufacturer’s address, telephone number, fax number, and e-mail address.
- Type (II or IV) for which testing is requested.

BASIS OF ACCEPTANCE. Highway joint sealants will be accepted at the contract based on the product name appearing on the appropriate Approved List entitled “Highway Joint Sealants (ASTM D 6690, Type II)” or “Highway Joint Sealants (ASTM D 6690, Type IV)” under “Joint Materials, Pavements.”

705-03 PREFORMED RUBBER JOINT FILLER

SCOPE. This specification contains the material requirements pertaining to preformed rubber joint filler.

GENERAL. The joint filler shall be of the dimensions shown on the plans or in the specifications.

MATERIAL REQUIREMENTS. Preformed Rubber Joint Filler shall conform to the requirements of the Standard Specifications for ASTM D1752, Type (Sponge Rubber), except that the use of reclaimed rubber or factice will be permitted.

BASIS OF ACCEPTANCE. Acceptance of this material will be based on the manufacturer's certification of compliance with these specification requirements.

705-04 ARMORLESS BRIDGE JOINTS

SCOPE. This specification covers the material requirements for armorless bridge joint systems.

MATERIAL REQUIREMENTS. The materials used to construct the armorless bridge joint system will appear as approved materials on the Department’s Approved List for Materials and Equipment for use on NYSDOT Projects.

BASIS OF ACCEPTANCE. Acceptance of this material will be based on the manufacturer’s name and system appearing on the Department’s Approved List and a Manufacturer’s certification of conformance of the system to the approved Materials Detail Sheet (MDS.) The supplier will provide two copies of the approved Materials Details through the Contractor to the Engineer as part of the evidence of acceptability for the material at least 10 days prior to shipment of the product to the job site.

705-05 SILICONE JOINT SEALANTS FOR PAVEMENTS

SCOPE. This specification covers the material requirements for silicone joint sealants for pavements.
§705

GENERAL. Use equipment meeting §502-2.04 J, Joint Sealing (Silicone). Install the sealant in accordance with the manufacturer’s written instructions.

MATERIAL REQUIREMENTS. Silicone Joint Sealant shall conform to the following requirements:

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Specification ASTM D 5893</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tack-Free Time, min.</td>
<td>ASTM C 679</td>
<td>5 hrs. ± 10 min.</td>
</tr>
<tr>
<td>Accelerated Weathering</td>
<td>ASTM C 793</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>Flow</td>
<td>ASTM C 639</td>
<td>No Flow</td>
</tr>
<tr>
<td>Modulus of Elongation</td>
<td>ASTM D 412</td>
<td>600% (Minimum)</td>
</tr>
<tr>
<td>Bond, Non-Immersed</td>
<td>ASTM D 5329</td>
<td>Satisfactory</td>
</tr>
</tbody>
</table>

BASIS OF ACCEPTANCE. Acceptance of this material will be based on the manufacturer's name appearing on the Approved List for Joint Materials, Pavement for Silicone Joint Sealants (705-05).

705-06 CAULKING COMPOUND FOR STRUCTURES

SCOPE. This specification covers the material requirements for caulking compound for structures.

GENERAL. Caulking compound shall be applied with either a pneumatic or ratchet hand gun.

MATERIAL REQUIREMENTS. Caulking compound shall be a material which complies with Federal Specification TT-S-230 Sealing Compound, Synthetic-Rubber Base, Single Component, Chemically Curing. The color of the compound shall be cement mortar grey when tested in the manner described in TT-S-230 and compared against a color standard in possession of the Materials Bureau. This standard will be made available upon written request.

BASIS OF ACCEPTANCE. Acceptance of this material will be based on the manufacturer's certification of compliance with these specification requirements.

705-07 PREMOULDED RESILIENT JOINT FILLER

SCOPE. This specification contains the material requirements for premoulded resilient joint filler.

GENERAL. The joint filler shall be of the dimensions shown on the plans or listed in the specifications. When the material is delivered cut to dimension, it shall be banded in bundles of convenient size.

MATERIAL REQUIREMENTS. The premoulded resilient joint filler shall conform to the requirements of ASTM D1751. The asphalt content requirement may be waived if the material meets other requirements of D1751 based on supplementary testing performed by the Materials Bureau.

BASIS OF ACCEPTANCE. Application for approval of premoulded resilient joint filler shall be submitted to the Director, Materials Bureau. Upon approval, the product name and its manufacturer will be placed on the Department's Approved List. Each lift or bundle of joint filler shall be tagged by the manufacturer; the product will be accepted at the work site on the basis of the name and manufacturer of the product appearing on the tag and the Approved List. The Department reserves the right to sample and test the material after delivery at the project site.

705-08 PREFORMED, CLOSED-CELL FOAM MATERIAL

SCOPE. This specification covers the requirements for preformed, closed-cell foam material.
MATERIAL REQUIREMENTS

General. Closed-cell foam material is used primarily as the joint seal in structural expansion joint systems. The joint material shall remain unaffected by road salts and petroleum products. The material shall also be capable of maintaining a waterproof joint within the range of 50% compression and 25% tension. The joint material shall have grooves along the entire length of the bond surfaces for enhanced bonding performance. The grooves shall be 3 mm deep × 3 mm wide and spaced from 6 mm -13 mm apart.

Installation. Install the preformed, closed-cell foam material according to the manufacturer’s recommended procedure. If a bonding agent is required, it shall be one which is recommended by the manufacturer.

Physical Properties. The joint material shall be a closed-cell, cross linked, expanded polyethylene. Material will meet the properties of Table 705-1.

| TABLE 705-1 |
|-----------------|-----------------|-----------------|
| **Property**: | **Test Method**: | **Specification**: |
| | | **Minimum** | **Maximum** |
| Extrusion | ASTM D545 @ 50% Compression 3 Sides Restrained | -- | 6 mm |
| Compression Deflection | ASTM D3575, Suffix D 50% Deflection @ 25 °C | 69 kPa | 414 kPa |
| Density | ASTM D3575, Suffix W, Method A | 30 kg/m3 | 54 kg/m3 |
| Water Absorption | ASTM D545 | -- | 3 % |
| Compression Set | ASTM D1056, 50% Deflection for 22 hrs. @ 23 ± 2°C | -- | 15%@168hrs. |

DIMENSIONS. The joint material shall be of the thickness and width described in the contract documents within a tolerance of +10% and -2%. Joint material shall be heat welded to the proper dimensions by the manufacturer. No glue or chemical agents shall be used to join pieces together. No laminations in width shall be allowed.

BASIS OF ACCEPTANCE. Acceptance of this material will be based on the product name appearing on the Department’s Approved List for Preformed Closed-Cell Foam Material.

705-09 PREFORMED ELASTIC BRIDGE JOINT SEALER

SCOPE. This specification covers the material requirements for preformed elastic bridge joint sealer for use in bridge joints.

MATERIAL REQUIREMENTS. The preformed elastic joint sealer material shall be vulcanized elastomeric compound using polymerized chloroprene as the only basic elastomer.

Flexibility. The sealer shape shall be capable of withstanding compression, rotation, or other joint movements without change in the position of the point of foldability, misalignment, or other conditions felt detrimental by the Director, Materials Bureau. The sealer shall exhibit sufficient sealing pressures throughout its expected compression range to assure that no deleterious materials enter the joint.

The joint sealer material shall be tested in accordance with AASHTO M297 except that Compression Deflection properties shall be determined in accordance with Department written instructions. Compression Deflection Properties, LCmin and LCmax, shall comply to that specified in Table 705-2. Test specimens shall be cut and/or buffed from joint seal samples.
### TABLE 705-2 COMPRESSION DEFLECTION PROPERTIES

<table>
<thead>
<tr>
<th>Nominal Seal Size (mm)</th>
<th>LC Min.%</th>
<th>LC Max.%</th>
</tr>
</thead>
<tbody>
<tr>
<td>76 or less</td>
<td>85</td>
<td>55</td>
</tr>
<tr>
<td>89</td>
<td>85</td>
<td>50</td>
</tr>
<tr>
<td>102</td>
<td>85</td>
<td>48</td>
</tr>
<tr>
<td>127</td>
<td>85</td>
<td>45</td>
</tr>
<tr>
<td>152</td>
<td>90</td>
<td>45</td>
</tr>
</tbody>
</table>

**DIMENSIONS.** The measured width and depth of joint seal material shall meet the minimum and maximum allowable dimensions as determined from the original drawings and the applied tolerances.

**Dimensional Tolerances.** The nominal height of the uncompressed sealer shall be greater than or equal to the nominal uncompressed width.

The measured width and height of joint material shall satisfy the minimum and maximum allowable dimensions as determined from the nominal dimensions shown on the approved drawings and the following dimensional tolerances.

A dimensional tolerance of ±5% of the nominal dimensions shall be applied to seals less than 102 mm in width. A dimensional tolerance of ±6.4 mm shall be applied to the nominal dimensions for seals greater than or equal to 102 mm in width.

**SERVICEABILITY**

**Installation and Performance Requirements.** Each lot of joint sealer submitted for Department approval shall demonstrate that it possesses the properties necessary for satisfactory field installation.

The sealer shall not exhibit any twisting, rolling, misalignment of opposite top edges, tendencies to trap incompressibles or any other qualities which shall be deemed detrimental by the Department to the sealer's proper installation and performance.

**Joint Wall Contact with Sealer.** The top edges of the vertical walls shall remain in contact with the joint sealer faces throughout the compression range to which the sealer will be subjected in use.

**Lubricant.** The lubricant used to install the sealer shall conform to the requirements of §705-13, Lubricant for Preformed Elastic Joint Sealer, unless otherwise specified in the proposal.

**BASIS OF ACCEPTANCE.** Preformed elastic bridge joint sealer will be accepted on the basis of the manufacturer's name and location appearing on the Department's Approved List and a material certification that specifies the product conforms to this specification.

### 705-10 PREFORMED ELASTIC LONGITUDINAL JOINT SEAL

**SCOPE.** This specification covers the material requirements for preformed elastic joint seal for use in longitudinal concrete pavement joints.

**GENERAL.** The preformed elastic material shall be a vulcanized elastomeric compound using polymerized chloroprene as the only basic elastomer. The shape of any joint seal shall be approved by the Director of the Materials Bureau prior to the submission of any individual production lot for approval.

Such approval shall be requested in writing and be accompanied by a detailed drawing of the shape and a 4.5 m length of the proposed seal. The lubricant used to install the joint seal shall conform to §705-13, Lubricant for Preformed Elastic Joint Sealer, unless otherwise specified.

**MATERIAL REQUIREMENTS**

**Physical Requirements.** The joint seal material shall be tested in accordance with AASHTO M220 and meet the physical requirements therein. The requirements for compression-deflection, ozone resistance, and low-temperature recovery @ -10°C are waived.
The minimum percentage requirements for low-temperature recovery at -29°C, and for high temperature recovery at 100°C, shall be modified to 75%. Measurements for recovery may be made using an electronic caliper in addition to methods specified. The following exceptions shall be made to the recovery test when the seal shape has lips (a small protrusion on the top longitudinal edge). The seal shall be compressed to 50% of the nominal width of the seal. The denominator for the percent recovery calculation, however, shall be the width between the outer edges of the lips provided on the manufacturer's drawing. The numerator or recovered width shall be measured between the outer edges of the lips.

**BASIS OF ACCEPTANCE.** Preformed elastic longitudinal joint sealer will be accepted on the basis of a material certification that specifies the product conforms to this specification.

### 705-11 POLYVINYL CHLORIDE EXTRUDED SHAPES AND SHEET MATERIAL

**SCOPE.** This specification covers the quality requirements for polyvinyl chloride extruded shapes and sheet material for use in expansion, contraction, construction joints and drainage troughs.

**GENERAL.** The PVC material from which the shapes shall be extruded shall not contain any reclaimed, reground or reworked material whatsoever, but shall be compounded from virgin PVC resins, plasticizers, stabilizers and such materials that when compounded it shall meet the physical requirements contained in this specification.

Material shall be extruded in such a manner that all cross sections shall be dense, homogeneous and free from porosity or other imperfections.

The dimensional tolerances shall be as shown on the plans.

All splices shall be heat welded as approved by the Engineer.

Each extrusion shall be plainly marked at 1.5 m intervals with the manufacturer's name, lot number, and type.

**MATERIAL REQUIREMENTS.** The material for the extruded shapes shall meet the following performance requirements:

<table>
<thead>
<tr>
<th>Property</th>
<th>ASTM Test Method</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile strength, kPa</td>
<td>D412, Die C</td>
<td>9650 min.</td>
</tr>
<tr>
<td>Ultimate elongation, percent</td>
<td>D412, Die C</td>
<td>250 min.</td>
</tr>
<tr>
<td>Hardness, Type A durometer</td>
<td>D2240 **</td>
<td>65-88</td>
</tr>
<tr>
<td>Resistance to alkali</td>
<td>D543</td>
<td>-</td>
</tr>
<tr>
<td>Weight change, percent</td>
<td>-</td>
<td>-0.10 to +0.25</td>
</tr>
<tr>
<td>Hardness, Type A durometer points change</td>
<td>-</td>
<td>+5</td>
</tr>
<tr>
<td>Tensile strength, percent change</td>
<td>-</td>
<td>-15 max.</td>
</tr>
<tr>
<td>Water absorption, 48 hours percent</td>
<td>D570</td>
<td>0.5 max.</td>
</tr>
<tr>
<td>Specify gravity</td>
<td>D792</td>
<td>1.42 max.</td>
</tr>
</tbody>
</table>

* The hardness test shall be performed in accordance with D2240 except that the material is pressed to the durometer by thumb.
** Resistance to alkali. A specimen, weighing about 75 g, will be cut from the sample. The specimen will be washed in tap water, rinsed with distilled water, wiped with a clean cloth, and allowed to dry in laboratory air for approximately 1 hour. The weight of each specimen, to the nearest 0.001 g, will be recorded. The durometer reading will be taken as noted above. The specimens will be completely immersed in a freshly made solution containing 5.0 g of chemically pure potassium hydroxide and 5.0 g of chemically pure sodium hydroxide in one liter of distilled water, kept at 21°C to 24°C. At the end of seven days the specimens will be removed, rinsed with distilled water, the surfaces wiped with a clean cloth, and allowed to dry in laboratory air for approximately 1 hour. The weight and durometer hardness will be measured and recorded. Tensile strength shall be determined as noted above. The weight and tensile strength change shall be reported as a percentage of the original readings. The hardness change will be reported as the change relative to the original reading.

**Cold Bend Test.** A cold bend test shall be made by subjecting a 13 mm by 152 mm by 3 mm strip of extrusion material to a temperature of -29°C for 2 hours. The strip shall immediately thereafter be bent 180 degrees around a rod of 6 mm diameter by applying sufficient force to hold the sample in intimate contact with the rod. The sample shall then be examined for evidence of cracking. There shall be no cracking of the samples.
**BASIS OF ACCEPTANCE.** Polyvinyl chloride extruded shapes and sheet material will be accepted on the basis of the manufacturer's name and location appearing on the Department’s Approved List and a material certification that specifies the product conforms to this specification.

**705-12 PREFORMED ELASTIC TRANSVERSE CONTRACTION AND EXPANSION JOINT SEAL**

**SCOPE.** This specification covers the material requirements for preformed elastic joint seal for use in transverse contraction joints and transverse expansion joints in concrete pavement.

**GENERAL.** The preformed elastic material shall be a vulcanized elastomeric compound using polymerized chloroprene as the only basic elastomer. The shape of any joint seal, from any manufacturer, shall be approved by the Director of the Materials Bureau prior to the submission of any individual production lot for approval. Such approval shall be requested in writing and be accompanied by a detailed drawing of the shape and a 4.5 m length of the proposed seal. The lubricant used to install the joint seal shall conform to §705-13, Lubricant for Preformed Elastic Joint Sealer, unless otherwise specified.

**MATERIALS REQUIREMENTS**

**Geometric Requirements.** Joint seals shall meet the geometric requirements in the following table:

<table>
<thead>
<tr>
<th>PROPERTY OR REQUIREMENT AT SPECIFIED WIDTH</th>
<th>TYPE OF SEAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall width, min.</td>
<td>Transverse Contraction</td>
</tr>
<tr>
<td>17 mm</td>
<td>20 mm</td>
</tr>
<tr>
<td>Contact Dimension, min.</td>
<td>Transverse Contraction</td>
</tr>
<tr>
<td>17 mm @ 16 mm width</td>
<td>20 mm @ 16 mm width</td>
</tr>
<tr>
<td>Overall depth, max.</td>
<td>Transverse Contraction</td>
</tr>
<tr>
<td>50 mm @ 13 mm width</td>
<td>50 mm @ 13 mm width</td>
</tr>
</tbody>
</table>

**Physical Requirements.** For all properties except compression-deflection, low-temperature recovery @ -10°C, and ozone resistance, the joint seal material shall be tested in accordance with AASHTO M220 and meet the physical requirements therein. The requirements for compression-deflection, low-temperature recovery @ -10°C and ozone resistance are waived. Measurements for recovery may be made using an electronic caliper in addition to methods specified.

The following exceptions shall be made to the recovery test when the seal shape has a lip (a small protrusion at the top longitudinal edge). The seal shall be compressed to 50% of the nominal width of the seal. The denominator for the percent recovery calculation, however, shall be the width between the outer edges of the lips on the manufacturer's drawing. The numerator or recovered width shall be measured between the outer edges of the lips.

**Force-Deflection Requirements.** Force-Deflection properties shall be determined in accordance with the force-deflection test established by the Materials Bureau. A description of this test is available on request from the Materials Bureau.

The preformed elastic transverse joint seal shall conform to the following force-deflection requirements:
<table>
<thead>
<tr>
<th>PROPERTY OR REQ. AT SPECIFIED WIDTH</th>
<th>TYPE OF SEAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>17 mm</td>
<td>20 mm</td>
</tr>
<tr>
<td>Transverse</td>
<td>Transverse Contraction</td>
</tr>
<tr>
<td>Contraction</td>
<td>Width</td>
</tr>
<tr>
<td>Min. Resisting Force (N/mm) @ 16 mm width</td>
<td>0.5</td>
</tr>
<tr>
<td>Max. Resisting Force (N/mm) @ 13 mm width</td>
<td>1.9</td>
</tr>
</tbody>
</table>

The seal shall not creep more than 6 mm horizontally during force-deflection testing, nor shall there be any loss of contact between the top edges of the seal and the compression plates. All test sections used in the above procedures shall be cut and/or buffed from the joint seal specimens.

**BASIS OF ACCEPTANCE.** Preformed elastic transverse contraction expansion joint sealers will be accepted on the basis of a material certification that specifies the product conforms to this specification.

### 705-13 LUBRICANT FOR PREFORMED ELASTIC JOINT SEALER

**SCOPE.** This specification covers the lubricant used for the installation of preformed elastic joint sealers.

**GENERAL.** The lubricant shall be a one-component polychloroprene compound containing only soluble phenolic resins blended together with anti-oxidants and acid acceptors in an aromatic hydrocarbon solvent mixture.

**MATERIAL REQUIREMENTS.** The lubricant shall meet the following physical requirements:

- For use with concrete pavement sealers the lubricant shall conform to the requirements of ASTM D2835.
- For use with bridge sealers the lubricant shall conform to the requirements of ASTM D4070.

**PACKAGING.** Each lot of the lubricant shall be delivered in containers plainly marked with the manufacturer's name or trademark, lot number and date of manufacture.

**BASIS OF ACCEPTANCE.** The basis of acceptance for the lubricant shall be the manufacturer's certification as to compliance with this specification which shall accompany the material delivered to the job site. Any lubricant not used within 270 days of its manufacture shall be unacceptable. The Department reserves the right to sample and test this material subsequent to delivery at the project site.

### 705-14 LONGITUDINAL JOINT TIES

**SCOPE.** This specification details the requirements for longitudinal joint ties (LJTs) and their support assemblies used at longitudinal joints in portland cement concrete (PCC) pavement.

**GENERAL.** LJTs are either one-piece deformed bar reinforcement or multiple-piece systems consisting of deformed bar reinforcement with 1 or 2 threaded ends and a coupler. For longitudinal joints between lanes placed simultaneously, one-piece LJTs must be supported by an assembly that secures them in position when the assembly is affixed to the underlying pavement layer. For longitudinal joints between lanes placed separately, the LJTs are either:

- Loose, one-piece, deformed bars drilled and anchored into the vertical placement edge.
- Loose, multiple-piece systems.
In the latter case, the first piece is bolted to the paving forms in the initial concrete placement and the second piece threaded into the first piece after form removal from the initial placement. Refer to Section 502, PCC Pavement, to identify which method is used.

All LJTs not referenced on the Department’s Approved List entitled “Longitudinal Joint Ties (705-14),” under “Joint Materials, Pavement,” will be subject to approval testing before their use is allowed on Department contracts. Submit approval applications to the Director, Materials Bureau, at least 120 days before their intended use. Approved LJTs and their support assemblies will be placed on the Approved List and referenced by the drawing number and approval date. Any change to a previously approved LJT requires approval by the Director, Materials Bureau, before its use.

In case of conflict between the requirements of this specification and specifications referenced herein, the requirements of this specification or the instructions of the Director, Materials Bureau, will apply.

The Department may perform supplementary sampling and testing of the LJTs that arrive at Department contracts.

MATERIAL REQUIREMENTS

A. **Deformed Bar Reinforcement.** Obtain deformed bar reinforcement from a manufacturer appearing on the Department’s Approved List entitled “Reinforcing Bars (709-01),” under “Reinforcing, Steel.” Use number 19 deformed bars made of Grade 420 steel. Materials other than steel may be proposed, but their use is subject to the approval of the Director, Materials Bureau.

Use one-piece LJTs having lengths as required by Section 502, PCC Pavement, and the associated 502 Standard Sheets for PCC Pavement, i.e.:

- 900 mm between travel lanes placed simultaneously (in support assemblies).
- 700 mm between travel lanes placed separately (drill and anchor method).
- 500 mm between a travel lane and PCC shoulder placed simultaneously (in support assemblies).
- 450 mm between a travel lane and PCC shoulder placed separately (drill and anchor method).

Use multiple-piece LJTs having lengths of 900 mm between travel lanes placed separately and 500 mm between a travel lane and a PCC shoulder placed separately. The length of a multiple-piece LJT includes only the deformed bar segment lengths, not the thread lengths nor the coupling length. When assembled, the coupler must cover all threads in the threaded ends.

B. **Coatings.** All LJT components must be epoxy-coated steel except for threaded connections. Coatings other than epoxy (and their applicators) may be proposed, but their use is subject to the approval of the Director, Materials Bureau. Use an epoxy coating appearing on one of the following Approved Lists under, “Reinforcing, Epoxy and Coating:”

- Epoxy Coatings for Steel Reinforcing Bars (709-04).
- Epoxy Coatings for Longitudinal Joint Ties (705-14).

Apply the epoxy coating in accordance with “Coating Application” in §709-04, Epoxy Coated Bar Reinforcement, by an epoxy coating applicator appearing on one of the following Approved Lists under “Reinforcing, Epoxy and Coating:”

- Applicators for Steel Reinforcing Bars (709-04).
- Epoxy Coatings for Longitudinal Joint Ties (705-14).

Coatings must be continuous over the bar length, including couplers for multiple-piece ties, and 0.20 mm - 0.30 mm thick. Coatings must be within 6 mm of threaded ends in multiple-piece ties. The cross-sectional ends of the bars may be uncoated.

Damaged coatings may be repaired at the epoxy coating applicator’s facility or at the fabricator’s facility in accordance with “Repair of Coated Bars” in §709-04, Epoxy Coated Bar Reinforcement. Field repair of damaged coating is allowed, provided the damage is less than 25 mm long in any direction and more than 100 mm from the center of the bar or the threaded ends. Use a patching material supplied by the epoxy coating manufacturer that is compatible with the epoxy coating and inert in concrete.
Follow the manufacturer’s written recommendations regarding surface preparation and application. Provide those recommendations to the Engineer before field repairs are made. Apply the patching material to the damaged area only. Dipping the bar into the patching material, or liberally coating undamaged areas, is not allowed. Epoxy-coated bars with perforations, cracks, other damage, or improperly applied coatings will be rejected.

C. LJT Support Assemblies. Support one-piece LJTs in longitudinal joints between lanes placed simultaneously in assemblies or “baskets” that securely hold more than 1 LJT in position as detailed in Geometric Requirements below. Fabricate the assemblies using steel wire as depicted in the approved Materials Details. Affix 1 or both ends of each LTD to the assembly by welding or mechanical fixation within 50 mm of the end of the LJT.

D. Corrosion Inhibitors for Threaded Connections (Multiple-piece LJTs Only). Use one of the following:
- Medium setting asphalt emulsion meeting Table 702-5, Asphalt Emulsions.
- Thread-sealing compound approved by the Materials Bureau.

Apply the corrosion inhibitor to all threaded connections before the LJTs are assembled such that all surfaces of the assembled LJT are covered with an unbroken seal of epoxy coating or corrosion inhibitor. Do not apply corrosion inhibitors to bolts that hold multiple-piece LJTs to forms.

GEOMETRIC REQUIREMENTS. Unless otherwise indicated in the contract documents, fabricate the support assemblies or bolt multiple-piece LJTs to forms such that the:
- Assembly holds at least 2 LJTs.
- Entire longitudinal axis of each bar is located at the middepth of the pavement slab (25 mm).
- Longitudinal axes of the bars are aligned perpendicular to the pavement centerline and parallel with the pavement surface such that the maximum misalignment of 1 bar end relative to the other is 25 mm.
- Midpoint of the longitudinal axis of each bar is at the center of the joint (25 mm).
- Longitudinal axes of adjacent bars do not exceed the maximum spacing identified in the contract documents.
- Bars are 75 mm (minimum) away from other LJTs or transverse joint supports.

TESTS

A. Materials Details – LJT Support Assemblies. The LJT manufacturer must submit 3 Materials Details (shop drawings) to the Director, Materials Bureau, for review and approval before any other testing begins. The Materials Details must depict the following minimum information:
- Manufacturer’s name, address, telephone number, fax number, and e-mail address.
- Drawing number.
- Support assembly dimensions and tolerances.
- LJT positioning within the joint support assembly.
- LJT ASTM steel grade designation.
- A cross section showing the relative positioning of LJTs to their support legs.
- Method used to affix LJTs to the support assembly and the locations of points of fixation.
- Methods used to affix wires together in the support assembly and the locations of points of fixation.
- Diameter of wires used in joint support assembly fabrication including wires used as assembly frames, LJT support legs, stakes, and spacer wires, if any.
- A detail of wire legs that hold LJTs to the support assembly.
- A detail of the stakes used to hold the supports to the underlying pavement layers during construction.
- The positioning and number of stakes required to hold the supports to the underlying pavement layers during construction. The minimum number of stakes must equal the number of LJTs in the assembly.
B. Materials Details – Multiple-Piece LJTs. The LJT manufacturer must submit 3 Materials Details (shop drawings) to the Director, Materials Bureau, for review and approval before any other testing begins. The Materials Details must depict the following minimum information:

- Manufacturer’s name, address, telephone number, fax number, and e-mail address.
- Drawing number.
- Length of threaded ends.
- Thread size designations.
- LJT ASTM steel grade designation.
- Coupler dimensions and tolerances.
- Method used to affix LJTs to forms.

C. Joint Support Assemblies. Submit 2 complete LJT support assemblies and 6 loose, epoxy-coated LJTs to the Director, Materials Bureau, for conformance verification with the submitted Materials Details and this specification.

D. One-Piece LJTs. In addition to meeting Grade 420 yield strength requirements of the ASTM designation indicated on the Materials Details, epoxy-coated deformed bars must meet the Chemical Resistance, Cathodic Disbondment, Salt Spray Resistance, Coating Flexibility, Relative Bond Strength in Concrete, and Impact Test requirements of AASHTO M284 (ASTM A775), Epoxy Coated Steel Reinforcing Bars.

E. Multiple-Piece LJTs.Submit 12 multiple-piece LJTs to the Director, Materials Bureau, for conformance verification with the submitted Materials Details and this specification. When assembled, the multiple-piece ties shall have minimum yield strengths of 410 MPa. Also, multiple-piece LJTs must meet the Chemical Resistance, Cathodic Disbondment, Salt Spray Resistance, Coating Flexibility, Relative Bond Strength in Concrete, and Impact Test requirements of AASHTO M284 (ASTM A775), Epoxy Coated Steel Reinforcing Bars.

BASIS OF ACCEPTANCE. Longitudinal Joint Ties will be accepted at the contract based on the Manufacturer’s appearance on the Department’s Approved List entitled “Longitudinal Joint Ties (705-14),” under “Joint Materials, Pavement.” The contractor shall provide 2 copies of each of the following to the Engineer:

- Approved Materials Details identified by drawing number and approval date as shown on the Approved List.
- Manufacturer’s certification that the LJTs were manufactured in accordance with this specification and the submitted Materials Details.
- The name, address, telephone number, and e-mail address of the rolling mill that manufactured the LJTs and the mill’s certification as to the type, grade, and ASTM designation of steel used in the LJTs.
- The brand name of the epoxy coating used on the LJTs and the name, address, telephone number, and e-mail address of the manufacturer.
- The name, address, telephone number, and e-mail address of the epoxy coating applicator and the applicator’s certification that the coatings were applied in conformance to this specification.
- The brand name of the corrosion inhibitor for threaded coatings used on multiple-piece LJTs and the name, address, telephone number, and e-mail address of the manufacturer.

705-15 TRANSVERSE JOINT SUPPORTS

SCOPE. This specification details the requirements for load transfer devices (LTDs) and their support assemblies used at transverse joints in portland cement concrete (PCC) pavement.

GENERAL. All Transverse Joint Supports not referenced on the Department's Approved List entitled “Transverse Joint Supports (705-15),” under “Joint Materials, Pavement,” will be subject to approval testing before their use is allowed on Department contracts. Submit approval applications to the
Director, Materials Bureau, at least 120 days before their intended use. Approved supports will be placed on the Approved List and referenced by the drawing number and approval date. Any change to a previously approved transverse joint support requires approval by the Director, Materials Bureau before its use.

In case of conflict between the requirements of this specification and specifications referenced herein, the requirements of this specification or the instructions of the Director, Materials Bureau, will apply.

The Department may perform supplementary sampling and testing of the joint supports assemblies that arrive at Department contracts.

MATERIAL REQUIREMENTS

**A. Dowels.** Dowels are the LTD component of transverse contraction and expansion joint support assemblies. They are also used at transverse construction joints. Obtain dowels from a manufacturer appearing on the Department’s Approved List entitled “Reinforcing Bars (709-01),” under “Reinforcing, Steel.”

Use 460 mm long dowels made of plain, Grade 420 steel bar reinforcement having uniform circular cross sections for their entire lengths. Saw cut dowel ends such that they are free of burrs or projections. Materials other than steel may be proposed, but their use is subject to the approval of the Director, Materials Bureau. Dowel diameters vary with pavement thickness as detailed in the Section 502 Standard Sheets. Coating thickness is not included in the dowel diameter.

**B. Deformed Bar Reinforcement.** Deformed bar reinforcement is the LTD component of transverse hinge joint support assemblies. Obtain bars from a manufacturer appearing on the Department’s Approved List entitled “Reinforcing Bars (709-01),” under “Reinforcing, Steel.” Use number 19 deformed bars, 600 mm long, made of Grade 420 steel. Materials other than steel may be proposed, but their use is subject to the approval of the Director, Materials Bureau.

**C. Coatings.** Steel LTDs (dowels and deformed bars) must be epoxy coated. Coatings other than epoxy (and their applicators) may be proposed, but their use is subject to the approval of the Director, Materials Bureau. Use an epoxy coating appearing on one of the following Approved Lists under “Reinforcing, Epoxy and Coating:”

- Epoxy Coatings for Steel Reinforcing Bars (709-04).
- Epoxy Coatings for Longitudinal Joint Ties (705-14).

Apply the epoxy coating in accordance with “Coating Application” in §709-04, Epoxy Coated Bar Reinforcement, by an epoxy coating applicator appearing on one of the following Approved Lists under “Reinforcing, Epoxy and Coating:”

- Applicators for Steel Reinforcing Bars (709-04).
- Epoxy Coatings for Longitudinal Joint Ties (705-14).
- Epoxy Coatings for Dowel Bars for Transverse Joint Supports (705-15).

Coatings must be continuous over the length of the LTD and 0.25 mm – 0.45 mm thick, except for the cross-sectional ends, which may be uncoated. Field repair of damaged coatings is not allowed. Plant or facility repairs are not allowed unless the damage results from welding or mechanical fixation to the support assembly and is within 25 mm of the weld or fixation point. Such damage must be repaired before visible rust occurs. Use a patching material supplied by the epoxy coating manufacturer that is compatible with the epoxy coating and inert in concrete. Apply the patching material to the damaged area only. Dipping the LTD into the patching material, or liberally coating undamaged areas, is not allowed. Supports containing LTDs with perforated, cracked, otherwise damaged, or improperly applied coatings will be rejected.

Completely coat each dowel with a bond breaker applied at the epoxy coating applicator facility or the joint support assembly facility. The bond breaker is subject to approval by the Materials Bureau. Do not apply a bond breaker to deformed bar reinforcement.
§705

D. Premoulded Resilient Joint Filler (§705-07). Use 10 mm – 15 mm thick filler in transverse expansion joint assemblies only.

E. Joint Support Assemblies. Support LTDs in assemblies or “baskets” that securely hold them in position as detailed in Geometric Requirements below. Fabricate the assemblies using steel wire as depicted in the approved Materials Details. Affix 1 end of each LTD to the assembly by welding or mechanical fixation. Affix alternating ends of adjacent LTDs to the assembly such that the point of fixation is within 50 mm of the end of the LTD.

GEOMETRIC REQUIREMENTS

A. Transverse Contraction Joints. Unless otherwise indicated in the contract documents, fabricate the support assemblies such that the:
   • Entire longitudinal axis of each dowel is located at the middepth of the pavement (± 6 mm).
   • Longitudinal axes of the dowels are aligned parallel with the pavement centerline and pavement surface such that the maximum misalignment of one dowel end relative to the other is 4 mm.
   • Midpoint of the longitudinal axis of each dowel is at the center of the joint (± 25 mm).
   • Longitudinal axes of the two end dowels are 100 mm - 200 mm from the longitudinal joints.
   • Longitudinal axes of the dowels are spaced 100 mm - 300 mm apart.

B. Transverse Expansion Joints. Fabricate the support assemblies such that the dowels are positioned in accordance with paragraph A, Transverse Contraction Joints. Include a one-piece premoulded resilient joint filler in the assembly that extends completely across the slab width. The joint filler must either equal the full depth of the slab, or extend from the bottom of the slab to within 40 mm - 50 mm of the top of the slab with a finishing cap that extends to the top of the slab.
   Vertically support the filler at the longitudinal midpoints of the dowels and perpendicular to the longitudinal axes of the dowels. Depict support mechanisms in the Materials Details. Do not weld the dowels to filler supports.
   Place plastic expansion caps on the free ends of the dowels (the ends opposite the fixed ends). Use expansion caps with essentially the same inner diameter as the outer diameter of the dowel plus coating thickness (+ 1 mm).

C. Transverse Hinge Joints. Unless otherwise indicated in the contract documents, fabricate the support assemblies such that the:
   • Entire longitudinal axis of each deformed bar is located at the middepth of the pavement slab (± 25 mm).
   • Longitudinal axes of the deformed bars are aligned parallel with the pavement centerline and pavement surface such that the maximum misalignment of one bar end relative to the other is 25 mm.
   • Midpoint of the longitudinal axis of each bar is at the center of the joint (± 25 mm).
   • Longitudinal axes of the two end bars are 100 mm - 300 mm from the longitudinal joints.
   • Longitudinal axes of the bars are spaced 100 mm - 450 mm apart.

TESTS

A. Materials Details. The transverse joint support manufacturer must submit 3 Materials Details (shop drawings) to the Director, Materials Bureau, for review and approval before any other testing begins. Depict only one type of joint on each detail submitted for approval. The Materials Details must depict the following minimum information:
   • Manufacturer’s name, address, telephone number, fax number, and e-mail address.
   • Type of support (contraction, expansion, or hinge joint).
   • Drawing number.
   • Joint support assembly dimensions and tolerances.
   • LTD length, spacing, and positioning within the joint support assembly.
   • LTD ASTM steel grade designation.
• Bond breaker brand name and manufacturer.
• A cross section showing the relative positioning of LTDs to their support legs.
• Method used to affix LTDs to the support assembly and the locations of points of fixation.
• Methods used to affix wires together in the joint support assembly and the locations of points of fixation.
• Diameter of wires used in joint support assembly fabrication including wires used as assembly frames, LTD support legs, premoulded resilient joint filler supports (expansion joints only), stakes, and spacer wires that hold cages in place during transport.
• A detail of wire legs that hold LTDs to the support assembly.
• A detail of the stakes used to hold the supports to the underlying pavement layers during construction.
• The positioning and number of stakes required to hold the supports to the underlying pavement layers during construction.
• Methods used to support premoulded resilient joint fillers (expansion joints only).
• Expansion cap material and dimensions (expansion joints only).

B. Joint Support Assemblies. Submit 2 complete joint support assemblies and 6 loose, epoxy-coated LTDs to the Director, Materials Bureau, for conformance verification with the submitted Materials Details and this specification.

C. Epoxy-Coated Dowels. In addition to meeting the Grade 420 yield strength requirements of the ASTM designation indicated on the Materials Details, epoxy-coated dowels must meet the Load-Deflection, Pull-out, Abrasion, Corrosion, Chemical Resistance, Cathodic Disbonding, Coating Hardness, and Coating Impact Resistance requirements of AASHTO M254, Corrosion-Resistant Coated Dowel Bars, when tested in accordance with AASHTO T253, Coated Dowel Bars.

D. Epoxy-Coated Deformed Bar Reinforcement. In addition to meeting Grade 420 yield strength requirements of the ASTM designation indicated on the Materials Details, epoxy-coated deformed bars must meet the Chemical Resistance, Cathodic Disbondment, Salt Spray Resistance, Coating Flexibility, Relative Bond Strength in Concrete, and Impact Test requirements of AASHTO M284 (ASTM A775), Epoxy Coated Steel Reinforcing Bars.

E. Field Test. Only joint support assemblies meeting the above test requirements will be considered for trial installation in a field test. The supplier or manufacturer is responsible for coordinating the field test. The field test location may be:
• Part of a Department contract.
• Part of a contract under the jurisdiction of an agency other than the Department.
• A test site arranged by the supplier or manufacturer.

If the field test is outside New York State, the location must meet the approval of the Director, Materials Bureau.

If the field test is part of a Department contract, the Contractor must obtain the Engineer’s approval before any support assemblies are installed. If the field test is at a test site arranged by the supplier/manufacturer, install the joint support assemblies in a 200 m long (minimum) pavement constructed in accordance with Section 502, Portland Cement Concrete Pavement. In any case, a minimum of 50 joints must be constructed using the joint supports.

Conduct field tests in the presence of Materials Bureau personnel. Specific attention will be given to handling, coating integrity, damage, alignment before and after paving, fixation failure, securing to underlying layers, contraction joint formation, and general specification conformance. Failing assemblies, and the pavement they are constructed into if part of a Department contract, will be rejected and removed and replaced at no cost to the State.

The Director, Materials Bureau, may waive field tests for hinge and expansion joint assemblies or from manufacturers who have an established history of successful contraction joint assembly installations with the Department.
§705

BASIS OF ACCEPTANCE. Transverse joint supports will be accepted at the contract based on the Manufacturer’s appearance on the Department's Approved List entitled “Transverse Joint Supports (705-15),” under “Joint Materials, Pavement.” The contractor shall provide 2 copies of each of the following to the Engineer:

- Approved Materials Details identified by drawing number and approval date as shown on the Approved List.
- Manufacturer’s certification that the joint supports were manufactured in accordance with this specification and the submitted Materials Details.
- The name, address, telephone number, and e-mail address of the rolling mill that manufactured the LTDs and the mill’s certification as to the type, grade, and ASTM designation of steel used in the LTD.
- The brand name of the epoxy coating used on the LTDs and the name, address, telephone number, and e-mail address of the manufacturer.
- The name, address, telephone number, and e-mail address of the epoxy coating applicator and the applicator’s certification that the coatings were applied in conformance to this specification.
- The brand name of the bond breaker used on the dowels and the name, address, telephone number, and e-mail address of the manufacturer.

705-16 CONCRETE PIPE JOINT SEALING COMPOUND

SCOPE. This specification covers a flexible/rubber sealer used for joints in elliptical pipe, cattle pass and drainage units.

MATERIAL REQUIREMENTS. Concrete pipe joint sealing compound shall conform to the requirements of either AASHTO M198 Type B or ASTM C990.

BASIS OF ACCEPTANCE. Label stating conformance to either AASHTO M198 Type B or ASTM C990. Labels shall be either attached directly to the sealing compound or to the packaging in which the compound arrives at the project site.

705-17 CONCRETE PIPE JOINT ELASTOMERIC GASKETS

SCOPE. This specification covers elastomeric gaskets used for joints in round pipe.

MATERIAL REQUIREMENTS. Concrete pipe joint elastomeric gaskets shall conform to the requirements of either ASTM C443 or ASTM C361.

BASIS OF ACCEPTANCE. Label stating conformance to either ASTM C443 or ASTM C361. Label shall be either stenciled on the elastomeric gaskets, attached directly to the gaskets or attached to the packaging in which the gaskets arrive at the project site.

705-18 THRU 705-20 (VACANT)

705-21 MASONRY MORTAR

SCOPE. Requirements for the 3 common types of masonry mortar (N, S and M - increasing in strength, respectively). Use these mortars to bind masonry units together to construct masonry structures, repair masonry structures (tuck pointing), or bed and bond masonry or concrete units together. For historic masonry structures made with soft hydrated lime mortars, use a specially designed lime mortar as shown in the Contract Documents or as approved by the Engineer.

Type N Masonry Mortar- for tuck pointing repair of structures made with fired clay bricks
Type S Masonry Mortar- for new structures made with all types of masonry, including brick
“ ” ” - for tuck pointing repair of structures made with masonry other than clay brick
Type M Masonry Mortar- for new and tuck pointing repair of rigid masonry riding surfaces, such as bridge decks, pavements, sidewalks, and other roadway areas subject to severe weathering and abrasion conditions

**MATERIAL REQUIREMENTS**

<table>
<thead>
<tr>
<th>Material Requirement</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portland Cement, Type II or VI</td>
<td>§701-01</td>
</tr>
<tr>
<td>Masonry or Mortar Cement, Type N, S or M</td>
<td>§701-02</td>
</tr>
<tr>
<td>Blended Portland Cement</td>
<td>§701-03</td>
</tr>
<tr>
<td>Mortar Sand</td>
<td>§703-03</td>
</tr>
<tr>
<td>Concrete Sand</td>
<td>§703-07</td>
</tr>
<tr>
<td>Water</td>
<td>§712-01</td>
</tr>
</tbody>
</table>

Proportion the N, S or M mortar type by loose volume parts as follows:

<table>
<thead>
<tr>
<th>Portland or Blended Portland Cement</th>
<th>Masonry or Mortar Cement</th>
<th>Sand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type N Mortar (make with Type N Masonry or Mortar Cement)</td>
<td>0</td>
<td>1 (Type N)</td>
</tr>
<tr>
<td>Type S Mortar (make with Type S or N Masonry or Mortar Cement)</td>
<td>0</td>
<td>1 (Type S)</td>
</tr>
<tr>
<td></td>
<td>¼</td>
<td>1 (Type N)</td>
</tr>
<tr>
<td>Type M Mortar (make with Type M or N Masonry or Mortar Cement)</td>
<td>0</td>
<td>1 (Type M)</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>1 (Type N)</td>
</tr>
</tbody>
</table>

After adding all ingredients (including water) to a mechanical mixer, mix for 3 to 5 minutes to entrain air and produce a workable and uniform consistency. Discard all unused mortar 2½ hours after initial mixing. Mortar that has stiffened may be re-tempered up to 2½ hours after initial mixing by adding water to restore the original workable consistency.

Use a uniform layer of mortar, 6 to 18 mm thick, for joints between uniform masonry units. For a tuck pointing (raking out and repointing) mortar, add the minimum water to the dry ingredients to produce a mortar that retains its form when hand squeezed and released. Allow this mortar to stand covered (prehydrate) for 1 to 1½ hours to greatly reduce shrinkage. Then mix with sufficient water to produce a stiff, but workable consistency, and use within 2½ hours of initial mixing.

Avoid re-tempering the mortar when tuck pointing, matching a color, or to avoid color variations between batches (mix smaller quantities, if needed).

No admixtures, except for mortar coloring agents made from light-fast, durable, alkali-resistant minerals, will be permitted without written permission of the Director, Materials Bureau. If colored mortar is specified, submit samples of hardened mortar to the Engineer. Upon approval, use the same, uniform, mortar color throughout the work.

**BASIS OF ACCEPTANCE.** Inspection and approval by the Engineer.

### 705-22 PORTLAND CEMENT MORTAR BONDING GROUT

**SCOPE.** This specification covers the material requirements for portland cement mortar grout used for bonding fresh concrete to hardened concrete in both vertical and horizontal planes.

**MATERIAL REQUIREMENTS.** The ingredients for the portland cement mortar grout shall comply with the following:

<table>
<thead>
<tr>
<th>Material Requirement</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portland Cement, Type 1 or Type 2</td>
<td>701-01</td>
</tr>
<tr>
<td>Mortar Sand</td>
<td>703-03</td>
</tr>
<tr>
<td>Concrete Sand</td>
<td>703-07</td>
</tr>
<tr>
<td>Water</td>
<td>712-01</td>
</tr>
</tbody>
</table>
Proportioning. The mortar grout shall have the cement and mortar or concrete sand proportioned 1:1 in separate volumetric containers. The sand shall be deposited into an approved mechanical grout mixer prior to the cement. Both the sand and cement shall be dry mixed for one (1) minute. After dry mixing, water shall be added in sufficient quantity to result in a workable consistency. An additional three (3) minutes of mixing is required after adding desired water. Workable consistency is defined as a grout that will not run on vertical faces or puddle in low spots. Any grout that has dried or become unworkable, as determined by the Engineer, shall not be incorporated in the work. Hand mixing of the mortar may be permitted only for small quantities as approved by the Engineer.

BASIS OF ACCEPTANCE. The mortar grout shall be accepted on the basis of inspection and approval by the Engineer.

SECTION 706 - CONCRETE, CLAY AND PLASTIC PIPE

706-01 NON-REINFORCED CONCRETE PIPE

SCOPE. This specification covers the material and quality requirements for non-reinforced concrete pipe 600 mm and smaller used for culverts.

GENERAL. The provisions of §706-02, Reinforced Concrete Pipe, shall apply except that all references to reinforcing steel shall be deleted. In addition, physical and dimensional requirements of concrete pipe under 300 mm in diameter shall be as stated in Table 1, Class 1, of ASTM C14. Plain concrete pipe 300 mm to 600 mm in diameter shall conform to Table 1, Class 2, of ASTM C14.

MATERIAL REQUIREMENTS. The Material Requirements contained in §706-02 shall apply except that all references to reinforcing steel shall be deleted.

FABRICATION REQUIREMENTS. The Fabrication Requirements contained in §706-02 shall apply except as noted herein.

Marking. No pipe class or wall designation shall be marked on the pipe.

PHYSICAL REQUIREMENTS. The Physical Requirements contained in §706-02 shall apply except as noted herein.

Strength. The strength requirements for the respective diameter pipe sizes shall be as stated in Table 1 of ASTM C14M. Details of the three-edge bearing test shall comply with ASTM C14M.

SAMPLING AND TESTING. The Sampling And Testing requirements contained in §706-02 shall apply.

FINAL PRODUCTION INSPECTION. The Final Production Inspection requirements contained in §706-02 shall apply.

SHIPPING. The Shipping requirements contained in §706-02 shall apply.

BASIS OF ACCEPTANCE. The Basis Of Acceptance requirements contained in §706-02 shall apply.

706-02 REINFORCED CONCRETE PIPE CLASSES II, III, IV, V

SCOPE. This specification covers the material, fabrication, and physical requirements of reinforced concrete pipe and cattle pass.

GENERAL. Apply the requirements of AASHTO M 170M, Reinforced Concrete Culvert, Storm Drain and Sewer Pipe, Classes II, III, IV, and V, except as modified by this specification. Produce reinforced
concrete pipe by either machine made or wet cast methods in accordance with working drawings approved by the Department and in full compliance with the details of this specification. Pipe manufactured for a specific class will be acceptable for any class having a lower design strength. Methods of manufacture include the following:

**A. Wet Cast Pipe And Cattle Pass.** Wet cast units are those made from concrete placed and consolidated by conventional equipment. These units develop resistance to freeze-thaw damage through the use of entrained air in the concrete. Air content in wet cast concrete shall range between 5.0% and 9.0%.

Manufacture wet cast pipe, for Department acceptance, in accordance with this specification and the current Materials Procedure for precast concrete titled “Procedures For Achieving And Maintaining Precast Concrete Manufacturer’s Approved List Status”.

**B. Machine Made Pipe.** Machine made units use very low slump concrete and methods of consolidation which produce a dense product with low permeability and good resistance to freeze-thaw damage.

Manufacture machine made pipe, for Department acceptance, in accordance with this specification and the current Materials Method titled “Quality Assurance Procedure For Concrete Pipe Items”.

**MATERIAL REQUIREMENTS**

**A. Materials**

- Portland Cement (Type 1, Type 2 or Type 3) 701-01
- Concrete Repair Material 701-04
- Coarse Aggregate 703-02
- Concrete Sand 703-07
- Bar Reinforcement, Grade 420 (Reinforcement & Stirrups) 709-01
- Wire Fabric for Concrete Reinforcement 709-02
- Bar Reinforcement, Grade 300 709-03
- Cold Drawn Wire for Concrete Reinforcement 709-09
- Admixtures 711-08
- Water 712-01
- Concrete Pipe Joint Sealing Compound 705-16
- Concrete Pipe Joint Elastomeric Gaskets 705-17
- Fly Ash 711-10
- Ground Granulated Blast Furnace Slag 711-12

**B. Cementitious Content.** Use a minimum combined cementitious content of 335 kilograms per cubic meter. This includes the Portland Cement and pozzolan (fly ash and/or ground granulated blast furnace slag). The maximum allowable total chloride content in concrete shall not exceed 0.10 percent by weight of cementitious material tested in accordance with written procedural directives of the Materials Bureau.

**C. Pozzolans.** Fly ash and/or ground granulated blast furnace slag may, in total, be substituted for cement up to a maximum of 20% by weight of the total amount of cement plus pozzolan in the mix.

**D. Admixtures.** Calcium Chloride is not allowed in concrete. Admixtures, other than an approved Air Entraining agent for wet cast pipe, are not allowed unless otherwise approved by the Materials Bureau.

**E. Reinforcement.** Sample the reinforcement in accordance with the written directives of the Materials Bureau. Accept stirrups based on the manufacturer's certification, unless otherwise directed by the Materials Bureau.
§706

F. Pipe Joint Materials

1. Elastomeric Gaskets. The gaskets used in the installation of round pipe shall meet the specification requirements of §705-17 and only those types and sizes designated by the pipe manufacturer on the approved drawings of the particular pipe.

2. Sealing Compounds. Concrete pipe joint sealing compound, meeting the specification requirements of §705-16, shall be used only on elliptical pipe and reinforced cattle pass.

FABRICATION REQUIREMENTS

Drawings. Submit detailed working drawings conforming to the Materials Bureau concrete pipe templates. All diameter sizes of a particular geometric shape can be included on one drawing. Separate drawings are required for cattle pass, jacking pipe and special designs.

Full approval of the working drawings is required prior to the manufacture of any concrete pipe.

Design, Reinforcement and Dimensions

A. General. Apply the Design, Reinforcement and Permissible Variations requirements of AASHTO M 170M for Class II, III, IV and V pipe, walls B & C. The AASHTO tables show minimum reinforcement. The manufacturer may submit drawings detailing alternatives to the specified reinforcement and/or wall thickness for Materials Bureau consideration. To gain full approval of alternate designs, manufacture and test pipe samples in accordance with the written procedural directives of the Materials Bureau.

B. Reinforced Concrete Cattle Pass. Apply the requirements of NYSDOT Standard Sheet M603-4 with the following modification. A minimum length of 1200 mm is required for each section. The maximum allowable variation in laying lengths of two opposite sides of a cattle pass section is 3 mm per 300 mm of diameter, not to exceed 16 mm in any length of cattle pass, except where beveled or curved cattle pass lengths have been specified.

Concrete Batch Placement

A. Machine Made Pipe. Clean and properly assemble the forms prior to placing any concrete. Transport and place the concrete mixture such that no segregation of the concrete materials or displacement of the reinforcing steel occurs within the form.

B. Wet Cast Pipe And Cattle Pass. Apply the Concrete Placement And Consolidation requirements contained in §704-03.

Curing. Include the type of curing, curing time and any temperature requirements on the drawing.

A. Machine Made Pipe. Cure the pipe in accordance with AASHTO M 170M. Other methods of curing are subject to approval by the Director, Materials Bureau.

B. Wet Cast Pipe And Cattle Pass. Apply the Curing requirements contained in §704-03.

Joints. Use either bell and spigot or tongue and groove design. Design the joints so as to permit effective jointing to reduce leakage and infiltration and to permit placement without irregularities.

Marking. The pipe markings must be identified on the inside barrel for pipe diameters of 450 mm and greater. If the diameter is less than 450 mm the markings may be stenciled on the outside of the pipe. Mark each piece of pipe with the following information, as applicable.

1. Name or trademark of manufacturer.
2. Date of manufacture.
3. Pipe class.
4. Wall designation.
5. Pipe diameter.
6. NYSDOT lot number (“NYSDOT ”) (Machine made pipe only.)
7. Indelibly mark the word “TOP” on the inside and outside of the barrel at the appropriate location on each pipe length with elliptical or quadrant reinforcing.

**Repair**

**A. Machine Made Pipe.** Pipe may be repaired at the plant or in the field using 701-04 Concrete Repair Material. Repairs to more than 10% of a lot will not be permitted. Repairs will be acceptable if, in the opinion of the Department, the repairs are sound, properly finished and cured, and the repaired pipe conforms to the requirements of these Specifications and the written procedural directives of the Materials Bureau.

**B. Wet Cast Pipe And Cattle Pass.** Apply the Repair requirements contained in §704-03.

**PHYSICAL REQUIREMENTS**

**Strength.** Apply the requirements of AASHTO M 170M except that the compressive strength requirements do not apply except for cattle pass. Conduct such number and type of three edge bearing tests as the Materials Bureau deems necessary to establish the quality of pipe.

Reinforced concrete cattle pass will not require a three-edge bearing test. The minimum 28 day compressive strength for cattle pass, as determined by concrete cylinders, is 25 MPA.

**Absorption Requirements For Machine Made Pipe.** The maximum average absorption for all pipe is 8.0% by weight for the last three specimens tested.

**Freeze-Thaw Requirements.** The Materials Bureau reserves the right to test the pipe for durability by freeze-thaw testing. The test will be run in accordance with written procedural directives of the Materials Bureau.

**SAMPLING AND TESTING.** It is required that each manufacturer have a testing machine, of a type approved by the Materials Bureau, to carry out three edge bearing tests. Employ a commercial testing agency to calibrate the testing machine according to ASTM E4 at a minimum of once a year. Upon request of the Materials Bureau, furnish a record of this calibration. Sample and test reinforced concrete pipe and cattle pass units, manufactured under the requirements of this specification, as follows.

**A. Machine Made Pipe.** Separate machine made reinforced concrete pipe into specific and identifiable production lots. Follow the written procedural directives of the Materials Bureau to determine the maximum number and type of units in a lot and the number of samples to be taken per lot. Test each lot of machine made reinforced concrete pipe as follows:

1. **Three Edge Bearing Test.** Follow the requirements for strength testing indicated above using the test procedure identified in the procedural directives issued by the Materials Bureau. Perform tests in the presence of a representative of the Department.

2. **Absorption Test.** Cores from each lot, drilled by the manufacturer in the presence of a representative of the Department, will be used for this test. The cores will be tested by the Materials Bureau in accordance with the test method specified in ASTM C497 except that under “absorption test” the drying period will be 48 hours at a temperature of 110°C.

Plug the holes when cores are taken. Ensure that plugs are sound, properly finished and cured according to the requirements of “Pipe Repair.”
In addition to the above tests, pipe will be subject to inspection at any time prior to placing, and rejection may be made through failure to comply with the criteria shown in the written procedural directives of the Materials Bureau.

**B. Wet Cast Pipe And Cattle Pass.** Sample and test wet cast reinforced concrete pipe and cattle pass in accordance with Materials Bureau requirements contained in the current Materials Procedure for precast concrete, titled “Procedures For Achieving And Maintaining Precast Concrete Manufacturer’s Approved List Status”.

**FINAL PRODUCTION INSPECTION.** For wet cast units only, follow the Final Production Inspection requirements contained in §704-03.

**SHIPPING**

**A. Machine Made Pipe.** No units will be considered for shipment unless the units are free from defects as noted under Pipe Repair in this specification and according to the written procedural directives of the Materials Bureau.

**B. Wet Cast Pipe And Cattle Pass.** Follow the Shipping requirements contained in §704-03.

**BASIS OF ACCEPTANCE**

**A. Machine Made Pipe.** Units will be accepted in stock lot quantities at the manufacturing location in accordance with the current version of Materials Method 1 titled “Quality Assurance Procedure For Concrete Pipe Items”.

**B. Wet Cast Pipe And Cattle Pass.** Follow the Basis Of Acceptance requirements contained in §704-03.

**706-03 REINFORCED CONCRETE ELLIPTICAL PIPE; CLASSES HE-II, HE-III, HE-IV, VE-IV, VE-V AND VE-VI**

**SCOPE.** This specification covers the material and quality requirements for both horizontal and vertical elliptical reinforced concrete pipe of the classes noted above for use as culvert pipe. Pipe designed for placement with the major axis horizontal is designated as horizontal elliptical pipe. Pipe designed for placement with the major axis vertical is designated as vertical elliptical pipe.

**GENERAL.** The provisions of §706-02, Reinforced Concrete Pipe Classes II, III, IV, V shall apply except as noted herein.

All references to AASHTO M 170M, contained in §706-02, shall be replaced with AASHTO M 207M. All reference to Classes II, III, IV and V, contained in §706-02, shall be deemed to include all classes of elliptical pipe.

**MATERIAL REQUIREMENTS.** The Material Requirements contained in §706-02 shall apply except that the pipe joint material shall be a sealing compound meeting the requirements of §705-16.

**FABRICATION REQUIREMENTS.** The Fabrication Requirements contained in §706-02 shall apply except as noted herein.

**Design, Reinforcement and Dimensions.** In the case of elliptical pipe, the working drawings indicate the equivalent round pipe diameter, rise, span and class. A tolerance of plus or minus 2% from the nominal rise and span of the pipe, as shown on the approved working drawing, will be permitted.

Variations in laying lengths of two opposite sides of a pipe section shall not be more than 10 mm/m of equivalent diameter, with a maximum of 16 mm in any length of pipe, except where beveled or curved lengths have been specified.
Marking. No wall designation shall be marked on the pipe. An equivalent round pipe diameter shall be used for markings.

**PHYSICAL REQUIREMENTS.** The Physical Requirements contained in §706-02 shall apply.

**SAMPLING AND TESTING.** The Sampling And Testing requirements contained in §706-02 shall apply.

**FINAL PRODUCTION INSPECTION.** The Final Production Inspection requirements contained in §706-02 shall apply.

**SHIPPING.** The Shipping requirements contained in §706-02 shall apply.

**BASIS OF ACCEPTANCE.** The Basis Of Acceptance requirements contained in §706-02 shall apply.

### 706-04 PRECAST CONCRETE DRAINAGE UNITS

**SCOPE.** This specification covers the material and fabrication requirements for precast concrete drainage units including transverse drainage interceptors.

**MATERIAL REQUIREMENTS.** The Material Requirements contained in §704-03 shall apply except as noted herein.

- The concrete used to fabricate round precast concrete drainage units shall have a minimum compressive strength of 30 Mpa @ 28 days. The concrete used to produce machine made units shall have a maximum absorption of 8.0% by weight and is not required to be air entrained.

- Additional materials listed below shall meet the requirements of the following subsections:

  - Frames And Grates 655
  - Concrete Grouting Material 701-05
  - Concrete Pipe Joint Sealing Compound 705-16
  - Concrete Pipe Joint Elastomeric Gaskets 705-17
  - Mortar For Concrete Masonry 705-21
  - Steps For Manholes 725-02

**DRAWINGS.** The Drawing requirements contained in §704-03 along with the following shall apply.

- Fabricator Working Drawings are required for all round drainage structures. Cut sheets, showing structure heights, the size and location of pipe openings and step locations are required for all drainage structures.

**FABRICATION.** The Fabrication requirements contained in 704-03, along with the following shall apply.

**Manufacturing Process.** Precast concrete drainage units shall be wet cast or machine made.

- **A. Wet Cast.** Wet cast units are manufactured from concrete, placed and consolidated by conventional equipment, containing entrained air to develop resistance to freeze-thaw damage.

- **B. Machine Made.** Machine made units are manufactured with very low slump concrete, consolidated to produce a dense product with low permeability and good resistance to freeze-thaw damage. Machine made units are those made by the following methods:
  - Packerhead
  - Roller suspension
  - Centrifugal
  - Machine tamped
  - Machine vibrated
  - Other methods as approved by the Materials Bureau
Reinforcing. Reinforcing bar splices shall be lapped a minimum of 30 bar diameters and tied securely. Wire fabric splices shall be secured by one of the following methods:

A. **Tying.** Under this method the ends shall lap to a length of not less than 30 diameters of the reinforcement and the lap shall contain a longitudinal member. A sufficient number of laps shall be tied to maintain continuity of the cage through the period of placement and curing of the concrete.

B. **Welding.** Each circular member shall be lapped a minimum of 50 mm and welded. The weld shall develop a minimum of 50 percent of the specified strength of the wire.

Round Units. Precast bases, floors, risers, conical top sections, grade rings and flat slab tops shall conform to the design, dimension and reinforcement requirements of ASTM C478M. The C478M requirements for splices, laps and welds shall not apply.

Transverse Drainage Interceptors. Bar reinforcement shall be epoxy coated meeting the requirements of §709-04.

Joints. Joints between precast riser sections shall be formed with male and female ends so that when the sections are assembled they will make a continuous and uniform unit.

Joint Sealant Materials. Joints between precast sections are to be sealed with flexible watertight Elastomeric Gaskets, Pipe Joint Sealing Compounds, Mortar for Concrete Masonry, Concrete Grouting Material or Concrete Repair Material meeting the requirements of the Standard Specifications. If elastomeric Gasket Sealers are used the shape, size and placement shall be recommended by the precast manufacturer.

Steps for Drainage Units. Steps for drainage units shall conform to §725-02, Steps for Manholes. Steps in risers and conical top sections shall be aligned to form a continuous ladder with rungs equally spaced vertically in the completed unit at a maximum spacing of 400 mm. All steps in a completed drainage unit shall be the same size. Steps shall be embedded into the walls of the section a minimum of 75 mm. The rung shall project a minimum clear distance of 100 mm from the walls of the section measured from the point of embedment. If the steps are grouted, the grouting material shall conform to §701-04 Concrete Repair Materials or §701-05 Concrete Grouting Material. If plastic inserts are used for installing steps, they shall be approved by the Materials Bureau. Steps which are damaged during installation or handling shall be replaced.

Frames for Grates. Frames cast into the top slab or top of the uppermost riser shall be secured and held in place by a minimum of 4 stirrups or studs per frame, welded to the frame near the corners.

Frames for Grates. Frames cast into the top slab or top of the uppermost riser shall be secured and held in place by a minimum of 4 stirrups or studs per frame, welded to the frame near the corners.

Parallel bar frames shall contain shear stud anchors, for the purpose of transferring loads, as required and detailed on the standard sheet for parallel bar grates and frames. Shear stud anchors, when required, shall replace the frame securing stirrups or studs.

Dimensional Tolerances. The inside width and length dimensions shall not vary by more than 10mm from the design dimensions.

SAMPLING AND TESTING. The sampling and testing requirements contained in 704-03 shall apply except as noted herein.

A. **Machine Made Units.** Testing for air content is not required. Cores shall be taken from the hardened concrete and tested for absorption. A minimum of 3 cores per 5 batches of a single mix with a minimum of three cores per day per mix shall be used to measure absorption. The average absorption of the 3 cores shall not exceed the maximum absorption specified herein. Testing shall be in accordance with ASTM C497 M except that the drying period shall be 48 hours at a temperature of 110° C.
MARKING. The Marking requirements contained in §704-03 shall apply except as noted herein.
Markings shall be placed on the inside face of all precast pieces. Each flat slab top that doesn't have
an integral frame or a design that readily indicates the top surface shall have the words “INSTALL THIS
SIDE UP” placed on its top surface.

The markings on rectangular drainage units, including base slabs, bases and risers, shall include the
maximum placement depth in mm (“MPD...mm”). The maximum placement depth is based on wall
thickness and reinforcement and shall be in accordance with the Department’s Standard Sheets or the
contract plans.

Instead of marking the contract number on each unit they may be marked with “NYSDOT”.

FINAL PRODUCTION INSPECTION. The Final Production Inspection requirements contained in
§704-03 shall apply.

SHIPPING. The Shipping requirements contained in §704-03 shall apply.

BASIS OF ACCEPTANCE. The Basis Of Acceptance requirements contained in 704-03 shall apply.

706-05 POROUS CONCRETE PIPE UNDERDRAIN

SCOPE. This specification covers the material and quality requirements for porous concrete pipe and
extra strength concrete porous concrete pipe underdrains.

GENERAL. Porous concrete pipe and extra strength porous concrete pipe shall be manufactured in
accordance with approved working drawings and in compliance with details set forth below.

MATERIAL REQUIREMENTS. All materials shall comply with the requirements of

FABRICATION. Porous concrete pipe and extra strength porous concrete pipe shall conform in size and
shape to the details shown on the standard sheet for porous concrete pipe underdrain and the approved
working drawing.

The inside surface of the pipe shall be straight and true to dimensions with a permissible variation
from the true form of not more than 1 ½ percent. A tolerance of 5% will be permitted in the diameter of
the pipe. The wall thickness of the pipe may be greater than shown on the standard sheet, but it shall not
be less than 95% of the stipulated wall thickness.

High early strength cement, calcium chloride or any other additive shall not be used unless otherwise
approved by the Materials Bureau.

Concrete mix proportions will be such that will produce a concrete mix of such quality that the pipe
will conform to the test and design requirements of these specifications.

Each length of pipe shall be clearly marked on the outside with the name or trademark of the
manufacturer. Extra strength porous concrete pipe underdrain shall be clearly marked, "Extra Strength".

Curing. All pipe shall be cured in accordance with the provisions of §706-02.

Strength Requirements. The minimum ultimate strength for the size of the pipe being tested shall be
as specified on the standard sheet. Requirements of §706-02 shall apply except that no determination of
a 0.25 mm crack will be required and the ultimate strength values as determined on full length specimens
shall be as specified on the standard sheet.

Infiltration Requirements. Pipe shall be tested for rate of infiltration in accordance with the method
of test outlined in AASHTO Designation M176. The minimum rate of infiltration shall not be less than
0.15 liters per minute per millimeters of internal diameter per 300 millimeters of pipe for all sizes.
All tests shall be performed by the manufacturer at their plant and shall be witnessed by a representative of the Department. The number of samples for test shall be as directed by the Materials Bureau.

**Other Requirements.** In addition to the above tests, the pipe shall be subject to inspection at all times prior to placing and rejection will be made through failure to comply with any of the following conditions:

- **A. Dimensions.** The pipe shall not vary in any dimensions more than permitted by this specification.

- **B. Fractures or Cracks.** The pipe shall have no fractures or cracks passing through the shell or socket of the pipe, except that a single crack not exceeding 50 mm in length at either end of a pipe shall not be considered cause for rejection unless the defect exists in more than 5% of the lot offered for sampling and testing.

- **C. Quality.** There shall be no defects that indicate imperfect mixing and molding.

- **D. Strength.** There shall be no cracks that are sufficient to impair the strength, durability or serviceability of the pipe.

- **E. Shape.** The shape of the pipe shall be such that there shall be no variation in alignment of more than 10 mm per linear meter.

**Basis of Acceptance.** The material will be considered for acceptance in stock lot quantities at the manufacturing location in accordance with procedural directives of the Materials Bureau. In addition, the manufacturer shall furnish the Department representative at the plant a certification for each lot manufactured certifying that all pipe in the lot was manufactured in accordance with the terms of this specification and that the pipe details conform to drawings previously approved by the Department. Pipe shall be considered ready for acceptance when a lot conforms to the indicated test requirements. The manufacturer shall be permitted to retest to determine specification compliance. Pipe not used within two years after its original acceptance shall be retested by the Department before it can be used.

**706-06 Polyester Formed in Place Pipe Liner**

**Scope.** This specification covers the material requirements for polyester formed in place pipe liners used in rehabilitation applications of culverts and storm drains.

**General.** The flexible liner will be fabricated from one or more layers of polyester felt. An impermeable polyurethane or polyvinyl chloride material will be bonded to the outside of the felt liner. Once inverted, the impermeable plastic membrane will become the inside of the pipe liner.

**Material Requirements.** Supply a resin system material conforming to the following:

<table>
<thead>
<tr>
<th>Property</th>
<th>Standard</th>
<th>Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile Stress, MPa</td>
<td>ASTM D638</td>
<td>20</td>
</tr>
<tr>
<td>Flexural Stress, MPa</td>
<td>ASTM D790</td>
<td>30</td>
</tr>
<tr>
<td>Flexural Modulus, MPa</td>
<td>ASTM D790</td>
<td>1700</td>
</tr>
</tbody>
</table>

**Basis of Acceptance.** Acceptance of this material will be based on the manufacturer’s name appearing on the Approved List for rehabilitation of Culverts and Storm Drains.
706-07 REINFORCED CONCRETE PIPE END SECTIONS

SCOPE. This specification covers the material and fabrication requirements for reinforced concrete pipe end sections.

MATERIAL REQUIREMENTS. The Material Requirements contained in §704-03 shall apply.

DRAWINGS. The Drawing requirements contained in §704-03 shall apply.

FABRICATION. The Fabrication requirements contained in §704-03, along with the following, shall apply:

The barrel portion of the end section shall meet the Design, Reinforcement and Permissible Variations requirements of AASHTO M 170M for Class III Pipe, Wall Designation B.

SAMPLING AND TESTING. The Sampling and Testing requirements contained in §704-03 shall apply, unless otherwise approved by the Director, Materials Bureau.

MARKING. The Marking requirements contained in §704-03 shall apply.

FINAL PRODUCTION INSPECTION. The Final Production Inspection requirements contained in §704-03 shall apply, unless otherwise approved by the Director, Materials Bureau.

SHIPPING. The Shipping requirements contained in §704-03 shall apply, unless otherwise approved by the Director, Materials Bureau.

BASIS OF ACCEPTANCE. The Basis Of Acceptance requirements contained in §704-03 shall apply, unless otherwise approved by the Director, Materials Bureau.

706-08 AND 706-09 (VACANT)

706-10 POLYVINYL CHLORIDE PIPE (relining)

SCOPE. This specification covers the material requirements for polyvinyl chloride pipe when used in rehabilitation applications of culverts and storm drains.

General. The polyvinyl material from which the pipe and fittings are extruded or molded will not contain any reclaimed, reground or reworked material and will be comprised of virgin polyvinyl resins only. The resins used will meet the requirements contained in this specification. The pipe and fittings will be manufactured in such a manner so that all cross sections will be dense, homogeneous, and free from any imperfections.

MATERIAL REQUIREMENTS. The Polyvinyl Chloride pipe materials must conform to ASTM F1803 (Profile Wall) or ASTM F949 (Corrugated). All materials supplied will be clearly marked with the appropriate ASTM as certified.

BASIS OF ACCEPTANCE. Acceptance of this material will be based on the manufacturer's name appearing on the Approved List for Rehabilitation of Culverts and Storm Drains.

706-11 HIGH DENSITY POLYETHYLENE PIPE (relining)

SCOPE. This specification covers the material requirements for high density polyethylene pipe when used in rehabilitation applications of culverts and storm drains.

General. The high density polyethylene material from which the pipe and fittings are extruded will not contain any reclaimed, reground or reworked material and will be comprised of virgin high density polyethylene resins only. The resins used will meet the requirements contained in this specification.
The pipe and fittings will be manufactured in such a manner so that all cross sections will be dense, homogeneous, and free from any imperfections.

**MATERIAL REQUIREMENTS.** The high density polyethylene pipe material must conform to ASTM F894 (Profile Wall) or ASTM F714 (Smooth Wall). All materials supplied will be clearly marked with the appropriate ASTM as certified.

**BASIS OF ACCEPTANCE.** Acceptance of this material will be based on the manufacturer’s name appearing on the Approved List for rehabilitation of Culverts and Storm Drains.

### 706-12 SMOOTH INTERIOR CORRUGATED POLYETHYLENE PIPE

**SCOPE.** This specification covers the material and quality requirements for smooth interior corrugated polyethylene pipe and fittings.

**MATERIAL REQUIREMENTS.** The polyethylene material for the pipe and fittings shall meet the requirements of A.A.S.H.T.O. M294, Type S or Type SP. In addition, when checked with a 300 mm straight edge the smoothness of the interior liner shall not deviate more than 6 mm.

**BASIS OF ACCEPTANCE.** Smooth interior, corrugated polyethylene pipe will be accepted on the basis of the manufacturer's name and location appearing on the Department’s Approved List and a material certification that specifies the product conforms to this specification.

The supplier shall provide two copies of the approved Materials Details through the Contractor to the Engineer as part of the evidence of acceptability for the material at least 10 days prior to shipment of the product to the job site.

### 706-13 PERFORATED CORRUGATED POLYETHYLENE UNDERDRAIN TUBING

**SCOPE.** This specification covers the material and quality requirements for corrugated polyethylene tubing and fittings.

**MATERIAL REQUIREMENTS.** The corrugated polyethylene tubing and fittings 100 mm thru 250 mm in diameter shall meet the requirements of A.A.S.H.T.O. Designation: M252, Corrugated Polyethylene Drainage Tubing except that tubing manufactured from material meeting A.S.T.M. Designation D1248, Class B, shall also be acceptable.

The corrugated polyethylene tubing and fittings 300 mm in diameter shall meet the requirements of A.A.S.H.T.O. M252 except the pipe stiffness requirement shall be 310 kPa at 5% deflection.

**BASIS OF ACCEPTANCE.** Perforated corrugated polyethylene underdrain tubing will be accepted on the basis of the manufacturer's name and location appearing on the Department’s Approved List and a material certification that specifies the product conforms to this specification.

### 706-14 CORRUGATED INTERIOR POLYETHYLENE PIPE

**SCOPE.** This specification covers the material and quality requirements for corrugated interior polyethylene pipe and fittings.

**MATERIAL REQUIREMENTS.** The polyethylene material for the pipe and fittings shall meet the requirements of A.A.S.H.T.O. M294, Type C.

**BASIS OF ACCEPTANCE.** Corrugated interior polyethylene pipe will be accepted on the basis of the manufacturer's name and location appearing on the Department’s Approved List and a material certification that specifies the product conforms to this specification.
706-15 PVC PLASTIC DRAIN PIPE SYSTEM

SCOPE. This specification covers the material and quality requirements for poly (vinyl chloride) plastic drain pipe, fittings and solvent cement when used as a drain pipe system.

GENERAL. The PVC material from which the pipe and fittings shall be extruded or molded shall not contain any reclaimed, reground or reworked material whatsoever, but shall be compounded from virgin PVC resins, plasticizers, stabilizers, and such materials that when compounded, it shall meet the requirements contained in this specification.

The pipe and fittings shall be extruded or molded in such a manner that all cross sections shall be dense, homogeneous, and free from porosity or other imperfections. The solvent cement shall be a solution of unplasticized PVC tetrahydrofuran and cyclohexanone.

MATERIAL REQUIREMENTS. The PVC material for the pipe and fittings shall meet the requirements of ASTM D1784 for Rigid Poly (Vinyl Chloride) Compounds and Chlorinated Poly (Vinyl Chloride) Compounds, Class 12444-B.

The molded or extruded pipe shall conform to ASTM D1785 for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedule 80, PVC 1120.

The molded or extruded fittings shall conform to ASTM D2467 for Socket-Type Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80, PVC 1.

The solvent cement shall meet the requirements of ASTM D2564 for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

<table>
<thead>
<tr>
<th>Nominal Size</th>
<th>Outside Diameter (Millimeters)</th>
<th>Inside Diameter (Millimeters)</th>
<th>Wall Thickness Schedule 80 (Millimeters)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>114.3</td>
<td>97.2</td>
<td>8.6</td>
</tr>
<tr>
<td>125</td>
<td>141.3</td>
<td>122.3</td>
<td>9.5</td>
</tr>
<tr>
<td>150</td>
<td>168.3</td>
<td>146.3</td>
<td>11.0</td>
</tr>
<tr>
<td>200</td>
<td>219.1</td>
<td>193.7</td>
<td>12.7</td>
</tr>
<tr>
<td>250</td>
<td>273.1</td>
<td>242.9</td>
<td>15.1</td>
</tr>
</tbody>
</table>

DIMENSIONS. The dimensions and tolerances of the pipe and fittings shall conform to ASTM D1785 and D2467 respectively.

MARKING. All material furnished shall be plainly marked in accordance with ASTM D1785, D2467, and D2564 for the pipe, fittings and solvent cement, respectively.

BASIS OF ACCEPTANCE. All pipe, fittings and solvent cement shall be accepted on the basis of the manufacturer's certification that the material conforms to this specification.

706-16 CELLULAR POLYSTYRENE PROTECTIVE COVER

SCOPE. This specification covers the material and quality requirements for cellular polystyrene when used as protective cover for pipes.

GENERAL. The protective cover shall be fabricated from rigid extruded cellular polystyrene such that it shall meet the requirements contained in this specification.

The polystyrene shall be extruded in such manner that all cross sections shall be uniform and free from imperfections.

MATERIALS REQUIREMENTS. The fabricated cellular polystyrene protective cover shall meet the following requirements:
### Property ASTM Test Procedure Requirement

<table>
<thead>
<tr>
<th>Property</th>
<th>ASTM Test Procedure</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density, kg/m³</td>
<td>D1622</td>
<td>32 ± 2</td>
</tr>
<tr>
<td>Compressive Strength, kPa</td>
<td>D1621</td>
<td>205 ± 35</td>
</tr>
<tr>
<td>Flammability</td>
<td>D1692</td>
<td>Self-Extinguishing</td>
</tr>
</tbody>
</table>

**DIMENSIONS.** The protective cover shall be fabricated in cylindrical half-sections of any convenient length for application to straight pipe and half-sections of suitable shape and length to protect any non-linear portions of the pipe or fittings.

The thickness of the protective cover shall be maintained within ±1.5 mm of the thickness shown on the plans.

The protective cover shall be fabricated such that it mates with the pipe without leaving gaps at the seams. It shall have the following maximum clearance between outside diameter of nominal pipe and inside diameter of protective cover:

<table>
<thead>
<tr>
<th>Nominal Pipe Size, Millimeters</th>
<th>Maximum Clearance, Millimeters</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 to 38 incl.</td>
<td>.397</td>
</tr>
<tr>
<td>50 to 100 incl.</td>
<td>.794</td>
</tr>
<tr>
<td>125 to 280 incl.</td>
<td>1.984</td>
</tr>
<tr>
<td>300 and over</td>
<td>2.381</td>
</tr>
</tbody>
</table>

**BASIS OF ACCEPTANCE.** All protective cover furnished shall be marked with the following information: manufacturer's name, type of material, and nominal size.

All protective cover shall be accepted on the basis of the Manufacturer's certification that the material conforms to this specification.

### 706-17 PRECAST CONCRETE BOX CULVERTS

**SCOPE.** This specification covers the material and quality requirements for precast concrete box culverts.

**MATERIAL REQUIREMENTS.** The Material Requirements contained in §704-03 shall apply except as noted herein.

The concrete used to fabricate precast concrete box culverts shall have a minimum compressive strength of 35 MPA @ 28 days. Joint gasket material shall meet the requirements of ASTM D1056, Grade # 2A1 or # 2A2.

**DESIGN.** When the contract plans contain complete design details for the culvert, alternate designs will not be considered. When the contract plans do not contain complete design details for the culvert the Contractor shall be responsible for providing them. Precast concrete box culvert designs shall meet the requirements of the “NYSDOT Reinforced Concrete Box Culvert Design Guidelines”. Design details for bridge size culverts shall also include load rating information. Design calculations shall be stamped by a Professional Engineer licensed, and registered, to practice in New York State. The transmittal, processing and approval of box culvert designs will be in accordance with procedural directives of the Materials Bureau.

**DRAWINGS.** The Drawing requirements contained in §704-03, along with the following shall apply.

All fabrication drawings for Contractor provided designs shall be stamped by a Professional Engineer licensed, and registered, to practice in New York State. Fabrication drawings for bridge size culverts shall include load rating information. Reproducible drawings are required for bridge size culverts only.

**FABRICATION.** The Fabrication requirements contained in §704-03, along with the following shall apply.

**Reinforcing.** Unless noted otherwise in the contract plans or approved fabrication drawings the concrete cover over reinforcing steel shall be 25 mm minimum on the walls, floor slab and roof slab of
culverts and 38 mm minimum on wingwalls. When fill heights over the box culvert are less than 600 mm the concrete cover on the outside face of the roof slab shall be 50 mm minimum and all reinforcing steel in the top mat of the roof slab shall be epoxy coated or the concrete shall contain corrosion inhibitor. Fill heights shall be measured from the top of pavement to the top of the culvert roof slab. All reinforcing steel in the wall section of wingwalls shall be epoxy coated or the concrete shall contain corrosion inhibitor.

Joints. Precast concrete box culvert sections shall be fabricated with a female joint on the upstream end and male joint on the downstream end. Joint depth shall be a minimum of 50 mm and a maximum of 105 mm. The ends of longitudinal reinforcing steel shall have 15 mm minimum concrete cover at the mating surface of the joint. The circumferential reinforcing steel shall have 25 mm minimum concrete cover, as measured to the outermost bars, at the mating surface of the joint. When interferences occur which prevent this, the concrete cover shall be increased accordingly as shown on the approved fabrication drawings. Joints shall be fabricated such that when box culvert sections are fully drawn together the gap between adjacent culvert sections is 20 mm maximum. The outside mating surface of the joint shall have a continuous 25 mm x 25 mm gasket installed at the precast plant.

Corrosion Inhibitor. Corrosion inhibitor may be used in lieu of epoxy coated reinforcing.

Dimensional Tolerances
- Internal and external unit dimensions shall not vary by more than 10 mm from the design dimensions.
- Slab and wall thickness shall not vary from the design dimension by more than 5 mm for thicknesses less than 250 mm and 10 mm for thicknesses of 250 mm or greater.
- The length of section shall not vary more than 10 mm from the design dimension.
- Variations in laying lengths of two opposite surfaces of the box section shall not be more than 10 mm.

Repair. Minor defects in the mating surface of the joint, that do not come in contact with the joint gasket material and are 5 mm or less in depth, do not require repair.

SAMPLING AND TESTING. The Sampling and Testing requirements contained in §704-03 shall apply.

MARKING. The Marking requirements contained in §704-03 shall apply except as noted herein. Markings shall be placed on the inside face of one wall of each culvert barrel section.

FINAL PRODUCTION INSPECTION. The Final Production Inspection requirements contained in §704-03 shall apply.

SHIPPING. The Shipping requirements contained in §704-03 shall apply.

BASIS OF ACCEPTANCE. The Basis of Acceptance requirements contained in §704-03 shall apply.

706-18 PERFORATED POLYVINYL CHLORIDE UNDERDRAIN PIPE

SCOPE. This specification covers the material and quality requirements for smooth-wall perforated polyvinyl chloride (PVC) plastic pipe, couplings and fittings intended for use in underdrains.

MATERIAL REQUIREMENTS. Perforated polyvinyl chloride underdrain pipe and fittings shall conform to A.A.S.H.T.O. M278 Class PS46.

BASIS OF ACCEPTANCE. Acceptance of the perforated polyvinyl chloride underdrain pipe will be based on the manufacturer's certification of compliance with these specifications.
SECTION 707 - METAL PIPE

707-02 CORRUGATED STEEL PIPE

SCOPE. The material requirements of corrugated steel pipe with metallic, bituminous, portland cement concrete/or polymer coating intended for use in construction of culverts and drainage systems.

GENERAL. The corrugated steel pipe covered by this specification is classified as follows:

1. Type I. A full circular cross-section, with a single thickness of corrugated sheet.
2. Type IR. A full circular cross-section, with a single thickness of smooth sheet, fabricated with helical ribs projecting outwardly.
3. Type II. A Type I pipe which has been reformed into a pipe-arch, having an approximately flat bottom.
4. Type IIR. A Type IR pipe which has been reformed into a pipe-arch having an approximately flat bottom.
5. Type III. A Type I pipe which has been perforated to permit the in-flow or out-flow of water.

MATERIAL REQUIREMENTS. Apply the requirements of AASHTO M 36M Types I, IR, II, IIR, and III except as modified herein for all metallic coated corrugated steel pipe. Apply the requirements of AASHTO M 190M except as modified herein for all bituminous coated corrugated steel pipe. Apply the requirements of AASHTO M 245M Types I and II except as modified herein for all polymer coated steel pipe.

When Type IR or Type IIR corrugated steel pipe (spiral rib) is specified, the nominal dimension of the ribs shall be 19 mm by 19 mm at 190 mm pitch.

A. Coatings. Coat pipe with one of the following:

1. Metallic. The steel sheet will have a protective coating of zinc galvanizing (AASHTO M 218M) or of Aluminum-Coated (Type 2) (AASHTO M 274M).

2. Fully bituminous coated and paved invert (AASHTO M 190M, Type C). In addition to one of the metallic coatings, the pipe will be fully bituminous coated and have a bituminous paved invert.

3. Fully bituminous coated and 100 percent paved (AASHTO M 190M, Type D). In addition to one of the metallic coatings, the pipe will be fully bituminous coated and have a fully paved, smooth bituminous interior.

4. Polymer coated. The steel sheet will have a protective coating of zinc (galvanizing). In addition, the pipe will have a minimum interior polymer coating thickness of 0.25 mm and an optional exterior polymer coating. If an exterior polymer coating is applied, it will have a minimum thickness of 0.08 mm.

5. Polymer coated with a bituminous paved invert. In addition to the zinc and polymer coatings, the pipe will have a bituminous paved invert.
6. Portland Cement Concrete Lined. The steel sheet will be covered with dense, homogeneous, nonsegregating concrete lining. The concrete will be a minimum thickness of 13 mm over the crest of the corrugations of the carrier pipe. In no case will the amount of portland cement, blended cement, or portland cement plus flyash be less than 275 kg/m³. Flyash in the mix may not exceed 20% by weight of the cementitious material. When type IP cement is used, no flyash will be added in batching. All concrete will have a water-cement ratio not exceeding 0.50 by weight. Cure the concrete lining prior to installation as per manufactures instructions.

The bituminous material for coating and/or paving will be homogeneous and have the following properties in addition to those specified by AASHTO M 190M:

<table>
<thead>
<tr>
<th>Penetration at 25°C, 110 g, 5 seconds</th>
<th>AASHTO T49</th>
<th>25-50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Penetration Ratio (4°C/25°C x 100)</td>
<td>AASHTO T49</td>
<td>80-90</td>
</tr>
<tr>
<td>Softening Point °C (Ball &amp; Ring)</td>
<td>AASHTO T53</td>
<td>88-110</td>
</tr>
</tbody>
</table>

Apply the requirements of AASHTO M 246M for polymer material. Polymer coating materials must appear on the Department's Approved List.

Apply the material requirements of §501-2.02 Materials for portland cement concrete liner material.

B. Gauge. The nominal metal thickness corresponding to any gauge is shown in Table 707-2-1.

C. End Finish. To facilitate field joining, reroll the ends of all helical corrugated steel pipe with diameters of 300 mm or greater to form a minimum of two annular corrugations of no less than 68 mm pitch by 13 mm depth. Reroll the ends of Type IR and IIR pipe to form only two corrugations.

D. Coupling Bands. Supply annular corrugated steel coupling bands for all round pipe sections (Types I, IR, and III) 300 mm or greater in diameter. The band corrugations will have the same dimensions as the pipe ends. Mesh the band with at least one full corrugation and lap it equally on each pipe end. The band width will be a minimum of 180 mm for pipe diameters up to and including 800 mm. The band width will be a minimum of 265 mm for pipe diameters greater than 800 mm.
The thickness of the band cannot be less than 2 nominal sheet thicknesses thinner than the pipe and in no case thinner than 1.30 mm.

Pipe arches (Type II and IIR) may be joined by the annular corrugated bands described above or by special projection type coupling bands. The special projection bands will consist of two rows of projections at 75 mm center-to-center that will mesh with at least one full corrugation and will lap equally on each pipe end. The thickness of the special projection bands will not be less than 2 nominal sheet thicknesses thinner than the pipe and in no case thinner than 1.60 mm.

Regular projection type coupling bands (dimpled bands) will not be acceptable for 300 mm in diameter pipe and larger. Dimpled bands may be used on pipe diameters smaller than 300 mm, all sizes of perforated underdrain pipe (Type III), and for connecting pipe extensions to existing helical corrugated metal pipe without rerolled ends, unless otherwise shown on the plans.

Coupling bands may be one or two piece. Use two piece coupling bands on pipe 1200 mm or greater in diameter.

- Use one of the following coupling band connectors:
  - Galvanized steel angles, 50 mm x 50 mm x 5 mm
  - Lug connectors
  - Bar and strap connectors

Rivet, bolt, or weld these connectors to the coupling bands. Any evidence of loose bolts or rivets, bearing failure, or weld or band tearing are cause for rejection and replacement of that coupling band. As an alternate to the coupling band connectors stated above, a corrugated angle which conforms to an approved Materials Detail may be used.

Coat the steel sheet used for coupling bands with a polymer or metallic coating. If polymer or metallic coated corrugated steel pipe is being joined, the bands must have the same coating as the pipe.

Joints for concrete lined pipe will meet the requirements of §603-3.06 Joints.

**E. Coating Repair.** Repair damaged metallic, bituminous, portland cement concrete and/or polymer coating.

- Metallic coating field repairs will be allowed only when the total damaged area on each piece is less than 0.20 m² of coated surface, excluding aluminum coated rerolled ends. Any piece having damaged areas totaling more than 0.20 m², excluding aluminum coated rerolled ends, will be rejected.

Repair metallic coatings as follows:

  - Power disk sand or mechanically wire brush areas of damaged coating to bright metal
  - Remove oil, grease, and corrosion products from repair areas
  - Spray or brush a zinc-rich paint on clean, dry repair areas. The paint brand must appear on the Department's Approved List, Materials for Use in Repairing Galvanized Surfaces §719-01. The dry film paint thickness shall be at least 0.13 mm. Do not apply paint below 4°C.

Repair aluminum coatings damaged during rerolling at the manufacturing location. The rerolled ends may be either spot repaired or completely painted to repair small areas of damaged coating. Make repairs to the rerolled ends of aluminum coated pipe as referenced above. These rerolled end repairs, when properly completed, will not be counted toward the 0.20 m² of allowable damaged coating described above.

Repair damaged interior bituminous coatings using the original material or a Corrugated Metal Pipe Bituminous Coating Repair Material appearing in the Department's Approved List. Exterior damage to a bituminous coated pipe requires repair to the metallic coating only.

Repair damaged interior polymer coatings using Polymer Repair Materials for Steel Sheet used for Corrugated Pipe appearing in the Department's Approved List. Exterior damage to a polymer coated pipe requires repair to the metallic coating only.

Repair damaged portland cement concrete linings with Item 701-08, vertical and overhead patching material. The lining will be free of cracks exceeding 1 mm in width or the pipe will be rejected.

**F. Marking.** Mark or tag each length of corrugated steel pipe over the coating as approved by the Department to properly cross-reference the supplier's certification.
G. Additional Defects. In addition to coating damage and other criteria established in Materials Bureau procedural directives, the following additional defects along with those listed in AASHTO will be cause for rejecting the pipe when inspected at the project:

- Variation from a straight centerline of more than 20 mm in 6 m.
- Any dents greater than 75 mm in diameter
- Any punctures
- Loosely formed or cracked lock seams
- Cracks through the metal
- Sharp bends in pipe arches that are less than the specified minimum corner radius for that size.

BASIS OF ACCEPTANCE. Corrugated steel pipe will be accepted on the basis of certified documentation issued by a supplier appearing on the Department's Approved List. Certification will accompany all shipments arriving at the project in accordance with Materials Bureau procedural directives. Shipments arriving without certification, or with improper certification will be rejected.

The Engineer will measure gauge and coating thicknesses at the project. The pipe will be rejected if the metal and/or coating thickness is less than required or certified. The Contractor will supply equipment required to measure metal and coating thicknesses as detailed in §603-3.02H, Thickness Measuring Equipment.

Acceptance requirements including thickness measurements, visual inspection instructions, certification format, and fabrication shop approval will be in accordance with Materials Bureau procedural directives. At the option of the Department, this material may be subjected to shop inspection. Polymer coatings, coating applicator facilities, and application methods are subject to Materials Bureau approval. Samples are required for laboratory and field testing. Field testing will be a minimum of two years duration. Upon approval, the brand of polymer coating and applicator will be placed on the Department's Approved List. Certifications for polymer coated pipe received at the project will include the brand and applicator of polymer coating, which must appear on the Department's Approved List. Corrugated connecting angles will be accepted provided an approved Materials Detail appears on the Department's Approved List from that supplier.

707-03 DUCTILE IRON PIPE (NON-PRESSURE)

SCOPE. This specification covers the material and quality requirements for 350 mm to 1375 mm Ductile Iron Culvert Pipe.

GENERAL. Ductile Iron Pipe. (Non-Pressure) shall be a centrifugally cast iron pipe conforming to the requirements of ASTM A716, Ductile Iron Culvert Pipe.

BASIS OF ACCEPTANCE. Ductile Iron Pipe (Non-Pressure) shall be accepted on the basis of the Manufacturer's certification that the material conforms to this specification. The certification shall accompany the material delivered to the job site.

The Department reserves the right to sample and test this material subsequent to delivery at the project site.

707-04 DUCTILE IRON PIPE (PRESSURE)

SCOPE. This specification covers the material, and quality requirements for 75 mm to 1375 mm Ductile Iron Pipe (Pressure).

GENERAL. Ductile Iron Pipe (Pressure) shall be a centrifugally cast iron pipe conforming to the requirements of ANSI A21.51., Ductile-Iron Pipe, Centrifugally Cast In Metal Molds or Sandline Molds, for Water or Other Liquids.

BASIS OF ACCEPTANCE. Ductile Iron Pipe (Pressure) shall be accepted on the basis of the Manufacturer's certification that the material conforms to this specification. The certification shall accompany the material delivered to the job site.
The Department reserves the right to sample and test this material subsequent to delivery at the project site.

707-05 TUNNEL LINER PLATE (relining)

SCOPE. This specification covers the material and fabrication requirements for tunnel liner plate.

MATERIAL REQUIREMENTS. Tunnel liner plate steel must conform to ASTM A569. Tunnel liner plate aluminum must conform to AASHTO M219 (ASTM B746). Before cold forming into tunnel liner plate the plates must conform to the following mechanical requirements:

<table>
<thead>
<tr>
<th></th>
<th>STEEL</th>
<th>ALUMINUM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(3.17-3.81 mm)</td>
<td>(4.44-6.35 mm)</td>
</tr>
<tr>
<td>Tensile Strength, MPa</td>
<td>290 min.</td>
<td>240 min.</td>
</tr>
<tr>
<td>Yield Point, MPa</td>
<td>193 min.</td>
<td>165 min.</td>
</tr>
<tr>
<td>Elongation in 50 mm, percent</td>
<td>30 min.</td>
<td>6 min.</td>
</tr>
</tbody>
</table>

Prepare test specimens in accordance with ASTM A570 for steel sheets or ASTM A283 for steel plates and ASTM B209M for aluminum plates. Deliver the Mill test reports, for each heat and thickness to the Engineer with each shipment of liner plates.

Galvanizing. Galvanize steel plates in accordance with AASHTO M167 M. Galvanize after the plates are formed, punched and curved. Hot dip galvanize all bolts and nuts, when used with galvanized tunnel liner plate in accordance with ASTM A153.

Liner Plate. Punch all plate for bolting on both the longitudinal and circumferential seams or joints and fabricate so as to permit complete erection from the inside of the tunnel liner plate structure. The minimum edge distance from the center of a bolt hole to the edge of a plate will be in accordance with the manufacturer’s standard spacing. Provide a sufficient number of plates with 50 mm, or larger, grouting holes with pipe plugs, and spaced so that when the plates are installed there will be one line of holes at the crown of the pipe and one line on each side at approximately the midpoint. The holes in each line will not be more than two (2) meters apart, and they will be staggered along the tunnel length.

Tunnel Liner Plate (Two-Flange). The minimum moment of inertia in mm4 per mm of plate width, based on the average of one ring of plates is as follows:

<table>
<thead>
<tr>
<th></th>
<th>STEEL</th>
<th>ALUMINUM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Uncoated</td>
<td></td>
</tr>
<tr>
<td>Plate Thickness (mm)</td>
<td>Moment of Inertia (mm4/mm)</td>
<td>Thickness (mm)</td>
</tr>
<tr>
<td>3.43</td>
<td>1049</td>
<td>3.18</td>
</tr>
<tr>
<td>4.17</td>
<td>1295</td>
<td>3.81</td>
</tr>
<tr>
<td>4.55</td>
<td>1426</td>
<td>4.45</td>
</tr>
<tr>
<td>5.31</td>
<td>1688</td>
<td>5.08</td>
</tr>
<tr>
<td>6.07</td>
<td>1934</td>
<td>5.72</td>
</tr>
</tbody>
</table>

The longitudinal seams will be of the lap type. The depth of the offset will be equal to the thickness of the metal for the full width of plate, including flanges. Fabricate the lap to allow the cross section of the plates to be continuous through the seam. The lapped longitudinal joints will contain at least five (5) bolts per 450 mm plate width, with bolts in ridges and valleys staggered. Circumferential bolt spacing will be in accordance with the manufacturer’s standard spacing and will be a multiple of the plate length so that the plates having the same curvature are interchangeable. Bolts and nuts for liner plate assemblies will not be less than 16 mm in diameter. Circumferential (flange) seams will conform to ASTM A307, with chemical and mechanical requirements conforming to Grade A and dimensions conforming to Grade B. Bolts and nuts for longitudinal seams will have square heads with a square shoulder to engage the plate. Longitudinal seams of plates 2 mm to 4.5 mm thick, inclusive will conform to ASTM A307, with
Basis of Acceptance. Acceptance of this material will be based on the manufacturer's name appearing on the Approved List.

707-06 Thru 707-08 (Vacant)

707-09 Corrugated Structural Steel Plate for Pipe, Pipe Arches and Underpasses

Scope. This specification covers corrugated structural steel plates intended for use in the construction of pipe, pipe arches and underpasses.

Material Requirements. Structural steel plate, nuts and bolts shall conform to the requirements of AASHTO M167 except as herein specified, and shall be of the thickness and shape shown on the plans. When a gauge number is specified in the contract documents it shall conform to Table 707-2-1. Plates shall have approximately a 50 mm lip beyond each end crest, which will result in the actual length of a given structure being approximately 100 mm longer than the nominal length, except where skewed or beveled.

If directed by the Engineer, the Contractor shall, at its own expense, repair damaged spelter on plate items as directed under §719-01, Galvanized Coatings and Repair Methods. This repair method shall be allowed only when it is in the best interest of the Department. All repairs shall be made at no cost to the State.

Basis of Acceptance. This material will be accepted on the basis of certified documentation issued by a fabrication shop appearing on the Department's Approved List. Certification format and fabrication shop approval shall be in accordance with procedural directives issued by the Materials Bureau. At the option of the Department, this material may be subjected to shop inspection.

707-10 Galvanized Steel End Sections

Scope. This specification covers galvanized steel end sections to be attached to the inlet and outlet ends of corrugated steel pipe.

Material Requirements. Galvanized steel end sections shall be manufactured from material meeting the requirements of AASHTO M218. The units shall conform to the shape, dimensions, and thickness shown on the applicable standard sheet and/or contract plans. The nominal metal thickness corresponding to any gauge shall be as shown in Table 707-2-1. Marking and coating repair shall meet the requirements of §707-02, Corrugated Steel Pipe.

Basis of Acceptance. End sections will be accepted on the basis of certified documentation issued by a fabrication shop appearing on the Department's Approved List. All shipments shall arrive at the project with certification prepared in accordance with Materials Bureau procedural directives. Shipments arriving without certification, or with improper certification, will be rejected.

Metal and coating thicknesses will be measured at the project by project inspectors. If the metal and/or coating thickness is less than required or certified, the material shall be rejected. Equipment required to measure metal and coating thickness shall be supplied by the contractor as detailed in §603-3.02G, Thickness Measuring Equipment.

Acceptance requirements including thickness measurements, visual inspection instructions, certification format, and fabrication shop approval shall be in accordance with Materials Bureau procedural directives. At the option of the Department, this material may be subjected to shop inspection.
§707

707-11 ALUMINUM END SECTIONS

SCOPE. This specification covers aluminum end sections to be attached to the inlet and outlet ends of corrugated aluminum pipe.

MATERIAL REQUIREMENTS. Aluminum end sections shall be manufactured from material meeting the requirements of AASHTO M197M. The units shall conform to the shape, dimensions, and thickness shown on the standard sheet for galvanized steel end sections and/or contract plans. The nominal metal thickness corresponding to any gauge shall be as shown in Table 707-2-1. Marking shall meet the requirements of §707-13, Corrugated Aluminum Pipe.

BASIS OF ACCEPTANCE. End sections will be accepted on the basis of certified documentation issued by a fabrication shop appearing on the Department's Approved List. All shipments shall arrive at the project with a certification prepared in accordance with Materials Bureau procedural directives. Shipments arriving without certification, or with improper certification, will be rejected.

Metal thickness will be measured at the project by project inspectors. If the metal thickness is less than required or certified, the material shall be rejected. Equipment required to measure thickness shall be supplied by the contractor as detailed in §603-3.02H, Thickness Measuring Equipment.

Acceptance requirements including thickness measurements, visual inspection instructions, certification format, and fabrication shop approval shall be in accordance with Materials Bureau procedural directives. At the option of the Department, this material may be subjected to shop inspection.

707-12 (VACANT)

707-13 CORRUGATED ALUMINUM PIPE

SCOPE. This specification covers corrugated aluminum pipe intended for use in the construction of culverts and drainage systems. The corrugated aluminum pipe covered by this specification is classified as follows:

Type I. This pipe shall have a full circular cross-section with a single thickness of corrugated sheet fabricated with annular (circumferential) or helical corrugations.

Type IA. This pipe shall have a full circular cross-section with an outer shell of corrugated sheet fabricated with helical corrugations and an inner liner of smooth (uncorrugated) sheet attached to the shell at helical lock seams.

Type IR. This pipe shall have a full circular cross-section with a single thickness of smooth sheet fabricated with helical ribs projecting outwardly.

Type II. This pipe shall be a Type I pipe which has been reformed into a pipe-arch having an approximately flat bottom.

Type IIR. This pipe shall be a Type IR pipe which has been reformed into a pipe-arch having an approximately flat bottom.

Type III. This pipe, intended for use as underdrains or for underground disposal of water, shall be a Type I pipe which has been perforated to permit the in-flow or out-flow of water.

MATERIAL REQUIREMENTS. Corrugated aluminum pipe shall conform to the requirements of AASHTO M196M Types I, IA, IR, II, IIR, and III except as modified herein. When Type IR and Type IIR corrugated aluminum pipe (spiral rib) is specified, the nominal dimension of the ribs shall be 19 mm by 19 mm at 190 mm spacing.

Gauge. The nominal metal thickness corresponding to any gauge shall be as shown in Table 707-2-1.
End Finish. To facilitate field joining, the ends of all helical corrugated aluminum pipe with 300 mm or greater diameters shall be rerolled to form a minimum of two annular corrugations of no less than 68 mm pitch by 13 mm depth. When the ends of Type IR or Type IIR pipe are rerolled, there shall be only two such corrugations. Rerolled pipe ends shall be uniquely and indelibly labeled so the pipe may be assembled in the field in the same order it was manufactured.

Coupling Bands. All round pipe sections (Types I, IA, IR, and III) 300 mm or greater in diameter shall be field joined with aluminum coupling bands. Helical corrugated pipe without rerolled ends may be joined with helical corrugated bands. Pipe with rerolled ends or annular corrugations shall be joined with annular corrugated coupling bands.

All bands shall have corrugations with the same dimensions as the pipe ends. Annular corrugated bands shall mesh with at least one full corrugation and shall lap equally on each pipe end. The band widths shall be a minimum of 180 mm for pipe diameters up to and including 800 mm. The band widths shall be a minimum of 265 mm for pipe diameters greater than 800 mm.

The bands shall not be more than 2 nominal sheet thicknesses thinner than the pipe and in no case thinner than 1.30 mm.

Pipe arches (Type II and Type IIR) may be joined by the annular corrugated bands described above or by special projection type coupling bands. The special projection bands shall consist of two rows of projections at 75 mm center-to-center that will mesh with at least one full corrugation and will lap equally on each pipe end. The special projection bands shall not be more than 2 nominal sheet thicknesses thinner than the pipe and in no case thinner than 1.60 mm.

Regular projection type coupling bands (dimpled bands) will not be acceptable for pipe 300 mm in diameter and larger. Dimpled bands may be used on pipe smaller than 300 mm in diameter, all sizes of perforated underdrain pipe, and for connecting pipe extensions to existing helical corrugated pipe without rerolled ends, unless otherwise shown on the plans.

Coupling bands may be one or two piece. Two piece coupling bands shall be used on pipe 1200 mm or greater in diameter.

Coupling band connectors shall be one of the following types:
• Aluminum angles, 50 mm x 50 mm x 5 mm
• Aluminum lug connectors
• Aluminum bar and strap connectors.

These connectors shall be riveted, bolted, or welded to the coupling bands. Evidence of loose bolts or rivets, bearing failure, or weld or band tearing shall be cause for rejection and replacement of that coupling band. As an alternate to the coupling band connectors stated above, an aluminum corrugated angle which conforms to an approved Materials Detail may be used.

MARKING. Each length of corrugated aluminum pipe shall be marked or tagged as approved by the Department to properly cross-reference the supplier's certification.

Additional Defects. In addition to criteria established in Materials Bureau procedural directives and defects listed in AASHTO, the following defects will be cause for rejecting the pipe when inspected at the project:
• Variation from a straight centerline of more than 20 mm in 6 m.
• Any dents greater than 75 mm in diameter
• Any punctures
• Loosely formed or cracked lock seams
• Cracks through the metal
• Sharp bends in pipe arches that are less than the specified minimum corner radius for that size.

BASIS OF ACCEPTANCE. Corrugated aluminum pipe will be accepted on the basis of certified documentation issued by a supplier appearing on the Department's Approved List. All shipments shall arrive at the project with certification prepared in accordance with Materials Bureau procedural directives. Shipments arriving without certification, or with improper certification, shall be rejected.
Gauge shall be measured at the project by project inspectors. If the gauge is less than required, the pipe shall be rejected. Equipment required to measure gauge shall be supplied by the contractor as detailed in §603-3.02H, Thickness Measuring Equipment.

Acceptance requirements including thickness measurements, visual inspection instructions, certification format, and fabrication shop approval shall be in accordance with Materials Bureau procedural directives. At the option of the Department, this material may be subjected to shop inspection. Corrugated connecting angles will be accepted provided an approved Materials Detail appears on the Department's Approved List from that supplier.

707-14 CORRUGATED ALUMINUM STRUCTURAL PLATE FOR PIPE AND PIPE ARCHES

SCOPE. This specification covers corrugated aluminum structural plates for use in the construction of pipe and pipe arches.

MATERIAL REQUIREMENTS. Structural plate, nuts and bolts shall conform to the requirements of AASHTO M219 except as herein specified, and shall be of the thickness and shape shown on the plans. When a gauge number is specified in the contract documents, it shall conform to Table 707-2-1.

The corrugations shall run at right angles to the longitudinal axis of the structure. Plates shall have approximately a 45 mm lip beyond each end crest, which will result in the actual length of a given structure being approximately 90 mm longer than the nominal length, except where skewed or beveled.

All sections which are damaged from any cause, including handling, or where any dimension varies from that specified, shall be replaced at the Contractor's expense in a manner approved by the Engineer.

BASIS OF ACCEPTANCE. This material will be accepted on the basis of certification by the fabricator. Each fabricator shall furnish upon request by the Materials Bureau a certified analysis and guarantee executed by the manufacturer of the base metal as described in AASHTO M219.

At the option of the Department, structural plates may be subjected to shop inspection or may be shipped to the project site accompanied by certified documentation executed in a form prescribed by the Department.

707-15 THRU 707-19 (VACANT)

707-20 ANCHOR BOLTS FOR CORRUGATED CULVERTS

SCOPE. This specification covers the material details and quality requirements for the anchorage system securing the ends of corrugated metal pipe, arch pipe, and structural plate to reinforced or plain concrete headwalls.

MATERIAL REQUIREMENTS. Anchor bolts shall be 19 mm diameter heavy hex bolts, ASTM A307. Grip shall be 140 mm threaded over at least first 63 mm. The bolts shall be fitted with two nuts, ASTM A563 heavy hex. Nuts shall be chamfered on at least one face using a 25 mm spherical radii. The nuts and bolts shall be so assembled that in the final assembly, the bolt and one of the nuts is embedded in concrete, that the chamfered faces of the nuts face each other, and secure the pipe between them. Nuts and bolts shall be galvanized as per ASTM A153 after all machining operations are completed. Following galvanization, threads shall be cleaned to produce a free running fit.

When 485 mm hook bolts are used as anchor bolts they shall be detailed on the plans and shall conform to the requirements of ASTM A36.

Anchor bolts shall be spaced around the periphery of the pipe at intervals not exceeding 460 mm. At least two anchor bolts shall be provided.

BASIS OF ACCEPTANCE. Anchor bolts and nuts for corrugated metal pipes, pipe arches, and structural plate pipe will be accepted on the Manufacturer's Certification that they conform with these specifications.
SECTION 708 - PAINTS

708-01 STRUCTURAL STEEL PAINTS CLASS 1

SCOPE: This specification defines the requirements for materials appearing on the Department’s Approved List, “Structural Steel Paints, Class 1.”

MATERIAL REQUIREMENTS: The system shall be able to be applied as a shop or a field-applied coating over an SSPC SP-10 cleaned surface.

The primer shall be an organic zinc-rich epoxy with pigment primarily consisting of zinc dust.

The paint shall have undergone National Transportation Product Evaluation Program (NTPEP). The coating manufacturer shall submit NTPEP results, field histories of the coating, Material Safety Data Sheets, and Technical Data Sheets to the Materials Bureau. Any formulation or technical data sheet change may affect approval status, and shall be reported to the Materials Bureau. Failure to notify the Materials Bureau shall result in the removal of the system from the Approved list.

The system’s Technical Data Sheets shall contain the following information:
- Temperature Range for Storage
- Profile Range
- Temperature for Application
- Cure to Handle/Overcoat Schedule
- Humidity and Dew Point Restrictions
- Mixing Recommendations
- Thinners allowed and resulting VOC levels
- Recoat Window
- Paint Film Thickness Range, Wet and Dry-Film Values
- Surface preparation requirements
- Application Requirements

If the data sheet does not have all of the above information, the manufacturer will be required to submit a letter to the Engineer with the above information. The letter will be considered an addendum to the technical data sheet.

BASIS OF ACCEPTANCE: Contract acceptance will be based on the appearance of the product on the Approved List.

708-02 STRUCTURAL STEEL PAINTS CLASS 2

SCOPE: This specification defines the requirements for materials appearing on the Department’s Approved List, “Structural Steel Paints, Class 2.”

MATERIAL REQUIREMENTS: The system shall be able to be applied in the field over an SSPC SP-11 cleaned surface or a previously painted surface.

The paint shall have undergone National Transportation Product Evaluation Program (NTPEP) or NYSDOT approved alternative testing. The coating manufactures shall submit NTPEP results and field histories of the coating to the Materials Bureau.

Any formulation or technical data sheet change may affect approval status and shall be reported to the Materials Bureau. Failure to notify the Materials Bureau shall result in the removal of the system from the Approved list.

The system’s Technical Data Sheets shall contain the following information:
- Temperature Range for Storage
- Profile Range
- Temperature for Application
- Cure to Handle/Overcoat Schedule
- Humidity and Dew Point Restrictions
- Mixing Recommendations
If the data sheet does not have all of the above information, the manufacturer will be required to submit a letter to the Engineer with the above information. The letter will be considered an addendum to the technical data sheet.

**BASIS OF ACCEPTANCE:** Contract acceptance will be based on the appearance of the product on the Approved List.

### 708-03 (VACANT)

### 708-04 ZINC CHROMATE PRIMER

**SCOPE.** This paint is used as a prime coat on aluminum in contact with fresh concrete to reduce the effect of alkali attack.

**MATERIAL REQUIREMENTS.** The composition of this paint shall be as shown in the following table using ingredients conforming to the requirements of the applicable specifications indicated.

<table>
<thead>
<tr>
<th>Component</th>
<th>Specification</th>
<th>Grams Per Liter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zinc Yellow</td>
<td>(TT-P-465)</td>
<td>324</td>
</tr>
<tr>
<td>Titanium Dioxide, Rutile,</td>
<td>Chalk Resistant</td>
<td>90</td>
</tr>
<tr>
<td>Zinc Oxide (American Process Type)</td>
<td>(ASTM D79)</td>
<td>114</td>
</tr>
<tr>
<td>Sienna, Raw</td>
<td>(ASTM D765)</td>
<td>30</td>
</tr>
<tr>
<td>Magnesium Silicate</td>
<td>(ASTM D605)</td>
<td>90</td>
</tr>
<tr>
<td>Aluminum Stearate</td>
<td>(MIL-A-15206A)</td>
<td>7.2</td>
</tr>
<tr>
<td>Resin, alkyd Solution</td>
<td>(TT-R-266C, Type I)</td>
<td>413</td>
</tr>
<tr>
<td>Dipentine</td>
<td>(TT-D-376)</td>
<td>26.3</td>
</tr>
<tr>
<td>Petroleum Spirits</td>
<td>(TT-T-291, Type I, Grade A)</td>
<td>281.4</td>
</tr>
<tr>
<td>Lead Napthenate</td>
<td>(ASTM D600, Class B)</td>
<td>14.4</td>
</tr>
<tr>
<td>Cobalt Napthenate</td>
<td>(ASTM D600, Class B)</td>
<td>1.4</td>
</tr>
<tr>
<td>Magnesium Napthenate</td>
<td>(ASTM D600, Class B)</td>
<td>1.4</td>
</tr>
</tbody>
</table>

The quantitative requirements of zinc chromate primer shall be as follows:

<table>
<thead>
<tr>
<th></th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pigment</td>
<td>45.0%</td>
<td>49.0%</td>
</tr>
<tr>
<td>Vehicle</td>
<td>51.0%</td>
<td>55.0%</td>
</tr>
<tr>
<td>Volatile by weight of paint</td>
<td>29.5%</td>
<td>33.5%</td>
</tr>
<tr>
<td>Weight (kg/L)</td>
<td>1.32</td>
<td>1.39</td>
</tr>
<tr>
<td>Water</td>
<td>-</td>
<td>0.5%</td>
</tr>
<tr>
<td>Coarse particles &amp; skins (total residue retained on 45 µm sieve based on paint)</td>
<td>-</td>
<td>0.5%</td>
</tr>
<tr>
<td>Fineness of Grind (North Standard)</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>Viscosity at 25°C (Stormer-Krebs Units)</td>
<td>62</td>
<td>82</td>
</tr>
<tr>
<td>Zinc oxide (ZnO), by weight of pigment</td>
<td>34.0%</td>
<td>39.0%</td>
</tr>
<tr>
<td>Titanium Dioxide (TiO2), by weight of pigment</td>
<td>12.0%</td>
<td>14.5%</td>
</tr>
<tr>
<td>Chromium Trioxide (CrO3), by weight of pigment</td>
<td>20.0%</td>
<td>-</td>
</tr>
<tr>
<td>Phthalic Anhydride, by weight of non-volatile vehicle</td>
<td>23.0%</td>
<td>-</td>
</tr>
<tr>
<td>Flash Point</td>
<td>30°C</td>
<td>-</td>
</tr>
</tbody>
</table>
The percentages noted relate to mixture by weight. The paint shall dry set to touch within two hours and dry hard within 6 hours. No resin and resin derivatives shall be present in the paint. The paint shall show no evidence of cracking when subjected to a 3 mm “mandrel flexibility test.”

708-05 STANDARD PAINT COLORS

SCOPE: This specification defines commonly used colors.

DEFINITIONS:

<table>
<thead>
<tr>
<th>Color Reference Standard</th>
<th>Munsell Color Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sage Green Paint</td>
<td>7.5 GY 5/4</td>
</tr>
<tr>
<td>Light Gray Paint</td>
<td>10B 6/1</td>
</tr>
<tr>
<td>Blue Paint</td>
<td>Federal Color Standard 595, # 35177</td>
</tr>
<tr>
<td>Brown Paint</td>
<td>Federal Color Standard 595, # 30111</td>
</tr>
<tr>
<td>Brown-Gray Paint</td>
<td>Federal Color Standard 595, # 36306</td>
</tr>
<tr>
<td>Dark Blue Paint</td>
<td>Federal Color Standard 595, # 15090</td>
</tr>
<tr>
<td>Textured Concrete Finish Paint</td>
<td>Federal Color Standard 595, # 36440</td>
</tr>
<tr>
<td>Weathered Brown Guide Rail Paint</td>
<td>Federal Color Standard 595, # 20059</td>
</tr>
</tbody>
</table>

Assistance in providing definitions for other colors is offered by the Materials Bureau.

BASIS OF ACCEPTANCE: The Engineer may require manufacturer’s certification that the color provided meets the requirements of this specification.

708-06 PAINT FOR GALVANIZED SURFACES

SCOPE. This specification covers the materials requirements for paints to be applied over galvanized surfaces.

PAINT. Paint shall be a two-coat system with an polyamide epoxy primer and an aliphatic urethane, suitable for exterior use. The paints shall have a VOC level below 340 g/L, shall be produced by the same manufacturer, and the prime and top coat shall be compatible. The primer shall be specifically formulated for use over galvanized surfaces.

BASIS OF ACCEPTANCE. The material shall be accepted with the submission of the technical data sheets and the manufacturer’s certification ensuring compliance with this specification.

708-07 PAINT FOR ALUMINUM SURFACES

SCOPE. This specification covers the materials requirements for paints to be applied over aluminum surfaces not in contact with concrete.

PAINT. Paint shall be a two-coat system with an epoxy primer and an aliphatic urethane, suitable for exterior use. The paints shall have a VOC level below 340 g/L, shall be produced by the same manufacturer, and the prime and top coat shall be compatible. The primer shall be specifically formulated for use over aluminum surfaces.

BASIS OF ACCEPTANCE. The material shall be accepted with the submission of the technical data sheets and the manufacturer’s certification ensuring compliance with this specification.

708-08 THRU 708-29 (VACANT)

708-30 WOOD PRESERVATIVE - CREOSOTE OIL

SCOPE. These specifications cover creosote used in the treatment of piles, timber and lumber.
MATERIAL REQUIREMENTS. The requirements of American Wood Preservers' Association Standards shall apply except as modified herein.

Creosote used in the treatment of piles, timber and lumber shall conform to the requirements of the following American Wood Preservers' Association Standards:

<table>
<thead>
<tr>
<th>Type of Preservative</th>
<th>AWPA Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal-Tar Creosote</td>
<td>P 1 Land &amp; Fresh Water</td>
</tr>
<tr>
<td></td>
<td>P13 Marine (Coastal Water)</td>
</tr>
<tr>
<td>Creosote-Coal Tar Solution</td>
<td>P 2 Standard Creosote-Coal Tar-Grade C</td>
</tr>
<tr>
<td></td>
<td>P12 Marine (Coastal Waters) Piles and Timber</td>
</tr>
</tbody>
</table>

Method of application shall be in conformance with American Wood Preservers' Association Standards C1, C2, C3, C4, C5, C14 and C18. Minimum net retention shall be as required for material in contact with soil.

BASIS OF ACCEPTANCE. Acceptance of this material shall be in accordance with procedural directives of the Department.

708-31 WOOD PRESERVATIVE - WATERBORNE

SCOPE. These specifications cover waterborne wood preservatives used in the treatment of piles, timber, and lumber.

MATERIAL REQUIREMENTS. Waterborne wood preservatives shall be Alkaline Copper Quarternary (ACQ), Copper Azol, Ammoniacal Copper Arsenite (ACA) or Chromated Copper Arsenate (CCA) conforming to the requirements of American Wood-Preservers' Association Standard P5.

Waterborne wood preservatives shall be applied in conformance with American Wood Preservers' Association Standards C1, C2, C3, C4, C5, C14 and C18. Minimum net retention shall be as required for material in contact with soil.

BASIS OF ACCEPTANCE. Acceptance of this material shall be in accordance with procedural directives of the Department.

708-32 WOOD PRESERVATIVE - OIL BORNE

SCOPE. These specifications cover oil-borne wood preservative used in the treatment of timber and lumber.

MATERIAL REQUIREMENTS. Pentachlorophenol for pressure treatment shall conform to American Wood-Preservers' Association Standard P8.

Oil-borne wood preservative shall be applied in conformance with American Wood-Preservers' Association Standards C1, C2, C5 and C14. The net retention of pentachlorophenol shall be as required for material in contact with soil.

BASIS OF ACCEPTANCE. Acceptance of this material shall be in accordance with procedural directives of the Department.

SECTION 709 - REINFORCING STEEL

709-01 BAR REINFORCEMENT, GRADE 420

SCOPE. This specification covers the material requirements for deformed billet steel and deformed rail steel reinforcing bars used in portland cement concrete. Plain and deformed steel for the fabrication of spirals is included.
MATERIALS REQUIREMENTS

A. Deformed Bar Reinforcement. Steel reinforcing bars shall be deformed billet steel bars meeting the requirements of ASTM A615, Grade 420, or deformed rail steel bars meeting the requirements of ASTM A996M, Grade 420 including Supplementary Requirement S1.

B. Spirals. Spirals shall be plain wire meeting the requirements of ASTM A82, or plain or deformed bars in coils or cut lengths, meeting the requirements of ASTM A615, Grade 420. When specified the spirals shall be epoxy coated in accordance with the applicable requirements of §709-04 or §709-08.

BASIS OF ACCEPTANCE. Bar reinforcement and spirals will be accepted on the basis of the manufacturer's name and location appearing on the Department’s Approved List and a material certification that specifies the product conforms to this specification. Buy America requirements apply.

709-02 WIRE FABRIC FOR CONCRETE REINFORCEMENT

SCOPE. This specification covers the material requirements for wire fabric reinforcement used in portland cement concrete pavement, precast concrete products and other concrete construction.

MATERIALS REQUIREMENTS. Wire fabric reinforcement shall conform to the requirements of either ASTM A185 or ASTM A497, exclusive of the portions pertaining to rejection, retests and rehearing, except as indicated on the plans, in the proposal or as modified herein.

The weld shear test will not be required for acceptance of wire fabric for concrete pipe.

BASIS OF ACCEPTANCE. Welded wire fabric for concrete reinforcement will be accepted on the basis of the manufacturer's name and location appearing on the Department’s Approved List and a material certification that specifies the product conforms to this specification. Buy America requirements apply.

709-03 (VACANT)

709-04 EPOXY-COATED BAR REINFORCEMENT

SCOPE. This specification covers bar reinforcement with protective epoxy coatings applied by the electrostatic spray method.

MATERIAL REQUIREMENTS

A. Bar Reinforcement. Steel reinforcing bars shall conform to the requirements of §709-01, Bar Reinforcement, Grade 420 or §709-14, Bar Reinforcement, Grade 520.

B. Epoxy Coating Material. The epoxy coating material shall be an organic, powdered-epoxy resin that is applied by electrostatic methods.

Epoxy coating material shall be approved by the Materials Bureau. Detailed requirements and procedures for the acceptance of epoxy coating materials are available from the Materials Bureau. Upon approval of the product, the epoxy coating will be placed on a Department “Approved List” of materials. The epoxy coating manufacturer shall supply written certification to the coating applicator that the coating material is the same as that approved by the Materials Bureau.

C. Patching Material. Patching or repair materials shall be supplied by the epoxy coating manufacturer. The patching material shall be compatible with the epoxy coating, inert in concrete, and suitable for use in making shop or field repairs.
Coating Application

**A. Coating Applicator.** The coating applicator's facilities shall be approved by the Materials Bureau. Applications for approval of facilities shall be made to the Materials Bureau by the coating applicator. Upon approval, the name and address of the coating applicator will be placed on the Department's list of "Approved Applicators."

**B. Surface Preparation**

1. The surface of bars to be coated shall be blast cleaned in accordance with the Steel Structures Painting Council - Surface Preparation Specification No. 10 (SSPC-SP10), Near White Blast Cleaning. After blasting, the cleaned surface of the bar shall be defined by SSPC-Vis 1-89, Pictorial Standards A SP 10, B SP 10, or C SP 10, as applicable.
2. A suitable anchor pattern shall be produced by the cleaning media. A target profile of approximately (1/3) the coating thickness shall be considered suitable as an anchor pattern. Measurements shall be taken using a surface profile gage, or replica tape, approved by the Materials Bureau.
3. The powdered epoxy resin coating shall be applied to the cleaned surface as soon as possible after cleaning and before visible oxidation occurs. In no case shall more than 8 hours elapse between cleaning and coating.

**C. Coating Application.** The powdered epoxy resin coating shall be electrostatically applied to pre-heated bars, and cured in accordance with the recommendations of the coating manufacturer. The epoxy coating may be applied before or after fabrication (bending) of the reinforcement bars.

**D. Coating Thickness**

1. The epoxy coating shall be applied as a uniform, smooth coat. After curing, the coating thickness shall be 0.25 ± 0.05 mm.
2. Coating thickness shall be determined by taking measurements on a minimum of five coated bars from each production lot. Five spot measurements shall be obtained from evenly spaced locations along each side of the test bar (a minimum of 10 spot measurements per bar). A spot measurement is defined as the average of three individual readings obtained from three adjacent areas on the body, or on the deformations of the bar.
3. For acceptance purposes at least ninety (90) percent of all spot thickness measurements shall be 0.20 mm to 0.30 mm after cure, and no spot measurement of coating thickness shall be less than 0.20 mm or greater than 0.38 mm.
4. Coating thickness shall be measured by the method outlined in ASTM G12, except that the number and location of thickness measurements shall be in accordance with this specification. All magnetic gages shall be approved by the Materials Bureau.

**E. Continuity of Coating**

1. The coating shall be checked visually after cure for continuity. It shall be free from holes, voids, contamination, cracks and damaged areas.
2. The coating shall have not more than two holidays (pinholes not visible to the naked eye) in any 0.3 m length of the coated bar. A 67.5 volt, 80,000 ohm, d-c holiday detector shall be used in-line to check the coating for holidays at all times during the application of epoxy protective coating. Bar reinforcement that is coated when the in-line detector is inoperable shall be automatically rejected.

**F. Coating Cure.** The coating applicator shall check each production lot to determine that the entire production lot of coated bars is in a fully-cured condition.
G. Adhesion of Coating

1. The adhesion of the coating shall be evaluated on a minimum of two bars from each production lot. The coated bar shall be bent 120 degrees (after rebound) around a mandrel of specified size as designated in Table 709-4. The bend shall be done at a uniformly slow rate and may take up to 45 seconds to complete. The bend test specimen shall be positioned so that the two longitudinal deformations are in a plane perpendicular to the mandrel radius. The test specimens shall be between 20°C and 30°C at the time of testing.

2. No cracking, disbondment, or other coating defect shall be visible to the naked eye on the outside, or on the inside radius of the bent bar.

3. If both test specimens show evidence of cracking or disbondment, the production lot represented by the samples shall be rejected.

If only one of the two test specimens shows evidence of cracking or disbondment of coating, two additional random samples shall be tested. If the test results from both retests show no defects, the production lot represented by the samples shall be accepted. If the test results of either retest fails, the production lot represented by the samples will be rejected.

<table>
<thead>
<tr>
<th>TABLE 709-4 BEND TEST REQUIREMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bar Number</td>
</tr>
<tr>
<td>(3)</td>
</tr>
<tr>
<td>(4)</td>
</tr>
<tr>
<td>(5)</td>
</tr>
<tr>
<td>(6)</td>
</tr>
<tr>
<td>(7)</td>
</tr>
<tr>
<td>(8)</td>
</tr>
<tr>
<td>(9)</td>
</tr>
<tr>
<td>(10)</td>
</tr>
<tr>
<td>(11)</td>
</tr>
<tr>
<td>(14)</td>
</tr>
<tr>
<td>(18)</td>
</tr>
<tr>
<td>Mandrel Diam. (mm)</td>
</tr>
</tbody>
</table>

NOTE: Numbers in parenthesis are bar sizes marked in eighths of inches

SAMPLING AND TESTING

A. Lot Size. For test purposes a production lot is the smallest number of reinforcement bars of the same type, heat and size as determined by the following requirements:

1. A lot shall not exceed a single order.
2. A lot shall consist of the number of bars as defined by the coating applicator, except that it shall not exceed the number of reinforcement bars coated within a single working shift.

B. Quality Control. The coating applicator shall be responsible for performing quality control and test. This will include inspection for compliance with the requirements of Coating Thickness, Continuity of Coating, and Coating Cure, and the testing required under Adhesion of Coating.

C. Plant Inspection

1. The Department reserves the right to have its authorized representative observe the preparation, coating, and testing of the reinforcement bars. The representative shall have free access to the plant. Any work done when access has been denied shall be automatically rejected.
2. If the representative elects, lengths of coated bars may be taken from the production run, on a random basis, for test, evaluation and check purposes by the Materials Bureau.

Repair of Coated Bars

A. Repairs at the Coating Applicator’s Facility

1. Repairs will not be allowed on epoxy-coated reinforcement bars that do not meet the requirements for Coating Thickness, Continuity of Coating, Coating Cure, or Adhesion of Coating. Reinforcement bars exhibiting any one of these defects shall be replaced, or stripped of epoxy coating, recleaned, and recoated in accordance with this specification.
2. All other damage that occurs from handling, or for other reasons, at the coating applicator’s facility shall be repaired with patching material. All repairs shall be performed as soon as possible.
and before visible rust (oxidation) appears on the steel surface. All repairs shall be performed in accordance with the recommendations of the manufacturer of the patching material.

3. The coating applicator shall be responsible for repair to the coating due to damage at the coating applicator's facility.

**B. Repair at the Fabrication Facility**

1. The fabricator shall be responsible for repair to the coating due to damage during fabrication and handling at the fabricator's facility.

2. All coating damage due to fabrication, or handling, or for other reasons that occurs at the fabricator's facility shall be repaired with patching material.

3. Wherever bond loss or damaged areas of coating exist, they shall be cleaned and repaired. The cleaning shall remove loose or deleterious material, or both. In cases where rust is present it shall be removed by blast cleaning prior to repairs. The requirements of Surface Preparation, part 2a., shall apply.

4. Visible cracks, including hairline cracks without bond loss that occur due to fabrication of the bars, shall be repaired with patching material.

5. When coated bars are sheared, saw-cut, or cut by other means during the fabrication process, the exposed ends shall be coated with patching material.

6. All repairs shall be performed as soon as possible and before visible rust (oxidation) appears on the steel surface.

**HANDLING AND STORAGE.** All systems for handling coated bars shall have padded contact areas for the bars. All bundling bands shall be padded and all bundles shall be lifted with a strong back, multiple supports or a platform bridge so as to prevent bar to bar abrasion from sags in the bar bundle. The bars or bundles shall not be dropped or dragged.

Epoxy-coated bar reinforcement shall be stored above the ground on wooden or padded supports. Epoxy-coated bar reinforcement shall not be stored unprotected outdoors. All coated bars that are stored outdoors shall be protected from sunlight and moisture, using opaque waterproof covers. The covers shall be placed in a manner that will permit constant air circulation so as to minimize the formation of condensation on the epoxy-coated bar surface.

**BASIS OF ACCEPTANCE.** Epoxy-coated bar reinforcement, grade 420 or grade 520, will be accepted on the basis of the names and locations of the reinforcing bar manufacturer and the epoxy reinforcing bar applicator appearing on the Department’s Approved List and a material certification from the epoxy reinforcing bar applicator that specifies the product conforms to this specification. In addition, fabricated, epoxy-coated bar reinforcement will be supplied by a fabricator appearing on the Department’s Approved List, Fabricators for Epoxy-Coated Steel Reinforcing Bars. *Buy America requirements apply.*

**709-05 STUD SHEAR CONNECTORS**

**SCOPE.** This specification covers the material requirements for stud shear connectors used in bridge structures.

**MATERIALS REQUIREMENTS.** Steel used for the manufacture of stud shear connectors shall conform to the Specification for Steel Bars, Carbon, Cold Finished, Standard Quality, ASTM A108, UNS Designation G10100 thru G10200, either Semi-Killed, or Killed Deoxidation.

Stud shear connectors shall be furnished in the dimension shown on the Contract Plans.

**BASIS OF ACCEPTANCE.** Acceptance of this material will be based on the manufacturer's certification of compliance with these specification requirements.

ASTM quality control tests shall have been made not more than six months prior to the date of manufacture of the studs.
709-06 LOW-RELAXATION PRESTRESSING STEEL, GRADE 1860

SCOPE. This specification covers the material requirements for low-relaxation prestressing steel used in the fabrication of prestressed concrete units.

MATERIAL REQUIREMENTS. Low-relaxation prestressing steel shall conform to the requirements of ASTM A416M, Grade 1860. Low-relaxation prestressing steel shall be free of dirt, oil, paint, mill scale, corrosion, coatings, lubricants, or any other foreign material that may prevent an acceptable bond between the steel and the concrete.

BASIS OF ACCEPTANCE. Low-relaxation prestressing steel will be accepted on the basis of the manufacturer's name and location appearing on the Department’s Approved List and a material certification that specifies the product conforms to this specification. Buy America requirements apply.

709-07 STONE CURB ANCHOR BARS

SCOPE. This specification covers the material requirements for stone curb bars used in bridge construction.

MATERIAL REQUIREMENTS. Anchor bars for Types F1, G1, M, R1, R2, S and T1 curbs shall meet the requirements of ASTM A615M, Grade 420 or Grade 520, deformed billet-steel bars shall be galvanized in accordance with §719-01, Galvanized Coatings and Field Repair Methods, Type I. As an alternate to galvanizing, the bars may be treated with a protective epoxy coating. This coating shall be applied by either the electrostatic spray method of the electrostatic fluidized bed method, as specified in §709-04 Epoxy Coated Bar Reinforcement or in accordance with the applicable requirements of §705-14 Longitudinal Joint Ties.

BASIS OF ACCEPTANCE. The stone curb anchor bars will be accepted when on the basis of evaluation by the Engineer, the product complies with these specification requirements.

709-08 EPOXY COATED WIRE FABRIC REINFORCEMENT

SCOPE. This specification covers sheets of wire fabric reinforcement with protective epoxy coatings that are applied by the electrostatic spray method or electrostatic fluidized bed method.

MATERIAL REQUIREMENTS

A. Wire Fabric Reinforcement. Wire fabric reinforcement shall conform to the requirements of §709-02.

B. Epoxy Coating Material

1. The epoxy coating material shall be an organic, powered epoxy resin that is applied by electrostatic methods. Epoxy coating materials shall be approved by the Materials Bureau. Detailed requirements and procedures for the acceptance of epoxy coating materials are available from the Materials Bureau. Upon approval of the product, the epoxy coating will be placed on a Department Approved List of materials.

2. The epoxy coating manufacturer shall supply written certification to the coating applicator that the coating material is the same as that approved by the Materials Bureau.

C. Patching Material. Patching or repair materials shall be supplied by the epoxy coating manufacturer. The patching material shall be compatible with the epoxy coating, inert in concrete, and shall be suitable for use in making field repairs.
Coating Application

A. Coating Applicator. The coating applicator's facilities shall be approved by the Materials Bureau. Applications for approval of facilities shall be made to the Materials Bureau by the coating applicator. Upon approval, they will be placed on the Department's list of "Approved Applicators For Epoxy Coated Wire Fabric Reinforcement."

B. Surface Preparation
1. The surface wire fabric to be coated shall be blast cleaned in accordance with the Steel Structures Paint Council - Surface Preparation Specification No. 10 (SSPC-SP10), near White Blast Cleaning. After blasting, the cleaned surface of the bar shall be defined by SSPC-Vis 1-89, Pictorial Standards A SP 10, B SP 10, or C SP 10, as applicable.
2. The powdered epoxy resin coating shall be applied to the cleaned surface as soon as possible after cleaning and before visible oxidation occurs. In no case shall more than 8 hours elapse between cleaning and coating.

C. Coating Application. The powdered epoxy resin coating shall be electrostatically applied in accordance with the recommendations of the coating manufacturer.

D. Coating Thickness. The epoxy coating shall be applied as a smooth, uniform coat. After curing, the coating thickness shall be a minimum of 0.10 mm. Coating thickness shall be controlled by taking measurements on a representative sample from each production lot. Coating thickness measurements shall be conducted by the method outlined in ASTM B499.

E. Continuity of Coating
1. The coating shall be checked visually after cure for continuity. It shall be free from holes, voids, contamination, cracks and damaged areas.
2. The coating shall not have more than two holidays (pinholes visible to the naked eye) in any 0.3 m length of a coated single wire. A holiday detector shall be used, in accordance with the manufacturer's instructions, to check the coating for holidays. Sharp edges at the welded intersection of the wires shall not be considered to be holidays.

F. Coating Cure. The coating applicator shall check each production lot to determine that the entire production lot of coated fabric is in a fully-cured condition.

G. Flexibility of Coating
1. The flexibility of the coating shall be evaluated on two representative sections of wire fabric from each production lot or two #16, Grade 420 reinforcing bars that have been coated simultaneously with the wire fabric. A representative wire from the wire fabric shall be bent 120 degrees (after rebound) around a pin or mandrel of 10 diameters or alternately, a reinforcing bar shall be bent 120 degrees around a 150 mm diameter pin or mandrel. Bending shall be done at a minimum rate and may take up to one minute to complete. The test specimens shall be a thermal equilibrium between 20°C and 30°C at the time of testing.
2. When examined by the naked eye, the outside radius of the bent wire or bar shall be free of cracks in the coating.

TESTING AND SAMPLING

A. Lot Size. For test purposes a production lot is the smallest number of sheets of wire fabric of the same style (gauge, spacing size) from a given manufacturer as determined by the following requirements:
1. A lot shall not exceed a single order, or delivered load of 1500 sheets, whichever is smaller.
2. A lot shall consist of the number of sheets as defined by the coating applicator except that it shall not exceed the number of sheets coated within a single working shift.
3. A lot shall consist of the number of sheets of mesh coated with the same batch or lot of epoxy.
B. Quality Control. The coating applicator shall be responsible for performing quality control and tests. This will include inspection for compliance with the requirements of Coating Thickness, Continuity of Coating and Coating Cure and the testing required under Flexibility of Coating.

C. Plant Inspection.

1. The Department reserves the right to have its authorized representative observe the preparation, coating and testing of wire fabric. The representative shall have free access to the plant. Any work done while access was denied will be rejected.
2. If the representative elects, samples of coated fabric may be taken from the production run, on a random basis, for test, evaluation and check purposes by the Materials Bureau.

REPAIR. Epoxy coated wire fabric reinforcement which does not meet the requirements of Coating Thickness, Continuity of Coating, Coating Cure or Flexibility of Coating shall not be repaired.

Reinforcement with these defects shall be replaced or stripped of epoxy coating, recleaned and recoated in accordance with the requirements of this specification.

Any damage to the coated reinforcement, occurring at the coating applicator's facility shall be cleaned and repaired with patching material. The cleaning shall remove loose or deleterious material or both. If rust is present, it shall be removed by blast cleaning prior to patching.

HANDLING. All systems for coated wire fabric shall have padded contact areas, wherever possible. All bundling bands shall be padded and all bundles shall be lifted with a strong back, multiple supports or a platform bridge so as to prevent sheet to sheet abrasion from sags in the bundle. The sheets or bundles shall not be dropped or dragged.

BASIS OF ACCEPTANCE. Epoxy-coated wire fabric will be accepted on the basis of the names and locations of the welded wire fabric manufacturer and the epoxy applicator appearing on the Department’s Approved List and a material certification from the epoxy applicator that specifies the product conforms to this specification. Buy America requirements apply.

709-09 COLD-DRAWN WIRE FOR CONCRETE REINFORCEMENT

SCOPE. This specification covers the material requirements for cold-drawn wire for concrete reinforcement used in portland cement concrete pavement, precast concrete products and other concrete construction.

MATERIAL REQUIREMENTS. Cold-drawn wire shall conform to the requirements of either ASTM A82 or ASTM A496, exclusive of the portions pertaining to rejection, retests and rehearing, except as indicated on the plans or in the proposal.

BASIS OF ACCEPTANCE. Cold-drawn wire will be considered for acceptance on the basis of the Manufacturer's name appearing on the Approved List and certification in accordance with procedural directives of the Materials Bureau.

Alternately, cold-drawn wire from a Manufacturer not appearing on the Approved List may be considered for acceptance in stock lot quantities at manufacturing locations based on sampling and testing in accordance with procedural directives of the Materials Bureau.

709-10 MECHANICAL CONNECTORS FOR REINFORCING BAR SPLICES

SCOPE. This specification covers the material requirements for mechanical connectors for splicing reinforcing bars.

GENERAL. Mechanical connectors for use on epoxy coated reinforcing bars shall be epoxy coated. Mechanical connectors coated prior to installation shall be coated in conformance with the applicable requirements for epoxy coatings contained in §709-04, Epoxy Coated Reinforcement. Mechanical connectors coated after installation shall be coated with an epoxy repair material compatible with the
reinforcing bar epoxy coating. The assembled connection on epoxy coated reinforcing bars shall have no exposed uncoated steel. Any damage to the epoxy on the mechanical connector or reinforcing bars shall be repaired with a compatible epoxy repair material.

Mechanical connectors used on Galvanized Bar Reinforcement shall be galvanized in accordance with §719-01 Galvanized Coatings and Repair Methods.

Mechanical connectors for Stainless Clad Reinforcement and Stainless Steel Reinforcement shall be fabricated from stainless steel meeting the requirements of ASTM A959 UNS S31600.

MATERIAL REQUIREMENTS. Mechanical connectors will be tested for the following three parameters:

- The maximum slip, at 50% of the yield strength of the reinforcing bar, shall be 0.254 mm. At least 70% of the maximum slip shall have occurred on the first cycle.
- The maximum slip, at 90% of the yield strength of the reinforcing bar, shall be 0.457 mm.
- The tensile strength of the splice shall be at least 90% of the specified minimum tensile strength of the reinforcing bar.

BASIS OF ACCEPTANCE. Application for approval of mechanical connectors shall be submitted to the Materials Bureau. Detailed requirements and procedures for approval are available from the Materials Bureau. Upon approval the name of the mechanical connector will be placed on an Approved List.

Project acceptance will be based on the manufacturer's name and type of mechanical connector appearing on the Department's Approved List titled "Mechanical Connectors for Reinforcing Bar Splices."

709-11 GALVANIZED BAR REINFORCEMENT

SCOPE. This specification covers bar reinforcement with a hot dipped galvanized coating. Bar reinforcement will be coated before or after bending, as required by the payment specification.

MATERIAL REQUIREMENTS

A. Reinforcing Steel. The material for the reinforcing steel shall meet the requirements of §709-01 Bar Reinforcement, Grade 420 or §709-14, Bar Reinforcement, Grade 520.

B. Galvanizing. The bar reinforcement shall be galvanized in accordance with ASTM A767 “Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement” to a Class I Coating.

C. Embrittlement Testing. The coating applicator shall take the necessary precautions to prevent embrittlement by conforming to the requirements of STM A-143 “Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedures for Detecting Embrittlement”. The test for embrittlement shall be conducted by the coating applicator or his representative according to the bend test described in ASTM A-615 “Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement”. The coating applicator shall include one reinforcing bar test specimen at least 1 meter long for each lot for this testing. The test specimen shall have the same diameter as the lot members and shall be quenched, and galvanized in the same manner and at the same time as the bars whose characteristics it is intended to represent. If the test specimen cracks or otherwise fails the bend test, the entire lot it represents shall be rejected. For test purposes, a lot is any one of the following:

- Reinforcing bars of the same diameter comprising a single order
- A number of reinforcing bars of the same diameter identified as a lot by the coating applicator, providing the bars are all been coated within a single production shift
- One thousand reinforcing bars of the same diameter. Notwithstanding the above two, no lot shall exceed one thousand bars.

D. Identification. The Contractor shall coordinate the tagging and identification requirements for the project and for lot identification and shall provide a non-destructive metal tag system for bent reinforcing bars.
E. Inspection. The materials Bureau shall be notified 30 days prior to the beginning of the coating application. The Materials Bureau representative and any other Department authorized representative shall have free access to the plant for inspection. Work done while any Department representative has been refused access shall be automatically rejected.

If the Department representative so elects, preparation of the bars, quenching and coating shall be done in his presence. On a random basis, lengths of coated bars may be taken by the representative from the production run at the point of coating application for test, evaluation and check purposes.

F. Zinc Rich Paint. Zinc rich paint used for field repairs of galvanized coatings shall meet the following requirements:

- One application of the material shall provide a dry film thickness of 50 mm
- The dried fill shall have a minimum zinc dust content of 94% by mass
- The paint shall be compatible with the galvanizing and shall be inert in concrete
- The brand of material used shall be approved by the galvanizer.

BASIS OF ACCEPTANCE. The coating applicator shall furnish a Certificate of Compliance with each shipment of coated bars. The Certificate of compliance shall state the representative samples of the coated bars have been tested and that the test results conform to the requirements described herein. Test results shall be retained and made available, if requested. The Certificate of Compliance and the documentation required for uncoated reinforcement bars by §709-01 Bar Reinforcement, Grade 420 or §709-14, Bar Reinforcement, Grade 520, shall accompany each shipment to the job site.

709-12 STAINLESS-CLAD-BAR REINFORCEMENT

SCOPE. This specification covers composite bar reinforcement consisting of a mild steel core with a bonded exterior layer of stainless steel.

MATERIAL REQUIREMENTS

Mechanical Properties. The composite bar reinforcement shall meet the mechanical property requirements of ASTM A615M, Grade 420 or ASTM A615M, Grade 520.

Stainless-Steel-Cladding. The stainless-steel-cladding shall meet the requirements of ASTM A959 UNS S31600. The completed composite bar reinforcement shall have a minimum stainless-steel-cladding thickness of 180 µm.

Quality Control. The manufacturer shall provide a quality control plan for review and approval by the Director, Materials Bureau a minimum of thirty (30) days prior to delivery. The plan shall clearly demonstrate the ability to manufacture, test, certify, maintain, and assure the identity of bars from manufacture to placement.

Inspection. The receipt of the manufacturer’s quality control plan will serve as Department notification of the manufacturer’s intention to supply reinforcing bars to Department work. The Materials Bureau will arrange for the inspection and sampling of bars by a Department representative. Department representatives shall have free access to the plant for inspection and/or sampling to verify specification compliance. Work done while any Department representative has been refused access shall be automatically rejected.

Randomly selected lengths of clad bars will be taken by the representative from the production run for test, to assure specification compliance. The manufacturer shall allow fourteen (14) days from the receipt of the samples in the Materials Bureau’s laboratory for evaluation to verify the acceptability of the bars and subsequent authorization for shipment.

BASIS OF ACCEPTANCE. Subsequent to the review and approval of the manufacturer’s Quality Control Plan, stainless clad reinforcing bars will be considered for acceptance in mill-banded, stock-lot quantities at manufacturing sites in accordance with procedural directives of the Materials Bureau.
709-13 STAINLESS STEEL BAR REINFORCEMENT

SCOPE. This specification covers steel bar reinforcement consisting of stainless steel.

MATERIAL REQUIREMENTS

Material Properties. The stainless steel shall meet the requirements of ASTM A955 M and its designated grade, either 420 or 520, and shall also meet the requirements of either ASTM A 276 UNS S31653 or UNS S31803.

Quality Control. The manufacturer shall provide a quality control plan for review and approval by the Director, Materials Bureau, a minimum of thirty (30) days prior to delivery. The plan shall clearly demonstrate the ability to manufacture, test, certify, maintain, and assure the identity of bars from manufacture to placement.

Inspection. The receipt of the manufacturer’s quality control plan will serve as Department notification of the manufacturer’s intention to supply reinforcing bars to Department work. The Materials Bureau will arrange for the inspection and sampling of bars by a Department representative. Department representatives shall have free access to the plant for inspection and/or sampling to verify specification compliance. Work done while any Department representative has been refused access shall be automatically rejected.

Randomly selected lengths of stainless bars will be taken by the representative from the production run for test, to assure specification compliance. The manufacturer shall allow fourteen (14) days from the receipt of the samples in the Materials Bureau’s laboratory for evaluation to verify the acceptability of the bars and subsequent authorization for shipment.

BASIS OF ACCEPTANCE. Subsequent to the review and approval of the manufacturer’s quality control plan, stainless reinforcing bars will be considered for acceptance in mill-banded, stock-lot quantities at manufacturing sites in accordance with procedural directives of the Materials Bureau.

709-14 BAR REINFORCEMENT, GRADE 520

SCOPE. This specification covers the material requirements for deformed billet steel reinforcing bars used in portland cement concrete. Plain and deformed steel for the fabrication of spirals is included.

MATERIAL REQUIREMENTS

Deformed Bar Reinforcement. Steel reinforcing bars shall be deformed billet steel bars meeting the requirements of ASTM A615, Grade 520.

BASIS OF ACCEPTANCE. Bar Reinforcement and spirals will be accepted on the basis of the manufacturer's name and location appearing on the Department’s Approved List and a material certification that specifies the product conforms to this specification. Buy America requirements apply.

SECTION 710 - FENCE AND GUIDE RAIL

710-01 ALUMINUM FENCE FABRIC

SCOPE. This specification covers the requirements for aluminum alloy, chain link fence fabric.

MATERIAL REQUIREMENTS. Aluminum chain link fence fabric shall conform to the requirements of AASHTO M181, Chain Link Fence, Type III, except as modified herein.

A. Wire. The aluminum alloy wire shall be 6061-T94 conforming to the applicable chemical composition limits of ASTM B211M.
B. Mesh Size and Wire Diameter. The size of the mesh and the wire diameter shall be 50 mm and 9 gage (3.759 mm) respectively unless otherwise specified in the plans or proposal.

SHIPPING. Fabric shall be furnished in a clean condition free of all foreign material, including oil, dust, film, etc.

BASIS OF ACCEPTANCE. Aluminum fence fabric will be accepted on the basis of a material certification that specifies the product conforms to this specification.

710-02 GALVANIZED STEEL FENCE FABRIC

SCOPE. This specification covers the requirements for galvanized steel chain link fence fabric.

MATERIALS REQUIREMENTS. Galvanized steel chain link fence fabric shall conform to the requirements of AASHTO M181, Chain Link Fence, Type I, except as modified herein.

A. Mesh Size Coated Wire Diameter. The size of the mesh and the coated wire diameter shall be 50 mm and 9 gage (3.759 mm) respectively unless otherwise specified in the plans or proposal.

B. Zinc-Coating. The 50 mm mesh shall be galvanized with a Class D coating (610 g/m2) by the hot-dip process after weaving. When 25 mm mesh is specified, it shall be galvanized with Class D Coating (610 g/m2) before weaving by the electrolytic process.

SHIPPING. Fabric shall be furnished in a clean condition free of all foreign material, including oil, dust, film, etc.

BASIS OF ACCEPTANCE. Galvanized steel fence fabric will be accepted on the basis of a material certification that specifies the product conforms to this specification. Buy America requirements apply.

710-03 VINYL COATED STEEL FENCE FABRIC

SCOPE. This specification covers the material requirements for Class A-Extruded Polyvinyl Chloride (PVC)-Coated Steel Fence Fabric, and Class B-Bonded Polyvinyl Chloride (PVC)-Coated Steel Fence Fabric.

MATERIAL REQUIREMENTS. Vinyl coated steel chain link fence fabric shall conform to the requirements of AASHTO M181, Chain Link Fence, Type IV, except as modified herein.

A. Mesh Size. The size of the mesh shall be 50 mm unless otherwise specified in the contract documents.

B. Wire Diameter. The wire diameter shall be as follows unless specified otherwise in the contract documents:

1. Class A- Extruded Polyvinyl Chloride (PVC)-Coated Steel shall have a 9-gage (3.759 mm) metallic coated core wire.

2. Class B- Bonded Polyvinyl Chloride (PVC)-Coated Steel shall have an 11-gage (3.048 mm) metallic coated core wire.

C. Vinyl Coating. The color of the vinyl coating shall be dark green unless shown otherwise in the contract documents. The Engineer shall have the option of approving an alternate color if the specified color is unavailable. An adhesion test is not required for coatings which are extruded or extruded and bonded.
§710

SHIPPING. Fabric shall be furnished in a clean condition, free of all foreign material, including oil, dust, film, etc.

BASIS OF ACCEPTANCE. Vinyl-coated steel fence fabric will be accepted on the basis of a material certification that specifies the product conforms to this specification. Buy America requirements apply.

710-04 ALUMINUM COATED STEEL FENCE FABRIC

SCOPE. This specification covers the requirements for Aluminum Coated Chain Link Fence Fabric.

MATERIAL REQUIREMENTS. Aluminum coated steel fabric shall conform to the requirements of AASHTO M181, Chain Link Fence, Type II, except as modified herein.

Mesh Size and Coated Wire Diameter. The size of the mesh and the coated wire diameter shall be 50 mm and 9 gage (3.759 mm) respectively unless otherwise specified in the contract documents.

SHIPPING. Fabric shall be furnished in a clean condition, free of all foreign material including oil, dust, film, etc. except that a methacrylate lacquer may be used to protect it under storage conditions.

BASIS OF ACCEPTANCE. Aluminum-coated steel fence fabric will be accepted on the basis of a material certification that specifies the product conforms to this specification. Buy America requirements apply.

710-05 COATED STEEL FENCE FABRIC, (95% ZINC 5% ALUMINUM - MISCHMETAL ALLOY)

SCOPE. This specification covers the requirements for coated steel fence fabric (95% zinc 5% aluminum - mischmetal alloy).

MATERIAL REQUIREMENTS. Coated steel fence fabric (95% zinc 5% aluminum - mischmetal alloy) shall conform to the dimensional and strength requirements of AASHTO M 181 Chain Link Fence Type I, except as modified herein.

A. Mesh Size. The size of the mesh shall be 51 mm unless otherwise specified in the contract documents.

B. Coated Wire Diameter. The size of the coated wire diameter shall be 9 gage (3.759 mm) unless otherwise specified in the contract documents.

C. Coating. The coating shall meet the requirements of ASTM F 1345 Class 2 (305 g/m2).

SHIPPING. Fabric shall be furnished in a clean condition, free of all foreign material including oil, dust, film, etc.

BASIS OF ACCEPTANCE. Coated steel fence fabric will be accepted on the basis of a material certification that specifies the product conforms to this specification. Buy America requirements apply.

710-06 THRU 710-09 (VACANT)

710-10 STEEL AND IRON POSTS, RAILS, BRACES, AND FITTINGS FOR CHAIN LINK FENCE

SCOPE. This specification covers the requirements for steel and iron posts, rails, braces and fittings used in erecting chain link fence. The contractor shall have the option of supplying any one of the post sections shown on the Standard Sheets.
MATERIALS REQUIREMENTS. The following specifications cover the material requirements for each of the sections, fittings, and tension wires shown in the Post and Rail schedule on the Standard Sheets for Chain Link Fence:

A. Class A, Schedule 40 Pipe. Posts, rails and braces shall be standard weight Schedule 40 Pipe, manufactured in accordance with ASTM F1083, except that the protective coating system shall be as specified herein.

B. Class B, Steel Tubing. Posts, rails and braces shall be manufactured by one of the following methods with the steel conforming to ASTM A1011 or ASTM A1008 and A1011/A1011M with a minimum yield strength of 345 MPa:
- Furnace butt welded, continuous welded
- Cold rolled and electric resistance welded
- Seamless

The tubing shall conform to the following dimensions:

<table>
<thead>
<tr>
<th>Nominal Size</th>
<th>Outside Diameter, mm</th>
<th>Minimum Wall Thickness, mm</th>
<th>Mass Kg/m</th>
</tr>
</thead>
<tbody>
<tr>
<td>1¼ NPS</td>
<td>42.16</td>
<td>2.819</td>
<td>2.732</td>
</tr>
<tr>
<td>1½ NPS</td>
<td>48.26</td>
<td>3.048</td>
<td>3.394</td>
</tr>
<tr>
<td>2 NPS</td>
<td>60.32</td>
<td>3.302</td>
<td>4.639</td>
</tr>
<tr>
<td>2¼ NPS</td>
<td>73.02</td>
<td>4.064</td>
<td>6.904</td>
</tr>
</tbody>
</table>

C. Class C, Rolled-Formed Shapes. Posts, rails and braces shall be roll formed shapes which meet the requirements of ASTM F1043.

D. H-Posts. H Posts shall be fabricated from hot-rolled steel sections which meet the requirements of ASTM F1043.

E. Fittings. Fittings shall be manufactured of weldable steel, malleable iron, cast steel, cast iron, or aluminum alloy.

1. Weldable Steel. Weldable steel shall be commercial quality or better, produced by one of the following processes: Open-Hearth, Electric Furnace, or Basic Oxygen.


3. Cast Iron. Cast iron shall conform to the requirements of §715-05.

4. Cast Steel. Cast steel shall conform to the requirements of §715-02.

5. Aluminum Alloy. Aluminum alloy shall meet the material requirements of §710-11.

Fittings other than aluminum fittings in contact with galvanized surfaces shall be galvanized in accordance with §719-01, Type II. Fittings in contact with aluminum surfaces shall be made of aluminum alloy or be aluminum coated in accordance with §719-03.

F. Tension Wire. Tension wire shall meet the requirements of ASTM A641M, as modified herein. The wire shall be a no. 7 gauge minimum 4.50 mm in diameter, having a minimum tensile strength of 550 MPa., with a minimum galvanized coating of 240 g/m² or a minimum aluminum coating of 120 g/m².

Protective Coating Systems. Posts, rails and braces shall be coated with a protective coating system conforming to one of the following depending on structural member.
A. Class A Schedule 40 Pipe; Class B Steel Tubing

1. Galvanized Coatings. Galvanized both inside and out in accordance with ASTM F1083.

2. Combined Coatings

   a. External surfaces. The external surfaces shall be coated with the following combined coating system:

      (1) Hot Dip Galvanizing. The external surface shall be hot-dip galvanized with “Special High Grade” or “High Grade” slab zinc conforming to ASTM B6. The weight of the coating shall be a minimum 275 g/m².

      (2) Chromate Conversion Coating. Chromate conversion coating shall be specifically designed for use as a pretreatment of galvanized surfaces. The coating shall be applied prior to the application of the thermoplastic acrylic coating at the manufacturer’s recommended rate.

      (3) Clear Coating. A thermoplastic acrylic or cross linked polyester coating shall be applied with a minimum dry film thickness of 7.62 µm.

   b. Internal Surfaces. The internal surfaces of the pipe or tubing shall be coated with one of the following:

      (1) Zinc rich coating. The zinc rich coating shall contain not less than 87% zinc dust by weight and shall be capable of providing galvanic protection. The minimum coating thickness shall be 7.62 µm.

      (2) Cross linked polyester coating containing a corrosion inhibitor

      (3) Hot-dip galvanized coating. The hot-dipped galvanized coating shall average not less than 105 g/m² and no single specimen shall show less than 75 g/m².

B. Class C Roll Formed Shapes and H Posts. All surfaces shall be hot-dip galvanized in accordance with the requirements of §719-01, Type I.

C. Class A Schedule 40 Pipe; Class B Steel Tubing; Class C Roll Formed Shapes, H-Posts.

1. Aluminum with Chromate Coatings. All surfaces shall be given a hot-dipped 99% pure aluminum, Type II coating. The aluminum coating shall average 200 g/m² and no single specimen shall show less than 185 g/m² when tested in accordance with ASTM A428. The coating shall meet the adherence and quality requirements of §719-03. The aluminum coated surfaces shall be given a colorless chromate chemical treatment. The external surfaces shall be given a colorless protective resin coating to protect the material from abrasion in shipment and storage.

2. Mischmetal Alloy Coating (95% Zinc 5% Aluminum). Coating shall meet the requirements of ASTM F 1043 Protective Coatings on Steel Framework for Fences Type C, except the coating weight shall be 305 g/m².

Basis of Acceptance. Steel and iron posts, rails, braces, and fittings for chain link fence will be accepted on the basis of a material certification that specifies the product conforms to this specification. Buy America requirements apply.
710-11 ALUMINUM POSTS, RAILS, BRACES AND FITTINGS FOR CHAIN LINK FENCE

SCOPE. This specification covers the requirements for aluminum posts, rails, braces and fittings to be used in erecting chain link fencing.

MATERIAL REQUIREMENTS. Posts, Rails, Braces and Fittings shall conform to the following materials specifications, alloy, temper and dimensional requirements in Table below.

BASIS OF ACCEPTANCE. Aluminum posts, rails, braces and fittings for chain link fence will be accepted on the basis of a material certification that specifies the product conforms to this specification.

<table>
<thead>
<tr>
<th>Material</th>
<th>Material Spec</th>
<th>Alloy &amp; Temper</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fabric Ties</td>
<td>715-04</td>
<td>5052-H-38, 1100-H18 or 3003-H14</td>
<td>3.50 mm nom. dia. or 12.70 mm wide X 1.5 mm thick</td>
</tr>
<tr>
<td>Top &amp; Bottom Tension Wires</td>
<td>715-04</td>
<td>6061-T94</td>
<td>4.90 mm nom. dia.</td>
</tr>
<tr>
<td>Hog Rings</td>
<td>715-04</td>
<td>6061-T94</td>
<td>2.80 mm nom. dia.</td>
</tr>
<tr>
<td>Stretcher Bars</td>
<td>715-04</td>
<td>6063-T5 or 6063-T6</td>
<td>6 mm X 19 mm</td>
</tr>
<tr>
<td>Truss Rods</td>
<td>715-04</td>
<td>6061-T6 or 6063-T6</td>
<td>9.50 mm nom. dia.</td>
</tr>
<tr>
<td>Cast Tumblers</td>
<td>715-03</td>
<td>356.0-T6</td>
<td></td>
</tr>
<tr>
<td>Wrought Turnbuckles</td>
<td>715-04</td>
<td>6061-T6 or 6063-T6</td>
<td></td>
</tr>
<tr>
<td>Brace &amp; Stretcher Bands</td>
<td>715-04</td>
<td>3003-H14 or 6063-T6</td>
<td>3.20 mm X 22.20 mm</td>
</tr>
<tr>
<td>Carriage Bolts</td>
<td>715-04</td>
<td>2024-T4</td>
<td></td>
</tr>
<tr>
<td>Brace Ends &amp; Rail Ends</td>
<td>715-03</td>
<td>356.0-T6, 360.0, D712.0, or ZG 61A-T5</td>
<td></td>
</tr>
<tr>
<td>Expansion Sleeves</td>
<td>715-04</td>
<td>6063-T6 or 6063-T832</td>
<td>See Note 1</td>
</tr>
<tr>
<td>Nuts</td>
<td>715-04</td>
<td>2024-T4 or 6061-T6</td>
<td>-</td>
</tr>
<tr>
<td>Line Posts</td>
<td>715-04</td>
<td>6063-T6</td>
<td>Sched. 40 pipe NPS 2</td>
</tr>
<tr>
<td>End, Corner &amp; Intermediate Posts</td>
<td>715-04</td>
<td>6063-T6</td>
<td>Sched. 40 pipe NPS 2 1/2</td>
</tr>
<tr>
<td>Post Tops</td>
<td>715-03</td>
<td>356.0-F, 360.0, D712.0, or ZG61A-T5</td>
<td>-</td>
</tr>
<tr>
<td>Top Rails</td>
<td>715-04</td>
<td>6063-T6</td>
<td>Sched. 40 pipe NPS 1/4</td>
</tr>
<tr>
<td>Brace Rails</td>
<td>715-04</td>
<td>6063-T6</td>
<td>Sched. 40 pipe NPS 1/4</td>
</tr>
</tbody>
</table>

NOTE: 1. Modified Schedule 40 pipe, NPS 1 1/2, 42.9 mm Inside Diameter, 1.98 mm Minimum Wall Thickness, 152.4 mm long.

710-12 PLASTIC COATED POSTS, RAILS, BRACES AND FITTINGS FOR CHAIN LINK FENCE

SCOPE. This specification covers the requirements for plastic coated posts, rails, braces and fittings used for erection of chain link fencing.

MATERIAL REQUIREMENTS. Posts, rails, braces, fittings, and accessories shall comply with the requirements of §710-10, except for the galvanized coatings. Post, rails, braces, fittings and accessories shall be resin-clad with either an epoxy modified ply (vinyl chloride), or a thermoplastic polyester resin. The coating shall have a minimum thickness of 0.178 mm and shall be of the same color as the fabric.

Fabrication Requirements. The epoxy modified poly (vinyl chloride) coating shall be chemically bonded to heated pipe, fittings, etc., or the fitting and pipe, etc., shall be clad with a heavy molecule, saturated, linear thermoplastic polyester resin applied by electrostatic spray and fusing or equal method. Each length of pipe shall be sealed with two snug-fitting polyethylene plug-type seals to prevent condensation and eliminate internal corrosion.
§710  

**BASIS OF ACCEPTANCE.** Plastic-coated posts, rails, braces, and fittings for chain link fence will be accepted on the basis of a material certification that specifies the product conforms to this specification. *Buy America requirements apply.*

### 710-13 WOOD AND TIMBER POSTS AND TIMBER BLOCKOUTS

**SCOPE.** This specification covers wood posts used as witness posts, timber posts, and blockouts used in guiderail construction.

**MATERIALS REQUIREMENTS.** Wood posts, timber posts, and timber blockouts shall comply with the requirements of §712-14, Stress Graded Timber and Lumber, except that not every timber blockout in the lot need be branded, provided that approximately 10% of the blockouts are branded, and that the un-branded blockouts are visually similar, as determined by the engineer, to the branded blockouts. Using the clean wood properties of ASTM D2555, the bending stress (Modulus of Rupture) shall not be less than 28 MPa. They shall be surfaced on four sides and the dimensions shall be actual or nominal as indicated on the plans. If the dimensions are indicated to be nominal, the actual dimensions provided shall be in accordance with current trade practice. Surface dried redwood, red cedar, cypress or black locust may be used untreated. Other lumber including douglas fir, pine, oak, birch, apple, and beech may also be used but shall be pressure treated in accordance with §708-31, Wood Preservative-Water Borne after all the holes have been drilled and all other woodworking operations have been performed.

Bituminous preservative treatments will not be permitted. Before using, the Contractor shall submit to the Engineer, for approval, information as to the species of timber to be used and method of preservative treatment to be employed.

**BASIS OF ACCEPTANCE.** Wood and timber posts and timber blockouts will be accepted on the basis of a material certification that specifies the product conforms to this specification.

### 710-14 GALVANIZED STEEL BARRIER POSTS

**SCOPE.** This specification covers galvanized steel posts used as guiderail and median barrier posts, I-beam posts for existing guide railing and median barrier, and required soil plates and slip impact bases.

**MATERIAL REQUIREMENTS.** Galvanized steel barrier post shall conform to the following:

- **Galvanizing** | §719-01 Galvanized Coatings and Repair Methods, Type I  
- **Steel** | ASTM A36M

**Posts.** Steel posts used as guiderail and median barrier posts or I-beam posts for existing guide railing and median barrier, shall be fabricated from steel conforming to the ASTM A6M shape specified on the standard sheet for the guide railing or median barrier being utilized.

**Soil Plates, Slip Impact Bases, and Other Post Components.** Soil plates, slip impact bases, and other post components shall be fabricated from steel conforming to the dimensions shown on the standard sheet for the guide railing or median barrier being utilized.

**FABRICATION.** Guiderail and median barrier posts or I-beam posts for existing guide railing and median barrier shall be fabricated with all required welding, punching, drilling, or cutting of the post or any component of the post completed prior to galvanizing. Welding shall be done in accordance with the requirements of the *New York State Steel Construction Manual*, except that radiographic inspection of shop welds will not be required.

**BASIS OF ACCEPTANCE.** Galvanized steel barrier posts will be accepted on the basis of a material certification that specifies the product conforms to this specification. *Buy America requirements apply.*

### 710-15 THRU 710-19 (VACANT)
SCOPE. This specification covers corrugated beam guide railing and median barrier including corrugated beams, posts, anchorage units and accessory hardware.

MATERIAL AND FABRICATION REQUIREMENTS

Posts. Posts shall meet the requirements of §710-14 Galvanized Steel Barrier Posts

Beams, Terminal Sections and Hardware. Corrugated beams, terminal sections and all hardware shall be fabricated in accordance with the details shown on the standard sheets. Bolt holes in the beam at the post hole and elsewhere, as necessary, shall be enlarged or slotted to permit expansion and contraction, and to facilitate erection. The beams shall be of uniform section and straight, unless shop curved beams are required by the plans or specifications. The edges shall be rolled to eliminate sharp edges. When shop curving of corrugated beams is required the radius of curvature shall be stamped into the base metal of the beam. The stamping shall be on the back, at or near both ends of the beam, and in a location where it will be visible to a worker after erection.

Beams and terminal sections shall be rolled from 12 gage (nominal thickness 2.67 mm -0.23 mm tolerance) or heavier sheet or coil stock. The sheet or coil stock shall be new billet open hearth, electric furnace, or basic oxygen steel sheet. The minimum yield point and elongation of the steel used in the beam sections shall be 345 MPa and 12% in 50 mm gage length respectively. Terminal sections, used for finishing-off or ornamental purposes, may be of mild steel, 227 MPa yield point.

Plates and Anchorage Units. Plates and Anchorage Units shall be as detailed on the standard sheet for corrugated beam type guide railing and median barrier. They shall conform to ASTM A36M.

Splices. Splices shall be made with flat, roundheaded, grippable, galvanized bolts, nuts and washers conforming to the following unless specified otherwise in the contract documents: Bolts ASTM F568 Class 4.6, Nuts ASTM A563M Grade A or better, and Washers ASTM F844. They shall be galvanized in accordance with the requirements of §719-01 Galvanized Coatings and Repair Methods, Type II (ASTM A153) unless another coating is specified.

Fabrication Welding. Fabrication welding shall be done in accordance with the New York State Steel Construction Manual, except radiographic inspection of shop welds will not be required.

Galvanizing. The rail element shall be galvanized in accordance with §719-01, Galvanized Coatings and Repair Methods, Type I (ASTM A123) or Type IV (ASTM A525M) of the standard specifications, except that the minimum check limits for the weight of coating as determined by the triple spot and single spot tests for §719-01, Galvanized Coatings and Repair Methods, Type IV (ASTM A525M), shall be 1220 g/m² and 915 g/m² respectively, (total amount both sides of sheet). Posts, plates, and anchorage units shall be galvanized in accordance with §719-01, Galvanized Coatings and Repair Methods, Type I (ASTM A123). Hardware shall be galvanized in accordance with §719-01, Galvanized Coatings and Repair Methods, Type II (ASTM A153).

When beams are to be galvanized in accordance with §719-01, Galvanized Coatings and Repair Methods, Type I (ASTM A123), they shall be blanked to the proper shape, fabricated and ready for assembly before galvanizing. No punching, drilling, cutting or welding will be permitted after galvanizing. When galvanizing in accordance with §719-01, Galvanized Coatings and Repair Methods, Type IV (ASTM A525M), the beam may be fabricated, cut, punched or drilled from galvanized sheet or coil stock. The exposed edges resulting from this process do not have to be repaired or touched up in any way.

BASIS OF ACCEPTANCE. All components of the corrugated beam type guide railing and median barrier shall be accepted in accordance with directives issued by the Department.
§710

710-21 BOX BEAM GUIDE RAILING AND MEDIAN BARRIER

SCOPE. This specification covers box beam guide railing and median barrier including the guide rail, posts, end assembly units and accessory hardware.

MATERIAL REQUIREMENTS

Posts. Posts shall meet the requirements of §710-14 Galvanized Steel Barrier Posts.

Rails. Rails shall be cold-formed welded and seamless structural tubing. The rails shall conform to ASTM A500, Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes, Grade B, except as modified below. Splice plates and plates welded to tubes for splice assemblies shall be Charpy V-Notch tested. Splice tubes need not be tested.

All rail shall be tested in accordance with ASTM E436 "Drop-Weight Tear Tests of Ferritic Steels" except as modified below.

The tests shall be done after all galvanizing and associated operations have been performed on the rail. The testing shall be conducted at a temperature of -18°C, without removing the galvanizing, on 51 x 229 mm specimens supported to achieve a 178 mm span.

The percent shear area will be determined by testing nine (9) specimens, three (3) from each of three (3) sides not containing a weld. The shear areas of the three specimens from the side with the lowest average shear area shall be disregarded and the final average based on the remaining six specimens. If the average percent shear area falls below 50, the material represented by these tests shall be rejected.

To facilitate acceptance and rejection of material the manufacturer of the structural shape shall, before galvanizing, identify the product with the steel heat number, or some number which is traceable to the heat number, and its own unique identification code. The identification method shall be such that it can be read after the structural shape is galvanized. The identification information shall be placed on the structural shape at intervals not to exceed 1.2m.

When shop curving of box beams is required, the radius of curvature shall be stamped into the base metal of the beam. The stamping shall be the vertical faces, at or near both ends of the beam, and in a location where it will be visible to a worker after erection.

No mill transverse welds will be permitted on the rail sections. Longitudinal welds shall be made by the resistance, gas shielded arc, submerged arc or plasma arc welded process; shall be sound, free from defects, and shall not be repaired. The welded joint, in cold-formed welded rail, shall have a minimum tensile strength specified for the railing when tested according to the tensile strap test of ASTM Method E8M. All fabrication shall be done in accordance with the requirements of the Steel Construction Manual.

Rails shall be galvanized in accordance with §719-01, Type I, Galvanized Coatings and Repair Methods. Slots and round holes may be subsequently drilled, punched, burned, or cut and regalvanized according to the paragraph below on “Regalvanizing Iron and Steel Using a Flame Sprayed Coating System.” This repair procedure shall also apply to curved rail sections and splice plates as required.

Regalvanizing Iron and Steel Using a Flame Sprayed Coating System. Those areas to be regalvanizing shall be blasted with silica sand or crushed garnet of such gradation that sand shall be mesh size 850 µm to 425 µm (# 20 to # 40 U.S. Standard Sieve) with a minimum of 40% retained on a 600 µm mesh screen (# 30 U.S. Standard Sieve). Pressure of not less than 520 kPa shall be maintained at the blast generator.

A sample steel plate shall be blasted until the surface cannot be further cleaned or roughened. This plate shall be used for visual comparison and any areas that do not meet this standard as to roughness or cleanliness shall be reblasted.

The wire used in spraying shall be 3.2 or 4.8 mm diameter, zinc 99.0% purity. Air pressure at the Air Control Unit shall be 415 kPa and there shall be no more than 10 m of 9.5 mm I.D. hose between the Air Control Unit and the gun.

The metal coating shall be applied at a minimum thickness of 0.11 mm. At least one coating shall be applied within 4 hours of blasting and the surface shall be completely coated within 8 hours of blasting. The specified thickness of coating shall be applied in multiple layers and in no case shall less than two passes be made over every part of the surface.
§710

Fasteners. Fasteners shall be galvanized and conform to the following unless specified otherwise in the contract documents. Bolts ASTM F568 M Class 4.6, nuts ASTM A563M Grade A or better, and washers ASTM F844.

BASIS OF ACCEPTANCE. All components of the box beam guide railing and median barrier shall be accepted in accordance with directives issued by the Department.

710-22 CABLE GUIDE RAILING

SCOPE. This specification covers cable guide railing including cable, posts, anchorage units, and accessory hardware.

MATERIAL REQUIREMENTS. Cable Guide Railing shall conform to the following:

<table>
<thead>
<tr>
<th>Component</th>
<th>ASTM Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posts, Soil Plates</td>
<td>§710-14 Galvanized Steel Barrier Posts</td>
</tr>
<tr>
<td>Reflectors</td>
<td>§730-01 Aluminum Sign Panels</td>
</tr>
<tr>
<td>Reflective Sheeting</td>
<td>§730-05 Reflective Sheeting</td>
</tr>
<tr>
<td>Cable</td>
<td>AASHTO M30 or ASTM A741 Type I Construction, Class A Coating</td>
</tr>
<tr>
<td>Anchor Angle</td>
<td>ASTM A36M</td>
</tr>
<tr>
<td>Bolts</td>
<td>ASTM F568 Class 4.6</td>
</tr>
<tr>
<td>Nuts</td>
<td>ASTM A563M Grade A</td>
</tr>
<tr>
<td>Washers</td>
<td>ASTM F844</td>
</tr>
</tbody>
</table>

Reflectors. The alloy for the aluminum used for the reflectors shall be as specified on the standard sheet for cable guide railing.

Reflective Sheeting. The material designation for the reflective sheeting used for the reflectors shall be as specified on the standard sheet for cable guide railing.

Galvanizing. The bolts, including the “J” bolt used to mount the cable, nuts, washers, anchor rods, spring compensator components, steel turnbuckle cable end assembly, and all cast steel or malleable iron hardware, except the wedge shown in “Detail X” on the standard sheet, shall be galvanized in accordance with the requirements of §719-01 Galvanized Coatings and Repair Methods, Type II, unless another coating is specified. The wedge shown in “Detail X” shall be ungalvanized (black).

The anchor angles shall be galvanized in accordance with the requirements of §719-01 Galvanized Coatings and Repair Methods, Type I.

Welding. Welding shall be performed in accordance with the requirements of the New York State Steel Construction Manual, except radiographic inspection of shop welds will not be required.

BASIS OF ACCEPTANCE. Acceptance shall be based on the manufacturer's certification and in accordance with directives issued by the Department.

710-23 STEEL BRIDGE RAILING

SCOPE. This specification covers the material requirements for Steel Bridge Railing and its component parts.

MATERIAL REQUIREMENTS. Steel Bridge Railing materials shall conform to the following requirements:

<table>
<thead>
<tr>
<th>Piece</th>
<th>ASTM Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rail Tubes</td>
<td>A500 Grade B 1</td>
</tr>
<tr>
<td>Rail End Caps</td>
<td>A36M or A588M (A709 Grade 250 or 345W)</td>
</tr>
<tr>
<td>Base Plates</td>
<td>A588M or A572M Grade 345 (A709M Grade 345 or 345W)</td>
</tr>
</tbody>
</table>
Anchor Studs & Splice Bolts, F568M Class 8.8 or Class 8.8.3
Round Head Bolts F568M Class 8.8 or Class 8.8.3
Nuts 3 A563M
Washers 3 F436M
Lock Washers High carbon Heat Treated Spring Steel: ASME B18.21.1
Anchor Plates A36M (A709M Grade 250)
Plate Shims A36M or A588M (A709M Grade 250 or 345W)
Tube Rail Splices A500 Grade B
Solid Rail Splices A588M or A572M Grade 345 (A709M Grade 345 or 345W)
Angle 2 A588M or A572M Grade 345 (A709M Grade 345 or 345W)
Splice Plates A588M or A572M Grade 345 (A709M Grade 345 or 345W)
Railing Post 2 A588M or A572M Grade 345 (A709M Grade 345 or 345W)
Tubular Posts ASTM A500, Grade B

1 Where unpainted A588M (A709M Grade 345W) steel is used for the post, the tube shall be unpainted A500 Grade B with the chemical properties of either A588M (A709M Grade 345W) or A606, Type 4. Railing tube meeting the foregoing requirements will be acceptable if its elongation is a minimum of 21% in 50 mm.
2 All post material, including base plates, shall be furnished to minimum Charpy V-Notch Toughness requirements as required by §715-01, under Charpy V-Notch Impact test.
3 Use the following nut and washers for the given bolt class:

<table>
<thead>
<tr>
<th>BOLT or STUD class</th>
<th>NUT (F563M class &amp; dimension style of nut)</th>
<th>WASHER (A563M type)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.6</td>
<td>5 H1</td>
<td>1 or 3</td>
</tr>
<tr>
<td>8.8</td>
<td>10S HH</td>
<td>1 or 3</td>
</tr>
<tr>
<td>8.8.3</td>
<td>8S3 HH</td>
<td>3</td>
</tr>
</tbody>
</table>

Beveled shims may be machined from the same type of metal as in the post base plates or may be cast from material conforming to the requirements of §715-02, Steel Castings, or §715-09, Malleable Iron Castings.

All rail, except bicycle and pedestrian rail, shall be tested in accordance with ASTM E436 - "Drop-Weight Tear Tests of Ferritic Steels", except as modified below.

The tests shall done after all galvanizing and associated operations have been performed on the rail. The testing shall be conducted at a temperature of -18°C, without removing the galvanizing, on 50 mm x 230 mm specimens supported to achieve a 180 mm span.

The percent shear will be determined by testing nine (9) specimens, three (3) from each of three (3) sides not containing a weld. The shear areas of the three specimens from the side with the lowest average shear area shall be disregarded and the final average based on the remaining six specimens. If the average percent shear area falls below 50 the material represented by these tests shall be rejected.

Splice plates and plates welded to tubes for splice assemblies shall be Charpy V-notch tested. Splice tubes need not be Charpy V-notch tested.

To facilitate acceptance and rejection of material, the manufacturer of the structural shape shall, before galvanizing, identify the product with the steel heat number, or some number which is traceable to the heat number, and its own unique identification code. The identification method shall be such that it can be read after the structural shape is galvanized. The identification information shall be placed on the structural shape at intervals not to exceed 1.2 m.

FABRICATION. Bridge Railing shall be fabricated to the dimensions shown in the contract plans and in compliance with the specifications.

A. Shop Drawings. Shop drawings, when required by the contract documents, shall be provided in accordance with the requirements of the S.C.M., except that: 1) the drawings shall be submitted to the Engineer for review and approval and 2) the computed weights need not be shown.
B. **Welding.** Shop welding shall be performed only where specifically noted on the contract documents. Transverse welds shall not be permitted unless directly called for on the contract plans. All welding shall be done in accordance with the requirements of the SCM.

C. **Cutting.** All exposed flame cut surfaces shall have a surface roughness not to exceed 250, as defined by the ANSI standard specification B46.1. Grind all edges of Posts and Post Base Plates so that all sharp edges are removed.

D. **Bending.** Rails for curved structures shall be curved in the shop prior to galvanizing. To facilitate bending, rails may be heated to a temperature not exceeding 650°C.

E. **Galvanizing.** Galvanizing shall conform to the requirements of §719-01, Galvanized Coatings and Repair Methods, Type I. All components of the railing, including anchor studs, nuts and washers, shall be galvanized. The rails, post assemblies, splices and all hardware shall be fabricated and ready or assembly prior to galvanizing.

   All galvanized bolts and galvanized anchor studs shall have a Class 6g Thread. All galvanized nuts shall have a standard oversized tap to allow for the galvanizing on the bolts and nuts.

   Shop galvanizing repair of uncoated areas will be permitted on localized areas. Repair of localized areas is limited to a total of 1300 mm² on any post or rail. A post or rail which contains galvanizing defects totaling more than 1300 mm² shall be stripped and regalvanized.

   Shop repair shall be made in accordance with the methods given in §719-01.

   The following areas will not require galvanizing repair: One 3 mm maximum dimension spot of tight flux remaining in the fusion line of any 180 mm length of weld after blast cleaning picking and galvanizing.

   When paint is used to obtain a rustic appearance, all components of the railing system shall be galvanized and then the visible portions of the system shall be painted in accordance with §657 Painting Galvanized and Aluminum Surfaces. Paint color shall be ‘Weathered Brown’ as defined by 708-05 Standard Paint Colors.

**BASIS OF ACCEPTANCE.** The manufacturer shall furnish the Department with three (3) certified copies of physical test and chemical analysis of the materials used in the manufacture of the railing. Check analysis may be made by the Department from delivered material.

   Inspection will be performed in accordance with the provisions of the SCM, except that mill inspection will not be done.

   Materials that do not bear the Inspector's mark of acceptance shall not be accepted at the project site.

### 710-24 BOX BEAM GUIDE RAIL END ASSEMBLY, TYPE III; AND BOX BEAM MEDIAN BARRIER END ASSEMBLY, TYPE C

**SCOPE.** These specifications cover the material and quality requirements for Box Beam Guide Rail End Assembly Type III and Box Beam Median Barrier End Assembly, Type C. These end assemblies are manufactured articles requiring federal approval as Test Level 3 end terminals for box beam guide rail and median barrier. They function by absorbing energy either through crushing of fiberglass elements or by splitting the beam element at the corners of the box beam. When specified, these end assemblies are used to terminate the ends of box beam guide rails and box beam median barriers. Box Beam Guide Rail End Assembly Type III and Box Beam Median Barrier End Assembly, Type C are fabricated in accordance with these specifications, the manufacturer's instructions, and the manufacturer's drawings. They are available in two styles. These are Wyoming style and another style that uses a box beam splitting mandrel.

**MATERIALS REQUIREMENTS.**

A. **GENERAL.** Soil plates, struts, bearing plates shall meet the requirements of ASTM A36 or ASTM A36 M. All metal components shall be hot dip galvanized in accordance with §719-01, Galvanized Coatings and Repair Methods.
Rustic versions of box beam bursting style Type III End Assembling shall comply with the above requirements except the metal parts exposed to view shall be painted in accordance with §740-03 Painting Galvanized Surfaces.

Reflective sheeting pre-mounted on a frangible material shall be provided by the manufacturer for the free end of the end assembly. If approaching traffic will be permitted on one side only, reflectorization shall consist of alternating reflectorized 100 mm yellow and non-reflectorized 115 mm black stripes oriented at a 45 degree angle, with the lower edge of the stripes near the traveled way to be used by the approaching traffic. The reflective material shall meet the requirements of §730-05, Reflective Sheeting, Class B. If approaching traffic will be permitted on both sides of the end assembly reflectorization shall be upward pointing chevrons of the same dimensions.

B. END ASSEMBLIES USING CRUSHABLE FIBERGLASS ELEMENTS (WYOMING STYLE): Materials used in the fabrication of the Box Beam Guide Rail End Assemblies Type III and Box Beam Median Barrier End Assembly, Type C (Wyoming style) shall conform with the following requirements:

Wood and Timber Post Posts and Timber Blockouts §710-13
Foundation Tubes, Nose Assembly, Outer Tube, Telescoping Section and Intermediate Spacer Block §710-21
Fasteners, except shear bolts on posts 6,7, & 8 ASTM A307
Shear bolts on posts 6, 7, & 8 SAE Grade 0
Rubber Pad Hard Rubber Division II Sect18.2
Steel Posts, Shelf Angles, and other metal parts ASTM A36M
Galvanized Coatings and Repair Methods §719-01

The Cable Assembly shall consist of galvanized steel cable, 6 X 19 mm, with 19 mm threaded rod swaged to both ends.

The composite tube shall be MMFG Extren series 500 pulltruded fiberglass structural tubes and shall exhibit the following properties:

1. Composite tubing shall be manufactured using the pulltrusion process. Tubing shall be manufactured of glass fiber reinforced resin with a glass resin ratio of 50%. The resin shall be isophthalic polyester. Glass reinforcement shall include the following three varieties:

   A. Surface mat shall be used on all exterior surfaces.
   B. Continuous glass strand rovings shall be used internally.
   C. Continuous strand mats shall be used internally.

2. The composite material shall exhibit the following minimum mechanical properties:

   A. Ultimate Tensile Strength: Ultimate Tensile strength shall be longitudinally 207 MPa and transversely 48.3 MPa measured from coupons. Bending strength of the full section shall be 138 MPa.
   B. Ultimate Compressive Strength shall be as given above except Transversely shall be 105.5 MPa.
   C. Ultimate Shear Strength shall be 31 MPa.
   D. Modulus of Elasticity shall be 17 300 MPa
   E. Barcol Hardness shall be 50.

3. The energy dissipation properties of the alternate fiberglass epoxy composite tube shall be evaluated using static compressive testing. Each test specimen shall be 610 mm long with a 102 mm long tulip shape cut into one end of the test specimen. The test specimen shall be crushed statically at a rate of 50 mm per minute and the total crush length shall be not less than 305 mm. A minimum of three static compressive tests shall be conducted. The results of each test shall meet the following static energy dissipation properties:
First Stage Energy Absorber
Average Crush Force 80 kN ± 9kN
Maximum Compressive Force 115 kN
Allowable Compressive Force Variation ± 11 kN
Second Stage Energy Absorber
Average Crush Force 182 ±13 kN
Maximum Compressive Force 245 kN
Allowable Compressive Force Variation ± 22.3 kN

C. END ASSEMBLIES USING BOX BEAM BURSTING MANDREL:

Materials used in the fabrication of the Box Beam Guide Rail End Assemblies Type III (BEAT) shall conform with the following requirements:

<table>
<thead>
<tr>
<th>Item</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mandrel Tube, Box Beam rail</td>
<td>§710-21</td>
</tr>
<tr>
<td>Impact Head and components, including face plate, top and bottom plates, lower and upper support boxes, Gussets</td>
<td>10 Ga. ASTM A36M</td>
</tr>
<tr>
<td>Steel post, guide plates and mandrel support block, gusset plate, guide support, bent and front guide plates, and all metal parts</td>
<td>ASTM A36M</td>
</tr>
<tr>
<td>Mandrel Plate shall be ASTM A514, with Brinell hardness number of 250, min.</td>
<td></td>
</tr>
</tbody>
</table>

Ordinary box beam guide rail and ordinary box beam median barrier included within the pay limits for the bursting style Type III End Assembly for guide rail and Type C End Assembly for median barrier shall conform to the same specifications as box beam guide rail to which the Type III or Type C bursting style end assembling is attached.

BASIS OF ACCEPTANCE. Box Beam Guide Rail End Assembly Type III and Box Beam Median Barrier End Assembly, Type C will be accepted at the site of the work by the Engineer on the basis of conformance of the delivered articles with the manufacturer's drawings, and upon the manufacturer's certification of compliance with these specifications.

710-25 GUIDE RAIL AND MEDIAN BARRIER SYSTEMS (RUSTIC)

SCOPE. This specification covers the material and quality requirements for rustic barrier systems fabricated from structural and high-strength low alloy structural steel that in a reasonable time after erection in a rural environment of average atmosphere, will develop a uniform, permanent, and tightly adhering protective oxide coating.

MATERIAL REQUIREMENTS. Except as modified herein, all requirements of §710-20-Corrugated Beam Guide Railing and Mall Barrier and §710-21 - Box Beam Guide Railing and Median Barrier shall apply including Drop Weight Tear Testing. Galvanizing shall not be required unless specifically stated otherwise in the contract documents.

A. Box Beam Rail. The base metal for the structural shape, plate and bar components of box beam guide rail and median barrier shall meet the requirements of ASTM A242M or A588M. The fabrication of structural tube shall comply with ASTM A500, Grade B. The mechanical properties of the finished tube shall conform to the requirements of ASTM A500, Grade B except that the minimum elongation in 50.8 mm shall be 21 percent. Splice plates shall be fabricated of ASTM A36M steel ready for assembly before galvanizing and galvanized in accordance with §719-01, Type 1 (ASTM A123).

B. Corrugated Beam Rail. The base metal for the corrugated beam rail shall meet the requirements of ASTM A606, Type 4.
§710

C. Welds. All welds shall develop the strength of, and exhibit the same corrosion resistance characteristics as, the base metal used for the structural shape, plate and bar components.

D. Soil Plates. Soil plates of high strength, low alloy steel guide rail system shall be made of either ASTM A36M, ASTM A242M, ASTM A588M, or ASTM A606 Type 4 and shall be galvanized or epoxy coated in accordance with the applicable requirements in this specification.

E. Miscellaneous Hardware. The base metal of all accessory hardware of high strength, low alloy steel guide rail system including blockouts, backup plates, rail connecting angles, bolts, nuts and washers shall be fabricated from steel having corrosion resistance of approximately 4 times carbon structural steel without copper. Hardware to be excepted from this requirement is listed below and shall be supplied in conformance to the requirements as detailed on the standard sheets, and galvanized in accordance with §719-01, Type 1 (ASTM A123).
- All bolts less than 13 mm diameter and their associated washers and nuts.
- 44 mm x 44 mm square washers; 76 mm x 44 mm washers.
- 20 mm diameter anchor rods, nuts and washers associated with concrete anchors.
- Other miscellaneous nuts, bolts, washers and connectors not exposed to view.

High strength bolts, nuts and washers specified on the standard sheets as ASTM A325 shall conform to ASTM A325M, Type 3. Commercially available anti-seizing compound shall be applied to the threads of corrosion resistant bolts used in rail splices.

F. Epoxy Coating Material

1. The epoxy coating materials shall be powdered polyamide epoxy resin suitable for fusion bonding. The finish shall not be glossy. A dull or matted finish shall be supplied.
2. The color of the epoxy coating shall be a reasonable visual match to the brown color of Federal Color Standard 595 - plate numbers 10075, 10079, and 10091. Fifteen (15) days prior to commencement of coating operations, three (3) 100 mm x 150 mm coated metal plates shall be submitted to the Director, Materials Bureau for determination as to acceptability of the color match. The epoxy coating shall not fade, change color or chalk appreciably when subjected to a 30 hour exposure (20 minute cycle) in the high intensity ultra violet weatherometer model DMC-RHC. Each cycle (continuously repeating) starts with 17 minutes of light followed by 3 minutes of light and waterspray.
3. Upon approval of the product and the color match, the epoxy coating will be placed on a Department Approved List of Materials.

G. Posts. Posts shall conform to any of the following requirements:

1. ASTM A36M steel with a fusion bonded polyamide epoxy coating throughout meeting the epoxy requirements of this specification.
2. ASTM A588M steel with the embedded portion of the post galvanized in accordance with §719-01, Type 1 (ASTM A123). The posts shall be prepared in accordance with standard galvanizing industry practice. The lower 0.8 m of light posts and the lower 1 m of heavy posts shall be galvanized.
3. ASTM A588M steel with the embedded portion of the post having a fusion bonded polyamide epoxy coating meeting the epoxy requirements of this specification. The lower 1 m of the posts, regardless of rail type, shall be epoxy coated.

FABRICATION REQUIREMENTS

Epoxy Coating

A. Coating Applicator. The facilities of the coating applicator and method of application for the epoxy shall be subject to approval by the Director, Materials Bureau. Approval shall be obtained in accordance with the written procedures of the Materials Bureau. Upon approval, the complete name
and address of the coating applicator will be placed on the Department's List of Approved Products titled "Fusion Bonded Coating Applicators."

Coating applicators on the “approved list” for Longitudinal Joint Ties and Steel Reinforcing Bars are approved applicators for epoxy coated posts as described in this specification.

**B. Plant Inspection.** The Department reserves the right to have its authorized representative observe the preparation coating and testing of the posts. The representative shall have free access to the plant. Any work done while access was denied will be rejected.

If the representative elects, lengths of coated posts may be taken from the production run, on a random basis, for test, evaluation and check purposes by the Materials Bureau.

**C. Quality Control.** The coating applicator shall be responsible for performing quality control and tests. This will include inspection for compliance with the requirements of Coating Thickness, Continuity of Coating and Coating Cure.

**D. Preparation.** Posts shall be pickled according to accepted industry standards and then rinsed in a slightly basic solution to remove all traces of pickling residue. The cleaned surfaces shall be free of all residue and millscale. Only the portion of post to be coated needs to be cleaned. In lieu of the pickling process, posts may be blast cleaned in accordance with the Steel Structures Painting Council - Surface Preparation Specification No. 6 (SSPC-SP 6), Commercial Blast Cleaning. The cleaned surface shall be defined by SSPC-Vis 1-89, Pictorial Standards B SP 6 or C SP 6 as applicable.

**E. Coating Thickness.** .127 mm minimum dry film thickness. Coating thickness measurements shall be conducted by the method outlined in ASTM G12.

**F. Continuity of Coating.** The coating shall be checked visually after cure for continuity. It shall be free from holes, voids, contamination and damaged areas.

**G. Coating Cure.** The coating applicator shall check each shipment to determine that the epoxy coating is in fully-cured condition.

**Field Repair of Damaged Coatings.** Posts with coating breaks, due to handling, that exceed 13 mm in any dimension shall not be incorporated into the work. The Contractor shall set aside such damaged units and may effect a field repair. Coating breaks may be repaired with a patching material approved by the epoxy coating manufacturer. The patching material shall be an epoxy compatible with the epoxy coating. The patching epoxy shall be a color match to the coating epoxy.

**BASIS OF ACCEPTANCE.** All components of the box beam or corrugated beam guide railing and median barrier shall be accepted in accordance with directives issued by the Department and in conformance with the standard sheets.

All epoxy coated posts shall be accepted by the Engineer at the contract site on the basis of the following:

- The epoxy coating manufacturer's certification that the coating material is identical to that approved by the Materials Bureau.
- The coating applicator's certification that the posts have been coated and that they conform to the requirements of this specification.
- The appearance of the name of the coating applicator and epoxy coating material on the Department's Approved List of Products.

The manufacturer's certification that the metal used conforms to the requirements of this specification. The ASTM designation and Grade shall be included.
§710

710-26 PLASTIC AND SYNTHETIC BLOCK-OUTS FOR HEAVY POST GUIDERAIL SYSTEMS

SCOPE. This specification describes plastic and synthetic material block-outs used to provide uniform offset distance from the corrugated beam rail to the heavy post.

GENERAL. The block-out shall have the same general dimensions as detailed in the Department Standard Sheets. The block-out shall not contain excessive voids that would compromise its physical strength. The material shall be designed for outdoor exposure and shall include chemical additives to resist UV degradation. If the product contains recycled materials, they shall be environmentally friendly and non-hazardous. Blocks shall contain no materials that will negatively affect their field performance, such as materials that absorb moisture.

BASIS OF ACCEPTANCE. Manufacturers or suppliers may submit their product for evaluation to the Director of the Materials Bureau. This submission shall include copies of drawings, specifications, test reports, the quality control procedure and Federal Acceptance Letters. At the Department's discretion, the material will be evaluated for conformance to these specifications, and product samples will be tested in accordance with procedural directives of the Materials Bureau.

The product will be accepted at the job site based on its appearance on the Approved List. In addition, the contractor shall provide manufacturer certification that the supplied product has the same chemical composition, mechanical properties as the product used in the testing accepted for Federal Approval. Modifications to this product are acceptable, provided the resulting product is an equivalent or of higher level of quality, and supporting documentation is provided.

710-27 THRU 710-29 (VACANT)

710-30 RIGHT-OF-WAY FENCING

SCOPE. These specifications cover the material requirements required for the construction of right-of-way fences comprised of (a) galvanized steel or aluminum coated steel fence fabric, and (b) posts, braces and hardware designed to support and retain the fencing.

MATERIAL REQUIREMENTS

Fence Fabric. Right-of-way fencing fabric shall conform to the requirements of ASTM A116 “Zinc Coated (Galvanized) Steel Woven Wire Fence Fabric” or ASTM A584 “Aluminum-Coated Steel Woven Wire Fence Fabric.” The fabric shall be woven in accordance with Design Number 1047-6-9 or 1047-6-11 as shown in Table 1 of both ASTM A116 and ASTM A584. The weight of the coating on the Zinc-Coated (Galvanized) Fence Fabric shall conform to the coating weight requirements of Class 3 shown in Table 3 of ASTM A116.

Fence Posts and Braces. Posts and brace sizes shall be as indicated on the Standard Sheets. Steel line posts shall conform to the requirements of Section 6.5 through Section 6.5.4 of ASTM A702; or the requirements for Class A, Schedule 40 Pipe or Class B, Steel Tubing of §710-10.03 of the Standard Specifications. Posts and braces conforming to the requirements of ASTM A702 shall be galvanized in accordance with the requirements of §719-01 Type I. Type A Schedule 40 Pipe and Type B Steel Tubing shall use one of the protective coating system specified in 7A of §710-10.03.

Wood posts and braces shall be seasoned southern yellow pine, red (Norway) pine, spruce, douglas fir, hemlock, larch, or redwood. All wood posts and braces shall be pressure treated with a water-borne wood preservative conforming to the requirements of §708-31. The wood posts shall be subject to inspection before and during treatment at the option of the Department. They shall be sound, free from loose knots or decay, and with no through checks on tops or butts. Posts shall be machine peeled to a smooth uniform appearance and free from all inner bark. The preservative pressure treatment shall be by the empty cell process in accordance with C5 of the American Wood-Preservers' Association Standards.
**Fittings.** Fittings shall be manufactured of weldable steel, malleable iron, cast steel, cast iron, or aluminum alloy. Fittings other than aluminum shall be galvanized in accordance with the requirements of §719-01 Type II.

**Fasteners.** Bolts, nuts, and washers shall conform to the following, unless specified otherwise in the contract documents:

<table>
<thead>
<tr>
<th>Material</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bolts</td>
<td>ASTM F568 Class 4.6 or A307</td>
</tr>
<tr>
<td>Nuts</td>
<td>ASTM A563M or A568, Grade A or better</td>
</tr>
<tr>
<td>Washers</td>
<td>ASTM F844</td>
</tr>
</tbody>
</table>

The fasteners shall be galvanized in accordance with the requirements of §719-01 Type II.

**Gates.** Gates shall be constructed of Class A Schedule 40 Pipe conforming to §710-10 welded at all corners or assembled with corner fittings. The size of the pipe used to fabricate the gate shall be as shown on the Standard Sheets. When corner fittings are used the gates shall have truss rods of minimum 9.50 mm diameter to prevent sag or twist. Gate leaves shall have vertical intermediate bracing so that no vertical members are more than 2.50 m apart. Gate leaves over 3 m shall have a truss rod of minimum 9.50 mm minimum diameter even if the corners are welded. The fence fabric used on the gate shall conform to the fence fabric in the remainder of the fence.

**A. Hinges.** Hinges shall be weldable steel, cast steel, or malleable iron 180° offset industrial type. The hinges shall not twist or turn under the action of the gate. The gate shall be able to be opened by one person. The hinges shall be galvanized in accordance with the requirements of §719-01 Type I.

**B. Latches.** Latches, stops, and keepers shall be provided for all gates.

Latches for single leaf gates may be a forked latch type. Double leaf gates shall have a plunger bar type latch arranged to engage a stop. Latches shall be capable of being locked and the Contractor shall provide a lock with triplicate keys for each gate. Keepers shall consist of a mechanical device for securing the free end of a gate when in the full open position.

**C. Gate Posts.** Gate posts shall conform to the dimensions shown on the Standard Sheets.

Steel gate posts shall be fabricated from either Class A Schedule 40 Pipe or Class B Steel Tubing conforming to the requirements of §710-10.

Wood gate posts shall be made from wood conforming to the requirements for wood posts and braces as specified in “Fence Posts and Braces”.

**BASIS OF ACCEPTANCE.** Right-of-way fencing will be accepted on the basis of a material certification that specifies the product conforms to this specification. Buy America requirements apply.

**SECTION 711 - CONCRETE CURING MATERIALS AND ADMIXTURES**

**711-01 (VACANT)**

**711-02 QUILTED COVERS (FOR CURING)**

**SCOPE.** These specifications cover cotton mats to be used for curing Portland Cement concrete pavements and bases, and concrete structures.

**GENERAL.** The mats shall consist of a filling material of cotton “bat” or “bats” covered with unsized cloth, and tufted or stitched to maintain the shape and stability of the unit under job conditions of handling.
MATERIALS REQUIREMENTS

Cotton. Cotton cloth covering shall weigh not less than 213.6 grams per square meter and shall have an average of not less than 32 threads in warp and not less than 28 threads in filling, having a minimum average breaking strength (grab method) of 265 newtons in the warp and of 265 newtons in the filling.

The weight of the cotton cloth covering shall not fall below the specified weight by more than 5 percent. The raw materials used in the manufacture of the cotton cloth shall be raw cotton, comber waste, cotton card strip waste, or combination thereof. The other physical characteristics of the cloth shall be equal to those in such material for industrial purposes.

Burlap or Jute. Burlap or jute covering for cotton mats shall weigh not less than 227.2 grams per square meter and shall have not less than 8 threads per 25 mm of warp and not less than 8 threads per 25 mm of filling. It shall be the grade known commercially as “firsts” and shall be free from avoidable imperfections in manufacture and from defects or blemishes affecting the serviceability. A tolerance in weight of minus 5 percent will be permitted.

Filling Material. The filling material for the mats shall be cotton bat, or bats, made of raw cotton, cotton waste, cotton linters, or combinations thereof, and shall weigh not less than 406.9 grams per square meter. The batting used shall not be lower in quality than a batting made of U. S. Standard Grade No. 3 Linters.

Thread

A. Tufting. The cotton thread for tufting shall be not less than 4-cord number 12's.

B. Sewing or Stitching. The thread used for all sewing or stitching shall be at least equivalent in size and strength to standard 3-cord number 30 cotton thread.

DIMENSIONS

A. Mats. Mats shall have a filler of 1750 mm in width and shall have a flap 150 mm or more in width, consisting of an extension of two thicknesses of the covering material, extending along one longitudinal edge of the mat. The length of the mats shall be 760 mm greater than the width of pavement slab to be cured.

B. Tolerance. The length or width of the mats shall not be less than that specified by more than 2 percent.

FABRICATION

A. Covering Material. The covering material for each surface of the mat shall consist of two widths of cloth joined by a lapped seam or by a seam formed by superimposing the two widths and uniting them by one row of stitches. If the seam of the latter type, the edges shall be on the inside of the finished mat.

B. Filling. The cotton filling materials in the form of a bat or bats shall be held in place between the coverings by sewing or tufting all around the periphery of the mat within 25 mm of each of the four edges of the filler, and by sewing or quilting longitudinally at intervals not greater than 100 mm, or by tufting at intervals both longitudinally and transversely, not greater than 75 mm. The sewing or tufting shall be sufficiently loose to permit substantially all of the surface of the mat to come in contact with a flat surface when in use, but not so loose as to permit the filling material to shift.

C. Flap and Ends. The flap shall be constructed by sewing the upper and lower covering together longitudinally within 25 mm of the outer edges of the flap. Along the edge of the mat opposite the flap, the filling materials shall be within 25 mm of the edges of the covering material, and the covering material shall be sewn together so as to enclose the filling material. The ends of the mats
shall be finished by running an additional seam (i.e., a seam in addition to the seam holding the filling material in place) across the mats. This seam shall not be closer to the seam holding the filling material in place than 6 mm and not closer to the end of either covering than 12 mm, unless the ends of the mat are finished with an overlying or whip stitch, or in a manner which will not leave a raw edge.

**D. Stitching.** All longitudinal sewing or quilting shall average at least three stitches per 25 mm and shall have not less than five stitches in any 50 mm. All other sewing shall average six stitches per 25 mm and shall have not less than nine stitches in any 50 mm.

**BASIS OF ACCEPTANCE.** Quilted covers (for curing) will be accepted on the basis of a material certification that specifies the product conforms to this specification.

### 711-03 PLASTIC COATED FIBER BLANKETS (FOR CURING)

**SCOPE.** These specifications cover white plastic coated fiber blankets or white plastic coated absorbent synthetic fabric blankets.

**MATERIAL REQUIREMENTS.** The blankets shall conform to the test requirements of A.S.T.M. C171, for White burlap - polyethylene sheets, for Moisture Loss and Reflectance.

**BASIS OF ACCEPTANCE.** Application for approval of plastic fiber blankets shall be submitted to the Director, Materials Bureau. Upon approval, the name and manufacturer of the product will be placed on the Department's Approved List. Each roll of the blankets shall be marked with an indelible marking, every 3 meters, with the following.

- Manufacturer's name and/or logo
- Product name
- Meet ASTM C171, White Burlap - Polyethylene Sheets, for Moisture Loss and Reflectance

The product shall be accepted at the work site on the basis of the appearance of the name and manufacturer of the product on the Approved List and marking as required herein.

### 711-04 POLYETHYLENE CURING COVER (WHITE OPAQUE)

**SCOPE.** This specification covers the material requirements for polyethylene curing covers (white opaque) to be used for curing of Portland Cement concrete.

**MATERIAL REQUIREMENTS.** The blankets shall conform to the material requirements of AASHTO M171 (ASTM C171) for Polyethylene Film: White Opaque. Rolls shall be wound on serviceable handling members which extend beyond the edges of the roll, forming handles to facilitate applying the covers over concrete.

**BASIS OF ACCEPTANCE.** Each shipment shall be accompanied by the manufacturer's certificate attesting to the fact that the shipment meets the specified standards. Upon request, the manufacturer shall supply a record of the results of the prescribed tests as made on the samples.

### 711-05 MEMBRANE CURING COMPOUND

**SCOPE.** This specification covers white-pigmented and clear membrane curing compound material and quality requirements for spray application on surfaces of newly placed Portland Cement concrete.

**GENERAL.** Samples of membrane curing compound shall be submitted to the Materials Bureau by the manufacturer upon application for approval. Approved material shall be delivered to the work site in clean containers. The curing compound shall be agitated mechanically to a uniform consistency throughout the container immediately before use.
MATERIAL REQUIREMENTS

A. White Pigmented. The compound shall consist of finely ground white pigment and wax-free vehicle, ready mixed for immediate use without alteration. When applied to freshly placed damp concrete at the rate of one liter per 3.5 square meters, the compound shall adhere and present a uniform white appearance and effectively obscure the original color of the concrete. The compound applied at the specified rate shall provide a curing compound displaying the following properties:

1. **Drying.** The compound shall produce a uniform coating at a minimum temperature of 5°C and shall dry tack-free within 4 hours.

2. **Permeability.** The moisture loss through the membrane shall be no more than 0.04 grams per square centimeter of surface area after three days.

3. **Reflectivity.** The membrane shall have a reflectance value of 60 percent, minimum based on Magnesium Oxide as a standard.

4. **Durability.** The membrane shall remain intact for at least seven days before becoming powdery and non-adherent due to weathering.

B. Clear. The compound shall consist of a wax-free vehicle, ready mixed for immediate use without alteration containing a fugitive dye that will fade uniformly. When applied to freshly placed, damp concrete, at the rate of 1 liter per 3.5 m², it shall provide a curing membrane displaying the following properties:

1. **Drying.** The compound shall produce a uniform coating at a minimum temperature of 5°C and shall dry tack-free within 4 hours.

2. **Permeability.** The moisture loss through the membrane shall be no more than 400 grams per square meter of surface after three days.

3. **Durability.** The membrane shall remain intact for at least 7 days.

4. **Fugitive Dye.** The membrane-forming compounds with fugitive dye shall be readily distinguishable upon the concrete surface for at least 4 hours after application, but shall become inconspicuous within 7 days after application.

**TESTS.** The properties of a membrane curing compound shall be tested on laboratory specimens. Details of the tests may be obtained from the Materials Bureau.

**BASIS OF ACCEPTANCE.** The approval of the membrane curing compound shall be based upon tests performed by the Materials Bureau. Upon approval by the Materials Bureau, the name of the product will be placed on an Approved List. Such products shall then be accepted on the basis of the brand name labeled on the container.

711-06 BURLAP

**SCOPE.** This specification covers requirements for burlap for use in curing concrete.

**MATERIAL REQUIREMENTS.** Burlap shall conform to the requirements of AASHTO M182. The burlap shall be made from jute or kenaf and shall weigh 310 to 372 grams per meter. Burlap shall be cleaned and free from cuts, tears, uneven weaving and contaminants.

**BASIS OF ACCEPTANCE.** The burlap will be accepted on the basis of a visual inspection by the Engineer and weighing of a sample at the point of use.
711-07 FORM INSULATING MATERIALS FOR WINTER CONCRETING

SCOPE. This specification covers the material details, quality requirements, and method of application for approval of form insulating materials used for winter concreting operations.

MATERIAL REQUIREMENTS. Each insulating material will be judged on its ease and practicability of installation, durability and imperviousness to moisture penetration and absorption. The minimum thickness for any foam board and blanket insulation considered shall be 25 mm. The thermal conductivity (k) of any proposed insulating material shall not exceed 0.046 watt per meter kelvin (W/mK).

Application of approval of an insulating material shall be made to the Materials Bureau. Certified laboratory test results for thermal conductivity (k) and thermal resistance (R), kelvin meter²/watt (KAm²/W), measured at the nominal product thickness shall be required for evaluation. A one square meter (minimum) sample shall accompany each request for approval. The sample shall exhibit all major features of the insulating product such as covers, seams, fasteners, grommets, etc. All necessary and normal product information shall accompany the sample. If there is a specific process required to apply the insulating material, complete details of the process shall accompany the sample.

If sprayed foam is the material in question, the Contractor shall also be required to send the applicator's name plus a list of jobs done by the applicator during the last 12 months. If investigation of these jobs demonstrates quality workmanship, the applicator shall be issued a temporary approval good for one contract. Based upon its subsequent performance, a decision will be made as to whether or not to place the applicator's name on the Approved List.

BASIS OF ACCEPTANCE. Insulating materials for winter concreting shall be accepted on the basis of Approved List issued by the Materials Bureau.

711-08 ADMIXTURES

SCOPE. These specifications cover the material requirements for air-entraining, water-reducing and retarding and water-reducing admixtures used in the manufacture of Portland Cement concrete. The specification also covers the requirements for water-reducing (high range) admixtures.

GENERAL. All admixtures shall be in liquid form having a consistency that flows readily. The admixtures shall not contain chemicals which, when mixed with concrete, produce a condition that is injurious to the quality and durability of the concrete or reinforcing steel. This applies specifically to compounds which, when used in manufacturing process, produce a significant amount of chloride ions in the final product. The pH shall be equal to or greater than 7 for all admixtures used at a dosage rate of four liters or more per cubic meter. (Total chloride ion content shall be less than 1000 ppm.) Admixtures manufactured from carbohydrates such as sucrose (table sugar), glucose, and maltose when used alone will not be permitted.

MATERIAL REQUIREMENTS

Air-Entraining. The air-entraining agent shall entrain air in the concrete and the concrete containing an air-entraining agent shall conform to the following requirements:

A. Bleeding. The bleeding of the concrete made with the admixture under test shall not exceed that of concrete made with the reference admixture by more than 2 percentage points, the bleeding being computed as a percentage of the net amount of mixing water in each concrete. The net mixing water is the water in excess of that present as absorbed water in the aggregate.

B. Time of Setting. The initial time of setting of concrete containing the admixture under test shall not deviate from that of the concrete made with the reference admixture by more than ±1 hour and 15 minutes.
C. Compressive Strength. The compressive strength of concrete containing the admixture under test shall be not less than 90 percent of the control concrete, at the same air content, containing the reference admixture at 48 hours, 7 days and 28 days.

D. Resistance to Freezing and Thawing. The hardened concrete containing the admixture under test shall not exceed a weight loss of 4.0 percent in 25 cycles in a 10% NaCl solution.

E. Length Change. Length changes shall be based on initial measurements taken at the time of removal of the specimens from the molds and final measurements taken at the end of 14 days of air drying. The specimens shall be moist-cured for 14 days followed by 14 days of air drying. Length change shall not be greater than ± 20% of similar concrete containing the reference admixture.

Water-Reducing and Retarding Admixtures (ASTM TYPE D). The water-reducing and retarding admixtures shall reduce the quantity of mixing water required to produce concrete of a given consistency, and retard the setting of concrete. Concrete containing this admixture shall conform to the following requirements:

A. Water Reduction. The mixing water required for concrete containing the admixture under test shall be reduced at least 5.0 percent when compared to that of the reference concrete without the admixture under test.

B. Time of Setting. The initial set time of the concrete containing the admixture under test shall be increased by at least 50 percent when compared to that of the reference concrete without the admixture under test.

C. Compressive Strength. The compressive strength of the concrete containing the admixture under test, when compared to concrete without the admixture under test, shall be equal or greater at 48 hours, 7 days and 28 days.

D. Resistance to Freezing and Thawing. The hardened concrete containing the admixture under test shall not exceed a weight loss of 4.0 percent, in 25 cycles in a 10% NaCl solution.

E. Length Change. Length changes shall be based on initial measurements taken at the time of removal of the specimens from the molds and final measurements taken at the end of 14 days of air drying. The specimens shall be moist-cured for 14 days followed by 14 days of air drying. Length change shall not be greater than ± 35% of similar concrete containing the reference admixture.

Water-Reducing Admixtures (ASTM TYPE A). The water-reducing admixtures shall reduce the quantity of mixing water required to produce concrete of a given consistency. Concrete containing this admixture shall meet the requirements of the water reducing and retarding admixtures above except that the time of setting of the concrete containing the admixture under test shall not deviate from that of similar concrete without the admixture under test used as a reference by more than ±1 hour and 15 minutes.

Water-Reducing (High Range) Admixtures (ASTM TYPE F). The water-reducing (High Range) admixture shall reduce the quantity of mixing water required to produce concrete of a given consistency. Concrete containing this admixture shall conform to the following requirements:

A. Water Reduction. The mixing water required for concrete containing the admixture under test shall be reduced at least 12.0 percent when compared to that of the reference concrete without the admixture under test.

B. Time of Setting. The initial set time of the concrete containing the admixture under test when compared to that of the reference concrete shall not be more than 1 hour earlier nor 1 hour, 30 minutes later.
C. Compressive Strength. The compressive strength of the concrete containing the admixture under test when compared to concrete without the admixture under test shall be as follows:

<table>
<thead>
<tr>
<th></th>
<th>1 day</th>
<th>3 days</th>
<th>7 days</th>
<th>28 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressive Strength, minimum percent of control:</td>
<td>140%</td>
<td>125%</td>
<td>115%</td>
<td>110%</td>
</tr>
</tbody>
</table>

The compressive strength of the concrete containing the admixture under test at any test age shall be not less than 100% of that attained at any previous age.

D. Resistance to Freezing and Thawing. The hardened concrete containing the admixture under test shall not exceed a weight loss of 4.0 percent in 25 cycles in a 10% NaCl solution.

E. Length Change. Length changes shall be based on initial measurements taken at the time of removal of the specimens from the molds and final measurements taken at the end of 14 days of air drying. The specimens shall be moist-cured for 14 days followed by 14 days of air drying. Length change shall not be greater than ± 35% of similar concrete containing the reference admixture.

SAMPLING AND TESTING. A liter sample of admixture shall be submitted to the Materials Bureau by the manufacturer applying for approval except that for Water-Reducing (High Range) Admixtures two liters will be required. Along with the sample the manufacturer shall include data from test performed in accordance with these specifications. Data from tests performed in accordance with ASTM C260 for air-entraining agents and ASTM C494 for water-reducing and retarding admixtures and water-reducing admixtures may be substituted.

In addition to the sample and test data, information on the formulation of the product, including the raw materials from which it is compounded and a description of the manufacturing process, shall be submitted.

The Department will test the submitted admixture sample according to written Department instructions. The test procedures are available from the Materials Bureau upon request.

The Department reserves the right to monitor the performance of any previously approved admixture. Samples of admixture may be taken from actual concrete operations and retested by the Materials Bureau.

BASIS OF ACCEPTANCE. The approval of the admixture shall be based upon the submitted information and tests performed by the Materials Bureau. Upon approval by the Materials Bureau, the name of the product will be placed on the Approved List. Such products shall then be accepted on the basis of the brand name labeled plainly on the containers.

Any admixtures sampled from actual concrete operations and retested in the Materials Bureau shall give substantially the same results, at the same dosage rate, as the original tests. Any significant change will be cause for rejection of that material and may require a resubmission of the admixture by the manufacturer for a complete retest to determine specification compliance. The admixture may be withdrawn from the Approved List during the retest period.

711-09 EMULSIFIED CARBON BLACK

SCOPE. This specification covers the material requirements for Emulsified Carbon Black, which is used as a coloring agent in mortar or concrete.

GENERAL. The method of test shall conform to the requirements of AASHTO T 106, the standard method of test for compressive strength of hydraulic cement mortars.

MATERIAL REQUIREMENTS. Emulsified Carbon Black shall be a uniform colloidal dispersion of standard carbon black in a liquid medium. The air content of the concrete shall not be changed by more than 10% by addition of 2%, by weight of cement, of the dispersed carbon black. The ash content shall not exceed 3% by weight of the finished product. At least 25% of the commercial product shall be carbon black.
The Emulsified Carbon Black shall be stable and shall have the same effect on the air entrainment, after standing for a period of 28 days, as specified above.

The color produced on the broken surface after the seven day test shall be equal to that produced by a previously established standard of color.

The Emulsified Carbon Black shall show uniform dispersion in mortars or concrete when used in concentrations necessary to produce the desired pigmentation.

**TEST.** Test specimens shall be prepared as follows: Portland Cement Type 2 containing 2% by weight of Emulsified Carbon Black shall be used with standard Ottawa Sand to prepare 1:2.75 compressive cubes. The compressive strength of these cubes at the age of seven days and thereafter shall be not less than 85% of the strength of similar cubes with no pigment added.

**BASIS OF ACCEPTANCE.** This material will be considered for acceptance in stock lot quantities at manufacture of supply locations in accordance with procedural directives of the Materials Bureau.

### 711-10 FLY ASH

**SCOPE.** This specification covers the material requirements for fly ash when used as a partial replacement for Portland Cement in Portland Cement concrete.

**MATERIAL REQUIREMENTS.** Fly ash shall conform to the chemical and physical requirements for Mineral Admixture, Class F listed in AASHTO M 295 including Table 2 (except for Footnote A). Loss of Ignition shall not exceed 4.0%.

**A. Storage.** The fly ash shall be stored at its source of supply in weather-tight silos approved by the Director, Materials Bureau. All silos shall be completely empty and clean before fly ash is deposited therein unless the silo contains fly ash of the same type.

Fly ash remaining in bulk storage at the source of distribution terminal for a period greater than one year after completion of tests will be resampled and retested by the Materials Bureau before shipment or use. However, fly ash which has been in bulk storage at sources or distribution terminals more than two years from the time of original manufacture shall not be used.

**B. Shipment.** All shipments of fly ash shall be made in accordance with procedural directives issued by the Materials Bureau. Conveyances for bulk fly ash shipment shall be of a type approved by the Director, Materials Bureau. The compartments of all such conveyances shall be completely empty and clean before any fly ash is deposited therein.

**C. Inspection and Testing.** Inspection and testing shall be in accordance with procedural directives by the Materials Bureau. Tests for chemical and physical properties shall be in accordance with test methods stipulated by AASHTO M 295 as modified in test methods prescribed by the Materials Bureau.

**Special Note.** The Department will consider requests to evaluate alternate classes of fly ash, such as Class C or N. The Department's evaluation may include laboratory testing, field trials and other related work required to determine equivalency with specified materials, mix designs, and performance. Use of alternates is subject to approval by the Director, Materials Bureau.

**BASIS OF ACCEPTANCE.** Fly ash will be considered for acceptance at the source or terminal locations in accordance with procedural directives issued by the Materials Bureau.

### 711-11 MICROSILICA

**SCOPE.** This specification covers the material requirements for microsilica admixture for use in portland cement concrete and other mixes.
GENERAL. Supply microsilica admixture as a dry powder or slurry. When necessary for testing purposes, microsilica slurries will be dried to obtain a representative sample of dry powder.

MATERIAL REQUIREMENTS. The microsilica powder shall conform to the requirements of AASHTO M 307* (including optional chemical and optional physical requirements) and the following:

Uniformity of Silicon Dioxide Content. Maximum ±7.0% from the acceptance value.

Chloride Content. Maximum 0.20% as determined by AASHTO T 260, Procedure B.

Fineness. Maximum 5.0% retained on a 45-µm sieve (wet method).

Uniformity of Percent Solids (Slurry). Maximum ±5.0% from the acceptance value.

* For Materials other than Silica fume as defined by AASHTO M307, the requirement for SiO2 may be reduced if the combined quantity of reactive SiO2+AlO2+FeO2 is at least 85%, and all other chemical and physical requirements are met as determined by the Materials Bureau.

SAMPLING AND TESTING. Submit two - 1 liter samples of microsilica to the Materials Bureau for approval, with the following:

Supplier and Manufacturer's Names and Addresses. If the material will be manufactured at several locations, identify each location and submit a separate sample representing each location.

Product Label, Product Information Sheets and Material Safety Data Sheets. Include the date of manufacture and shelf life of the supplied sample.

Test Results. Submit laboratory test results indicating the product meets all specification requirements.

The testing laboratory must be acceptable to the Director, Materials Bureau. The Department will test the submitted microsilica sample in accordance with the specification and Department instructions. Test procedures are available from the Materials Bureau upon request. Upon approval by the Materials Bureau, the name of the product will be placed on the Approved List. The Department reserves the right to monitor the performance of any approved microsilica. Samples of microsilica may be taken from actual concrete operations and tested by the Materials Bureau. If these test results indicate that the sampled microsilica does not meet this specification, concrete incorporating the microsilica represented by the sample may be rejected.

BASIS OF ACCEPTANCE. Each shipment of microsilica will be considered for acceptance where it will be incorporated into the concrete. Acceptance will be based on the product name appearing on the Approved List and Manufacturer's certification of conformance to this specification.

711-12 GROUND GRANULATED BLAST- FURNACE SLAG

SCOPE. This specification covers the material requirements for ground granulated blast-furnace slag when used as a partial replacement for portland cement in portland cement concrete.

MATERIAL REQUIREMENTS. Ground granulated blast-furnace slag (GGBFS) shall conform to the chemical and physical requirements for Grade 100 slag as described in AASHTO M 302.

Storage. The ground granulated blast-furnace slag shall be stored at its source of supply in approved weather-tight silos. Facilities shall be provided for maintaining such silos under Department seal control when and as directed by the Materials Bureau. All silos shall be completely empty and clean before GGBFS is deposited therein unless the silo contains Department specification GGBFS of the same type. GGBFS remaining in bulk storage at the mill and/or distribution terminal for a period greater than one year after completion of tests shall be resampled and retested before shipment. However, GGBFS which has been in bulk storage at mills and/or distribution terminals more than two years from the time of original manufacture shall not be used. No GGBFS stored by the Contractor over the winter shall be used until retested by the Materials Bureau.
§711

SHIPPING. All shipments of ground granulated blast-furnace slag shall be made in accordance with procedural directives issued by the Materials Bureau. Conveyances for bulk shipment shall be of a type approved by the Department. The compartments of all such conveyances shall be completely empty and clean before any GGBFS is loaded therein.

INSPECTION AND TESTING. All inspection and testing shall be in accordance with procedural directives issued by the Materials Bureau. When required by the Materials Bureau, GGBFS shall be sampled by means of an automatic sampling device constructed so as to obtain continuous samples across the full stream of GGBFS and deliver such samples into a sealed container approved by the Materials Bureau.

Tests for chemical and physical properties shall be in accordance with test methods stipulated by AASHTO M 302.

BASIS OF ACCEPTANCE. Ground granulated blast-furnace slag will be considered for acceptance at mill or terminal locations in accordance with procedural directives issued by the Materials Bureau.

711-13 CALCIUM NITRITE BASED CORROSION INHIBITORS

SCOPE. This specification covers the material requirements for corrosion inhibitors used in the manufacture of Portland Cement Concrete.

GENERAL. The corrosion inhibitor shall consist of a calcium nitrite solution. The admixture shall not contain chemicals which, when mixed with concrete, produce a condition that is injurious to the quality and durability of the concrete or reinforcing steel.

MATERIALS REQUIREMENTS. The corrosion inhibitor shall consist of a calcium nitrite solution, containing 30 +/-2% calcium nitrite solids by mass and having a specific gravity of 1.27 +/-0.02. The corrosion inhibitor when used in the manufacturing process shall not produce a significant amount of chloride ions in the final product (Less than 1000 ppm, as determined by the Department). The pH shall be greater than 8.

SAMPLING AND TESTING. A two liter sample of admixture shall be submitted to the Materials Bureau by the manufacturer applying for approval. Along with the sample, the Manufacturer shall provide information to include the manufacturer's name and address, a copy of the product literature, material safety data sheets, and written certification stating that the material meets the physical and chemical requirements of this specification (711-13, Calcium Nitrite Based Corrosion Inhibitors).

The Department will test the sample for specific gravity and percent calcium nitrite in accordance with written Department instructions. The Sampling and testing procedure is available from the Materials Bureau upon request. Upon testing by the Materials Bureau, if the sample submitted is within tolerance, it will be placed on the Department's Approved List of Materials for corrosion inhibitors. In order to ensure their quality, regular monitor sampling and testing will be performed at the point of use. The concrete batching facility is typically the point of use.

BASIS OF ACCEPTANCE. The initial approval of the admixture shall be based upon the submitted information and tests performed by the Materials Bureau. Upon approval by the Materials Bureau, the name of the product will be placed on the Approved List. Such products shall then be accepted on the basis of the brand name labeled plainly on the containers.

SECTION 712 - MISCELLANEOUS

712-01 WATER

SCOPE. This specification contains the requirements for water used in Portland Cement concrete, mortar, concrete curing, treated subgrade, soil cement and for application to plants, seeded or sodded areas and planted areas.
MATERIAL REQUIREMENTS. Water used for mixing and curing Portland Cement concrete, mortar, treated subgrade and soil cement shall meet the requirements indicated in Table 712-1, Water. NYSDOT Test Method No. 712-01P shall apply to all physical tests.

Water for curing concrete shall not contain any impurities in sufficient amount to cause discoloration or surface deterioration.

Water applied to seeded or sodded areas, plants or planted areas shall be free from oil, have a pH not less than 6.0 nor greater than 8.0 and shall be free from impurities injurious to vegetation.

BASIS OF ACCEPTANCE. Municipal water supplies are considered acceptable sources. Acceptance of questionable sources of water, as determined by the Regional Director or his/her representative, shall be determined by the Materials Bureau on samples taken by Department representatives.

<table>
<thead>
<tr>
<th>TABLE 712-1 - WATER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Content of Mortar, percent by volume</td>
</tr>
<tr>
<td>Soundness, Autoclave Expansion, percent</td>
</tr>
<tr>
<td>Compressive Strength, 7 day, 28 day (optional) percent of compressive strength of mortar cubes made with standard water</td>
</tr>
<tr>
<td>Time of Setting, Vicat Test, Initial Set, minutes</td>
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<tr>
<td>Final Set, hours</td>
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<tr>
<td>Presence of Oil</td>
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<tr>
<td>pH, AASHTO T26</td>
</tr>
<tr>
<td>Organic Solids, AASHTO T26, ppm</td>
</tr>
<tr>
<td>Total Inorganic Solids, AASHTO T26, ppm</td>
</tr>
<tr>
<td>Chloride Ion Content, ppm</td>
</tr>
<tr>
<td>Sulphate Ion Content, ppm</td>
</tr>
</tbody>
</table>

712-02 CALCIUM CHLORIDE

SCOPE. This specification covers the material requirements for calcium chloride for use in dust control, stabilization, ice control and for other highway construction related purposes. Calcium chloride material shall be either Type A - Solid Flake Calcium Chloride or Type B - Liquid Calcium Chloride Solution.

MATERIAL REQUIREMENTS

Type A - Solid Flake Calcium Chloride. Solid Flake Calcium Chloride shall meet the requirements of ASTM D98 and upon analysis shall show not less than 77.0% CaCl₂. The calcium chloride shall be supplied in the form of dry, loose flakes, pellets or granules and shall be fine enough to feed through the common types of spreaders used in roadwork. The Engineer reserves the right to reject any material that has become caked or otherwise damaged.

Type B - Liquid Calcium Chloride Solution. Liquid Calcium Chloride shall be supplied as a mixed solution which upon analysis shall show not less than 30.0% of CaCl₂.

Equivalent Spreading Rates. For purposes of these specifications 0.6 kg/m² of Type A, Solid Flake CaCl₂ is equivalent to 1.0 L/m² of Type B, Liquid CaCl₂ Solution. These factors shall be used as the basis for determining other rates of application.

PACKAGING, MARKING & SHIPPING

Type A - Solid Flake Calcium Chloride. Solid Calcium chloride shall be packaged in moistureproof bags containing not more than 45 kg each, or in airtight drums weighing not more than 205 kg each, or it may be delivered in bulk in tank cars, covered hopper cars, or covered trucks. All bulk shipments that are to be stored and stockpiled on the job site shall be protected with waterproof
§712

covers. The location and protection of stockpiled material shall be approved by the Engineer prior to shipment.

The name of the manufacturer, name of the product, net weight, and the percentage of calcium chloride (\(\text{CaCl}_2\)) guaranteed by the manufacturer shall be legibly marked on each container, except in the case of bulk shipments where the invoice shall be accepted as evidence of compliance with these requirements.

**Type B - Liquid Calcium Chloride Solution.** Liquid calcium chloride shall be delivered in bulk shipments on a supplied-and-applied basis. The delivery equipment shall be capable of applying the liquid solution at the specified rate(s). The delivery equipment shall be subject to approval by the Engineer and shall be equipped with suitable calibration devices to insure the correct rate of application. Each bulk shipment shall be accompanied with the manufacturer's invoice.

**BASIS OF ACCEPTANCE.** Calcium chloride will be accepted based on its use as follows:

**A. For dust control, ice control and other highway construction related purposes.** Type A and Type B calcium chloride will be accepted based on the Engineer's approval.

**B. For soil stabilization.** Type A and Type B calcium chloride will be accepted on the basis of the manufacturer's certification that the product conforms to the above specifications. The certification shall reference the number of containers shipped, or in the case of bulk deliveries, the invoice numbers associated with each delivery.

**712-03 SODIUM CHLORIDE**

**SCOPE.** This specification covers the material requirements for sodium chloride to be used as a soil admixture or deicing agent for maintenance.

**MATERIAL REQUIREMENTS.** Sodium chloride shall meet the requirements of ASTM D632, Sodium Chloride - Type 1, Grade 1.

Sodium chloride shall be packaged in moistureproof bags containing not more than 45 kg each, or in airtight drums weighing not more than 205 kg each, or it may be delivered in bulk in tank cars, covered hopper cars, or covered trucks. All bulk shipments that are to be stored and stockpiled on the job site shall be protected with waterproof covers. The location and protection of stockpiled material shall be approved, by the Engineer, prior to shipment.

**BASIS OF ACCEPTANCE.** Sodium chloride will be accepted based upon the Engineer's approval. The Department reserves the right to sample and test this material subsequent to delivery at the project site.

**712-04 HYDRATED LIME**

**SCOPE.** This specification contains the material requirements pertaining to Hydrated Lime.

**MATERIAL REQUIREMENTS.** Hydrated Lime shall meet the requirements of ASTM C207, Hydrated Lime for Masonry Purposes - Type NA or SA.

**BASIS OF ACCEPTANCE.** The manufacturer's certification shall constitute sufficient documentation for acceptance of this material at the site of the work. The Department reserves the right to sample this material to test for conformance to these specifications.

**712-05 PRECAST CONCRETE RIGHT-OF-WAY MARKERS**

**SCOPE.** This specification covers the material and fabrication requirements for precast concrete right-of-way markers.
MATERIAL REQUIREMENTS. The Material Requirements contained in §704-03 shall apply.

DRAWINGS. The Drawing requirements contained in §704-03 shall apply.

FABRICATION. The Fabrication requirements contained in §704-03, along with the following shall apply.

Precast right-of-way markers shall be fabricated to conform to the size and shape shown on the standard sheet unless otherwise shown on the plans.

SAMPLING AND TESTING. The Sampling And Testing requirements contained in §704-03 shall apply.

MARKING. The Marking requirements contained in §704-03 shall apply except as noted herein.

Markings shall be placed on the bottom end face of each unit such that they won’t be exposed to view after installation. Instead of marking the contract number on each unit they may be marked with “NYSDOT”.

FINAL PRODUCTION INSPECTION. The Final Production Inspection requirements contained in §704-03 shall apply.

SHIPPING. The Shipping requirements contained in §704-03 shall apply.

BASIS OF ACCEPTANCE. The Basis of Acceptance requirements contained in §704-03 shall apply.

712-06 MOBILE CONSTRUCTION ZONE IMPACT ATTENUATORS

SCOPE. This specification covers the material and testing requirements for crash cushions or impact attenuators mounted on the rear of designated work vehicles. These devices are commonly called truck mounted attenuators or TMAs.

MATERIAL REQUIREMENTS. Truck Mounted Attenuators having initial purchase dates on or before October 1, 1998 shall have been satisfactorily tested in accordance with the National Cooperative Highway Research Program (NCHRP) Report 350 or 230 or other testing protocol acceptable to the State. Those purchased new after that date shall be only those that have been satisfactorily tested in accordance with NCHRP Report 350. Testing shall consist of full scale crash testing conducted by recognized testing agencies. TMAs meeting the requirements of NCHRP 350 Test Level 2 or, for devices originally purchased on or before October 1, 1998, NCHRP 230 are the standard TMA, and shall be acceptable for all circumstances except as stated in this specification or in the Contract Documents.

NCHRP 350 Test Level 3 TMAs shall be required, however, whenever indicated in the Contract Documents or whenever the posted speed limit within 335 meters upstream of the TMA is sixty five miles per hour (65 mph.)

An NCHRP 350 Test Level 3 TMA may be substituted for a NCHRP 350 Test Level 2 TMA or NCHRP 230 TMA, but a NCHRP 350 Test Level 2 TMA or NCHRP 230 TMA may not be substituted when a NCHRP 350 Test Level 3 TMA is required.

BASIS OF ACCEPTANCE. The Director of the New York State Department of Transportation's Materials Bureau maintains an Approved List, which lists TMAs which have successfully passed the above requirements. Acceptance of NCHRP 350 Test Level 2 or 3 Mobile Construction Zone Impact Attenuators shall be at the contract site based on compliance with these specifications and either the product's appearance on the Approved List or a letter from the Department to the vendor indicating the TMA is approved.

Acceptance of NCHRP 230 qualified devices shall be on the basis of compliance with these specifications, appearance of the TMA on the Approved List, or letter from the Department indicating approval of the TMA, plus the provision of certification satisfactory to the Engineer. This certification shall indicate that the NCHRP 230 qualified TMA was sold new to a user on or prior to October 1, 1998. The current owner and the original purchaser need not be the same.
§712

Manufacturers or Vendors wishing to have products considered for inclusion on the Approved List shall provide copies of drawings, specifications, test reports, and Federal Acceptance Letters to the Director of the Materials Bureau. The review process requires thirty (30) days minimum.

712-07 INERTIAL BARRIER MODULES

SCOPE. This specification covers the material and performance requirements for sand-filled inertial barrier systems used for site hazard protection.

GENERAL. Modules composing the array shall be free-draining with respect to residual moisture in the fill sand. Their lids shall be such that they divert precipitation and stop moisture from seeping into the shell. Lids shall be fastened with a minimum of six equally spaced pop rivets or secured by other approved fasteners so as to provide a reasonably vandal resistant, closed barrel.

MATERIAL REQUIREMENTS. The modules shall be federal yellow or as shown on the plans. They shall be durable, waterproof, resistant to deterioration from ultra-violet rays, deformation from dynamic loadings due to vibration in the placement area and long-term stresses induced by thermal expansion and contraction and fill settlement.

The fill sand shall conform to the requirements of either §703-06, Cushion Sand, or §703-07, Concrete Sand. Sodium chloride, as dry rock salt, equal to 3-5 percent by weight of the sand, shall be thoroughly mixed into the sand. Sodium chloride shall meet the requirements of §712-03, Sodium Chloride.

TESTS. To determine the crash worthiness of inertial barrier modules not on the NYSDOT's Approved List, an array containing each size module shall be subjected to crash tests to verify that the barrier system can safely decelerate an impacting vehicle. These tests shall be done in accordance with the National Cooperative Highway Research Program Report 350, test numbers, 3-40, 3-41, 3-42, 3-43 and 3-44. Evaluation criteria shall conform to the safety evaluation guidelines found in Table 5.1, as specified in Table 3.2.

Crash cushion arrays shall be designed to conform to the occupant risk values found in NCHRP Report 350, Table 5.1, Criteria D, H and I.

Any values deviating from these shall be justified by site and/or shape limitations, or cost, and approved by the Director, Materials Bureau.

BASIS OF ACCEPTANCE. The Department requires the submission of Materials Details. The manufacturer or supplier shall prepare and submit the appropriate material in accordance with the procedural directives of the Materials Bureau. Upon approval by the Materials Bureau, the name of the product and/or supplier, and the reference number assigned to the approved Materials Details will be placed on the Approved List. Such products shall then be accepted on the basis of their brand and conformance to the approved Materials Details.

712-08 THRU 712-11 (VACANT)

712-12 ASPHALT ROOFING FELT

SCOPE. These specifications contain the material requirements pertaining to Asphalt Roofing Felt.

MATERIAL REQUIREMENTS. Roofing shall conform to the requirements of the standard specifications for Asphalt-Saturated Roofing Felt for use in Waterproofing and in Constructing Built-Up Roofs, ASTM D226.

BASIS OF ACCEPTANCE. Acceptance of this material will be based on the manufacturer's certification of compliance with these specification requirements.
§712

712-13 TIMBER AND LUMBER

GENERAL. Unless otherwise specified or noted upon the plans or in the itemized proposal, timber and lumber shall be of any kind acceptable to the Engineer. The material shall be sound, square-edged, free from shakes, loose knots or decay.

712-14 STRESS GRADED TIMBER AND LUMBER

GENERAL. Stress graded timber and lumber shall be graded for the stress grade selected, in accordance with grading rules for the indicated stress grade, developed from ASTM D245.

Commercial stress grades of timber and lumber, with grade descriptions providing material which will meet the indicated stress requirements under rules conforming to ASTM D245, will be acceptable.

MATERIAL REQUIREMENTS. The manufacturer shall inspect and grade the timber and lumber. Each piece shall be clearly branded with the stress grade mark of the manufacturer's inspector. Stress graded timber and lumber will be subject to inspection by representatives of the Department, to whom the manufacturer shall supply three copies of its certification of inspection and piece tally.

The Contractor shall furnish all facilities for the inspection of this material by the Department's representatives and shall allow them free access to all premises where inspections can be made.

BASIS OF ACCEPTANCE. This material will be accepted on the basis of certification by the manufacturer that the timber and lumber has been inspected and stress graded under grading rules which conform to the requirements of ASTM D245. The certification shall show the identifying stress grade mark used by the manufacturer's inspector.

712-15 GABIONS

SCOPE. This specification covers the material and quality requirements for galvanized gabions and galvanized with polyvinyl chloride (PVC) gabions.

GENERAL. The materials used in fabricating and filling of gabions shall comply to specifications and tests set forth below.

MATERIAL REQUIREMENTS.

Gabions. Gabions produced from twisted wire shall conform to the requirements of ASTM A 975. Gabions produced from welded wire shall conform to the requirements of ASTM A 974. The physical properties of the PVC coating shall conform to the requirements of ASTM A 975 or ASTM A 974, as appropriate.

Tiewire or Lacing Wire. Tiewire or lacing wire shall conform to the requirements of ASTM A 975 or ASTM A 974, as appropriate.

Stone Fill. The baskets shall be filled with approved stone of the following sizes:

<table>
<thead>
<tr>
<th>Basket Depth or Height</th>
<th>Minimum Stone Size</th>
<th>Maximum Stone Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>300 mm</td>
<td>100 mm</td>
<td>200 mm</td>
</tr>
<tr>
<td>Greater than 300 mm</td>
<td>100 mm</td>
<td>300 mm</td>
</tr>
</tbody>
</table>

The soundness of all stone used for gabions shall be approved on the basis of a geologic evaluation in accordance with the control procedure in effect on the date of advertisement for bids. Prior to the evaluation, the Contractor shall stockpile the material. Where the State elects to conduct tests, a material will be rejected if it fails to meet the following criteria:

A. Freeze-Thaw Test. A maximum 10 percent loss, by weight, after 25 cycles of freezing and thawing.
B. Magnesium Sulfate Soundness Test. A maximum 10 percent loss, by weight, after 10 cycles of the magnesium sulfate soundness test.
**Fabrication.** Gabions shall be supplied, as specified, in various lengths and heights. The lengths shall be multiples (2, 3, or 4) of the horizontal width. The heights shall be fractions (1, ½, or 1/3) of the horizontal width. The horizontal width shall not be less than one meter. However, all gabions furnished by a manufacturer shall be uniform width. Dimensions for height, lengths and widths are subject to a tolerance limit of ±5% of manufacturer's stated sizes.

Gabions shall be fabricated in such a manner that the front, back, sides, ends, lid and diaphragms can be assembled at the construction site into a rectangular basket of the specified sizes. Gabions shall be of single-unit construction. The base, lid, ends, front and back shall be either woven into a single unit or one edge of these members connected to the base section of the gabion in such a manner that strength and flexibility at the point of connection is at least equal to that of the mesh. Where the length of the gabion exceeds its horizontal width, the gabion shall be equally divided by diaphragms of the same mesh and gage as the body of the gabion, forming cells such that the length does not exceed the horizontal width.

The gabion shall be furnished with the necessary diaphragms secured in proper position on the base in such a manner that no additional tying at this juncture will be necessary. All perimeter edges of the mesh forming the gabion shall be securely selvedged so that the joints formed by tying the selvedges have at least the same strength as the body of the mesh.

**BASIS OF ACCEPTANCE.** Each shipment of gabions to a job site shall be accompanied by a certification which states that the material conforms to the requirements of this specification. A shipment shall consist of all material arriving at the job site at substantially the same time. The certification shall be on company letterhead and shall be signed by an officer of the company having legal authority to bind the company.

### 712-16 PIGMENT FOR COLORED SYNTHETIC RESIN BINDER CONCRETE

**SCOPE.** This specification covers the material requirements for pigment used in colored synthetic resin binder concrete.

**MATERIAL REQUIREMENTS.** The pigment shall be compatible with the synthetic resin binder material and shall provide the colored synthetic resin binder concrete with a non-fading, heat stable color. When the color specified is white, the pigment shall be Rutile Titanium Dioxide.

**BASIS OF ACCEPTANCE.** Acceptance of this material shall be in accordance with procedural directives of the Department.

### 712-17 WOOD CROSS TIES

**SCOPE.** This specification covers the material requirements for wood cross ties for railroads.

**MATERIAL REQUIREMENTS**

**A. Species.** The following kinds of wood suitable for cross ties will be accepted.

<table>
<thead>
<tr>
<th>Ash</th>
<th>Elm</th>
<th>Sassafras</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beech</td>
<td>Hackberry</td>
<td>Sycamore</td>
</tr>
<tr>
<td>Birch</td>
<td>Locust</td>
<td>Walnut</td>
</tr>
<tr>
<td>Black Gum</td>
<td>Maple</td>
<td></td>
</tr>
<tr>
<td>Catalpa</td>
<td>Mulberry</td>
<td></td>
</tr>
<tr>
<td>Cherry</td>
<td>Oak</td>
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</table>

**B. Manufacture.** Cross ties shall be well sawed in top, bottom and sides. A cross tie shall be considered well sawed as long as score marks are not more than 6.4 mm deep and the surfaces are even.
Cross ties shall be straight, cut square at the ends, have bottom and top parallel, and have all bark entirely removed. A cross tie shall be considered straight only if it meets both of the following requirements:

1. A straight line drawn along the top of the tie from the middle of one end to the middle of the other end of the tie, falls entirely within the width of the tie.
2. A straight line drawn along a side of the tie from the middle of one end to the middle of the other end of the tie, is everywhere more than 51 mm from the top and 51 mm from the bottom of the tie.

The top and bottom of a tie will be considered parallel if any difference in the thickness at the sides or ends does not exceed 13 mm.

C. Dimensions. All thicknesses and widths apply to areas of the tie defined as the `rail bearing area(s)'. The rail bearing areas are those areas which lie between 508 mm and 1016 mm on both sides of the mid-point of the tie length. The rail bearing area for switch ties is the area between 305 mm from each end of the switch tie.

All determinations of width shall be made on the top of the tie. The top is defined as the narrower of the horizontal surfaces, or the surface with the least or no heartwood if both surfaces are the same width.

Standard size thickness and width dimensions are shown in Table 712-17, and apply to the rail bearing areas. The dimensions of the tie shall not be averaged. All ties shall be 2591 mm long, or as required.

<table>
<thead>
<tr>
<th>TABLE 712-17</th>
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<tbody>
<tr>
<td><strong>Size</strong></td>
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<td>4</td>
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<td>3</td>
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<tr>
<td>2</td>
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<tr>
<td>1</td>
</tr>
</tbody>
</table>

D. Tolerances. Individual untreated ties shall have the following tolerances applied to the thickness and width dimensions shown in Table 712-17.

<table>
<thead>
<tr>
<th></th>
<th>plus 51 mm,</th>
<th>minus 25 mm</th>
<th>plus 51 mm,</th>
<th>minus 6.4 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Thickness</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Width</td>
<td></td>
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</tbody>
</table>

It is not the intent of this specification that all ties shall be manufactured to the minimum allowable dimensions. A minimum of 75% of the ties presented for inspection shall conform to the dimensions shown in Table 712-17 without the application of the minus tolerances.

E. Defects. The occurrence of any of the following defects in an individual tie shall be the cause for rejection.

1. **Shakes.** A separation along the grain, occurring between the annual growth rings. A shake length more than one-third the nominal width of the tie shall not be allowed.

2. **Slant or Slope of Grain.** Except in the case of woods with interlocking grain, a slant or slope of grain in excess of 1 in 15 shall not be allowed.

3. **Holes.** Large holes shall not be allowed. A large hole is more than 12.7 mm in diameter and 76.2 mm deep within the rail bearing areas, or more than one-fourth the width of the surface on
which it appears and 76.2 mm deep outside the rail bearing area. Numerous holes shall not be allowed. Numerous holes are any number equalling a large hole in size.

4. Knots. Large knots shall not be allowed. A large knot is one whose average diameter exceeds one-fourth the width of the face on which it appears. Numerous knots shall not be allowed. Numerous knots are any number equalling a large knot in size.

5. Checks. A separation along the grain of the wood occurring across the annual rings. Fully seasoned and treated ties with check depths greater than one-fourth the thickness and longer than one-half the length of the tie shall not be allowed.

6. Decay. Ties shall contain no decay. Although blue stain is not considered decay and is not a defect, ties shall be inspected with extra care for presence of decay in heavily stained areas.

7. Wane. The lack of wood on the edge or corner of the tie due to the natural curvature of the log from which the tie is cut. Wane which reduces the face dimension greater than 76 mm outside the rail bearing area shall not be allowed. In the rail bearing area, dimensions given in Table 712-17 apply.

8. Splits. A split is a separation of the wood extending from one surface to an opposite or adjacent surface. In unseasoned ties, a split more than 3.2 mm wide or longer than 127 mm shall not be allowed.

After treatment, a split in either end of the tie greater than 3.2 mm wide or longer than 127.0 mm is not acceptable without an anti-splitting device. A split tie which has had an anti-splitting device applied but which re-opens after treatment to exceed 12.7 mm in width is not acceptable.

9. Twist. The deviation from a flat plane of all four faces by a spiraling or torsional action. A rotation of more than 3.5° from end face to end face shall not be allowed.

F. Anti-Splitting Devices. Anti-Splitting devices are to be installed prior to preservative treatment.

1. Dowelling. Dowels are anti-splitting devices driven or pushed into pre-bored holes. The length of dowel embedded shall not be less than half the width or thickness through which it is placed. Use of lubricants to facilitate driving of dowels is prohibited.

a. Equipment. These specifications are based on dowelling by mechanical dowel machines. Alternate methods may be used if the results are equal to those obtained by mechanical devices that press the tie together, drill and dowel in one or two operation. Dowelling by mechanical means is considered satisfactory as long as sufficient pressure is applied to completely close the split. Substitution of hand drills and pneumatic hammers for drilling dowels in switch ties is satisfactory as long as splits are held closed during dowelling by the use of clamps or other devices.

b. Pre-Drilled Holes. The maximum diameter of the pre-drilled holes is 3.2 mm less than the diameter of dowel. The minimum length of the hole shall be equal to the length of the dowel, except that holes drilled from the face opposite the face where the dowel enters shall be completely through the tie.

c. Location of Dowels. Dowels shall be driven perpendicular to the face most parallel to the split. Two dowels shall be used to close each split. They shall be located a minimum of 100 mm and a maximum of 152 mm from the end of the tie. Where the tie is split parallel to the narrow faces, the 197 mm long dowels shall be located 38.1 mm plus or minus 6.4 mm from each wide face. Where the tie is split parallel to the wide faces, 146 mm long dowels are driven 51 mm plus or minus 6.4 mm from each narrow face.
d. Protruding Dowels. Dowels not completely driven by dowelling machines shall be driven flush with the wood with a hammer. Dowels which protrude more than 6.4 mm after driving should be burned off with an oxyacetylene torch. However, dowels bent over flush with the surface of the wood will be accepted, provided this is done without splitting the wood.

2. Irons. Anti-splitting irons are driven into the ends of ties and shall be placed to cross at right angles and the greatest possible number of radial lines of the wood. Irons shall be placed far enough from the wide faces to prevent splitting of the tie.
   
   a. Design. Anti-splitting irons shall be made from a strip of steel formed to an “S” iron or “C” iron design. They will be of adequate size to prevent splitting of the tie.
   
   b. Material. Irons shall conform to specifications for anti-splitting irons given in the AREA Manual, Chapter 3, Section 1.9.2.1.

3. Nail Plates. Anti-splitting nail plates shall be applied to the ends of the ties.
   
   a. Design. Anti-splitting nail plates shall be rectangular and perforated to form multiple nails.
   
   b. Material. Nail plates shall be stamped from 1.214 mm galvanized sheet steel.
   
   c. Size. The area of anti-splitting nail plates shall not be less than 60% of the nominal end area of the tie.

G. Conditioning. Ties shall be dried before preservative treatment until the amount of moisture in the wood will not prevent adequate penetration and retention of preservative. The producer may use any of the following methods as long as satisfactory results are obtained.

1. Air Seasoning. Ties shall be stacked for air seasoning in accordance with the American Wood Preservers Association (AWPA) Standard C6, Cross Ties and Switch Ties - Preservative Treatment by Pressure Process. Stacking dates during the period of stacking shall be painted on the front of the stack. A maximum of 60 days age spread shall be allowed between the dates of the first ties stacked and the last ties stacked.
   
   Ties shall be stacked as grouped below:

<table>
<thead>
<tr>
<th>Group Ta</th>
<th>Group Tb</th>
<th>Group Tc</th>
<th>GroupTd</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black Locust</td>
<td>Black Gum</td>
<td>Ash</td>
<td>Hackberry</td>
</tr>
<tr>
<td>Black Walnut</td>
<td></td>
<td>Beech</td>
<td>Hard Maples</td>
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<tr>
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<tr>
<td>Red Oaks</td>
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<td>Catalpa</td>
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</tr>
<tr>
<td>White Oaks</td>
<td></td>
<td>Cherries</td>
<td>Sycamores</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Elms</td>
<td>White Walnut</td>
</tr>
</tbody>
</table>

2. Accelerated Seasoning. Ties may be conditioned by the Boulton drying process, kiln drying, vapor drying or controlled air seasoning in accordance with AWPA Standard C6, Cross ties and Switch Ties - Preservative Treatment by Pressure Process.

H. Preservative Treatment. Plants used for the treatment of wood shall conform to AWPA Standard 3, Standard Quality Control Procedures for Wood Preserving Plants.
   
   All cross ties shall be treated with creosote-coal tar solution conforming to AWPA Standard P2, Standard for Creosote and Creosote Solutions, Grade C. Grades A or B may be substituted for Grade C.
   
   Preservative treatment shall be carried out in accordance with AWPA Standard C1, All Timber Products - Preservative Treatment by Pressure Processing or C6, Cross Ties and Switch Ties -
Preservative Treatment by Pressure Processes. The method used shall be the empty cell process by use of initial air to control retention.

Retention of preservative shall be 112.1 kg/m³ of preservative of wood. Retention shall be determined by gauge in accordance with paragraph 3.1 of AWPA Standard C1.

When specified, pentachlorophenol in heavy AWPA Standard P9A solvent may be used as a preservative. Minimum retention shall be 6.4 kilograms of preservative per cubic meter of wood.

**INSPECTION AND TESTING.** The Contractor shall give the Materials Bureau thirty days written notice prior to the start of preservative treatment. This notice shall include at the minimum, the name of the tie treater, the location of the treating plant and that date of the initial treatment.

The treating company is responsible for performing quality control in accordance with AWPA M3, Standard Quality Control Procedures for Wood Preserving Plants. All records required to be maintained in accordance with the quality control procedure shall be made available to the Department upon request. A Department representative may be assigned, at the option of the Materials Bureau, to perform sampling and inspection in accordance with Materials Bureau directives and AWPA M2, Standard For Inspection of Treated Timber Products. The producer shall furnish all facilities and equipment for the inspection and testing of the materials and workmanship.

In the event plant inspection is waived, written notice will be provided to the tie treater by the Materials Bureau. The tie treater shall then supply the Materials Bureau with all preservative charge reports, which describe the treatment process and preservative retention, and written certification that the treatment and ties conform to these specifications.

All treated ties shipped to the project site shall bear in legible form, the inspector's stamp of approval; however, in the event plant inspection has been waived, ties shall be shipped only if they are accompanied by a copy of the Materials Bureau notification waiving plant inspection.

Treated ties shall be subject to final inspection and approval by the Engineer after arrival at the project site.

**SHIPMENT AND STORAGE.** Ties delivered at the job site shall be stacked not less than 3048 mm from the nearest rail of any track at suitable and convenient places. They shall not be stacked at public crossing or where they will interfere with the view of trainmen or of people approaching the railroad.

Where room for spaced stacking is not available, ties may be piled together provided the lowest layer is at least 150 mm above the ground.

**BASIS OF ACCEPTANCE.** The wood cross ties will be considered for acceptance in stock lot quantities at the treatment facility in accordance with procedural directives of the Materials Bureau.

**712-18 IMPACT ATTENUATOR, HDPE CYLINDER AND CABLE TYPE**

**SCOPE.** Impact Attenuators, HDPE Cylinder and Cable Type are manufactured, NCHRP 350 crash tested products intended for the protection of narrow objects having width of 610 mm or less. These impact attenuators are four, six, or nine cylinders in length. They are suitable in situations where frequent frontal impacts are expected.

**MATERIALS REQUIREMENTS.** Impact Attenuator, HDPE Cylinder and Cable Type components shall meet the following requirements:

**Cylinders.** Cylinders shall be black, high molecular weight polyethylene conforming to ASTM D3350 cell class 345434C. Dimensions and wall thicknesses of all cylinders shall be as given on the manufacturer's drawings.

**Cables.** Cables shall be approved 6 X 25 FW plow steel conforming to API STD-9A, galvanized, prestretched and nominally 260 kN minimum breaking strength of the size and lengths indicated on the manufacturer's drawings. Cables shall be fitted both ends with galvanized fittings of the type indicated on the approved manufacture's drawings.
Other Steel Parts. Anchor plates and structural angles shall be ASTM A36M steel, galvanized after fabrication. Structural tube used to construct the back up structure, used in the rear section of the rail unit of the six (6) and nine (9) cylinder units and in the railing for the four (4) cylinder units shall be ASTM A500, Grade B. Chain shall be high strength steel linked chain of the indicated sizes, galvanized and fitted each end with screw pin anchor shackles. Fasteners, anchor bolts and anchor pins and other parts not specified herein shall be as given on the manufacturer's drawings or in the fabricators instructions.

All metal parts shall be galvanized after fabrication in accordance with §719-01 Galvanized Coatings and Repair Methods, Type I. Welding shall be in accordance with the Steel Construction Manual.

Reflectorization. Reflectorization, consisting of Class B (High Intensity) sheeting conforming to §730-05 directly applied to aluminum sheeting, shall be affixed to the front cylinder of the impact attenuator in a manner satisfactory to the Engineer. Aluminum sheeting shall be 6061T6, 0.81mm thick. The pattern and color of the reflectorization shall be as indicated on the plans.

If no pattern is provided, the pattern shall be approximately square, 450 mm on a side. Whenever approaching traffic is allowed to pass on both sides of the unit, the pattern shall be upward pointing chevrons formed with alternating 100 mm reflectorized stripes and black opaque non-reflectorized stripes. When traffic will be permitted on only one side, the pattern shall be diagonal 100 mm stripes, downward sloping to the side traffic is to be permitted, formed as indicated above. If no color is given, color shall be yellow.

BASIS OF ACCEPTANCE. Impact Attenuator, HDPE Cylinder and Cable Type will be accepted at the project site on the basis of the manufacturer's name appearing on the Approved List, conformance of the delivered article with the manufacturer's drawings, and the manufacturer's certification that the product delivered is in conformance with these specifications.

712-19 IMPACT ATTENUATOR, QUAD BEAM TYPE WITH EXPENDABLE MODULES

SCOPE. Impact Attenuator, Quad Beam Type With Expendable Modules are manufactured, NCHRP 350 crash tested products intended for the protections of objects having widths of 610 mm to 2290 mm. These attenuators are three, four, five, six, and nine bays in length, and may transition to concrete barriers, vertical walls, corrugated barrier, and tri-beam corrugated barrier.

MATERIALS REQUIREMENTS Each Impact Attenuator, Quad Beam Type With Expendable Modules shall contain all external and internal parts necessary to give satisfactory service at the indicated site. Components shall meet the following requirements:

Cartridges. The cartridge boxes shall be Type I and Type II cartridge boxes and shall be of the number and arrangement indicated by the manufacturer for the intended application. Cartridge boxes shall be manufactured from a weather resistant plastic material. Type I cartridges shall contain paper honeycomb material. Type II cartridges shall contain steel honeycomb material which shall be coated to minimize the effects of corrosion.

Cartridge Brackets. Each bay shall be equipped with cartridge brackets.

Diaphragms. Diaphragms shall be made from 10 gage ASTM A 36 M steel quadruple corrugated beam. The length of each diaphragm shall be as required for each application. Two support legs shall be welded to a channel which, in turn, shall be welded to the quadruple corrugated beam. Ski shaped plates shall be welded to the bottom of the support legs. The diaphragms shall be designed to lock onto, and be guided by, an anchored and mounted center monorail support structure.

Fender Panels. Fender panels shall be fabricated from 10 gage steel quadruple corrugated beam guide rail sections. Each fender panel shall be drilled and slotted so that when assembled in the field, the front end shall be bolted to a diaphragm by means of the three horizontally placed 16 mm bolts, one of which shall be a “mushroom bolt”. The back end of each quadruple corrugated beam fender panel shall overlap and be connected to the fender panel of the next bay by means of mushroom bolts which shall fit through the long horizontal slot in the forward fender panel and the short vertical slot in the overlapped fender
panel. (The bolt shall have a nut and square washer on the inside.) This permits movement, front to back, of one set of fender panels relative to the panels in the following bay.

**Monorail Assembly.** The monorail assembly shall be fabricated to the dimensions shown on the manufacturer's or working drawings.

**Tension Strut Back-up.** If a concrete back-up structure is not to be provided, a tension strut back-up assembly shall be provided. The details of this assembly shall be as indicated in the manufacturer's or working drawings.

**Nose Cover.** The nose cover shall be made from a high density polyethylene plastic material of the color indicated in the plans or directed by the Engineer.

**Metal Work.** All metal work, except transition panels, shall be fabricated from either M1020 Merchant Quality or ASTM A36M steel. After fabrication, all metal work shall be hot dip galvanized in accordance with §719-01 Galvanized Coatings and Repair Methods. Welding shall be in accordance with the New York State Steel Construction Manual.

**Fasteners.** All bolts shall be American Standard Regular Bolts, unless indicated otherwise in the Plans. Anchor bolts shall be ASTM A193 grade B7 grouted into the concrete slab with polyester grout.

**Transition Panels.** Transition panels shall be fabricated from steel conforming to ASTM A36 M, hot dip galvanized in accordance with ASTM A123. Five standard transition panels shall be available. These shall transition to: Jersey Barrier; W-rail Corrugated Beam; Thrie Beam; vertical surfaces; and Single Slope Concrete Barrier.

**Reflectorization.** Reflectorization, consisting of Class B (High Intensity) sheeting conforming to §730-05 directly applied to aluminum sheeting, shall be affixed to the nose cover of the Quad Beam Type Impact Attenuator in a manner satisfactory to the engineer. Aluminum sheeting shall be 6061T6, 0.81mm thick. The pattern and color of the reflectorization shall be as indicated on the plans. If no pattern is provided, the pattern shall be approximately square, 450 mm on a side. Whenever approaching traffic is allowed to pass on both sides of the unit, the pattern shall be upward pointing chevrons formed with alternating 100 mm reflectorized stripes and black opaque non-reflectorized stripes. When traffic will be permitted on only one side, the pattern shall be diagonal 100 mm stripes, downward pointing to the side traffic is to be permitted, formed as indicated above. Unless otherwise noted, the color shall be yellow.

**BASIS OF ACCEPTANCE.** Impact Attenuator, Quad Beam Type With Expendable Modules will be accepted at the site of the work on the basis of appearance of the product on the Approved List, conformance of the delivered product with the manufacturer's or working drawings, and receipt of the manufacturer's certificate of compliance with these specifications.

**712-20 IMPACT ATTENUATOR, CORRUGATED BEAM TYPE WITH METAL TEARING STRIPS**

**SCOPE.** Impact Attenuator, Corrugated Beam Type With Metal Tearing Strips are fabricated, NCHRP 350 crash tested products intended for the protection of narrow objects 610 mm or less in width and for the protection of concrete jersey shaped median barrier barrier. These impact attenuators are available in six and nine bay lengths.

**MATERIAL REQUIREMENTS.** Each Impact Attenuator, Corrugated Beam Type with Metal Tearing Strips shall contain all external and internal parts necessary to give satisfactory service at the indicated site.

The major components of the Each Impact Attenuator, Corrugated Beam Type with Metal Tearing Strips are - 1 sled assembly, 7 (nine bay) or 4 (six bay) intermediate frames, 1 backup frame, base assembly, cross ties and 20 (nine bay) or 12 (six bay) fender panels. One or more of the following
components may also be required—metal transition panels, wood or plastic block outs, backup frame adapter and W-beam end shoes.

**Fender Panels.** Fender panels shall be fabricated from 10 gage steel, double corrugated beam guide rail sections.

**Nose Cover.** The nose cover shall be made from a high density polyethylene plastic material of the color indicated in the contract documents. If no color is given, the color of the nose cover shall be yellow, or the color directed by the Engineer.

**Metal Work.** All metal work except fasteners shall be fabricated from ASTM A36M steel. After fabrication, all metal work shall be galvanized in accordance with §719-01, Galvanized Coatings and Repair Methods, Type I. Welding shall be in accordance with the *New York State Steel Construction Manual*.

**Fasteners.** All bolts shall be American Standard Regular Bolts, unless indicated otherwise in the Plans. Anchor studs shall be ASTM A193 grade B7, grouted into the concrete or asphalt.

**Grout.** Anchors requiring grouting shall be grouted with material approved under §701-05 Concrete Grouting Material or §701-07 Anchoring Materials - Chemically Curing.

**Transition Panels.** Standard transition panels between Impact Attenuator, Corrugated Beam Type with Metal Tearing Strips and Jersey Barrier shall be available. Transition panels shall be fabricated from 12 gage steel, double corrugated beam guide rail sections. They shall be terminated at the concrete barrier end with W-beam end shoes. Details of the transition shall be provided by the manufacturer.

**Plastic Block Outs.** Plastic block outs shall conform to §710-26 Plastic and Synthetic Block Outs for Heavy Post Guiderail System, except the dimensions shall be as per the approved manufacturer’s or working drawings.

**Wood Block Outs.** Wood block outs shall conform to §710-13 Wood and Timber Posts and Timber Block outs, except the dimensions shall be as per the approved manufacturer’s or working drawings. Pressure treatment shall be done after all cutting, sawing, trimming and drilling has been completed.

**Reflectorization.** Reflectorization, consisting of Class B (High Intensity) sheeting conforming to §730-05 directly applied to aluminum sheeting, shall be affixed to the front face of the sled assembly in a manner satisfactory to the engineer. Aluminum sheeting shall be 6061T6, 0.81 mm thick. The pattern and color of the reflectorization shall be as indicated on the plans.

If no pattern is provided, the pattern shall be approximately square, minimum 625 mm on a side. Whenever approaching traffic is allowed to pass on both sides of the unit, the pattern shall be upward pointing chevrons formed with alternating 100 mm reflectorized stripes and black opaque non-reflectorized stripes. When approaching traffic is permitted on only one side, the pattern shall be diagonal 100 mm stripes, downward pointing to the side traffic is to be permitted, formed as indicated above. If no color is given, color shall be yellow.

**BASIS OF ACCEPTANCE.** Each Impact Attenuator, Corrugated Beam Type with Metal Tearing Strips will be accepted at the project site on the basis of the manufacturer's name appearing on the Approved List, its conformance with the manufacturer's drawings, and the manufacturer's certificate of compliance with these specifications.

### 712-21 IMPACT ATTENUATOR, THRIE BEAM TYPE WITH EXPENDABLE MODULES

**SCOPE.** Impact Attenuators, Thrie Beam Type With Expendable Modules are manufactured, NCHRP 350 crash tested products intended for the protection of objects having widths of up to 2.6 m. These attenuators are configured with a varying number of bays (4-12), and may transition to vertical walls,
safety-shape concrete barriers, thrie beam corrugated barrier, and corrugated beam (when using an intermediate thrie beam transition).

**MATERIAL REQUIREMENTS.** Each Impact Attenuator, Thrie Beam Type with Expendable Modules shall contain all external and internal parts necessary to give satisfactory performance at the indicated site. Components shall meet the following requirements:

**Modules.** The module shall be Type A and Type B and shall be of the number and arrangement indicated by the manufacturer for the intended application. The modules shall be manufactured from a weather-resistant, high-density, cross-linked, polyethylene plastic material. The modules shall be designed to collapse under a manufacturer-defined critical loading consistent with the designed system requirements.

**Front Support and Diaphragms.** The diaphragms and front supports shall be rectangular frame structures constructed of ASTM A36 M steel C 75 x 7 channels, or equal. They shall include centrally-located, horizontal and vertical cross bracing. They shall have provisions to retain and support the modules.

A. **Diaphragms.** The top width of each interior diaphragm shall vary based on the design configuration and shall include 13 mm lips on both sides to reduce fender panel ride up during and immediately after an impact. Attached to the bottom horizontal support channel shall be two support legs connected to a ski-shaped base plate with turned up ends. The diaphragms shall include cable guide mounts for the anchor cables.

B. **Front Support.** The top width of the front support shall vary based on the design configuration. Two rubber or polyurethane support legs shall be attached to the bottom horizontal channel

**Fender Panels.** Fender panels shall be fabricated from 10-gage, steel thrie beam guide rail sections. Each fender panel shall be factory drilled and slotted for field assembly. The front end shall be fastened to a diaphragm using 20 mm stainless steel hex bolts. The back end of each thrie beam fender panel shall overlap and be connected to the fender panel of the next bay using sliding mushroom bolts inserted through the long horizontal slot in the forward fender panel and the short vertical slot in the overlapped fender panel, thus permitting movement, front to back, of one set of fender panels relative to the panels in the following bay. The rear panel is fixed to the rear support using a through bolt connection, through a 150 mm diameter, 6 mm thickness, steel pipe with cut out conical sections on the front end.

**Cable.** Two cables, of the length required for the particular installation according to the manufacturer’s instructions, shall provide tension in the system to support the diaphragms and guide them during and immediately after impact. The cables shall be 25 mm diameter steel wire rope, galvanized in accordance with ASTM A603. Both cable ends shall have steel reinforcement eyes formed using a swaged steel connector. A threaded eye bolt shall be connected to one of these eyes during its fabrication for field connection to the rear anchor lugs. The cable tension is adjusted by rotating the nut attached to this bolt.

**Front Anchor Plate.** The front cable anchor shall consist of a rectangular ASTM A36 steel plate, 25 mm thickness, 508 mm x 305 mm, with welded 100 mm lugs to connect to fasteners to cables. Eight holes, four along each longitudinal edges, shall be provided to accept anchor bolts.

**Rear Diaphragm.** The rear diaphragm shall be constructed of fabricated C 75 x 7 channels, or equal, with both horizontal and vertical bracing. The height shall be approximately 800 mm. The width of the support will vary based on the design configuration.

The diaphragm shall be attached to the rear support structure in accordance with the manufacturer’s drawings.

**Rear Support Structure and Cable Anchorage for Transitions to Concrete Barriers and Concrete Structures.** When the attenuator is transitioned to a concrete barrier, the barrier may provide rear structural support. In such a case, the cables shall be anchored to a built-up steel plate
connection bolted to the barrier. The transition to the concrete barrier shall be in accordance with the manufacturer’s details. The attenuating system shall be in accordance with the manufacturer’s details when protecting concrete piers, concrete parapets, concrete walls, or other rigid objects.

Rear Anchor Plate and Backstop. For designs using steel backup structure, the fabricated steel support structure shall be as detailed on the manufacturer’s drawings.

Nose Cover. The nose cover shall be made from a polyurethane material of the color indicated in the contract documents. The cover shall be bolted to the front support.

Metal Work. All metal work, except transition panels, shall be fabricated from ASTM A36M steel. After fabrication, all metal work shall be hot-dip galvanized in accordance with §719-01 Galvanized Coatings and Repair Methods. Welding shall be in accordance with the New York State Steel Construction Manual.

Fasteners. All bolts shall be ANSI Standard Regular Bolts, unless indicated otherwise in the plans.

A. Anchor Bolts. Anchor bolts shall be 20 mm diameter, ASTM A193, Grade B7 grouted into the concrete slab with polyester grout. The length of the anchor bolts shall be 210 mm for installations.

B. Front Cable Fastener. A shackle with screw pin shall attach the cable to the front anchor.

Transitions. Transition panels shall be standard AASHTO fabricated panels from steel conforming to ASTM A36 M and hot-dip galvanized in accordance with ASTM A123. Transitions can be made directly to thrie beam guide rail; to corrugated beam using a thrie beam transition to corrugated beam; and to safety-shape concrete barrier and vertical walls using an additional thrie beam section and a thrie beam bridge shoe.

Reflectorization. Reflectorization, consisting of Class B (High-Intensity) sheeting conforming to §730-05 directly applied to aluminum sheeting, shall be affixed to the nose cover of the Thrie Beam Type Impact Attenuator. Aluminum sheeting shall be 6061T6, 0.81mm thick. The pattern and color of the reflectorization shall be as indicated in the contract documents.

If no pattern is provided, the pattern shall be approximately square, 450 mm on a side. Whenever approaching traffic is allowed to pass on both sides of the unit, the pattern shall be upward-pointing chevrons formed with alternating 100 mm reflectorized stripes and black opaque nonreflectorized stripes. When traffic will be permitted on only one side, the pattern shall be diagonal 100 mm stripes, downward pointing to the side traffic is to be permitted, formed as indicated above. Unless otherwise noted, the color shall be yellow.

BASIS OF ACCEPTANCE. Impact Attenuator, Thrie Beam Type With Expendable Modules will be accepted at the site of the work on the basis of appearance of the product on the Approved List, conformance of the delivered article with the manufacturer’s drawings, and the manufacturer’s certification that the product delivered is in conformance with these specifications.

712-22 IMPACT ATTENUATOR, HDPE CYLINDERS WITH MONORAIL AND DIAPHRAGMS

SCOPE. Impact Attenuator, HDPE Cylinders with Monorail and Diaphragms are manufactured, NCHRP 350 Test Level 3 crash-tested products intended for the protection of objects having width of 3000 mm or less. These impact attenuators have 27 HDPE cylinders arranged in 14 rows or 29 arranged in 15 rows. They are suitable in situations where frequent frontal impacts are expected.

MATERIALS REQUIREMENTS. The components shall meet the following requirements:

Cylinders. Cylinders shall be black, high-molecular-weight polyethylene conforming to ASTM D3350 cell class 345434C. Dimensions and wall thicknesses of all cylinders shall be as given on the manufacturer’s drawings.
§712

**Steel Parts.** Metal parts shall be fabricated from M1020 Merchant Quality or ASTM A36 steel. Chain shall be high-strength-steel-linked chain of the indicated sizes, galvanized, and fitted each end with screw-pin anchor shackles. Fasteners, anchor bolts and anchor pins, and other parts not specified herein shall be as given on the manufacturer’s drawings or in the fabricator’s instructions.

All metal parts shall be galvanized after fabrication in accordance with §719-01 Galvanized Coatings and Repair Methods, Type I. Welding shall be in accordance with the Steel Construction Manual.

**Refractorized Sheeting.** Class B (High-Intensity) sheeting conforming to §730-05, premounted on a weatherproof substrate, shall be affixed to the front cylinder of the impact attenuator. Aluminum sheeting, if used, shall be 6061T6, 0.81 mm thick. The pattern and color of the refractorization shall be as indicated on the plans.

If no pattern is provided, the pattern shall be approximately square, 450 mm on a side. Whenever approaching traffic is allowed to pass on both sides of the unit, the pattern shall be upward-pointing chevrons formed with alternating 100 mm refractorized stripes and black-opaque-nonrefractorized stripes. When traffic will be permitted on only one side, the pattern shall be diagonal 100 mm stripes, downward sloping to the side traffic is to be permitted, formed as indicated above. If no color is given, the color shall be yellow.

**BASIS OF ACCEPTANCE.** Impact Attenuator, HDPE Cylinder with Monorail and Diaphragms will be accepted at the project site on the basis of the manufacturer’s name appearing on the Approved List, conformance of the delivered article with the manufacturer’s drawings, and the manufacturer’s certification that the product delivered is in conformance with these specifications.

SECTION 713 - LANDSCAPE DEVELOPMENT MATERIALS

**713-01 TOPSOIL**

**SCOPE.** This specification covers the material requirements for topsoil for use in turf and wildflower establishment, sodding or planting.

**MATERIAL REQUIREMENTS.** Topsoil may be naturally occurring or may be manufactured. Topsoil shall be free from refuse, material toxic or otherwise deleterious to plant growth, subsoil, woody vegetation and stumps, roots, brush, stones, clay lumps or similar objects. Manufactured topsoil shall consist of a mineral component and amendments to meet the specified organic content, pH and other requirements. Sod and herbaceous growth such as grass and weeds need not be removed but shall be thoroughly broken up and mixed with the soil during handling or manufacturing operations. Topsoil shall meet the following requirements unless otherwise specifically stated in the contract documents:

- The pH of the material shall be between 5.5 and 7.6.
- The organic content shall be not less than 2% or more than 20%.
- Gradation:

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<tr>
<th>Sieve Size</th>
<th>Percent Passing by Weight</th>
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<tr>
<td>50.0 mm</td>
<td>100</td>
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<tr>
<td>25.0 mm</td>
<td>85 to 100</td>
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<tr>
<td>6.3 mm</td>
<td>65 to 100</td>
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<td>75 µm</td>
<td>20 to 80</td>
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The maximum size of objects other than stones shall be 50.0 mm.

- The Contractor may amend topsoil with approved materials and by approved methods to meet the above specifications. Materials used to amend the organic content of topsoil shall conform with the requirements of 713-15 Organic Material. Amendments shall not contain any material that is deleterious to soil structure, plant growth or seed germination.
STOCKPILING. Topsoil may be acquired from sites that are designated in the contract documents or approved by the Engineer. If no topsoil sites are designated in the contract documents, the material proposed for use as either naturally occurring topsoil or manufactured topsoil must be stockpiled, sampled and tested prior to its use. Topsoil deficient in organic content and/or pH may be used prior to amending and retesting only when used for turf and wildflower establishment or sodding.

Stockpiles shall contain not less than 150 cubic meters, or the minimum required for the contract, shall have a height of at least 1.2 meters unless otherwise approved, and shall be trimmed to uniform surfaces and slopes.

SAMPLING. Samples of naturally occurring topsoil, manufactured topsoil or amended soil mixture will be taken by a representative of the Department. Samples taken for topsoil that has been amended or manufactured with approved composted sewage sludge shall be identified as such. Topsoil containing foreign material may be rejected on the basis of a visual examination prior to testing. The topsoil sampling procedure shall be as required in the Department's "Sampling Procedures for Topsoil."

Contractors may obtain copies of the procedures from the Engineer. Contractors who believe that an error was made in sampling the topsoil shall, within one work day, indicate the alleged error in writing to the Engineer.

TESTING. All material tests required by this section, except for the testing of composted sewage sludge and topsoil containing composted sewage sludge, will be done by the Department in conformance with the procedures contained in the appropriate Department publications or test methods current on the date of advertisement for bids.

Composted sewage sludge used to amend or manufacture topsoil shall conform to the applicable requirements of §713-15 Organic Material. Composted sewage sludge shall require a certificate, from a laboratory approved by the DEC, verifying compliance with all applicable laws, rules and regulations. The certification shall be supplied by the Contractor, at the Contractor's sole expense, and prior to the delivery of any composted sewage sludge, topsoil containing composted sewage sludge or other such regulated material to the contract site. The material shall be approved before it is used. A copy of the specifications shall be furnished to the laboratory by the Contractor.

Topsoil that has been amended with approved composted sewage sludge or other such regulated material shall be tested by an established Engineering or Agronomy firm which provides soils laboratory services. The test is to assure compliance with the pH, organic content and gradation requirements of this section. A copy of the specification and the Department's current test methods shall be furnished to the laboratory by the Contractor. The testing of topsoil amended with approved composted sewage sludge shall be done at the Contractor's sole expense. Samples shall be taken by a representative of the Department and the laboratory results shall be returned to the Regional Landscape Architect.

The Contractor shall notify the Engineer of the intended source of the material at least three weeks in advance of the scheduled use of the material to allow time for sampling, shipping of the sample and testing.

BASIS OF ACCEPTANCE. Acceptance of topsoil will be based upon the test results unless otherwise specified. Tested topsoil must be approved in writing by the Engineer before any material is used, except that topsoil used for establishing turf and wildflowers or sodding may be placed at the Contractor's option, prior to amending it to correct deficiencies in its organic content and/or pH. Acceptance of topsoil placed prior to correcting organic content and/or pH deficiencies will be based on retest results of samples taken after the placed topsoil has been amended.

713-02 LIMESTONE

SCOPE. This specification covers the material requirements for limestone.

MATERIAL REQUIREMENTS. Limestone shall be ground limestone having a minimum total neutralizing value of 88% calcium carbonate equivalence. A minimum of 90% shall pass the 0.85 mm mesh sieve and a minimum of 60% shall pass the 0.15 mm mesh sieve.
§713

PACKAGING. Agricultural limestone packed in the manufacturer's standard containers shall weigh not over 45 kg each, with the name of the material, net weight of contents and the manufacturer's name and guaranteed analysis appearing on each container.

DELIVERY. Bulk shipments shall be accompanied by a certificate providing the names, weight and analysis as specified herein for packaged material.

BASIS OF ACCEPTANCE. The manufacturer's label or certificate indicating compliance with these specifications shall be the basis of acceptance.

713-03 FERTILIZER

SCOPE. This specification covers the material requirements for fertilizers.

MATERIAL REQUIREMENTS. Fertilizers may be either fluid or dry formulations of commercial carriers of available plant nutrients.

The following mixed commercial fertilizers shall contain total nitrogen, phosphoric acid and soluble potash in the ratios stated:

- Type No. 1. 1-2-1 (approximate analysis)
- Type No. 2. 1-1-1 (approximate analysis)

The following fertilizers shall be as specified:

- Type No. 3. 10-6-4 (50% N/UF). 50% of total nitrogen shall be derived from ureaform furnishing a minimum of 3.5% water insoluble nitrogen (3.5%WIN). The balance of the nitrogen shall be present as methylene urea, water soluble urea, nitrate and ammoniacal compounds.
- Type No. 4. Nitrate of soda, shall contain a minimum of 16% nitrogen.
- Type No. 5. Ammonium sulfate shall contain a minimum of 20.5% nitrogen.
- Type No. 6. Ammonium nitrate shall contain a minimum of 33% nitrogen, one-half of which is in the ammonium form and one-half of which is in the nitrate form.
- Type No. 7. A nitrogen carrier containing a minimum of 45% nitrogen such as Urea or equivalent.
- Type No. 8. Bonemeal shall be commercial steamed bonemeal, finely ground with a minimum of 1.0% nitrogen and a minimum of 20% phosphoric acid.
- Type No. 9. Superphosphate shall be an approximate 0-20-0 formulation with an acceptable minimum of eighteen percent (18%) available phosphoric acid.
- Type No. 10. Vacant
- Type No. 11. A fertilizer in standardized packets designed to control the release of their contents over a specified period of time. The minimum guaranteed analysis shall be 16-8-8.
- Type No. 12. Shall be as specified in the contract documents.

PACKAGING. Fertilizers shall be in the manufacturer's standard containers. Containers shall not weigh more than 45 kg and shall include a label stating the name of the material, the net weight of the contents, the manufacturer's name, and the guaranteed analysis of the fertilizer. Labels on containers of fluid fertilizers shall state the net volume of the container.

DELIVERY. Bulk delivery of fertilizer shall be accompanied by the manufacturer's certificate stating the name of the manufacturer, the guaranteed analysis and the weight of the shipment. Certificates accompanying bulk deliveries of fluid fertilizers shall also state the net volume of the shipment.

BASIS OF ACCEPTANCE. The manufacturer's label or certificate indicating compliance with these specifications shall be the basis of acceptance. The Engineer reserves the right to reject any material that has become caked or otherwise damaged.

713-04 SEEDS

SCOPE. This specification covers the material requirements for seeds.
MATERIAL REQUIREMENTS. Each species, variety and strain of grasses, legumes, wildflowers and cereals and the minimum percentage of germination of each shall be as specified in the contract documents unless otherwise approved.

Material other than pure live seed shall comprise only nonviable seed, chaff, hulls, live seed of crop plants other than those specified, harmless inert matter and weed seeds except that weed seeds other than seeds of noxious weeds will be permitted up to 1% of the gross weight of each kind of seed. Legume seeds requiring inoculation shall be accompanied by adequate amounts of their proper inoculants unless accompanied by certification of preinoculation.

The percentage of purity shown on the label will be acceptable. The percentage of germination for each of the species, variety or strains of seeds shown on the label shall not be less than the minimum percentage specified in the contract documents. The percentage of pure live seed of each kind in each container or bag of seeds delivered will be computed by multiplying the percent germination by percent purity and dividing by 100. The percentage of pure live seed of each kind multiplied by the net weight of the container or bag will indicate the number of kilograms of pure live seed of each kind in the container or bag.

Nomenclature. The common and scientific names of grasses, legumes, wildflowers and cereals specified in the contract documents shall conform to one or more of the authorities on botanical nomenclature recognized by the American Association of Nurserymen.

Legume Inoculants. Inoculants for treating legume seeds shall be a standard culture of nitrogen fixing bacteria that is not more than one year old. Each inoculant shall be the specific culture required for each legume. It shall be supplied only from manufacturers licensed to sell legume inoculants in New York State.

Packaging. Seeds shall be furnished and delivered in labeled containers or bags that are acceptably sealed or sewn tight.

When seeds are to be accepted by certification, they may be mixed prior to delivery.

When sampling and testing is specified, seeds shall not be sown until written approval is issued. Approved seeds may be mixed prior to delivery.

LABELING. All seed and seed labels shall be in accordance with State and Federal Laws, Rules and Regulations, including Article 9 Section 137 of the Agriculture and Markets Law.

SAMPLING AND TESTING

A. Certification. Seeds will be accepted on the basis of certification unless otherwise specified in the contract documents. The certification shall consist of the label that shall be attached to each container of seed in accordance with the provisions of the New York State Agriculture and Markets' Law. Seeds will not be accepted by certification unless the test dates shown on the seed container labels are within the same calendar year that the seeds are sown.

Seeds will not be accepted if seed container labels are removed prior to the time of sowing nor will seeds be accepted if container labels have been altered, are obliterated or are otherwise illegible.

B. Sampling and Testing. Seeds will be subject to sampling and testing when specified in the contract documents and/or whenever the Engineer determines that seed damage or deterioration may have occurred as a result of handling, transit or storage.

Seeds specified for sampling and testing, and other seeds to be sampled and tested as determined by the Engineer, shall not be sown until test results are received and written approval is issued.

Sampling shall be done by a representative of the New York State Department of Transportation. Testing shall be done by the Department of Seed Investigations, New York State Agricultural Experiment Station, Geneva, New York, and the test results obtained will be considered final.

Tolerances established by the Agricultural Experiment Station will be used to determine if the seeds conform to the specifications.
§713

**BASIS OF ACCEPTANCE.** The seeds shall meet the minimum specified requirements regardless of the guarantee of qualities or dates of testing and after the application of tolerances approved by the Department of Seed Investigations, New York State Agricultural Experiment Station, Geneva, New York. Seed that has become wet, moldy or otherwise damaged in transit or storage will not be acceptable. After delivery to the Contractor, seed shall be stored so that it is protected from damage or deterioration from any source. Provisional acceptance of seeds shall be obtained before the seeds are sown. Final acceptance may be subject to the results of official sampling and testing. The Contractor shall furnish the vendor with the specifications for the material.

### 713-05 WOOD CHIPS

**SCOPE.** This specification covers the material requirements for wood chips used as mulch, landscape bedding or erosion control.

**MATERIAL REQUIREMENT.** Wood chips used for mulch, landscape bedding or erosion control may be either of the following, unless otherwise specified in the contract documents. Wood chips shall not exceed 80 mm in the greatest dimension.

#### A. **TYPE A.**
This shall be derived from green hardwood or softwood. The chips shall be free from leaves, young growth, unchipped branches, twigs 50 mm or less in diameter, wood shavings, sawdust or foreign materials such as stones, nails, plastic, etc.

#### B. **TYPE B.**
Shall be either Type A green wood chips or wood chips derived from unadulterated construction and/or demolition waste wood. Wood chips derived from construction and/or demolition waste wood shall not be contaminated with paint, chemicals, shingles, glass, nails, etc.

**BASIS OF ACCEPTANCE.** Acceptance shall be based on inspection, upon delivery, by the Engineer for compliance with the materials requirements and applicable certification of compliance with 6 NYCRR Part 360.

### 713-06 TREES, SHRUBS AND VINES

**Nomenclature.** The common and scientific nomenclature for plants shall be in conformity with the American Association of Nurserymen's currently recognized authorities on botanical nomenclature.

**Quality and Size.** Plants, including root spread and ball size, shall be in accordance with the current edition of “American Standard for Nursery Stock (ANSI Z60.1),” unless otherwise specified in the contract documents. All plants shall have a normal habit of growth and be typically characteristic of their respective kinds. The specified plant sizes shall be the minimum size allowed and shall include plants from that size up to but not including the next larger size. Plants shall not be pruned at the time of digging or before delivery and no plants shall be cut back from larger sizes to meet the sizes specified. Plants shall be free from injury, insect damage, infestation and disease. Plants shall be nursery grown unless otherwise specified and bear evidence of proper nursery care, including adequate transplanting and root pruning. Plants specified from collected sources shall be clean, sound stock, free from decayed stumps and from fire injury.

Container grown material, including container sizes and soil, shall be as specified in the Contract Documents.

Containers shall be sufficiently rigid to hold the ball shapes and protect the root balls during handling and shipping. Container grown plants shall have been grown in the container long enough for new fibrous roots to have developed so that the root ball is firm and will retain its shape and hold together when removed from the container. The plants shall be in a healthy growing condition with tops which are of good quality, and shall have been adequately hardened off before shipment.

Specimen plants shall be as specified in the Contract Documents.

**Digging Plants.** Plants shall be dug with care and skill immediately before shipment. Digging shall avoid all possible injury to, or loss of roots, but when required, roots cut shall be cleanly cut. No cold
storage plants will be accepted unless approved in writing prior to delivery. Plants stored temporarily shall be properly heeled in or otherwise protected from injury.

**Root Protection.** After plants are dug, their roots shall be protected from injury such as caused by heat, sun, wind and freezing temperatures. All bare roots of trees, shrubs and vines shall be puddled at the time of digging unless otherwise approved. Puddling shall be done in a wet clay mixture, of a quality to adhere to all parts of the root system. Roots of bare root plants which have been thoroughly covered at the time of digging with an anti-desiccant as specified under §713-08 will not require puddling. Bare roots shall be further protected by wrapping in wet straw, moss, burlap or other suitable material.

**Transportation.** Tarpaulins or other covers shall be placed over plants transported by open trucks or by open freight cars. Closed trucks and closed railroad cars shall be ventilated to avoid overheating and the doors shall be kept closed during shipment to prevent plants from drying. The heads of trees shall be tied-in carefully to prevent fracturing or breaking the branches. Trunks and branches shall be adequately supported and padded to avoid scraping or bruising.

**GENERAL.**

**Trees.** Nursery grown trees shall have no pruning cuts which are not healing and no cuts over 20 mm which have not completely calloused over, no cut back crowns or leaders and no abrasions of the bark. Trees must have good fibrous root systems characteristic of the kind. Deciduous trees shall have normal spread of crowns unless otherwise specified.

Bare root trees shall not require earth adhering to the roots except as required for puddling as specified. Any trees specified as bare root will be accepted balled and burlapped at the unit price bid for bare root trees.

Balled and burlapped trees shall be properly dug and protected to preserve the natural earth in contact with the roots. No manufactured balls will be accepted. The balls shall be of the required size, firmly wrapped and tied with approved materials. No balled plants will be acceptable if the ball is cracked or broken.

Balled and platformed trees shall be balled as specified for balled and burlapped trees. Platforms shall be square or octagonal shaped in a size slightly larger than the diameter of the bottom of the soil mass, inserted under each ball and securely lashed to the ball by means of ties from the platform corners to the rope collar on top of the ball.

Container grown trees shall be as specified in the contract documents.

The tops of trees shall be well formed structurally, but they are not required to have more than reasonably straight trunks, nor better than average well balanced crowns, nor be of specimen quality unless the requirements for “specimen” trees are specified on the plans.

When “street trees” are specified, they shall be consistent with the current American Standard For Nursery Stock standards for street trees, and the branching heights shall be as specified in the contract documents.

**Shrubs.** Shrubs shall have good fibrous root systems. The quality of balled and burlapped and balled and platformed shrubs shall be as specified for balled and burlapped and balled and platform trees herein. Container grown shrubs shall be as specified in the contract documents.

Plants specified as sods or clumps shall be dug from good soil which has produced a fibrous root system typical of the nature of the plant. The sods shall be dug with earth and incidental vegetation adhering to the roots. If the soil or habit of the root growth is such that the roots are not adequately protected, the sods shall be wrapped in burlap or other suitable material.

**Vines.** Vines shall be vigorous, well-furnished plants with good vigorous root systems. Vines shall be field grown unless otherwise specified. Pot grown plants shall be vigorous, well-developed plants, well established in pots with sufficient roots to hold the earth intact after removal from containers but they shall not be rootbound.

**Substitutions.** No change of size, kind or quality of plants as specified will be accepted except upon written approval of the engineer.
Labeling. Labeling shall be in accordance with currently accepted nursery labeling practice except that the Contractor may be required at any time to supply positive identification of any plant.

Inspection. The Contractor shall be responsible for all certificates of inspection of plant materials which may be required by federal, state, provincial or other authority to accompany shipments of plants. When nursery inspections are specified in the contract documents, they shall be limited to inspections of plants specified elsewhere in the contract documents. Unless otherwise specified in the contract documents, the Contractor shall provide at least 15 days notice to the Engineer stating the date, time and place where specified nursery inspections may be conducted. The Contractor shall be represented at all inspections. The Department’s expenses associated with inspections, will be paid for by the Department under the provisions of Section 106 Control of Material of the Standard Specifications. The Department reserves the right and option to place Department seals on any or all materials selected. Selection and/or tagging of material shall cover the type and body quality of the plant only, but shall not constitute acceptance nor preclude the right of rejecting plants not fully meeting the requirements of the specifications.

The Department reserves the right to identify by suitable non-injurious means such as painting, marking by various methods, etc. all plant material rejected upon delivery to the contract site.

BASIS OF ACCEPTANCE: Acceptance shall be based on inspection, upon delivery, by the Engineer for compliance with the materials requirements.

713-07 ROLLED EROSION CONTROL PRODUCTS AND SOIL STABILIZERS

SCOPE. This specification covers the material requirements for Rolled Erosion Control Products and Soil Stabilizers.

MATERIAL REQUIREMENTS

Class I (Short-Term) Light-duty, organic, or synthetic erosion control products.

Type A. Products for use where the slopes do not exceed 1:4. No minimum shear stress is required. The product shall be capable of withstanding moderate foot traffic without tearing or puncturing.

Type B. Products for use on slopes 1:3 and flatter. No minimum shear stress is required.

Type C. Products for use on slopes 1:3 or flatter, or in channels. Products shall have the ability to protect soil from hydraulically induced shear stresses under bench scale conditions for at least 70 Pa at 13 mm soil loss.

Class II (Intermediate) Erosion-control products.

Type A. Jute-Mesh. For use on slopes 1:2 or flatter. Jute-mesh shall be of a uniform, open, plain weave of undyed and unbleached, single-jute yarn. Jute-mesh shall be woven as follows:

- Approximately 55 warp ends per meter width.
- Approximately 37 weft ends per linear meter.
- Mass of jute mesh shall average 0.5 (± 5%) kilogram per square meter

Type B. Organic or nonorganic products for use on slopes 1:2 or flatter, or in channels. Products shall have the ability to protect soil from hydraulically induced shear stresses under bench scale conditions for at least 95 Pa at 13 mm soil loss.

Type C. Products made entirely of organic materials. For use on slopes 1:2 or flatter, or in channels. Only 100% organic materials are allowed. Products shall have the ability to protect soil from hydraulically induced shear stresses under bench scale conditions for at least 95 Pa at 13 mm soil loss.
Class III (Permanent Nondegradable synthetic products [fibers, filaments, or nettings] which may be supplemented with degradable natural fiber components).

**Type A.** Products for use on slopes 1:2 or flatter, or in channels. Products shall have the ability to protect soil from hydraulically induced shear stresses under bench scale conditions for at least 95 Pa at 13 mm soil loss.

**Type B.** Products for slopes 1:2 or flatter, or in channels. Products have the ability to protect soil from hydraulically induced shear stresses under bench scale conditions for at least 170 Pa at 13 mm soil loss.

**Type C.** Products for slopes 1:1 or flatter, or in channels. Products shall have the ability to protect soil from hydraulically induced shear stresses under bench scale conditions for at least 240 Pa at 13 mm soil loss.

**Type D.** Products for slope 1:1 or flatter, or in channels. Products shall have the ability to protect soil from hydraulically induced shear stresses under bench scale conditions for at least 380 Pa at 13 mm soil loss.

Class IV Soil Stabilizers. Soil stabilizers are short-term duration, erosion control products. When used alone, they shall be used on slopes 1:2 or flatter. They shall not be used in channels.

**Type A.** A cementitious soil binder which is added to wood cellulose fiber mulch, a Flexible Growth Medium(FGM), or a Bonded Fiber Matrix(BFM). Intended to form a thick, heavy-bodied crust or mat-like barrier that controls water-, and wind-induced erosion. Type A products may be used alone and are approved for use with Class III, Types A, B, and C rolled erosion control products where those products are used on slope applications.

**Type B.** A polyacrylamide (PAM) and calcium solution intended to reduce the erodibility of bare soils during construction activities or to enhance the performance of mulching on permanent slopes. Soil stabilizer, Type B, shall bond soil particles and shall effectively increase the soil particle size to 1.0 mm or larger. Soil stabilizers, Type B shall reduce the movement of soil through chemical bonding, increase the particle size thus making silt fence more effective, and increase the water absorption of the soil.

**BASIS OF ACCEPTANCE.** Acceptance of this material shall be in accordance with procedural directives of the Department.

713-08 MATERIALS FOR PROTECTION OF PLANTS

**SCOPE.** This specification covers the material requirements for materials used in planting operations. For methods of installation, see current standard sheet, as applicable.

**MATERIAL REQUIREMENTS**

Rodent Guards. Rodent guards shall be capable of protecting plants from girdling by rodents and shall be as specified in the contract documents or as approved by the Engineer.

Stakes for Supporting Trees

**A. Above Ground Support.** Stakes for supporting trees shall be of white or red cedar, or other approved material. Stakes 2.5 m to 3.0 m long shall have a minimum diameter of 50 mm to 60 mm. Stakes 3.75 m long shall have a minimum diameter of 80 mm. The maximum diameter of stakes shall not exceed 100 mm. Stakes shall be pointed at one end and shall have a maximum allowable
deflection of 40 mm for every meter of length. All stakes shall be sound and free from insects and fungi.

**B. Underground Support.** Stakes for supporting trees shall be of approved hardwood or other approved material. Hardwood stakes shall be 50 mm by 100 mm nominal size, approximately 1.25 m long. Stakes shall be pointed at one end. All stakes shall be sound and free from insects and fungi.

**Deadmen and Guy Stakes.** Deadmen and guy stakes used to anchor guy wires or cables, which support trees, shall be of the quality and sizes required.

**Wire.** Wire for guying plants shall be new annealed steel wire (either galvanized or ungalvanized) or aluminum wire of the A.S. & W. gauge specified.

**Bracing Materials.** The size and quality of cables, turnbuckles, thimbles, leg hooks, eye bolts, rods, washers and nuts shall be as specified on the plans or as approved.

**Jute Burlap.** Jute burlap shall be in 100 mm wide strips and weigh 265 g/m2.

**Hose.** Hose for protecting the bark from guy wires shall be good quality braided rubber, plastic hose as approved, or reinforced materials. Hose shall be at least 20 mm outside diameter.

**Twine.** Twine for use in wrapping trees shall be jute twine not less than two ply for trees 80 mm or less in diameter, and three ply for trees over 80 mm in diameter.

**Paper.** Wrapping paper for trees shall be waterproof paper 30-30-30 krinklecraft or equal in 100 mm wide strips.

**Anti-Desiccants.** Anti-desiccants shall be emulsions or other materials which will provide a protective film over plant surfaces, permeable enough to permit transpiration.

**BASIS OF ACCEPTANCE.** Acceptance shall be based on inspection by the Engineer for compliance with the material requirements.

713-09 AND 713-10 (VACANT)

713-11 WOOD FIBER MULCH

**SCOPE.** This specification covers the material requirements for wood fiber for use as a mulch in conjunction with turf establishment or erosion control.

**MATERIAL REQUIREMENTS.** Wood fiber shall be a first generation product manufactured directly from 100 percent wood which has been recovered or diverted from solid waste. Wood fiber shall be manufactured from unadulterated wood that is not contaminated with paint, chemicals, shingles, plastic or other foreign materials. Wood fiber mulch shall not be manufactured from or include paper.

Wood fiber mulch shall be manufactured so that the wood fibers will remain uniformly suspended in water under agitation and will blend with seeds, fertilizer and other additives to form a homogeneous slurry. It shall have the characteristics which, upon hydraulic application, shall form a blotter-like ground coating with moisture absorption and percolation properties and the ability to cover and hold seeds in contact with the soil.

Wood fiber mulch shall contain no growth or germination inhibiting factors, and shall contain a non-permanent green dye. Wood fiber mulch shall be supplied in the manufacturer's standard containers, with the name of the material, net weight of contents, the manufacturer's name and the air dry weight of fiber (equivalent to 10% moisture) appearing on each container.
BASIS OF ACCEPTANCE. The Engineer’s acceptance of wood fiber mulch shall be based on the manufacturer’s product label, including methods and rates of applications, and certification indicating compliance with these specifications and any applicable regulatory requirements pertaining to solid waste management.

713-12 MULCH ANCHORAGE

SCOPE. This specification covers the material requirements for mulch anchorage.

MATERIAL REQUIREMENTS. Mulch anchorage shall be Type A, unless otherwise specified in the contract documents.

Type A: Shall be approved non-asphaltic commercially available products that are specifically formulated for the purpose of anchoring or tacking hay or straw mulch. Mulch anchorage shall include a non-permanent green dye. The paper content of paper-based hydraulic mulch anchorage shall be 100 percent post consumer recovered from solid waste. At least 98 percent of such paper shall be recovered newsprint. The materials shall be mixed and applied in accordance with the manufacturer’s instructions.

Type B: Shall be either Type A or asphalt emulsion meeting the requirements of either 702-3201 Asphalt Emulsion or 702-90 Asphalt Emulsion Tack Coat. When asphalt emulsion is used it shall be uniformly applied at the rate of 0.02 L/m², unless otherwise specified in contract documents.

PACKAGING. Mulch Anchorage Type A shall be furnished in the manufacturer’s standard containers with the name of the material, net weight of contents, the manufacturer’s name and the dry weight of fiber (equivalent to 10% moisture) appearing on each container. The instructions for mixing and application shall also appear on each container.

Asphalt emulsion used for Mulch Anchorage Type B has no packaging requirements. The Engineer shall reject any asphalt material that is not homogenous or has separated. Asphalt separation caused by freezing unacceptable.

The Engineer shall reject any materials that have become wet, caked, frozen, separated or otherwise unfit for use.

BASIS OF ACCEPTANCE. The basis of acceptance for Mulch Anchorage Type A shall be the manufacturer’s product label or product literature that indicates compliance with this specification. The basis of acceptance for asphalt emulsion used as Mulch Anchorage Type B shall be as specified under Section 702 Bituminous Materials.

713-13 PESTICIDES

SCOPE. This specification covers the material requirements for pesticides used to manage vegetation, insects, rodents and/or other target pests.

MATERIAL REQUIREMENTS. Pesticides shall be approved commercially available products that are currently registered by the United States Environmental Protection Agency and the New York State Department of Environmental Conservation. Pesticides shall also have all required labels indicating that they are approved for the intended use.

Pesticides shall be mixed and used in strict conformance with the instructions on the label or supplemental labels.

PACKAGING. Pesticides shall be delivered and securely stored until used in the manufacturer's standard containers that have legible labels affixed in accordance with the provisions of the federal and state pesticides laws, rules and regulations in effect at the time of delivery.

Pesticides that do not meet these packaging requirements, at any time, will be rejected by the Engineer and shall be removed from the Contract site immediately.

The Engineer shall reject any pesticides that have become wet, caked or otherwise unfit for use.
§ 713

BASIS OF ACCEPTANCE. The basis of acceptance shall be original, sealed, and properly labeled pesticide containers; and two copies of sample labels and supplemental labels that include instructions for the intended use of the pesticide.

The Department reserves the right to inspect the condition of pesticides and pesticide containers at any time while they are on the Contract site and to direct immediate removal of any pesticides and/or containers that do not meet these specifications.

713-14 SOD

SCOPE. This specification covers the material requirements for sod.

MATERIAL REQUIREMENTS. Sod shall be commercially grown sod and shall be accompanied by a certificate indicating compliance with the regulations of the New York State Department of Agriculture and Markets.

Sources of sod shall be made known to the Engineer at least five days before cutting. Sod shall be cut into squares or rectangular portions which shall be 300 mm wide, or as approved, and may vary in length, but shall be of a size which will permit them to be lifted without breaking. The sod, when delivered to the contract site, shall be sufficiently moist so the soil will adhere firmly to the roots when it is handled. Height of the grass shall not exceed 80 mm. The sod shall be cut to a minimum thickness of 20 mm. The sod shall be reasonably free from weeds in conformance with accepted commercial practice and shall consist of a mixture of permanent grasses such as bluegrass and/or fine leaved fescues, unless otherwise specified.

BASIS OF ACCEPTANCE. Acceptance shall be based on inspection by the Engineer for compliance with the material requirements.

713-15 ORGANIC MATERIAL

SCOPE. This specification covers the material requirements for organic material used in conjunction with amending or manufacturing topsoil.

GENERAL. Organic materials regulated by the New York State Department of Environmental Conservation shall meet all applicable regulatory requirements.

MATERIAL REQUIREMENTS

A. Humus or Peat. The material shall be commercially produced natural humus or peat from freshwater sources and may contain sedge peat, sphagnum peat or reed peat. The material shall be free from hard lumps, roots, stones and other objectionable materials. There shall be no admixture of refuse or material toxic to plant growth. It shall be in a shredded or granular form able to pass through a 12.5 mm sieve. According to methods of testing of A.O.A.C. in effect on the date of the invitation of bids, the acidity shall be not less than 3.5 pH and the organic matter shall be not less than 85% as determined by loss on ignition. The minimum water holding capacity shall be 200% by weight on an oven-dry basis.

B. Peat Moss. Peat moss shall be commercially produced and shall be composed of the partly decomposed stems and leaves of any or several species of sphagnum moss. It shall be free from wood, decomposed colloidal residue and other foreign matter. It shall have an acidity range of 3.5 pH to 5.5 pH as determined in accordance with methods of testing of A.O.A.C. in effect on the date of advertisement for bids. Its water absorbing ability shall be a minimum of 1100% by weight on an oven-dry basis.

C. Source-Separated Compost. Source-separated compost shall be commercially or municipally produced and shall be an organic substance produced by the biological and biochemical decomposition of source-separated compostable material that is separated at the point of waste
Source-separated compostable materials may include, but are not limited to, leaves and yard trimmings, food scraps, food processing residues, manure and/or other agricultural residuals, forest residues and bark, and soiled and/or unrecyclable paper.

Source-separated compost shall be reasonably free of sticks, stones, refuse, materials deleterious to soil structure, or any material toxic or detrimental to plant germination and growth. Source-separated compost shall also meet the following additional specifications:

A) Minimum organic matter shall be 30% (dry weight basis) as determined by loss on ignition;
B) Product shall be loose and friable, not dusty, and have a moisture content of 35% - 60%;
C) Particle size shall be <12.5 mm.
D) Soluble salts content shall be <4.0 mmhos/cm (ds/m);
E) Compost shall be stable to very stable according to the test method current on the date of advertisement for bids.
F) pH shall be between 6.0-8.0.

**D. Composted Sewage Sludge.** Composted sewage sludge is regulated by the New York State Department of Environmental Conservation (DEC) and must meet all applicable regulatory requirements.

**TESTING.** Source separated compost will be subject to testing by the Department to assure it is stable. Composted sewage sludge used to amend or manufacture topsoil shall have a certificate, from a laboratory approved by the DEC, verifying compliance with all applicable laws, rules and regulations. Only facilities permitted to compost sewage sludge under 6 NYCRR Part 360, Solid Waste Management Facilities, shall be allowed to furnished finished compost for use in topsoil. The certification shall be supplied by the Contractor, at the Contractor's sole expense, and prior to the delivery of any composted sewage sludge, topsoil containing composted sewage sludge or other such regulated material to the contract site. The material shall be approved before it is used. A copy of the specifications shall be furnished to the laboratory by the Contractor.

**BASIS OF ACCEPTANCE.** Acceptance of humus, peat and peat moss will be based on the Producer's label or certificate of analysis by an established laboratory indicating compliance with the material requirements.

Acceptance of source-separated compost shall be based upon the Producer's label or certificate of analysis by an established laboratory indicating compliance with the material requirements; and a delivery inspection by the Engineer. Source-separated compost may be sampled and tested by the Department to assure compliance with the material requirements.

Acceptance of composted sewage sludge shall be based on certification by a DEC approved laboratory indicating compliance with the material requirements and all applicable regulations.

**713-16 AND 713-17 (VACANT)**

**713-18 HAY**

**SCOPE.** This specification covers the material requirements for hay.

**MATERIAL REQUIREMENTS.** Hay for mulching shall be mowings of acceptable herbaceous growth which is free from noxious weeds. Materials which are low grade and unfit for farm use such as "U.S. sample grade" will be acceptable. Weight shall be calculated on the basis of material having not more than 15% of moisture content.

**BASIS OF ACCEPTANCE.** Acceptance shall be based on inspection by the Engineer for compliance with material requirements.

**713-19 STRAW**

**SCOPE.** This specification covers the materials requirements for straw.
MATERIAL REQUIREMENTS. Straw for mulching shall be stalks of oats, wheat, rye or the approved crops which are free from noxious weeds. Materials which are low grade and unfit for farm use, such as "U.S. sample grade" will be acceptable. Weight shall be calculated on the basis of the materials having not more than 15% of moisture content.

BASIS OF ACCEPTANCE. Acceptance shall be based on inspection by the Engineer for compliance with the material requirements.

SECTION 714 - CURBING AND GUTTER

714-01 STONE CURB

SCOPE. This specification covers the material and fabrication requirements for stone curb used in highway and bridge construction.

MATERIAL REQUIREMENTS. Stone curb shall be either a bluestone, sandstone or granite. The stone shall be sound and durable, free from seams which impair its structural integrity and of a smooth splitting and machining character. Natural color variations that are characteristic of the deposit will be permitted. Any curb containing discoloration other than cleanable surface stains shall be sampled and submitted to the Materials Bureau for evaluation.

Dimensions

A. General. Curb shall be cut to conform to the shape and size shown on the standard sheets and contract plans.

B. Curbs on Straight Sections. Minimum lengths of straight segments of Economy and Sloped curbs shall be 600 mm. All other straight curb types shall have 900 mm minimum lengths.

C. Curbs on Curved Sections. No minimum length requirements are specified for curb segments on curves with radii of 60 meters or less. When directed by the Engineer, curb segments on curves with radii 31 to 60 meters shall be cut in 900 mm to 1200 mm straight lengths. With exception of Economy and Sloped curbs, segments on curves with radii of 30 meters or less shall be shaped to the required curvature and the ends cut on radial lines. Economy and Sloped curbs shall be furnished only in straight segments and on curves with radii less than 3 meters, their ends shall be cut on radial lines.

D. Transition Curb for Bridge to Roadway Curbs. A transition curb for bridge curb to roadway curb shall be furnished, if required. Where an 200 mm exposed face is desired for a roadway curb, the appropriate curb sections with a 150 mm exposed face shown on the appropriate section of the standard sheet shall be increased 50 mm in depth.

E. Curb Widths. The bottom width of the various types of curbing shall be as follows:

<table>
<thead>
<tr>
<th>Type</th>
<th>Width</th>
</tr>
</thead>
<tbody>
<tr>
<td>A,B,C,D,E,T2 and Economy</td>
<td>100 mm minimum for 2/3 of length</td>
</tr>
<tr>
<td>F1,G1,M and T1</td>
<td>100 mm minimum for entire length</td>
</tr>
<tr>
<td>R1 and R2</td>
<td>200 mm minimum for entire length</td>
</tr>
<tr>
<td>S</td>
<td>125 mm minimum for entire length</td>
</tr>
</tbody>
</table>

Finish

A. General. Curb surfaces shall be finished as indicated on the plans or standard sheets.
B. Top Surfaces. Top surfaces shall be finished to approximately true planes. When sawed, hammered or thermal finishes are applied, no projection or depression shall be greater than 5 mm. Saw marks normal to the sawing process will be permitted if within the 5 mm tolerance.

C. Arris Lines. Top front arris lines shall be straight and true with no variations greater than 3 mm measured from a 600 mm straightedge placed along the arris line.

Back arris lines on curb types E,F1,M,T1, and T2 curb and the lower front arris lines on types E,F1,M,R1,R2,S,T1 and T2 curbs shall be straight and true with no variations from a straight line greater than 6 mm measured in the same manner. Back arris lines are not required for types R1,R2 and S curbs.

Exposed arris lines at the joints shall not project beyond the plane of a split face and shall not fall under the plane of a split face more than 6 mm.

D. Back Surfaces. Back surfaces shall have no projection or depression which exceeds a batter of 25 mm in 75 mm for a distance of 75 mm from the top.

E. Front Exposed Faces. Front exposed faces of straight Types A, F1, and G1 curbs, when split, shall have no projection greater than 25 mm or depression greater than 13 mm measured from a vertical plane passing through the arris line at the top of the split face. For radius units the front exposed faces when split, shall have no projection greater than 30 mm. The entire face of Type G1 curb shall be considered as exposed face. Front exposed faces of types M, R1, R2, S, T1 and T2 curbs, when split, shall have no projection or depression greater than 13 mm measured from a vertical plane passing through the arris line at the top of the split face. Front faces below grade shall have no projection or depression greater than 25 mm measured in the same manner.

No projection on the exposed face of type C curb shall extend over 6 mm beyond a vertical plane extending from the intersection of the pavement grade line and the curb face. The exposed face of type C curb shall have no depression greater than 13 mm measured from the plane of the face through the top arris line.

F. Ends. Ends of curbs shall be approximately square with the planes of the exposed curb surfaces and shall be finished so that when curbs are set, no space greater than 20 mm shall show in the joints for the full length of the exposed joint. The curb ends below the pavement surface or shoulder shall break not over 200 mm from the joint plane on curb types A, B, C, D, E and T2 curbs and not more than 50 mm on types G1, R1, R2, and T1.

Ends of types F1, G1, M, R1, R2, S and T1 curbs shall be sawed at locations called for on the contract plans.

G. Drill Holes. Drill holes will not be permitted in exposed curb surfaces.

Exceptions to Finish Requirements

A. Economy Type Curbs. Top surfaces shall be split so that no projections or depressions are greater than 13 mm. Front arris lines shall not vary from a straight line more than 13 mm. Exposed joint openings shall not exceed 40 mm. Drill holes will be permitted in top and face surfaces.

B. Sloped Type Curb. Exposed faces shall be smooth and quarry split to an approximately true plane having no projection or depression greater than 25 mm from a 600 mm straightedge placed as closely as possible to the plane of the curb face.

Drill holes not more than 75 mm long and 13 mm deep will be permitted in the face. Arris lines at joints shall not project beyond the plane of the split face and shall not fall more than 13 mm under the plane of the split face.

Curb ends shall be approximately square with the plane of the exposed curb surfaces and finished so that when curbs are set, no space greater than 40 mm shall show in the joints for the full width of the face.
§714

**BASIS OF ACCEPTANCE.** Stone curb shall be from a source appearing on the Department's Approved List and will be accepted in accordance with procedural directives of the Materials Bureau. In addition, the stone curbing will be inspected for dimensional compliance at the project site by the Engineer. Curbing not in compliance with the dimensions on the standard sheets or contract plans will be rejected by the Engineer.

714-02 AND 714-03 (VACANT)

714-04 PRECAST CONCRETE CURB

**SCOPE.** This specification covers the material and fabrication requirements for precast concrete curb.

**MATERIAL REQUIREMENTS.** The Material Requirements contained in §704-03 shall apply.

**DRAWINGS.** The Drawing requirements contained in §704-03 shall apply.

**FABRICATION.** The Fabrication requirements contained in §704-03, along with the following shall apply. Precast curb shall be fabricated to conform to the size and shape shown on the standard sheet unless otherwise shown on the plans.

Minimum curb lengths shall be 1.75 meters except for radial curb and closures. Maximum curb lengths shall be 3.05 meters. Curb to be set on a radius of 30 meters or less shall be cast to the curve required and the ends shall be formed or sawed on radial lines. Curbs to be set on a radius of 31 meters to 60 meters may be cast or cut in 1 or 1.25 meter straight lengths, if approved by the Engineer.

**Reinforcing.** Reinforcement is optional, however if the manufacturer chooses to reinforce the curb for handling the reinforcement shall be epoxy coated or the concrete shall contain corrosion inhibitor.

**SAMPLING AND TESTING.** The Sampling And Testing requirements contained in §704-03 shall apply.

**MARKING.** The Marking requirements contained in §704-03 shall apply except as noted herein.

Markings shall be placed on an end face of each unit such that they won’t be exposed to view after installation. Instead of marking the contract number on each unit they may be marked with “NYSDOT”.

**FINAL PRODUCTION INSPECTION.** The Final Production Inspection requirements contained in §704-03 shall apply.

**SHIPPING.** The Shipping requirements contained in §704-03 shall apply.

**BASIS OF ACCEPTANCE.** The Basis Of Acceptance requirements contained in §704-03 shall apply.

714-05 (VACANT)

714-06 ASPHALT CONCRETE CURB

**SCOPE.** This specification covers the material requirements for asphalt concrete curb.

**MATERIAL REQUIREMENTS.** The Contractor shall have the option of supplying the mix specified herein or he may elect to furnish an alternate mixture subject to prior approval by the Director, Materials Bureau. The requirements of Section 401 - Hot Mix Asphalt Production shall apply with the following modifications:

A. Automatic batching and recording equipment will not be required.
B. The asphalt concrete mix shall include a powdered, devulcanized tire rubber which is moisture free, black in color, free flowing and containing no fabric or cord material. The gradation shall conform to the following sieve analysis; percent passing of total weight:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>% Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.75 mm</td>
<td>100</td>
</tr>
<tr>
<td>2.36 mm</td>
<td>85-100</td>
</tr>
<tr>
<td>1.70 mm</td>
<td>65-100</td>
</tr>
<tr>
<td>850 µm</td>
<td>35-80</td>
</tr>
<tr>
<td>600 µm</td>
<td>15-40</td>
</tr>
</tbody>
</table>

C. The asphalt cement used in the mix shall comply with either material specification §702-0400, §702-0500, or §702-0600.

D. The aggregate gradation shall be as follows:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>% Passing (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.5 mm</td>
<td>100</td>
</tr>
<tr>
<td>6.30 mm</td>
<td>90-100</td>
</tr>
<tr>
<td>3.15 mm</td>
<td>80-100</td>
</tr>
<tr>
<td>850 µm</td>
<td>30-70</td>
</tr>
<tr>
<td>425 µm</td>
<td>15-45</td>
</tr>
<tr>
<td>180 µm</td>
<td>5-23</td>
</tr>
<tr>
<td>75 µm</td>
<td>2-10</td>
</tr>
<tr>
<td>Asphalt Cement (2)</td>
<td>6-9</td>
</tr>
<tr>
<td>Tire Rubber (2)</td>
<td>½ - 2</td>
</tr>
</tbody>
</table>

(1) Based on total aggregate weight.
(2) Based on total weight of mix.

**BASIS OF ACCEPTANCE.** The acceptance of the asphalt concrete used in asphalt curb shall be in accordance with the Department written instructions.

**714-07 PRECAST CONCRETE GUTTER**

**SCOPE.** This specification covers the material and fabrication requirements for precast concrete gutter.

**MATERIAL REQUIREMENTS.** The Material Requirements contained in §704-03 shall apply.

**DRAWINGS.** The Drawing requirements contained in §704-03 shall apply.

**FABRICATION.** The Fabrication requirements contained in §704-03, along with the following shall apply:

Precast concrete gutter shall be fabricated to conform to the size and shape shown on the standard sheet unless otherwise shown on the plans.

**Reinforcing.** Wire mesh reinforcement shall consist of one layer of Size 102x102 - MW26 x MW26 embedded midway between the upper and lower surfaces, unless otherwise shown on the plans. Reinforcing bars of equivalent area may be substituted for the wire mesh reinforcement. Reinforcement shall be epoxy coated or the concrete shall contain corrosion inhibitor.

**SAMPLING AND TESTING.** The Sampling And Testing requirements contained in §704-03 shall apply.

**MARKING.** The Marking requirements contained in §704-03 shall apply except as noted herein. Markings shall be placed on an end face of each unit such that they won’t be exposed to view after installation. Instead of marking the contract number on each unit they may be marked with “NYSDOT”.

**FINAL PRODUCTION INSPECTION.** The Final Production Inspection requirements contained in §704-03 shall apply.

**SHIPPING.** The Shipping requirements contained in §704-03 shall apply.
BASIS OF ACCEPTANCE. The Basis Of Acceptance requirements contained in §704-03 shall apply.

SECTION 715 - CASTINGS, FORGINGS AND METALS

715-01 STRUCTURAL STEEL

SCOPE. This specification covers structural steels used in bridge construction that have a minimum specified yield point of 345 MPa, or less. Steel ordered under this specification may be subject to stress in any direction; longitudinal, transverse and/or through-thickness.

MATERIAL REQUIREMENTS. The manufacture, testing, delivery, and requirements for mill inspection of structural steel shall comply with the requirements of the applicable ASTM Specifications except as modified herein.

Requirements for shop inspection of plates and shapes, and provisions for rejection or shop repair of plates and shapes because of rejectable surface or internal discontinuities, are described in the New York State Steel Construction Manual.

Steels to be Furnished. The contract plans or specifications will indicate, by the proper ASTM Designation, the steel to be used in specific portions of the structure. If the steel type is not indicated on the plans or specifications, the type to be furnished shall meet the requirements of ASTM A36M.

All structural steel plates and shapes used in areas subject to tensile stress as designated on the plans or as listed herein shall be furnished to minimum Charpy V-Notch toughness requirements as provided in this specification. Structural Steel furnished to minimum notch toughness requirements shall include but not necessarily be limited to the following:

- Tension flanges and webs of stringers and girders, splice plates, and lateral gusset plates welded to the members in areas subject to tensile stress.
- Structural shapes used as main stress carrying members including attached cover plates and gusset plates welded to the members in areas subject to tensile stress.
- All truss web and chord members and attached gusset and splice plates.
- Truss lateral bracing
- Portions of Arches, Bents, Towers and Rigid Frames, plus attached gusset and splice plates, designated on the plans as being subject to tensile stress.

TESTS. Physical (mechanical) tests and chemical analysis shall be conducted by the steel manufacturer as required by the specifications.

The method of sampling, preparing test specimens and testing shall be in accordance with the applicable ASTM Designation, except as modified herein.

Charpy V-Notch Impact Test. When the provisions of these specifications require that steel be furnished with specified impact properties, and the steel is not "fracture-critical" as defined in Section 9 of the SCM, the steel shall be accepted on the basis of heat-lot qualification tests as described herein. The tests shall be performed as described for V-Notch test specimens under the heading, "Charpy Impact Testing" of ASTM Designation A370. Full size (10 mm x 10 mm) specimens shall be used whenever thickness permits. When plate thickness requires that subsize specimens be used, the specimens shall be 10 mm x 7.5 mm, or 10 mm x 5 mm. The largest possible specimens shall be used in each case.

When steel thickness is 25 mm or greater, Charpy specimens shall be taken midway between the center and the surface of the plate.

The manufacturer shall conduct and report the results of Charpy V-Notch impact tests to the State. For heat qualification, sampling and testing shall be in conformance with ASTM A673 using the “H” testing frequency.

For any heat to qualify, the average energy, as defined in ASTM A370, absorbed by a full-size specimen shall not be less than that shown for the type of steel in the Table 715-01-1.

If test specimens fail to meet the heat qualification impact requirements, the plate thickness represented by the failed specimens shall be rejected. The producer may test specimens from the next thinner material proposed to be furnished from the same heat and if they meet specification requirements,
the heat will be considered qualified for those thicknesses equal to or less than that tested and found acceptable in the retest.

Any thickness that fails to qualify in the as-rolled condition may be normalized and retested provided that all required mechanical tests are remade on the normalized material. Those thicknesses that passed the test above described in the as-rolled condition need not be normalized even though they were rolled from the same heat of steel.

<table>
<thead>
<tr>
<th>TYPE OF STEEL</th>
<th>ENERGY (J @ 5° C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A36M, A242M</td>
<td>20</td>
</tr>
<tr>
<td>A572M Grade 345</td>
<td>201</td>
</tr>
<tr>
<td>A588M (up to 100 mm mechanically fastened)</td>
<td>201</td>
</tr>
<tr>
<td>A588M (up to 50 mm welded)</td>
<td>201</td>
</tr>
<tr>
<td>A588M (50 mm to 100 mm welded)</td>
<td>271</td>
</tr>
<tr>
<td>Sign Structure steel plates and shapes greater than 13 mm thick</td>
<td>27</td>
</tr>
</tbody>
</table>

NOTE:
1. If the yield strength of the material exceeds 448 MPa, the temperature for the Charpy V-Notch tests for acceptability shall be reduced by 8 C for each increment of 69 MPa above 448 MPa.
2. Samples shall be taken after galvanizing.

If the plate thickness requires that subsize specimens be used, Table 715-01-2 shall be used to find the equivalent absorbed energy for the full size specimen:

Impact tests for fracture-critical members shall be as described in section 9 of the SCM

<table>
<thead>
<tr>
<th>TABLE 715-01-2 EQUIVALENT ABSORBED ENERGY (Joules)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Size (10 x 10 mm)</td>
</tr>
<tr>
<td>27</td>
</tr>
<tr>
<td>20</td>
</tr>
<tr>
<td>18</td>
</tr>
<tr>
<td>16</td>
</tr>
<tr>
<td>14</td>
</tr>
<tr>
<td>10</td>
</tr>
</tbody>
</table>

BASIS OF ACCEPTANCE. A certified copy of test results of chemical analyses and physical (mechanical) tests required shall be furnished for all steel. These test data shall be given to the shop inspector for submittal to the Deputy Chief Engineer (Structures) with his/her final inspection report.

When steel is furnished under an item which does not require shop inspection, these data shall be submitted to the Engineer-in-Charge who will perform the visual inspection required by this specification and the payment item.

A manufacturer's certification of the results of chemical and physical (mechanical) tests conducted as required by the specifications will be interpreted to mean that the manufacturer has tested the product as required by the specifications, and has found both materials and workmanship to conform to the specification designation listed on the report of physical and chemical test results that are certified to be accurate. Workmanship as defined herein shall include dimensional accuracy, surface finish, temper and any other physical and/or mechanical property which may be affected by manufacturing procedures.

715-02 STEEL CASTINGS

SCOPE. This specification covers the material requirements for steel casting for highway bridges.

GENERAL. Steel castings shall conform to the requirements of ASTM A27M. Unless otherwise specified, all steel castings shall be Grade 485-275 Class 1.

MATERIAL REQUIREMENTS

Fracture. Test specimens shall show a fracture having a silky or fine granular structure throughout.
Structural Defects. Steel castings shall be true to pattern in form and dimensions, without sharp unfilleted angles, or corners, and shall be free of pouring faults, sponginess, cracks, blow holes and other defects in positions affecting their strength and value for the service intended.

Blow holes appearing upon finished castings shall be so located that a straight line laid in any direction will not cut a total length of cavity greater than 25 mm in any 300 mm, nor shall any single blow hole exceed 25 mm in any dimension or have an area greater than 325 square millimeters. Blow holes shall not have a depth injuriously affecting the strength of the casting as determined by the Deputy Chief Engineer (Structures). Minor defects which do not impair the strength may, with the approval of the Deputy Chief Engineer (Structures), be welded by an approved process. The defects shall be removed to solid metal by drilling, grinding, or air-carbon arc gouging followed by grinding. After welding, the castings shall be heat treated again if required by the approved repair procedure.

Castings which have been, or are being, welded without prior approval of the repair welding procedure will be rejected.

Large castings may be subjected to non-destructive tests if required by the Contract Documents.

BASIS OF ACCEPTANCE. Acceptance shall be based upon shop inspection at the manufacturing plant by representatives of the Department, or on the basis of inspection at the project site by the Engineer-in-Charge. Certified copies of the results of the chemical and physical tests required by the specifications shall be submitted as required under the provisions of “Basis of Acceptance” in 715-01, Structural Steel.

715-03 ALUMINUM CASTINGS

SCOPE. This specification covers the requirements for various aluminum alloys and shapes.

GENERAL. Aluminum castings shall conform to the requirements of ASTM Specifications as shown in the following table, and as modified herein and by the plans and specifications.

<table>
<thead>
<tr>
<th>Commercial Specification</th>
<th>ASTM Alloy &amp; Temper</th>
<th>ASTM Alloy &amp; Temper</th>
<th>ASTM Specification</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alloy &amp; Temper</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B443.0-F</td>
<td>S5A-F</td>
<td>B108</td>
<td>Permanent Mold Castings</td>
<td></td>
</tr>
<tr>
<td>B443.0-F</td>
<td>S5A-F</td>
<td>B26M</td>
<td>Sand Castings</td>
<td></td>
</tr>
<tr>
<td>A356.0(modified)1</td>
<td>SG 70-B(modified)1</td>
<td>B108</td>
<td>Permanent Mold Castings</td>
<td></td>
</tr>
<tr>
<td>356.0-T6</td>
<td>SG 70A-T6</td>
<td>B26M</td>
<td>Sand Castings</td>
<td></td>
</tr>
<tr>
<td>356.0-F</td>
<td>SG 70A-F</td>
<td>B26M</td>
<td>Sand Castings</td>
<td></td>
</tr>
<tr>
<td>360.0</td>
<td>SG 100-B</td>
<td>B85</td>
<td>Die Castings</td>
<td></td>
</tr>
<tr>
<td>A712.0</td>
<td>ZG 61-B</td>
<td>B26M</td>
<td>Sand Castings</td>
<td></td>
</tr>
</tbody>
</table>

NOTE: 1. Where this material is required, castings shall be solution treated and aged to produce the following mechanical properties (Yield strength need not be determined unless ordered by the Deputy Chief Engineer (Technical Services)):

Ultimate Tensile Strength: 172 MPa min.
Yield Strength (0.2 percent offset): 124 MPa min.²
Elongation (measured with gage length of four times the diameter of the specimen.): 6 percent min.

MATERIAL REQUIREMENTS

Quality. The castings shall be of uniform quality and condition, free from cracks, blow holes, porous places, hard spots, or shrinkage defects which affect the suitability of the castings for their intended use. Before inspection the castings shall be smooth and clean.

Heat Treatment. Casting shall be heat treated in such a manner as to produce material which will conform to the properties specified herein with the approved uniformity.

Castings to be used as bridge railing posts shall be produced under radiographic control. This shall consist of radiographic examination of castings until proper foundry technique, which will produce castings consistently free from harmful internal defects, is established for each mold. Production castings shall be examined as necessary to insure maintenance of satisfactory quality.
Tension test specimens shall be machined from integrally cast test coupons extending sufficiently from one side of the base of the posts to obtain a 8.89 mm diameter test specimen as defined in "Methods of Tension Testing of Metallic Materials" ASTM E8M, with the exception that the radii at the ends of the reduced section shall not be less than 12.5 mm.

The method of test and determination of tensile properties shall be in accordance with ASTM E8. A minimum of one percent of the posts in any lot, but not less than one, shall be sampled for tensile testing. For the purpose of sampling, a lot shall consist of not more than 450 kg of clean castings when produced from a batch type furnace charged with one heat of ingot of known analysis or not more than 900 kg of clean castings when produced from one continuous furnace in not more than 8 consecutive hours.

If the results of any tensile test do not conform to the requirements prescribed, two additional tests shall be taken from the same group of castings, and the average of the three tests must meet the requirements.

**BASIS OF ACCEPTANCE.** This material is accepted on the basis of a manufacturer's certification of compliance as described in "Basis of Acceptance," 715-01 except as follows, when the material is used in:

**Bridge Railings.** Accepted on the basis of shop inspection by the Department in accordance with Department directives.

**Fencing.** Accepted on the basis of samples secured in accordance with Department directives.

### §715-04 WROUGHT ALUMINUM

<table>
<thead>
<tr>
<th>PRODUCT</th>
<th>ALLOY &amp; TEMPERS</th>
<th>ASTM SPEC.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheet and Plate</td>
<td>1100-0</td>
<td>B209M</td>
</tr>
<tr>
<td></td>
<td>2024-T4</td>
<td>B209M</td>
</tr>
<tr>
<td></td>
<td>3003-H14</td>
<td>B209M</td>
</tr>
<tr>
<td></td>
<td>3004-H38</td>
<td>B209M</td>
</tr>
<tr>
<td></td>
<td>5052-H32,-H38</td>
<td>B209M</td>
</tr>
<tr>
<td></td>
<td>5154-H38</td>
<td>B209M</td>
</tr>
<tr>
<td></td>
<td>6061-T6</td>
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</tr>
<tr>
<td></td>
<td>7075-T6</td>
<td>B209M</td>
</tr>
<tr>
<td></td>
<td>ALCLAD 2024-T3,-T42</td>
<td>B209M</td>
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<tr>
<td></td>
<td>ALCLAD 6061-T6</td>
<td>B209M</td>
</tr>
<tr>
<td>Wire</td>
<td>1100-H38</td>
<td>B211M</td>
</tr>
<tr>
<td></td>
<td>3003-H14</td>
<td>B211M</td>
</tr>
<tr>
<td></td>
<td>5052-H38</td>
<td>B211M</td>
</tr>
<tr>
<td></td>
<td>6061-T941</td>
<td>B211M</td>
</tr>
<tr>
<td>Bars and Rod</td>
<td>2024-T4</td>
<td>B211M</td>
</tr>
<tr>
<td></td>
<td>6061-T6</td>
<td>B211M</td>
</tr>
<tr>
<td>Extruded Bars and Rods and Shapes</td>
<td>5154-0</td>
<td>B221M</td>
</tr>
<tr>
<td></td>
<td>6061-T6</td>
<td>B221M</td>
</tr>
<tr>
<td></td>
<td>6063-T5</td>
<td>B221M</td>
</tr>
<tr>
<td>Extruded Shapes</td>
<td>6063-T6</td>
<td>B211M</td>
</tr>
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<td></td>
<td>6005-T5</td>
<td>B211M</td>
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<td></td>
<td>6351-T6</td>
<td>B211M</td>
</tr>
<tr>
<td>Drawn Seamless Tube</td>
<td>6061-T6</td>
<td>B210M</td>
</tr>
<tr>
<td></td>
<td>6063-T832</td>
<td>B210M</td>
</tr>
<tr>
<td>Extruded Tube</td>
<td>6061-T6</td>
<td>B241M</td>
</tr>
<tr>
<td>Pipe</td>
<td>6061-T6</td>
<td>B241M</td>
</tr>
<tr>
<td></td>
<td>6063-T6</td>
<td>B241M</td>
</tr>
<tr>
<td>Structurals, Rolled or Extruded</td>
<td>6061-T6</td>
<td>B308M</td>
</tr>
<tr>
<td>Welding Rods and Bare Electrodes</td>
<td>4043-O</td>
<td>Not ASTM²</td>
</tr>
<tr>
<td></td>
<td>5154-0</td>
<td>Not ASTM²</td>
</tr>
</tbody>
</table>

**NOTES:**
1. See Mechanical Properties.
**SCOPE.** This specification covers the requirements for various aluminum alloys and shapes.

**MATERIAL REQUIREMENTS**

**Physical & Chemical Requirements.** Wrought aluminum shall conform to the requirements of ASTM specifications as shown in Table 715-04-1 and as modified herein and by the plans and specifications.

Each piece shall be marked with the manufacturer's name or trade mark and with alloy and temper designations in the manner described in the pertinent ASTM specifications.

When a clad material is specified, it shall be clad on both sides unless specified otherwise.

**Mechanical Properties.** When alloy 6061-T94 is required by the plans or specifications, it shall be defined as that temper which will produce in the wire the following mechanical properties after weaving:

- minimum ultimate tensile strength: 375 MPa
- minimum tensile yield strength: 325 MPa

**BASIS OF ACCEPTANCE.** This material shall be accepted on the basis of a manufacturer's certification of compliance except when this material is used in Bridge Railing when it shall be accepted on the basis of shop inspection by the Department in accordance with Department directives, or Fencing when it shall be accepted on the basis of samples received in accordance with Departmental directives.

### 715-05 IRON CASTINGS

**SCOPE.** This specification covers material requirements for iron castings.

**MATERIAL REQUIREMENTS.** Iron castings shall conform to the requirements of AASHTO M 105, Class 30B or Class 35B.

**FABRICATION.** Castings shall be true to pattern in form and dimensions, free from pouring faults, sponginess, cracks, blow holes and other defects at locations affecting their strength and value for the service intended. Castings shall be boldly filleted at angles and the arises shall be sharp and perfect. Castings having blow holes plugged or filled with putty or cement of any kind will be rejected.

Grates, covers and curb boxes shall have continuous, full, and uniform bearing contact with their corresponding frames and shall be non-rocking when in place and under the influence of traffic or other loads. Methods that are permissible to achieve secure non-rocking fit between grates, covers and their corresponding frames are:

- Ground mating surfaces
- Machined and milled mating surfaces (horizontal and/or vertical).

All cast gratings, covers, frames and curb boxes shall be delivered to the work site free of any coatings unless specified otherwise.

Castings that fail to meet the requirements of this specification shall be rejected and immediately removed from the work site.

**BASIS OF ACCEPTANCE.** Iron castings shall be accepted in accordance with the procedural directives of the Department.

### 715-06 STEEL FORGINGS

**MATERIAL REQUIREMENTS.** Steel forgings shall conform to the requirements of ASTM A 668/A 668M, Class C, or other class approved by the DCES.

**BASIS OF ACCEPTANCE.** Acceptance of this material shall be in accordance with procedural directives of the Department.
715-07 PROOF LOADED IRON CASTINGS

SCOPE. This specification covers material and testing requirements for proof loaded iron castings.

MATERIAL REQUIREMENTS. Iron castings shall conform to the requirements of AASHTO M 105, Class 30B or Class 35B. Castings shall be true to pattern in form and dimensions, free from pouring faults, sponginess, cracks, blow holes and other defects at locations affecting their strength and value for the service intended.

Grates, covers and curb boxes shall have continuous, full, and uniform bearing contact with their corresponding frames and shall be non-rocking when in place and under the influence of traffic or other loads. Methods that are permissible to achieve secure non-rocking fit between grates, covers and their corresponding frames are:

- Ground mating surfaces
- Machined and milled mating surfaces (horizontal and/or vertical).

All gratings, covers, frames and curb boxes shall be delivered to the work site free of any coatings unless specified otherwise.

Castings shall be boldly filleted at angles, and the arises shall be sharp and perfect.

Castings having blow-holes plugged or filled with putty or cement of any kind will be rejected.

Castings that fail to meet the requirements of this specification shall be rejected and immediately removed from the work site.

Approved List. All iron castings conforming to the requirements of Standard Sheets "Cast Manhole Frames, Grates and Covers" and "Cast Frames and Curb Boxes and Welded Frames" will be approved without any proof load requirements. No Materials Details need be prepared for those articles.

For all other iron castings Materials Details shall be prepared and submitted to the Director of Materials Bureau for approval. All dimensions shall conform to those depicted on the standard sheets - "Proof Loaded Cast Steel or Iron Manhole Frames, Grates, Covers" and "Welded Frames and Proof Loaded Cast Steel or Iron Frames and Curb Boxes." Also the articles will be proof-load tested in accordance to the Department's Test Method "Proof Loading of Cast Iron Frames, Grates, Covers and Curb Boxes", a copy of which may be obtained from the Director of Materials Bureau. After the proof-load tests are successful and the drawings are approved, the manufacturer's name, material details reference number and approval date will be placed on the Department's Approved List.

DETAILS. All dimensions, including specified tolerances, in the Material Details shall be within the limits specified on the standard sheets - "Proof Loaded Cast Steel or Iron Manhole Frames, Grates, Covers" and "Welded Frames and Proof Loaded Cast Steel or Iron Frames and Curb Boxes."

Corresponding section thicknesses of frames F1, F2 and F3 shall be same unless load tested.

Corresponding section thicknesses and number of stiffeners of the mountable curb boxes (CMs) and unmountable curb boxes (CUs) shall be same. Also corresponding section thicknesses and number of stiffeners of all curb boxes, CUs and CMs, shall be same unless load tested. The class of iron to be used shall be clearly identified. Payment areas as indicated on the standard sheets shall be included.

Testing Facility. The Department's laboratory will conduct the proof load testing for acceptance of the design.

SAMPLES AND SUBMISSIONS. The manufacturer/supplier shall provide the following to the Materials Bureau before any testing can begin:

- Two (2) copies of the Material Details for each iron casting to be approved
- Two (2) samples of each cast iron article to be load tested as directed by the Materials Bureau
- One (1) sample of corresponding reticuline grate and any nuts and bolts required for assembly
- Two (2) B-Bar test specimens cast within an hour of casting each of the test samples and machined as per AASHTO M 105. Both ends of the specimen shall be machined to 28.5 mm X 7 threads per 25 mm.
It is the manufacturer/supplier's responsibility to remove in an expedient manner all supplied material from the Department's premises after the tests are done.

**Failure Criteria.** The design of an iron casting will be rejected if the following conditions are not met:

**A. Permanent Set.** This criterion applies to cast iron grate and cover. The maximum permanent set in any article, measured relative to a fixed horizontal plane, shall not exceed the lesser of 3.0 mm or 1/150 of the clear opening.

**B. Cracks.** All articles will be inspected after the completion of each test. No part of any article shall break or have any cracks.

**Retests and Re-submissions.** If the dimensions of the article(s) do not fall within the limits of the Material Details, either new article(s) or new Details shall be submitted at the manufacturer's option. Upon failure under proof loading no retests will be allowed. Complete new designs shall be submitted for further testing.

**Quality Assurance During Production.** The B-Bar test results for each lot of castings (a lot is defined as per AASHTO M 105) shall be maintained by the foundry for a period of seven (7) years and shall be made available to the Department upon request. Although proof load testing is not required during the production phase, the Department reserves the right to test any piece at any time.

**BASIS OF ACCEPTANCE.** Cast iron frames, grates, covers and curb boxes shall be accepted at the project site based on the manufacturer's name appearing on the Approved List, conformance to the approved Materials Details or standard sheets, and the required manufacturer's certifications. For each contract supplied, the following shall be provided to the Engineer:

**A. Manufacturer's Certification.** The manufacturer shall provide certification that every piece of cast iron frame, grate, cover and curb box supplied was manufactured in accordance with these specifications and the approved Materials Details or Standard Sheets - "Cast Manhole Frames, Grates and Covers" (M655-9r1) and "Cast Frames and Curb Boxes and Welded Frames" (M655-11r1).

**B. Materials Details.** Two (2) copies of the approved Material Details, identified by reference number and approval date as shown on the Approved List.

715-08 (VACANT)

715-09 MALLEABLE IRON CASTINGS

**SCOPE.** Malleable Iron Castings shall conform to the requirements of ASTM A 47/A 47M. The Grade shall be Grade 22010 unless Grade 24018 is required by the plans or specifications.

**MATERIAL REQUIREMENTS.** Castings shall be true to pattern in form and dimensions, free from pouring faults, sponginess, cracks, blow holes and other defects in positions affecting their strength and value for the service intended.

The casting shall be boldly filleted at angles and the arises shall be sharp and perfect. The surface shall have a standard quality finish.

When galvanizing is required, it shall be in accordance with 719-01, Galvanized Coatings and Repair Methods, Type II. Particular care shall be exercised so as not to embrittle malleable castings when galvanizing. All galvanized castings shall meet specification requirements after galvanizing.

**BASIS OF ACCEPTANCE.** Acceptance of this material shall be in accordance with procedural directives of the Department.

715-10 (VACANT)
715-11 METAL BIN TYPE RETAINING WALL

SCOPE. This specification covers the material and quality requirements for metal bin-type retaining walls.

MATERIAL REQUIREMENTS

Base Metal. The base metal for all components except fasteners shall be manufactured by the open hearth, basic oxygen process or electric furnace process and shall conform to the requirements of AASHTO M218. Base metal for the fasteners shall conform to the requirements of ASTM A307.

FABRICATION

Details. All members shall be so fabricated that members of the same nominal size shall be freely interchangeable. No drilling, punching or drifting to correct defects in manufacture shall be permitted. Any units having holes improperly punched shall be replaced by the Contractor at no expense to the State.

The members in the wall shall conform to the gages, surface treatments and descriptions in Table 715-11, as well as the gages and dimensions shown in the plans. All materials receiving the Type IV surface treatment shall have a nominal zinc coating weight of 0.61 kg/m² such that the minimum check limits for the triple-spot and single-spot tests shall be 0.61 kg/m² and 0.55 kg/m² respectively.

Configuration. Walls shall consist of a series of pairs of columns, one column in each pair being in the plane of the wall face and the other column being in the plane of the rear of the wall, with the pair of columns spaced longitudinally with overlapping S-shaped facing and rear members (stringers) and transversely with overlapping U-shaped tie-members (spacers). All necessary bolts and appurtenances shall be furnished to form a continuous closed-face wall of connected bins.

BASIS OF ACCEPTANCE. The metal bin-type retaining wall members shall be accepted on the basis of the manufacturer's certified analysis and guarantee for the metal and the Engineer's inspection.

<table>
<thead>
<tr>
<th>Name</th>
<th>Gage</th>
<th>Surface Treatment</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Column</td>
<td>8</td>
<td>719-01 Type IV</td>
<td>Vertical Member, Front &amp; Back</td>
</tr>
<tr>
<td>Column Cap</td>
<td>12</td>
<td>719-01 Type IV</td>
<td>Cover for front Column</td>
</tr>
<tr>
<td>Stringer Stiffener</td>
<td>8</td>
<td>719-01 Type IV</td>
<td>Top flange return</td>
</tr>
<tr>
<td>Stringer</td>
<td>16,14,12,10</td>
<td>719-01 Type IV</td>
<td>Horizontal Longitudinal members, front &amp; rear</td>
</tr>
<tr>
<td>Connecting Channel</td>
<td>8</td>
<td>719-01 Type I</td>
<td>Connector, Stringer to Column</td>
</tr>
<tr>
<td>Spacer</td>
<td>16,14,12</td>
<td>719-01 Type IV</td>
<td>Horizontal Transverse member</td>
</tr>
<tr>
<td>Bottom Spacer</td>
<td>16,14,12</td>
<td>719-01 Type IV</td>
<td>Special bottom transverse member</td>
</tr>
<tr>
<td>Base Plate</td>
<td>1</td>
<td>719-01 Type I</td>
<td>All connections</td>
</tr>
<tr>
<td>16 mm dia. nuts</td>
<td>6 mm</td>
<td>719-01 Type II</td>
<td>All connections</td>
</tr>
<tr>
<td>16 mm dia. nuts</td>
<td></td>
<td>719-01 Type II</td>
<td>All connections</td>
</tr>
<tr>
<td>16 mm dia. Spring nuts</td>
<td></td>
<td>None</td>
<td>All connections</td>
</tr>
</tbody>
</table>

715-12 (VACANT)

715-13 PREFABRICATED ADJUSTMENT RINGS, FRAMES AND UTILITY VALVE RISERS FOR DRAINAGE UNITS, MANHOLES AND UTILITIES

SCOPE. This specification covers the material requirements and fabrication of adjustment rings, frames and utility valve risers for drainage structures, manholes and utilities. The adjustment rings, frames and utility valve risers shall consist of one of the following types unless otherwise approved by the Director, Materials Bureau:
§715

RINGS
Type AR1 - Single Height Segmented Unit
Type AR2 - Single Height - One Cut Unit
Type AR3 - Single Height - Solid Unit

FRAMES
Type AF1 - Single Height Segmented Unit
Type AF2 - Single Height Solid Unit

UTILITY VALVE RISERS
Type UVR1 - Single Height - Solid Ring Unit
Type UVF1 - Single Height - Solid Frame Unit

MATERIAL REQUIREMENTS All adjustment rings, frames and utility valve risers shall be fabricated from steel, iron castings, a combination of these two materials, or an alternative material or materials as approved by the Director of the Materials Bureau.

The steel used for fabrication of rings, frames and utility valve risers shall meet the requirements of ASTM A36, A108, A242 or equivalent. If cast iron is used, the cast iron units shall be iron castings meeting the requirements of §715-05, IRON CASTINGS. All welding shall meet the requirements of the New York State Steel Construction Manual. All bolts, nuts, washers and threaded studs shall be stainless steel meeting the requirements of ASTM A240 or equivalent.

FABRICATION. All adjustment rings, frames and utility valve risers shall be designed to allow full bearing of the unit on the existing frame seat. Designs shall include a clamping device capable of securing the adjustment ring, frame or utility valve riser to the existing frame. Alternate methods of securing the rings, frames and utility valve risers to the existing frame shall be approved by the Director, Materials Bureau. All adjustment rings, frames and utility valve risers shall be reinforced to prevent bending during construction and routine service.

Steel rings, frames and utility valve risers shall be galvanized in accordance with §719-01 Galvanized Coatings and Repair Methods. When steel rings, frames and utility valve risers contain no component parts which are less than 6 mm in thickness, they may be coated with a bituminous base or coal tar product and will not require galvanizing. Any alternate coating system shall be approved by the Director, Materials Bureau. Cast iron rings, frames and utility valve risers do not require any galvanizing, but may instead be coated with a bituminous based or coal tar product approved by the Director, Materials Bureau.

Rings

Type AR1 - Single Height Segmented Unit. This ring shall consist of two or more radial segments which may be adjusted to open and close the diameter of the ring. When fully expanded the ring shall bear firmly against the sidewalls and seat of the existing manhole frame.

Type AR2 - Single Height - One Cut Unit. This ring shall consist of a single circular unit which is cut through its circumference at one point. The ring shall include an adjusting device that shall enable the ring to be expanded to bear firmly against the sidewalls and seat of the existing manhole frame.

Type AR3 - Single Height - Solid Unit. This ring shall consist of a solid unit with no cuts or openings in its circumference. The diameter of this ring is not field adjustable, unless approved by the Materials Bureau.

Frames

Type AF1 - Single Height Segmented Unit. This frame shall consist of a rectangular, segmented unit which is adjustable for length and width. When expanded the frame shall bear firmly against the sidewalls and seat of the existing frame.
**Type AF2 - Single Height Solid Unit.** This frame shall consist of a solid rectangular unit with fixed lengths and widths.

**Utility Valve Risers**

**Type UVR1 - Single Height Solid Ring Unit.** This unit shall consist of a solid ring with no cuts or openings along its length.

**Type UVF1 - Single Height Solid Frame Unit.** This unit shall consist of a solid rectangular with fixed lengths and widths.

**BASIS OF ACCEPTANCE.** The Department requires the submission of Materials Details. The manufacturer or supplier shall prepare and submit the appropriate material in accordance with the procedural directives of the Materials Bureau. Upon approval by the Materials Bureau, the name of the manufacturer or supplier along with the drawing number and date assigned to the approved Materials Details will be placed on the Approved List. Such products shall then be accepted on the basis of their appearance on the Approved list and conformance to the approved Materials Details.

The manufacturer or supplier shall provide two copies of the approved Materials Details through the Contractor to the Engineer as part of the evidence of acceptability for the product at least 10 days prior to its use.

**715-14 HIGH STRENGTH BOLTS, NUTS AND WASHERS**

**SCOPE.** This specification covers the requirements for high-strength steel bolts, nuts and washers used for structural steel connections.

**MATERIAL REQUIREMENTS.** The bolts, nuts and washers shall conform to the provisions of ASTM A325M and §715-01 except as modified herein.

**Bolt and Nut Dimensions.** Bolt and nut dimensions shall conform to the current requirements of the American National Standard for Metric Heavy Hexagon Structural Bolts (ANSI B18.2.3.7M), and Metric Heavy Hexagon Nuts (ANSI B18.2.4.6M). Alternate fasteners which differ in dimensions from those specified by the ANSI may be used provided that the body diameter and bearing areas under the head and nut, or their equivalent areas, are not less than those of the same nominal dimensions specified by the ANSI, and that approval for the use is given by the DCES.

<table>
<thead>
<tr>
<th>Bolt Size</th>
<th>Circular Washers</th>
<th>Beveled Washer for American Standard Beams and Channels</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nominal Outside Diam.</td>
<td>Nominal Diam. of hole</td>
</tr>
<tr>
<td>M16</td>
<td>33 18</td>
<td></td>
</tr>
<tr>
<td>M20</td>
<td>41 22</td>
<td></td>
</tr>
<tr>
<td>M22</td>
<td>43 24</td>
<td></td>
</tr>
<tr>
<td>M24</td>
<td>49 26</td>
<td></td>
</tr>
<tr>
<td>M27</td>
<td>55 30</td>
<td></td>
</tr>
<tr>
<td>M30</td>
<td>59 33</td>
<td></td>
</tr>
<tr>
<td>M36</td>
<td>71 39</td>
<td></td>
</tr>
<tr>
<td>M42</td>
<td>83 45</td>
<td>4.6³</td>
</tr>
<tr>
<td>M48</td>
<td>94 51</td>
<td>4.6</td>
</tr>
<tr>
<td>Over M48</td>
<td>2D-1 D+3</td>
<td></td>
</tr>
</tbody>
</table>

**OVER M100 incl.**

**NOTES:**
1. Dimensions in mm.
2. May be exceeded by 5 mm
3. 5 mm nominal.
4. 6.5 mm nominal.
**Washer Dimensions.** Circular washers shall be flat and smooth and their nominal dimensions shall conform to the dimensions given in Table 715-14. Beveled washers for American Standard beams and channels shall be square or rectangular, shall have an average thickness of 8 mm, and shall conform to the dimensions and taper in thickness given in Table 715-14.

**TESTS AND ACCEPTANCE.** Tests and acceptance of high strength bolts, nuts and washers shall be as described in section 10 of the SCM.

**715-15 PINS AND ROLLERS**

**SCOPE.** This specification covers steel pins and rollers used in bridge construction.

**GENERAL.** The material furnished for pins and rollers shall conform to the following requirements:
- Pins and rollers designed for a minimum yield stress of 248 MPa shall conform to ASTM A668, Class D.
- Pins and rollers designed for a minimum yield stress of 344 MPa shall conform to the requirements of ASTM A668, Class F.
- Any pin or roller greater than 300 mm in diameter shall be furnished in conformance with the requirements of ASTM A668, Class G.

**Tests and Acceptance.** Tests are to be performed as required in the applicable ASTM Designation. Certified copies of the results of the specified tests are to be furnished as described in “Basis of Acceptance,” of §715-01. Acceptance of material will be based on satisfactory test results and dimensional compliance with the contract plans and specifications.

**715-16 STAINLESS STEEL CONNECTING PRODUCTS**

**SCOPE.** This specification covers stainless steel bolts, nuts, washers, and set screws used in the construction of sign structures.

**MATERIAL REQUIREMENTS.** Stainless steel connecting products shall conform to the following:
- Hex bolts designed for 585 MPa minimum yield strength shall conform to the requirements of ASTM A193, Grade B6 (AISI 410).
- Nuts for Grade B6 bolts shall conform to the requirements of ASTM A194, Grade B6 (AISI 416).
- Hex bolts and U-bolts designed for 205 MPa minimum yield strength shall be either AISI 304 or 305 stainless steel conforming to the requirements of ASTM A193, Grade B8 or Grade B8P, Class 1.
- Hex bolts and U-bolts designed for 690 MPa minimum yield strength shall be either AISI 304 or 305 stainless steel conforming to the requirements of ASTM A193, Grade B8 or Grade B8P, Class 2.
- Nuts for Grade B8 or Grade B8P bolts shall conform to the requirements of ASTM A194, Grade B8 (AISI 304).
- Flat washers shall be circular, flat, smooth, and fabricated from material conforming to the requirements of ASTM A167 (AISI 302B (UNS S30215) or ASTM A240 (AISI 302 or 304 (UNS S30200 or S30400))).
- Lock washers shall be fabricated in accordance with ANSI B18.21.1 from material conforming to the requirements of ASTM A313 (AISI 302, 304, or 305 (UNS S30200, S30400, or S30500)) with a hardness Rc 35-43.
- Set screws shall conform to the requirements of ASTM A320, Grade B8F (AISI 303).

**Cleaning.** Following heat treatment, all stainless steel connecting products shall be descaled and cleaned in accordance with the requirements of ASTM A380. After cleaning and descaling the stainless steel hardware shall be passivated. Stainless steel hardware with a black or speckled rusty appearance is acceptable provided the discoloration does not run when installed, as determined by the Engineer.
Delivery. All stainless steel connecting products shall be delivered to the project site no less than 30 days prior to utilization of the hardware to allow ample time for sampling and testing.

SAMPLING AND TESTING. Stainless steel connecting products will be sampled at the project site or supply location. Sampling and testing will be in accordance with procedural directives of the Materials Bureau.

BASIS OF ACCEPTANCE. Stainless steel connecting products will be accepted in stock-lot quantities at the project site or supplier's location in accordance with procedural directives of the Materials Bureau. Grade B8 bolts less than 9.52 mm in diameter will be accepted based on chemical properties only.

SECTION 716 - BEARINGS AND EXPANSION PLATES

716-01 THRU 716-04 (VACANT)

716-05 SELF-LUBRICATING BRONZE PLATES

SCOPE. This specification covers requirements for self-lubricating bronze plates used as bearing plates in expansion bearings.

MATERIAL REQUIREMENTS. Self-lubricating bronze shall conform to the requirements of ASTM B22, Alloy 911.

The lubricant shall be of the solid type and shall consist of graphite, metallic substances having lubricating properties and a lubricating binder. Materials which do not have lubricating qualities or promote chemical or electrolytic reactions, shall not be acceptable. The lubricant shall be integrally molded and compressed into the lubrication recesses with hydraulic pressure of at least five times the maximum design unit loading to form a dense, non-plastic lubricant which shall project above the surface of the bronze a minimum of 0.125 mm.

The recesses for the lubricant shall consist of annular rings with or without central circular recess with a depth at least equal to the width of the ring or diameter of hole for proper containment of lubricant. The recesses shall be arranged in a geometrical pattern such that successive rows shall overlap in the direction of motion and the distance between extremities of recesses shall be closer in the direction of motion than that perpendicular to motion. The entire bearing area of all surfaces which have provision for motion shall be lubricated by means of these lubricant filled recesses. The total area of these recesses shall comprise not less than 25 percent nor more than 35 percent of the total bearing area of the plate.

The bearing plates shall be furnished to the sizes and shapes specified on the plans. The maximum permissible variation in the specified thickness of bronze plates shall be ±0.25 mm. The lay of the tool marks shall be in the direction of motion or shall be omnidirectional.

On flat faces the machined surface shall be flat to a tolerance of 15 µm in each 30 mm of length and width.

On curved faces the radius of the machined surface shall have the following tolerances:

<table>
<thead>
<tr>
<th>Surface Type</th>
<th>Positive Tolerance</th>
<th>Negative Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concave Surface</td>
<td>0.25 mm</td>
<td>Zero</td>
</tr>
<tr>
<td>Convex Surface</td>
<td>0.25 mm</td>
<td>0.25 mm</td>
</tr>
</tbody>
</table>

The curved surface shall be machined to a tolerance of 15 µm in each 30 mm length perpendicular to the circular section.

Surfaces of bronze plates in contact with machined surfaces of steel plates shall be machine finished in accordance with the requirements of the SCM, Section 6, Part 612 (When the SCM requires DCES approval, delete the term "DCES" and replace it with "the Regional Director."). Machining shall be of the same surface roughness as that required for sliding bearings.

The coefficient of friction between the self-lubricating bronze plates and the steel plates in contact with them shall not exceed 0.10 when subjected to the maximum designed unit loading and also at twice the maximum design unit loading.
§716

Basis of Acceptance. The manufacturer shall supply the Engineer with certification that the bronze plate was manufactured in accordance with this specification. This certification must be received by the Engineer prior to the placement of the bronze plate or any fabricated piece containing the bronze plate into any construction work.

716-06 Disc-Design Structural Bridge Bearings

Scope. This specification covers the material requirements for disc-design structural bridge bearings. Bearings furnished under this specification shall adequately provide for the thermal expansion and contraction, rotation, camber changes, and creep and shrinkage of structural members, where applicable.

General. Disc-design structural bridge bearings shall consist of a polyether urethane structural element (disc) confined by upper and lower steel bearing plates. The bearings shall be equipped with a shear restriction mechanism to prevent movement of the disc.

Disc-design structural bridge bearings shall be supplied as fixed bearings; guided expansion bearings; and non-guided expansion bearings as designated by the Contract Documents.

Fixed Bearings. Fixed bearings shall allow rotation but no longitudinal or transverse movement in the bearing plane.

Guided Expansion Bearings. Guided expansion bearings shall allow rotation and longitudinal movement in the bearing plane; transverse movement shall be restricted. To allow longitudinal movement, the upper steel bearing plate shall be faced with polytetrafluoroethylene (PTFE) sheet and support a sliding steel top bearing plate. The mating surface of the sliding steel top bearing plate shall be faced with polished stainless steel. To restrict transverse movement, either a guide bar or keyway system shall be used. If required, the guide bar or keyway systems and their mating steel surfaces shall be faced with strips of either PTFE or PTFE-stainless steel.

Non-Guided Expansion Bearings. Non-guided expansion bearings shall allow rotation, longitudinal, and transverse movement in the bearing plane. To allow longitudinal and transverse movement, the upper steel bearing plate shall be faced with polytetrafluoroethylene (PTFE) sheet and support a sliding steel top bearing plate. The mating surface of the sliding steel top bearing plate shall be faced with polished stainless steel.

Material Requirements. All material shall be new and unused, with no reclaimed material incorporated in the finished bearing.

<table>
<thead>
<tr>
<th>Physical Property</th>
<th>ASTM Test Method</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardness, Type D Durometer</td>
<td>D2240</td>
<td>57</td>
</tr>
<tr>
<td>Tensile Stress, MPa</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 100% elongation</td>
<td>D412</td>
<td>14</td>
</tr>
<tr>
<td>At 300% elongation</td>
<td></td>
<td>26</td>
</tr>
<tr>
<td>Tensile Strength, MPa</td>
<td>D412</td>
<td>34.5</td>
</tr>
<tr>
<td>Ultimate Elongation, %1</td>
<td>D412</td>
<td>220</td>
</tr>
<tr>
<td>Compression Set¹, %</td>
<td>D395</td>
<td>---</td>
</tr>
</tbody>
</table>

Notes: 1. A 10% deviation from specified values is permissible. 2. 22 hours at 70°C

Polyether Urethane Structural Element. The polyether urethane structural element used in the construction of disc-design bearings shall be molded from a polyether urethane compound. The physical properties of the polyether urethane shall conform to the requirements of Table 716-06-1.
Steel. All steel except stainless steel components of the bearing shall conform to the requirements of the type of steel designated on the Contract Plans and applicable provisions of the New York State Steel Construction Manual.

Stainless Steel. Stainless steel shall conform to the requirements of ASTM A167, or ASTM A240, Type 304. Stainless steel in contact with PTFE shall be polished to a No. 8, bright mirror finish. The minimum thickness of the stainless steel shall be 1.25 mm.

Polytetrafluoroethylene Sheet and Strip. Polytetrafluoroethylene (PTFE) sheet and strip shall be manufactured from pure virgin (not reprocessed) unfilled TFE resin; or from TFE resin uniformly blended with either 15% glass fiber or 25% carbon (maximum, percent by weight).

PTFE sheet shall be bonded to or recessed into its steel substrate. Bonded PTFE sheet shall be etched on its bonding side, and shall have a minimum thickness of 1.6 mm. Recessed PTFE sheet shall have a minimum thickness of 3.0 mm and be recessed for at least one-half its thickness into its steel substrate. The surface of filled PTFE sheet in contact with stainless steel shall be polished or burnished to insure smooth and low friction movement of the bearing.

Finished PTFE sheet and strip shall be resistant to all acids, alkalis and petroleum products, stable at temperatures from -215°C to +260°C, non-flammable, non-absorbing of water, and shall conform to the physical requirements of Table 716-01-2.

<table>
<thead>
<tr>
<th>Physical Property</th>
<th>ASTM Test Method</th>
<th>Unfilled</th>
<th>Filled 15% Glass</th>
<th>Filled 25% Carbon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultimate Tensile Strength, MPa</td>
<td>D638M</td>
<td>19.3</td>
<td>13.8</td>
<td>9.0</td>
</tr>
<tr>
<td>Ultimate Elongation, %</td>
<td>D638M</td>
<td>200</td>
<td>150</td>
<td>75</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>D792</td>
<td>2.13</td>
<td>2.18</td>
<td>2.05</td>
</tr>
</tbody>
</table>

FABRICATION. The finish of the mold used to produce the bearing elements shall conform to good machine shop practice. Every bearing shall have the Project Identification Number, NYSDOT Lot Number and individual bearing number indelibly marked with ink on a side that will be visible after erection.

The PTFE sheet shall be bonded to its grit blasted steel substrate using an epoxy resin adhesive under controlled factory conditions in accordance with the instructions of the adhesive manufacturer. Alternately, the PTFE sheet may be recessed into its steel substrate for one-half its thickness. The bearing manufacturer shall have the option of bonding recessed PTFE sheet.

All steel surfaces exposed to the atmosphere, except stainless steel surfaces and metal surfaces to be welded, shall be shop painted with one coat of coal-tar epoxy. Coal-tar epoxy paint shall meet the requirements of SSPC Paint Specification No. 16, and be applied at a minimum wet film thickness of 0.25 mm. Prior to painting, the exposed steel surfaces shall be cleaned in accordance with the recommendations of the coating's manufacturer. Metal surfaces to be welded shall be given a coat of clear lacquer, or other protective coating approved by the Engineer, if exposure is to exceed three months prior to welding. The coating shall be removed at the time of welding. No painting will be done to these surfaces prior to the completion of welding.

Except as noted, all bearing surfaces of steel plates shall be finished or machined flat within 0.25 mm. Out-of-flatness greater than 0.25 mm on any plate shall be cause for rejection. The bottom surfaces of lower bearing plates (masonry plates) designed to rest on bearing pads shall not exceed an out-of-flatness value of 1.6 mm. Oxygen cut surfaces shall not exceed a surface roughness value of 25 µm, as defined by ANSI B46.1. Repair, when necessary, shall conform to the requirements of the New York State Steel Construction Manual (When the SCM requires DCES approval, delete the term “DCES” and replace it with "the Regional Director.").

The steel base pot of all bearings shall be either integrally machined or continuously welded to its bottom steel masonry plate. Unless otherwise approved by the Regional Director, all welding shall conform to, and all welders shall be qualified in accordance with the requirements of the New York State Steel Construction Manual (When the SCM requires DCES approval, delete the term "DCES" and replace it...
with "the Regional Director.").

Gross bearing dimensions shall have a tolerance of -0, +3.0 mm.

PERFORMANCE CHARACTERISTICS

Compression Strain. The compression stress is based on the net area of the rotational element using the total overall diameter. The compression strain is measured as a percentage of the original thickness of the rotational element.

A load equal to 150% of the bearing’s design capacity shall first be applied to seat the bearing components. The 150% load shall then be gradually reduced, over a time period of 30 to 90 seconds, to a pre-load equal to 3% of the bearing’s design capacity. Each compression strain shall be recorded relative to the initial 3% pre-load deflection, one minute after the desired stress level has been reached, on dial indicators, at four locations 90° apart on the perimeter of the bearing.

The test results will be evaluated as follows:
• The bearing will be visually examined both during and after the test. Any resultant visual defects (such as extruded elastomer, damaged seals, or cracked steel) shall be cause for rejection
• Non-uniform compression deflections at a desired stress level shall be cause for rejection
• The compression strain of each bearing shall conform to the following requirements:

<table>
<thead>
<tr>
<th>Compression Stress (MPa)</th>
<th>Compression Strain, Max. %</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.9</td>
<td>5.0</td>
</tr>
<tr>
<td>13.8</td>
<td>8.5</td>
</tr>
<tr>
<td>20.7</td>
<td>11.0</td>
</tr>
<tr>
<td>27.6</td>
<td>13.2</td>
</tr>
<tr>
<td>35.0</td>
<td>16.0</td>
</tr>
</tbody>
</table>

Sliding Coefficient of Friction. For all guided and non-guided expansion disc-design bearings, the coefficients of friction shall be measured at the bearing’s design capacity, on the fifth and fiftieth cycles, at a sliding speed of 25 mm per minute.

The sliding coefficient of friction shall be calculated as the horizontal load required to maintain continuous sliding of one bearing, divided by the bearing’s design capacity vertical load. The vertical load shall have been applied continuously for a minimum of 12 hours prior to testing.

The test results will be evaluated as follows:
• The measured sliding coefficients of friction shall not exceed 75% of the maximum design coefficient of friction
• The bearing will be visually examined both during and after the test. Any resultant visual defects (such as bond failure, physical destruction, cold flow of PTFE, or damaged components) shall be cause for rejection.

Rotation. For all disc-design bearings, the polyether urethane element shall be capable of maintaining its initial uniform contact with the steel bearing plates throughout a rotation range of 0.02 radians under a compressive load equal to 150% of the design capacity of the bearing.

The test results will be evaluated as follows:
• The bearing will be visually examined both during and after the test. Any resultant visual defects shall be cause for rejection
• Continuous and uniform contact between the polyether urethane element and bearing plates, and between the sliding steel top and upper bearing plates shall be maintained for the duration of the test. Any observed “lift-off” shall be cause for rejection.

DRAWINGS. The Contractor shall submit detailed shop drawings, drawn by the Manufacturer only, in conformance with the applicable requirements of the New York State Steel Construction Manual, for approval by the Regional Director prior to the start of fabrication.

In addition to the above requirements, the Manufacturer shall note the following on the shop drawings.
• The total quantity of each kind of disc-design bearing required, i.e., fixed, guided expansion, or non-guided expansion, grouped first according to type (load range) and then by actual design capacity
• The thickness and plan area of the polyether urethane structural elements required
The maximum design coefficient of friction as noted on the Contract Plans
The type of PTFE sheet (filled or unfilled) and, if applicable, the type and amount (by weight) of filler
The type(s) of steel(s) to be used
If applicable, any welding process used in the bearing manufacture that does not conform to the approved processes of New York State Steel Construction Manual shall be clearly described and detailed
The location of the fabrication plant
The Manufacturer's name and the name of the manufacturer's representative who will be responsible for coordinating production, inspection, sampling and testing with the Materials Bureau.

The Contractor shall also provide the Materials Bureau with written notification thirty (30) days prior to the start of bearing fabrication. This notification shall include all of the information required by numbers 1 through 8 above. A copy of this notification shall be sent to the Regional Director.

**SAMPLING AND TESTING.** The manufacturer shall furnish the required number of samples to perform testing in accordance with Table 716-06-3.

**Lot Size.** Sampling, testing and acceptance consideration will be made on a lot basis. A lot shall be defined as those bearings presented for inspection at a specific time or date. A lot shall be further defined as the smallest number of bearings as determined by the following criteria:
- A lot shall not exceed a single contract or project quantity
- A lot shall not exceed 25 bearings
- A lot shall consist of those bearings that can be manufactured with polyether urethane rotation elements from one batch of polyether urethane material. The mass of one batch shall not exceed 205 kg
- A lot shall consist of those bearings of the same type, regardless of load capacity. Bearing types shall be fixed type bearings or expansion type bearings. Guided and non-guided expansion bearings will be considered as a single type.

**TABLE 716-06-3  DISC BEARING SAMPLING AND TESTING REQUIREMENTS**

<table>
<thead>
<tr>
<th>Test</th>
<th>Performed By</th>
<th>Samples Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotation</td>
<td>Manufacturer</td>
<td>One production bearing per lot1</td>
</tr>
<tr>
<td>Coefficient of Friction</td>
<td>Manufacturer</td>
<td>One production bearing per lot1</td>
</tr>
<tr>
<td>Compression Strain</td>
<td>Materials Bureau</td>
<td>Three production bearings per lot 2</td>
</tr>
<tr>
<td>Physical Properties Polyether</td>
<td>Materials Bureau</td>
<td>One 250 x 375 mm sheet of polyether urethane material (thickness of 1.5 to 3.0 mm) per lot3</td>
</tr>
<tr>
<td>Urethane Rotational Element (except compression set)</td>
<td>Materials Bureau</td>
<td>One 100 x 100 mm sheet of polyether urethane material, molded or cut to the thickness requirements of ASTM D395, Method B.4</td>
</tr>
<tr>
<td>Compression Set of Polyether Urethane Rotation Element</td>
<td>Materials Bureau</td>
<td>One 250 x 375 mm sheet of polyether urethane material per lot 5</td>
</tr>
<tr>
<td>Physical Properties PTFE Sheet</td>
<td>Materials Bureau</td>
<td>One 250 x 375 mm sheet of polyether urethane material per lot 5</td>
</tr>
</tbody>
</table>

**NOTES:**
1. Sample production bearings of such size that cannot be tested by the manufacturer at 150% design capacity for rotation shall be tested at actual design capacity. Bearings which are tested at actual design capacity will be tested at that capacity because it is not possible, or not practical in the Department's opinion to test them at a higher capacity. Therefore, bearings tested at 150% design capacity which are rejected, will not be retested below 150% design capacity for the purpose of rendering such bearings acceptable. Sample production bearings that cannot be tested by the manufacturer at their actual design capacity for rotation and/or friction shall be tested by an outside laboratory selected by the Materials Bureau. The Manufacturer shall assume the cost of this testing and submit the certified test results to the Materials Bureau.
2. Bearings with load capacities greater than 2650 kN will be tested by an outside laboratory approved by the Materials Bureau. The Department will assume the cost of this testing. The Contractor shall be responsible for transportation, scheduling and related costs. All bearings will be made available for return to the Contractor.
3. All submitted sample sheets of polyether urethane material shall be certified by the bearing manufacturer as having been taken from the same batch of polyether urethane material as was used in the actual production bearings.

4. The manufacturer shall have the option of supplying four (4) die cut specimens in accordance with ASTM D-395, Method B. All submitted specimens of polyether urethane material shall be certified by the bearing manufacturer as having been taken from the same batch of polyether urethane material as was used in the actual production bearings.

5. Single sheets of PTFE Material from which the bearing has been fabricated may be submitted to the Materials Bureau for consideration of multiple lot acceptance, provided that the thickness of the material does not vary from lot to lot. All submitted sample sheets shall be certified by the bearing manufacturer as having been taken from the same batch of PTFE material as was used in the actual production bearings.

**Schedule.** The manufacturer shall complete the required testing and determine compliance with this specification before submitting the lot(s) for inspection, sampling and acceptance consideration.

A minimum of thirty (30) days shall be allowed for the Department's inspection, sampling and testing of production bearings and component materials.

**Sampling Method.** The manufacturer shall select, at random, the required sample bearing(s) from the completed lots of bearings for testing by the manufacturer.

The Department's representative shall select, at random, the required sample bearing(s) from completed lots of bearings, and samples of the polyether urethane and the PTFE materials for testing by the Materials Bureau. All samples shall be taken in accordance with the Department's written instructions.

**Finish and Accessories.** All exterior surfaces of sampled production bearings shall be smooth and free from irregularities or protrusions that might interfere with testing procedures.

Bearings with tapered sole plates which are selected for testing by the Materials Bureau, shall be delivered to the test site accompanied by a single unattached matching beveled plate. This plate shall be made of the same material and be the same size and thickness as the tapered plate. Additionally, the single beveled plate shall be made so constructed that when placed in contact with the tapered sole plate the two shall form a single body, rectangular in shape and uniform in thickness.

**Shipping Costs.** The Contractor shall assume the cost of transporting all samples from the place of manufacture to the Materials Bureau and return, or, if applicable, to the project site.

**BASIS OF ACCEPTANCE.** Bearings will be considered for acceptance in project lot quantities, or portions thereof, at the manufacturing site in accordance with the procedural directives of the Materials Bureau.

**716-07 POT-DESIGN STRUCTURAL BRIDGE BEARINGS**

**SCOPE.** This specification covers the material requirements for pot-design structural bridge bearings. Bearings furnished under this specification shall adequately provide for the thermal expansion and contraction, rotation, camber changes, and creep and shrinkage of structural members, where applicable.

**GENERAL.** Pot-design structural bridge bearings shall be supplied as fixed bearings; guided expansion bearings; and non-guided expansion bearings as designated by the Contract Documents.

**Fixed Bearings.** Fixed bearings shall allow rotation but no longitudinal or transverse movement in the bearing plane. Fixed bearings shall consist of an elastomeric rotational element, confined and sealed by a steel piston and steel base pot.

**Guided Expansion Bearings.** Guided expansion bearings shall allow rotation and longitudinal movement in the bearing plane; transverse movement shall be restricted. Guided expansion bearings shall consist of an elastomeric rotational element, confined and sealed by a steel piston and steel base pot. To allow longitudinal movement, the upper surface of the steel piston shall be faced with polytetrafluoroethylene (PTFE) sheet and support a sliding steel top bearing plate. The mating surface of the sliding steel bearing plate shall be faced with polished stainless steel. To restrict transverse movement, either a guide bar or keyway system shall be used. If required, the guide bar or keyway systems and their mating steel surfaces shall be faced with strips of either PTFE or PTFE-stainless steel.
Non-Guided Expansion Bearings. Non-guided expansion bearings shall allow rotation, longitudinal, and transverse movement in the bearing plane. Non-guided expansion bearings shall consist of an elastomeric rotational element, confined and sealed by a steel piston and steel base pot. To allow longitudinal and transverse movement, the upper surface of the steel piston shall be faced with polytetrafluoroethylene (PTFE) sheet and support a sliding steel top bearing plate. The mating surface of the sliding steel bearing plate shall be faced with polished stainless steel.

MATERIAL REQUIREMENTS. All material shall be new and unused, with no reclaimed material incorporated in the finished bearing.

Elastomeric Rotational Element. The elastomeric rotational element used in the construction of pot-design bearings shall contain only virgin crystallization resistant polychloroprene (neoprene) or virgin natural polyisoprene (natural rubber) as the raw polymer. The physical properties of neoprene and natural rubber used in these bearings shall conform to ASTM or AASHTO requirements, with modifications as noted, in Table 716-07-1.

<table>
<thead>
<tr>
<th>Elastomeric Compound</th>
<th>ASTM Requirement</th>
<th>AASHTO Standard Specifications for Bridge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neoprene</td>
<td>D2000, Line Call Out</td>
<td>Section 2.25.2, Materials, 50</td>
</tr>
<tr>
<td></td>
<td>M2BC517A14B34</td>
<td>Durometer Hardness.</td>
</tr>
<tr>
<td>Natural Rubber</td>
<td>D2000, Line Call Out</td>
<td>Section 2.25.2, Materials, 50</td>
</tr>
<tr>
<td></td>
<td>M4AA517A13B33</td>
<td>Durometer Hardness.</td>
</tr>
</tbody>
</table>

NOTES:
1. The Shore A Durometer hardness shall be 50±10 points.
2. Samples for compression set tests shall be prepared using a Type 2 die. The compression set of the neoprene specimens shall not exceed 35%. The compression set of the natural rubber specimens shall not exceed 25%.
3. For the purpose of determining conformance with these specifications, an observed or calculated value shall be rounded off to the nearest 10 kPa for tensile strength, to the nearest 10% for elongation, and to the nearest 1% for the change in aged tensile and aged elongation. Hardness and aged hardness shall be rounded off to the nearest point.

Sealant. If used, the type of sealant between the steel base pot and the top steel bearing plate shall be as recommended by the Manufacturer.

Sealing Rings. The sealing rings between the steel piston and the elastomeric rotational element shall be brass formed to the size recommended by the Manufacturer.

Steel. All steel except stainless steel components of the bearing shall conform to the requirements of the type of steel designated on the Contract Plans and applicable provisions of the New York State Steel Construction Manual (When the SCM requires DCES approval, delete the term “DCES” and replace it with “the Regional Director.”).

Stainless Steel. Stainless steel shall conform to the requirements of ASTM A167, or ASTM A240, Type 304. Stainless steel in contact with PTFE sheet shall be polished to a No. 8. bright mirror finish. The minimum thickness of the stainless steel shall be 1.25 mm.

Polytetrafluoroethylene Sheet and Strip. Polytetrafluoroethylene (PTFE) sheet and strip shall be manufactured from pure virgin (not processed) unfilled TFE resin; or from TFE resin uniformly blended with either 15% glass fiber or 25% carbon (maximum filler, percent by weight).

PTFE sheet shall be bonded to or recessed into its steel substrate. Bonded PTFE sheet shall be etched on its bonding side, and shall have a minimum thickness of 1.6 mm. Recessed PTFE sheet shall have a minimum thickness of 3.0 mm and be recessed for at least one-half its thickness into its steel substrate. The surface of filled PTFE sheet in contact with stainless steel shall be polished or burnished to insure smooth and low friction movement of the bearing.
Finished PTFE sheet and strip shall be resistant to all acids, alkalis and petroleum products, stable at temperatures from -215°C to +260°C, non-flammable, non-absorbing of water, and shall conform to the physical requirements of Table 716-07-2.

<table>
<thead>
<tr>
<th>Physical Property</th>
<th>ASTM Test Method</th>
<th>Unfilled</th>
<th>Filled 15% Glass</th>
<th>Filled 25% Carbon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultimate Tensile Strength, MPa</td>
<td>D638M</td>
<td>19.3</td>
<td>13.8</td>
<td>9.0</td>
</tr>
<tr>
<td>Ultimate Elongation, %</td>
<td>D638M</td>
<td>200</td>
<td>150</td>
<td>75</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>D792</td>
<td>2.13</td>
<td>2.18</td>
<td>2.05</td>
</tr>
</tbody>
</table>

**FABRICATION.** The finish of the mold used to produce the elastomeric rotational elements shall conform to good machine shop practices. Every bearing shall have the Contract D#, Project Identification Number, NYSDOT Lot Number and individual bearing number indelibly marked with ink on a side that will be visible after erection.

The PTFE shall be bonded to its grit blasted steel substrate using an epoxy resin adhesive under controlled factory conditions in accordance with the instructions of the adhesive manufacturer. Alternately, the PTFE sheet may be recessed into its steel substrate for one-half its thickness. The bearing manufacturer shall have the option of bonding recessed PTFE sheet.

All steel surfaces exposed to the atmosphere, except stainless steel surfaces and metal surfaces to be welded shall be shop painted with one coat of coal-tar epoxy. Coal-tar epoxy paint shall meet the requirements of SSPC Paint Specification No. 16, and be applied at a minimum wet film thickness of 0.25 mm. Prior to painting, the exposed steel surfaces shall be cleaned with the recommendations of the coating's manufacturer. Metal surfaces to be welded shall be given a coat of clear lacquer, or other protective coating approved by the Engineer, if exposure is to exceed three months prior to welding. The coating shall be removed at the time of welding.

Except as noted, all bearing surfaces of steel plates shall be finished or machined flat within 0.25 mm. Out-of-flatness greater than 0.25 mm on any plate shall be cause for rejection. The bottom surface of lower bearing plates (masonry plates) designed to rest on bearing pads shall not exceed an out-of-flatness value of 1.6 mm. Oxygen cut surfaces shall not exceed a surface roughness value of 25 µm, as defined by ANSI B46.1. Repair, when necessary shall conform to the requirements of the New York State Steel Construction Manual.

The steel base pot of all bearings shall be either integrally machined or continuously welded to its bottom steel masonry plate. Unless otherwise approved by the Regional Director, all welding shall conform to, and all welders shall be qualified in accordance with, the requirements of the New York State Steel Construction Manual (When the SCM requires DCES approval, delete the term “DCES” and replace it with “the Regional Director.”).

Gross bearing dimensions shall have a tolerance of -0, +3.0 mm.

**PERFORMANCE CHARACTERISTICS**

**Sliding Coefficient of Friction.** For all guided and non-guided expansion type pot-design bearings, the sliding coefficients of friction shall be measured at the bearing's design capacity, on the fifth and fiftieth cycles, at a sliding speed of 25 mm per minute.

The sliding coefficient of friction shall be calculated as the horizontal load required to maintain continuous sliding of one bearing, divided by the bearing's design capacity vertical load. The vertical load shall have been applied continuously for a minimum of 12 hours prior to testing.

The test results will be evaluated as follows:

- The measured sliding coefficients of friction shall not exceed 75% of the maximum design coefficient of friction
- The bearing will be visually examined both during and after the test. Any resultant visual defects (such as bond failure, physical destruction, cold flow of PTFE, or damaged bearing components) shall be cause for rejection.
Rotation. For all pot-design bearings, the elastomeric rotational element shall be capable of maintaining its initial uniform contact with the steel piston and steel base pot throughout a rotation range of 0.02 radians, under a compressive load equal to 150% of the design capacity of the bearing.

The test results will be evaluated as follows:

- The bearing will be visually examined both during and after the test. Any resultant defects shall be cause for rejection
- The sole plate, top bearing plate, and steel piston shall maintain continuous and uniform contact for the duration of the test. Any observed “lift-off” will be cause for rejection.

DRAWINGS. The Contractor shall submit detailed shop drawings, drawn by the Manufacturer only, in conformance with the applicable requirements of the New York State Steel Construction Manual, for approval by the Regional Director prior to the start of the fabrication. (When the SCM requires DCES approval, delete the term “DCES” and replace it with “the Regional Director.”).

In addition to the above requirements, the Manufacturer shall note the following on the shop drawings.

- The total quantity of each kind of pot-design bearing required, (i.e. fixed, guided expansion, or non-guided expansion), grouped first according to type (load range) and then by actual design capacity
- The thickness and plan area of the elastomeric rotational elements and the internal diameters of the steel base pots required
- The maximum design coefficient of friction as noted on the Contract Plans
- The type of PTFE sheet (filled or unfilled) and, if applicable, the type and amount (by weight) of filler
- The type(s) of steel(s) to be used
- If applicable, any welding process used in the bearing manufacture that does not conform to the approved processes of the New York State Steel Construction Manual shall be clearly described and detailed. (When the SCM requires DCES approval, delete the term “DCES” and replace it with “the Regional Director.”).
- The location of the fabrication plant
- The Manufacturer's name and the name of the manufacturer's representative will be responsible for coordinating production, inspection, sampling and testing with the Materials Bureau.

The Contractor shall also provide the Materials Bureau with written notification thirty (30) days prior to the start of the bearing fabrication. This notification shall include all of the information required by numbers 1 through 8 above. A copy of this notification shall be sent to the Regional Director.

SAMPLING AND TESTING

Lot Size. Sampling, testing and acceptance consideration will be made on a lot basis. A lot shall be defined as the smallest number of bearings as determined by the following criteria:

- A lot shall not exceed a single contract or project quantity
- A lot shall not exceed 25 bearings
- A lot shall consist of those bearings of the same type, regardless of load capacity. Bearing types shall be fixed type bearings or expansion type bearings. Guided and non-guided expansion bearings will be considered a single type.

Sampling and Testing Requirements. The manufacturer shall furnish the required number and size of samples to perform testing in accordance with Table 716-07-3.

A minimum of thirty (30) days shall be allowed for the Department's inspection, sampling and testing of production bearings and component materials.

All exterior surfaces of sampled production bearings shall be smooth and free from irregularities or protrusions that might interfere with testing procedures.

The manufacturer shall select, at random, the required sample bearing(s) from completed lots of bearings for testing by the manufacturer. The manufacturer shall complete the required testing and determine compliance with this specification before submitting the lot(s) for inspection, sampling and acceptance consideration.

The Department's representative shall select, at random, samples of elastomeric and PTFE materials for testing by the Materials Bureau. All samples shall be taken in accordance with the Department's
The Contractor shall assume the cost of transporting all samples from the place of manufacture to the Materials Bureau and return, or, if applicable, to the project site.

<table>
<thead>
<tr>
<th>Test</th>
<th>Performed By</th>
<th>Samples Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotation</td>
<td>Manufacturer</td>
<td>One production bearing per lot¹</td>
</tr>
<tr>
<td>Coefficient of Friction</td>
<td>Manufacturer</td>
<td>One production bearing per lot¹</td>
</tr>
<tr>
<td>Physical Properties of Elastomeric</td>
<td>Materials Bureau</td>
<td>One Elastomeric element per lot²</td>
</tr>
<tr>
<td>Rotational Element</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical Properties of PTFE Sheet</td>
<td>Materials Bureau</td>
<td>One 250 x 375 mm sheet of polyether urethane material per lot³</td>
</tr>
</tbody>
</table>

NOTES:
1. Sample production bearings of such size that cannot be tested by the manufacturer at 150% design capacity for rotation shall be tested at actual design capacity. Bearings which are tested at actual design capacity will be tested at that capacity because it is not possible, or not practical in the Department's opinion to test them at a higher capacity. Therefore, bearings tested at 150% design capacity which are rejected, will not be retested below 150% design capacity for the purpose of rendering such bearings acceptable. Sample production bearings that cannot be tested by the manufacturer at their actual design capacity for rotation and/or friction shall be tested by an outside laboratory selected by the Materials Bureau. The Manufacturer shall assume the cost of this testing and submit the certified test results to the Materials Bureau.
2. At the time of sampling the Department representative shall remove an elastomeric rotational element from a production bearing (not from a bearing that requires compressive strain testing) and forward it to the Materials Bureau for test. This testing will be destructive and the manufacturer shall, at the cost of the manufacturer, replace the sample elastomeric element.
3. The sample sheet of PTFE material shall be certified by the Manufacturer as having been taken from the same batch of material as was used in the actual production bearings.

BASIS OF ACCEPTANCE. Bearings will be considered for acceptance in project lot quantities, or portions thereof, at the manufacturing site in accordance with the procedural directives of the Materials Bureau.

716-08 AND 716-09 (VACANT)

716-10 PLAIN ELASTOMERIC BRIDGE BEARINGS

SCOPE. This specification covers the material requirements for plain elastomeric bridge bearings. Bearings furnished under this specification shall be adequate for the specified design load, and provide for the thermal expansion and contraction, rotation, camber changes, creep, and shrinkage of structural members.

GENERAL. Plain elastomeric bridge bearings (Type EP bearings) are composed entirely of elastomeric material. They may be used for both fixed and expansion applications without changes in details. The bearings will accommodate longitudinal, transverse, and rotational movements.

MATERIAL REQUIREMENTS. All materials shall be new with no reclaimed material incorporated in the finished bearing. The elastomeric compound used in the construction of these bearings shall contain only virgin crystallization resistant polychloroprene (neoprene) or virgin natural polyisoprene (natural rubber) as the raw polymer. The resulting product shall be free of porous areas, weak sections, bubbles, foreign matter, or other defects affecting serviceability. The physical properties of the cured elastomeric compound shall meet the requirements of Table 716-10-1.

The manufacturer shall certify that the elastomeric compound passes Grade 3 Low - Temperature Brittleness as determined by ASTM D746 - Brittleness Temperature of Plastics and Elastomers by Impact Procedure B.

DRAWINGS. Shop drawings are not required for Type EP bearings.

FABRICATION. The finish of the mold used to produce these bearings shall conform to good machine shop practice. Each bearing shall be marked in indelible ink or flexible paint. The marking
shall consist of the manufacturer's name and location. The marking shall be placed on at least one side or face that will be visible after erection and, if possible, on two sides or faces.

**TABLE 716-10-1  PROPERTIES OF ELASTOMERIC MATERIAL**

<table>
<thead>
<tr>
<th>PHYSICAL PROPERTIES:</th>
<th>ASTM TEST METHOD</th>
<th>REQUIREMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile Strength, Min., (MPa)</td>
<td>D412</td>
<td>NEOPRENE</td>
</tr>
<tr>
<td>Ultimate Elongation, Min., (%)</td>
<td>D412</td>
<td>NATURAL RUBBER</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>REQUIREMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEOPRENE</td>
</tr>
<tr>
<td>NATURAL RUBBER</td>
</tr>
</tbody>
</table>

**TABLE 716-10-1-1  PROPERTIES OF ELASTOMERIC MATERIAL**

<table>
<thead>
<tr>
<th>Tensile Strength, Min., (MPa)</th>
<th>NEOPRENE</th>
<th>NATURAL RUBBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.8</td>
<td>13.8</td>
<td></td>
</tr>
</tbody>
</table>

**TABLE 716-10-2  BEARING TOLERANCES**

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Vertical</td>
<td>-0, +3 mm</td>
</tr>
<tr>
<td>Overall Horizontal</td>
<td>-0, +6 mm</td>
</tr>
<tr>
<td>Position of Holes and Slots centerline</td>
<td>±1.6 mm from centerline</td>
</tr>
<tr>
<td>Size of Holes, Slots and Internal Steel Plates</td>
<td>-0, +1.6 mm</td>
</tr>
</tbody>
</table>

**NOTES:**
1. Tolerances for samples cut from finished parts have already been applied to each of these requirements. No greater tolerances will be allowed.
2. For the purpose of determining conformance with these specifications, an observed or calculated value shall be rounded off to the nearest 0.10 MPa for tensile strength and to the nearest 10% for elongation.

The bearings shall be cast in a mold under pressure and heat to the specified thickness. They may be molded and vulcanized in large sheets and cut to size. Cutting shall not heat the material, and the finish produced shall be equal to a surface roughness average of 6.3 µm as defined by ANSI B46.1. A type EP bearing that has been cut from a larger piece of material and fabricated to the finished size by bonding or plying smaller pieces together will not be acceptable.

**Bearing Tolerances.** Finished elastomeric bearings shall conform to the design dimensions, with the tolerances listed in Table 716-10-2.

**PERFORMANCE CHARACTERISTICS**

**Compression Deflection.** The compression deflection of each bearing shall not exceed 10.0% of the design effective rubber thickness at a compressive load equal to the actual design load.

The compression deflection shall be determined by loading the bearings to 3.4 MPa and 5.5 MPa. At each load a deflection reading will be taken and the readings used to calculate the slope between the two loads. The slope shall then be used to determine the deflection at the bearing's design load.

The bearing and ambient temperature shall be 23°C ± 2°C at the time of testing.

**NOTE:** For conformance to this specification an observed or calculated value shall be rounded off (ASTM E29) to the nearest 0.1% for compression deflection.

**BASIS OF ACCEPTANCE.** Acceptance of this material will be based upon the manufacturer’s name appearing on the Department’s Approved List for Elastomeric Bridge Bearings, and a manufacturer’s certification stating conformance with these specifications.

**716-11 STEEL LAMINATED ELASTOMERIC BRIDGE BEARINGS**

**SCOPE.** This specification covers the material requirements for steel laminated elastomeric bridge bearings without external load plates. Bearings furnished under this specification shall be adequate for the specified design load, and provide for the thermal expansion and contraction, rotation, camber changes, creep, and shrinkage of structural members.
§716

GENERAL. Steel laminated elastomeric bridge bearings (Type EL bearings) are composed of multiple layers of elastomeric material separated by steel plates. They may be used for both fixed and expansion applications without changes in details. The bearings will accommodate longitudinal, transverse, and rotational movements.

Elastomeric bridge bearings shall be designed in accordance with New York State Standard Specifications for Highway Bridges.

MATERIALS REQUIREMENTS. All materials shall be new with no reclaimed material incorporated in the finished bearing.

Elastomeric Material. The elastomeric compound used in the construction of these bearings shall contain only virgin crystallization resistant polychloroprene (neoprene) or virgin natural polyisoprene (natural rubber) as the raw polymer. The resulting product shall be free of porous areas, weak sections, bubbles, foreign matter, or other defects affecting serviceability. The physical properties of the cured elastomeric compound shall be determined by using samples taken from bearings and shall meet the requirements of Table 716-10-1.

The manufacturer shall certify that the elastomeric compound passes Grade 3 Low-Temperature Brittleness as determined by ASTM D746 - Brittleness Temperature of Plastics and Elastomers by Impact Procedure B.

Internal Steel Plates. Steel plates for internal laminates shall be rolled mild steel conforming to the requirements of ASTM A36M, ASTM 1008/A 1008/M or ASTM 1011/A 1011/M (Grade 33, 36, and 40).

DRAWINGS. Shop drawings are not required for Department approval unless a change in the details shown on the plans is proposed. When Department approved shop drawings are required, they shall be furnished in accordance with the Steel Construction Manual (SCM), Section 2, except that in place of two sets of Department approved drawings submitted to the designated Shop Inspection Agency, five sets of Department approved drawings shall be submitted to the Materials Bureau. The Contractor shall submit one copy of these drawings to the Engineer.

When the bearing details are identical to the plans, the Contractor shall be responsible for supplying shop drawings prepared by the Manufacturer. The Manufacturer shall certify that the bearings depicted on the drawings are in conformance with the contract documents. The Contractor shall submit one copy of the certified drawings to the Engineer and five copies of their certified drawings to the Materials Bureau. The Department's acceptance procedures will commence subsequent to receipt of these drawings. The Manufacturer shall note the following on all shop drawings:

- The Contract number, bridge identification number (BIN), feature carried/feature crossed, specification pay item no. and the type, size and quantity of bearings being produced.
- The design load (dead load plus live load) for each type and size bearing. If bearings of the same type and size are designed for differing load conditions the maximum design load shall be noted.
- The effective rubber thickness, typical laminate thickness, compressive area, shear area and shape factor.
- The Manufacturer's name, the location of the fabrication plant and the name and phone number of the Manufacturer's representative who will coordinate production, inspection, and sampling and testing with the Materials Bureau.
- The specification reference and grade of steel used.

FABRICATION. The finish of the mold used to produce these bearings shall conform to good machine shop practice. Each bearing shall be marked in indelible ink or flexible paint. The marking shall consist of the manufacturer's name, contract number, lot number, and individual bearing number. The marking shall be placed on at least one side or face that will be visible after erection and, if possible, on two sides or faces.

Type EL bearings shall be cast as a single unit in a mold and bonded and vulcanized under pressure and heat to the specified size and thickness. The internal steel plate(s) shall be commercially blast cleaned to a condition matching that of SSPC-Vis1, Pictorial Standards A SP6, B SP6 or C SP6, and cleaned of all oil or grease before bonding.
**Bearing Tolerances.** Finished elastomeric bearings shall conform to the design dimensions, with the tolerances listed in Table 716-11 and the following details:

<table>
<thead>
<tr>
<th>TABLE 716-11 BEARING TOLERANCES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dimension</strong></td>
</tr>
<tr>
<td>Overall Vertical</td>
</tr>
<tr>
<td>Overall Horizontal</td>
</tr>
<tr>
<td>Position of Holes and Slots centerline</td>
</tr>
<tr>
<td>Size of Holes, Slots and Internal Steel Plates</td>
</tr>
<tr>
<td>Edge Cover over External Steel Plates</td>
</tr>
<tr>
<td>Bedding Surface (Top and Bottom) Over Internal Steel Plates</td>
</tr>
</tbody>
</table>

**NOTES:**
1. No edge cover will be required over internal details that will not be exposed after erection (i.e.- vertical holes covered by bearing seats or flanges).
2. For 716-12, With external load plate(s) there shall be an effective rubber laminate between the load plate(s) and internal steel plate(s).

**A. Internal Steel Plates.** The internal steel plates shall be checked for parallelism by measuring the distance between each individual steel plate, and between the top or bottom edge of the bearing to the first adjacent steel plate. For rectangular bearings, take measurements for each plate along the vertical surface of the bearing, located 25 mm from the edge of the four alternate corners. For round bearings, measurements will be taken at four points located at 90° intervals around the perimeter. The smallest of the four measurements shall be recorded for each plate. The cumulative total of these measurements shall not be less than 75% of the design effective rubber thickness.

**B. Elastomeric Laminae.** The average thickness of individual layers of elastomer in steel laminated elastomeric bearings shall not vary more than ±20% of the design thickness and in no case exceed the design thickness by 3 mm. Average thickness will be calculated from measurements taken at four points, located at 25 mm from the edge of the four alternate corners for rectangular bearings and at 90° intervals around the perimeter for round bearings.

**PERFORMANCE CHARACTERISTICS**

**Compression Deflection.** The compression deflection of each bearing shall not exceed 10.0% of the design effective rubber thickness at a compressive load equal to the actual design load.

The compression deflection shall be determined by loading the bearings to 3.4 MPa and 5.5 MPa. At each load a deflection reading will be taken and the readings used to calculate a slope between the two loads. The slope shall then be used to determine the deflection at the bearing's design load.

The bearing and ambient temperature shall be 23° ± 2°C at the time of testing.

**Adhesion.** The adhesion of the elastomer to the internal plates shall be demonstrated by subjecting the bearing to a compressive load equal to 150% of the actual design load. Upon visual examination, the bearing shall be free of visual defects.

The bearing and ambient temperature shall be 23° ± 2°C at the time of testing.

**NOTE:** For conformance to this specification an observed or calculated value shall be rounded off (ASTM E29) to the nearest 0.1% for compression deflection.

**SAMPLING AND TESTING**

**Lot Size.** Sampling, testing and acceptance consideration will be made on a lot basis. A lot shall be defined as those bearings presented for inspection at a specific time or date. A lot shall be further defined as the smallest number of bearings as determined by the following criteria:
• A lot shall not exceed a single contract quantity.
• A lot shall consist of bearings with the elastomer being of the same dimensions and configuration.
• A lot shall consist of bearings produced in a continuous manner.

Procedure. The Department's representative shall select at random the required sample bearings from completed lots of bearings for testing by the Materials Bureau. Bearings with a plan area of less than 0.4 m² shall be tested for performance characteristics by the Materials Bureau. Bearings with a plan area greater than 0.4 m² shall be tested by an outside laboratory approved by the Materials Bureau. The Department shall assume the cost of testing the sampled bearings and the Contractor shall assume the responsibility and cost of transporting the sampled bearings from the place of manufacture to the testing laboratory. After testing, the Contractor has the responsibility for the cost of transporting the sampled bearings back to the bearing manufacturer or, if applicable, to the project site. All samples shall be taken and delivered for tests in accordance with the Department's written instructions. A minimum of thirty (30) days shall be allowed for inspection, sampling and testing by the Materials Bureau. This thirty days is exclusive of shipping time which is the Contractor's responsibility. The sampling procedure and test methods may be obtained from the Materials Bureau.

BASIS OF ACCEPTANCE. Acceptance of this material will be based on the manufacturer's name appearing on the Department's Approved List for Elastomeric Bridge Bearings and in accordance with the procedural directives of the Materials Bureau.

716-12 ELASTOMERIC BRIDGE BEARINGS WITH EXTERNAL LOAD PLATES

SCOPE. This specification covers the material requirements for elastomeric bridge bearings with external load plates. Bearings furnished under this specification shall be adequate for the specified design load, and provide for the thermal expansion and contraction, rotation, camber changes, and creep and shrinkage of structural members.

GENERAL. Elastomeric bridge bearings with external load plates (Type EB bearings) are composed of either plain elastomeric or laminated elastomeric bearings with external steel load bearing plates. The steel load bearing plates are bonded to the elastomer by vulcanization during the primary molding process. These bearings may be used for both fixed and expansion applications with appropriate changes in details, as shown on the contract plans. The bearings will accommodate longitudinal, transverse, and rotational movements.

Elastomeric bridge bearings with external load plates shall be designed in accordance with New York State Standard Specifications for Highway Bridges.

MATERIALS REQUIREMENTS. All materials shall be new with no reclaimed material incorporated in the finished bearing.

Elastomeric Material. The elastomeric compound used in the construction of these bearings shall contain only virgin crystallization resistant polychloroprene (neoprene) or virgin natural polyisoprene (natural rubber) as the raw polymer. The resulting product shall be free of porous areas, weak sections, bubbles, foreign matter, or other defects affecting serviceability. The physical properties of the cured elastomeric compound shall be determined by using samples taken from bearings and shall meet the requirements of Table 716-10-1.

The manufacturer shall certify that the elastomeric compound passes Grade 3 Low - Temperature Brittleness as determined by ASTM D746 - Brittleness Temperature of Plastics and Elastomers by Impact Procedure B.

Internal Steel Plates. Steel plates for internal laminates shall be rolled mild steel conforming to the requirements of ASTM A36M, or ASTM 1008/A 1008/M ASTM 1011/A 1011/M (Grade 33, 36 and 40).

External Load Bearing Plates and Steel Backing Plates. External load bearing plates shall conform to the requirements of ASTM A36M and to the requirements of the Steel Construction Manual (SCM), unless otherwise provided for in the contract documents.
Except as noted, all bearing surfaces of external load plates shall be finished or machined flat within 0.25 mm. Out-of-flatness greater than 0.25 mm on any plate, except the bottom surface of the lower external plates (masonry plates), shall be cause for rejection. The bottom surface of lower external load plates (masonry plates) shall not exceed an out-of-flatness value of 1.6 mm. Oxygen cut surfaces shall not exceed a surface roughness average of 25μm as defined by ANSI B46.1. Repairs shall conform to the requirements of the SCM.

External load bearing plate surfaces to be welded shall be painted with one coat of lacquer or other protective coatings approved by the Director of the Materials Bureau. This coating shall be removed before welding. All surfaces shall be cleaned and painted in accordance with §572, Structural Steel Paint System, Shop Applied. Color shall match that of the finish coat of other structural steel. For bearing used in conjunction with unpainted steel, the finish coat shall match “Weathered Brown” as defined by 708-05 Standard Paint Colors.

**DRAWINGS.** Department approval of shop drawings are not required unless a change in the details shown on the plans is proposed. When Department approved drawings are required, they shall be furnished in accordance with SCM, Section 2, except that in place of two sets of Department approved drawings submitted to the designated Shop Inspection Agency, five sets of Department approved drawings shall be submitted to the Materials Bureau. The Contractor shall submit one copy of these drawings to the Engineer.

When the bearing details are identical to the plans, the Contractor shall be responsible for supplying shop drawings prepared by the manufacturer. The manufacturer shall certify that the bearings depicted on the drawings are in conformance with the contract documents. The Contractor shall submit one copy of the certified drawings to the Engineer and five copies of their certified drawings to the Materials Bureau. The Department's acceptance procedures will commence subsequent to receipt of these drawings. The Manufacturer shall note the following on all shop drawings:

- The Contract number, bridge identification number (BIN), feature carried/feature crossed, specification pay item no. and the type, size and quantity of bearings being produced.
- The design load (dead load plus live load) for each type and size bearing. If bearings of the same type and size are designed for differing load conditions the maximum design load shall be noted.
- The effective rubber thickness, typical laminate thickness, compressive area, shear area and shape factor.
- The Manufacturer's name, the location of the fabrication plant and the name and phone number of the manufacturer's representative who will coordinate production, inspection, and sampling and testing with the Materials Bureau.
- The specification references and grades of steel to be used.
- All welding procedures to be used in the manufacture of the bearings.

**WELDING PROCEDURE.** The bearing manufacturer shall submit a Welding Procedure to the Deputy Chief Engineer Structures (DCES) for each welding process to be used in the manufacture of the bearings. No welding shall be performed until the manufacturer receives an approved Welding Procedure.

**FABRICATION.** The finish of the mold used to produce these bearings shall conform to good machine shop practice. Each bearing shall be marked in indelible ink or flexible paint. The marking shall consist of the manufacturer's name, contract number, lot number, and individual bearing number. The marking shall be placed on at least one side or face that will be visible after erection and, if possible, on two sides or faces.

The bearings shall be cast as a single unit in a mold and bonded and vulcanized under pressure and heat to the specified size and thickness. They shall be cast as a single unit with the external load plate(s) bonded to the elastomer by vulcanization during the primary molding process. If internal steel plate(s) are required, they shall be commercially blast cleaned to a condition matching that of SSPC-Vis1, Pictorial Standards A SP6, B SP6 or C SP6, and cleaned of all oil or grease before bonding.

During any welding, the temperature of the steel adjacent to the elastomer shall not exceed 90°C. Temperature shall be controlled by welding procedures and temperature indicating crayons,
or other devices approved by the Engineer. Unless otherwise approved by the DCES, all welding shall conform to, and all welders shall be qualified in accordance with the requirements of the SCM.

**Bearing Tolerances.** Finished elastomeric bearings shall conform to the design dimensions, with the tolerances listed in Table 716-11 and the following details:

**A. Internal Steel Plates.** The internal steel plates shall be checked for parallelism by measuring the distance between each individual steel plate, and between the top or bottom edge of the bearing to the first adjacent steel plate. For rectangular bearings, take measurements for each plate along the vertical surface of the bearing, located 25 mm from the edge of the four alternate corners. For round bearings, measurements will be taken at four points located at 90° intervals around the perimeter. The smallest of the four measurements shall be recorded for each plate. The cumulative total of these measurements shall not be less than 75% of the design effective rubber thickness.

**B. Elastomeric Laminae.** The average thickness of individual layers of elastomer in steel laminated elastomeric bearings shall not vary more than ±20% of the design thickness and in no case exceed the design thickness by 3 mm. Average thickness will be calculated from measurements taken at four points, located at 25 mm from the edge of the four alternate corners for rectangular bearings and at 90° intervals around the perimeter for round bearings.

**Performance Characteristics**

**Compression Deflection.** The compression deflection of each bearing shall not exceed 10.0% of the design effective rubber thickness at a compressive load equal to the actual design load. The compression deflection shall be determined by loading the bearings to 3.4 MPa and 5.5 MPa. At each load a deflection reading will be taken and the readings used to calculate a slope between the two loads. The slope shall then be used to determine the deflection at the bearing's design load.

The bearing and ambient temperature shall be $23^\circ \pm 2^\circ C$ at the time of testing.

**Adhesion.** The adhesion of the elastomer to the internal plates shall be demonstrated by subjecting the bearing to a compressive load equal to 150% of the actual design load. Upon visual examination, the bearing shall be free of visual defects.

The bearing and ambient temperature shall be $23^\circ \pm 2^\circ C$ at the time of testing.

**NOTE:** For conformance to this specification an observed or calculated value shall be rounded off (ASTM E29) to the nearest 0.1% for compression deflection.

**SAMPLING AND TESTING**

**Lot Size.** Sampling, testing and acceptance consideration will be made on a lot basis. A lot shall be defined as those bearings presented for inspection at a specific time or date. A lot shall be further defined as the smallest number of bearings as determined by the following criteria:

- A lot shall not exceed a single contract quantity
- A lot shall consist of bearings with the elastomer being of the same dimensions and configuration
- A lot shall consist of bearings produced in a continuous manner.

**Procedure.** The Department's representative shall select at random the required sample bearings from completed lots of bearings for testing by the Materials Bureau. The manufacturer shall supply the Department's representative with a copy of an approved Welding Procedure for each welding process used in the manufacture of the bearings. Bearings with a plan area greater than 0.4 m² shall be tested by an outside laboratory approved by the Materials Bureau. The Department shall assume the cost of testing the sampled bearings and the Contractor shall assume the responsibility and cost of transporting the sampled bearings from the place of manufacture to the testing laboratory. After testing the Contractor has the responsibility for the cost of transporting the sampled bearings back to the bearing manufacturer or, if applicable, to the project site. All
samples shall be taken and delivered for test in accordance with the Department's written instructions. A minimum of thirty (30) days shall be allowed for inspection, sampling and testing by the Materials Bureau. This thirty days is exclusive of shipping time which is the Contractor's responsibility. The sampling procedure and test methods may be obtained from the Materials Bureau.

BASIS OF ACCEPTANCE. Acceptance of this material will be based on the manufacturer's name appearing on the Department's Approved List for Elastomeric Bridge Bearings and in accordance with the procedural directives of the Materials Bureau.

SECTION 717 - CONCRETE PROTECTIVE COATINGS

717-01 AND 717-02 (VACANT)

717-03 PENETRATING TYPE PROTECTIVE SEALERS

SCOPE. This specification covers the material requirements of penetrating type protective sealers for use on portland cement concrete.

GENERAL. The material shall be a one component material consisting of a penetrating sealer which does not alter the color or texture of portland cement concrete.

MATERIAL REQUIREMENTS. Penetrating sealers shall be a one-part liquid, composed of a minimum of 40 percent (40%) silane or siloxane material, with no petroleum distillates. The Department will test the sealers as delivered, in accordance with Department written instructions, to ensure that the following properties are attainable. If the material attains these properties, the Department will place the material on its Approved List. The properties are:

Water Absorption. The final average percent water absorbed, for concrete coated with the protective sealer, shall not be greater than 20.0% of the final average percent water absorbed by the uncoated reference concrete.

Moisture Vapor Transmission. The final average percent moisture loss, for concrete coated with the protective sealer, shall not be less than 75.0% of its final average percent water absorption.

Chloride Ion Penetration. The final average absorbed chloride ion content, for concrete coated with the protective sealer, shall not be greater than 15.0% of the final average absorbed chloride ion content of the uncoated reference concrete.

Durability. The protective sealer shall not show any signs of weathering, discoloration, or deterioration after six (6) months of exposure to atmospheric conditions.

PACKAGING. All materials shall be packaged in strong, substantial containers. Each container shall be plainly marked with the following information: name of the product; name and address of Manufacturer; application instructions; lot/batch number; date of manufacture; quantity of material; and date of expiration or shelf life. The printed shelf life shall not exceed one year from the date of manufacture.

BASIS OF ACCEPTANCE. Acceptance of penetrating type sealers will be based upon the product appearing on the Department's Approved List, and the Manufacturer's certification that the material meets the requirements of this section. The shelf life of this material shall not exceed one year from the date of manufacture printed on the product label. The Department reserves the right to sample and test the material at its discretion.
§717

717-04 COATING TYPE PROTECTIVE SEALERS

SCOPE. This specification covers the material requirements of coating type protective sealers for use on portland cement concrete.

GENERAL. The coating system shall be either a single coating material or a primer coat followed by a top coat. After application, the sealer shall be opaque and uniform in color.

MATERIAL REQUIREMENTS. The Department will test the sealers as delivered, in accordance with Department written instructions, to ensure that the following properties are attainable. If the material attains these properties, the Department will place the material on its Approved List. The properties are:

Water Absorption. The final average percent water absorbed, for concrete coated with the protective sealer, shall not be greater than 25.0% of the final average percent water absorbed by the uncoated reference concrete.

Moisture Vapor Transmission. The final average percent moisture loss, for concrete coated with the protective sealer, shall not be less than 50.0% of its final average percent water absorption.

Chloride Ion Penetration. The final average absorbed chloride ion content, for concrete coated with the protective sealer, shall not be greater than 25.0% of the final average absorbed chloride ion content of the uncoated reference concrete.

Durability. The protective sealer shall not show any signs of weathering, discoloration, or deterioration after six (6) months of exposure to atmospheric conditions.

PACKAGING. All materials shall be packaged in strong, substantial containers. Each container shall be plainly marked with the following information: name of the product; name and address of Manufacturer; mix proportions (if applicable) and application instructions; lot/batch number; date of manufacture; quantity of material; and date of expiration or shelf life. The printed shelf life shall not exceed one year from the date of manufacture.

BASIS OF ACCEPTANCE. Acceptance of coating type sealers will be based upon the product appearing on the Department's Approved List, and the Manufacturer's certification that the material meets the requirements of this section. The shelf life of this material shall not exceed one year from the date of manufacture printed on the product label. The Department reserves the right to sample and test the material at its discretion.

SECTION 718 - PRESTRESSED CONCRETE UNITS

718-01 PRESTRESSED CONCRETE UNITS (STRUCTURAL)

SCOPE. This specification covers the material and fabrication requirements for prestressed concrete units.

GENERAL. Prestressed concrete units provided under this specification shall meet all design requirements for the structure for which they are being fabricated.

MATERIAL REQUIREMENTS

Concrete. The concrete shall meet the requirements of §501-2, under 501, Portland Cement Concrete, General, with the following modifications:

- Cement shall be either Type 1, Type 2 or Type 3. Only one type of cement shall be used to fabricate units for any one structure
- Coarse aggregate gradation shall be No. 1 Size or ASTM D448, No. 67
- Concrete requirements for Classes A and C concrete shall not apply
• Air content shall be 7 percent + 2 percent
• The use of calcium chloride, or an admixture containing calcium chloride will not be permitted.

Steel.

Bar Reinforcement 709-01
Wire Fabric 709-02
Chairs or other devices to ensure proper placement of steel items 556-2.02
Prestressing steel 709-06
Bearing plates, if required 715-01

Epoxy. Epoxy shall meet the requirements of §721-01, Epoxy Resin System; §721-03, Epoxy Polysulfide Grout, or §721-05, Epoxy Repair Paste.

Fine Aggregate. Fine aggregate shall meet the requirements of §703-03, Mortar Sand or §703-04, Grout Sand. Fine aggregate shall be absolutely dry.

DRAWINGS

Contract Drawings. Drawings which accompany the contract proposal are designated as contract drawings. These drawings are not intended to be working drawings.

Working Drawings. Complete and accurate drawings shall be made by the Contractor, indicating how each prestressed concrete unit is to be fabricated. The Contractor shall be responsible for modifying the dimensions of units to compensate for elastic shortening, shrinkage, grade correction and other phenomena that make in-process fabricating dimensions different from those shown on the contract drawings. Approval of the working drawings by the DCES shall not relieve the Contractor from the responsibility for the correctness of all dimensions shown on these drawings. These drawings shall be made as soon as possible after the award of contract and they shall be designated as working drawings.

A. Size and Type. Working Drawings shall be neatly drawn and clearly legible to produce microfilm negatives. The drawings shall be made in ink, or reproduced from the pencil drawings by a process subject to the approval of the DCES, on tracing cloth or mylar of acceptable quality. Working drawings shall be cut to a standard size of 560 mm x 860 mm (nominal) and arranged to conform to the contract drawings.

Failure to submit working drawings of the required size will be cause for their return without examination. The margin line shall be drawn 13 mm from the top, bottom, and right-hand edges and 50 mm from the left-hand edge to permit binding. A space 75 mm x 280 mm, and parallel to the length of the sheet shall be reserved in the lower right-hand corner for title and approval signature. Each working drawing shall have an identical (top right) corner box to the one shown on the contract drawings. The sheets shall be arranged so that, as far as possible, the notes will appear above each other near the right edge of the sheet.

B. Information Required on Working Drawings. The working drawings shall include the following information:
• Plan layout of superstructure indicating the piece mark assigned to each prestressed unit
• Fabricating plant production schedule
• Description of the fabricating plant, including any backup concrete mixing facilities, original design mix and proposed method of placement. Modifications or deviations from the original mix at any time after the working drawings have been approved, shall be submitted, in writing to the DCES
• Proposed admixture to be added to the concrete mix
• Quality control tests and procedures
• Method and outline of unit and cylinder curing procedure, as required by “Curing”
• The name of the manufacturer of the prestressing steel, including any alternate source
• Material and manner of sealing the exposed portions of the prestressing steel
• Transfer of prestress procedure for all unit types to be fabricated
• Complete details, including anticipated camber, tensioning force (initial and final), concrete strength (transfer and 28 day), and type and location of lifting device for all prestressed concrete units to be fabricated.
• Proposed method of handling and transporting prestressed concrete units to the project site
• Working drawings shall clearly indicate any proposed deviations from the prestressed concrete unit shown on the contract drawings
• Winter concreting procedures, if need is anticipated.

Submission of Working Drawings. When the working drawings, prepared by the Contractor, as specified, are completed, check prints shall be submitted to the DCES, who will indicate thereon such corrections as may be necessary to secure the completion of the contract in accordance with the requirements of the contract documents. The Contractor shall submit three sets of check prints for the DCES and two additional sets of check prints for each Railroad or other Agency involved with the contract. All sets of check prints shall be submitted to the DCES, who will make the distribution to the Railroad and other Agencies involved. One set of check prints or sepias with desired corrections indicated thereon in colored crayon or pencil, will be returned to the Contractor. When the revisions have been completed to the satisfaction of the DCES, the original drawings shall be forwarded to the DCES for written approval, after which a set of approved drawings will be returned. The original drawings shall remain the property of the State.

The DCES shall be allowed two work days for the examination of each drawing in a set of working drawings, or ten work days minimum per set. A set of working drawings shall be considered to be all drawings received by the DCES from any given Contractor for a particular contract on any calendar day. If the working drawings are detained for examination for a period longer than that previously stated, such detention will be taken into account when considering application by the Contractor for an extension of time for the completion of the contract. All working drawings are time and date stamped as they are received and recorded in a log at the office of the DCES. This log shall be the basis for determining when drawings must be returned without consideration for an adjustment of the completion date as described herein.

Approval of working drawings shall not constitute approval for the following information required on the working drawings 2B(3) and 2B(7). This data is required for information only.

FABRICATION

Approval of Working Drawings. No fabrication shall be started until after the working drawings have been approved and the Inspector has received prints made from the original drawings.

Data Required with Working Drawings. Data required by the DCES prior to approval of the working drawings shall be as follows:
• Calculations of strand elongation for each unique casting length (grip-to-grip)
• A calibration certificate indicating the load calibration of each gage and hydraulic jack combination used for tensioning. The gage shall be calibrated from zero, throughout its entire load range. The gage shall have clearly marked divisions that are easily readable at the initial and final tensioning force. The calibration date of each combination gage and hydraulic jack shall be within the 12 month period immediately prior to the start of the work.
• A calibration certificate attesting to the fact that the concrete cylinder testing machine to be used has been calibrated within the 12 month period immediately prior to the first date of actual use of the machine.

Data for Inspector. Data required to be submitted to the Inspector for approval prior to the inclusion of the respective materials in the unit, shall be as follows:
A. Prestressing Steel Certification. A certificate from the prestressing steel manufacturer stating that the prestressing steel has been manufactured in accordance with §709-06.

B. Load-Strain Curves. Typical load-strain curves made during the processing of steel from which the elongation appropriate to the required prestressing force can be determined, including the following information:
- The breaking strength
- The elongation at rupture
- The load at one percent elongation
- The test dates

The aforesaid information shall be submitted to the Inspector, in triplicate, for each 20 metric ton lot, or fraction thereof, of prestressing steel.

C. Other Certifications. Certificates indicating acceptance of bar reinforcement, concrete materials and any other material used in the prestressed concrete unit.

Inspection. Fabrication of units shall be inspected by an Inspector designated by the State. The Contractor shall inform the State 72 hours prior to:
- Commencement of work
- Commencement of work after a work suspension of 48 hours or more
- Unit shipping

The Contractor shall keep the Inspector informed of the day-to-day scheduling of operations. The Inspector shall have free access throughout the fabrication plant to see that the work being done is in conformance with the contract documents. Work done while the Inspector has been refused access shall be automatically rejected. The Inspector shall be present when necessary tests are made on the prestressing steel at the place of manufacture.

Concrete Forms

A. General. Forms shall be well-constructed, carefully aligned, clean, substantial and firm, securely braced and fastened together and sufficiently tight to prevent leakage of mortar. They shall be strong enough to withstand the action of mechanical vibrators. All forms for each unit shall be approved by the Inspector prior to placing concrete.

All form surfaces that come in contact with the concrete shall be thoroughly treated with an approved form coating in the manner and at the rate specified by the manufacturer. Forms so treated shall be protected against damage and dirt prior to placing concrete.

Any form coating material that will stick to or discolor concrete shall not be used.

B. Void-Producing Forms. Void forms shall be coated with a waterproofing material on the outside and shall have a 20 mm (nominal) diameter drain placed at each end of each void.

When units are steam-cured, all voids shall be vented.

Reinforcement and Prestressing Steel. Prior to installation in the units, reinforcement and prestressing steel shall be free of frost, dirt, oil, paint, mill scale, corrosion, or any foreign material that may prevent bond between the steel and the concrete.

Tack welding of bar reinforcement shall not be allowed under any circumstances.

Welded wire fabric, smooth or deformed, may be substituted for the required bar reinforcement provided that:
- The required cover is maintained
- The design steel area of the fabric equals that of the bar reinforcement
- Splices to the fabric are made in accordance with the requirements of the N.Y.S.D.O.T. Standard Specifications for Highway Bridges, §1.5.22D and §1.5.22E as applicable.
If wire fabric is used, the details shall be indicated on the working drawings. Design computations shall also be included.

**Tensioning of Prestressing Strands.** A calibrated force of 13.0 kN shall be applied initially to each strand. Consideration will be given by the DCES to a different initial force for special cases. This force shall be the starting point for additional tensioning by elongation.

For draped strands, the additional tensioning or prestressing force induced in the prestressing steel shall be measured by jacking gages and by elongation of the steel. The jacking gages shall read within 5 percent of the force theoretically calculated to be induced by elongation.

For straight strands, elongation only shall determine the prestressing force.

During tensioning of any one strand, the process shall be so conducted that the applied load and the elongation of the strand may be measured at all times.

Two copies of recorded gage pressures and measured elongations, as required for the tensioning of prestressing strands in each unit, shall be submitted to the Inspector.

The use of load cells or other tension measuring devices may be required. They shall be furnished by the Inspector and used in accordance with his/her instructions.

**Concrete Mix Design and Proportioning.** The Contractor shall be responsible for designing a concrete mix to produce the strength and other requirements specified on the contract plans. If no strength is indicated, the required minimum strength shall be 28 MPa at transfer and 35 MPa at 28 days. Maximum cement content for any proposed mix shall be 445 kg/m$^3$. Proposed mixes shall be submitted in accordance with the requirements of Drawings, Paragraph 2B(3). Automatic proportioning equipment will not be required.

The Contractor may request permission from the DCES to incorporate a High Range Water Reducing (HRWR) admixture into the concrete mix. The DCES will grant such permission only if deemed to be in the best interests of the State and then only under such conditions as the DCES requires.

**Placing Concrete.** No concrete shall be placed without the Inspector's approval. Compliance with the precasting tolerances is a prerequisite for casting approval by the Inspector.

When the atmospheric temperature is below 4°C, the fabrication of the units shall be in accordance with the winter concrete procedures as approved on the working drawings.

Suitable means shall be used for placing concrete without segregation. The concrete mixture shall not be dropped from a height greater than 300 mm above the top of the forms. Special care shall be taken to deposit the concrete in its final position in each part of the form.

The plastic concrete shall be consolidated in place by either external or internal vibration methods, or both, if necessary. The vibrators shall be of a type and design approved by the Inspector and the size of the vibrating head will be governed by the spacing of the prestressing steel and reinforcement. Vibrators shall be used only to consolidate the concrete after it has been properly placed.

The internal vibrator shall be slowly inserted and removed from the concrete.

The following quality control tests shall be performed, by the Contractor in the presence of the Inspector from the same concrete sample as that used for the Concrete Strength Requirements of this specification:

- Slump
- Air content
- Temperature
- Unit mass.

**Finishing.** To assure production of well-formed matching beams with overall pleasing appearance, all surfaces of concrete shall be true and even, free from rough, open or honeycombed areas, depressions or projections. After all the concrete has been placed and thoroughly compacted as required under Placing Concrete, the tops of units shall be magnesium-float finished, or finished as shown on the Working Drawings. If required, all exposed surfaces shall be finished by bagging.

All exposed reinforcement shall be coated with neat cement paste prior to placement in the storage area.
Curing. The Contractor shall indicate on the working drawings, for approval, the method of cure and complete outline of the proposed procedure under each of the phases of the curing cycle. The full curing cycle consists of an Initial Curing Phase and Final Curing Phase. The Contractor may choose any one of the following acceptable curing methods, however only one curing method will be allowed for the units of a single structure.

To ensure complete hydration of cement, and to prevent the formation of cracks, moisture must be retained within the concrete. Therefore, immediately upon the completion of concrete placement for each unit, an enclosure shall be placed over the casting bed. The Contractor shall submit all covers for inspection prior to the commencement of work.

A. Accelerated Cures. Acceptable methods for accelerated cures are by application of low pressure steam or by application of radiant heat and moisture.

1. Initial Curing Phase. The initial curing phase for each unit shall be that period beginning from the time each unit is completely covered and continuing until the final curing phase commences.

The Contractor shall indicate the duration of the initial curing phase for each unit. However, the initial curing phase shall not exceed eight hours. During this phase, the enclosure temperature shall be maintained at approximately the concrete placing temperature; artificial heat shall be applied if necessary.

2. Final Curing Phase. The final curing phase for each unit shall be that period required to raise the initial curing phase temperature to the selected temperature range at a rate not exceeding 30°C per hour and continuing until the concrete has attained the minimum transfer strength as noted on the contract plans or as noted in this specification, under the paragraph Concrete Mix Design and Proportioning, whichever is applicable.

The selected curing temperature range shall be as approved on the working drawings.

B. Non-Accelerated Cure. The acceptable method of non-accelerated cure is by the application of a saturated cover.

1. Initial Curing Phase. The requirements of A1 above, shall apply.

2. Final Curing Phase. The final curing phase may begin at anytime after commencement of the initial curing phase. Each unit shall be covered with heavy, water saturated burlap, or other material acceptable to the Inspector. The burlap shall be kept saturated, and the concrete surface temperature shall not drop below 20°C. These conditions shall be maintained until either of the following has occurred:

a. Seventy-two hours have passed from the time of burlap placement; or
b. Minimum transfer strength has been reached.

Record of Curing Time - Temperature. The Contractor shall provide one (1) automatic temperature recorder for every 30 m of casting bed. The recorder shall continuously record curing temperatures for the initial and final curing phases. Temperature sensors shall be carefully placed within the curing enclosure to ensure that ambient temperatures are measured at the designated locations. Recorder accuracy shall be certified once every 12 months and the certificate displayed with each recorder. In addition, random temperature checks of each recorder shall be made by the Inspector.

Each temperature chart shall indicate the casting bed, date of casting, time of commencing graphic plot and units represented by chart. The start of artificial heat and the transfer of prestress shall be indicated on each graphic record.

After completion of the final curing phase, the charts shall be properly marked and given to the Inspector. Temperatures recorded on the charts shall be considered as verification of whether the units have been cured in accordance with the approved working drawings.
Transfer of Prestress. Transfer of prestress shall be accomplished as soon as the final curing phase is complete.

Concrete Strength Requirements

A. Test Cylinders. The concrete strength shall be determined from concrete test cylinders made in conformance with ASTM C31, except that all cylinders shall be vibrated. All cylinders shall be tested in conformance with ASTM C39, on an approved testing machine. All cylinders shall be made and tested by the Contractor in the presence of the Inspector.

The cylinders shall be made from concrete actually placed in the units. The Inspector shall be the sole judge of which cylinders are defective or damaged and are not to be included in the determination of the strength class. Test cylinders used to determine required strengths for detensioning shall be cured as specified on the working drawings.

All cylinders used to test for concrete strength shall be cured in the same manner as the units they represent unless otherwise indicated on the working drawings.

The Contractor shall cast a sufficient number of concrete test cylinders to fulfill the concrete strength test requirements as stated in 2 below. This testing procedure may be altered by the DCES. If an alternate procedure is to be followed, it shall be indicated on the contract drawings. The number of test cylinders to be cast for each unit shall be shown on the working drawings.

B. Testing for Concrete Strength. The strength requirements for each unit shall be certified by the Contractor, as follows, before the unit is accepted for strength:

1. Transfer Strength. Two cylinders from each unit shall be tested in immediate succession to verify prestress transfer strength. One of the two cylinders tested to determine the strength of the last unit cast in any bed shall be taken from the last batch of concrete placed in that unit. The strength of each cylinder shall be at least 95 percent of the required prestress transfer strength. The average strength of the two cylinders shall be equal to or greater than the required prestress transfer strength.

2. 28 Day Strength

a. Two cylinders from each unit shall be tested in immediate succession at 28 days of age to verify the required 28 day strength of the concrete. The average strength of the two cylinders shall be equal to or greater than the required 28 day strength. If this requirement is not met, any remaining cylinders representing the unit shall be tested at 28 days of age. The average strength of all cylinders representing the 28 day strength of any one unit shall be equal to or greater than the required 28 day strength.

b. The Contractor may elect to test two cylinders from each unit in immediate succession, prior to the 28 day age limit. If this option is exercised sufficient cylinders shall be made to ensure that at least two cylinders are available for the 28 day test. Each cylinder shall have a strength of at least 95 percent of the required 28 day strength. The average of the two cylinders must be equal to or greater than the required 28 day strength. If these requirements are met, the cylinder test at 28 days of age shall be waived.

Rejection of Units. Any unit not fabricated in accordance with the contact documents or displaying any of the following defects shall be subject to rejection:

A. Strength Requirement. Any unit represented by cylinders not meeting the required strengths, as specified in Concrete Strength Requirements.

B. Exposed Prestressing Steel. Any unit that has one (1) prestress strand exposed in excess of 24 diameters, or two (2) or more exposed strands.
**C. Honeycombing.** Honeycombing of the unit to such an extent that chipping away from the honeycombed concrete results in the conditions described in the above paragraph 2, Exposed Prestressing Steel.

All honeycombed areas in a unit must be chipped until sound concrete is detected. Sound concrete is defined as that point at which chipping causes fracture of the aggregates.

**D. Stress Cracks.** Any unit that has a stress crack in the area beginning 100 mm from the unit end to the center line of the unit that is greater than 13 mm in depth and 63 µm in width.

**E. Injurious Materials.** Materials used for the manufacture of concrete shall not contain, nor cause concentration of, chemicals, or other materials injurious to concrete.

Concentrations of total chloride ions in excess of 0.05% by mass of cement are considered injurious.

Other material and concentration injury potential will be determined by the D.C.E.T.S. according to Department written instructions.

**Damaged units.** The Inspector shall determine whether spalled, honeycombed, or otherwise defective concrete shall be repaired or be subject to rejection. The decision to repair a unit or reject a unit shall require the concurrence of the DCES.

**Removal of Unsuitable Material.** Prior to beginning the repair, all spalled, honeycombed or disintegrated concrete shall be removed by chipping the unsuitable material away until sound concrete is reached. Sound concrete shall be as defined under Rejection of Units, Subparagraph 3. Chipping tools shall be pneumatic. The type and size of tools and the depth at which sound concrete is reached shall be determined by the Inspector.

**Blast Cleaning Surfaces.** All surfaces to be repaired shall be thoroughly blast-cleaned with No. 40 boiler slag grit or No. 2 sandblast sand, or as ordered by the Inspector.

**REPAIR.** Repair shall be designated as “structural repair” or “nonstructural repair” by the Deputy Chief Engineer (Structures). Repair to a unit shall be done in accordance with the following.

**Structural Repair.** Repair, designated as “structural” by the DCES, shall be made with an epoxy grout comprised of an epoxy resin system (721-01), or an epoxy polysulfide grout (721-03), mixed with fine aggregate. The grout shall be mixed and placed in accordance with the following:

**A. Mixing.** No mixing shall be started until all preparations have been made to use the grout. The Contractor shall be familiar with the pot life limitations of the epoxy being used, and its operations shall be governed accordingly. Mixing shall be carried out in strict accordance with the manufacturer's instructions and the following:

- Mixing shall be done as close as possible to the portion to be repaired.
- All necessary equipment for mixing and placing shall be present at the site, and in good working order, prior to the start of mixing.
- The grout shall be proportioned by volume in the approximate ratio of two (2) parts fine aggregate to one (1) part epoxy. The exact ratio of sand to epoxy resin system shall be determined on-site to produce a dense void-free grout.
- Dry, fine aggregate shall be placed in the mix container first. It shall be thoroughly agitated prior to the addition of the epoxy.
- The two components of the epoxy system shall be thoroughly mixed together before being added to the fine aggregate.
- The epoxy shall be added to the fine aggregate slowly, but mixing time shall not exceed three minutes.
- All grout, in any individual batch, shall be used within 25 minutes after the start of mixing of the two components to create the epoxy system. All grout not used within the time limit shall be discarded.
• The epoxy grout shall not be retempered.

**B. Placing.** The epoxy grout shall be placed against a clean, primed, receiving surface, in accordance with the following:

- The receiving surface shall be cleaned of all oil, grease, or other material which may prevent effective bond, immediately prior to priming the surface with neat epoxy (epoxy without aggregate).
- The priming of the receiving surface shall be done immediately prior to the placement of the epoxy grout.
- The epoxy grout shall be placed quickly and continuously. It shall not be overworked.
- The temperature of the receiving surface shall be above 10°C at the time of grout placement.
- Grout placement shall not be permitted when ambient temperatures are 10°C or lower, unless methods of protection, acceptable to the Inspector, are employed. Methods of protection, if permitted, shall be continued for a period of 15 hours following grout placement. The 15 hour period may be shortened, at the discretion of the Inspector, but under no circumstances will it be less than 12 hours. Methods of protection, if permitted, are conveniences granted by the State. As such, they are not considered extra work, and therefore they are not entitled to extra compensation.
- Upon completion of grout placement, the new surface of the repaired area shall be flush with the adjacent surfaces, unless the design of the unit specifically requires otherwise.
- On surfaces which will be exposed to view after installation, the repaired area shall be color matched to the adjacent surfaces by use of cement dust, or other means acceptable to the Inspector.

**Nonstructural Repair.** Repair, designated as “nonstructural” by the DCES shall be made with either of the following:

- Epoxy grout composed of §721-01 Epoxy Resin System or §721-03 Epoxy Polysulfide Grout, and fine aggregate; or,
- §721-05 Epoxy Repair Paste.

The Contractor has the choice of materials.

**A. Mixing.** Epoxy grout shall be mixed in accordance with the requirements of A. Mixing as given under Structural Repair.

- Epoxy repair paste shall be mixed in strict accordance with the manufacturer's instructions.

**B. Placing.** Placing of either material shall be done in accordance with the requirements of B. Placing as given under Structural Repair.

**TOLERANCES.** Tolerances of the Prestressed Concrete Units shall meet the requirements specified in the Contract Documents.

- Units which fail to meet the tolerances shall be rejected with the concurrence of the DCES.

**SHIPPING.** Units shall not be shipped until the minimum 28 day strength has been attained, but in no case, before 72 hours' storage time has elapsed following transfer of prestress.

**BASIS OF ACCEPTANCE.** The Inspector's stamp of approval shall constitute the basis of acceptance for shipment to the job site. The Inspector's stamp shall be placed on the unit after loading for shipment.

- Application of the Inspector's acceptance stamp indicates that at the time of shipment, it was the Inspector's opinion that the unit was fabricated from accepted materials, by approved processes, and was properly loaded for shipment.
- Such application does not imply that the material will not be rejected by the State if it is subsequently found to be defective.
**SCOPE.** This specification contains the requirements for prestressed concrete form units. These units are used to form the lower portion of a structural slab. They act compositely with the cast-in-place portion of the slab and become an integral part of the structural slab.

**GENERAL.** §718-01 Prestressed Concrete Units (Structural) shall apply except for the following modifications to the FABRICATION, REPAIR and TOLERANCES:

**FABRICATION.** §718-01 shall apply except as follows:

- **Reinforcement and Prestressing Steel.** §718-01 shall apply. In addition, devices which will be used as hold-down points for outside reinforcing steel shall be placed prior to concrete placement in the forms. Devices used to lift the units are acceptable for this purpose. The maximum spacing between hold-down devices shall be 1.2 meters center-to-center of device.

- **Finishing.** §718-01 shall apply except the tops of units do not have to be magnesium float finished.

- **Concrete Strength Requirements.** §718-01 shall apply except the testing shall be as follows:

  **Testing for Concrete Strength.** The strength requirements for each day's production shall be certified by the Contractor before that day's production is accepted for strength. Certification shall be done in accordance with the terms of this subsection. All cylinders cast shall be cast in sets of three. One set shall be cast from the first concrete placement of the day. One set shall be cast from the last concrete placement of the day. In addition to those, there shall be a set cast for each 10 m$^3$ of concrete, or major fraction thereof, placed in any one day.

    1. **Transfer Strength.** Three cylinders from each day's production shall be tested in immediate succession to verify prestress transfer strength. One cylinder shall be taken from the first set cast; one cylinder shall be taken from the last set cast. The strength of each cylinder shall be at least 95 percent of the required prestress transfer strength. The average strength of the three cylinders shall be equal to, or greater than, the required prestress transfer strength.

    2. **28-Day Strength.** Three (3) cylinders representing each day's production shall be tested in immediate succession at twenty-eight (28) days of age to verify the required 28-day strength. The strength of each cylinder shall be at least ninety-five (95) percent of the required 28-day strength. The average strength of the three cylinders shall be equal to, or greater than, the required 28-day strength. If these requirements are not met, any remaining cylinders representing the day's production shall also be tested at 28 days of age. The average strength of all cylinders representing the 28-day strength of any one day's production shall be equal to, or greater than, the required 28-day strength.

    3. **Option.** The Contractor may test three (3) cylinders, representing each day's production in immediate succession, prior to the 28-day age limit. Each cylinder shall have a strength of at least ninety-five (95) percent of the required 28-day strength. The average strength of the three cylinders shall be equal to, or greater than, the required 28-day strength. If these requirements are met, the cylinder test at 28 days of age shall be waived. If this option is exercised, sufficient cylinders shall be made to ensure that at least 3 cylinders are available for the 28-day test.

**Rejection of Units.** Any unit not fabricated in accordance with the Contract Documents, or displaying any of the following defects, shall be subject to rejection:

- **A. Strength Requirements.** Any unit represented by cylinders not meeting the required strengths, as specified in Concrete Strength Requirements, of this specification.
§718

**B. Exposed Prestressing Steel.** Any unit which exhibits one or more exposed prestressing strand(s) on a top or bottom surface.

**C. Honeycombing.** Honeycombing of the unit to such an extent that chipping away from the honeycombed concrete results in the exposure of one, or more, prestressing strands on a top, or bottom, surface.

All honeycombed areas shall be chipped until sound concrete is reached. Sound concrete is defined as that point at which chipping causes fracture of the aggregates. If chipping of the honeycombed portion results in a hole more than one-half the thickness of the unit, the unit will be rejected.

**D. Cracks.** Any unit which exhibits a crack that is greater than 13 mm in depth, and 64 µm in width.

**REPAIR.** Repair, if allowed by the DCES, shall be made with §721-05 Epoxy Repair Paste. Epoxy repair paste shall be mixed and placed in strict accordance with the manufacturer's instructions.

**Form Supports** Form supports for installation of the units shall be supplied as part of this work. They shall conform to the latest specification for ASTM A446, Grades A through E. Fabrication shall be in conformance with ASTM A653/A653M, Coating Class G165.

The Contractor shall supply the Engineer with certification that the form supports meet the foregoing requirements.

**TOLERANCES.** All units shall be checked for compliance with the tolerances listed below, after the units have completed the final curing phase and within three (3) days prior to shipping. The Inspector shall document to the DCES any unit with dimensions out of tolerance. Any unit which fails to meet these tolerances shall be rejected with the concurrence of the DCES.

<table>
<thead>
<tr>
<th>Finished Dimensions</th>
<th>Position of Strands</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Width ± 6 mm</td>
<td>Vertical ± 6 mm</td>
</tr>
<tr>
<td>Length ± 13 mm</td>
<td>Horizontal ± 13 mm</td>
</tr>
<tr>
<td>Depth ± 6 mm</td>
<td></td>
</tr>
</tbody>
</table>

*Width is defined as the dimension measured parallel to the prestressing strands.

718-06 HIGH PERFORMANCE CONCRETE FOR PRECAST AND PRESTRESSED BRIDGE BEAMS

**SCOPE.** This specification covers the material requirements for high performance concrete for precast and prestressed bridge beams.

**MATERIAL REQUIREMENTS.** The concrete shall meet the requirements of the approved Mix Design Sheet, described below, and the PCCM. The concrete mix shall contain a minimum of 5% microsilica measured as a percent of the total cementitious material.

**MIX DESIGN SHEETS (MDS).** These sheets shall contain all the information on the mix design, materials, material sources, production facilities, quality control, curing, and preproduction testing of the mix. Once approved for production, the MDS may be used in any contract requiring high performance concrete for precast and prestressed bridge beams.

The MDS will have a two-step approval process. The first submittal shall contain all the information required in A. through N. Complete submittals that meet the specification requirements will be examined according to Section 2.5 of the PCCM and, if found acceptable, it will be returned with the notation “APPROVED FOR TESTING.” Section 2.5.7 of the PCCM does not apply.

Following required testing of the mix, the MDS shall be submitted to the DCES with the information in O. through Q. added to the sheet. If the test results meet the requirements of this specification, the MDS will be returned with the notation “APPROVED.” After approval for production, no changes in materials sources, production, curing, or mix design shall be made, except those changes necessitated by a change in the fineness modulus of the aggregate.
If changes are required after the approval of the MDS, a revised MDS with all the required changes shall be submitted to the DCES. After examining the revised MDS, the DCES will determine if repetition of any testing is required for the approval of the revised MDS. If it is determined that some or all tests shall be repeated, the revised MDS will be returned marked up, specifying the required tests to be repeated and stamped “APPROVED FOR TESTING.” Remaining portions of the approval process will exactly follow the procedure used for the initial approval of the MDS except that the tests to be performed will be limited to the tests to be repeated marked up by the DCES.

If it is determined that there is no need for repeating the preproduction testing and if the proposed changes are acceptable to the DCES, the revised MDS will be approved and returned.

**Information Required on MDS.** The MDS shall include the following information:

A. The source and type of cement.
B. The specific source of the coarse aggregate.
C. The specific source of the fine aggregate and the fineness modulus of the material proposed for use in the preproduction testing.
D. The brand and type of all admixtures that will be used.
E. The complete mix design including all ingredient and quantities proposed for the production concrete.
F. The maximum water-to-total-cementitious-material ratio that is proposed for production.
G. Description of the concrete batching and mixing facilities, including the date of last annual inspection and date of last scale calibration check.
H. Description of the concrete transport equipment.
I. The method of concrete placement.
J. Outline of the curing procedure to be used for the production units and test samples.
K. Quality control tests and procedures that the fabricator will perform.
L. Detailed description of the preproduction testing procedure to establish that concrete made from the proposed mix design meets the required performance criteria.
M. The name and address of the testing laboratory(s) conducting the tests.
N. A fabricator selected identifier for the mix.
O. Test results for the preproduction test mix.
P. Actual fineness modulus of the fine aggregate used in the preproduction test mix.
Q. Graph of compressive strength versus age.

**TESTING.** The concrete mix design shall be tested prior to making any bridge beams and shall meet the following performance criteria.

<table>
<thead>
<tr>
<th>PROPERTY</th>
<th>TEST METHOD</th>
<th>ACCEPTANCE CRITERIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressive Strength (at 56 days)</td>
<td>AASHTO T22</td>
<td>&gt; 70MPa (all tests)</td>
</tr>
<tr>
<td>Freeze/Thaw Durability (x=relative dynamic modulus of elasticity after 300 cycles)</td>
<td>AASHTO T161 Procedure A</td>
<td>x ≥ 80%</td>
</tr>
<tr>
<td>Scaling Resistance (y= visual rating of surface after 50 cycles)</td>
<td>ASTM C672</td>
<td>y ≤ 3</td>
</tr>
<tr>
<td>Elasticity (E = modulus of elasticity) (s= microstrain)</td>
<td>ASTM C469 (Note C)</td>
<td>E ≥ 30GPa</td>
</tr>
<tr>
<td>Shrinkage</td>
<td>AASHTO T160-97 (at 56 days)</td>
<td>s &lt; 600</td>
</tr>
<tr>
<td>Creep (c = microstrain/pressure unit)</td>
<td>ASTM C512(at 56 days, 40% fc')</td>
<td>c ≤ 60/MPa</td>
</tr>
<tr>
<td>Chloride Penetration (p= increase in percent of chloride ion by weight of concrete)</td>
<td>AASHTO T259 modified (Note A)</td>
<td>p ≤ 0.025% at 25 mm</td>
</tr>
<tr>
<td>Air Content</td>
<td>AASHTO T 152</td>
<td>A = % selected by contractor, A ≥ 3%</td>
</tr>
<tr>
<td>Water/Cementitious-Materials ratio (W= mass ratio)</td>
<td>AASHTO TP23-93 (Note B)</td>
<td>Supplier selects W, W &lt; 0.40</td>
</tr>
</tbody>
</table>

Note A: The test specimens are to be cured under the same conditions and for the same time as proposed for production. They shall then be stored for 28 days in the drying room specified by the AASHTO T259.
Note B: The AASHTO TP23 test shall be corrected for the absorbed water in the aggregate. This correction shall be made using the mass percentage of absorption shown under “ABS” in the Approved List of Sources of Fine and Coarse Aggregates (or as determined by AASHTO T-84 for fine aggregates and AASHTO T-85 for coarse aggregate) by an A.A.S.H.T.O. accredited testing laboratory.

Note C: Test two samples. Each sample is to be loaded at 40% of the load required to break a companion sample cast from the same mix at the same time as the test sample. Sample 1 is to be loaded when the strength of a companion sample achieves a strength of 49 MPa ± 3 MPa. Sample 2 is to be loaded when the strength of a companion sample achieves a strength of 70 MPa ± 5 MPa.

**PREPRODUCTION TESTING**

The Contractor shall engage an A.A.S.H.T.O. Accredited testing laboratory for testing of all preproduction concrete specimens except compressive strength, air content, and water/cementitious-materials ratio. These tests shall be performed in the presence of the Quality Assurance (QA) Inspector. The DCES may approve laboratories with equivalent certification from another organization. The testing laboratory shall send a copy of the test results directly to the DCES.

The Contractor shall notify the Department at least three work days prior to casting preproduction test specimens. No test specimens shall be cast unless the QA Inspector is present to witness the mixing, casting, and curing of the specimens. The test specimens shall be prepared of concrete made using materials from sources shown on the “Approved For Testing” MDS.

The water-to-total-cementitious-materials ratio for concrete mix for purposes of preparing specimens for chloride penetration testing shall be 0.03 higher than the maximum water-to-total-cementitious-materials ratio that is proposed for production. In addition to those specimens needed for AASHTO T259 testing, the fabricator shall cast eighteen 100 mm x 200 mm cylinders from the chloride penetration test mix, cure the cylinders in accordance with the approved production curing procedures for long-term independent testing and research. These cylinders shall be delivered to the testing laboratory designated by the DCES.

The test mix for all other tests shall be the water-to-total-cementitious-materials ratio that is proposed for production within a tolerance of 0.01. Include the total aggregate moisture, as determined according to AASHTO T 255, in the calculation of the water-to-total-cementitious-materials ratio with appropriate adjustments. (See Note B in Material Requirements.)

Using the test mix, cast and test compressive strength cylinders at 18 hours, 3 days, 7 days, 28 days, and 56 days. Present the test results in a graph.

**Acceptance of Test Specimens.** All test specimens shall be prepared in accordance with an “Approved for Testing” MDS. The preparation, casting, and curing of the test specimens shall be done in the presence of the QA Inspector. The QA Inspector shall indicate the procedures on the MDS were followed by affixing the inspection agency stamp on the samples prior to shipping to the Independent Testing Laboratories.

**FABRICATION.** The requirements of the PCCM shall apply with the following modifications:

1. Submitted Shop Drawings shall include approved Mix Design Sheets.
2. The required 56-day strength is 70 MPa, unless shown otherwise in the Contract Documents.
3. The required minimum strength for imparting prestressing force into the concrete is 49 MPa unless shown otherwise in the Contract Documents.
4. The fineness modulus of the fine aggregate shall not vary more than 0.2 from the actual fineness modulus used in the preproduction test mix.
5. Water/Cementitious-materials ratio shall be measured by the Fabricator for the first batch of concrete in a day’s placement and monitored by slump tests throughout production. If the QA Inspector has reason to believe the water/cementitious-materials ratio is changing, or if the slump increases by more than the allowed increase in the table below, additional water/cementitious-materials ratio tests may be ordered.

<table>
<thead>
<tr>
<th>Slump of First Batch</th>
<th>Allowed Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 100 mm</td>
<td>25 mm</td>
</tr>
<tr>
<td>100 mm or more</td>
<td>37 mm</td>
</tr>
</tbody>
</table>

6. Batch tickets shall be provided to the Inspector to verify the concrete mix contents.
BASIS OF ACCEPTANCE. Units will be considered for acceptance at the manufacturing location in accordance with the PCCM.

718-07 THRU 718-29 (VACANT)

SECTION 719 - METAL COATINGS

719-01 GALVANIZED COATINGS AND REPAIR METHODS

SCOPE. These specifications cover the galvanized coatings applied to various materials and the repair thereto.

MATERIAL REQUIREMENTS. Materials shall be galvanized in accordance with the specification indicated by Type on the plans or in the specifications.

Type I. ASTM A123 Zinc (Hot-Dip Galvanized) Coating on Iron and Steel Products.

Type II. ASTM A153, Zinc Coating (Hot Dip) on Iron and Steel Hardware. As an alternate to the hot dip method of ASTM A153, nuts, bolts, washers and other miscellaneous hardware, approved by the Engineer, may be mechanically galvanized. The mechanically zinc-coated product(s) shall conform to the applicable coating thickness, adherence and quality requirements of ASTM A153. Mechanically zinc-coated nuts for assembly with mechanically zinc-coated bolts shall be tapped oversize prior to coating and need not be re-tapped afterwards.

Type III. ASTM A123 Zinc (Hot-Dip Galvanized) Coating on Iron and Steel Products, except as modified herein. A minimum weight of coating (g/m² of surface) for base metal less than 1.6 mm thickness shall be as follows:

<table>
<thead>
<tr>
<th>Average of Specimen</th>
<th>Any Individual Specimen or Computed Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>460</td>
<td>380</td>
</tr>
</tbody>
</table>

Type IV. ASTM A653/A653M, Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process, Coating Designation G 210 unless otherwise specified.

Type V. Flame Sprayed Coating System.

A. Preparation of Base. Those areas to be coated shall be sand blasted with silica sand or crushed garnet of such gradation that sand shall be mesh size 20 to 40 with a minimum of 40% retained on a 600 μm mesh screen (U.S. Standard Sieve series). Pressure of not less than 520 kPa shall be maintained at the blast generator. A sample steel plate shall be blasted until the surface cannot be further cleaned or roughened. This plate shall be used for visual comparison and any areas that do not meet this standard as to roughness or cleanliness shall be reblasted.

B. Zinc Application. The wire used in spraying shall be 15 ga., 3.2 mm or 4.8 mm diameter, zinc 99.0% purity. Air pressure at the Air Control Unit shall be 410 kPa and there shall be no more than 11 m of 9.5 mm I.D. hose between the Air Control Unit and the gun. The metal coating shall be applied at a minimum thickness of 0.076 mm. At least one coating shall be applied within 4 hours of blasting and the surface must be completely coated within 8 hours of blasting. The specified thickness of coating shall be applied in multiple layers and in no case shall less than two passes be made over every part of the surface.

C. Finish Coat. The zinc coating shall be given a finish coating consisting of two coats of Aluminum Vinyl sealer. This sealer shall consist of a volatile vehicle containing a minimum of 20% Vinyl Copolymer and plasticizer and a minimum of 10% Non-Leafing Aluminum Flake.
REPAIR. The Contractor shall be required to repair damaged areas of galvanized zinc coating. Damage may result from wet storage (white rust), welding or cutting (flame), or from excessive rough handling during shipping or erection. In general, only field repairs will be allowed. Shop repairs shall only be permitted when the total area of damage on any single piece is less than 2% of the coated surface or 10,000 mm², whichever is less. Any coated piece on which the total area of damage exceeds these amounts in the shop shall be rejected.

Materials for field repair shall be selected from Department's Approved List of Galvanized Repair Materials. Zinc solders shall be zinc-cadmium and zinc-tin-lead alloys supplied in stick or paste form, and that liquidize for application at temperature ranges of from 270 to 275°C and 230 to 260°C, respectively. Zinc paints shall contain not less than 65% zinc dust (by weight) in the dried paint film and shall meet current standards for the emission of volatile organic compounds. Detailed requirements for the approval of galvanized repair materials are available from the Materials Bureau.

Corrosion deposits shall be removed in a manner satisfactory to the Department prior to incorporation of the material in the work. After removal of these deposits, the coating shall have a uniform appearance free from uncoated spots, lumps, blisters, gritty areas, acid, flux and black spots. Materials with these defects will be rejected and shall be immediately removed from the worksite. Acceptable material shall be provided to replace rejected material at no additional expense to the State.

Damaged areas of loose and deteriorated galvanized zinc coating shall be cleaned by power sanding, power grinding, or abrasive blast cleaning to bright metal.

If zinc solder is used for repairs the cleaned area shall be preheated in accordance with the manufacturer's instructions for use. The heated surface shall then be rubbed with a repair stick to evenly distribute a layer of zinc alloy, or if zinc paste is used it shall be spread evenly using a spatula or similar tool. Zinc solder shall be deposited in a uniform layer at a minimum dry film thickness of 75 µm.

If zinc paint is used for repairs it shall be applied in accordance with the manufacturer's instructions for use, using a brush or by spray methods. Zinc paint shall be applied in such quantity as to produce a minimum dry film thickness of 75 µm.

BASIS OF ACCEPTANCE. The acceptance of galvanized coating and repairs is included in the acceptance of the materials receiving the coating.

719-02 ALUMINUM ANODIC COATINGS

SCOPE. This specification covers the material requirements for Anodic Coatings for Aluminum and Aluminum Alloys.

<table>
<thead>
<tr>
<th>TABLE 719-02-1 MINIMUM COATING THICKNESS AND WEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coating Designation</td>
</tr>
<tr>
<td>--------------------</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Type 022</td>
</tr>
<tr>
<td>Type 202</td>
</tr>
<tr>
<td>Type 302</td>
</tr>
<tr>
<td>Type 204</td>
</tr>
<tr>
<td>Type 205</td>
</tr>
<tr>
<td>Type 210</td>
</tr>
<tr>
<td>Type 215</td>
</tr>
<tr>
<td>Type 226</td>
</tr>
</tbody>
</table>

MATERIAL REQUIREMENTS. Anodic coatings for Aluminum and its alloys shall conform to the requirements of Table 719-02-1 for the coating designation shown on the plans or in the proposal.
§719

719-03 ALUMINUM COATING (HOT DIP)

SCOPE. This specification covers the material requirements for hot dip aluminum coatings applied to steel appurtenances in contact with aluminum surfaces, or where applied as shown on the contract plans.

MATERIAL REQUIREMENTS. The material used shall be 99 percent pure aluminum conforming to the specifications for Aluminum Alloy Number 1100 according to ANSI H 35.1.

Thickness of the coating shall not be less than 51 µm on any individual specimen and the average of the specimens tested shall not be less than 58 µm. The thickness of coating may be determined by the use of a Magna-Gage.

The aluminum coating on threads, except on topped threads, shall not be subjected to a cutting, rolling, or finishing tool operation, unless specifically authorized by the Engineer.

The coating shall be continuous and uniform in thickness. The coating shall adhere tenaciously to the surface of the base metal. When the coating is cut or pried into, such as with a stout knife applied with considerable pressure in a manner tending to remove a portion of the coating, it shall only be possible to remove small particles of the coating by paring or whittling, and it shall not be possible to peel any portion of the coating so as to expose the steel.

The aluminum coated articles shall be free from uncoated spots and other defects not consistent with good aluminum coating practice.

SECTION 720 - PILES

720-01 UNTREATED TIMBER PILES

SCOPE. This specification covers the material requirements for untreated timber piles.

GENERAL. Timber piling shall consist of any species of wood that will withstand driving, except white or gray birch, poplar or basswood.

Piles shall be clean-peeled and shall conform to the requirements of ASTM D25.

BASIS OF ACCEPTANCE. The inspector's indelible stamp of approval shall constitute sufficient basis of acceptance at the job site.

720-02 TREATED TIMBER PILES

SCOPE. This specification covers the material requirements for treated timber piles.

GENERAL. The requirements for treated timber piles shall conform to the applicable provisions of §720-01 Untreated Timber Piles with the following additions and modifications:

Piles shall be Southern Yellow Pine or Douglas Fir containing a minimum thickness of sapwood of not less than 40 mm in Southern Yellow Pine and not less than 25 mm of Douglas Fir at the butt ends.

Piles shall be peeled clean of bark, including the inner bark, soon after cutting, so that the piles are smooth and clean. Care shall be taken to remove as little sapwood as possible in the bark peeling operation.

The preservative used in the treatment of piles shall conform to the requirements of §708-30, Wood Preservative Creosote Oil, American Wood Preservers' Association Standard P-1 for land and fresh water use; P-13 for Marine (Coastal Waters) or §708-31 Wood Preservative-Water Borne.

Conditioning and treatment. The conditioning before treatment and the preservative treatment shall conform to the requirements of American Wood Preservers' Association Standards C-1, C-3, C-12, C-14, or C-18.

Inspection of piles. The Contractor shall give the Department ample notice relative to the location of, and time when treating operations will take place. Inspection of piles will be made by inspectors designated by the Department, before, during and after the piles are treated at the treatment plant. No piles shall be shipped which do not bear, in legible form, the inspector's stamp of approval.
The piles shall be subject to inspection by the Engineer after arrival at the site and no previous approval at the plant shall bar rejection in the field for injury, breakage, or defects discovered after the piles have left the treatment plant.

Piles shall be free from damage or defects which would impair their usefulness or durability for the purpose intended. The use of “S” irons or other devices for repairing or preventing checks, splits, or other defects will not be permitted.

**STORAGE AND HANDLING.** All treated timber piles shall be carefully handled and properly stored. Any surface breaks which do not warrant the rejection of the pile shall be treated in accordance with AWPA M4 with the addition that at least three coats of preservative shall be applied.

**Treatment of Pile Heads and Bolt Holes.** The heads of piles shall be treated as follows: The sawed surface shall be treated in accordance with AWPA M4 with the addition that at least three coats of preservative shall be applied followed by a thick application of a mixture of 30% creosote and 70% pitch. The application of the pitch coat shall not apply to pile heads encased in concrete. All bolt holes bored subsequent to treatment shall be treated with preservative by means of an approved pressure bolt hole treater.

Any unfilled holes, after being treated with preservative shall be plugged with preservative treated plugs.

The Contractor shall obtain all necessary permits pertaining to the purchase and field application of wood preservatives from the U.S. Environmental Protection Agency (EPA) and the New York State Department of Environmental Conservation.

**BASIS OF ACCEPTANCE.** The Inspector's indelible stamp of approval shall constitute basis of acceptance at the job site.

**720-03 CASINGS FOR CAST-IN-PLACE CONCRETE PILES**

**SCOPE.** This specification covers the material requirements for casings used for cast-in-place concrete piles.

**GENERAL.** When the diameter and thickness of pipes are shown on the plans, the material used shall conform to the requirements of ASTM A252, Grade 2, unless otherwise specified. The Contractor will be required to furnish the Engineer with two certified copies of the records of the physical tests performed on the newly manufactured pipe in accordance with the above ASTM requirements. In addition, a manufacturer's statement of certification, which explicitly verifies that the material and workmanship comply with the current ASTM standards for ASTM A252, Grade 2, must accompany each heat.

**Thickness Requirements.** The metal of shells which are directly driven shall have a thickness sufficient to withstand the driving without fracture or failure, but in no case shall the thickness be less than 2.67 mm. Shells driven with a mandrel shall have a thickness not less than 1.37 mm.

Pipes shall have a thickness sufficient to withstand driving without fracture or failure but in no case shall the thickness of pipes be less than 4.76 mm unless otherwise shown on the plans.

**BASIS OF ACCEPTANCE.** The manufacturer's certification shall constitute sufficient basis of acceptance at the job site.

**720-04 STEEL BEARING PILES**

**SCOPE.** This specification covers the material requirements for steel bearing piles.

**GENERAL.** All steel bearing piles shall be rolled HP sections of standard dimensions. Steel for bearing piles shall be new and unused and shall conform to the requirements of §715-01, Structural Steel. Stock steel may be used.
BASIS OF ACCEPTANCE. Material acceptance will be by manufacturer's certification. The certifying statement must accompany each heat and must verify that the material and workmanship comply with the current ASTM standards for ASTM A36. Two copies shall be furnished to the Engineer.

720-05 PILE SHOES

SCOPE. This specification covers the material requirements for pile shoes.

GENERAL. The pile shoes shall consist of ASTM A36 steel or equivalent material capable of withstand ing driving without excessive deformation.

BASIS OF ACCEPTANCE. Approval by the DCES shall constitute acceptance.

720-06 MECHANICAL PILE SPLICES

SCOPE. This specification covers the requirements for mechanical splices for steel bearing piles.

GENERAL. Steel used in the mechanical pile splices shall meet the requirements of §715-01.

BASIS OF ACCEPTANCE. The product will be accepted at the job site based on its appearance on the Approved List. The Contractor shall provide the Engineer with an installation drawing approved by the DCES showing the sizes and types of welds that are required. In addition, the Contractor shall provide manufacturer certification that the supplied product has the same chemical composition and mechanical properties as the product used in the testing.

At the Department’s discretion, the material will be evaluated for conformance to the stated specifications, and product samples may be required to be submitted for testing.

Manufacturers may submit their product for evaluation to the DCES. The submission shall include copies of installation drawings, specifications, welding procedures meeting the requirements of the Steel Construction Manual, engineering calculations, test results, and quality control procedures for the splice manufacture.

Stamped engineering calculations, performed by a New York State Licensed Professional Engineer with current registration, shall show that the spliced pile has a theoretical bending capacity of at least 95% of the unspliced pile.

Test results by an independent testing agency shall show that the bending strength on both the strong and weak axes of the spliced pile is at least as great as the calculated capacity of the splice. The tests shall be third point loadings of a spliced pile with the splice in the middle of the span. The tests shall be continued to failure. A minimum of two pile sizes shall be tested in each direction to prove the engineering calculations.

If the submission is acceptable, the installation drawings will be stamped approved, returned to the manufacturer and the product will be placed on the Approved List. Any changes to the product, product manufacturing, or installation procedure will require re-submission and re-approval.

SECTION 721 - CONCRETE ADHESIVES AND REPAIR MATERIALS

721-01 EPOXY RESIN SYSTEM

SCOPE. This specification covers the material requirements of a two-component, rapid setting, high strength epoxy resin system for use as an adhesive and for making epoxy mortar for the repair of minor damaged areas of hardened concrete. This material should not be used when the temperature is below 5°C or when there is moisture present in any of the materials or surfaces it will be in contact with while in the uncured state.
MATERIAL REQUIREMENTS

Component A. Component A shall consist of a blend of epoxy resin, plasticizer and fillers so that when mixed with component B the mix will have the characteristics described under “Characteristics of the Mixture”.

Component B. Component B shall consist of an amine adduct curing agent capable of curing the epoxy system from 5°C and above when mixed according to the manufacturer's recommendations.

| TABLE 721-01-1  EPOXY RESIN MIXTURE REQUIREMENTS |
|----------------|---------------------------------|--------|--------|
| Property        | Test Method                     | Minimum | Maximum |
| Pot life for 0.5 liter unit, minutes | measured from time of original mixing at 23°C±2°C | 10     | 30     |
| Viscosity, PaCs @ 23±2°C   | Brookfield Model RVT Spindle No. 3 @20 RPM | —      | 2      |

Characteristics of the Mixture. Mixture shall meet the requirements of Table 721-01-1.

Cured Materials. Mixed with three (3) parts by volume of Ottawa silica sand conforming to the requirements for graded standard sand in ASTM C778, the resulting mortar shall have the following characteristics after being cured at 23°C±2°C for 24 hours:

| TABLE 721-01-2  COMPRRESSIVE AND TENSILE STRENGTH |
|----------------|---------------------------------|--------|--------|
| Property              | Test Method                     | Specimen size and shape | Min. |
| Compressive Strength, MPa | AASHTO T 106                  | 50 mm cubic            | 55    |
| Tensile Splitting Strength, MPa | NYSDOT TM 721-04 P          | 50 mm x 100 mm cylinder | 10    |

PACKAGING. All material furnished must be shipped in strong, substantial containers. The containers shall be identified as “Part A - contains epoxy resin” and “Part B - contains curing agent” and shall be plainly marked with the following information:
- N.Y.S.D.O.T. materials specification number
- Name of product
- Mixing proportions and instructions
- Name and address of the manufacturer
- Lot number and batch number
- Date of manufacture
- Quantity
- Date of expiration of acceptance

SAMPLING. Material shall be sampled and inspected at the place of manufacture or in warehouse lots as determined by the Department. Samples submitted to the Materials Bureau shall be taken as directed by the Department.

TESTING

Pot Life. The pot life shall be determined as follows: The mixed components shall be set on a bench top and probed with a small flat stick every two (2) minutes. The time at which a soft ball forms in the center of the container is the pot life.

Initial Viscosity. Components A and B shall be conditioned at 23°C±2°C prior to mixing and the reading taken two (2) minutes after mixing. The viscosity shall be measured with a Brookfield Model RVT viscometer, spindle No. 3 at 20 RPM.
BASIS OF ACCEPTANCE. This material will be considered for acceptance in stock lot quantities at manufacture or supply locations in accordance with procedural directives of the Materials Bureau. The expiration date of acceptance of this material shall be one year after the date of manufacture. Any unauthorized tampering or breaking of the seals on the containers between the time of sampling and delivery to the job site will be cause for rejection of the material.

721-02 (VACANT)

721-03 EPOXY POLYSULFIDE GROUT

SCOPE. This specification covers the material requirements of a two-component, flexible, polysulfide modified epoxy grout containing an inert mineral filler. This material is used for bonding fresh concrete to hardened concrete in both vertical and horizontal planes; grouting studs, etc. into hardened concrete; and making epoxy mortar for the repair of minor damaged areas on hardened concrete. This material should not be used when the temperature is below 10°C.

GENERAL. The two-component epoxy system shall have a maximum ratio of epoxy resin to polysulfide polymer of 2:1 by weight (Min. 1 3/4:1). In addition, the ratio of epoxy resin to curing agent shall be 11:1 by weight (Max. 12:1, Min. 10:1). The fine inert mineral filler when incorporated into the carrying component(s) shall be nonsettling.

MATERIAL REQUIREMENTS

Component A. This component shall consist of an unmodified epoxy resin and may contain a portion of fine inert mineral filler. It shall not contain solvents or reactive diluents. The epoxy resin shall be the condensation product of the reaction of bisphenol A with epichlorohydrin, shall be translucent, and shall have the following physical characteristics:

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color, Hellige</td>
<td>ASTM D1544</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Epoxide equivalent</td>
<td>ASTM D1652</td>
<td>180</td>
<td>200</td>
</tr>
</tbody>
</table>

Component B. This material shall consist of a blend of a low viscosity polysulfide polymer and a tertiary amine catalyst. The “B” component shall include a fine inert mineral filler. The component shall not contain solvents or diluents. When mixed with Component “A” as directed by the manufacturer, the resulting characteristics shall be as specified in “Characteristics of the Mixture.”

The polysulfide polymer flexibilizer shall be a dichloroethyl formal polysulfide in the 1000-molecular weight range having the following characteristics:

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color, Hellige</td>
<td>ASTM D1544</td>
<td>9</td>
<td>12</td>
</tr>
<tr>
<td>Sulphur Content, percent</td>
<td>ASTM D129</td>
<td>36</td>
<td>40</td>
</tr>
<tr>
<td>Shelf Life</td>
<td>---</td>
<td>1 year</td>
<td>---</td>
</tr>
</tbody>
</table>

Characteristics of the Mixture. When the two components are mixed in accordance with the manufacturer’s instructions, the mixture shall have the physical characteristics in Table 721-03-3.
TABLE 721-03-3 MIXTURE REQUIREMENTS

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pot Life at 25°C, minutes</td>
<td>See TESTING</td>
<td>30</td>
<td>---</td>
</tr>
<tr>
<td>Initial Viscosity at 25°C, PaCs</td>
<td>See TESTING</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>Spray applications</td>
<td>See TESTING</td>
<td>2</td>
<td>40</td>
</tr>
<tr>
<td>Other applications</td>
<td>See TESTING</td>
<td>2</td>
<td>40</td>
</tr>
<tr>
<td>Tack free time at 25°C, hrs</td>
<td>---</td>
<td>2</td>
<td>---</td>
</tr>
<tr>
<td>Degree of temporary gelation, mm</td>
<td>See TESTING</td>
<td>3.5</td>
<td>---</td>
</tr>
<tr>
<td>Ash content, percent</td>
<td>ASTM D482</td>
<td>—</td>
<td>50</td>
</tr>
<tr>
<td>Volatiles, percent</td>
<td>ASTM D1259</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>

Properties of Cured Materials. The grout, when mixed according to the manufacturer's instructions, shall harden into a solid having the physical characteristics in Table 721-03-4.

TABLE 721-03-4 CURED MATERIALS REQUIREMENTS

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressive Shear</td>
<td>Federal Specification</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Double Strength, MPa</td>
<td>MMM-B-350 Paragraph 4.4.3</td>
<td>2.75</td>
<td>---</td>
</tr>
<tr>
<td>Beam Break Test, MPa</td>
<td>Described under &quot;Test&quot;</td>
<td>5.5</td>
<td>---</td>
</tr>
</tbody>
</table>

PACKAGING. All material furnished must be shipped in strong substantial containers. The containers shall be identified as “Part A - contains epoxy resin” and “Part B- contains curing agent” and shall be plainly marked with the following information:
- N.Y.S.D.O.T. materials specification number
- Name of product
- Mixing proportions and instructions
- Name and address of the manufacturer
- Lot number and batch number
- Date of manufacture
- Quantity
- Date of expiration of acceptance

SAMPLING. Material shall be sampled and inspected at the place of manufacture or in warehouse lots as determined by the Department. Samples submitted to the Materials Bureau shall be taken as directed by the Department.

TESTING

Pot Life. The pot life shall be determined as follows: The two components are conditioned to 25°C and mixed in accordance with the manufacturer's instructions. The pot life of the material shall be considered to have ended when the viscosity reaches 85 Pa•s (Brookfield Model MBT with Helipath Attachment) at 25°C ambient. The time from initial mixing of the components until the mixture reaches 85 Pa•s shall be recorded as the pot life.

Initial Viscosity. The initial viscosity shall be measured with a Brookfield Model HBT, Spindle No. 3 at 20 RPM.

Tack Free Time. The epoxy mixture shall remain tacky and capable of bonding during a contact period of at least two hours at 25°C ambient measured from the time of spreading.
Degree of Temporary Gelation. The epoxy grout mixture shall have a degree of temporary gelation such that a 3.5 mm film can be maintained on the surface of a standard 50 mm x 125 mm paint panel after dripping ceases.

Compressive Shear Test. The test shall be performed in accordance with Federal Specification MMM-B-350 Paragraph 4.4.3 except that hand mixing of the epoxy will be permitted.

Beam Break Test. The specimens shall be tested for flexural strength using a simple beam with third point loading. The specimen shall be prepared and tested in accordance with ASTM Methods C192 and C78 except that the concrete shall be designed for 5.50 to 6.25 MPa flexural strength and shall be cast in 75 mm x 100 mm x 405 mm molds using a well-graded coarse aggregate all of which passes a 25 mm square sieve. Each beam to be tested shall be sawed transversely at midpoint, the sawed faces etched with a 10 percent aqueous solution of HCl and then thoroughly washed, and bonded with a 0.25 mm thickness of the epoxy adhesive under test. The surface to be bonded shall be maintained in a vertical position during application and cure of epoxy adhesive and plastic concrete. The hardened specimens shall be cured for a total time of at least 96 hours. During the last 24 hours of the curing period, they shall be immersed in water.

The result reported shall be the average of two tests. Any result below 2.75 MPa which fails outside the plane of adhesion will be disregarded and a retest performed. Any result below 5.50 MPa and above 2.75 MPa, of which 80% of the failure occurs outside the plane of adhesion, shall be considered acceptable. Any result above 5.50 MPa will be considered acceptable regardless of where the failure occurs.

BASIS OF ACCEPTANCE. This material will be considered for acceptance in stock lot quantities at manufacture or supply locations in accordance with procedural directives of the Materials Bureau. The expiration date of acceptance of this material shall be one year after the date of manufacture. Any unauthorized tampering or breaking of the seals on the containers between the time of sampling and delivery to the job site will be cause for rejection of the material.

721-04 (VACANT)

721-05 EPOXY REPAIR PASTE

SCOPE. This specification covers the material requirements of a two-component, flexible, rapid-hardening epoxy resin paste for making epoxy mortar. This material is used for the repair and sealing of cracks and other minor damaged areas in hardened concrete. It is suitable for patching on horizontal, vertical, and overhead applications. It develops high early strengths and achieves final cure in seven (7) days. This material shall not be used when the concrete or ambient temperature is below 10°C or above 40°C. It is suitable for damp, moist, and underwater applications.

MATERIAL REQUIREMENTS

Component A. Component A shall be the condensation product of the reaction of bisphenol A with epichlorohydrin. It may contain fillers but shall not contain non-reactive diluents. When mixed with Component B the mixture shall have the characteristics described under Characteristics of the Mixture.

Component B. Component B shall be the curing agent for the system and shall be capable of curing the system from 5°C and above when mixed according to the manufacturer's instructions. It shall contain no non-reactive diluents but may contain flexibilizers or fillers. Component B shall be completely reactive with Component A.

Components A and B shall each have a shelf life of one (1) year.

Characteristics of the Mixture. When Components A and B are mixed according to the manufacturer's instructions, the mixture will have a paste or gel consistency such that a 12.5 mm thick layer of the mixture will not sag or drip from an overhead surface throughout the temperature range from 10°C to 40°C. It shall also have the following characteristics:
§721

NEW YORK STATE DEPARTMENT OF TRANSPORTATION
STANDARD SPECIFICATIONS of May 4, 2006

**Properties of Cured Material.** For testing purposes the Components A and B shall be mixed with ASTM C109 Ottawa Silica Sand in the ratio of 1 part sand to 1 part epoxy by volume. This paste shall also be non-sagging and non-dripping as stated under Characteristics of the Mixture. The cured material shall have the following physical properties:

<table>
<thead>
<tr>
<th>Property</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pot Life @ 25°C, minutes</td>
<td>10 min.- 60 max.</td>
</tr>
</tbody>
</table>

**TABLE 721-05-1 CURED MATERIAL REQUIREMENTS**

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Minimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressive Strength1, MPa</td>
<td>AASHTO T 106</td>
<td>21</td>
</tr>
<tr>
<td>Bond Test Modulus of Rupture, MPa</td>
<td>See Testing</td>
<td>5.5</td>
</tr>
<tr>
<td>Freeze-Thaw</td>
<td>See Testing</td>
<td>80% Bond Strength</td>
</tr>
</tbody>
</table>

**NOTE:** 1. 50 mm cubic samples conditioned 24 hrs.

**PACKAGING.** All materials furnished shall be shipped in strong, substantial containers. The containers shall be identified as “Part A contains epoxy resin” and “Part B contains curing agent.” It shall also be plainly marked with the following information:
- N.Y.S.D.O.T. materials specification number
- Name of product
- Mixing proportions and instructions
- Name and address of manufacturer
- Lot number and batch number
- Date of manufacturer
- Quantity
- Date of expiration of acceptance.

**TESTING**

**Pot Life.** The components will be conditioned to 25°C and mixed according to the manufacturer's instructions. A 60±0.4 g. total mass will be placed in an unwaxed paper cup and placed on a work bench. The mixture will be probed every 2 minutes with a small stick starting 8 minutes from the time of mixing. The time at which a small ball forms in the center of the container is recorded as the pot life.

**Bond Test.** The epoxy will be tested for flexural strength using a simple beam with third point loading. The concrete will be designed for 5.50 to 6.25 MPa flexural strength and will be cast in 75 mm x 100 mm x 405 mm molds using a well-graded coarse aggregate all of which passes a 25 mm square sieve. Each beam to be tested will be sawed transversely at midpoint, the sawed faces etched with a 10% aqueous solution of HCL and then thoroughly washed. A 0.25 mm thickness of the epoxy adhesive under test will be applied to both wet etched surfaces while in a vertical position and worked into the surface. One of the prism halves will be inverted and placed on the matching half and allowed to cure for 72 hours. The result reported will be the average of two tests. Any result below 2.75 MPa which fails outside the plane of adhesion will be disregarded and a retest performed. Any result below 5.50 MPa and above 2.75 MPa, of which 80% of the failure occurs outside the plane of adhesion, will be considered acceptable. Any result above 5.5 MPa will be considered acceptable regardless of where the failure occurs.

**Freeze-Thaw.** Testing will be conducted in accordance with New York Test Method 216. In addition bond test specimens will be subjected to 25 freeze-thaw cycles before breaking in third point loading. A bond strength of 80% of the original average bond strength will be considered acceptable.

**BASIS OF ACCEPTANCE.** This material will be considered for acceptance in stock lot quantities at the manufacture or supply locations in accordance with procedural directives of the Materials Bureau. The expiration date of acceptance of this material shall be one year after the date of manufacture. Any
unauthorized tampering or breaking of the seals on the containers between the time of sampling and
delivery to the job site will be cause for rejection of the material.

721-06 THRU 721-19 (VACANT)

721-20 RAPID HARDENING POLYMER CONCRETE

SCOPE. This specification covers the material requirements of a two component, rapid hardening,
methyl methacrylate based polymer concrete repair material. The material is used with a primer to repair
hardened concrete.

MATERIALS REQUIREMENTS

Polymer Concrete Mortar. The polymer concrete mortar shall be a two component methyl
methacrylate based system. One component shall be a premixed powder consisting of catalyst, fine fillers,
and fine aggregate not to exceed 1.5 mm in size. The other component shall be a methyl methacrylate
monomer liquid capable of chemically reacting with the powder component such that the mixture hardens
to a completely cured condition within three (3) hours at temperatures between 2°C and 40°C inclusive.
The working life of the mixture shall be a minimum of 10 minutes and its workability shall be
consistent throughout the above temperature range. The shelf life of the unopened components, stored at
room temperature and in a dry atmosphere, shall be 6 months, minimum. Material older than 12 months
from the date of manufacturer shall not be used.

Properties of Cured Polymer Concrete. Polymer Concrete Mortar specimens, when prepared in
accordance with the manufacturer's mixing instructions, shall exhibit the following properties when cured
168±2 hours at 23°C:

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modulus of Rupture, MPa</td>
<td>ASTM C580</td>
<td>10</td>
<td>---</td>
</tr>
<tr>
<td>Elastic Modulus, MPa</td>
<td>ASTM C580</td>
<td>3450</td>
<td>6900</td>
</tr>
<tr>
<td>Thermal Expansion Coefficient, mm/mm/°C</td>
<td>ASTM C531</td>
<td>(1.8 to 3.6) x 10⁻⁵</td>
<td>---</td>
</tr>
</tbody>
</table>

The material shall also exhibit the following properties when tested under NYSDOT Test Method 701-13F:
A minimum one hour compressive strength of 17 MPa, a 24 hour strength of 24 MPa, and a 28 day
strength of 35 MPa.
Be able to withstand 50 cycles of freeze-thaw (10% NaCl solution) with a maximum loss of 4%.

Primer. The primer shall be a two component methyl methacrylate resin system capable of enhancing
the bond between the polymer concrete and the substrate. It shall have a curing time of 20 to 60 minutes
at temperatures between 2°C and 40°C inclusive.

Flammability. The polymer concrete shall not support or sustain combustion within five (5) minutes
after mixing.

PACKAGING. The material delivered from the manufacturer shall be in moisture proof bags and the
contents shall weigh within ±3% of the labeled bag weight. The manufacturer's name, address, date of
manufacture and mixing instructions shall be printed on each bag.

BASIS OF ACCEPTANCE. Application for material approval shall be submitted to the Director of
the Materials Bureau accompanied by at least a 25 kg, production run, sample of material. Upon approval,
the name of the product will be placed on the Department's Approved List. Products so listed will be
acceptable at the work site on the basis of the brand name labeled on the container. The Department
reserves the right to sample and test the material at any time.


SECTION 722 - WATER SUPPLY

722-01 DUCTILE IRON WATER PIPE, FITTINGS AND ENCASEMENT

SCOPE. This specification covers the material and quality requirements for ductile iron water pipe, miscellaneous fittings, coatings and encasement.

GENERAL. Ductile iron water pipe, fittings and encasement shall conform to the requirements of the following:

Cement-Mortar Lining for
Ductile-Iron Pipe and Fittings for Water AWWA C104 / ANSI A21.4
Polyethylene Encasement for Ductile-Iron Pipe Systems AWWA C105 / ANSI A21.5
Ductile Iron and Gray Iron Fittings, 3 NPS through 48 NPS for Water AWWA C110 / ANSI A21.10
Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings AWWA C111 / ANSI A21.11
Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges AWWA C115 / ANSI A21.15
Thickness Design of Ductile-Iron Pipe AWWA C150 / ANSI A21.50
Ductile-Iron Pipe, Centrifugally Cast, for Water AWWA C151 / ANSI A21.51
Ductile-Iron Compact Fittings, 3 NPS through 24 NPS and 54 NPS through 64 NPS, for Water Service AWWA C153 / ANSI A21.53

BASIS OF ACCEPTANCE. Ductile iron water pipe and fittings will be accepted on the basis of the Manufacturer’s certification that the material conforms to this specification. The certification for iron fittings shall list a fitting description, quantity, bare fitting weight and source, (AWWA Standard C110, C153 or Manufacturer, if fitting is not listed in either standard). The certification shall accompany the material delivered to the project site.

The Department reserves the right to sample and test this material subsequent to delivery at the project site.

722-02 STEEL WATER PIPE AND FITTINGS

SCOPE. This specification covers the material and quality requirements for steel water pipe and miscellaneous fittings.

GENERAL. Steel water pipe and fittings shall conform to the requirements of the following:

Steel Water Pipe - 6 NPS and Larger AWWA C200
Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied AWWA C203
Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 NPS and Larger - Shop Applied AWWA C205
Field Welding of Steel Water Pipe AWWA C206
Steel Pipe Flanges for Waterworks Service - Sizes 4 NPS to 144 NPS AWWA C207
Dimensions for Fabricated Steel Water Pipe Fittings AWWA C208
Cold-Applied Exterior Tape Coatings for the Exterior of Special Sections, Connections and Fittings for Steel Water Pipelines AWWA C209
Liquid-Epoxy Coatings for Steel Pipelines AWWA C210
Fusion-Bonded Epoxy Coatings Systems for the Interior and Exterior of Steel Water Pipelines AWWA C213
Tape Coating Systems for the Exterior of Steel Water Pipelines
Extruded Polyolefin Coatings for the Exterior of Steel Water Pipelines
Heat-Shrinkable Cross-Linked Polyolefin Coatings for the Exterior
of Fittings for Buried or Submerged Steel Water Pipelines
Cold-Applied Petroleum Tape and Petroleum Wax Tape Coatings
for the Exterior of Special Sections, Connections and Fittings
for Buried Steel Water Pipelines
Coating the Exterior of Aboveground Steel Water Pipelines and Fittings
Bolted, Sleeve-Type Couplings for Plain-End Pipe
Stainless-Steel Pipe, 4 NPS and Larger
Fabricated Steel Mechanical Slip-Type Expansion Joints
Polyurethane Coatings for the Interior and Exterior
of Steel Water Pipe Fittings

BASIS OF ACCEPTANCE. Steel water pipe and fittings will be accepted on the basis of the
Manufacturer's certification that the material conforms to this specification. The certification shall
accompany the material delivered to the project site.

The Department reserves the right to sample and test this material subsequent to delivery at the project
site.

722-03 CONCRETE WATER PIPE

SCOPE. This specification covers the material and quality requirements for concrete water pipe.

GENERAL. Concrete water pipe shall conform to the requirements of the following:

Reinforced Concrete Pressure Pipe, Steel Cylinder Type
Prestressed Concrete Pressure Pipe, Steel Cylinder Type
Reinforced Concrete Pressure Pipe, Noncylinder Type
Concrete Pressure Pipe, Bar-Wrapped, Steel Cylinder Type

BASIS OF ACCEPTANCE. Concrete water pipe will be accepted on the basis of the Manufacturer's
certification that the material conforms to this specification. The certification shall accompany the
material delivered to the project site.

The Department reserves the right to sample and test this material subsequent to delivery at the project
site.

722-04 WATER VALVES AND HYDRANTS

SCOPE. This specification covers the material and quality requirements for water valves and hydrants.

GENERAL. Water valves and hydrants shall conform to the requirements of the following:

Metal-Seated Gate Valves for Water Supply Service
Cast-Iron Sluice Gates
Dry Barrel Hydrants
Rubber-Seated Butterfly Valves
Ball Valves (6 NPS through 48 NPS)
Swing Check Valves for Waterworks Service (2 NPS through 24 NPS)
Resilient-Seated Gate Valves
Double-Check Valve Backflow Prevention Assembly
Reduced-Pressure Principle Backflow Prevention Assembly
Air-Release, Air/Vacuum and Combination Air Valves
for Waterworks Service
Open-Channel, Fabricated Metal Slides
Reduced-Wall, Resilient Seated Gate Valves for Water Supply Service


\section*{\texttt{§722}}

Power Actuating Devices for Valves and Sluice Gates \quad AWWA C540
Protective Epoxy Interior Coatings for Valves and Hydrants \quad AWWA C550

\textbf{BASIS OF ACCEPTANCE.} Water valves and hydrants will be accepted on the basis of the Manufacturer's certification that the material conforms to this specification. The certification shall accompany the material delivered to the project site.
The Department reserves the right to sample and test this material subsequent to delivery at the project site.

\section*{722-05 PLASTIC WATER PIPE AND FITTINGS}

\textbf{SCOPE.} This specification covers the material and quality requirements for plastic water pipe and fittings.

\textbf{GENERAL.} Plastic water pipe and fittings shall conform to the requirements of the following:

Polyvinyl chloride (PVC) Pressure Pipe 4 NPS Through 12 NPS for Water Distribution \quad AWWA C900
Polyvinyl chloride (PVC) Pressure Pipe and Fabricated Fittings (14 NPS through 48 NPS) for Water Transmission and Distribution \quad AWWA C905
Polyethylene Water Pipe and Fittings, 4 NPS through 63 NPS, for Water Distribution and Transmission \quad AWWA C906
Polyvinyl chloride (PVC) Pressure Fittings for Water, 4 NPS through 8 NPS \quad AWWA C907
PVC Self-Tapping Saddle Tees for Use on PVC Pipe \quad AWWA C908
Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4 NPS through 12 NPS \quad AWWA C909
Fiberglass Pressure Pipe \quad AWWA C950

\textbf{BASIS OF ACCEPTANCE.} Plastic water pipe and fittings will be accepted on the basis of the Manufacturer's certification that the material conforms to this specification. The certification shall accompany the material delivered to the project site.
The Department reserves the right to sample and test this material subsequent to delivery at the project site.

\section*{722-06 WATER SERVICE PIPE, SERVICE VALVES AND FITTINGS}

\textbf{SCOPE.} This specification covers the material and quality requirements for water service pipe, service valves and fittings.

\textbf{GENERAL.} Water service pipe, service valves and fittings shall conform to the requirements of the following:

Underground Service Line Valves and Fittings \quad AWWA C800
Polyethylene (PE) Pressure Pipe and Tubing (1/2 NPS through 3 NPS) for Water Service \quad AWWA C901
Steel Water Service Pipe (1/2 NPS to 4 NPS) \quad ASTM A53
Seamless Copper Water Tube, Type K \quad ASTM B88

\textbf{BASIS OF ACCEPTANCE.} Water service pipe, service valves and fittings will be accepted on the basis of the Manufacturer's certification that the material conforms to this specification. The certification shall accompany the material delivered to the project site.
The Department reserves the right to sample and test this material subsequent to delivery at the project site.
§722

722-07 WEDGE TYPE MECHANICAL RESTRAINT GLANDS

SCOPE. This specification covers the material and quality requirements for wedge type mechanical restraint glands.

GENERAL. Wedge type mechanical restraint glands shall have a number of individually activated wedges around the circumference of a pipe which grip the pipe surface and bolts through the gland which are attached to a fitting or a gland that restrains a pipe bell. Glands shall be constructed of high strength ductile iron in accordance with ASTM Standard A536, and shall have a minimum pressure rating exceeding the system test pressure identified in the Owner requirements. Glands shall be specifically manufactured for the type of pipe used, and may be solid or split ring (two piece). Glands shall be manufactured with twist off bolts.

BASIS OF ACCEPTANCE. Wedge type mechanical restraint glands will be accepted on the basis of the Manufacturer's certification that the material conforms to this specification. The certification shall accompany the material delivered to the project site.

The Department reserves the right to sample and test this material subsequent to delivery at the project site.

722-08 INSULATION FOR WATER MAINS

SCOPE. This specification covers the material and quality requirements for insulation for water mains.

GENERAL. Insulation for water mains shall be made of fiberglass, cellular glass, urethane or cellular phenol and shall conform to the requirements of the following:

- Fiberglass Pipe Insulation      ASTM C547
- Cellular Glass Insulation      ASTM C552
- Urethane Foam Pipe Insulation   ASTM C591
- Spray Applied Urethane Insulation    ASTM C1029
- Rigid Cellular Phenolic Pipe Insulation   ASTM C1126, Type III
- Waterproof Jacket for Insulation     ASTM C1136

BASIS OF ACCEPTANCE. Insulation for water mains will be accepted on the basis of the Manufacturer's certification that the material conforms to this specification. The certification shall accompany the material delivered to the project site.

The Department reserves the right to sample and test this material subsequent to delivery at the project site.

SECTION 723 - LIGHTING

723-01 ALUMINUM LIGHT STANDARDS AND ARMS

SCOPE. This specification covers the material and quality requirements for aluminum light standard shafts and aluminum bracket arms.

MATERIAL REQUIREMENTS

General. All light standards and arms shall be designed in accordance with the latest edition of the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals. The ARTBA Guide to Standardized Highway Lighting Pole Hardware may be used in conjunction with the AASHTO Standard Specifications in lieu of actual design computations. Wind pressure for design purposes shall be determined in accordance with the above AASHTO Standard Specifications, utilizing the wind speeds listed below. In addition, the dimensions of all lighting hardware shall also be consistent with the requirements of the appropriate maintenance agency.
Shaft. The shaft shall be a one-piece, seamless, round tapered spun aluminum tube of alloy 6063. The aluminum shaft shall be heat treated for its full length to produce a T6 temper, and an anchor base shall be welded to the bottom of the shaft. Shafts, which are to be mounted without transformer bases, shall be equipped with a 100 mm wide by 150 mm to 200 mm high reinforced handhole centered 0.35 m to 0.45 m above the base of the shaft, and located 90 degrees from the plane of the arm and on the side away from traffic if possible. Each handhole shall have a cover with stainless steel attachment screws to secure the cover. A grounding nut shall be provided inside the shaft opposite the handhole to accommodate a 12 mm threaded bolt or stud. The shaft shall have a satin finish accomplished by mechanical rotary grinding.

An anchor base shall be joined to the shaft by means of complete circumferential welds, externally at top of anchor base and internally at bottom of shaft.

The anchor base shall be a one-piece permanent mold casting, aluminum alloy 356-T6 provided with four (4) slots to receive 25 mm diameter bolts. The casting shall be free of cracks, pits, blow holes and non-metallic inclusions. Each anchor base shall be provided with four anchor bolt covers fabricated from aluminum alloy with stainless steel screws for attaching the covers.

If bracket arm light standards are proposed, a removable ornamental cast aluminum pole cap with stainless steel setscrews to hold it in place shall be provided and installed on the top of each shaft. A 36 millimeter diameter hole shall be furnished near the top of each shaft where the arm is to be attached to provide a cable entrance from the shaft into the bracket arm. The opening shall have an approved metal or rubber grommet placed to provide a smooth cable guide for pulling the electrical cable through. The pole cap and hole are not required for davit arm light standards. Wall thickness and tube diameters for 129 km/h wind zones shall conform to Table 723-01-1 Light Standard Dimensions.

Truss Arms. The upper and lower members shall be fabricated from seamless tubing of 6063-T6 or 6061-T6 aluminum alloy. The upper member shall be the continuous or wiring member and shall have a 3 mm minimum wall thickness. Truss bracket arms shall be designed with the upper and lower members joined near the luminaire end of the arm. The arms shall be braced with one or two vertical pipe struts depending on the arm length. Each truss bracket arm shall be equipped with a 50 mm pipe size slip fitter tenon projecting 125 mm from the luminaire end. The arm shall be secured to the shaft with a bolt type or clamp type attachment similar to those shown in drawings ASA 2-1 or ASA 2-2 of the ARTBA Guide to Standardized Highway Lighting Pole Hardware. Attachments that require welding a fitting directly onto the shaft, similar to ARTBA drawing SPS 2-1, will not be allowed on aluminum light pole shafts. Bolts and nuts shall be fabricated from AISI Type 302 stainless steel according to ANSI B1.1. Washers shall be fabricated from AISI 300 series stainless steel according to the requirements of ANSI B18.21.2. In projects where arm lengths are intermixed, the rise for each length is to be set to keep the upper chord of all arms at approximately equal slopes.

<table>
<thead>
<tr>
<th>TABLE 723-01-1 LIGHT STANDARD DIMENSIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Pole Height (m)</td>
</tr>
<tr>
<td>-------------------------</td>
</tr>
<tr>
<td>8</td>
</tr>
<tr>
<td>9</td>
</tr>
<tr>
<td>9</td>
</tr>
<tr>
<td>11</td>
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<tr>
<td>16</td>
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<td>9</td>
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<td>11</td>
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<tr>
<td>13</td>
</tr>
<tr>
<td>14</td>
</tr>
<tr>
<td>16</td>
</tr>
</tbody>
</table>

NOTE: *Twin-Arm.
**Single Bracket Arms.** 1.2 to 2.4 meters. The single member arms shall be fabricated from seamless tubing of 6063-T6 or 6061-T6 aluminum alloy. Wall thickness shall not be less than 3 mm. The arms shall be designed in accordance with AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals. Each arm shall be equipped with a 2 NPS pipe size slip fitter tenon projecting 150-200 mm from the luminaire end. The arms shall be secured to the shaft with a bolt type or clamp type attachment similar to those shown in drawings ASA 2-1 or ASA 2-2 of the ARTBA Guide to Standardized Highway Lighting Pole Hardware. Attachments that require welding a fitting directly onto the shaft, similar to ARTBA drawing SPS 2-1, will not be allowed on aluminum light pole shafts. Bolts and nuts shall be fabricated from AISI Type 302 stainless steel according to ANSI B1.1 Washers shall be fabricated from AISI 300 series stainless steel according to the requirements of ANSI B18.21.2.

**Bracket Arms for Wood Utility Poles.** Bracket arms to be mounted on wooden utility poles shall be tapered, seamless tube aluminum with a 3 mm minimum wall thickness. The bracket arm shall be welded to an appropriate connection plate at the pole end and have a 50 mm slip-fitter tenon at the luminaire end.

A 32 mm cable opening on the underside near the pole shall be protected with a rubber grommet. Arms over 1.8 meters long shall be trussed, with upper and lower members securely joined by means of vertical strut(s). All aluminum shall be alloy 6063-T6 and all connecting hardware such as nuts, bolts, etc. shall be stainless steel.

**Davit Arm Poles.** For davit arm poles the top of the shaft shall terminate in a tenon (or twin tenons for double arm poles) and be equipped with a friction fit outer sleeve to produce a flush joint with the arms(s). The davit arm(s) shall be constructed of the materials and methods specified for the shaft and as dimensioned on the drawings. The davit arm(s) shall be secured to the shaft in a flush connection with two stainless steel bolts, nuts and lockwashers. The davit arm(s) shall terminate in a cast or fabricated flush tenon for a slipfit connection to the luminaire. The tenon shall be secured to the davit arm by stainless steel bolts.

**SHIPPING.** Shafts and arms shall be tire-wrapped with a heavy water resistant paper, for protection during shipping and installation. All small parts shall be boxed.

**Wind speeds.** Poles, arms and attachments covered by this specification shall be designed for the following wind speeds in accordance with the AASHTO Standard mentioned above.

- 129 km/h - Counties of Allegany, Bronx, Cattaraugus, Chautauqua, Erie, Genesee, Kings, Livingston, Monroe, Nassau, New York, Niagara, Orleans, Ontario, Queens, Richmond, Rockland, Suffolk, Wayne, Westchester & Wyoming.
- 113 km/h - All Other Counties.

**Welding.** All aluminum welding on light standards shall be performed in the shop, using the inert metal-arc welding process. Filler metal shall conform to the A.W.S. Specification A5-10. Welders shall be certified by A.S.M.E. Section 9 or A.W.S. D 1.2.

**Vibration Shims.** Vibration shims (dampeners) shall be provided by the pole manufacturer for all aluminum poles nine (9) meters or longer. Vibration shims shall also be provided for poles installed in excessively windy locations or on viaducts with continuous vibration.

**BASIS OF ACCEPTANCE.** Acceptance of the shaft, anchor base, truss bracket arms, and single member arms covered by this specification will be based on:

- Manufacturer's certification of compliance with these specification requirements.
- Submission, to the Engineer, of design and fabrication details for each shaft, anchor base and arm intended for a particular design load as specified in the contract documents. The design and fabrication details being submitted shall have been approved and signed by a professional engineer licensed to practice in New York State. This submission shall be sent in time to be received at least 10 working days prior to the date the Contractor orders the poles, anchor bases and arms.
§723

723-02 HIGH MAST POLE, HEAD FRAME ASSEMBLY WITH LUMINAIRE RING AND LOWERING DEVICE

SCOPE. This specification covers the material and quality requirements for the pole and head frame assembly with luminaire ring and lowering device to be used in a high mast lighting system.

MATERIAL REQUIREMENTS

General. The steel pole, head frame assembly, luminaire ring and lowering system shall be designed to meet or exceed "AASHTO Standard Specifications, for Structural Supports for Highway Signs, Luminaires and Traffic Signals." The design wind loading shall be chosen to be consistent with the location of the structure and the height factor. See §723-01 Aluminum Light Standards and Arms. It shall be the contractor's responsibility to obtain verification of all necessary weights and effective projected areas as required in the plans.

Poles. The steel pole shall be capable of supporting the combined weight and projected area of both lowering system and number of luminaires with built-in ballast as shown on the contract plans.

The pole shall consist of sections of tapered steel tubes, round or polygonal (8 or more equal sides) in cross section, which telescope into each other with an overlap of 1.5 diameters. Steel used in fabricating the shaft shall have a minimum yield strength of 345 MPa after all fabricating operations have been completed.

In the base of the pole will be located an adequate size hand hole complete with a weatherproof cover and lock. A plate shall be welded opposite the hand hole for mounting the lowering system winch (unless externally mounted on the portable power drive), circuit breakers and other hardware. The hand hole area shall have a 1.8 meter reinforcing sleeve. The hand hole and plate shall be designed to accommodate the required High Mast Head Frame and Lowering Assembly.

The finished pole shall be galvanized in accordance with §719-01 Coating and Repair Methods, Type I. If A588M weathering steel is used for the pole, all slip joints shall have a barrier coating conforming to the requirements of the Materials Bureau or as stated in the proposal.

Anchor Base. The anchor base shall be fabricated of steel meeting or exceeding the yield strength of ASTM-A-36M. The anchor base shall telescope the butt end of the pole and be welded on the inside bottom and outside top.

Anchor bolts, nuts, and washers. Anchor bolts and nuts shall be fabricated of steel meeting or exceeding ASTM A-572M (minimum yield strength 345 MPa). The top of the anchor bolts shall have a minimum of 230 mm of thread and a minimum of 300 mm of galvanizing in accordance with ASTM-A-153. Each bolt shall be furnished with two (2) heavy duty, galvanized, hex nuts with a strength equal to or exceeding the proof load of the bolts. The Contractor may wish to install pre-assembled anchor bolt cages, subject to approval by the Engineer, in lieu of the design shown on the plans.

Washers shall be plain hardened washers. Nuts, washers and a minimum of the top 300 mm of the anchor bolts shall be hot-dipped galvanized in accordance with the requirements of §719-01 Galvanized Coating and Repair Method, Type II.

The pole manufacturer shall design the anchor bolts and nuts in accordance with “AASHTO Standard Specification for Structural Supports for Highway Signs, Luminaires and Traffic Signals.”

Welding. Pole sections shall have no more than two longitudinal welded seam and no transverse seams. All welding shall be performed in accordance with the N.Y.S. Steel Construction Manual. Longitudinal welds shall have a minimum 60% penetration. All circumferential welds for slip joints and shaft to base shall be 100% penetration. All 100% welds shall be inspected ultrasonically by the State.

Reinforcing sleeve. The reinforcing sleeve shall be fabricated of steel meeting or exceeding AISI 1020 steel. The sleeve shall be galvanized under the same ASTM specification as the pole.

NEW YORK STATE DEPARTMENT OF TRANSPORTATION
STANDARD SPECIFICATIONS of May 4, 2006
Head Frame. The head frame shall be capable of supporting the combined weight and projected areas of the luminaire ring assembly and luminaires with built in ballast as shown on the plans. The luminaire ring shall be designed to use the number and configuration of luminaires shown on the plans.

The head frame shall be equipped with a suitable weather resistant and bird proof cover.

The head frame shall be a zinc-coated steel structure attached to the pole by means of a steel slip fitter and secured by at least four (4) stainless steel set screws.

The head frame shall provide at least three point suspension for the luminaire ring assembly.

For raising and lowering the luminaire ring assembly, three 7X19 aircraft-grade stainless steel, hoisting cables, of sufficient size to support the load shall be included. Hoisting cable sheaves shall be grooved to the exact diameter of the hoisting cable for 1800 bearing surface and be equipped with suitable guides to prevent jumping the sheaves. Sheave bearings shall be permanently lubricated on stainless steel shafts.

Permanently lubricated power cable sheave(s) shall be provided over a stainless steel shaft. The grooved diameter of the sheave(s) shall be coordinated with the power cable diameter and be equipped with guides to prevent jumping the sheave(s).

The power cable supplied shall be a minimum of 6 meters longer than the street lighting pole installed. It shall be a water proof cable with the necessary number of conductors and sized to properly operate the street lighting system.

Three latching devices shall be provided to support the luminaire ring assembly when in the latched position. There will be no tension on the hoisting cables when the luminaire ring is in the latched position. The latches shall be actuated from the ground. Locking of the luminaire ring shall be signalled by indicators visible from the ground. All moving parts of the latch mechanism shall be serviceable from the ground. The latching mechanism shall not be impaired by the formation of ice and shall not require adjustment. Each of the latches, independently, shall be strong enough to support eight times the weight of the luminaire ring assembly and all luminaires installed.

Lowering System and Luminaire Assembly. The luminaire ring assembly shall be fabricated of steel with the appropriate number of 50 mm nominal steel pipe mounting arms. It shall be zinc plated and prewired to distribute the power to the required number of luminaires. Power cables shall be positively attached to the ring assembly through a watertight wiring chamber, with watertight cable connectors. A 600 volt terminal block, completely prewired shall be included in the watertight wiring chamber. A watertight twist lock power receptacle shall be installed in the luminaire ring to allow testing of the luminaires at ground level. A cable support shall be provided to hold the power cable in the luminaire ring.

Attached to the luminaire ring assembly shall be a spring loaded roller contact guidance mechanism with a minimum of three arms that maintain positive contact with the pole surface, centering and guiding the ring assembly during lowering to prevent jamming. Rollers shall be made of water resistant non-marking material with permanently lubricated bearings on stainless steel shafts.

Winch Assembly, if permanently mounted in the pole, shall be a worm-gear self locking type (Torque rated) and designed for both hand operation or operation by means of a portable power unit. Winch Cable shall be 6 mm or greater diameter stainless steel aircraft cable to support the load. There shall be a take-up guide on the winch assembly to eliminate cable 'fall-off'. Compression springs shall be used in the connection of the hoisting cables to the luminaire ring assembly, but ultimate support of the luminaire ring will not be sacrificed by individual or total compression spring failure.

The lowering system shall also include circuit breaker assembly, twist-lock receptacle and plugs for the power cable.

BASIS OF ACCEPTANCE: Acceptance of the steel poles and appurtenances will be based on the delivery, by the Contractor to the Engineer, of the manufacturer's certification, signed by a N.Y. State P.E., of compliance with the specification requirements and the details of the poles and their appurtenances as indicated in the contract documents. As a condition of acceptance, the Contractor shall submit five copies of the shop drawings, used to fabricate the poles and appurtenances, to the Engineer along with the required certification as per §670-3.02.

When the Contractor proposes to use a shape of pole and/or appurtenances different from that indicated in the contract documents, written approval of the change in shape must be received from the Engineer prior to fabrication of the poles and/or appurtenances. Where the pole and/or appurtenances to
be used are not as indicated in the contract documents, the manufacturer shall certify, in writing, to the Engineer, that the pole and/or appurtenances are equal to or superior to the pole and/or appurtenances indicated in the contract documents. Additionally, the differences shall be highlighted on the shop drawings submitted to the Structures Division for approval.

It will be the responsibility of the Contractor to ensure that the required certifications and shop drawing copies are received by the Engineer prior to the arrival of the poles and/or appurtenances on the site. The Engineer will require ten (10) working days, measured from the date of receipt, to approve any request for a change in shape of poles and/or appurtenances.

723-03 PORTABLE POWER DRIVE FOR HIGH MAST LUMINAIRE LOWERING SYSTEM

SCOPE. This specification covers the functional requirements for a portable power drive unit, and winch when necessary, issued for a High Mast Luminaire Lowering System.

MATERIAL REQUIREMENTS. The portable power drive unit shall be a heavy duty reversing electric drill motor and drive shaft coupled with a torque limiter which shall supply all of the necessary driving power to the winch. A portable winch assembly shall be included with the portable power drive unit unless the winch has been permanently installed in the base of the high mast pole. The power drive shall be provided with a step down transformer and a remote control cord which will enable the operator to stand at least 5 meters from the pole. The unit shall be designed so as to be simply strapped to the base of the pole with a quick-connect securing mechanism that will accommodate any size or shape pole. The unit shall be capable of raising or lowering the lowering ring and luminaires at an approximate rate of 3 meters per minute. All aspects of the power drive shall be compatible with the detailing of the pole base and the lowering system for which it is to be used.

Detail specifications, parts lists, instruction sheets and shop drawings of the portable power drive shall be submitted in accordance with §670-3.02 Shop Drawings.

BASIS OF ACCEPTANCE: Acceptance of the portable power drive will be based on the manufacturer's certificate of compliance with these specification requirements, and the Engineer's approval of the detail specifications and shop drawings.

723-04 THRU 723-09 (VACANT)

723-10 ANCHOR BASE (ALUMINUM)

SCOPE. This specification covers the material and quality requirements for cast aluminum anchor bases for lighting standards.

MATERIAL REQUIREMENTS. Aluminum anchor bases shall be a one piece casting of 356.0 aluminum alloy. The casting shall be free of cracks, pits, blow holes and non-metallic inclusions. Each anchor base shall be provided with four anchor bolt covers fabricated from B443.0 aluminum alloy with stainless steel screws for attaching the covers.

BASIS OF ACCEPTANCE. Anchor bases will be accepted upon the manufacturer's certification that they meet the requirements of this section.

723-11 THRU 723-14 (VACANT)

723-15 BREAKAWAY TRANSFORMER BASE (ALUMINUM)

SCOPE. This specification covers the material and quality requirements for Breakaway Aluminum Transformer Bases for Lighting Standards.

GENERAL. Transformer bases shall be one-piece aluminum alloy sand or aluminum alloy permanent-mold castings. The bases shall be equipped with a removable, aluminum or plastic, trapezoidal shaped
door (approximately 0.33 m high; 0.18 m wide (top); 0.23 m wide (bottom). Each door shall be secured to the base with a stainless steel screw(s).

For attachment to the shaft anchor base, each transformer base shall be supplied with four (4) loose bearing plates or other acceptable bearing surfaces and four (4) 25 mm diameter by 95 mm long or longer hot-dipped galvanized hexhead machine bolts.

A grounding connection, accommodating a 12 mm threaded bolt or nut shall be provided inside each transformer base.

The light pole manufacturer shall obtain the base and bolt circle dimensions from the plans and shall then provide the Contractor with a template print, giving complete information for setting the anchor bolts.

Transformer bases shall be so designed as to minimize the possibility of hooking or snagging an impacting vehicle.

MATERIAL REQUIREMENTS. Transformer bases shall be cast of Aluminum-Alloy 356.0-T6 (SG70A-T6) in conformance with ASTM B26M, Aluminum-Alloy Sand Castings or ASTM B108, Aluminum-Alloy Permanent Mold Castings. The trapezoidal shaped door shall be fabricated from B443.0 (S5A) or 356.0-T6 (SG70A-T6) Aluminum Alloy.

Transformer bases and doors may be made of an Aluminum Alloy equivalent to 356.0-T6 (SG70A-T6) upon approval of the Materials Bureau.

TESTS. To determine acceptable breakaway characteristics, transformer bases shall be subjected to dynamic laboratory testing. The test shall apply to transformer bases accommodating poles of less than 317 kg in weight (including luminaire and bracket) and poles of less than 15 meter mounting height only.

A full size pole, together with luminaire or a suitable weight to simulate the luminaire, shall be mounted on the transformer base. A ballistic pendulum, equipped with a crushable nose, as approved by FHWA, and weighing 820 kg, shall be swung in such a manner so as to strike the transformer base at a velocity of 35 km/h. The point of impact shall be at a height of 0.5 meters from the bottom of the transformer base.

Transformer bases shall be considered to have acceptable breakaway features if they produce a change in velocity of 5.0 meters per second or less. For further specific information concerning the test equipment and procedure, contact the Materials Bureau.

BASIS OF ACCEPTANCE. The Department requires the submission of Materials Details. The manufacturer or supplier shall prepare and submit the appropriate material in accordance with the procedural directives of the Materials Bureau. Upon approval by the Materials Bureau, the name of the product and/or supplier, and the reference number assigned to the approved Materials Details will be placed on the Approved List. Such products shall then be accepted on the basis of their brand name and conformance to the approved Materials Details.

The supplier shall provide two copies of the approved Materials Details through the Contractor to the Engineer as part of the evidence of acceptability for the material at least 10 days prior to the use of the product.

723-16 THRU 723-18 (VACANT)

723-19 RIGID PLASTIC CONDUIT

SCOPE. This specification covers the material requirements for rigid plastic conduits (PVC and high-density PE) for use as raceway for wires or cables of an electrical system. Rigid plastic conduit is acceptable for up to 75°C wiring service. Rigid PVC (polyvinyl chloride) conduit is suitable for installation above or below ground and with or without concrete encasement; high-density PE (polyethylene) conduit is intended for below ground installations only, and with or without concrete encasement.

GENERAL. Under these requirements either Class 1, Heavy Wall PVC or Class 2, High Density PE conduit may be supplied for underground installation. For above ground use, only Class 1 conduit shall be allowed.
MATERIAL REQUIREMENTS. Rigid plastic conduit shall conform to the requirements of UL 651A. All fittings, couplings and expansion fittings shall conform to the applicable requirements of UL514A. Solvent cement for joining Class 1 conduit and conduit fittings shall meet the requirements of ASTM D2564, or alternately be of the type recommended by the conduit manufacturer. Unless otherwise recommended by the manufacturer, fittings for Class 2 conduit shall be of a drive-on type and solvent cement will not be needed for “jointing.”

BASIS OF ACCEPTANCE. Rigid plastic conduit shall be accepted upon the basis of the manufacturer's certification that it meets the requirements of this specification, as well as being Underwriters Laboratory Listed. Fittings, couplings and solvent cement shall be accepted upon the manufacturer's certification that they meet the requirements of this specification.

723-20 METAL STEEL CONDUIT, ZINC COATED

SCOPE. This specification covers the material requirements for zinc coated rigid metal steel and intermediate metal steel conduits, used as raceways for wires or cable of an electrical system. Steel conduit may be embedded in concrete or earth; or may be used under all atmospheric conditions, including those locations classified as hazardous; and may be used in high voltage (over 600 volts) installations.

GENERAL. Under these requirements, either Class 1, Rigid Metal Steel Conduit or Class 2, Intermediate Metal Steel Conduit may be supplied. In addition, Class 1 and Class 2 conduits may be interchanged in the same run, providing the ends of both of the conduits are reamed, so as to create beveled edges and a smooth area over which the wires and cables will pass. Where conduit is to be jacked or exposed to the atmosphere, only Class I, Rigid Metal Steel Conduit, is permitted.

Additionally, conduit exposed to the atmosphere shall be PVC coated.

MATERIAL REQUIREMENTS. The zinc coated metal steel conduit shall conform to the requirements of UL 6, Class 1 - Rigid Metal Conduit; or UL 1242, Class 2 - Intermediate Metal Conduit.

All fittings, couplings and expansion fittings shall be zinc coated and shall meet the same specifications as the conduits. Condulets shall be gasketed and shall be furnished with stainless steel or brass screws for the cover. Expansion fittings shall be metallogically connected for continuity of grounding on either side.

The zinc coating on the outside surfaces shall be equivalent to a minimum thickness of 0.02 mm.

BASIS OF ACCEPTANCE. Metal steel conduit may be accepted upon the manufacturer's certification that it meets the requirements of this section.

723-21 AND 723-22 (VACANT)

723-23 P.V.C. COATED GALVANIZED STEEL CONDUIT

SCOPE. This specification covers the material and quality requirements for P.V.C. coated galvanized steel conduit.

GENERAL. P.V.C. Coated Galvanized Steel Conduit. The hot-dipped galvanized Rigid Steel Conduit; prior to plastic coating, shall conform to N.E.M.A. Standards Publication No. RN 1, and ANSI C80.1.

Elbows in standard and special radii shall be coated as above except that no coupling will be coated with the elbow. Separate couplings will be furnished as required and ordered.

BASIS OF ACCEPTANCE. P.V.C. coated galvanized steel conduit will be accepted upon manufacturer's certification that it meets the requirements of this section.
723-24 FLEXIBLE LIQUID-TIGHT STEEL CONDUIT

SCOPE. This specification covers the material and quality requirements of flexible liquid-tight steel conduit.

GENERAL. The flexible liquid-tight steel conduit shall be of the size indicated on the plans. It shall conform to the requirements of Underwriters' Laboratory specification UL 360 and shall be listed with Underwriters' Laboratory Inc. Connectors furnished under this specification shall be standard liquid-tight connectors.

BASIS OF ACCEPTANCE. Flexible liquid-tight steel conduit will be accepted upon manufacturer's certification that it meets the requirements of this section.

723-25 AND 723-26 (VACANT)

723-27 HIGH PRESSURE SODIUM VAPOR LUMINAIRES (STANDARD MOUNT)

SCOPE. This specification covers the material and quality requirements for high pressure sodium vapor luminaires.

MATERIAL REQUIREMENTS. The luminaires shall be of the high pressure sodium vapor type designed for use with high pressure sodium vapor lamps, color corrected or clear, and fully weatherproof. The luminaires shall be constructed so they cover a complete self contained insect resistant and shock resistant unit. The entire luminaire assembly shall be completely pre-wired, at the factory, requiring only the connection of the primary circuit wires to the electric power source for its operation. All metallic component parts of the luminaire shall be made of a rust-resistant alloy or coated with an approved rust-resistant finish. Weep holes shall be provided for drainage.

Easy access to the lamp and major electrical components shall be provided requiring no special tools to gain entrance for maintenance purposes. The luminaire shall be provided with a means to prevent accidental exposure of the inner electrical components and accidental separation of the component parts. The luminaire shall be equipped with an adjustable lamp socket to simplify beam angle setting and an appropriate refractor for the wattage and lighting distribution specified.

The luminaire casing shall be precision die-cast aluminum for the wattage of the lamps specified, and painted inside and out with a coat of baked on epoxy enamel, or polyester powder, virtually pinhole free, leaving no exposed metal. The underside of the luminaire shall be marked with the standard NEMA decal, visible from the ground, indicating the type and wattage of the lamp.

The luminaire shall contain a complete ballast assembly to which are mounted the necessary electrical components for multiple operation including ballast, solid state starting aid, capacitors, adjustable twist-lock three prong receptacle for photo-electric control when specified, and a dead back terminal board with pressure type terminals.

The ballast shall be a high power factor (exceeding 90%) 3 coil lag type (magnetic regulator) capable of operation on a 120 volt, 60 cycle, multiple circuit (unless otherwise shown on the plans) and able to operate the lamp in an open or short-circuit condition for six months without significant loss of ballast life.

The ballast assembly shall be capable of starting and operating the lamp at a temperature of minus twenty nine degrees Celsius.

The entire ballast assembly shall be readily removable as a single unit and utilize quick disconnect plugs.

The slipfitter shall be suitable for mounting on a 50 mm standard pipe bracket and capable of securely fastening flush to the mounting brackets without the need of separate mounting parts or rearrangement of mounting components. Leveling and clamping of the luminaire to the bracket shall be accomplished by the tightening of bolts and capable of adjusting the luminaire at least three degrees above and below horizontal. Bird shields shall be supplied and installed on all slipfitter installations.

The optical assembly shall consist of a die cast aluminum lens holder with a glass or aluminum 'Alzak' finished, hydroformed, gasketed reflector, a heat and impact resistant refractor, and a porcelain or
polyester enclosed mogul socket. The mogul socket shall be equipped with lamp grip and a spring type center contact.

If a photo-electric control is specified, the receptacle shall be provided with a fully weatherproof covering that is readily removable without tools.

Luminaires shall be complete with compatible high pressure sodium lamps having the following characteristics:

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Mean lumens at 10 hours/start</td>
<td>90%</td>
</tr>
<tr>
<td>Warm-up time</td>
<td>3 to 4 minutes</td>
</tr>
<tr>
<td>Restart time</td>
<td>1 minute</td>
</tr>
<tr>
<td>Maximum power variance around design center</td>
<td>±5%</td>
</tr>
<tr>
<td>Lowest ambient starting temperature</td>
<td>-29 °C</td>
</tr>
</tbody>
</table>

The unit shall be supplied with an ANSI-IES vertical light distribution as specified on the plans. It shall be adjustable for a Type II, III or IV lateral light distribution and set at the factory for the distribution shown on the plans. For high mast installations a Type V distribution shall be provided. The downward light efficiency shall be at least 73%.

**BASIS OF ACCEPTANCE.** Acceptance of the roadway luminaire will be based on manufacturer's certification of compliance with these specification requirements and on inspection by the Engineer that no damage or defects are evident.

**723-28 LOW PRESSURE SODIUM VAPOR LUMINAIRES (UNDERDECK MOUNT)**

**SCOPE.** This specification covers the material and quality requirements for Low Pressure Sodium Vapor Underdeck Luminaires.

**MATERIAL REQUIREMENTS.** The luminaire shall be of the low pressure sodium vapor type suitable for underdeck or wall mounting, designed for use with a horizontally mounted lamp, fully weatherproof and watertight. The luminaire shall operate satisfactorily with any appropriately sized low pressure sodium lamp now commercially available.

The luminaire shall be equipped with a built-in ballast, and shall be designed for operation on a 120 volt, 60 hz. multiple circuit unless otherwise shown on the plans.

The luminaire shall provide efficient even illumination and shall be optically sealed and gasketed. It shall be mechanically strong and easy to maintain. The ballast components shall be mounted in a structurally sound manner within the housing of the luminaire, with provision made for optimum heat dissipation of the ballast. The reflector, socket, terminal board, fuse and ballast components shall be readily accessible. When closed for operation, the optical assembly shall be sealed against the entry of all contaminants.

The luminaire shall withstand severe outdoor conditions due to radical seasonal changes in temperature and shall be structurally capable of operating satisfactorily in winds of 129 km/h.

All exposed electrical live parts shall be protected to observe adequate safety precautions, subject to approval of the Engineer.

The whole luminaire assembly shall be completely prewired requiring only the connection of the primary circuit wires for its operation.

All components shall be corrosion resistant. Metals in contact with each other shall be compatible to prevent corrosion. Screws washers and nuts shall be stainless steel.

The luminaire housing shall be constructed of either heavy duty aluminum or heavy duty plastic and shall support the ballast, capacitor component, socket, lamp support, fuse, and terminal board. Those portions of the housing which support the ballast, and to which are connected the mounting hardware and the conduit, shall be aluminum. The underside of the housing shall be marked with the standard NEMA decal indicating the type and wattage of the lamp. All mounting hardware required for attaching the luminaire to the underdeck structure and for adjusting the luminaire about its longitudinal axis through an angle of 45 degrees from horizontal, shall be furnished with the luminaire when required. The luminaire shall be capable of being mounted flush against underdeck or, when required, suspended by rods from the
underdeck. The mounting hardware shall be made of stainless steel, prevent rotation of the luminaire, and be capable of adequately supporting the luminaire in winds of 129 km/h.

The reflector shall be fabricated from an aluminum alloy sheet mechanically polished and electrochemically processed to a specular finish. It shall not darken to the extent that it cannot be wiped clean with a soft cloth.

The refractor shall be formed of clear, heat resistant, ultra-violet stabilized polycarbonate plastic, free from imperfections and capable of being removed without the use of tools.

It shall be equipped with a latching arrangement and shall be hinged to the housing of the luminaire. Provisions shall be made to prevent accidental detachment of the refractor or any other luminaire part.

The ballast shall be a modified constant wattage type with high power factor (over 90%) and capable of regulating the output power within \( \pm 5\% \) when the input voltage fluctuates \( \pm 10\% \). The ballast and lamp shall be capable of starting and operating at ambient temperatures of minus 29 degrees Celsius.

The lamp socket shall be bayonet type provided with a means to hold the lamp against vibration and achieve close contact between lamp and socket terminals.

A means shall be provided to reduce entrance of foreign material through the wiring opening into the optical system.

The terminal board shall be equipped with two clamp type pressure terminals for connection to the phase leg and neutral of the primary circuit. The terminals shall be properly identified for connection, with notations on terminal board, color coding, or wiring diagram.

The fuse holder shall be gasketed and provide external access to the fuse.

Photometric distribution shall be symmetric or asymmetric as specified.

**BASIS OF ACCEPTANCE.** Low pressure sodium vapor underdeck luminaires will be accepted upon the manufacturers certification that they meet the requirements of this section and are U.L. approved and on inspection by the Engineer that no damage or defects are evident.

**723-29 HIGH PRESSURE SODIUM VAPOR LUMINAIRES (UNDERBRIDGE MOUNT)**

**SCOPE.** This specification covers the material and quality requirements for High Pressure Sodium Vapor Luminaires (Underbridge Mount).

**MATERIAL REQUIREMENTS.** The luminaires shall be of the high pressure sodium vapor underbridge type designed for use with high pressure sodium vapor lamps.

The luminaires shall be constructed to be a complete self contained waterproof and shock resistant unit. The entire luminaire assembly shall be completely pre-wired, at the factory, requiring only the connection of the primary circuit wires to the electric power source for its operation. All metallic component parts of the luminaire shall be made of a rust-resistant alloy or coated with an approved rust-resistant finish.

Easy access to the lamp and major electrical components shall be provided requiring no special tools to gain entrance for maintenance purposes. The luminaire shall be provided with a means to prevent accidental exposure of the inner electrical components and accidental separation of the component parts.

The luminaire casing shall be precision die-cast aluminum for the wattage of the lamps specified, and marked with the standard NEMA decal, visible from the ground, indicating the type and wattage of the lamp.

The ballast shall be a high power factor (exceeding 90%) 3 coil lag type (magnetic regulator) capable of operation on a 120 volt, 60 cycle, multiple circuit (unless otherwise shown on the plans) and able to operate the lamp in an open or short-circuit condition for six months without significant loss of ballast life.

The ballast assembly shall be capable of starting and operating the lamp at a temperature of minus twenty nine degrees Celsius.

All mounting hardware required for attaching the luminaire to the underdeck structure and for adjusting the luminaire about its longitudinal axis shall be furnished with the luminaire. The luminaire shall be capable of being mounted flush against underdeck or suspended from the underdeck. The mounting hardware shall prevent rotation of the luminaire and be capable of adequately supporting the luminaire in winds of 129 km/h.
The optical assembly shall consist of a die cast aluminum lens holder with a glass or aluminum 'Alzak' finished, hydroformed, gasketed reflector, a heat and impact resistant refractor, and a porcelain or polyester enclosed mogul socket. The mogul socket shall be equipped with lamp grip and a spring type center contact. Luminaires shall be complete with compatible high pressure sodium lamps having the following characteristics:

- % Mean lumens at 10 hours/start: 90%
- Warm-up time: 3 to 4 minutes
- Restart time: 1 minute
- Maximum power variance around design center: ±5%
- Lowest ambient starting temperature: -29°C
- Bulb finish: Clear

The unit shall be specifically designed and set to produce an ANSI-IES cutoff, type IV light distribution unless otherwise specified on the plans or ordered by the engineer. The downward light efficiency shall be at least 73%.

**BASIS OF ACCEPTANCE.** Acceptance of the underdeck luminaire will be based on manufacturer's certification of compliance with these specification requirements and on inspection by the Engineer that no damage or defects are evident.

### 723-30 MERCURY VAPOR LUMINAIRES (STANDARD MOUNT)

**SCOPE.** This specification covers the material and quality requirements for Mercury Vapor Luminaires.

**GENERAL.** The luminaire shall be of the mercury vapor type designed for use with a horizontally mounted mercury vapor lamp, color corrected or clear and shall be fully weatherproof. The luminaire and lamp combination shall produce Type II, III, or IV light distribution conforming to ASA Standards, and as shown on the plans. The luminaires shall be equipped with a built-in ballast for the wattage and operating voltage shown on the plans. The components comprising the assembly of the upper half of the luminaire shall include a reflector, a porcelain enclosed mogul socket, a twist-lock three prong receptacle for a photo-electric control, and a ballast.

**BASIS OF ACCEPTANCE.** Mercury vapor luminaires will be accepted upon the manufacturer's certification that they meet the requirements of this section.

### 723-31 MERCURY VAPOR LUMINAIRES (UNDERBRIDGE MOUNT)

**SCOPE.** This specification covers the material and quality requirements for Mercury Vapor Luminaires (Underbridge Mount).

**GENERAL.** The luminaire shall be complete for surface or pendent mounting, as shown on the plans. The luminaire shall be equipped with a prismatic refractor, be shock resistant, and protected with a cast guard. The door and guard assembly shall be equipped with stainless steel pressure latches and a safety chain. The housing shall be gasketed against which the door shall seat when closed. The luminaire shall provide a maximum candela beam of 60 degrees from the vertical for roadways up to 15 meters in width, and 70 degrees for wider roadways and approximately 180 degrees horizontal spread. The ballast shall be an integral part of the luminaire and shall be capable of operating a 175 watt or 250 watt mercury vapor lamp at minus 29°C. The lamps shall be included with the luminaire.

**BASIS OF ACCEPTANCE.** Mercury Vapor Luminaires will be accepted upon the manufacturer's certification that they meet the requirements of this section.

### 723-32 THRU 723-39 (VACANT)
723-40 CAST-IRON JUNCTION BOX

SCOPE. This specification covers the material and quality requirements for Cast-Iron Junction Boxes.

GENERAL. Junction boxes shall be hot-dipped galvanized cast-iron with a hot-dipped galvanized cast-iron cover. The cover shall be fastened to the box with brass or stainless steel screws. The box shall be so constructed that when the installation is complete and the cover is secured the box will be water tight.

Galvanizing shall be as specified in §719-01, Type II.

The Manufacturer shall refer to the plans for details and dimensions.

BASIS OF ACCEPTANCE. Junction boxes will be accepted upon the manufacturer's certification that they meet the requirements of this section.

723-41 THRU 723-44 (VACANT)

723-45 PRECAST REINFORCED CONCRETE FOUNDATIONS AND PULLBOXES

SCOPE. This specification covers the material and quality requirements for precast concrete foundations and pullboxes.

MATERIAL REQUIREMENTS. The Material Requirements contained in §704-03 shall apply.

DRAWINGS. The Drawing requirements contained in §704-03 shall apply.

FABRICATION. The Fabrication requirements contained in §704-03 shall apply.

SAMPLING AND TESTING. The Sampling and Testing requirements contained in §704-03 shall apply.

MARKING. The Marking requirements contained in §704-03 shall apply except as noted herein.

Markings shall be placed on the inside face of all pullboxes. Instead of marking the contract number on each unit they may be marked with “NYSDOT”.

FINAL PRODUCTION INSPECTION. The Final Production Inspection requirements contained in §704-03 shall apply.

SHIPPING. The Shipping requirements contained in §704-03 shall apply.

BASIS OF ACCEPTANCE. The Basis of Acceptance requirements contained in §704-03 shall apply.

723-46 THRU 723-49 (VACANT)

723-50 PHOTOELECTRIC CONTROL

SCOPE. This specification covers the material and quality requirements for Photoelectric Controls.

MATERIALS REQUIREMENTS. Photoelectric controls shall function to energize artificial lighting when natural lighting falls to a preset value, and to de-energize when natural lighting rises to a preset value. The photoelectric control shall be factory calibrated to energize the luminaire at approximately thirty (30) lux and de-energize at approximately thirty (30) lux. The photoelectric controls shall be adjustable by means of an outside adjustment system. The adjustment mechanism shall be easily accessible and provide a precise foolproof light level adjustment. Photoelectric controls which cannot be adjusted while the unit is in service or have to be disconnected while making adjustments will not be acceptable.
§723

Photoelectric controls shall be suitable for mounting in all three-pronged locking type receptacles that conform to Electrical Engineering Institute (EEI) or National Electrical Manufacturers Association (NEMA) Standard Specifications.

In the event of failure of any component of the control system, the artificial lighting shall be energized.

The housing for the photoelectric control shall be weather resistant and shall be unaffected by ultraviolet rays. A neoprene sponge gasket shall be cemented to the bottom of the base to seal out weather, dust and insects, and shall conform to EEI-NEMA Standards.

The photocell shall be hermetically sealed to prevent electrolysis from moisture. The manufacturer shall certify that each cell has had 24 hours of light preconditioning before assembly.

The photoelectric control shall be solid state and shall be capable of being faced in any direction except south. Generally, it is recommended that the photo sensitive device face north, as this affords maximum spectrum response.

The photoelectric controls shall have an operating voltage range of 105-285 volts, 50/60 cycle and shall be suitable for operation on nominal distribution voltages of 120, 208, 240, and 277 volts.

The controls shall be temperature compensated, and shall be suitable for operation from -40°C to +71°C and shall be completely unaffected by humidity. The switch mechanism shall be snap acting of sufficient capacity to adequately handle loads of 1000 watts of incandescent lighting, or 1800 volt-amperes of ballasted lighting. The photoelectric control shall be able to withstand an inrush current of a maximum of 170 amperes.

Time delay devices shall be built into the photoelectric control to prevent switching of artificial lighting due to transient lighting changes.

The photoelectric controls shall also be equipped with a built-in expulsion-type surge and lightning protection arrester.

**BASIS OF ACCEPTANCE.** Photoelectric controls will be accepted upon the manufacturer's certification that they meet the requirements of this section.

723-51 THRU 723-59 (VACANT)

723-60 ANCHOR BOLTS

**SCOPE.** This specification covers the material and quality requirements for anchor bolts.

**MATERIALS REQUIREMENTS.** Anchor bolts shall meet the requirements of ASTM F568 Class 8.8, or ASTM A449, or they may be manufactured from steel meeting the requirements of ASTM A576, Grades 1020 through 1050 inclusive, having a minimum yield strength of 345 MPa. A hex nut, lock washer, and flat washer shall be supplied with each anchor bolt and their dimensions shall be shown on the plans. The hex nut and flat washer shall be manufactured in accordance with ASTM A325M or A325 and the lock washer shall be manufactured in accordance with Table 730-22-1 Steel Fasteners. The nuts, washers and the top 300 mm of the anchor bolts shall be galvanized in accordance with the requirements for Type II or Type V galvanizing as stated in section 719-01, Galvanized Coatings and Repair Methods.

The anchor bolt dimensions shall be shown on the plans.

**SHIPPING.** Anchor bolts, hex nuts, and washers shall be shipped to the construction site at a time convenient to the masonry construction.

**BASIS OF ACCEPTANCE.** Anchor bolts will be accepted upon the manufacturer's certification that they meet the requirements of this section.

723-61 THRU 723-69 (VACANT)

723-70 SINGLE CONDUCTOR CABLE

**SCOPE.** This specification covers the material and quality requirements for single conductor cable used in highway lighting.
MATERIAL REQUIREMENTS. Single conductor cable shall be copper, Type THW, RHW-2, or XHHW-2 (XLP) as designated by Underwriter's Laboratory Specifications. The single conductor cable shall have heat and moisture resistant insulation for a maximum operating temperature of 75°C, in wet and dry conditions.

BASIS OF ACCEPTANCE. Single conductor cable shall be accepted upon the manufacturer's certification that it meets the requirements of this specification as well as being Underwriter's Laboratory approved.

723-71 SINGLE CONDUCTOR DIRECT BURIAL CABLE

SCOPE. This specification covers the material and quality requirements for direct burial 600V type USE cable for use in conduit or in trenches as shown on the plans and as directed by the Engineer.

MATERIAL REQUIREMENTS. Cable shall bear Underwriters Laboratories Label for type USE. It shall consist of copper conductor and insulation constructed to conform to ICEA (Insulated Cable Engineers Association) Pub. S-95-658 and NEMA Pub. No. 7C-70 (Nonshielded 0-2kV Cables) or their equivalent.

Cable shall consist of 7 copper strands up to and including #2 AWG and shall be constructed of 19 copper strands for sizes larger than #2 AWG.

Insulation shall be chemically cross-linked (vulcanized) polyethylene insulating compound.

Cable shall be mechanically spliced and insulated using the highest quality poured splices available for underground 600V cables.

Cable shall be factory or shop twisted in a duplex or a triplex configuration in accordance with the publications listed above or as shown in the contract documents.

BASIS OF ACCEPTANCE. Single Conductor Direct Burial Cable will be accepted upon the manufacturer's certification that it meets the requirements of this specification as well as being Underwriter's Laboratory approved.

723-72 THRU 723-74 (VACANT)

723-75 GROUND WIRE

SCOPE. This specification covers the material and quality requirements for ground wire used in highway lighting.

MATERIAL REQUIREMENTS. Ground wire shall be #6, soft-drawn bare copper wire, 7 strand single conductor.

BASIS OF ACCEPTANCE. Ground wire shall be accepted upon the manufacturer's certification that it meets the requirements of this specification.

SECTION 724 - TRAFFIC SIGNALS

724-01 SIGNAL CABLE

SCOPE. This specification covers the material requirements for signal cable for use with traffic signal systems and for installation in underground ducts or as an aerial cable supported by a messenger.

MATERIALS REQUIREMENTS. The cable shall conform to the requirements of the International Municipal Signal Association (IMSA) Specification 20-1. The gauge and number of conductors shall be as specified in the plans. The conductors shall be stranded copper wire.
§724

BASIS OF ACCEPTANCE. Acceptance of material will be based on the manufacturer's certification of compliance with these specification requirements.

724-02 SPAN WIRE

SCOPE. This specification covers the material requirements for span wires used in the suspension of traffic signal heads. Span wires may be used as a single span wire or a dual span wire including a tether wire. The same wire may be used as messenger wires or guy wires.

MATERIALS REQUIREMENTS. Span wire shall meet the requirements of ASTM B228, Grade 30 EHS.

BASIS OF ACCEPTANCE. Acceptance of span wire will be based on the manufacturer's certificate of compliance with these specification requirements, together with supplementary sampling and testing at the discretion of the Materials Bureau.

724-03 TRAFFIC SIGNAL POLES

SCOPE. This specification covers the material requirements and fabrication details for poles used for traffic signals. Traffic signal poles are classified according to the following applications:

A. Span Wire. Span wire poles are used for supporting a steel cable or cables to which are attached traffic signals and overhead signs.

B. Mast Arm. Mast arm poles consist of a vertical shaft and an approximately horizontal arm to which are attached traffic signals and overhead signs. These poles may also be equipped with more than one mast arm.

C. Post Top Mount Post top mount poles are used for mounting traffic signals directly on the top of the pole.

D. Bracket Mount Bracket mount poles are used to support traffic signals and other items bracketed from or attached to the side of the pole.

Traffic Signal Poles with Lighting Arms - Lighting arms may also be attached to all pole types except post top mount.

DESIGN CRITERIA. The poles shall be designed in accordance with the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals (1994), except as modified by this specification. The following elements of a pole shall be designed for the most critical orientation of the loads, applied to a traffic signal pole:

- Any tubular segments of the structure.
- Hand hole reinforcement and other hole reinforcement.
- Device used to connect cable to pole.
- Base plate.
- Mast arm to pole connections.
- Anchor bolts.

The design shall be approved, stamped and signed by a professional engineer licensed in the State of New York.

All necessary holes in the pole below the load attachment point and greater than 18 mm in diameter shall be made by the manufacturer and reinforced according to the fabrication details and contract documents. Hand holes shall be located ninety (90°) degrees clockwise, top view, from the direction of the cable load, unless otherwise specified.

For those poles on which a traffic signal cabinet will be mounted the pole manufacturer will be required to weld a cabinet wiring access coupling into the pole as part of the pole manufacturing process.
This coupling shall be centered 300 mm from the bottom of the base plate and 90° clockwise (top view) from the axis of the hand hole. The coupling shall be designed to accept a standard chase nipple on the inside of the pole, and to accept 38 mm of a standard 4 NPS diameter galvanized pipe from the outside of the pole, and shall protrude no more than 12 mm on the out side of the pole. An insulated chase nipple shall be installed in the coupling on the inside of the pole. The coupling shall be designed to reinforce the hole in which it is installed.

**Wind Loads.** Poles and attachments thereto covered by this specification shall be designed for the following wind speeds in accordance with the AASHTO standard in “B” above.

- 129 km/h - Counties of Allegany, Bronx, Cattaraugus, Chautauqua, Erie, Genesee, Kings, Livingston, Monroe, Nassau, New York, Niagara, Orleans, Ontario, Queens, Richmond, Rockland, Suffolk, Wayne, Westchester and Wyoming.
- 113 km/h - All other counties.

**MATERIAL REQUIREMENTS.** The following materials, or approved alternates, as determined by the Deputy Chief Engineer, Design Division, shall be used for fabrication. Span Wire, Mast Arm and Bracket poles shall be galvanized steel. Post top poles may be either galvanized steel or aluminum. Acceptable aluminum materials are those contained in the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals (1994).

The following are the acceptable steel materials for the signal pole components.

**Poles and Arms.** The finished pole shall be galvanized in accordance with subsection 719-01 Galvanized Coatings and Repair Methods, Type 1, and be made of one of the following:

- ASTM A500, Grade B or ASTM A501.
- ASTM A53, Grade B pipe.
- ASTM A53, Grade B pipe, with a minimum yield of 330 MPa guaranteed by the manufacturer and documented by the submission of certified copies of physical tests performed on the lots of material from which the poles were manufactured.
- ASTM A252, Grade 2 or Grade 3.
- ASTM A252, Grade 2, with a minimum yield of 330 MPa guaranteed by the manufacturer and documented by the submission of certified copies of physical tests performed on the lots of material from which the poles were manufactured.
- ASTM A572M, Grades 290, 345, 415 or 450.
- ASTM A595, Grade A.
- ASTM A618, Grade I, II or III.
- ASTM A588M.
- ASTM A513, with a minimum yield strength of 248 MPa guaranteed by the manufacturer, and documented by the submission of certified copies of physical tests performed on the lots of material from which the poles were manufactured.
- ASTM A1008/A1008 M Grade 410 Class 2.
- ASTM A1011/A1011 M Grade 410 Class 2.

**Bases.** The base shall be galvanized under the same specification as the pole, and made of one of the following:

- ASTM A27M, Grade 65-35, mild to medium strength carbon steel castings.
- ASTM A36M.
- ASTM A588M.
- ASTM A572M, Grade 290, 345, 415 or 450.
- ASTM A633M (Any Grade).

**Anchor Bolts, Nuts and Washers**

Bolts and nuts shall meet the requirements of one of the following specifications:

- ASTM F568M Class 4.6 (Bolts and Nuts)
- ASTM F568M Class 8.8 (Bolts)
• ASTM A576 (bolts) Grades 1021 and 1025 with a minimum elongation of 18 percent in 50 mm tested in accordance with ASTM A370. The guaranteed minimum yield strength shall be stated by the manufacturer.
• ASTM A675M Grades 485 through 620 (Bolts).
• ASTM A563M Grades A, B, C, D, or DH (Nuts).
• ASTM F1554 Grades 36, 55 or 105 (Bolts).
• ASTM A36M (Bolts) modified to a minimum yield of 379 MPa, minimum tensile of 448 MPa and minimum elongation of 18 percent in 50 mm, tested in accordance with ASTM A370.
• ASTM A194, Grade 2H (Nuts)

The type and grade of steel for nuts shall be compatible and of comparable strength to the steel used for the bolts. Washers shall be plain hardened washers.

Nuts, washers and a minimum of the top 300 mm of anchor bolts shall be hot-dipped galvanized, in accordance with the requirements of subsection 719-01, Galvanized Coatings and Repair Methods, Type II.

Connection Devices
• ASTM A36M.
• ASTM A588M.
• ASTM A325M.

Pole Caps and Anchor Bolt Covers. Pole caps shall be galvanized steel, galvanized cast iron, aluminum or zinc alloy AG40A. Anchor bolt covers shall be galvanized steel, galvanized cast iron, or aluminum. Galvanizing shall be done in accordance with the requirements of §719-01, Galvanized Coatings and Repair Methods, Type II.

FABRICATION

Bases and Hardware. The base plate shall be welded to the pole by an acceptable weld in accordance with the New York State Steel Construction Manual.

All anchor bolts, nuts and washers required for each pole shall be supplied by the pole manufacturer. Anchor bolts are to be anchored using double nuts and plates or threaded plates and shall be designed by the fabricator. Anchor bolts shall be long enough to embed at least 30 bolt diameters into the concrete foundation. “L” bends will not be allowed. The number of anchor bolts and the bolt circle diameter shall be determined by the fabricator unless specified in the contract documents. Each anchor bolt shall be equipped with 2 nuts and one or more washers for attaching the pole plus those necessary to provide end anchorage to the anchor bolt.

Washers will not be required when the holes on the base plate are within the following tolerances:
• Hole diameter not more than 3mm greater than the bolt, bolt diameters less than 25mm.
• Hole diameter not more than 6mm greater than the bolt, bolt diameters equal to or greater than 25mm.
• Hole diameter not more than 9mm greater than the bolt, bolt diameters equal to or greater than 50mm.

Anchor bolt covers shall be furnished. These shall be affixed to the base or shaft with stainless steel cap screws.

Shafts and arms shall be equipped with end caps secured with stainless steel set screws.

Shafts. Shafts shall be round or multi-sided shapes.

Shafts shall be equipped with hand holes except for poles intended for transformer base mounting. Hand holes shall be centered approximately 600 mm above the base end of the pole. The maximum hand hole size shall not exceed 100 mm x 165 mm. Poles shall be equipped with a grounding terminal accessible through the hand hole. Grounding terminals are not necessary if there is no hand hole.

Holes for wiring fittings shall consist of a pipe coupling of the specified diameter and where feasible shall be shop installed. Hand holes and holes for wiring fittings located near the base of the pole shall be reinforced with metal at least equal to the area removed.

Shafts may be fabricated in any of the following shapes and styles:
A. Round Continuously Tapered. Shafts shall be fabricated with not more than one longitudinal seam which shall be continuously welded and ground or rolled flush. Shafts shall have a uniform wall thickness and shall taper uniformly, starting at the butt end, decreasing in diameter at the rate of not more than 12 mm, but not less than 6 mm per meter of length.

B. Round Step Tapered Construction. Shafts shall be fabricated from round pipe sections with not more than one longitudinal seam, joined by a hot-swaged shrink fit, continuously seal welded to prevent entrance of water. Stepped, round shafts shall achieve a tapered effect equal to a maximum rate of 12 mm and a minimum of 6 mm per meter of length by use of decreasing diameter round pipe sections.

C. Multi-sided Continuously Tapered Construction. The multi-sided pole shall conform to the requirements as set forth above under round continuously tapered construction, except that it shall have no more than 2 longitudinal seams which shall be continuously welded and ground or rolled flush. Square or hexagonal shafts will not be allowed.

D. Round Untapered. Poles 8 meters or less in length may be round untapered with not more than one longitudinal seam.

Welding. All welding shall be performed in accordance with the New York State Steel Construction Manual.

Poles with Lighting Arms. Poles with lighting arms shall be constructed in accordance with the configuration in the contract documents and this specification.

Except for bracket-mount traffic signal poles, lighting arms may be of either the single member type or of the truss type if type is not specified. When specified for bracket-mount traffic signal poles, lighting arms shall be of truss-type design with upper and lower members joined near the luminaire end of the arm. Lighting arms of the truss-type design with upper and lower members joined near the luminaire end of the arm shall be braced with one or two vertical struts depending on the length of the arm. Arms may be either galvanized steel or aluminum.

Span Wire Poles

A. Design Load. The design load for span wire poles shall be the Group II or III load per AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals (1994) Section 1.2.6, given in the contract documents and applied at a point 450 mm below the top of the pole. Allowable unit stresses shall be as specified in the above AASHTO specification.

B. Physical and Mechanical Properties. Span Wire poles shall conform to the following requirements.
   • Minimum Wall Thickness - 3 mm
   • Maximum Deflection - To be computed at a point 450 mm from the top of the pole, shall be a maximum of 50 mm per meter of pole length and a maximum deflection rate of 17 mm per 500 Newtons.
   • Maximum Pole Diameter at the Base - 58 mm per meter of pole length.

C. Pole Marking. The following information shall be stamped on the base plate or ground sleeve in 12 mm letters to such a depth as to be clearly visible through subsequent galvanizing:

<table>
<thead>
<tr>
<th>Desired Information</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pole Length in whole meters</td>
<td>10 m</td>
</tr>
<tr>
<td>Load in 10 kN Increments</td>
<td>20 kN</td>
</tr>
<tr>
<td>Manufacturers Name or Logo</td>
<td>-</td>
</tr>
<tr>
<td>Month and Year of Manufacture</td>
<td>1178</td>
</tr>
</tbody>
</table>
D. Span Wire Connecting Hardware. The manufacturer shall supply the necessary device for connecting each span wire to the pole. For polygonal poles this device may be either a galvanized thimble eyebolt or a circumferential pole clamp. For round poles, only thimble eyebolts shall be used. The design strength shall be 70% of yield strength of the connecting device. The yield strength shall be determined using a cable load aligned 85 degrees to the vertical axis of the pole.

Mast Arm Traffic Signal Poles

A. Design Loads. Each part of the structure shall be proportioned for the combination of loads producing the maximum effect, using unit stresses increased for the material and group loads as described in section 1.2.6 of the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals (1994). The wind speed, locations, dimensions, weights, and projected areas of the signals, signs, and supports shall be as specified in the contract documents.

B. Mast Arm Shapes. Arms shall be round or multi-sided shapes and have the same cross-sectional shape as the shaft.

C. Arm Construction. Mast arms of any length may be constructed by any of the methods indicated under Material Requirements Shafts. They may be of two piece construction with a telescoping joint secured by thru-bolt and locknut.

D. Mast Arm to Shaft Connection. The mast arm shall be secured to the shaft by a minimum of four bolts. The mast arm shall be equipped with a flange plate welded to the butt end of the mast arm. A flange plate shall be attached to the shaft using vertical and horizontal gusset plates both top and bottom and at each side. Flange plates on shaft and mast arms shall have a hole with a smooth cable guide for wiring.

E. Physical and Mechanical Properties. Mast arms and shafts shall conform to the following requirements:
- Minimum Wall Thickness - 3 mm.
- Maximum Deflection at Design Load.
- Shaft - 42 mm per meter of length.
- Arm - 42 mm per meter of length.
- Maximum Diameter at base of shaft or arm.
- Shaft - 58 mm per meter of length.
- Arm - 58 mm per meter of length.

F. Poles with Multiple Arms. Poles with multiple arms shall be constructed in accordance with the arm configuration in the contract documents.

G. Pole Marking. The following information shall be stamped on the top of the base plate or ground sleeve in 12 mm letters to such a depth as to be clearly visible through subsequent galvanizing.

<table>
<thead>
<tr>
<th>Desired Information</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wall Thickness</td>
<td>8 mm</td>
</tr>
<tr>
<td>Minimum Yield Strength</td>
<td>345 MPa</td>
</tr>
<tr>
<td>Manufacturers Name or Logo</td>
<td>-</td>
</tr>
<tr>
<td>Month and Year of Manufacture</td>
<td>10/77</td>
</tr>
</tbody>
</table>

Post Top Mount and Bracket Mount Traffic Signal Poles. These poles shall be proportioned for the combination of loads producing the maximum effect, using unit stresses increased as indicated for the material and group loads as described in section 1.2.6 of AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals (1994). The wind speed, location, weights, dimensions and projected areas shall be as given in the contract documents.
BASIS OF ACCEPTANCE. Acceptance for poles and mast arms covered by this specification will be based on the following, as appropriate:

All Poles and Arms

- Submission of fabrication details for each pole intended for a worst case configuration of the load as specified in the contract documents approved, stamped and signed by a Professional Engineer licensed and registered to practice in New York State.
- Submission of the manufacturer's certificate of compliance with these specification requirements and the approved fabrication details.

Span Wire Poles

- The acceptance requirements for All Poles and Arms, given above, shall apply.
- Submission of mill certifications for all structural materials.
- Appearance of the manufacturer's name on the Department's list of approved manufacturers.

724-04 TRAFFIC SIGNAL HEADS

SCOPE. This specification covers the material and fabrication requirements for vehicular and pedestrian traffic signal heads, including flashing signals and flashing beacons.

STANDARD SIGNAL HEADS

Material Requirements. Only virgin metal shall be used in making either sand castings or die castings, and where specified, the manufacturer shall furnish standard test bars, poured of the metal of which the castings are made, and a certified chemical analysis of the ingot from which the castings are made.

A. Housing. Unless otherwise specified, all traffic signal head housings shall be made of Aluminum alloy of one of the following compositions:

1. Aluminum Sand Castings. All aluminum sand castings shall be made of ingot, in accordance with ASTM B26, Alloy B443.0 or AC72A.

2. Aluminum Die Castings. All aluminum die castings shall be made of ingot, in accordance with ASTM B85, Alloys SC84A, SC84B, SG100A, SG100B, or S12B.

B. Suspension Components. All suspension components, brackets, clamps, trunnions, arms, elbows, crosses, etc., shall be made of one of the following materials:

1. Malleable iron. Malleable iron material shall be made in accordance with ASTM A47/ A47M.

2. Steel pipe. Steel pipe shall be made in accordance with ASTM A 53.


4. Aluminum Die Castings. Aluminum die castings shall be made in accordance with ASTM B85, Alloy SC 84B.

5. Aluminum pipe. All aluminum pipe shall be made in accordance with ASTM B429.
C. Fasteners. The following items shall be made of non-magnetic stainless steel, Type 303 or 304, in accordance with ASTM A296 (latest revision).
- All set screws.
- The U/J-bolts, rivet and their related nuts, washers and cotter pin in the span wire lamp.
- The eye-bolt, rivet, tightening bolt and their related nuts, washers, and cotter pin in the balance adjuster.

D. Pipe Arms. Pipe arms shall be made of steel pipe in accordance with ASTM A120 (latest rev.)

Wind Load. Signal heads, mounting brackets, attachments and fittings shall be designed for a wind load pressure for at least a 145 km/h wind in accordance with AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals (1994).

Painting. All aluminum traffic signal heads, bracket arms, and mounting attachments shall be painted by first applying a chromate conversion coating and then electrostatically applying a polyester powder coating.

Threads and threaded parts shall not be coated and shall be protected from the coating process at the time of application.

The chromate conversion coating shall be applied and conform to the requirements of ASTM B449, Standard Practice for Chromate Treatments on Aluminum, Class 2 coating. The conversion coating shall be allowed to dry thoroughly and shall be free of entrapped air and contaminants. After drying the chromated surface shall be coated with a polyester powder coating.

The polyester powder shall be electrostatically applied and cured in accordance with the coating manufacturers recommendations. If preheating of the aluminum substrate is required, care shall be taken to prevent damage to the chromate coated surface by not exceeding a preheat temperature of 71°C. The polyester coating shall be applied at a uniform thickness between 0.060 mm and 0.090 mm. The polyester powder used shall have the following properties:

<table>
<thead>
<tr>
<th>Property</th>
<th>ASTM Test Method</th>
<th>Test Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific Gravity</td>
<td>D3451</td>
<td>1.2 Minimum</td>
</tr>
<tr>
<td>Impact Resistance</td>
<td>D2794</td>
<td>16 Ncm Minimum</td>
</tr>
<tr>
<td>Pencil Hardness</td>
<td>B3363</td>
<td>H - 2H</td>
</tr>
</tbody>
</table>

The color of the finished polyester coating shall be such that a properly prepared color chip shall be a reasonable visual match to Federal Color Standard No. 595A, Color 14056. Viewing shall be done under North Standard Daylight.

Signal Indications. Signal indications shall be as indicated in the proposal or as shown on the plans.

Wiring. All wiring shall consist of No. 18 AWG stranded copper wire with thermoplastic insulation and a 600 volt rating.

Electrical Characteristics. All equipment shall be designed for operation on 115 volts ±30 volts, 60 Hertz, single phase A.C. power unless otherwise indicated.

Mounting. Signal heads shall be arranged for mounting on span wires, mast arms, post tops or vertical pole bracket mounts as specified in the contract documents. For a span wire mounting the signal head shall be provided with a span wire clamp, balance adjuster and wire outlet fitting. The span wire clamp shall consist of a shoe, lockbar, two “U” or “J” bolts, and a rivet, with cotter pin, nuts, washers, etc., as necessary. The balance adjuster shall consist of a body with threaded eye-bolt, a tightening bolt and a rivet, with cotter pin, nuts washers, etc., as necessary. The wire outlet fitting shall have a continuous opening of a minimum nominal diameter of 40 mm for insertion of signal head wiring. The upper opening shall have a weatherproof insulating composition cover that provides for the insertion of the wiring. The cover shall be securely mounted to the fitting. The bottom opening shall be threaded, and provided with two square or hex drive set screws, located at 180 degrees to each other. The bottom of the fitting shall have integral cast serrations, or shall be notched and provided with a serrated locking ring, or shall be
provided with a slotted check nut and serrated locking ring. A 12 or 18 circuit disconnect hanger shall be supplied if specified in the contract documents. The head shall be assembled so that it hangs plumb.

**A. One-way Signal Head.** Mounting hardware for a one-way signal head shall also include a 40 mm galvanized nipple with cast head, gasket, and steel washer for the connection between the wire outlet fitting and the top of the signal head. A metal weather-resistant cap/plug shall be provided for the unused hole in the bottom of the head. The cap/plug shall be of a threaded or flanged design.

**B. Multi-way Signal Head.** Mounting hardware for multi-way (2, 3 and 4-way) signal heads shall also include a center junction hub and pipe arms with tee or cross end connectors. Tee and cross connectors shall be notched for, and supplied with a serrated locking ring. No pipe/nipple shall be provided for the connection between the center junction hub and the wire outlet fitting. A 40 mm galvanized nipple with cast head, gasket and steel washer shall be supplied for the connection between the tee or cross connector and the top of the signal head. Tees and crosses will not be accepted in place of the center junction hub.

Center junction hubs shall have a threaded openings on the top and sides. The bottom of the hub shall be essentially fully open, except for the necessary thickness of the housing, and shall be securely covered by a flat plate of weather-resistant design. The plate shall be held in place by a minimum of two screws. Center junction hubs shall be provided with a square or hex drive set screw on all threaded openings, except that the top opening shall be provided with two set screws, located at 90 degrees to each other.

Center junction hubs shall have a minimum nominal opening of 90 mm in diameter for round openings, or a minimum nominal side length of 90 mm for rectangular openings.

Tees or crosses shall have threaded openings to accept the necessary pipe arm/signal head connections, plus at least one additional threaded opening to facilitate wiring. The extra opening shall be closed with a threaded metal pipe cap. All threaded openings on the tees and crosses shall be provided with a square or hex drive set screw.

Threaded openings on pipe arms shall be tapered. Threaded openings on other pipe fittings shall be pipe straight threads.

Flat arms or spiders shall be provided for the bottoms of multi-way signal heads, except that bottom hardware shall be omitted for multi-way one section head assemblies. Connections between the bottoms of the signal heads and the arm/spider shall be flanged or threaded to provide a locking, weather-resistant connection.

Signal heads for mast arm mounting shall be furnished with a mount consisting of upper and lower horizontal arms attaching to the top and bottom of the signal head housing. The horizontal arms shall attach to a vertical member which in turn clamps to the mast arm. The mast arm mount shall have provision for adjusting the vertical, angular and rotational positioning of the head in relation to the mast arm so that it is plumb, in line with other signal heads and properly oriented in relation to traffic. Wiring shall be concealed within the mount.

Post top signal heads shall be furnished with a post top type slilifter mounting. Vertical pole bracket mount signal heads shall be equipped with upper and lower horizontal brackets equipped with pole plates for attachment to the pole with stainless steel bands.

**Housing.** The housing for each face shall be of unitized sectional construction and shall consist of as many sections as necessary to provide the indications shown on the plan. All sections shall be rigidly and securely fastened together into one weather-tight signal face. An adjustable traffic signal head shall consist of two or more signal faces fastened to and supported by a pipe assembly and suitable entrance fitting.

Each housing shall be arranged with openings in the top and bottom so that it may be rotated about a vertical axis between waterproof supporting brackets or trunnions and shall be capable of being securely fastened at increments of not more than 7 degrees of rotation. The top and bottom of each housing shall have integrally cast locking rings or other provisions to provide positive interlocking and indexing.

The top and bottom of each housing shall be provided with tees or crosses equipped with pipe-plug knobs or caps which can be removed to assist in wiring.

Flat arms or spiders will be accepted as an alternative for use on the bottom of adjustable signals. One-section adjustable beacons may be supplied without bottom bracket arms.
Each housing shall be so designed that additional sections may be added. The construction shall permit the assembly of 300 mm signal sections with 200 mm sections of the same manufacturer. The assembly shall permit the joining of 200 mm sections either above or below the 300 mm sections.

**Doors.** The door shall be of cast aluminum alloy and shall be provided with four visor mounting holes located equidistant about the lens opening to allow the mounting of the visor in either a vertical or horizontal position. The holes shall be drilled and tapped, and provided with stainless steel mounting screws. Neoprene gasketing shall be provided between the body of the housing and the doors. The doors shall be suitably hinged and shall be forced tightly against the gasket and the housing by simple stainless steel locking devices. All other exterior hardware such as hinge pins, lens clips, etc. shall be of stainless steel. The locking device shall be capable of being operated without the use of tools. Hinges shall be arranged to allow convenient relamping. On the outside of the door, there shall be a rim encircling the lens opening to prevent any light leakage between optical systems.

**Visors.** The visors shall be separate and removable from the doors, held in place by stainless steel fastenings attached to the door in such a manner as to prevent the possibility of any light leakage between the door and hood which might be discernible from the side. Visors shall be of sheet aluminum, not less than 1.27 mm, and shall mount to the signal head through the use of four slotted mounting tabs which inter-mate with the mounting screws on the signal housing door. Unless otherwise specified in the contract documents all signal heads shall be provided with cap-type visors. The insides of visors and the entire surface of louvers or fins used in front of signal lenses shall be painted a flat black to minimize light reflection to the sides of the signals. Visors shall tilt down from the horizontal a minimum of $3.5^\circ$ and shall be a minimum of 241 mm in length for 300 mm diameter lenses and 177 mm in length for 200 mm diameter lenses.

**Connection Blocks.** Each signal face shall be equipped with a 5-point heat resistant terminal block. It shall have five terminals with connectors for receptacle leads and screw terminals for field wires.

The individual connection blocks in the separate faces of a signal head shall be interconnected. In one face of each multi-face head, there shall be an additional nine terminal block to which all field wires are connected. All socket leads of all signal faces shall terminate at this nine terminal block.

**Dust-Tight Optical System.** The optical system shall be properly gasketed to exclude dust and dirt from the reflecting surface of the reflector and the inner surface of the lens. Gaskets shall be placed between the reflector and supporting member, and between the reflector holder and the inner surface of the lens.

**Reflectors.** Reflectors shall conform to the requirements of “Vehicle Traffic Control Signal Heads” published by the Institute of Transportation Engineers (ITE) in ST-017B (Equipment and Material Standards).

Reflectors shall be made of a material that will not distort when subjected to the heat of the specified lamp. Reflectors may be either silvered glass or specular aluminum with anodic coating. Metalized plastic reflectors will not be accepted. The reflecting surface before coating shall be free of flaws. The reflective coating and the reflector shape shall be such that the light distribution and candle power intensity of the combined lamp lens reflector assembly shall meet the specification requirements in “Vehicle Traffic Control Signal Heads.”

**Reflector Rings.** No plastic material will be accepted for the reflector bracket or reflector ring. The reflector ring and complete reflector and socket assembly shall be pivoted between two (2) stainless steel pins in such a manner that it can be swung open for ease in servicing the signal without the use of any tools.

**Lenses.** Each traffic signal head shall be supplied with traffic signal lens. Lenses shall be red, yellow, or green. Lens shall be made of glass and shall conform to the requirements of "Vehicle Traffic Control Signal Heads" published by the Institute of Transportation Engineers. Except for multilane use control signals and pedestrian signals, all lenses shall be circular in shape with nominal diameters of either 200 mm or 300 mm. Each 300 mm lens shall be standard wide angle and clearly marked as such.
Lamp Receptacles. Lamp Receptacles shall conform to the requirements of “Vehicle Traffic Control Signal Heads” published by the Institute of Transportation Engineers.

Lamps. The lamp for the illumination of a 200 mm lens shall be a clear traffic signal lamp which produces a minimum of 595 lumens with an average minimum initial lumen rating of 550 lumens at a working voltage of 120-125 volts AC, has a rated life of at least 8,000 hours and is rated at no more than 60 watts.

The lamp for the illumination of a 300 mm lens shall be a clear traffic signal lamp which produces a minimum of 1750 lumens with an average minimum initial lumen rating of 1650 lumens at a working voltage of 120-125 volts AC, has a rated life of at least 7000 hours and is rated at no more than 135 watts.

Lamps and the intensity and distribution of light from each illuminated signal lens shall conform to the requirements of “Vehicle Traffic Control Signal Heads”, and “Standards for Traffic Signal Lamps.” Both publications are available from the Institute of Transportation Engineers.

OPTICALLY PROGRAMMED SIGNAL HEADS. The following additional requirements apply to Optically Programmed Signal Heads.

General. The optically programmed signal head shall permit the visibility zone of the indication to be determined optically and require no hoods or louvers. The projected indication may be selectively visible or veiled anywhere within 15° of the optical axis. No indication shall result from external illumination nor shall one light unit illuminate a second.

Optical System. The optical system shall accommodate projection of diverse, selected indicia to separate portions of the roadway such that only one indication will be simultaneously apparent to any viewer. The projected indication shall conform to ITE transmittance and chromaticity standards.

The following components shall comprise the optical system:

A. Lamp and Lamp Collar. The lamp shall be nominal 150 watt, 120 volt AC, three prong, sealed beam having an integral reflector with stippled cover and an average rated life of at least 6000 hours. An equivalent 75 watt lamp shall be used with pedestrian indications. The lamp shall be coupled to the diffusing element with a collar including a specular inner surface.

B. Optical limiter-diffuser. The diffusing element may be discrete or integral with the convex surface of the optical limiter. The optical limiter shall provide an accessible imaging surface at focus on the optical axis for objects 275 m to 370 m distant, and permit an effective veiling mask to be variously applied as determined by the desired visibility zone. The optical limiter shall be provided with positive indexing means and composed of heat resistant glass.

C. Objective lens. The objective lens shall be a high resolution, planar incremental lens hermetically sealed within a flat laminant of weather-resistant acrylic or approved equal. The lens shall be symmetrical in outline and may be rotated to any 90° orientation about the optical axis without displacing the primary image.

Construction. Signal case and lens holder shall be predrilled for backplates and visors. Hinge and latch pins shall be stainless steel. All access openings shall be sealed with weather-resistant rubber gaskets.

Mounting. The signal shall mount to standard 40 mm fittings as a single section, as a multiple section face, or in combination with other signals. The signal section shall be provided with an adjustable connection that permits incremental tilting from 0 to 10 degrees above or below the horizontal while maintaining a common vertical axis through couplers and mounting. Terminal connection shall permit external adjustment about the mounting axis in 5 degree increments. The signal shall be constructed such that it can be installed with ordinary tools and serviced with no tools.

Attachments such as visors, backplates or adapters shall conform and readily fasten to existing mounting surfaces without affecting water and light integrity of the signal.
The programmed signal head shall be arranged for rigid mounting to either a mast arm or a dual span wire assembly. It is important for proper operation of the signal that it be mounted as rigidly as practical to maintain its optical orientation with the roadway. In those cases where span wires are used it should be securely tethered to the lower span wire.

**Electrical.** Lamp fixture shall comprise a separately accessible housing and integral lamp support, indexed ceramic socket and self-aligning, quick-release lamp retainer. Electrical connection between case and lamp housing shall be accomplished with an interlock assembly which disconnects lamp housing when opened.

Each signal section shall include a covered terminal block for clip or screw attachment of field wires. Concealed No. 18 AWG, stranded and coded wires shall interconnect all sections to permit field connection within any section.

**Photo Controls.** Each signal section shall include integral means for regulating its intensity between limits as a function of individual background illumination. Lamp intensity shall not be less than 97% of uncontrolled intensity at 10,764 lx and shall reduce to 15 lx ± 2% of maximum at less than eleven (11) lx over the applied voltage and ambient temperature range. Response shall be proportional and essentially instantaneous to any detectable increase from darkness to 10,764 lx and damped for any decrease from 10,764 lx.

The intensity controller shall comprise an integrated, directional light sensing and regulating device interposed between lamp and field wires. The device shall be responsive over an applied voltage of 95 to 130V, 60 Hz. temperature range of -40°C to 74°C and may provide phase controlled output voltage but shall have a nominal open circuit terminal impedance of 1500 ohms. The Photo Control shall not produce sufficient electrical noise or interference to adversely affect the operation of solid state electronic equipment used on traffic signal controllers and associated auxiliary equipment and shall not cause false tripping of conflict monitors.

**STANDARD PEDESTRIAN SIGNAL HEADS.** In addition to applicable items in STANDARD SIGNAL HEADS the following requirements apply to Standard Pedestrian Signal Heads

**General.** Pedestrian signal indications are traffic indications intended for the exclusive purpose of controlling pedestrian traffic. These indications consist of the illuminated words WALK and DON'T WALK.

When specified, these messages can be replaced with the “MAN” and “HAND” display. The indications shall be single faced and rectangular in shape with letters made visible by internal illumination and with the legend DON'T WALK above or integral with the legend WALK.

When illuminated, the WALK indication shall be lunar white. When illuminated, the DON'T WALK indication shall be portland orange. All except the letters shall be obscured by an opaque material.

When not illuminated, the WALK and DON'T WALK indications shall not be distinguishable by pedestrians at the far end of the controller crossing.

Pedestrian signal construction and indications shall conform to the requirements of “Pedestrian Traffic Control Signal Indications" published by the Institute of Transportation Engineers, with the following modifications:

- Unless otherwise specified, the head shall be a two section unit. Lettering shall be a minimum of 114 mm.
- Lamps for the illumination of each section shall be a clear traffic signal lamp with an average initial rating of 1,280 lumens at a working voltage of 120-125 volts with a rated life of at least 8,000 hours. Lamp fixtures shall not be wired in series.
- Signal head shall be supplied with an 18 AWG, color coded wiring harness, and a four position, barrier type terminal block.
- Lenses shall be made of plastic.

**FIBEROPTIC PEDESTRIAN SIGNAL HEADS.** In addition to applicable items in STANDARD SIGNAL HEADS and STANDARD PEDESTRIAN SIGNAL HEADS the following requirements apply to Fiberoptic Pedestrian Signal Heads.
General. The unit shall consist of a matrix of fiberoptic bundles forming two displayed messages on a rectangular background facing the same direction. One message shall indicate WALK and the other shall indicate DON’T WALK. Both messages shall have a minimum letter height of 114 mm using a series B width. If the “MAN” and “HAND” display are specified both messages shall have a minimum symbol height of 267 mm and 165 mm width.

The messages shall be clearly legible and shall attract the attention of pedestrians and be readable, under any lighting conditions varying from total darkness to bright sunlight or where high intensity background lighting is present, at distances from 3 m to the width of the area to be crossed. A visor or hood shall not be required for legibility, but shall be provided with the housing.

The messages shall be visible at full intensity anywhere within a 90 degree cone centered about the optical axis and perpendicular to the surface of the matrix display. When not energized, the signal shall be blanked out (unreadable) with no phantom images, regardless of solar intensity or direction.

The messages shall be bright in color against a flat black background.

The displays shall be made from a single row of fiberoptic bundles with a nominal 13 mm spacing between centers.

The light source shall be designed and constructed so that in case of an electrical or mechanical failure of the word DON’T the word WALK in the DON’T WALK message will remain dark.

Each message shall be displayed separately and never concurrently.

Material Requirements. One 42 watt, 10.8 volt lamp type EPT or equivalent with a rated average life expectancy of 10,000 hours shall be as the light source for each display. The lamp shall be a multi-mirror reflector quartz halogen bulb operating at an approximate color temperature of 2900 K.

Optical System. The optical system shall consist of the following:
- Weatherproof housing, door, gaskets, and visor
- Fiberoptic module with individual output attached
- Color filters for desired message colors
- Light sources
- Transformers
- Protective back cover for the module
- Electrical system including wiring

Optical Requirements. The optics shall have a glass-on-glass fiber with an 83% core to 17% cladding ratio. It shall have an average numerical aperture of .56 with a maximum transmission attenuation of 800 DB per kilometer. Each fiber shall have a .05 ± .005 mm diameter with an included acceptance angle of 68 degrees. All fiber ends shall be ground smooth and polished to an 8 µm finish minimum, for maximum output and bundle-to-bundle consistency. Bundled fiber strands shall be kept free from the contamination of water and polishing agents. Maximum fiber breakage per fiber bundle shall not exceed 3%. A minimum of five spare fiberoptic output bundles shall be provided for each lamp and built into the unit. Damaged output bundles shall be replaceable using these spares. The output fiber bundles located at the face of the sign shall have a minimum diameter of 1.2 mm for the “DON’T” and 1.7 mm for the “WALK” message. The input fiber bundle located at each light source shall have a maximum diameter of 19 mm. The output bundles shall be protected by a vandal resistant prismatic polycarbonate lens 3.18 mm thick. Individual fiberoptic bundles shall not be jacketed or encased.

Color filters shall be optical quality glass. The filters shall be color fast and in accordance with the I.T.E. Signal Color Specification for Chromaticity.

The prismatic polycarbonate lens shall be mounted at a pre-focused distance in the door, away from the fiberoptic panel.

All optical fiber utilized in the production of the fiberoptic unit shall be tested for:
- Core to clad fusion
- Size
- Roundness of fiber
- Optical transmission
- Britteness
Results of these tests shall be available upon request.

**Construction.** The front panel shall be flat black aluminum alloy, minimum 3.18 mm thick, and shall have a maintenance-free black anodized, acid tested finish or an equivalent weather resistant polycarbonate.

A heavy plastic mylar water shield shall be used to prevent possible water leaks from dropping onto the lamps.

All fiberoptic transformers and lamps shall be mounted on the door of the unit. All screws, washers, nuts and bolts shall be corrosion resistant. All components shall be readily accessible when the door is opened. The only tool required for maintenance or replacement of components shall be a standard screwdriver.

No moving parts are permitted in the optical system.

**Electrical.** Electrical connection shall be provided by a barrier-type terminal strip for connecting field wires.

Transformers shall be used to reduce the incoming 120 volts AC to 10.8 volts AC. Transformers shall be rated at 48.5 volt-amps and shall have Class A insulation impregnated with a double coating of epoxy resin so as to preclude intrusion of moisture.

A separate transformer and bulb shall be used for each color, to allow connection with existing controller wiring and conflict monitors.

The transformer bracket shall be an extruded aluminum member and shall provide adequate heat sinking of transformers.

**Environmental Conditions.** The unit shall be capable of continuous operation over a temperature range of $-37^\circ C$ to $+75^\circ C$.

**FIBEROPTIC DUAL INDICATION ARROW.** In addition to applicable items in STANDARD SIGNAL HEADS, the following additional requirements apply to Fiberoptic Dual Indication 300 mm Turn Arrow.

**General.** The unit shall display alternate indications, consisting of either a green or yellow directional arrow. The indication shall be clearly legible and shall attract the attention of motorists and be visible, under any lighting conditions varying from total darkness to bright sunlight or where high intensity background lighting is present, at a distance of at least 450 m under normal atmospheric conditions. A visor or hood shall not be required for legibility.

The indication shall be visible at full intensity anywhere within a 60-degree cone centered about the optical axis and perpendicular to the surface of the display.

When not energized, the signal shall be blanked out (unreadable) with no phantom images, regardless of solar intensity or direction.

The indication shall be bright in color against a flat black background.

Each indication shall be displayed separately and never concurrently.

The borderline arrow indications shall be comprised of a dual row of fiber bundles. The indication shall be in total conformance with I.T.E. standards for Vehicle Control Signal Heads.

**Material Requirements.** One 42 watt, 10.8 volt lamp type EPT or equivalent with a rated average life expectancy of 10 000 hours shall be used as the light source for each indication. The lamp shall be a multi-mirror reflector quartz halogen bulb operating at an approximate color temperature of 2900 K.

**Optical System.** The optical system shall consist of the following:

- Weatherproof housing, door, gaskets, and visor
- Fiberoptic module with individual output attached
- Color filters for desired message colors
- Light sources
- Transformers
- Protective back cover for the module
- Electrical system including wiring
Optical Requirements. The optics shall have a glass-on-glass fiber with a 83% core to 17% cladding ratio. Each fiber shall have a .05 ± .005 mm diameter with an included acceptance angle of 68 degrees.

All fiber ends shall be ground smooth and polished to an 8 µm finish minimum, for a maximum output and bundle-to-bundle consistency. Bundled fiber strands shall be kept free from the contamination of water and polishing agents. Maximum fiber breakage per fiber bundle shall not exceed 3%. At least two (2) spare fiberoptic output bundles shall be provided for and built into each unit. Damaged output bundles shall be replaceable using these spares. A minimum of 56 bundles shall be provided. Each optical output shall have a minimum 3.5 mm (nominal) active bundle area for maximum light transmission. All optical fiber shall be fully bias randomized by individual fiber with approximately 50% fiber allocated to the green arrow indication and 50% to the amber arrow indication for balanced and corrected color output. Individual fiberoptic bundles shall not be jacketed or encased.

Color filters shall be optical quality glass. The filters shall be color fast and in accordance with I.T.E. Signal Color Specification for Chromaticity. Any combination of colors shall be available by changing color filters installed in the unit.

All optical fiber utilized in the production of the fiberoptic units shall be tested for:
- Core to clad fusion
- Size
- Roundness of fiber
- Optical transmission
- Brittleness

Results of these tests shall be available upon request.

Construction. Complete unit shall be supplied mounted in standard 300 mm vehicle signal section.

The front panel shall be either flat black aluminum alloy, minimum 3.18 mm thick having a maintenance-free black anodized, acid tested finish or an equivalent weather resistant polycarbonate.

Output bundles shall be mounted on the front panel at 90 degrees to the surface. Mounting shall be consistent in manufacture and shall be watertight. A heavy plastic mylar (or equivalent) water shield shall be used to prevent possible water leaks from dripping onto the lamps.

All fiberoptic transformers and lamps shall be mounted on the door of the unit. All screws, washers, nuts and bolts shall be corrosion resistant. All components shall be readily accessible when the door is opened. The only tool required for maintenance or replacement of components shall be a standard screwdriver.

No moving parts are permitted in the optical system.

Front panel, with fiberoptic indication shall be rotatable to form a right, left, or vertical arrow.

Electrical. Electrical connection shall be provided by a barrier type terminal strip for connecting field wires.

Transformers shall be used to reduce the incoming 120 volts AC to 10.8 volts AC.

Transformers shall be rated at 48.5 volt-amps and shall have a Class A insulation impregnated with a double coating of epoxy resin so as to preclude intrusion of moisture.

A separate transformer and bulb shall be used for each color, to allow connection with existing controller wiring and conflict monitors.

Environmental Conditions. The unit shall be capable of continuous operation over a temperature range of -37°C to +75°C.

STROBING SIGNAL INDICATION. In addition to applicable items in STANDARD TRAFFIC HEADS the following additional requirements apply to Strobing Signal Indications.

General. The unit shall consist of a standard red signal indication with the addition of a white bar strobe presented horizontally across the red face. The strobe shall flash at a rate of approximately once per second. The indication shall be single faced and the strobe bulb, control circuitry, and all necessary appurtenances shall be enclosed in and be an integral part of a standard 300 mm aluminum signal housing. The bar strobe shall attract the attention of motorists and be visible, under any lighting.
conditions varying from total darkness to bright sunlight or where high intensity background lighting is present, at a distance of at least 805 meters under normal atmospheric conditions.

When the bar strobe is not energized, the indication shall operate and appear as a standard red indication.

**Optical System.** The optical system shall consist of the following:
- Weatherproof housing, door, gaskets, and visor.
- Alzak parabolic reflector or equivalent. No plastic material will be accepted for the reflector or reflector bracket.
- One bar strobe bulb with a minimum 5000 hours duty life enclosed in a dustproof, shockproof and watertight enclosure.
- 300 mm glass red lens.
- Power supply.
- Electrical system including wiring and control circuitry.
- The strobe bulb shall be a minimum of 241 mm in length to effectively span the width of the lens.

**Construction.** The unit shall consist of a standard 300 mm red vehicle signal section with a bar strobe light interposed in front of the red lens.

All power supplies and control circuitry for the strobe shall be mounted to the visor assembly and contained within a watertight enclosure(s) which shall not interfere with mounting additional signal sections to form a multiple section signal head.

The strobe bulb shall be enclosed in a dustproof, shockproof and watertight housing securely mounted in front of the red lens. The strobe housing shall contain only the strobe bulb, terminal strips and necessary connecting wires, and shall not interfere with the general visibility of the red lens, nor the ability to change the red lens in the normal manner.

All screws, washers, nuts and bolts shall be stainless steel.

All components shall be readily accessible. The only tool required for maintenance or replacement of all components shall be a standard screwdriver.

**Electrical.** Electrical connection shall be provided by a barrier type terminal strip for connecting field wires. The power supply shall be of a capacitive discharge type sufficient to fire the bar strobe bulb at a rate of approximately once per second. The power supply shall be encased in a temperature stable epoxy so as to preclude intrusion of moisture. A door switch shall be provided so that when the housing door is opened the switch shall disconnect AC power to the strobe power supply and circuitry and shall also completely discharge the high voltage DC capacitive charge within 10 seconds.

The high voltage power supply shall be fused using a time delay fuse. The current rating of the fuse shall be no more than 50% above the maximum current expected at 135 V AC. The fuse shall be mounted in the housing and located before the door switch in the strobe circuitry.

The barrier type terminal strip shall be equipped with male quick connect spade terminals. Insulated female spade receiver terminals shall be required for the connection of the strobe circuitry to the terminal strip.

**Labeling.** A CAUTION or WARNING label should be affixed to the visor assembly near the housing door opening, notifying maintenance or repair personnel of the presence of a high voltage capacitive charge within the visor assembly and that the quick disconnect should be disconnected and a check for AC or DC voltage across the strobe bulb should be performed before servicing the strobe bulb or circuitry.

**STANDARD POLYCARBONATE TRAFFIC SIGNAL HEADS**

**General.** In addition to applicable material requirements for STANDARD SIGNAL HEADS and STANDARD PEDESTRIAN SIGNAL HEADS, the following additional requirements apply to Polycarbonate Traffic Signal Heads.
Material Requirements. The traffic signal housing, visor and door shall be made of injection molded polycarbonated resin which shall be capable of withstanding a 95 N\(\cdot\)m impact without fracture or permanent deformation.

Material used in the construction of the signal housing door, visor and lens shall be resistant to heat generated by the signal bulb. No deformation or discoloration shall be evidenced when 116 watts bulbs are used in 200 mm signal sections and 150 watt bulbs are used in 300 mm signal sections. The plastics shall be ultra-violet and heat stabilized and flame retardant.

The signal housing, door and visor shall be dark green and the color shall be fully impregnated into the polycarbonate resin.

Visor shall be made of one piece with a minimum thickness of 2 mm. The rear edge of the visor shall be provided with four mounting lugs for attaching the visor to the door using screws. The inside of the visor shall be dull black in color. Unless otherwise specified all signal heads shall be provided with cap-type visors.

Construction. The housing shall have a minimum thickness of 2.3 mm. The housing shall be of one piece construction and the door shall be of one piece construction. Both the 200 mm & 300 mm housings are to be designed in the same manner so when used in combination heads the design will match each other.

The top and bottom opening of each housing shall have integral serrated bosses that will provide positive positioning of the signal head to eliminate undesirable rotation or misalignment of the signal head between sections. Each opening accommodates standard 1.5 NPS pipe fittings and brackets.

Doors shall be hinged by two lugs and mounted to the housing using stainless steel pins. The door of each signal section shall be one-piece with a minimum thickness of 2.3 mm.

A neoprene gasket shall be provided between the body of the housing and the door. The doors shall be forced tightly against the gasket and housing by simple stainless steel locking devices. A slotted air cored neoprene lens gasket shall provide a positive seal between the lens and the signal door and between the lens and the reflector holder.

The gasket shall be an unbroken circular gasket with a "U" shaped cross section. The gasket and lens shall be held tightly into the door by four stainless steel clips and screws that shall allow easy removal of the lens and gasket from the door without removal of the door in the field.

The reflector shall be Alzak aluminum. Reflector rings shall be manufactured from die cast aluminum, hinged from one side to allow the reflector assembly to open without use of tools. The lamp receptacle shall be permanently focused to the reflector and held in place by a corrosion-resistant wire spring bail so that it can be removed without the use of tools. The center section shall contain a terminal barrier block having quick-disconnect terminals for the lamp receptacle leads and screw terminals for field wires.

LED TRAFFIC SIGNAL MODULES. In addition to applicable material requirements for STANDARD SIGNAL HEADS, and STANDARD PEDESTRIAN SIGNAL HEADS, the following additional requirements apply to Ball, Arrow, and Pedestrian LED Traffic Signal modules.

General. This specification refers to definitions and practices described in the Institute of Transportation Engineers (ITE) publication ST-017B "Vehicle Traffic Control Signal Heads" (referred to in this document as "VTCSH"), and "Pedestrian Traffic Control Signal Indications" (referred to in this document as "PTCSI"). LED traffic signal modules designed as retrofit replacements for existing signal lamps shall not require special tools for installation. They shall be a single, self-contained device, not requiring on-site assembly for installation into an existing traffic signal housing. The module shall be sealed to provide a weather tight enclosure and an insulating covering for all electrical connections and electronic components and shall fit securely in the housing. A one piece "U-shaped" cross section rubber gasket shall be provided with each module. This gasket shall fit around the perimeter of the module to ensure a weather tight fit between the door and the housing of the module. The module shall connect directly to existing electrical wiring by means of 6.35 mm (0.25 inch) female quick connect push on type terminals.

Material Requirements. Materials used for the lens and signal module construction shall conform to ASTM specifications for those materials.

Each LED signal module shall be identified on the back side with the manufacturer's trade mark, serial number, voltage rating, Volt-Ampere rating, power consumption (watts and volt amperes) and, if applicable, a vertical indexing indicator (i.e., "up arrow", or the word "UP" or "TOP"). Each LED signal
module shall also be identified on the back side with the part number as shown in the NYSDOT LED Traffic Signal Module QPL and the date of manufacture (month and year minimum). Single units shall have identification markings as to the type and color of the module. Bi-Modals shall be marked with model type.

Each LED signal module shall have a permanent sticker stating compliance to FCC Title 47, Subpart B, Section 15 regulations. The sticker will be located on the rear exterior of the unit.

A. Ball and Arrow Modules (Single and Bi-Modal) Only. Retrofit replacement LED signal modules shall fit into existing traffic signal housings built to the VTCSH Standard without modification to the housing. Installation of the retrofit replacement LED signal module into an existing signal housing shall only require the removal of the existing lamp components (i.e., lens, lamp module, gaskets, and reflector).

Red LED signal module lenses shall be tinted with the appropriate color to enhance on/off contrast. The material used to tint the lens shall not affect the luminous intensity or chromaticity and shall be uniform across the face of the lens. The Yellow and Green units shall be supplied with a clear lens. If a polymeric lens is used, a surface coating or chemical surface treatment shall be used to provide front surface abrasion resistance. The module lens shall be replaceable without the need for replacing the complete module unit.

The Arrow LED signal modules shall produce a pattern that conforms to the VTCSH standard for color, size and shape. The Arrow LED signal modules shall not require a specific orientation or have a variance in light output, pattern or visibility for any mounting orientation.

The lens of the LED signal module shall be capable of withstanding ultraviolet light (direct sunlight) exposure for a minimum time period of five years without exhibiting evidence of deterioration.

Each Ball LED shall have a sticker attached stating compliance to the ITE Standard for Color and Luminous Intensity and each Arrow LED shall have a sticker attached stating compliance to the ITE Standard for Color as specified in the VTCSH.

B. Pedestrian Modules (Single & Bi-Modal) Only.

Pedestrian LED traffic signal modules shall be designed as a retrofit replacement for the message bearing surface of a 300 mm by 300 mm or a 410 mm by 450 mm (with a 60 mm corner radius), pedestrian traffic signal housing built to the PTCSI Standard. The Single Pedestrian module shall be designed to display either a “HAND” or “WALKING MAN” symbol that complies with PTCSI standard for this symbol for the size specified. The Bi-Modal Pedestrian module shall be designed to display both “HAND” and “WALKING MAN” symbols that comply with the PTCSI standard for these symbols for the size specified.

The “HAND” and “MAN” symbols for both the Single and Bi-Modal Pedestrian shall be designed so that the entire area comprising the symbol appears illuminated. Outlined shapes will not be accepted.

The LED signal module shall fit into existing Pedestrian signal housings without the need to modify the housing. Installation of the retrofit replacement Pedestrian LED signal module into pedestrian signal housing shall only require the removal of the existing message bearing surface, existing lamp components (i.e., lens, lamp module, gaskets, and reflector), and insertion of the retrofit replacement into the area once occupied by the removed assembly.

Each pedestrian module shall have a sticker attached stating compliance to the ITE standard for chromaticity as defined in the PTCSI.

Optical

A. Ball and Arrow Modules (Single & Bi-modal) Only. The measured chromaticity coordinates of Ball and Arrow LED signal modules shall conform to the chromaticity requirements of Section 8.04, Limits of Chromaticity Coordinates and the associated Figure 1 of the VTCSH standard.

The light output distribution for Ball LED traffic signal modules shall be as defined in Section 11.04 and Table 1 of the VTCSH standard. The minimum luminous intensity values for Ball LED traffic signal modules shall be, at a line voltage of 120 ±3 volts rms, as listed in Table 1 of the VTCSH standard. Variations in operating line voltage of between 80 and 135 volts rms shall have
minimal effect (less than ±10%) on luminous output of the signal module. Minimum Initial Luminous Intensities of units supplied shall equal or exceed, at 2°C, 117.5% of the values defined in Table 1-Maintained Minimum Luminous Intensity Table-of the VTCSH standard for LED signal modules.

Ball LED signal modules, except for yellow modules, shall be designed so that when operated over the specified operating ambient temperature and voltage ranges during the luminous intensity warranty period, the luminous intensity of the unit shall exceed or equal the values shown in Table 1, “Maintained Minimum Luminous Intensity Table” of the VTCSH standard for LED signal modules.

Yellow modules shall be designed so that when operated at 25°C over the specified voltage range during the luminous intensity warranty period, the luminous intensity of the unit shall equal or exceed the values shown for the color Green.

Arrow LED signal modules shall be designed so that when operated over the specified ambient temperature and voltage ranges, the signal is clearly visible and attracts attention for a distance of at least 400 m under normal atmospheric conditions.

B. Pedestrian Modules (Single & Bi-Modal) Only. The measured chromaticity coordinates of Pedestrian LED signal modules shall conform to the chromaticity requirements of Section 5.3, Color and the associated Figure C of the PTCSI standard.

Pedestrian LED signal modules shall be designed so that when operated over the specified ambient temperature and voltage ranges, the signal shall attract the attention of, and be readable to, a viewer (at both day and night) at all distances from 3 m to the full distance to be crossed.

Performance Tests

A. All LED Modules. Prior to shipment, the vendor shall energize (burn in) each LED signal module for a minimum of 24 hours, at rated voltage, and at a 100 percent on-time duty cycle. This test shall be conducted at the rated voltage in an ambient temperature of 60°C. Any failure within an LED signal module occurring during burn-in shall be cause for rejection.

After burn-in procedure is completed, the following additional tests shall be performed. These tests shall be performed at rated operating voltage and at 25°C unless otherwise specified.

1. All units shall be powered off for a period of 1 second and then powered back on. Any unit failing to turn on after power restoration shall be rejected. This test shall be performed a minimum of 10 times.

2. A sample of 10% of units of each configuration, Balls or Arrows or Pedestrian signal modules, on the order shall be randomly selected and tested by the vendor in a flashing mode of operation, at 50 percent duty cycle with a 0.5 sec on time, and for a 24 hour period at 60°C. Any unit failing to function properly shall result in failure of the entire lot from which the sample was selected. Should this occur, the entire quantity ordered shall be tested as described above, and units not functioning properly shall be rejected.

3. Each LED signal module shall be visually inspected for any exterior physical damage or assembly anomalies. Careful attention shall be paid to the surface of the lens to ensure there are no scratches (abrasions), cracks, chips, discoloration, or other defects.

4. Each LED signal module shall be tested to ensure light output at 80 and 135 volts without adverse operational effects. Each LED signal under test shall be operated at each voltage level for a time period of five minutes. Signal modules illuminating with any adverse operational effects shall be rejected.

Contractors shall provide, with each shipment, a Manufacturer’s Certification of compliance. The certification shall certify that the LED signal modules comply with the requirements of these specifications. In addition to the certification, the modules shall be supplied with a list of the serial numbers of the units, copies of all applicable test reports on the LED signal modules, and signature of the person responsible for certifying the tests.

B. Ball Modules only. Each Ball LED signal module shall be tested for rated initial intensity. A single point measurement (at -2.5° V, 2.5° R or L) with a correlation to the minimum intensity requirements specified herein may be used. This test shall be performed after the burn-in procedure is completed, at rated operating voltage and at 25°C unless otherwise specified.
Electrical

**A. All LED modules.** All wiring and terminal blocks shall meet the requirements of Section 13.02 Wiring of the VTCSH standard. Each wire shall be approximately 1 m long.

Units shall be supplied with color coded wires as defined below:

- Red Balls & Red Arrows-Red & White
- Yellow Balls & Yellow Arrows-Yellow & White
- Green Balls & Green Arrows-Brown & White
- Bi-Modal Arrows- Brown (Green Arrow), Yellow & White (Common)
- Bi-Modal Pedestrians- Red (Hand), Brown (Man) & White (Common)
- Single Pedestrians (Hand)- Red & White
- Single Pedestrians (Walk Man)- Brown & White

The LED signal module shall operate with AC line voltage ranging from 80 volts to 135 volts rms 60±3 Hz. The circuitry shall prevent flicker over this voltage range. Rated voltage for all optical and power measurements shall be 120±3 volts rms.

The signal module on-board circuitry shall include voltage surge protection to withstand high-repetition noise transients and low-repetition high energy transients as stated in Section 2.1.6, NEMA Standard TS-2.

Each LED signal module shall be designed so that there is no noticeable light output when connected to rated voltage through an impedance of 15 kohm (either resistive or capacitive).

The signal module shall be designed so that, under normal operation, an AC voltage of no greater than 10 volts rms shall be developed across the unit when it is connected in series with any value of impedance greater than 15 kohm and for any applied AC voltage between 80 and 135 volts rms that is connected across this series combination. In addition, the signal module shall be designed so that the voltage across the module shall reduce in value to less than 10 volts rms within 100 msec when the module is switched off by any solid state switch or switchpack having an impedance of 15 kohm or greater.

The individual LED light sources shall be wired so that a catastrophic failure of one LED light source will not result in the loss of illumination of more than four LED light sources.

The LED signal module and associated on board circuitry shall meet Federal Communications Commission (FCC) Title 47, Subpart B, Section 15 regulations concerning the emission of electronic noise. All modules shall contain filtering dedicated to prevent inducing electronic noise into the AC power lines.

Modules shall be fused using a time-delay fuse. The fuse shall be located so that it can be easily changed without the need to disassemble the module. If in-line fuses are added into module wire leads, they will be installed in the colored wires of the units. Each individual circuit in the Bi-Modal models shall be fused separately.

All printed circuit boards used in the module shall be coated with a conformal coating containing an ultraviolet tracer.

All unit types shall be operationally compatible with the traffic signal equipment that each type is designed and intended to interface with. This equipment includes all controllers, conflict monitors, current monitors, switchpack and flashers currently in use by the Department.

**B. NYSDOT Standard & Type A LED Module Definitions.** NYSDOT Standard Units shall be designed so that a normally functioning signal module will generate the needed current to prevent a Model 215 Current Monitor from detecting a loss of current over the voltage range of between 95 and 135 volts rms. The minimum current required to prevent the Model 215 monitor from detecting a loss of current is a 500 milliamp peak AC or pulsed current with a minimum pulse width of 3 msec. Signal modules designed to specifically generate current pulses to prevent the monitor from tripping shall, as a minimum, generate 6 pulses per second. Generated current pulses shall be evenly spaced, with the first pulse generated within 100 msec after the application of AC power. (Additional information regarding the operation of the Model 215 Current Monitor can be obtained in the latest "New York State Transportation Management Equipment Specifications").

NYSDOT Standard Units shall incorporate circuitry to reliably detect the total loss of LED current due to failures such as, but not limited to, open circuits and power supply problems. Upon
detection of this failure, this circuit will disable any current generating circuitry within 400 msec to allow detection of this failure by a Model 215 current monitor.

Type “A” units shall be supplied without the necessary circuitry to function with a Model 215 current monitor.

Total harmonic distortion (current and voltage) induced into an AC power line for Type A units operating at rated voltage shall not exceed 20 percent for units consuming greater than 15 watts at 25°C and 40 percent for units consuming less than 15 watts at 25°C.

All Ball and Single Arrow LED modules may be procured using this specification as either NYSDOT Standard or Type A units. Single Pedestrian, Bi-Modal Pedestrian, and Bi-Modal Arrows will be procured as Type A only.

The maximum power consumption shall not exceed the following wattages at 25 degrees C:

<table>
<thead>
<tr>
<th>Size</th>
<th>Red</th>
<th>Yellow</th>
<th>Green</th>
</tr>
</thead>
<tbody>
<tr>
<td>300 mm Balls</td>
<td>14</td>
<td>24</td>
<td>18</td>
</tr>
<tr>
<td>200 mm Balls</td>
<td>10</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>300 mm Arrows</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Bi-Modal Arrows</td>
<td></td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>300 mm by 300 mm Signal Pedestrian</td>
<td>9</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>300 mm by 300 mm Bi-Modal Pedestrian</td>
<td>9</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>410 mm by 450 mm Bi-Modal Pedestrian</td>
<td>12</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

NYSDOT standard units supplied will meet the same low distortion standards without the current generating circuitry included in the measurement.

LED signal modules supplied in conformance with this specification shall have power factors of 0.90 or greater without the current generating circuitry included in the calculations for power factors for NYSDOT Standard units.

**C. Pedestrian Modules (Single & Bi-Modal) Only.** The maximum power consumed by a pedestrian LED unit shall not exceed 15 volt-amps (VA) at 120±3 volts rms.

**Environmental.** All LED signal modules shall be rated for use in the ambient temperature range of -40°C to +74°C. LED signal modules shall be sealed against dust and moisture intrusion per the requirements of NEMA Standard 250-1991 for Type 4 enclosures to protect all internal LED and electrical components. LED signal modules shall be capable of operating at rated voltage in an environment of +74°C/85% RH for 1000 hours without the formation of internal condensing moisture.

**BASIS OF ACCEPTANCE.** Acceptance of signal heads, sections, and/or LED signal modules will be based on manufacturer's certification of compliance with these specification requirements, a list of serial numbers of the units being supplied, copies of all applicable test reports on the signal modules, and signature of the person responsible for certifying the tests. In addition, LED module model number and manufacturer's name must be listed on the NYS Signal Qualified Products List (QPL). The QPL can be obtained from the NYSDOT website.

**724-05 THRU 724-07 (VACANT)**

**724-08 SHIELDED COMMUNICATION CABLE**

**SCOPE.** This specification covers the material requirements and fabrication details of shielded communication cable for use with traffic signal systems.

**MATERIALS AND CONSTRUCTION.** The cable shall conform to the requirements of the International Municipal Signal Association (IMSA) specification 20-2 for polyethylene insulated, polyethylene jacketed communication cable with electrical shielding. The gauge and number of conductors shall be as specified in the plans. The conductors shall be stranded copper wire.

**BASIS OF ACCEPTANCE.** Acceptance of material will be based on the manufacturer's certification of compliance with these specification requirements.
724-09 SIGNAL CABLE WITH INTEGRAL MESSENGER

SCOPE. This specification covers the material requirements for signal cable with integral messenger for use with traffic signal systems and for aerial installations.

MATERIALS AND CONSTRUCTION. The cable shall conform to the requirements of the International Municipal Signal Association (IMSA) Specification 20-3. The gauge and number of conductors shall be as specified in the plans. The conductors shall be stranded copper wire.

BASIS OF ACCEPTANCE. Acceptance of material will be based on the manufacturer's certification of compliance with these specification requirements.

724-10 SHIELDED COMMUNICATION CABLE WITH INTEGRAL MESSENGER

SCOPE. This specification covers the material requirements for shielded communication cable with integral messenger for use with traffic signal systems and for aerial installations.

MATERIALS AND CONSTRUCTION. The cable shall conform to the requirements of the International Municipal Signal Association (IMSA) Specification 20-4. The gauge and number of conductors shall be as specified in the plans. The conductors shall be stranded copper wire.

BASIS OF ACCEPTANCE. Acceptance of material will be based on the manufacturer's certification of compliance with these specification requirements.

724-11 THRU 724-14 (VACANT)

724-15 FIRE PRE-EMPTION TELL-TALE LIGHT

SCOPE. This specification covers the material requirements for fire pre-emption tell-tale light.

MATERIALS AND CONSTRUCTION. The fire pre-emption tell-tale light shall consist of a Xenon flash tube rated at 10.76 Mlx and 2000 hours life. The flash rate shall be 60 to 80 flashes per minute. The tell-tale light shall be capable of normal operation between outside temperature from -46°C to +60°C. The tell-tale light shall be contained in a vandal resistant weatherproof housing and mounting with a blue heat resistant and shatterproof globe. It shall be visible through 360° horizontally. The fire pre-emption tell-tale light shall operate from a 115 volt 60 Hz. single phase power source.

BASIS OF ACCEPTANCE. Acceptance of the fire pre-emption tell-tale light shall be based on the manufacturer's certification of compliance with these specification requirements.

724-16 THRU 724-19 (VACANT)

724-20 INDUCTANCE LOOP WIRE

SCOPE. This specification covers the material requirements for wire used in inductance loop vehicle detectors.

MATERIALS AND CONSTRUCTION. Loop wire shall be one conductor No. 14 AWG wire loosely encased in a tube in conformance to the requirements of the International Municipal Signal Association (IMSA) Specification 51-5.

BASIS OF ACCEPTANCE. Acceptance of material will be based on the manufacturer's certification of compliance with these specification requirements.
724-21 SHIELDED LEAD-IN CABLE

SCOPE. This specification covers the material requirements for shielded lead-in cable used with inductance loop vehicle detectors.

MATERIALS AND CONSTRUCTION. The cable shall consist of No. 14 AWG conductors in conformance to the requirements of the International Municipal Signal Association(IMSA) Specification 50-2.

BASIS OF ACCEPTANCE. Acceptance of material will be based on the manufacturer's certification of compliance with these specification requirements.

724-22 ROADWAY LOOP EMBEDDING SEALER

SCOPE. This specification covers the material requirements for Roadway Loop Embedding Sealer used when installing inductance loops.

MATERIALS AND CONSTRUCTION. Roadway Loop Embedding Sealer shall be used to encapsulate Traffic Signal Loop Wires embedded in highway materials. The sealer shall be cold applied and may be a one or two component system, the viscosity of which shall be sufficient to allow the material to be either poured or placed under pressure and fully encapsulate the loop wires. The sealer shall be curable at temperatures of 4.5°C and above.

When the sealer is bonded to common paving materials, it shall have sufficient strength and resiliency to withstand stresses due to vibrations and differences in expansion and contraction as a result of temperature changes or traffic conditions. The sealer shall be compatible with the sheathing or covering of loop inductance wires.

| TABLE 724-22-1 ROADWAY LOOP EMBEDDING SEALER PROPERTIES |
|---------------------------------|-----------------|---------|---------|---------|---------|
| Property                        | Test Method     | Flexible |         | Flexible |         |
|                                 |                 | Min.    | Max.    | Min.    | Max.    |
| Hardness, Shore                 | ASTM D2240      | A15     | A40     | A50     | D65     |
| Pot Life @22°C, minutes         | NYSDOT 724-40E  | 15      | ---     | 15      | ---     |
| Curing Time (tack free surface) @ 22°C, hours | NYSDOT 724-40E | ---     | 2       | ---     | 2       |
| Tensile Strength, kPa           | ASTM D412       | 345     | ---     | 2800    | ---     |
| Elongation, percent             | ASTM D412       | 150     | ---     | 20      | ---     |
| Water Absorption, percent       | NYSDOT 724-40E  | ---     | 1.0     | ---     | 1.0     |
| Adhesion to Asphalt Concrete, kg| NYSDOT 724-40E  | 91      | ---     | 227     | ---     |
| Adhesion to Concrete, kg        | NYSDOT 724-40E  | 23      | ---     | 136     | ---     |
| Extension, mm                   | NYSDOT 724-40E  | 6.4     | ---     | 3       | ---     |
| Accelerated Weathering          | NYSDOT 724-40E  | No cracking, checking, chalking, or shrinking |

Chemical Resistance. Cured sealer shall be resistant to most chemicals and solvents, including salts, acids, hydrocarbons, etc.

Packaged stability of each component in original unopened containers, stored in temperatures between 0°C and 38°C shall be a minimum of six months.

MATERIAL REQUIREMENTS. The material shall meet the requirements of either the Flexible or Hard designation in Table 724-22-1. Materials designated Flexible require a 180° mandrel bend test @ 26°C with no breaking as part of the accelerated weathering testing.

BASIS OF ACCEPTANCE. Applications for approval of Roadway Loop Embedding Sealer shall be submitted to the Materials Bureau by the manufacturer accompanied by a 4L sample of the product and all pertinent sealer information including, but not limited to, manufacturer's sealant test results, sealant
application procedures and safety precautions. Upon approval by the Materials Bureau, the name of the product will be placed on an “approved list” of Roadway Loop Embedding Sealers for use on asphalt and/or concrete pavements based on the compatibility of the sealer with the pavement material. The product may then be accepted on the basis of the name brand labeled on the container.

724-23 PEDESTRIAN PUSH BUTTON AND SIGN

SCOPE. This specification covers the material requirements for pedestrian push button and sign.

MATERIAL AND CONSTRUCTION. The push button unit shall be a direct push type having a cast aluminum housing. The unit shall be strongly constructed, rugged, abuse and tamper proof and suitable for operation under all weather conditions. It shall be provided with one normally-opened contact with ample contact area. The contacts shall be a material which will provide low contact resistance throughout the life of the device. The housing shall be of a design or be provided with adaptors to facilitate mounting on poles of different diameters. The unit shall have a convenient means of wiring.

The sign may be either reflectorized or non-reflectorized, with legend as specified on the plans and in accordance with Part 210 of the New York State Manual of Uniform Traffic Control Devices.

BASIS OF ACCEPTANCE. Pedestrian push button and sign shall be accepted upon the manufacturer's certification of compliance with these specification requirements.

SECTION 725 - MISCELLANEOUS METALS AND PLASTICS

725-01 COPPER FLASHING

SCOPE. This specification covers the material requirements for copper flashing.

MATERIAL REQUIREMENTS. Sheet copper for flashing shall be rolled from copper fulfilling the requirements of ASTM B5. This sheet metal shall be cold rolled soft copper.

BASIS OF ACCEPTANCE. Acceptance of this material will be based on the manufacturer's certification that the material meets the specification requirements.

725-02 STEPS FOR MANHOLES

SCOPE. This specification covers the material requirements for steps used in manholes.

GENERAL. The minimum design live load, for steps, appurtenances and fastenings, shall be a single concentrated load of 13.5 kN. The live loads imposed by persons occupying the steps shall be considered to be concentrated at such points as will cause the maximum stress in the structural member being considered.

Steps shall be designed so a worker's foot cannot slide off the end. The minimum length of the rungs shall be 250 mm.

Whenever a combination of dissimilar types of metals are used in the manufacture of steps, appurtenances and fastenings, the materials shall be treated to prevent deleterious effects.

MATERIALS. Manhole steps shall be fabricated from one of the following:

Ferrous Metal. Steps shall conform to one of the following requirements:

<table>
<thead>
<tr>
<th>Material</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron Castings</td>
<td>Class 25A, 715-05</td>
</tr>
<tr>
<td>Malleable Iron Castings</td>
<td>Grade 35018, 715-09</td>
</tr>
<tr>
<td>Steel</td>
<td>ASTM A575, Grade M 1020 galvanized in accordance with §719-01, Type 1.</td>
</tr>
</tbody>
</table>
The steps shall have a minimum cross sectional dimension of 25 mm exclusive of any coatings placed on them.

**Non-Ferrous Metal.** Steps shall conform to the following requirements:

- **Aluminum Castings**  Alloy 356-T6, 715-03.
- **Wrought Aluminum**  6061-T6, 6005-T5, or 6351-T6, 715-04

When aluminum steps are used, the portion of the step which will be in direct contact with cement concrete or concrete mortar, shall be coated with a zinc chromate primer or bituminous material approved by the Materials Bureau.

**Reinforced Plastic.** Steps shall consist of polypropylene or other plastic material completely covering a steel core. The plastic may be extruded, cast, or molded into the standard size and shape manhole steps, and provide corrosion protection.

The plastic material shall have the following characteristics:

**A. Resistance to Salt and Caustic Solutions.** Resistance to the following solutions when submerged for 30 days:

- 10% Sodium Chloride
- 10% Hydrochloric Acid
- 10% Sodium Hydroxide
- 10% Sulfuric Acid

**B. Flow Point.** A flow point of 160°C or greater.

**C. Flexibility.** It shall remain flexible over a temperature range of -30°C to +120°C upon long aging.

**D. Fire Resistance.** It shall be non-burning, self-extinguishing, or very slow burning.

The steel core shall be not less than 12 mm diameter and shall have the following physical characteristics:

- Tensile Yield, Minimum 275 MPa
- Tensile Strength, Minimum 482 MPa

The plastic step, when cast into a concrete block the proper depth, shall withstand a minimum load of 13.5 kN applied on 625 mm² area in the center of the step without cracking or breaking the plastic coating, loosening the step in the concrete or permanently deforming the step.

**Basis of Acceptance.** Manhole steps shall be accepted on the basis of the manufacturer's certification of compliance with this specification. However, the Department reserves the right to take random samples at any time for testing for compliance with the requirements of this specification.

**SECTION 726 (VACANT)**

**SECTION 727 - PAVEMENT MARKING MATERIALS**

**727-01 WHITE AND YELLOW THERMOPLASTIC REFLECTORIZED PAVEMENT MARKINGS**

**Scope.** This specification covers the white and yellow thermoplastic reflectorized pavement striping material that is extruded, in a molten state, onto the pavement. Following a surface application of glass beads and upon cooling to normal pavement temperatures, the resultant marking is an adherent reflectorized stripe, of specified thickness and width, that is capable of resisting deformation by traffic.
GENERAL. Methods and requirements for applying thermoplastic markings shall be as specified in section 687, Thermoplastic Reflectorized Pavement Markings.

MATERIAL REQUIREMENTS

Thermoplastic Composition. The thermoplastic composition shall be specifically formulated for application at temperatures greater than 205°C. The components in the composition shall show no significant break-down, or deterioration at 246°C.

The binder component shall be formulated as a hydrocarbon resin; or it shall be formulated as a mixture of high boiling point monohydric primary alcohol and modified maleic resin; or the manufacturer may submit an optional binder formulation to the Materials Bureau for evaluation and approval. The pigment, beads and filler shall be uniformly dispersed in the binder resin.

The thermoplastic composition shall be free from all skins, dirt and foreign objects and shall comply with the following requirements:

<table>
<thead>
<tr>
<th>Component</th>
<th>% by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>White</td>
</tr>
<tr>
<td>Binder</td>
<td>17.0 min</td>
</tr>
<tr>
<td>Titanium Dioxide</td>
<td>10.0 min</td>
</tr>
<tr>
<td>Glass Beads</td>
<td>30-40</td>
</tr>
<tr>
<td>Calcium Carbonate &amp; Inert Fillers</td>
<td>43.0 max</td>
</tr>
<tr>
<td>Yellow Pigments</td>
<td>---</td>
</tr>
</tbody>
</table>

* Amount and type of yellow pigment, calcium carbonate and inert fillers shall be at the option of the manufacturer, providing the other composition requirements of this specification are met.

Physical Properties of Composition.

A. Color. White thermoplastic composition, as placed, shall be white, free from dirt or tint. The color of the white composition shall be defined by the color chip in the possession of the Materials Bureau.

Yellow thermoplastic composition, as placed, shall be yellow, free from dirt or tint and shall be a reasonable visual match to Munsell Book Notation 10YR8/14 (ASTM D1535).

B. Drying Time. When installed at 21°C, and in thickness between 3 mm and 5 mm, the composition shall be completely solid and shall show no damaging effect from traffic after ten (10) minutes.

C. Yellowness Index. White thermoplastic composition shall not exceed a yellowness index of 0.12 when tested in accordance with AASHTO Designation T-250.

D. Softening Point. The composition shall have a softening point of not less than 90°C when tested in accordance with ASTM E28.

E. Specific Gravity. The specific gravity of the composition as determined by a water displacement method of 25°C shall be between 1.8 and 2.2 (referred to water at 25°C).

Reflective Glass Spheres (Pre-mix and Drop-On). Reflective glass spheres for use in the composition and for drop-on shall conform to the following requirements:

The glass spheres shall be colorless; clean; transparent; free from milkiness or excessive air bubbles; and essentially clean from surface scarring or scratching. They shall be spherical in shape and at least 70% of the glass beads shall be true spheres when tested in accordance with ASTM D1155.

The refractive index of the spheres shall be a minimum of 1.50 as determined by the liquid immersion method at 25°C.

The silica content of the glass spheres shall not be less than 60%.
The crushing resistance of the spheres shall be as follows: A 18 kg dead weight, for 850 µm to 600 µm mesh spheres, shall be the average resistance when tested in accordance with ASTM D1213.

The glass spheres shall have the following grading when tested in accordance with ASTM D1214 (Note: Requests for optional gradations may be submitted to the Materials Bureau for evaluation and approval):

<table>
<thead>
<tr>
<th>Standard Sieve</th>
<th>Mass % Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>850 µm</td>
<td>100</td>
</tr>
<tr>
<td>600 µm</td>
<td>79-95</td>
</tr>
<tr>
<td>300 µm</td>
<td>15-60</td>
</tr>
<tr>
<td>180 µm</td>
<td>0-15</td>
</tr>
</tbody>
</table>

Glass spheres for drop-ons shall be treated with a moisture-proof coating.

**Thermoplastic Primer.** The thermoplastic primer shall be specifically designed to enhance the bond of thermoplastic pavement markings to asphalt cement and/or portland cement concrete pavements.

The primer shall be either a one-component or two-component, cold or hot applied material of the type recommended by the thermoplastic pavement marking manufacturer.

Thermoplastic primers shall conform to current Federal, State and Local air pollution regulations, including those for the control (emission) of volatile organic compounds (VOC) as established by the U.S. Environmental Protection Agency, and the New York State Department of Environmental Conservation."

**PACKAGING AND SHIPPING.** The thermoplastic composition shall be shipped to the job site in containers that are strong, substantial and capable of being sealed in a manner approved by the Department. The containers shall be plainly marked with the manufacturer's name and address, New York State specification designation, date of manufacture and batch number.

The reflective glass spheres for drop-on application shall be shipped in moisture resistant bags. Each bag shall be marked with the name and address of the manufacturer and the name and net weight of the material.

Thermoplastic primers shall be shipped in pails, drums, or other strong substantial containers. Each container shall be plainly marked with the name of the product, the name and address of the manufacturer, the date of manufacture, the quantity of material, and the date of expiration or shelf life. In addition, two-component primer containers shall be identified as "Part A" and "Part B". Primers shall be shipped to the job site accompanied with written instructions for use.

**BASIS OF ACCEPTANCE.** White and yellow, thermoplastic, reflectorized pavement markings will be accepted on the basis of the manufacturer's name and location appearing on the Department’s Approved List and a material certification that specifies the product conforms to this specification.

Reflective glass spheres may be accepted at the job site on the basis of the manufacturer's certification, or samples may be submitted to the Materials Bureau for testing.

Thermoplastic primers shall be accepted at the job site on the basis of the manufacturer's certification that they conform to the requirements of this specification.

**727-02 WHITE AND YELLOW REMOVABLE REFLECTORIZED PAVEMENT MARKINGS**

**SCOPE.** This specification covers white and yellow removable reflectorized pavement marking material.

**GENERAL.** Methods and requirements for applying removable reflectorized pavement markings shall be as specified in Section 619 Maintenance and Protection of Traffic.

**MATERIAL REQUIREMENTS**

**General Requirements.** Removable pavement markings shall consist of white and yellow preformed reflectorized tape or white and yellow, raised type, reflectorized markers.
Removable preformed reflectorized marking tape shall be composed of a pigmented plastic or polymeric film, on a reinforced conformable backing. A retroreflective layer of glass spheres shall be bonded to, or embedded in the top surface. The preformed marking shall be pre-coated on its bottom side with a pressure sensitive adhesive and shall be capable of adhering to bituminous or portland cement concrete surfaces without the use of heat, solvents or other means.

Removable raised type reflective markers shall be designed as single units, and consist of an acrylic plastic or another type of durable casing, containing one or two reflective faces. The marker casing shall be approximately square in shape and designed to provide maximum daytime delineation. The removable marker shall be adhered to bituminous or portland cement concrete surfaces using the adhesives and/or methods recommended by the manufacturer.

Physical Properties

A. Color. White removable markings, as placed, shall be white, free from dirt or tint. Yellow removable markings, as placed, shall be yellow, free from dirt or tint, and conform to Highway Color Tolerance Chart, PR#1 (U.S. Department of Transportation, Federal Highway Administration, December, 1972).

B. Size. Removable preformed marking tape shall be of the specified size and shape and conform to the applicable requirements of the M.U.T.C.D. Removable raised type markers shall be fabricated to the following requirements:

1. Casing dimensions. The minimum casing dimensions shall be 100 mm x 100 mm x 19 mm.

2. Area of each reflective lens. The minimum area of the reflective lens shall be 245 mm².

C. Reflectance

1. White and Yellow Preformed Tape. Glass spheres for retro-reflectivity shall have a refractive index of not less than 1.50, as determined by the liquid immersion method at 25°C. The spheres shall be firmly bonded, or embedded in the surface of the marking tape.

The quantity of glass spheres shall be such that white and yellow preformed markings have the following initial average reflectance values at 0.2° and 0.5° observation angles and 86.0° entrance angle as measured in accordance with the testing procedures of Federal Test Method Standard 370. The photometric quantity to be measured shall be specific luminance (SL) and it shall be expressed as millicandelas per square meter per lux.

<table>
<thead>
<tr>
<th>TABLE 727-02-1</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td>White</td>
<td>Yellow</td>
</tr>
<tr>
<td>Observation Angle</td>
<td>0.2°</td>
<td>0.5°</td>
</tr>
<tr>
<td>Specific Luminance, ((mcd•m²)/lx)</td>
<td>1770</td>
<td>1270</td>
</tr>
</tbody>
</table>

2. White and Yellow Reflective Marker Lenses. White and yellow reflective lenses shall have the following initial average reflectance values, when measured with incident light parallel to the base of the marker, at an observation angle of 0.2° and entrance angles of 0° and 20°. The photometric quantity to be measured shall be specific intensity (SI) and it shall be expressed as millicandelas per lux.

<table>
<thead>
<tr>
<th>TABLE 727-02-2</th>
<th>REFLECTIVE MARKER LENSES REFLECTANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td>White</td>
</tr>
<tr>
<td>Entrance Angle</td>
<td>0°</td>
</tr>
<tr>
<td>Specific Intensity (mcd/lx)</td>
<td>93</td>
</tr>
</tbody>
</table>

NOTES:

1. Observation Angle. Shall mean the angle at the reflector between the observer's line of sight and the direction of light incident on the reflector.
2. Entrance Angle. Shall mean the angle in the horizontal plane between the direction of incident light and the normal to the leading edge of reflective marker.

3. Specific Intensity. Shall mean the luminous intensity (candelas) of returned light at the chosen observation and entrance angles for each lux of illumination at the reflector on a plane perpendicular to the incident light.

4. Photometric Test Procedure. The reflective marker to be tested shall be located with the center of the reflective lens at a distance of 1.5 m from a uniformly bright light source, having an effective diameter of 5.1 mm. The return of light shall be measured using an annular ring photocell (9.4 mm I.D. x 11.9 mm O.D.). The photocell shall be shielded to eliminate stray light. The distance from the light source center to the photocell center shall be 5.3 mm. If a test distance of other than 1.5 m is used, the source and receiver shall be modified in the same proportion as the test distance.

D. Removability. Preformed marking tapes and raised type markers shall be removable from bituminous and portland cement concrete pavements, intact or in substantially large pieces, either manually or by the use of a mechanical roll-up device, and without the use of heat, solvents, grinding or blasting. After removal, no permanent marks, scars or damage to the pavement surface shall result.

BASIS OF ACCEPTANCE. Removable marking materials shall be approved by the Materials Bureau. Detailed requirements and procedures for approval are available from the Materials Bureau.

Approval of removable markings will be based on engineering analysis for conformance with this specification and controlled field testing prior to their use on a Department project. If the proposed marking meets the specification requirements and performs satisfactorily in the controlled field tests, the product will be placed on the Department's "Approved List" of materials.

In no case shall the appearance of a marking material on the Department's approved list release the Contractor from compliance with the requirements under "Construction Details" of this specification. Neither shall its approval be considered a warranty by the State of satisfactory performance.

Project acceptance will be based on the appearance of the marking material on the Department's "Approved List" of removable reflectorized pavement markings.

727-03 WHITE AND YELLOW EPOXY REFLECTORIZED PAVEMENT MARKINGS

SCOPE. This specification covers white and yellow epoxy reflectorized pavement striping material that is sprayed onto the pavement. Following a surface application of glass beads and upon drying, the resultant marking is a reflectorized stripe of specified thickness and width, that is capable of resisting deformation by traffic.

GENERAL. Methods and requirements for applying epoxy markings shall be as specified in Section 685, Epoxy Reflectorized Pavement Markings.

MATERIAL REQUIREMENTS

Epoxy Material Composition. The epoxy resin composition shall be specifically formulated for use as a pavement marking material and for hot-spray application at elevated temperatures. The type and amounts of epoxy resins and curing agents shall be at the option of the manufacturer, providing the other composition and physical requirements of this specification are met.

The epoxy marking material shall be two-component (Part A and Part B), 100% solids type system formulated and designed to provide a simple volumetric mixing ratio (e.g. two volumes of Part A to one volume of Part B).

The epoxy marking material shall be supplied as either a regular-dry or a slow-dry material. Regular-dry may be used for all marking patterns. Slow-dry material is intended for marking hatchlines, edgelines, and other marking patterns located out of the general path of traffic.

A. Part A. Part A of either white or yellow shall conform to the following requirements:

<table>
<thead>
<tr>
<th>MARKING COLOR</th>
<th>MATERIAL (ASTM REF., TYPE)</th>
<th>PERCENT WEIGHT OF PART A</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pigment</td>
<td>Epoxy Resin</td>
</tr>
<tr>
<td>White</td>
<td>Titanium Dioxide (D476, II)</td>
<td>18 Minimum 75 to 82</td>
</tr>
<tr>
<td>Yellow</td>
<td>Medium Chrome Yellow (D211, Type III)</td>
<td>23 Minimum 70 to 77</td>
</tr>
</tbody>
</table>
ASTM D2371 shall be used to determine the pigment content of Part A, except toluene shall be substituted for benzene in the extraction mixture. No extender pigments are permitted. The white pigment, upon analysis, shall contain a minimum of 16.5% TiO₂ (100% purity). The yellow pigment, upon analysis, shall contain a minimum of 20% PbCrO₄ (100% purity).

The epoxy content of the epoxy resin in Part A will be tested in accordance with ASTM D1652 and calculated as the weight per epoxy equivalent (WPE) for both white and yellow. The epoxy content will be determined on a pigment-free basis. The epoxy content (WPE) shall meet a target value provided by the manufacturer and approved by the Director, Materials Bureau. A ±50 tolerance will be applied to the target value to establish the acceptance range.

B. Part B. The amine value of Part B shall be tested in accordance with ASTM D2074 to determine its total amine value. The manufacturer may specify an alternate test method for determining the amine value subject to the approval of the Director, Materials Bureau. The total amine shall meet a target value provided by the manufacturer and approved by the Director, Materials Bureau. A ±50 tolerance will be applied to the target value to establish the acceptance range.

Physical Properties of Mixed Components (Part A and Part B). Unless otherwise noted, all samples are to be prepared tested at an ambient temperature of 23 ± 2°C.

A. Color. The white epoxy composition shall be an approximate visual color match to Munsell Book Notation N 9.5/0 (ASTM D1535) when viewed under North Standard Daylight.

The yellow epoxy composition shall be within the following chromaticity coordinate limits.

<table>
<thead>
<tr>
<th>TABLE 727-03-1 CHROMATICITY COORDINATES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coordinate</td>
</tr>
<tr>
<td>x</td>
</tr>
<tr>
<td>y</td>
</tr>
</tbody>
</table>

Chromaticity coordinate testing shall be performed in accordance with ASTM E1347 using a color spectrophotometer with a 45° circumferential illumination/0° viewing geometry, illuminant C, and 2° standard observer angle. The color instrument shall measure the visible spectrum from 380 to 720 nm with a wavelength interval and spectral bandpass of 10 nm. The sample port aperture shall be 32 mm.

Yellow epoxy samples that are within the chromaticity coordinate limits but which visually are determined to significantly deviate from the color of normal quality assurance samples shall be compared to a visual color standard. Yellow epoxy samples shall be an approximate visual color match to Munsell Book Notation 10YR 8/14 (ASTM D1535) when viewed under North Standard Daylight.

Test specimens shall be prepared by applying the epoxy at a 0.38 mm ± 0.02 mm wet film thickness (without glass spheres) to a test panel consisting of a smooth rigid material, a smooth paper chart, smooth cardboard, or other suitable material and allowing the specimens to dry for a minimum 24 hours prior to testing.

B. Directional Reflectance. The directional reflectance (represented by CIE tristimulus value Y) of the white and the yellow epoxy composition shall be a minimum 84% and 54%, respectively, relative to a white standard.

Testing shall be performed in accordance with ASTM E1347 using a color spectrophotometer with a 45° circumferential illumination/0° viewing geometry, illuminant C, and 2° standard observer angle. The color instrument shall measure the visible spectrum from 380 to 720 nm with a wavelength interval and spectral bandpass of 10 nm. The sample port aperture shall be 32 mm.

The test specimens shall be prepared by applying the epoxy composition (without glass spheres) to black and white contrast panels (Leneta Form 5C or equivalent) to produce a wet film thickness of 0.38 mm ± 0.02 mm. The test specimens shall be allowed to dry for a minimum of 24 hours prior to testing.
**C. Drying Time (Laboratory).** When tested in accordance with ASTM D711 as modified below, regular-dry epoxy marking material shall reach a no-pick-up time in 30 minutes or less. Under these same test conditions, slow-dry epoxy marking material shall reach a no-pick-up time in 60 minutes or less. A Bird Applicator or other suitable instrument shall be used to spread a nominal 0.38 ± 0.02 mm thick wet film. Reflective glass spheres shall be immediately dropped onto the epoxy film at a rate of 3 kg/L.

**D. Drying Time (Field).** When installed at 25°C at the specified wet film thickness and reflectorized with glass spheres, regular-dry and slow-dry epoxy markings shall reach a no-track condition in approximately 30 minutes, and 60 minutes, respectively. Dry to “no-tracking” shall be considered as the condition where no visual deposition of the epoxy marking to the pavement surface is observed when viewed from a distance of 15 m, after a passenger car is passed over the line.

**E. Hardness.** The epoxy composition when tested in accordance with ASTM D2240 shall have a Shore D hardness of between 75 and 100. Samples shall be allowed to cure for not less than 72 hours nor more than 96 hours prior to testing.

**F. Infrared Spectrophotometer Analysis (ASTM D2621).** Samples of Part A and Part B shall be analyzed by infrared spectrography. The spectrum of each component shall be a reasonable match to the spectrum of the original formulation accepted by the Materials Bureau for the Department of Transportation Approved List of Materials.

**Reflective Glass Spheres.** Reflective glass spheres for drop-on application shall conform to the following requirements:

- The glass spheres shall be colorless, clean, transparent, free from milkiness or excessive air bubbles, and essentially clean from surface scarring or scratching. They shall be spherical in shape and at least 70% of the glass beads shall be true spheres when tested in accordance with ASTM D1155, Procedure A.
- The refractive index of the spheres shall be a minimum of 1.50 as determined by the liquid immersion method at 25°C.
- The silica content of the glass spheres shall not be less than 60%.
- The glass spheres shall have the following gradation when tested in accordance with ASTM D1214.

| TABLE 727-03-2 GLASS SPHERE GRADATION |
|-----------------------------|---|---|---|---|
| Sieve Size | 850 µm | 600 µm | 300 µm | 180 µm |
| Percent Passing | 100 | 80-95 | 9-42 | 0-10 |

The reflective glass spheres shall be treated with either a moisture-resistant coating or with a dual purpose type coating (moisture-resistant and adherence). The treated glass spheres shall flow freely from the dispensing equipment at any time when surface and atmospheric conditions are satisfactory for marking operations.

**PACKAGING, SHIPMENT AND MARKING**

**Epoxy.** Epoxy pavement marking materials shall be shipped to the job site in strong, substantial containers. Individual containers shall be plainly marked with the following information:

- Name of Product
- Item Number
- Lot Number
- Batch Number
- Test Number
- Date of Manufacture
- Date of Expiration of Acceptance (6 months from date of manufacture)
- The Statement (as appropriate): “Part A - Contains Pigment and Epoxy Resin,” or “Part B- Contains Catalyst"
Reflective Glass Spheres. Reflective glass spheres shall be shipped in moisture resistant bags or boxes. Each bag or box shall be marked with the name and address of the manufacturer, the brand name or product code of the glass sphere, the lot/batch number, the date of manufacture (mm/yy), and net weight of the material.

BASIS OF ACCEPTANCE. White and yellow, epoxy, reflectorized pavement markings will be accepted on the basis of the manufacturer’s name and location appearing on the Department’s Approved List and a material certification that specifies the product conforms to this specification.

All acceptances of uninstalled epoxy marking material shall expire six (6) months after the date of manufacture.

Reflective glass spheres may be accepted at the job site on the basis of the manufacturer's certification, or they may be submitted to the Materials Bureau for testing.

727-04 WHITE AND YELLOW PREFORMED REFLECTORIZED PAVEMENT MARKINGS

SCOPE. This specification covers the white and yellow preformed pavement stripes that are applied to the pavement, resulting in a marking that is capable of resisting deformation by traffic.

GENERAL. Methods and requirements for applying preformed markings are specified in Section 688, Preformed Reflectorized Pavement Markings. White and yellow preformed markings shall be composed of a mixture of plastics or polymeric materials, resins, pigments, and reflective glass and/or ceramic spheres that are uniformly distributed throughout the thickness of the material. In addition, a reflective layer of glass and/or ceramic spheres shall be bonded to, or embedded in the top surface.

The preformed markings shall be pre-coated, on its bottom side, with a pressure sensitive adhesive for adherence to bituminous or portland cement concrete surfaces.

The finished preformed marking material shall be of the specified dimension and shape, of good appearance, and free of cracks or other defects. The edges shall be clean cut and well defined. The material shall be weather resistant and through normal traffic wear shall show no appreciable fading, lifting or shrinkage.

When properly applied, the preformed markings shall be capable of molding itself to the contours, breaks and faults of bituminous or portland cement concrete surfaces; and shall show no significant tearing, roll-back, lifting or other signs of poor adhesion.

PHYSICAL PROPERTIES

Color. White preformed pavement markings, as placed, shall be white, free from dirt or tint. The color of the white marking shall be defined by the color chip in the possession of the Materials Bureau.

Yellow preformed pavement markings, as placed, shall be yellow, free from dirt or tint and shall be a reasonable visual match to Munsell Book Notation 10YR 8/14 (ASTM D1535).

Thickness. Preformed pavement marking material shall be a uniform film having a minimum thickness of 1.5 mm, or it shall be a patterned type material having a minimum thickness of 0.5 mm at the thinnest portions and a minimum thickness of 1.5 mm at the thickest portions of the patterned cross-section. The patterned top surface shall have approximately 50% of the surface area raised, and its design shall provide immediate and continuing retroreflection.

Reflective Glass and Ceramic Spheres. Glass and ceramic spheres for use in the preformed marking composition and for surface application shall have a refractive index of not less than 1.50, as determined by the liquid immersion method at 25°C.
Friction Resistance. The surface of the preformed marking material, with reflective glass and/or ceramic beads, shall provide a minimum friction resistance value of 45 BPN when tested in accordance with ASTM E303.

Tensile Strength. Preformed pavement marking material shall have a minimum tensile strength of 275 kPa when tested in accordance with ASTM D638M. Test specimens shall be Type MII prepared by die cutting with Die C as specified in ASTM D412, Test Method A. The testing machine shall operate at a speed of 5 mm per minute, and tests shall be conducted at an ambient temperature of 23 ± 2°C. For calculating the tensile strength of patterned type material, the thickness measurements shall be taken in the thinnest portions of the cross-sectional area.

Elongation. Preformed pavement marking material shall have a minimum elongation of 15% when tested in accordance with ASTM D638M, and under the conditions as specified for “e. Tensile Strength.” The chain extensometer shall be a Tinius Olsen Model R-2-1.

Plastic Pull Test. A 25 mm x 150 mm test specimen shall support a dead weight of 1.8 kg for not less than 5 minutes. Tests shall be conducted at an ambient temperature of 23 ± 2°C.

Primer. Primer or adhesive activators shall be of the type recommended by the manufacturer of the preformed marking material. All primers and adhesives shall conform to Federal, State, and Local regulations for the emission of volatile organic compounds (VOC).

PACKAGING AND SHIPMENT. Preformed reflectorized pavement marking and primer materials shall be shipped and packaged in accordance with commercially accepted standards. The following information shall be plainly marked on each container or on the shipping invoice: the name of the product, the name and address of the manufacturer, the quantity of material, the date of manufacture, and the date of expiration or the shelf life.

BASIS OF ACCEPTANCE. White and yellow preformed reflectorized pavement markings and primer materials shall be approved by the Materials Bureau. Detailed requirements and procedures for approval are available from the Materials Bureau. Approval of preformed markings will be based on laboratory analysis and field testing prior to their use on a Department project. If the proposed marking passes the requirements for laboratory analysis and initial field tests and it is considered acceptable by the Director, Materials Bureau, the product will be placed on the Department's “Approved List” of materials. Project acceptance will be based on the appearance of the marking and primer material on the Department's approved list of preformed reflectorized pavement markings.

727-05 GLASS BEADS FOR REFFLECTORIZED PAVEMENT MARKING PAINTS

SCOPE. This specification covers reflectorizing glass beads for application to traffic zone paints for the production of a reflective surface.

GENERAL. Methods and requirements for the application of glass beads shall be as specified in 640, Reflectorized Pavement Marking Paints, of these specifications.

MATERIAL REQUIREMENTS. The beads shall be glass of a composition designed to be highly resistant to traffic wear and to the effects of weathering. The beads shall be colorless, clean, transparent, free from milkiness or excessive air bubbles, and essentially free from surface scarring or scratching. They shall be spherical in shape and at least 70% of the glass beads shall be true spheres.

The silica content of the glass beads shall not be less than 60%.

The beads shall have a refractive index between 1.50 and 1.65 when tested by the liquid immersion method at 25°C.

The spheres shall meet the following gradation:
The beads shall show no tendency to absorb moisture in storage and shall remain free of clusters and hard lumps. They shall flow freely, and to the satisfaction of the Engineer, from the dispensing equipment at any time when surface and atmospheric conditions are satisfactory for painting.

The glass beads shall be packed in waterproof plastic lined burlap or plastic lined paper bags. Each bag shall be marked with the name and address of the manufacturer and the name and net weight of the material.

**TESTING.** The properties indicated above shall be determined in accordance with the following methods of test:

**A. Sphericity.** Irregularly shaped particles (out-of-round) shall be tested in accordance with ASTM D1155.

**B. Gradation.** Tested in accordance with ASTM D1214.

**C. Moisture Resistance.** The spheres shall pass the following moisture resistance test:
Place one kilogram of spheres in a washed cotton bag, having a thread count of approximately 8 per square centimeter (warp and woof) and immerse the bag in a container of water for 30 seconds. Remove the bag and force excess water from the sample by squeezing the bag. Suspend and allow to drain for two hours at room temperature ($23 \pm 2^\circ C$). Then, mix the sample in the bag by shaking thoroughly. Transfer sample slowly to a clean, dry glass funnel having a stem 100 mm in length, with a 9.5 mm inside diameter stem entrance opening and a minimum exit opening of 6.4 mm. The entire sample shall flow freely through the funnel without stoppage. When first introduced into the funnel, if the spheres clog, it is permissible to lightly tap the funnel to initiate the flow.

**BASIS OF ACCEPTANCE.** Application for approval of Glass Beads for use in Reflectorized Pavement Marking Paints shall be submitted to the Materials Bureau by the manufacturer, accompanied by one 27 kg bag sample of the product.

Upon approval by the Materials Bureau, the name of the product will be placed on an “approved list” of Glass Beads for Use in Reflectorized Pavement Marking Paints. This product may then be accepted on the basis of the brand name labeled on the container.

**SECTION 728 - COMPRESSIVE LOAD TRANSMITTING DEVICES**

**728-01 RUBBER IMPREGNATED WOVEN COTTON-POLYESTER FABRIC**

**SCOPE.** This specification covers the material requirements, tests and basis of acceptance for rubber impregnated, woven, cotton-polyester fabric.

**MATERIAL REQUIREMENTS.** Rubber impregnated woven cotton-polyester fabric shall be composed of multiple layers of prestressed cotton-polyester duck with a minimum mass of 0.25 kg/m$^2$, impregnated and bound with high quality rubber compound, containing rot and mildew inhibitors and anti-oxidants. The duck warp count shall be $50 \pm 1$ threads per 25 mm and the filling count shall be $40 \pm 2$ threads per 25 mm. Each thread shall contain 2 yarns. The material shall contain 64 plies per 25 mm. The number of piles in the furnished material shall be such as to produce the specified thickness.

**TEST.** This material shall exhibit a maximum load deflection of 10% at 6.9 MPa when tested in accordance with MIL-C-882.
BASIS OF ACCEPTANCE. This material will be accepted on the basis of the manufacturer's certification of compliance with these specification requirements.

728-02 RUBBER IMPREGNATED RANDOM FIBER PAD

SCOPE. This specification covers the material requirements, tests and basis of acceptance for rubber impregnated random fiber pads.

MATERIAL REQUIREMENTS. Rubber impregnated random fiber pad shall be composed of a high quality elastomer with a random distribution of non-asbestos fibers.

BASIS OF ACCEPTANCE. Rubber impregnated random fiber pad shall be accepted on the basis of the manufacturer's certification of compliance with these specification requirements.

728-03 PLAIN RUBBER PAD

SCOPE. This specification covers the material requirements, tests and basis of acceptance for plain rubber pads.

MATERIAL REQUIREMENTS. Plain rubber vertical load transmitting devices shall contain only polychloroprene as the raw elastomer polymer. The physical properties of the cured material shall comply with ASTM D2000 Line Call Out M2BC514A14B34. The rubber pads shall be cast in a mold under pressure and heat, or may be furnished to Department projects if they have been carefully cut from a larger piece of fully molded material. Shape factors of each device, i.e., net load area divided by the area free to bulge, must exceed twelve (12).

TEST. One plain rubber pad sample per size shall be submitted by the Engineer to the Materials Bureau for destructive test.

BASIS OF ACCEPTANCE. The presence of the appropriate form, validated by the Materials Bureau, shall constitute evidence of acceptability at the job site for plain rubber pads.

728-04 SHEET LEAD

SCOPE. This specification covers the material requirements and basis of acceptance for sheet lead.

MATERIAL REQUIREMENTS. Sheet lead shall be lead plate of nominal 3 mm thickness, meeting the standard specification for Pig Lead, ASTM B29.

BASIS OF ACCEPTANCE. This material shall be accepted on the basis of a manufacturer's certification of compliance with this specification.

728-05 (VACANT)

728-06 SHEET GASKET (TREATED BOTH SIDES)

SCOPE. This specification covers the material requirements for sheet gasket, treated both sides with a parting agent to prevent adhesion to working surfaces. This material is used as a bond breaker and sliding surface in bridge construction.

MATERIAL REQUIREMENTS. The sheet gasket shall have a nominal 1.6 mm thickness and shall be treated on both sides with a parting agent. The material shall meet the following requirements:
TABLE 728-06-1  SHEET GASKET REQUIREMENTS

<table>
<thead>
<tr>
<th>Property</th>
<th>ASTM Test Method</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water absorption, maximum</td>
<td>C642</td>
<td>6.7%</td>
</tr>
<tr>
<td>Coefficient of static friction, maximum</td>
<td>D1894</td>
<td>0.36</td>
</tr>
<tr>
<td>Coefficient of kinetic friction, maximum</td>
<td>D1894</td>
<td>0.24</td>
</tr>
<tr>
<td>Tensile strength, MPa min., in the weakest direction</td>
<td>F152, Type 2</td>
<td>8.3</td>
</tr>
</tbody>
</table>

**BASIS OF ACCEPTANCE.** Application for approval of sheet gasket (treated both sides) shall be submitted to the Director, Materials Bureau. Upon approval, the name and manufacturer of the product shall be placed on the Department's Approved List.

**SECTION 729 (VACANT)**

**SECTION 730 - SIGNS AND DELINEATORS**

**730-01 ALUMINUM SIGN PANELS**

**SCOPE.** These specifications cover aluminum sign panels used as the prepared surface backing in the application of reflective sheeting for location markers, delineators and traffic signs.

**MATERIAL REQUIREMENTS.** The panel material shall be either Aluminum Alloy 6061-T6, 5154-H38, 5052-H38 or 3004-H38 and shall conform to the requirements of material specification §715-04, Wrought Aluminum.

**FABRICATION**

**Preparation of Panel Surface for Reflective Sheetng.** The surface preparation of panels for the application of Reflective Sheetng, §730-05, shall be performed by Method I or Method II, in strict accordance with the recommendations of the manufacturer of the reflective sheeting.

**A. Method I**

1. **Cleaning (Vapor or Alkaline cleaning)**

   a. **Vapor Cleaning.** By total immersion of the sheeting or sign panel in a saturated vapor of trichlorethylene or perchlorethylene. Trademark printing shall be removed with lacquer thinner. Follow with a thorough rinse.

   b. **Alkaline Cleaning.** Sheetng shall be immersed in a tank containing alkaline solutions, controlled and titrated to the solution manufacturer's specifications. Immersion time shall depend upon the amount of soil present and the gage of the metal. Follow with a thorough rinse.

   **NOTE:** After cleaning and rinsing and prior to etching, the aluminum sheeting shall be checked with a "Water Break Test" as follows: If the metal is clean, water will completely cover the surface with no breaks. Whenever water breaks, oil is present and the plate shall be re-cleaned until all traces of oil disappear. The surface near the edges shall be examined with extreme care for presence of oil.

2. **Etching (Use Acid or Alkaline Etch)**

   a. **Acid Etch.** Etch in a 6% to 8% phosphoric acid solution at 38°C. Rinse thoroughly with running cold water followed by hot water tank rinse.

   b. **Alkaline Etch.** Etch the pre-cleaned aluminum surface in alkaline etching material that is controlled by titration, use time, temperature and concentration specified by the solution manufacturer. Rinse thoroughly, remove smut with an acidic chromium compound type solution as specified by the solution manufacturer and then thoroughly rinse.
B. Method II
Cleaning and Etching. Use a chemical conversion treatment in accordance with the requirements of Military Specification MIL-C-5541A, Chemical Films and Chemical Film Materials for Aluminum and Aluminum Alloys, or later addenda. Following the etching and rinsing, panels shall be dried by a forced hot air dryer or by immersion for one minute, in circulating hot water at 82°C and allowed to air dry.

Application of Reflective Sheeting. The metal shall not be handled between all cleaning operations and applications of the reflective sheeting except by device or clean canvas gloves.

Immediately prior to the application of the reflective sheeting, the aluminum panel shall be prepared as specified in Method I or Method II. The reflective sheeting shall be adhered to the aluminum panel by the vacuum applicator process or mechanical process in strict accordance with the recommendations of the manufacturer of the reflective sheeting.

BASIS OF ACCEPTANCE. Aluminum panels may be accepted on the basis of the manufacturer's certification that his/her product conforms to all of the above specifications. However, the Department reserves the right to conduct tests, upon aluminum panels supplied. When tests are to be made, all test samples without reflective sheeting applied shall be submitted to the Materials Bureau. The number of samples shall comprise approximately one percent of the number of panels. Each sample shall contain a minimum area of 0.1 m² for each thickness of panel used. Failure of the samples to meet all the requirements of the above specifications shall be cause for rejection of the aluminum panels represented by such samples.

730-02 PLYWOOD SIGN PANELS

SCOPE. These specifications cover plywood sign panels used in the construction of temporary and permanent guide signs.

GENERAL. Plywood sign panels for signs shall conform to the requirements for high density overlay as set forth in Product Standard PS 1-66-Soft Plywood, Construction and Industrial, for Douglas Fir Plywood and all amendments thereto as established through the United States Department of Commerce. The plywood panels shall be high density overlay, exterior type plywood, 5 ply and B-B grade or better. Inner plies shall be B grade veneers or better.

MATERIAL REQUIREMENTS. The thickness of the plywood sign panels and plywood battens shall be 19 mm. The edges of all plywood used in sign panels or battens shall be painted with two coats of approved black paint. The overlay faces, on both sides, shall be black in color, hard, smooth, and of such quality that further finishing by paint or varnish is not required. Panels shall consist of a cellulose-fibre or sheets, in which not less than 40 percent by weight of the laminate shall be a thermo-setting resin of the phenol or melamine type. The resin-impregnated material shall not be less than 0.2286 mm thick and shall weigh at least 29 kg/100 m² of single face, including both resin and fibre. The resin impregnation shall be sufficient to attach the surfacing material to the plywood. The bond shall be equal in performance to the glue lines between the sheets of veneer which make up the plywood.

Panel Preparation for Reflective Sheeting. In preparing the sign panel for material specification §730-05, Reflective Sheeting, the entire portion of the overlay surface to be covered, shall first be given a light, firm abrasion with steel wool (medium to fine grade) saturated with xylol, V.M.&P. Naphtha or similar commercial solvent. The surface shall then be wiped clean and dry. An alternate method of panel pre-treatment, which consists of a solvent wipe, immediately followed by vapor degreasing (trichloroethylene) for a minimum period of six (6) minutes may be used. After panel preparation, the edges of all panels and battens shall be painted with two coats of approved black paint. Panel and batten surfaces to be glued shall be slightly roughened with waterproof adhesive prior to assembly.

Each plywood shall be grade-marked and certified with the standards adopted by the Douglas Fir Plywood Association.
§730

BASIS OF ACCEPTANCE. Plywood sign panels may be accepted upon the manufacturer's certification that its product conforms to all of the above detailed specifications. However, the Department reserves the right to conduct tests on the plywood panels submitted. When tests are to be made, all test samples without reflective sheeting applied shall be submitted to the Materials Bureau. The number of test samples shall comprise one percent of the contract quantity and each sample shall have a minimum surface area of 0.1 m². Failure of the samples to meet all the requirements of the above specifications shall be cause for rejection of the plywood sign panels represented by such samples.

730-03 AND 730-04 (VACANT)

730-05 REFLECTIVE SHEETING

SCOPE. These specifications cover reflective sheeting for use in the fabrication of highway and construction signs, delineators and other traffic control devices.

GENERAL. The reflective sheeting supplied shall be colored, flexible, weather resistant, and shall have a smooth outer surface. If the reflective sheeting contains spherical lens elements, the lens elements shall be embedded within a transparent plastic, so as to produce a smooth, flat outer surface. All sheeting shall be of good appearance, free from ragged edges, cracks, scales, blisters, or other defects.

The back of the reflective sheeting shall be protected by a removable liner and shall include a precoated pressure-sensitive or a heat-activated adhesive, either of which may be applied without the necessity of additional adhesive tack coats on the reflective sheeting or application surface.

Reflective sheeting shall be one of the following ASTM D4956 types:

730-05.01 - ASTM Type I (Class A). A medium-intensity reflective sheeting often referred to as engineer grade. It is recommended for highway signs, except where high reflectivity is required, and for construction barricades, panels, and other work zone devices.

730-05.02 - ASTM Type III (Class B). A high-intensity reflective sheeting often referred to as high intensity. It is recommended for highway signs, construction signs, delineators, and other work zone devices.

730-05.03 - ASTM Type V (Class C). A super-high-intensity reflective sheeting recommended for delineators, construction barricades, and vertical panels. This material is not recommended for highway or construction zone sign faces.

730-05.04 - Fluorescent Orange (Class D). A fluorescent orange-colored sheeting with reflective properties similar to Class B high intensity. This sheeting is only recommended for use on orange-colored construction signs, and for the orange portions of construction barricades, vertical panels, and other work zone devices with rigid substrates, when a high level of conspicuity or visibility is needed.

730-05.05 - ASTM Type IX (Class E). A very-high-intensity retroreflective sheeting having highest retroreflective characteristics at short road distances. Recommended for permanent signs, delineators, construction zone devices, and vertical panels, when a high level of conspicuity or visibility is needed.

### TABLE 730-05-1 FLUORESCENT SHEETING REQUIREMENTS

<table>
<thead>
<tr>
<th>Fluorescent Color</th>
<th>Luminance Factor (Y %)</th>
<th>Maximum Spectral Radiance Factor (%)</th>
<th>Color Specification Limits ¹</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yt</td>
<td>Yf</td>
<td>x</td>
</tr>
<tr>
<td>Orange</td>
<td>25</td>
<td>15</td>
<td>110.0</td>
</tr>
<tr>
<td>Yellow</td>
<td>45</td>
<td>20</td>
<td>------</td>
</tr>
<tr>
<td>Yellow Green</td>
<td>60</td>
<td>20</td>
<td>------</td>
</tr>
</tbody>
</table>

NOTE:

1. Four pairs of chromaticity coordinates determine acceptable color in terms of the CIE, 1931 Standard Colorimetric System measured with Standard Illuminant D₆₅.
MATERIAL REQUIREMENTS. Reflective sheeting shall meet the requirements of ASTM D4956 and the following:

1. Fluorescent Colors. Shall conform to the requirements of Table 730-05-1.

2. Fluorescent Orange Class D - 730-05.04. Class D fluorescent orange reflective sheeting:

   A. Coefficient of Retroreflection ($R_A$). The coefficient of retroreflection shall meet or exceed the reflectivity requirements indicated in Table 730-05-2.

<table>
<thead>
<tr>
<th>Observation Angle (°)</th>
<th>Entrance Angle (°)</th>
<th>Minimum $R_A$ (cd/lx/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2</td>
<td>- 4</td>
<td>100.0</td>
</tr>
<tr>
<td>0.2</td>
<td>+ 30</td>
<td>34.0</td>
</tr>
<tr>
<td>0.5</td>
<td>- 4</td>
<td>64.0</td>
</tr>
<tr>
<td>0.5</td>
<td>+ 30</td>
<td>22.0</td>
</tr>
</tbody>
</table>

   B. Daytime Color. The color shall conform to the requirements for luminance factor, maximum spectral radiance factor (peak reflectance), and color specification limits indicated in Table 730-05-1. Color measurements shall be determined in accordance with ASTM E991, using instrumentation which has circumferential viewing (illumination). Calculations shall be performed in accordance with ASTM E308 for the CIE 1931 $2^\circ$ standard observer.

   C. Artificial Weathering. After 1500 hours of artificial weathering performed in accordance with ASTM G 26, Method A, using a Type B weatherometer, the following requirements shall be met:
   - The minimum coefficient of retroreflection shall be 55.0 cd/lx/m² at 0.2 degree observation angle; - 4 degree entrance angle.
   - The luminance factor (Y Percent) shall be from 20.0 to 45.0.
   - The maximum spectral radiance factor (peak reflectance) shall not be less than 60.0 percent.
   - The color specification limits shall conform to the requirements shown above in Class D, B. Daytime Color.

3. Type IX (Class E) - 730-05.05. All colors shall conform to the requirements of ASTM D4956, except fluorescent colors. Fluorescent colors shall conform to the requirements of Table 730-05-1 and Table 730-05-3 of this specification.

<table>
<thead>
<tr>
<th>Observation Angle (°)</th>
<th>Entrance Angle (°)</th>
<th>Fluorescent Orange</th>
<th>Fluorescent Yellow</th>
<th>Fluorescent Yellow-Green</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- 4°</td>
<td>200</td>
<td>400</td>
<td>380</td>
</tr>
<tr>
<td></td>
<td>+ 30°</td>
<td>110</td>
<td>250</td>
<td>300</td>
</tr>
<tr>
<td>0.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.2</td>
<td></td>
<td>115</td>
<td>150</td>
<td></td>
</tr>
<tr>
<td>0.5</td>
<td></td>
<td>72</td>
<td>165</td>
<td></td>
</tr>
<tr>
<td>1.0</td>
<td></td>
<td>24</td>
<td>45</td>
<td></td>
</tr>
</tbody>
</table>

FABRICATION. The reflective sheeting shall be so fabricated as to allow easy cutting to specified sizes and shapes.

The sheeting surface shall be solvent resistant and shall permit solvent cleaning. All solvents used for cleaning operations shall be as recommended by the sheeting manufacturer and shall comply with all Federal, State, and Local air quality regulations.
To ensure uniform appearance and brilliance under both nighttime and daytime conditions, the reflective sheeting shall be cut, matched and positioned on the prepared sign panel or other substrate in strict accordance with the recommendations of the sheeting manufacturer. Backgrounds, characters, delineators, etc., shall be coated and/or edge sealed in accordance with the recommendations of the sheeting manufacturer. When performed, coating operations shall be done in a workmanlike manner so as to create an even, clear, uniform coat which shall be free of streaks, drops or other defects which might affect reflectivity.

Reflective sheeting shall be furnished in both rolls and sheets. Rolls shall be packed individually and contain not more than four splices per 46 m linear measurement. Cut sheets shall be packaged flat and in such a manner as to minimize any damage or defacement that may occur to the sheeting during shipment or storage. The sheeting surface shall be capable of being readily processed and be compatible with recommended transparent and opaque process inks. The finished sheeting surface shall show no loss of the color with normal handling, cutting and application.

TESTING. Outdoor test specimen panels shall include both unprocessed reflective sheeting and reflective sheeting processed with the manufacturer’s recommended transparent and opaque inks. Type I (Class A), Type III (Class B), and Type IX (Class E), except Type IX fluorescent orange, reflective sheetings shall be exposed outdoors on a test deck for a minimum 3-year continuous time period. Class D and Type IX (Class E) fluorescent orange sheeting shall be exposed outdoors on a test deck for a minimum 1 year continuous time period. Outdoor exposure testing will not be required for Type V (Class C) reflective sheeting.

Outdoor testing shall consist of exposing reflective sheeting test specimen panels, facing south, and inclined at an angle of 45° from a horizontal position. The test deck facility shall be located in a climate similar to that in which the material is intended to be used, or at a site approved by the Materials Bureau. Testing shall be performed by an independent testing agency or in conjunction with the National Transportation Product Evaluation Program (NTPEP).

Following the specified outdoor exposure time period, all weathered test panels of reflective sheeting shall meet the following performance requirements. The sheeting on the test panels shall show no appreciable adhesion loss, cracking, blistering, crazing, dimensional change, or color change. The minimum percent retained coefficient of retroreflection ($R_A$) shall be as specified below when compared to a control unexposed specimen counterpart. The control specimen reflectivity values ($R_A$) shall be measured at the start of outdoor exposure testing. Measurements shall be taken at 0.2 degree observation angle; - 4 degree entrance angle.

<table>
<thead>
<tr>
<th>TABLE 730-05-4 MINIMUM PERCENT RETAINED COEFFICIENT OF RETROREFLECTION ($R_A$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type I (Class A) Materials Designation 730-05.01</td>
</tr>
<tr>
<td>Type III (Class B) Materials Designation 730-05.02</td>
</tr>
<tr>
<td>Class D (Materials Designation 730-05.04)</td>
</tr>
<tr>
<td>Type IX (Class E) Materials Designation 730-05.05</td>
</tr>
</tbody>
</table>

BASIS OF ACCEPTANCE. Approvals will be based upon independent laboratory analysis and outdoor exposure testing conducted in accordance with this specification. If the reflective sheeting passes the requirements for laboratory and outdoor exposure testing, the product will then be placed on the Department’s “Approved List” of materials. Detailed requirements and procedures for approval are available from the Materials Bureau.

Contract acceptance of Type I (Class A), Type III (Class B), Type IX (Class E), and Class D reflective sheetings will be based on the inclusion of the sheeting material on the Department’s “Approved List” of reflective sheeting materials and the manufacturer’s certification of compliance with this specification.

Contract acceptance of Type V (Class C) reflective sheeting will be based on the manufacturer’s certification of compliance with this specification.

730-06 THRU 730-08 (VACANT)

730-09 TUBULAR MARKERS

SCOPE. This specification covers the material, fabrication, and performance requirements for tubular markers.
MATERIAL REQUIREMENTS. Tubular markers shall be orange in color with a minimum height of 915 mm and a minimum outside diameter of 64 mm. Tubular markers shall be tubular in cross section maintaining either a round or elliptical shape over the entire length. The base and/or any non-flexible portion of the marker shall not extend more than 50 mm above the pavement surface.

The markers shall have two horizontal circumferential stripes of white reflective sheeting a minimum of 75 mm wide. The top edge of the upper band shall be a maximum of 50 mm from the top edge of the marker. The space between shall not exceed 150 mm. Reflective sheeting shall conform to §730-05 Reflective Sheeting, Class B (Materials Designation 730-05.02) or Class C (Materials Designation 730-05.03).

The sheeting shall be bonded to the post with a precoated pressure sensitive adhesive or a tack free heat activated adhesive. Mechanical fasteners to bond reflective sheeting to the post will not be allowed.

The bonding system used to fasten the marker to the pavement shall be any fast setting chemical compound, mastic-type material, or mechanical fastener capable of fixing the tubular marker to either concrete or asphalt pavement. The bonding system shall not present a hazard to traffic if the tubular marker or base unit becomes unfixed from the pavement.

TESTING. Tubular markers shall meet the requirements in the procedural directives of the Materials Bureau.

BASIS OF ACCEPTANCE. Application for approval of tubular markers shall be submitted to the Materials Bureau. The procedural directives outlining detailed requirements and procedures for approval are available from the Materials Bureau. Upon approval the name of the tubular marker will be placed on an Approved List.

Project acceptance will be based on the manufacturer's name and type of tubular marker appearing on the Department's Approved List titled ‘Tubular Markers.’

730-10 ACRYLIC PLASTIC REFLEX REFLECTORS

SCOPE. This specification covers acrylic plastic prismatic reflectors for delineators.

MATERIAL REQUIREMENTS

Delineator Reflector Lens. Delineator reflectors shall consist of a clear and transparent acrylic plastic face, herein referred to as the lens, with a heat plastic or plastic coated foil back fused to the lens under heat and pressure around the entire perimeter of the lens, and the central mounting hole, to form a unit permanently sealed against dust, water, and water vapor. The lens shall consist of a smooth front surface, free from projections or indentation, other than a central mounting hole and identification, with a rear surface bearing a prismatic configuration such that it will effect total internal reflection of light. The manufacturer's trademark shall be molded legibly into the reflector.

Definitions and Optical Requirements

A. Entrance Angle. Shall mean the angle at the reflector between the direction of light incident on it and the direction of reflector axis.

B. Observation Angle. Shall mean the angle at the reflector between observers line of sight and direction of light incident on the reflector.

C. Specific Intensity. Shall mean luminous intensity (candels) returned at the chosen observation angle by a reflector for each lux of illumination at the reflector.

Optical Test Procedure. The reflex reflector to be tested shall be located at a distance of 30.5 m from a single uniformly bright light source having an effective diameter of 50 mm the light source shall be operated at approximately normal efficiency. The return light from the reflector shall be measured by means of a photo-electric photometer having a minimum sensitivity of $1 \times 10^9$ lux per scale division.
The photometer shall have a receiver aperture 13 mm diameter shielded to eliminate stray light. The distance from light source center to aperture center shall be 53.1 mm for 1/10 degree observation angle, and 175 mm for a degree observation angle.

If a test distance other than 30.5 m is used, the source and aperture dimensions and the distance between source and aperture shall be modified accordingly.

**Seal Test.** Submerge 50 samples in water bath at room temperature. Subject the submerged samples to a vacuum of 127 mm gage for five minutes. Restore atmospheric pressure and leave sample submerged for five minutes, then examine the samples for water intake. Evidence of moisture or water intake on more than two (2) samples shall be cause for rejection of the lot represented by the samples.

**Heat Resistance.** Three reflectors shall be tested for four hours in a circulating air oven at 79.5 ± 2°C. The test specimens shall be placed in a horizontal position on a grid or perforated shell permitting free air circulation. At the conclusion of the test the samples shall be removed from the oven and permitted to cool to room temperature. The samples after exposure to heat shall show no significant change in shape and general appearance when compared with unexposed control standards. No failures will be permitted.

### TABLE 730-10-1  OPTICAL REQUIREMENTS

<table>
<thead>
<tr>
<th>Observation Angle Degrees</th>
<th>Entrance Angle Degrees</th>
<th>Specific Intensity Candela/lux</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Crystal</td>
</tr>
<tr>
<td>1/10</td>
<td>0</td>
<td>11.1</td>
</tr>
<tr>
<td>1/10</td>
<td>20</td>
<td>4.4</td>
</tr>
<tr>
<td>1/3</td>
<td>0</td>
<td>1.9</td>
</tr>
<tr>
<td>1/3</td>
<td>20</td>
<td>0.7</td>
</tr>
</tbody>
</table>

**NOTE:** Failure of reflectors to equal or exceed the minimum specific intensity value shall constitute failure of the reflector being tested; failure of more than 2 reflectors out of 50 begin subjected to test shall constitute failure to the lot represented by the samples. The specific intensity of delineator reflectors shall meet the above noted values, regardless of reflector orientation.

**BASIS OF ACCEPTANCE.** Acrylic plastic reflex reflectors will be accepted on the basis of the manufacturer's certification that their product conforms to all of the above detailed specifications. However, when the Department requires that tests be made, samples shall be submitted to the Materials Bureau. Fifty-three (53) samples will be selected at random from each shipment received from the reflector manufacturer. Each shipment may contain more than one lot. These samples shall be tested as specified above. Failure of the samples to meet all the requirements of the above specifications shall be cause for rejection of delineators represented by such samples.

### 730-11 REFLECTORIZED SHEETING SIGN CHARACTERS (TYPE III)

**SCOPE.** These specifications cover the material requirements for Type III reflectorized sheeting sign characters.

**MATERIAL REQUIREMENTS.** Type III characters shall consist of white reflective sheeting meeting the requirements of §730-05, Reflective Sheeting, Materials Designation 730-05.02 (Class B).

The reflective sheeting shall be applied to sheet aluminum with mechanical equipment in a manner specified by the sheeting manufacturer. The base material for demountable characters shall be made of sheet aluminum alloy 6061-T6 or 3003-M14 treated with applicable requirements of §730-01, Aluminum Sign Panels.

Characters up to and including 300 mm in height shall be fabricated from 1.0 mm thick sheet aluminum. Sheet aluminum 1.6 mm thick shall be used for characters over 300 mm in height.

Completed characters shall be dip-coated or edge sealed as specified by the sheeting manufacturer.

Character units shall be securely fastened to the sign background with aluminum or stainless steel screws, or pull-through blind rivets. Spacing of screws or rivets shall be determined by character size and shape but in no case shall be more than 200 mm on center.
BASIS OF ACCEPTANCE AND TESTS. Type III characters may be accepted on the basis of the manufacturer's certification that its product conforms to all of the above specifications. This certificate shall include the source or sources of all materials. However, when the Department requires that tests be made, samples for testing by the Materials Bureau shall be taken by a representative of the Department as follows:

Two (2) percent or a minimum of five (5) characters (whichever is the greater) for each size character used.

Two (2) percent or a minimum of 0.6 m of border (whichever is greater) for each width of border used.

These samples are to be tested as specified for §730-01 and 730-05. Failure of samples to meet all the requirements of the above specifications shall be cause for rejection.

730-12 REFLECTORIZED SHEETING AND SIGN CHARACTERS (TYPE IV)

SCOPE. These specifications cover the material requirements for Type IV, reflectorized sheeting sign characters.

MATERIAL REQUIREMENTS. Type IV characters shall consist of cutout reflective sheeting material meeting the requirements of §730-05, Reflective Sheeting, Materials Designation 730-05.02 (Class B).

Characters or borders shall be applied directly to clean, dust-free reflective sheeting background panels. Characters or borders shall be applied mechanically with equipment and in a manner specified by the sheeting manufacturer. Borders shall be cut neatly and butt-joined at corners and panel joints.

After the sign has been completed the entire sign face area shall be clear coated (sprayed or dipped) and/or edge sealed with a clear coating as specified by the sheeting manufacturer.

BASIS OF ACCEPTANCE. The requirements of §730-11 shall apply.

730-13 REFLECTORIZED SHEETING SIGN CHARACTERS (TYPE V)

SCOPE. These specifications cover the material requirements for Type V reflectorized sheeting sign characters.

MATERIAL REQUIREMENTS. Type V characters shall consist of a painted, screened, or reverse-screened application of paint, paste, or transparent color of a type and in a manner recommended by the manufacturer of the reflective material.

Reflective material used for reverse-screened signs shall meet the requirements of §730-05, Reflective Sheeting, Materials Designation 730-05.02 (Class B). Characters shall meet the optical requirements of 730-05.02. Panels shall be clear coated and/or edge sealed with a clear coating as specified by the sheeting manufacturer.

BASIS OF ACCEPTANCE. The requirements of §730-11 shall apply.

730-14 REFLECTORIZED SHEETING SIGN CHARACTERS (TYPE VI)

SCOPE. These specifications cover the material requirement for Type VI reflectorized sheeting sign characters.

MATERIAL REQUIREMENTS. Type VI characters shall consist of embossed aluminum frames meeting the requirements of Types I and II characters of §730-10. When reflective characters are specified, they shall meet the reflective requirements and finish of Type III characters. When non-reflective characters are specified, they shall be prepared in strict accordance with cleaning and etching requirements of §730-01, Aluminum Sign Panels. After preparation, frames shall be coated with one coat of gloss baked enamel per Federal Standard TT-E-489.

BASIS OF ACCEPTANCE. The requirements of §730-11 shall apply.
§730

730-15 THRU 730-19 (VACANT)

730-20 SIGN POSTS AND FOOTINGS

SCOPE. These specifications cover the material requirements for Sign Posts and Footings.

MATERIAL REQUIREMENTS. Steel posts for ground mounted signs shall meet the requirements of §715-01, Structural Steel, except that ASTM A1 or rerolled axle steel may be used for small angle posts and ASTM A36, A242, A441, A572, Grade 345 and A588 steel may be used for posts and slip-impact bases as shown on the plans or standard sheets. All steel posts after fabrication (punching, drilling, etc.) shall be galvanized in accordance with the applicable requirements of §719-01, Galvanized Coatings and Repair Methods.

Posts used with slip-impact base and hinge assemblies must be of weldable quality.

Welding shall be in accordance with the provisions of section on "Fabrication," in the New York State Steel Construction Manual.

Galvanized Material Repair. All damage to the galvanized surfaces due to handling, shipment, erection, etc., shall be repaired as described in §719-01

Aluminum Posts. Aluminum posts shall meet the requirements of §715-04, Wrought Aluminum, and shall be fabricated of alloys 6061-T6. Welding shall be in conformance with applicable provisions and general recommendations of the latest edition of the American Welding Society's "Standard Specifications for Welded Highway and Railway Bridges." All aluminum welding shall be performed in the shop using an inert gas arc welding process. Welders shall be qualified in accordance with the latest edition of the ASME Boiler and Pressure Vessel Codes, 6 IX, Welding Qualification, Part B.

Dirt, grease, lubricants or other foreign materials in areas to be welded shall be removed by cleaning with a solvent or by vapor degreasing. Preheating for welding is permissible up to a temperature of 200°C for a period not to exceed 30 minutes.

Any porosity, craters, cracks or undercutting shall be cause for rejection. Defective welds may be repaired by chipping or machining out defective material and rewelding.

Field welding will not be allowed.

The portions of the posts that will be in contact with the concrete shall be coated with a zinc coated primer, and the primer shall be thoroughly dry before the concrete is placed.

Embedded Footings. Embedded footings for signs with metal posts shall be constructed of Class A Concrete without reinforcement. If the sign footings are precast, the concrete shall meet the requirements of Class A Concrete in section 501, Portland Cement Concrete—General, except that the requirements for inspection facilities, automated batching controls and recordation do not apply. The batching, mixing and curing methods, and the inspection facilities shall meet the approval of the Department or its representative. The Contractor may submit, for approval by Director, Materials Bureau, a mix at least equivalent to the specified Class A Concrete, with a minimum cement content of 340 kg/m³.

Wood Posts. Wood posts shall comply with the requirements of §712-14 Stress Graded Timber and Lumber. Using the clean wood properties of ASTM D2555, the bending stress (Modulus of Rupture) shall not be less than 28 MPa. They shall be surfaced four sides and shall be of the dimension shown on the plans before surfacing. Surface dried redwood, red cedar, cypress or black locust may be used untreated. Other lumber including douglas fir, pine, oak, birch, maple and beech may be used but shall be pressure treated in accordance with §708-31, Wood Preservatives-Water Borne.

The requirements for inspections contained in §712-14 and §708-31 are waived and the material will be accepted upon certification of the manufacturer.

A Roadside Delineator, Type IV shall be included with each post.

Slip-Impact Base and Hinge Assemblies. Slip-impact base and hinge assemblies shall be fabricated as shown on the standards sheets. In general, these assemblies will only be used where signs
cannot be located behind existing guide rail and where it is impractical to provide guide rail solely for sign protection.

Post types 1-8 placed behind guide rail will not require slip-impact bases.

**BASIS OF ACCEPTANCE.** Acceptance shall be based on the manufacturer's certification that its product conforms to these specifications.

### 730-21 FLEXIBLE DELINEATOR POSTS

**SCOPE.** This specification covers the material, fabrication, and performance requirements for flexible delineator posts.

**MATERIAL REQUIREMENTS.** Flexible delineator posts shall be supplied with reflective sheeting of a size and color as required by the contract documents. The color of the posts shall match the color of the reflective sheeting unless otherwise specified in the contract documents. Where double unit reflectors are specified, elongated reflective sheeting may be substituted as in accordance with the New York State Manual of Uniform Traffic Control Devices.

Reflective sheeting shall be fabricated of a material conforming to the requirements of §730-05 Reflective Sheeting, Class B or Class C. Sheeting shall be applied in accordance with the sheeting manufacturer's written instructions.

**TESTING.** Flexible delineator posts shall meet the requirements in the procedural directives of the Materials Bureau.

**BASIS OF ACCEPTANCE.** Application for approval of flexible delineator posts shall be submitted to the Materials Bureau. The procedural directives outlining detailed requirements and procedures for approval are available from the Materials Bureau. Upon approval the name of the flexible delineator post will be placed on an Approved List.

Project acceptance will be based on the manufacturer's name and type of flexible delineator post appearing on the Department's Approved List titled 'Flexible Delineator Posts.'

### 730-22 STIFFENERS, OVERHEAD BRACKETS AND MISCELLANEOUS HARDWARE

**SCOPE.** These specifications cover the material requirements for stiffeners, overhead brackets and miscellaneous hardware used for signs.

**MATERIAL REQUIREMENTS**

**Aluminum Components.** Horizontal sign panel stiffeners (Z bars) and overhead panel brackets shall be fabricated of aluminum alloy 6061-T6.

Other miscellaneous hardware including vertical stiffeners, bolts, nuts, washers, screws, rivets, pull-type lockbolts and serrated or knob stem blind rivets shall be fabricated of the materials and in the manner shown on the plans or standard sheets and shall meet the requirements of §715-04, Wrought Aluminum.

Components designated as Alloy 2024-T4 shall be given a Type 205 coating in accordance with §719-02, Aluminum Anodic Coatings.

Certification, Sampling, Testing and Inspection of aluminum components shall be handled as noted in §715-04.

**Steel Components.** Steel bolts, nuts and washers referenced to this specification shall conform to the requirements of Table 730-22-1 unless otherwise specified.

Bolts, nuts and washers to be used in contact with aluminum shall be coated with cadmium or cadmium/tin combination.

All cadmium and cadmium/tin coatings shall be given a chromate treatment in or with an aqueous solution of salts, acids or both to produce a protective chromate coating. The chromate coating shall be distinctly colored iridescent yellow to bronze for cadmium. Cadmium/tin coatings, when given this
iridescent chromate treatment, may remain silver colored. Usual chromic and nitric acid bright dips are
not chromate treatments.

### TABLE 730-22-1 STEEL FASTENERS

<table>
<thead>
<tr>
<th>Bolt Size (ASTM F568)</th>
<th>Allowable Nuts¹ (ASTM A563m)</th>
<th>Bolt, Nuts &amp; Washer Coating Systems²</th>
<th>Plain Washer</th>
<th>Prevailing Torque Hex Nuts And Hex Flange Nuts³</th>
<th>Lock Washer</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLASS 4.6 M5 to M36</td>
<td>5 - H1</td>
<td>P or Z</td>
<td>&lt; M12, use ANSI B18.42M, soft</td>
<td>CLASS 5,9 or 10</td>
<td>General Motors Standard Metric Helical Spring General Specification</td>
</tr>
<tr>
<td></td>
<td>5 - HH</td>
<td>P or Z</td>
<td>≥M12, use ASTM F436M IFI</td>
<td>CLASS 5,9 or 10</td>
<td>General Motors Standard Metric Helical Spring General Specification</td>
</tr>
<tr>
<td></td>
<td>9 - H2</td>
<td>P</td>
<td>≥M12, use ASTM F436M IFI</td>
<td>CLASS 5,9 or 10</td>
<td>General Motors Standard Metric Helical Spring General Specification</td>
</tr>
<tr>
<td>CLASS 8.8 M16 to M36</td>
<td>12 - H2</td>
<td>Z</td>
<td>P or Z</td>
<td>CLASS 9 or 10</td>
<td>General Motors Standard Metric Helical Spring General Specification</td>
</tr>
<tr>
<td></td>
<td>9 - HH</td>
<td>P</td>
<td>P or Z</td>
<td>CLASS 9 or 10</td>
<td>General Motors Standard Metric Helical Spring General Specification</td>
</tr>
<tr>
<td></td>
<td>12 - HH</td>
<td>Z</td>
<td>P or Z</td>
<td>CLASS 9 or 10</td>
<td>General Motors Standard Metric Helical Spring General Specification</td>
</tr>
<tr>
<td>CLASS 10.9 M5 to M36</td>
<td>10 - H1</td>
<td>P</td>
<td>P or Z</td>
<td>CLASS 9 or 10</td>
<td>General Motors Standard Metric Helical Spring General Specification</td>
</tr>
<tr>
<td></td>
<td>12 - HH</td>
<td>P</td>
<td>P or Z</td>
<td>CLASS 9 or 10</td>
<td>General Motors Standard Metric Helical Spring General Specification</td>
</tr>
</tbody>
</table>

**NOTES:**

1. Class of nut (5,9,10 and 12):
   - H1 ANSI B18.2.4.1M hex nut, style 1
   - H2 ANSI B18.2.4.2M hex nut, style 2
   - HH ANSI B18.2.4.6M heavy hex nut
2. P > M9.5: ASTM B695, class 50, type 1
   - P ≤ M9.5: ASTM B695, class 40, type 1, cadmium coating
   - ASTM B696, class 8, type 2
   - ASTM B766, class 12, type 2, cadmium/tin coating
   - ASTM B635, class 8, type 2
3. Z > M9.5: ASTM A153, class C
4. Z ≤ M9.5: ASTM A153, class D
3. ANSI B18.16.1M

**BASIS OF ACCEPTANCE.** Acceptance will be based on the manufacturer's certification that its
product conforms to these specifications.

### 730-23 FIBERGLASS REINFORCED PLASTIC SIGN PANELS

**SCOPE.** This specification covers the material requirements for fiberglass reinforced plastic for use as a
sign panel substrate.

**GENERAL.** The fiberglass reinforced plastic sign panel shall be fiberglass reinforced thermoset
polyester laminate. The panel shall be acrylic modified and UV stabilized for outdoor weatherability. The
panel shall be stabilized so as not to release migrating constituents (i.e., solvents, monomers, etc.) over
time, and shall contain no residual release agents on the surface of the laminate that will interfere with
any subsequent bonding operations. The panel shall not contain visible cracks, pinholes, foreign
inclusions, or surface wrinkles that would affect implied performance, alter the specific dimensions of the
panel or otherwise affect its serviceability.

**MATERIALS REQUIREMENTS**

**Physical Requirements.** The fiberglass reinforced plastic sign panel materials shall conform to the
physical requirements in Table 730-23-1:
Panel Flatness Test. Panel flatness shall be determined by supporting a 760 mm by 760 mm panel at two opposite corners, the maximum deflection measured diagonally, parallel and perpendicular to the panel by lines drawn through the center of the panel, shall not exceed 13 mm. The panel shall then be supported in a like manner in an oven for 48 hours at 82°C. The maximum deflection shall again be measured as previously noted, and shall not exceed 13 mm. All measurements shall be made when the panels are at ambient temperature. The fiberglass reinforced plastic panel shall have a maximum Coefficient of Thermal Expansion of 3.24 mm/mm°C and maintain its strength and impact resistance qualities over a temperature range of -54°C to 100°C.

Application of Reflective Sheeting. The reflective sheeting shall be adhered to the fiberglass reinforced plastic panel in strict accordance with the recommendations of the manufacturer of the reflective sheeting.

BASIS OF ACCEPTANCE. Application for approval of fiberglass reinforced plastic sign panel by the producer shall be submitted to the Materials Bureau accompanied by a 7.5 m² sample of the product. Upon approval by the Materials Bureau, the name of the product will be placed on the Department's Approved List entitled "Fiberglass Reinforced Plastic Sign Panels 730-23."
§730-25 TYPE B SIGN POSTS

SCOPE. This specification covers the material requirements for Type B Sign Posts and Rustic Type B Sign Posts. These sign posts shall be equipped with breakaway bases and hinge assemblies per §730-26, Breakaway Bases and Hinge Assemblies, if installed at a location subject to vehicle impact.

MATERIALS AND FABRICATION REQUIREMENTS

Steel Sign Posts. Steel for sign posts and attachments to or components of sign posts shall be ASTM A36M, A242M, A572M Grade 345 and A588M and shall conform to §715-01 Structural Steel. Rustic Type B Sign Posts shall be ungalvanized weathering steel, ASTM A588M or A242M, meeting the requirements of §715-01 Structural Steel.

Sign posts, except Rustic Type B Sign Posts, shall be galvanized after fabrication (punching, drilling, welding, cutting, etc.) in accordance with §719-01, Galvanized Coatings and Repair Methods. Damage to galvanized surfaces of steel posts due to handling, shipment, erection, etc. shall be repaired as described in Repair of §719-01, when directed by the Engineer.

Sign posts with breakaway bases shall be of weldable quality, and all welding shall be in accordance with the provisions of the section on 'Fabrication' of the New York State Steel Construction Manual.

FABRICATION. Sign posts shall be fabricated as indicated on the standard sheets. Breakaway bases shall conform to the requirements of §730-26, Breakaway Bases and Hinge Assemblies.

BASIS OF ACCEPTANCE. Acceptance shall be based on the manufacturer's certification that the product conforms to these specifications.

§730-26 BREAKAWAY BASES AND HINGE ASSEMBLIES

SCOPE. This specification covers the material and fabrication requirements for bi-directional and omni-directional breakaway bases and hinge assemblies for use on Type B Sign Posts and for use on Rustic Type B Sign Posts.

Bi-Directional Breakaway Bases and Hinge Assemblies are intended for use when the expected impact angle is within 30 degrees of the axis of the base from the front and rear.

Omni-Directional Breakaway Bases and Hinge Assemblies are intended for use whenever the expected impact angle may be greater than 30 degrees, measured as described above.

MATERIAL AND FABRICATION REQUIREMENTS. Breakaway bases and hinge assemblies shown on standard sheets shall satisfy the following requirements:

Steel for breakaway bases and hinge assemblies shall be A-36M, A242M, A572M Grade 345, A588M and shall meet the requirements of §715-01, Structural Steel. Steel shall be of weldable quality.

Fasteners shall be of the size and shape shown on the Standard Sheets and meet the requirements of §730-22, Stiffeners, Overhead Brackets and Miscellaneous Hardware. Breakaway bases and hinge assemblies shall be galvanized in accordance with §719-01, Galvanized Coatings and Repair Methods, after the base is welded to the post. Welding shall be in accordance with the provisions of the section on 'Fabrication' of the 'New York State Steel Construction Manual.' Fabrication details shall be in accordance with the standard sheets.

Breakaway bases and hinge assemblies for use in conjunction with rustic sign posts shall meet the above requirements with the following exceptions:

- The upper slip base plate and attached post shall be ungalvanized weathering steel, ASTM A588M or A242M, meeting the requirements of §715-01, Structural Steel. The lower slip base plate, and the attached stub portion of the post, shall be galvanized steel. The remainder of the slip base shall be as shown on the contract drawings.

- When used on one-way, divided roadways, the back flange hinge plate shall be ungalvanized A588M or A242M steel installed as shown on the contract drawings. When used on two-way, undivided roadways, the back flange hinge plate shall meet the requirements, below, of the front flange hinge plate.
The front flange hinge plate shall be galvanized steel, except that an additional galvanized steel flat washer meeting the requirements of ASTM F436M shall be installed on all four bolts between the post and the hinge plate to assure proper slippage.

All exposed galvanized surfaces, except in the vicinity of the slots in the hinge plates, shall be painted in accordance with §657 Painting Galvanized and Aluminum Surfaces.

BASIS OF ACCEPTANCE. Breakaway bases and hinge assemblies fabricated as shown on the standard sheets shall be accepted based on the manufacturer's certification that the complete assembly conforms to these specifications.

730-27 PERMANENT VARIABLE MESSAGE SIGNS

SCOPE. This specification gives minimum material, fabrication, fatigue and strength requirements of variable message signs for permanent installation. Other requirements are in the Contract Documents. Within this specification, "overhead" shall mean to be mounted over the traveled way, or what the plans indicate will become the traveled way.

MATERIAL REQUIREMENTS

Housing. The enclosure housing shall be constructed of aluminum alloy 3003-H14, 6061-T6, 5154-H38 or as specified on approved shop drawings. The minimum thickness shall be 3.2 mm. Seams shall be continuously welded by an inert gas process only in the shop.

The housing shall be completely sealed to prevent the entry of water, insects, dust, dirt and corrosion. Neoprene gaskets shall be utilized as necessary.

Readily-available, changeable filtration devices shall be provided at drain holes and at all points where forced air enters the enclosure.

All hinged access panels and windows shall be equipped with hold-open devices which shall not release accidently or by the action of wind. The hold-open devices shall not interfere with the operation of the display, nor with the repair or replacement of user serviceable components.

Stiffeners, Hardware and Mounting Brackets. Hardware, framing members and mounting brackets shall meet the requirements of §730-22, unless indicated otherwise on the manufacturer's shop drawings approved by the Engineer.

Framing structural members shall be made of aluminum alloy 6061-T6 or an approved equivalent. All hardware shall be corrosion-resistant steel or protected from corrosion by suitable plating. Fasteners for securing access panels shall be captive.

MANUFACTURING

General. Fabrication shall be such that performance will not be impaired after the equipment has been subjected to shock and vibration caused by normal installation, transportation and maintenance handling. Particular attention shall be given to neatness and thoroughness of soldering, wiring, welding, plating, riveting, finishes and machine operations. All parts shall be free from burrs and sharp edges or any other defect that could make the part or equipment unsatisfactory for the operation or function intended in this specification.

Modules shall be designed such that major portions may easily be replaced. Modules of unlike functions shall be mechanically keyed to prevent insertion into the wrong socket or connector. All modules and assemblies shall be clearly identified with name, model number, serial number and any other pertinent information required to facilitate equipment maintenance. They shall be readily accessible for inspection and maintenance, using simple hand-held tools and standard meters.

Housing. The sign enclosure including doors and access panels shall be designed and constructed so as to present a clean, neat appearance; be smooth with exterior corners rounded; be weatherproof and vandal-resistant; and be free of burrs, blemishes and unspecified holes.

Drainage holes shall be drilled near each corner of the base of the enclosure.
The enclosure shall have internal lighting sufficient for all maintenance activity requirements of the VMS and 120 volt power receptacles every 3 m mounted on the rear interior panels.

If the variable message sign is designated as "walk-in," then its access door shall be a minimum of 610 mm wide X 1520 mm high.

**Environmental**

**A. Temperature.** Internal temperature shall be continuously monitored whenever electric power is applied to the sign. The internal temperature of the enclosure shall be reported to the local and central controller upon request. Ventilation shall be automatically turned on and off at internal temperatures specified in the Proposal. Exhaust and intake ports shall be protected by filter screens against moisture, dust and insect intrusion. The ventilation system shall be sufficient to circulate three times the volume of air inside the enclosure per minute. Multiple fans or blowers shall be used to provide the specified venting and shall be located within the enclosure to minimize heat stratification.

**B. Adverse Conditions.** The equipment shall meet all of its specified functions during and after subjection to any combination of the following conditions:

1. **Ambient Temperature.** Range of -30°C to +62°C.

2. **Temperature Shock.** 17°C per hour, during which the relative humidity shall not exceed 95%.

3. **Relative Humidity Range.** 0 to 95% over the temperature range of 4°C to 43°C.

4. **Moisture Condensation.** On all surfaces.

**C. Ambient Light.** The variable message sign shall be equipped with light sensors so that the display shall be able to automatically adapt its level of light output to maintain readability under varying ambient light conditions. There shall be a minimum of eight (8) levels of dimming, linearly spaced from nighttime to daylight brightness. The sign's automatic dimming control shall be overridable by central control. The dimming circuitry shall automatically compensate for variations in the AC line voltage to maintain the light output constant for the selected brightness level. The levels of lighting shall produce luminance measured on the optic axis, as follows:

1. **Daylight.** A minimum of 14 candela per pixule for typical daylight environment.

2. **Nighttime.** Between 1.5 and 2 candela per pixule for nighttime environment.

**Electrical Protection.** The equipment shall contain readily-accessible, normally resettable or replaceable circuit protection devices (such as circuit breakers or fuses) for equipment and power source protection.

**Electronic Components.** All components shall be UL listed. All printed circuit boards shall be FR4 or G10 fiberglass epoxy material, with 20oz. copper, double-sided with plated through-holes.

All etched connector fingers are to be plated with a minimum thickness of 2.5 µm (100 micro-inches) of gold over nickel.

Board connectors that are not an integral part of the printed circuit are to be plated with a minimum thickness of 0.38 µm (15 micro-inches) of gold over nickel.

**Sign Face.** In order to increase contrast, the pixules shall be arranged on a black, non-glossy background. All electronic components visible from outside the sign shall be of black color or coated with black, non-glossy paint.

The front of the sign shall be enclosed by a protective, weathertight face, 6 mm thick.

Variable spacing between letters shall approximate the recommended spacing for 460 mm Series E sign text found in the Federal Highway Administration Standard Alphabets for Highway Signs.
DESIGN CRITERIA

All Permanent Variable Message Signs. The equipment shall be designed such that the failure of one part shall not cause the failure of any other part. In the event of a power failure of 500 milliseconds or less, proper operation of the equipment shall commence after restoration of power, without creating false information.

Shop drawings and calculations that show the sign's ability to withstand the design loads shall be submitted to the Traffic Engineering and Highway Safety Division for approval, and shall be signed by a Professional Engineer licensed and registered to practice in New York State. If the drawings and calculations are approved by the Department, the manufacturer will be notified, and the manufacturer's name and drawing numbers will be placed on the Approved List.

Approved shop drawings shall be submitted to the Engineer prior to delivery of any variable message signs. The Contractor shall develop and deliver shop drawings signed by a licensed New York State Professional Engineer which illustrate in detail, how to mount and connect the variable message sign enclosure to the structure shown on the Plans.

All variable message signs covered by this specification shall be designed to withstand the following loads, combined in groups in accordance with the latest A.A.S.H.T.O. Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals. Each member and connection shall be designed for the maximum stress of all the different combinations, with the allowable stress increased as indicated in the A.A.S.H.T.O. Group Loading table. Unless noted otherwise, "Ice" load in the table shall mean "Ice and Snow loads simultaneously."

Non-Overhead Permanent Variable Message Signs

A. Dead Load. The weight of the variable message sign including all components, plus consideration of loads imposed during maintenance.

B. Live Load. Variable message signs designated as "walk-in," or otherwise intended to support personnel in service, shall be designed to support a live load of 4.8 kPa applied to the service platform.

C. Ice Load. The ice load shall be 145 Pa, unless historical accretion data for the location the variable message sign will be installed, the slope of a panel, or shielding hoods and the like indicate a different load. This load shall be considered on individual panels and the members and connections supporting only one panel. The load on members and connections supporting more than one panel shall be designed to support an ice load on:

1. The one end panel, and
2. Either the front or back panel, after considering panel slope and/or shielding hoods, which produces the largest load in the member or connection.

D. Snow Load. The snow load shall be 1.9 kPa, unless historical accretion data for the location the variable message sign will be installed, or the shape of a panel indicate that a different load is appropriate. This load shall be applied to the top panel and any hood or other nearly horizontal projection.


1. Individual nonhorizontal panels. Panels, members and connections carrying loads from only one nonhorizontal panel shall be designed for 100% of the Base Wind Load acting normal to the panel along with 20% of the Base Wind Load acting transverse to the panel.
2. Adjacent nonhorizontal panels. Panels, members and connections carrying wind loads from two adjacent, nonhorizontal panels perpendicular to each other shall be designed to withstand a wind load acting on both panels. For the purposes of determining direction of forces, the term "paramount" refers to the panel contributing the greatest load, and the adjacent panel termed the "adjoining" panel. If it is not clear which panel will contribute the greatest load, then analyze with one panel assumed to be paramount, and the adjacent one adjoining, then do a separate analysis with the roles reversed. The center of action of the wind loads shall be the centroid of the panel on which it acts. The magnitude of the components shall be:

a. Normal to the paramount panel. 100% of the Base Wind Load on the paramount panel, plus 30% of the base wind load on the adjoining panel;

b. Transverse to the paramount panel. 20% of the Base Wind Load on the paramount panel, plus 60% of the base wind load on the adjoining panel.

Members and connections carrying wind loads from adjacent, nonhorizontal panels at angles other than perpendicular to each other shall be designed to withstand an appropriate wind load coming from the direction producing the greatest stress in the member or connection.

Overhead Permanent Variable Message Signs. Variable message signs to be mounted over a traveled way, or over what the contract documents indicate will become a traveled way, shall be designed for the fatigue loads and using the allowable stresses given in the current version of the NYSDOT Standard Specifications for Overhead Sign Structures.

DELIVERY AND INSTALLATION

The contractor shall deliver, store, handle, and install all materials and equipment in such a manner as not to degrade quality, serviceability or appearance. Material to be stored shall be stored in a clean and dry location free from construction dust, precipitation, and condensing moisture. Any part of the equipment damaged during transportation, handling, or installation shall be repaired, or if determined by the Engineer as unfit for use in the finished work, shall be removed from the site and replaced by the Contractor at no additional cost.

All materials shall be delivered and stored in the manufacturer's original unopened protective packages and protected against soiling, physical damage, or wetting, before and during installation. Unloading and unpacking of all materials shall be done in a manner to prevent misalignment or damage.

The installation shall be performed by factory certified personnel. Installation shall be complete in all respects, including all framing and all related fastenings and anchors required for a complete installation. Equipment shall be placed in accordance with the general arrangement as shown on the Drawings. The general arrangement may be modified only as required to suit specific equipment. Modifications shall not affect the design of components. Layout dimensions as shown on the Drawings may be modified to improve operating efficiency.

MARKING. The contract number, pay-item number, and month and year of installation shall be marked using permanent ink, paint, or stamping into the wall. Characters shall be 25-45 mm high, horizontal when the variable message sign is in its final position, and be located in the following locations:

- The end panel of the vms, so as to be visible from the shoulder closest to the variable message sign.
- On the inside of a "walk-in" variable message sign, near the middle of the panel opposite the door.

Also, the manufacturer's name, product name, model number, serial number, and city and state or province of manufacture shall be permanently marked on the outside and an easily accessible location inside the variable message sign.

These markings shall not be visible when viewing the front of the variable message sign straight-on.

TESTS

Design Approval. In order to get on the Approved list, design approval tests shall be conducted by the fabricator on one (1) or more samples of each equipment type, as approved by the Traffic Engineering
and Highway Safety Director, to determine if the design of the equipment meets the requirements of this specification. In the case of standard product line equipment, the Traffic Engineering and Highway Safety Director may waive the design approval tests if:

- The manufacturer's written specifications (functional and environmental) are equal to or better than those specified in the contract documents and the manufacturer so states in writing; or
- The manufacturer provides certification by an independent testing laboratory that these design approval tests have been previously satisfactorily completed.

**Performance.** If specified in the Contract Documents, each variable message sign shall pass these performance tests both alone and fully integrated in the system:

- Factory Tests
- Installation Tests
- Pre-Acceptance Tests
- Project Acceptance Tests

A complete list of all equipment and system tests to be performed, including the testing plan and detailed testing procedures for each type of equipment, shall be submitted to the Engineer for approval. Test procedures shall be in accordance with the manufacturer's recommendations and shall demonstrate all functional requirements.

A minimum of two (2) weeks written notification will be provided for the witnessing of all testing, after approval of the testing plan and the appropriate testing procedures.

If a unit has been modified as a result of a test failure, a report shall be prepared and delivered to the Engineer prior to re-testing of the equipment. The report shall describe the nature of the failure and the corrective action taken. If the Engineer determines that a failure pattern exists, then design and construction modifications shall be made to all equipment without additional cost to the State or extension of the contract period. The Engineer will forward copies of the reports of modifications to the Regional Traffic and Safety Engineer, and to the Materials Bureau.

Rejected equipment may be offered again for retest provided all non-compliances have been corrected and retested by the Contractor. The contractor shall submit evidence that the sign(s) have passed, to the Engineer with the request and the schedule to rewitness the performance tests.

**BASIS OF ACCEPTANCE.** Variable message signs will be accepted based on the following:

- The manufacturer's name, product name or model number, and drawing number and date, appearing on the Department's Approved List.
- Submission of approved shop drawings, for each different variable message sign supplied.
- Manufacturer's written certification of compliance to these specifications and the approved shop drawings.
- If required by the Engineer or the approved shop drawings, submission of mill certifications for structural materials.
- Passing all performance tests in the specification.

Final inspection and acceptance of equipment shall be made after installation at the locations specified on the plans.

**SECTION 731 (VACANT)**

**SECTION 732 - DRILLING**

**732-01 DRILL RIGS**

**SCOPE.** This specification covers the equipment and performance requirements for drill rigs.

**GENERAL.** Drill rigs shall be specifically designed and manufactured for drilling, coring and sampling soil and rock.
§732

EQUIPMENT. Drill rigs shall have adequate capacity and power to accomplish the required work. Each rig shall be supplemented with the necessary auxiliaries, appurtenances, tools and other equipment required for proper operation.

BASIS OF ACCEPTANCE. The rigs and all necessary auxiliaries, appurtenances, tools, barges, platforms, support vessels and equipment shall be acceptable to the Engineer. Drill rigs that are not adequate, as determined by the Engineer, will not be permitted for use. Drill rigs required under the items for furnishing equipment including drive hammers, all necessary auxiliaries, appurtenances, tools, barges, platforms, support vessels and other equipment must be on site, inspected and approved by the Engineer in conjunction with a representative of the Geotechnical Engineering Bureau before any work is done by that rig. Each rig shall be complete and sharing of equipment between rigs will not be permitted.

732-02 DRIVE PIPE

SCOPE. This specification covers the material and quality requirements for drive pipe used in subsurface explorations.

MATERIAL REQUIREMENTS. Drive pipe shall be extra strong steel pipe, 65 mm or 100 mm nominal diameter as specified, with threaded ends in random 1.5 m lengths and shall conform to the requirements of ASTM A120, Schedule 80.

BASIS OF ACCEPTANCE. Drive pipe shall be subject to inspection and approval of the Engineer in conjunction with a representative of the Geotechnical Engineering Bureau.

732-03 CASING

SCOPE. This specification covers the material and quality requirements for casing used in subsurface explorations.

MATERIAL REQUIREMENTS. The casing shall be diamond drill flush-joint or flush coupled type, fabricated from high quality seamless steel tubing conforming to the requirements of the Diamond Core Drill Manufacturer's Association (DCDMA) Standards. The design shall permit any size casing to telescope into the next larger size.

BASIS OF ACCEPTANCE. Casing shall be subject to inspection and approval of the Engineer in conjunction with a representative of the Geotechnical Engineering Bureau.

732-04 SAMPLERS

SCOPE. This specification covers the material requirements for split barrel samplers.

MATERIAL REQUIREMENTS. Samplers shall be equipped with a ball check in the head section and have a minimum inside length of 0.5 m. For 50 mm diameter samplers, the outside diameter shall be 50.8 mm and the cutting shoe opening shall be 35.1 mm. For 65 mm samplers the outside diameter shall be 63.5 mm and the cutting shoe opening shall be 47.7 mm. For 75 mm samplers the outside diameter shall be 76.2 mm and the cutting shoe opening shall be 60.4 mm. For 90 mm diameter samplers, the outside diameter shall be 88.9 mm and the cutting shoe opening shall be 73.2 mm.

BASIS OF ACCEPTANCE. Samplers shall be subject to the inspection and approval of the Engineer in conjunction with a representative of the Geotechnical Engineering Bureau.

732-05 THIN WALL SAMPLE TUBES

SCOPE. This specification covers the material and quality requirements for thin wall sample tubes.
MATERIAL REQUIREMENTS. Thin walled sample tubes shall be fabricated from Type 304 stainless steel tubing meeting the requirements of ASTM A276 as specified for a nominal 90 mm O.D. seamless or welded tubing with nominal 1.65 mm wall thickness. Specific dimensions and fabrication details shall comply with the current Geotechnical Engineering Bureau Drawing entitled “Stainless Tube for 90 mm Undisturbed Soil Samples.” Liners for 90 mm samplers shall have an outside diameter of 76.2 mm and shall be 450 mm long. Liners shall be fabricated of brass or stainless steel only.

BASIS OF ACCEPTANCE. Sample tubes shall be subject to the inspection and approval of the Engineer in conjunction with a representative of the Geotechnical Engineering Bureau.

732-06 CORING BITS

SCOPE. This specification covers the material requirements for coring bits used in Subsurface explorations.

MATERIAL REQUIREMENTS. Coring bits shall be four sizes: AX, BX, NX and HX. The bits shall meet the outside diameter requirements specified by the National Bureau of Standards and the Diamond Core Drill Manufacturer's Association.

BASIS OF ACCEPTANCE. Coring bits shall be subject to inspection and approval of the Engineer in conjunction with a representative of the Geotechnical Engineering Bureau.

732-07 SAMPLE STORAGE BAGS

SCOPE. This specification covers the material requirements for sample storage bags used for containing soil samples.

MATERIAL REQUIREMENTS. Sample storage bags shall be moisture-proof, transparent, plastic bags with minimum dimensions 200 mm length, 250 mm width and 0.05 mm thickness.

BASIS OF ACCEPTANCE. Sample storage bags shall be subject to inspection and approval of the Engineer.

732-08 SAMPLE JARS

SCOPE. This specification covers the material requirements for sample jars used for containing soil samples.

MATERIAL REQUIREMENTS. Sample jars shall be glass, or plastic, wide-mouthed jars of one-liter capacity with air-tight screw covers fitted with rubber compo-lined caps.

BASIS OF ACCEPTANCE. Sample jars shall be subject to inspection and approval of the Engineer.

732-09 JAR CARTONS

SCOPE. This specification covers the material and fabrication requirements for jar cartons used to contain soil sample jars.

MATERIAL AND FABRICATION REQUIREMENTS. Jar cartons shall consist of corrugated Kraft paper cardboard fabricated into a box with overall nominal dimensions of 300 mm wide, 400 mm long and 180 mm deep. The box shall be partitioned and have sufficient strength to safely support twelve (12) sample jars conforming to §732-08 in a 3 x 4 array.

BASIS OF ACCEPTANCE. Jar cartons shall be subject to inspection and approval of the Engineer.
732-10 BOULDER AND ROCK CORE BOXES

SCOPE. This specification covers the material and fabrication requirements for boxes used to contain core samples of boulders and rock.

MATERIAL AND FABRICATION REQUIREMENTS. Boxes shall be fabricated of white pine, Grade No. 2 common or better, 25 mm stock (finished 20 mm) thickness or an approved equal material. Overall box dimensions for “AX” cores shall be 1.56 m long, 245 mm wide and 70 mm high. Dimensions for “BX” core boxes shall be 1.56 m long, 275 mm wide and 85 mm high. Dimensions for “NX” core boxes shall be 1.56 m long, 275 mm and 95 mm high. Dimensions for “HX” core boxes shall be 1.56 m long, 285 mm wide and 120 mm high. Core rows shall be separated by wooden or tempered hardboard, 3 mm thick strips recessed to 10 mm depth and glued with waterproof glue at the bottom and ends of the box.

Box covers shall be hinged with two, 50 mm steel butt hinges recessed and fastened with flat head wood screws. Box covers shall be secured in a closed position by two, 40 mm hook and eye fasteners. All boxes shall be coated with weatherproof wood preservative. Details are specified on the current Geotechnical Engineering Bureau Drawing entitled “Core Box AX, BX, NX and HX Sizes.”

BASIS OF ACCEPTANCE. Core boxes shall be subject to inspection and approval of the Engineer in conjunction with a representative of the Geotechnical Engineering Bureau.

732-11 OPEN WELL PIEZOMETER

SCOPE. This specification covers the material requirements for open well piezometers.

MATERIAL REQUIREMENTS. Monitoring pipe-riser pipe shall be 25 mm (nominal diameter) threaded PVC schedule 40 pipe. Slotted screen pipe shall be 1.5 m long and be 25 mm (nominal diameter) threaded PVC schedule 40 pipe. Caps shall be 25 mm (nominal diameter) PVC schedule 40 threaded male cap for the top, and 25 mm (nominal diameter) PVC schedule 40 threaded female cap for the bottom.

Sand. Provide well rounded, uniformly graded silica sand, which is correctly sized to the slotted screen. Ottawa sand is acceptable.

Bentonite pellets. Provide 6 mm (nominal diameter) bentonite pellets.

Manhole. Provide a 200 mm (inside diameter) steel flush mount manhole with a 200 mm skirt.

Cement. The material shall meet the requirements of §701-01 Portland Cement Type 1 or 2.

Water. The water for the mix shall conform to the requirements of §712-01 Water.

Bentonite Powder. There are no material requirements for the bentonite, except it shall be supplied in powder form from a reputable manufacturer and pass a 75 μm mesh particle size.

BASIS OF ACCEPTANCE. Materials used for the installation of open well piezometers shall be subject to inspection and approval of the Engineer.

732-12 GROUT

SCOPE. This specification covers the material requirements for the grouting of bore holes.

MATERIAL REQUIREMENTS. For cement, the material shall meet the requirements of §701-01. Portland Cement Type 1 or 2. Water for the mix shall conform to the requirements of §712-01.
Water. There are no material requirements for the bentonite, except it shall be supplied in powder form from a reputable manufacturer and pass a 75 \(\mu\)m mesh particle size.

**BASIS OF ACCEPTANCE.** The grout shall be subject to inspection and approval of the Engineer.

**SECTION 733 AND 734 (VACANT)**

**SECTION 735 - CONCRETE CYLINDER CURING BOX**

735-01 CONCRETE CYLINDER CURING BOX

**SCOPE.** This specification covers the material requirements, tests and basis of acceptance for a Concrete Cylinder Curing Box.

**MATERIAL REQUIREMENTS.** The Concrete Cylinder Curing Box shall be constructed of noncorroding materials. A moisture proof seal shall be provided between the lid and body of the box. Provision for automatic control of water temperature to \(22^\circ C \pm 3^\circ C\) shall be made when the box is located in an uncontrolled environment. A bimetallic thermometer shall be installed with its sensing element in the storage water. The thermometer shall be capable of being read from the outside without opening the box. The thermometer shall have minimum gradations of \(1^\circ C\) and shall be protected from damage. Electric utility connections shall be made in a lockable switch box securely attached to the outside of the curing box.

A rustproof wire or metal rack shall be set above the bottom of the box to support cylinders in an upright position. This rack and all temperature control elements shall be positioned to allow free circulation of water around the cylinders. A combination hose connection and drain shall be provided at the lower front edge of the box so that it may be drained or water may be circulated. A drain shall also be provided on the box in such a position that when open will drain water to within 25 mm over the top of the cylinders. All areas of the box shall be easily drained and accessible for cleaning.

**Test.** The Concrete Cylinder Curing Box shall be capable of maintaining the required water temperature through an ambient air temperature range of \(-23^\circ C\) to \(+38^\circ C\). The box shall be capable of holding a minimum of nineteen 150 mm X 300 mm cylinders. When filled with water, the box shall not leak.

**BASIS OF ACCEPTANCE.** The Concrete Cylinder Curing Box shall be accepted upon approval of the Engineer.

**SECTION 736 - PERMANENT CORRUGATED METAL FORMS FOR BRIDGE SLABS**

736-01 PERMANENT CORRUGATED METAL FORMS FOR BRIDGE SLABS

**SCOPE.** This specification covers the material requirements, method of manufacture, tests and basis of acceptance for Permanent corrugated Metal Forms for Bridge Slabs for use as described under §555, Structural Concrete.

**MATERIALS.** Forms and form supports shall conform to the latest specification for ASTM A653/A653M, Grades A thru E, Coating Designation G165. Fabrication shall be in conformance with ASTM A924/A924M.

Prior to fabrication of forms the Contractors shall submit to the Engineer certification for conformity of steel and galvanizing to ASTM A653/A653M.

**DESIGN REQUIREMENTS.** The following shall govern the design of permanent corrugated metal stay-in place (S. I. P.) forms:

- Design Span shall be the clear span of form plus 50 mm measured parallel to the form flutes.
- Design Load shall be the sum of the weights of form, bar reinforcement, plastic concrete and 2500 Newtons per square meter for construction loads.
§736

- Unit Working Stress shall not exceed 0.725 of the specified minimum yield strength of the material. In no case shall the unit working stress exceed 250 MPa.
- Dead Load Deflection shall not exceed 1/180 of the form span or 13 mm, whichever is less.
- Physical Design Properties shall be computed with the requirements of the American Iron and Steel Institute Specifications for the Design of Cold Formed Steel Structural Members, latest published edition.

**Certification.** For acceptance, the Contractor shall submit Manufacturer certification to the Engineer that all forms meet all design requirements stated in this section and all detail requirements shown on the plans.

**TEST.** No testing will be required.

**BASIS OF ACCEPTANCE.** All forms delivered to the job site must be accompanied by the manufacturer's certification that the materials used conform to ASTM A653/A653M as required by this section. Any forms delivered to the job site without such certification or which do not conform to the approved shop drawings shall be rejected by the Engineer.

**SECTIONS 737 THRU 799 (VACANT)**
INDEX

abbreviation ................................................................. 15
addenda ................................................................... 17
Admixtures ................................................................ 280, 282, 285, 287
Affirmative Action Steps ........................................... 40
aggregate ................................................................ 217, 227, 262
crude ...................................................................... 219, 257, 277, 278, 279, 283
crude ................................................................... 286, 289
fine ........................................................................ 277, 283
friction ................................................................... 225
friction ................................................................... 220
friction ................................................................... 258
HMA ....................................................................... 257
preparation ................................................................ 236
Aggregate
  bituminous surface .................................................. 266
Aggregates
  Preparation ................................................................ 236
Agreed Price ............................................................... 134
agreement .................................................................. 18
Agreement .................................................................. 61
Agreement, Final See Final Agreement
  aid ........................................................................ 59
  federal ................................................................ 19
Air void ..................................................................... 225
altering
  drainage structure ................................................... 491
amendment ................................................................ 17
amendments
  soil ........................................................................ 535
anchorages unit ......................................................... 503, 511
  concrete .................................................................. 502
  removing and disposing ......................................... 509
  removing and storing ............................................. 509
  re-setting .................................................................. 500, 509
Apprentices ................................................................ 36
approach .................................................................. 557
temporary .................................................................. 569
approved list ............................................................. 17
Approved List ........................................................... 100
archaeological .......................................................... 161
asbestos
  remove and dispose of material .............................. 192
asphalt ...................................................................... 218
asphalt
  hot mix .................................................................. 217
asphalt
  content .................................................................... 224
asphalt
  hot mix .................................................................. 239
assembly
  end ........................................................................ 503, 511
  flashing beacon ...................................................... 695
guy .......................................................................... 692
riser .......................................................................... 692
attenuator
  impact ...................................................................... 646, 648, 649
award ........................................................................ 17
bank and channel protection ....................................... 584
barricade ................................................................... 556
construction ................................................................ 557
lighting for ............................................................... 556, 569
permanent type .......................................................... 596
barrier
  box beam, temporary ............................................... 569
  concrete ............................................................... 500, 504
  concrete, temporary ................................................ 556
curing ........................................................................ 507
esposed ends ............................................................. 565
heavy post blocked out corrugated ......................... 500
highway .................................................................... 498
median ..................................................................... 500, 504
median, box beam ...................................................... 503
placement ................................................................ 506, 507
removing and disposing ........................................... 509
removing and storing ................................................ 509
re-setting ................................................................... 500, 508, 509
rustic ......................................................................... 510
traffic, temporary ....................................................... 569
base
  fence, concrete ........................................................ 521
  for controller cabinet ............................................. 696
  for power meter ...................................................... 696
  permeable ............................................................. 217, 296, 298, 300, 311, 312
base line data ............................................................ 17
Base Line Data ........................................................... 26
basin
  altering ................................................................... 491
  leaching ................................................................ 491, 492
batching .................................................................... 280
  concrete .................................................................. 288, 293
Batching Plants .......................................................... 230
beads
  glass ....................................................................... 708
bearing
  elastomeric, external load plate ................................ 895
  elastomeric, external load plates .............................. 380
  multi-rotational ........................................................ 380
  plain elastomeric ..................................................... 380, 889
  steel laminated elastomeric ...................................... 380
  steel rockers ............................................................ 380
  steel sliding .............................................................. 380
bedding ...................................................................... 585, 587
bicycle paths .............................................................. 524
Contract Documents
Components ........................................... 26
Subsurface Information .............................. 26
Contract Payment .................................... 140
contractor ............................................. 18
Control
Friction Aggregate .................................. 226
Mixing Plant .......................................... 226
moisture .................................................. 169
PG Binder .............................................. 228
photovoltaic .......................................... 679
Production ........................................... 225
controlled low strength material ............... 176
Cooperation ............................................ 83
coordination .......................................... 503
Coordination .......................................... 83, 86
course
bituminous stabilized .............................. 201
stabilized gravel .................................... 272
stabilized gravel .................................... 271
subbase .................................................. 299
subbase for barrier .................................. 506

damage
curing .................................................. 306
of foundation ........................................ 315

daylight .............................................. 315
donutz ..................................................... 561, 645
drum ...................................................... 562
delineator ............................................... 556
department ............................................. 19
Disability Hardship .................................. 70
director
construction division ............................ 19
regional ............................................... 23
Disadvantaged Business Enterprise (DBE) ..... 42
dip .......................................................... 564
disinfection .......................................... 566
water pipe ............................................. 667
disposal ................................................. 273
disposal
burying .................................................. 144
chipping ............................................... 144
dozer ...................................................... 144
salvage of marketable timber .................... 144
Dispute ................................................. 89
Certification .......................................... 93
Time Related ......................................... 138
Dispute ............................................... 74

Disputes .............................................. 268
division ................................................... 19
document
contract ............................................... 18
Documentation ........................................ 226
Quantity .............................................. 235
Dolomite ............................................. 218, 258, 267
downspout
ductile iron .......................................... 439
pvc ....................................................... 439
drainage ............................................... 161
maintenance of during construction .......... 562

drains
prefabricated composite ......................... 181
drawing ................................................. 503
misc. metal .......................................... 654
shop, for lighting .................................. 676
driller's log ............................................ 637
drilling ................................................. 989
concrete .............................................. 298

driveway .............................................. 524
asphalt concrete ..................................... 526
block paved .......................................... 525, 526, 527
brick ...................................................... 525, 527
concrete .............................................. 525, 526
drop-off .............................................. 562, 564

drum
plastic .................................................. 559
Drum Mix Plants ................................. 233
duration of the contract ......................... 553
dust ....................................................... 561, 645
EIC ....................................................... 19
embankment ........................................... 156, 164
INDEX

construction control devices ........................................ 157
foundation ............................................................... 156, 164
proof rolling ............................................................. 169
employee .................................................................. 19
emulsion
  asphalt .................................................................. 201
engineer .................................................................. 19
  chief .................................................................... 17
departmental geotechnical ............................................ 19
  in charge ............................................................. 19
Engineering Charges .................................................... 127
entrainment
  air ...................................................................... 287
Equal Employment Opportunity ..................................... 37
Equal Opportunity Employment ....................................... 96
equipment ................................................................ 209, 212
  admixture ............................................................ 290
  batching ............................................................... 290
  failure of ............................................................. 227
  fixed form paving .................................................. 297
  hauling ........................................................-------- 241
  mobile applicating ................................................ 704, 707
  paving ................................................................. 297
PG Binder ................................................................. 228
  portable applicating ............................................ 707
  proportioning ........................................................ 281
  recording ............................................................. 282, 290
  saw cutting ........................................................... 298
  slip form paving .................................................... 296
Equipment Charges .................................................. See Force Account, Equipment
Equipment, Construction .................................................. 82
excavation ................................................................ 156, 491
trenches, culverts, structures ......................................... 178
water pipe .................................................................. 662
Excavation Protection System .......................................... 324, 325
excavation protection system ........................................... 323
Extra Work .................................................................. 134, 650
fabricator .................................................................. 19
Fabricator .................................................................. 44
facility
  inspection ............................................................... 283
factor
  quality adjustment .................................................. 238, 253, 254
fastener
  for guide rail .......................................................... 499
Federal-Aid ................................................................. 51
fence gates
  right-of-way ........................................................... 521
fencing ..................................................................... 520
  chain link ............................................................. 520, 522
  chain link, plastic coated ........................................ 523
construction of ........................................................... 522
  right-of-way .......................................................... 521, 523
types ..................................................................... 520
filler

Mineral ...................................................................... 219
filling
  stone ..................................................................... 584, 585, 586
filter
  underdrain ............................................................. 495, 497
Final Acceptance .......................................................... 140
Final Agreement .......................................................... 141
Fine Aggregate .......................................................... 278, 289
finishing
  of foundation .......................................................... 314
flagger ..................................................................... 554, 561
floor
  open steel .............................................................. 474
force account ............................................................. 582, 592
Force Account ............................................................ 135, 137
  Equipment ............................................................. 135
form
  barrier, concrete .................................................. 505
  proposal ............................................................... 22
foundation
  for lighting .............................................................. 676
  for traffic signals .................................................. 688
fractured faces ............................................................. 673
frames
  drainage ............................................................... 653
gabion ................................................................. 584, 586, 587
   381
gate
  fence ..................................................................... 520, 521, 523
Gatekeeper .................................................................. 94
geologist
departmental engineering ............................................... 19
geotextiles ................................................................. 181
Goals ....................................................................... 43
Goals, Employment ..................................................... 38
Good Faith Effort ........................................................ 47
Gradation .................................................................. 201, 225
grading ................................................................... 161
granite ................................................................. 218, 267
grate
  drainage ............................................................... 492, 653
gravel ................................................................. 589, 217, 267
  for local roads ..................................................... 672
  stabilized ............................................................. 645
Gravel ..................................................................... 218
grinding
  diamond ............................................................... 298, 310
grounding
  for lighting .............................................................. 677, 680
  for traffic signals .................................................. 689
groundwater ............................................................... 638
grount
  bore hole ............................................................... 642
grubbing .................................................................. 143
gutter
  asphal concrete ..................................................... 589
cobble ................................................................. 590

NEW YORK STATE DEPARTMENT OF TRANSPORTATION
STANDARD SPECIFICATIONS of May 4, 2006
INDEX

pavement, preformed, application of........711
pavement, replacement of..................603
pavement, short term .......................553, 557, 570
pavement, thermoplastic ...................709
removal of ........................................575
Marshall Mix ..................................257, 259
masonry
  dimension stone ..........................364
  rubble stone ................................365
  split faced concrete ......................365, 367
  stone ............................................365
mass
  computed ......................................376
  payment .......................................376
material ........................................21
Material Supplier ..........................44, 100
Materials Certification ....................100
Mechanically Stabilized Earth System .....333
metal
  miscellaneous ..............................654
Methods and Equipment .....................82
microsilica ..................................278, 280, 287, 289
milling
  cold ...........................................273
  cold ..........................................274
Mineral Filler ................................259
Minor Item ....................................72, 132
Minority Business Enterprise (MBE) ......42
MIX
  volumetric design .........................223
misher ...........................................202
  concrete .......................................284
  small ...........................................286
  truck ..........................................284
mixing
  concrete .......................................292
Mixing .........................................203, 236, 264
  Base Course .................................237
  concrete .......................................291
  HMA ............................................226
  Top and Binder Course .....................237
Mixing and Spreading, Soil Cement .....213
Mobile Concrete Mixing Units ..........285
mobilization ................................718
moisture content ............................203, 224
mulching .......................................536
MURK ..........................................15
  laying .........................................21
MU/TCD
  of uniform traffic control devices ......21
  near ..........................................21
  negotiations with utility ...............687
  nighttime operations
    maintaining traffic during ............575
    maintenance and protection of .........575
  cold ..........................................273
notification
  one call ......................................21
NYCRR .........................................21
office
  engineer's ....................................603, 605, 607, 609
  Omnibus Act ..................................33
  opening highway ...........................572
order
  on contract ..................................22
  other work ....................................582
Overhead ......................................137
Overtime .......................................35
paint
  inspection equipment ......................421, 656
  painting ........................................
  galvanized surfaces .......................799
  Partial Payment .............................133
  Partnering .....................................60
pavement
  cleaning prior to marking .............602
  cold mix bituminous .......................262
  concrete .......................................311, 312
  curing of .....................................306
  density ........................................249
  finishing of ..................................305
  foundation for .............................313
  heavily reinforced .........................311, 313
  isolation .......................................311, 313
  opening to traffic ........................310
  portland cement concrete ...............294, 759
  protection .................................309
  quality adjustment .......................311, 313
  reclaimed asphalt .........................259
  texturing of ..................................305
  thickness determination ..................305
paver
  precast concrete ............................756, 758
Paver
  HMA .............................................241
paving
  fixed form paving ..........................300
  of irregular areas ..........................297, 301
  slip form paving .............................300
paving
  concrete for pipe ...........................487
paving
  block, concrete .............................586
paving
  block, concrete .............................587
Payrolls .......................................36
PCCM ...........................................15, 22
Permits ........................................89
piezometer .....................................172, 641
INDEX

1001

NEW YORK STATE DEPARTMENT OF TRANSPORTATION
STANDARD SPECIFICATIONS of May 4, 2006
INDEX

removal
bridge overlay .................................................. 449
concrete bridge pylons ........................................ 446
existing steel .................................................... 470
steel supported structural slab ........................... 446
structural concrete .............................................. 446
structures, obstructions ....................................... 145

repair
for barriers, of concrete ...................................... 508
galvanizing for .................................................... 501

Repairs to the bituminous stabilized course ............... 204
Restricted Highway ........................................... 75

retardation
concrete setting .................................................. 287
Retardation ........................................................ 287
right of way ....................................................... 23

Right-of-Way 520, 521, 523, 592, 594, 595, 596
ring
adjustment ......................................................... 492
rings
adjustment ....................................................... 490, 491
adjustment for manhole ......................................... 490, 491
rip-rap .............................................................. 585, 587
stone ............................................................... 584

RME ................................................................. 15
roadbed ............................................................ 23
roadway ............................................................. 23

roller
cut sections ....................................................... 171
sheepsfoot .......................................................... 168
smooth steel wheel .............................................. 169
stress ............................................................... 170

Roller ................................................................. 241
rubber-tired ....................................................... 242, 268
steel-wheel .......................................................... 242
Vibratory ............................................................ 241, 242, 252

Safety
Lifting ............................................................... 87
Safety ............................................................... 228
Sales Tax .......................................................... 50, 137
sample
rock ................................................................. 641
split barrel ........................................................ 639
thin-walled tube .................................................. 640

Sample
Loose Mix .......................................................... 250
Sampling ........................................................... 225
sand
concrete .......................................................... 278
Sandstone .......................................................... 218, 267
scale ................................................................. 281
Scales ............................................................... 227, 281

Truck ............................................................... 228
Schedule ........................................................ 126
SCM ................................................................. 15
steel construction ............................................... 23
Season Limitations .............................................. 213
section
end ................................................................. 508
road ................................................................. 23

Section
Test ................................................................. 246, 247

sediment control .................................................. 183
seed ................................................................. 535, 536, 537
select
borrow .............................................................. 158
fill ................................................................. 158
granular fill ....................................................... 159, 172
granular fill slope protection ................................ 159
granular subgrade .............................................. 160
structural fill ..................................................... 159

settlement
gages, rods ....................................................... 172

sheeting
permanent steel .................................................. 323
permanent timber ............................................... 323
reflective .......................................................... 974
temporary timber ............................................... 323

Sheeting
interim ............................................................ 322, 324, 325
interim timber .................................................... 323
permanent ......................................................... 322, 324, 325
temporary ......................................................... 322, 324, 325
temporary steel .................................................. 323
shotcrete ............................................................ 452
shoulder ............................................................... 23

shoulder, Optional Flexible .................................. 204
sidewalk ............................................................ 524
asphalt concrete ................................................. 526
blk paved .......................................................... 526
block paved ....................................................... 525, 526, 527
brick ................................................................. 525, 527
cement ............................................................. 526

sign
construction ....................................................... 553, 555, 565
existing, maintenance of ....................................... 564
fixed support for .................................................. 566
overhead ............................................................ 696
portable support for ............................................. 566
removing and storing ............................................ 636

signal
maintaining ....................................................... 558, 572
temporary .......................................................... 557, 572
traffic ............................................................... 686
traffic, temporary ............................................... 553

Significant Changes ............................................. 71
Site ................................................................. 101

slag ................................................................. 217
Slag aggregate .................................................... 217, 257
slope
cut ................................................................. 157


steel construction ............................................... 23
INDEX

tube .......................................................... 496
derain ...................................................... 496
turf ............................................................ 535
soil ............................................................ 536
Unacceptable Work ..................................... 84
Uncompleted Work Agreement ................... 142
underdrain .................................................. 495
utility .......................................................... 659
utility .......................................................... 24
Utility ......................................................... 304, 314, 660, 680, 687, 877, 925
Utilization .................................................... 48
Value Engineering Change Proposal (VECP) .76
valves 
  tapping sleeve ........................................... 665
vehicle 
  shadow ..................................................... 552
vibrator 
  concrete ..................................................... 297
void 
  air .......................................................... 224, 238
Wage Rates .................................................... 35
Warranty ....................................................... 96
waste 
  bridge washing ........................................... 418, 420
  disposing paint removal .................................. 417
  hazardous ................................................... 417
  paint .......................................................... 419
  paint removal .............................................. 418
  transporter .................................................. 418
  treating ...................................................... 417
water 
  applying .................................................... 157
  Water ......................................................... 285, 287
weather limitation ......................................... 210
weather and season ........................................ 299
weather and seasonal ..................................... 240, 263, 267, 270, 506, 613, 703, 708, 710
welding ....................................................... 385, 502
wildflower ..................................................... 535, 537, 538
  period of stablishment .................................. 538
Winter Operations ......................................... 82
wire 
  direct bury ................................................. 937
  for traffic signals ......................................... 687
  messenger .................................................. 692
Women's Business Enterprise (WBE) .............. 42
wood preservative 
  water-borne ............................................... 800
work 
  extra .......................................................... 19
  Workforce and Training Utilization Schedule .39
zone 
  tolerance ................................................... 24
## METRIC/ENGLISH BOLT SUBSTITUTION TABLE

**METRIC – ASTM GRADE SPECIFIED**

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<th>METRIC (MM)</th>
<th>ENGLISH (INCHES)</th>
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### METRIC BOLT EQUIVALENT BOLT SIZES

**METRIC/ENGLISH BOLT SUBSTITUTION**

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### ENGLISH BOLT SUBSTITUTION - ASTM GRADE

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### ENGLISH BOLT  APPROPRIATE NUTS

**A-307 GRADE A** | **A-325 TYPE 1** | **A-354 GRADE BD**

*ZINC COATED AS PER ASTM A153
**PLAIN OR ZINC COATED
WASHERS SHALL BE F-436 WITH SAME FINISH (PLAIN OR ZINC COATED) AS THE BOLT.

**No substitution will be allowed for any A325M bolts supplied under §715-14 and used for structural connections on bridges, unless approved by the DCES.**
Table Errata to 2006 Standard Specifications

Pages 728, 730, 731, and 732, under Section 702 - Butuminus Materials replace Tables 702-1, 702-5, 702-6, and 702-9 and corresponding notes with the following:

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**Original Binder**

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<td></td>
<td></td>
</tr>
<tr>
<td>Dynamic Shear, TP5(2) G*/sin δ, Min., 1.00 kPa Test Temp @ 10 rad/s, ºC</td>
<td>58</td>
<td>64</td>
<td>70</td>
<td>76</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Rolling Thin Film Oven (T 240) or Thin Film Oven (T 179) Residue**

<p>| | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass Loss, Maximum, %</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dynamic Shear, TP5: G*/sin δ, Min., 2.20 kPa Test Temp @ 10 rad/s, ºC</td>
<td>58</td>
<td>64</td>
<td>70</td>
<td>76</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Pressure Aging Vessel Residue (PP1)**

<p>| | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>PAV Aging Temp, ºC</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dynamic Shear, TP5: G*sin δ, Max., 5000 kPa Test Temp @ 10 rad/s, ºC</td>
<td>19</td>
<td>16</td>
<td>25</td>
<td>22</td>
<td>28</td>
<td>31</td>
</tr>
<tr>
<td>Physical Hardening(3) Report</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Creep Stiffness, TP1: S, Maximum, 300 MPa m-value, Minimum, 0.300 Test Temp, @ 60 sec, ºC</td>
<td>-18</td>
<td>-24</td>
<td>-12</td>
<td>-18</td>
<td>-12</td>
<td>-12</td>
</tr>
<tr>
<td>Direct Tension, TP3: Failure Strain, Min, 1.0% Test Temp @ 1.0 mm/min, ºC</td>
<td>-18</td>
<td>-24</td>
<td>-12</td>
<td>-18</td>
<td>-12</td>
<td>-12</td>
</tr>
</tbody>
</table>

**NOTES:**

1. This requirement may be waived by the Director, Materials Bureau if the supplier warrants that the PGB can be adequately pumped and mixed at temperatures that meet all applicable safety standards.
2. For quality control of unmodified PGB production, measurement of the viscosity of the original PGB may be substituted for dynamic shear measurements of G*/sin δ at test temperatures where the PGB is a Newtonian fluid. Any suitable standard means of viscosity measurement may be used, including capillary or rational viscometry (AASHTO T 201 or T 202).
3. Physical Hardening - TP1 is performed on a set of PGB beams according to Section 13.1, except the conditioning time is extended to 24 hours ± 10 minutes at 10ºC above the minimum performance temperature. The 24-hour stiffness and m-value are reported for information purposes.
4. If the creep stiffness is below 300 MPa, the direct tension test is not required. If the creep stiffness between 300 and 600 MPa the direct tension failure strain requirement can be used in lieu of the creep stiffness requirement. The m-value requirement must be satisfied in both cases.
### TABLE 702-5
#### ASPHALT EMULSIONS

<table>
<thead>
<tr>
<th>TYPE</th>
<th>RAPID SETTING</th>
<th>MEDIUM SETTING</th>
<th>SLOW SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATERIAL DESIGNATION</td>
<td>702-3001</td>
<td>702-3101</td>
<td>702-3102</td>
</tr>
<tr>
<td>GRADE</td>
<td>RS-1</td>
<td>RS-2</td>
<td>HFRS-2</td>
</tr>
<tr>
<td>Tests on Emulsion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Viscosity, Saybolt Furol, 25ºC, Sec.</td>
<td>Min</td>
<td>Max</td>
<td>Min</td>
</tr>
<tr>
<td>-</td>
<td>100</td>
<td>200</td>
<td>-</td>
</tr>
<tr>
<td>Viscosity, Saybolt Furol, 50ºC, Sec.</td>
<td>-</td>
<td>75</td>
<td>400</td>
</tr>
<tr>
<td>Storage Stability Test, 1 Day (Difference in % Residue)</td>
<td>-</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Demulsibility, 35 ml, 0.02 N CaC12, %</td>
<td>-</td>
<td>60</td>
<td>-</td>
</tr>
<tr>
<td>Cement Mixing Test, %</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Sieve Test, %</td>
<td>-</td>
<td>0.10</td>
<td>-</td>
</tr>
<tr>
<td>Residue by Distillation, %</td>
<td>55</td>
<td>63</td>
<td>63</td>
</tr>
<tr>
<td>Oil Distillate, Volume Total Emulsion, %</td>
<td>-</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>Tests on Residue From Distillation Test</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Penetration, 25ºC, 100 g, 5 Sec.</td>
<td>100</td>
<td>200</td>
<td>100</td>
</tr>
<tr>
<td>Float Test, 60ºC, Sec.</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Tests on Asphalt Base for Emulsion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Penetration, 25ºC, 100 g, 5 Sec.</td>
<td>100</td>
<td>200</td>
<td>100</td>
</tr>
<tr>
<td>Solubility or Trichloroethylene, %</td>
<td>99.0</td>
<td>-</td>
<td>99.0</td>
</tr>
<tr>
<td>Ductility, 25ºC, 5cm/min, cm</td>
<td>100</td>
<td>-</td>
<td>100</td>
</tr>
<tr>
<td>Flash Point, ºC</td>
<td>177</td>
<td>-</td>
<td>177</td>
</tr>
<tr>
<td>Typical Applications: (3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spray Patch, Penetration Macadam</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surface Treatment, Penetration Macadam</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Base and Shoulder Stabilization, Cold Mixes, Shoulder Seal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Penetration Macadam, Hot and Cold Mixes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stockpile Patching Mix</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Base and Shoulder Stabilization</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suggested Temperature Range</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mixing, ºC</td>
<td>Min</td>
<td>Max</td>
<td>Min</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Spraying, ºC</td>
<td>25</td>
<td>60</td>
<td>55</td>
</tr>
</tbody>
</table>

**NOTES:**

1. This viscosity requirement at 50ºC applies to emulsion used for shoulder sealing.
2. Float Test AASHTO T 50, except that the residue from distillation shall be poured immediately into the float collar at 260ºC.
3. These typical applications are intended only as a guide for selecting the proper emulsion grade.
### TABLE 702-6
CATIONIC ASPHALT EMULSIONS

<table>
<thead>
<tr>
<th>TYPE</th>
<th>RAPID SETTING</th>
<th>MEDIUM SETTING</th>
<th>SLOW SETTING</th>
<th>QUICK SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRADE</td>
<td>CRS-1</td>
<td>CRS-2</td>
<td>CMS-2</td>
<td>CMS-2h</td>
</tr>
<tr>
<td>Tests on Emulsion</td>
<td>Min</td>
<td>Max</td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td>Viscosity, Saybolt Furol, 25°C, Sec.</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Viscosity, Saybolt Furol, 50°C, Sec.</td>
<td>20</td>
<td>100</td>
<td>100</td>
<td>400</td>
</tr>
<tr>
<td>Storage Stability Test, 1 Day (Difference in % Residue)</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Classification Test</td>
<td>Passes</td>
<td>Passes</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Sieve Test, %</td>
<td>-</td>
<td>0.10</td>
<td>-</td>
<td>0.10</td>
</tr>
<tr>
<td>Cement Mixing Test, %</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Demulsibility, (ASTM D 244)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Ring and Ball Softening Point, ºC</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Polymer Content, %</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Residue by Distillation, %</td>
<td>60</td>
<td>-</td>
<td>65</td>
<td>-</td>
</tr>
<tr>
<td>Oil Distillate, Volume Total Emulsion, %</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>Tests on Residue From Distillation Test</td>
<td>Min</td>
<td>Max</td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td>Penetration, 25°C, 100 g, 5 Sec.</td>
<td>100</td>
<td>200</td>
<td>100</td>
<td>200</td>
</tr>
<tr>
<td>Tests on Asphalt Base for Emulsion</td>
<td>Min</td>
<td>Max</td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td>Penetration, 25°C, 100 g, 5 Sec.</td>
<td>100</td>
<td>200</td>
<td>100</td>
<td>200</td>
</tr>
<tr>
<td>Ductility, 25°C, 5 cm/min, cm</td>
<td>100</td>
<td>-</td>
<td>100</td>
<td>-</td>
</tr>
<tr>
<td>Flash Point, ºC</td>
<td>177</td>
<td>-</td>
<td>177</td>
<td>-</td>
</tr>
<tr>
<td>Typical Applications</td>
<td>Spray Patch, Penetration Macadam</td>
<td>Surface Treatment, Penetration Macadam</td>
<td>Cold Mixes, Penetration Macadam</td>
<td>Base and Shoulder Stabilization</td>
</tr>
<tr>
<td>Suggested Temperature Range</td>
<td>Min</td>
<td>Max</td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td>Mixing, ºC</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Spraying, ºC</td>
<td>25</td>
<td>60</td>
<td>55</td>
<td>75</td>
</tr>
</tbody>
</table>

**NOTES:**

1. If the Particle Charge Test result is inconclusive, material having a maximum pH value of 6.7 will be acceptable.
2. According to AASHTO T 53.
3. According to AASHTO T 59.
4. These typical applications are intended only as a guide for selecting the proper emulsion grade.
### TABLE 702-9

**ASPHALT EMULSION TACK COAT**

<table>
<thead>
<tr>
<th>MATERIAL DESIGNATION</th>
<th>702-90</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Test Requirements</strong></td>
<td>Minimum</td>
</tr>
<tr>
<td>Sieve Test, %</td>
<td></td>
</tr>
<tr>
<td>Residue by Distillation, %</td>
<td>28</td>
</tr>
<tr>
<td>Oil Distillate, Volume of Total Emulsion, %</td>
<td>2</td>
</tr>
<tr>
<td>Test on Residue from Distillation: Penetration, 25ºC, 100 g, 5 s</td>
<td>40</td>
</tr>
</tbody>
</table>

**The asphalt emulsion tack coat shall be produced by diluting one of the following bituminous materials with a suitable emulsifier solution and thoroughly mixing into a homogeneous liquid:**

- Asphalt Emulsion
  - HFMS-2h 702-3401
- Asphalt Emulsion
  - SS-1h 702-3601
- Cationic Asphalt Emulsion
  - CSS-1h 702-4501

**Suggested Spraying Temperature, ºC**
- 25 min.
- 65 max.

---

**Grid lines** have been added to various Tables for clarity and improved readability, *replace* the following corresponding Tables of the same number and title.

### TABLE 401-1 COMPOSITION OF HOT MIX ASPHALT MIXTURES

<table>
<thead>
<tr>
<th>Mixture Requirements</th>
<th>Permeable Base</th>
<th>Shim</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type 1</strong></td>
<td><strong>Type 2</strong></td>
<td><strong>Type 5</strong></td>
</tr>
<tr>
<td><strong>Screen Sizes</strong></td>
<td>General Limits % Passing¹</td>
<td>Job Mix Tolerance %</td>
</tr>
<tr>
<td>50.0 mm</td>
<td>100</td>
<td>-</td>
</tr>
<tr>
<td>37.5 mm</td>
<td>95-100</td>
<td>-</td>
</tr>
<tr>
<td>25.0 mm</td>
<td>80-95</td>
<td>±6</td>
</tr>
<tr>
<td>12.5 mm</td>
<td>30-60</td>
<td>±6</td>
</tr>
<tr>
<td>6.3 mm</td>
<td>10-25</td>
<td>±6</td>
</tr>
<tr>
<td>3.2 mm</td>
<td>3-15</td>
<td>±6</td>
</tr>
<tr>
<td>850 µm</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>425 µm</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>180 µm</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>75 µm</td>
<td>0-4</td>
<td>±2</td>
</tr>
<tr>
<td>Asphalt Content, %²³</td>
<td>2.0-4.0</td>
<td>NA</td>
</tr>
<tr>
<td>Mixing and Placing Temperature Range ºC</td>
<td>110-150</td>
<td>110-150</td>
</tr>
</tbody>
</table>
### Table Errata to 2006 Standard Specifications

#### TABLE 401-3 QUALITY CONTROL SAMPLING AND TESTING

<table>
<thead>
<tr>
<th>Plant Test Property</th>
<th>Sample Location</th>
<th>Test Method</th>
<th>Quality Control Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggregate Gradation</td>
<td>NYS DOT MM 5.0</td>
<td>AASHTO T27</td>
<td>Note 1</td>
</tr>
<tr>
<td>Aggregate Moisture</td>
<td>NYS DOT MM 5.0</td>
<td>NYS DOT MM 5.0</td>
<td>1 every other sublot Minimum 2 per day</td>
</tr>
<tr>
<td>Air Voids</td>
<td>NYS DOT MM 5.0</td>
<td>AASHTO T166 &amp; T209 MM 5.16M</td>
<td>1 per sublot</td>
</tr>
<tr>
<td>Mix Moisture</td>
<td>NYS DOT MM 5.0</td>
<td>NYS DOT MM 5.0</td>
<td>1 minimum per day</td>
</tr>
<tr>
<td>Mix Temperature</td>
<td>Plant and Haul Vehicle</td>
<td>N/A</td>
<td>Routinely, minimum 4 per day</td>
</tr>
<tr>
<td>Asphalt Binder Content</td>
<td>NYS DOT MM 5.0</td>
<td>NYS DOT MM 5.0</td>
<td>Routinely, minimum 4 per day/mix</td>
</tr>
<tr>
<td>RAP Binder Content</td>
<td>NYS DOT MM 5.0</td>
<td>NYS DOT MM 5.0</td>
<td>NY400-13C 2 per week</td>
</tr>
<tr>
<td>RAP Gradation</td>
<td>NYS DOT MM 5.0</td>
<td>AASHTO T 27</td>
<td>2 per week</td>
</tr>
<tr>
<td>RAP Moisture</td>
<td>NYS DOT MM 5.0</td>
<td>NYS DOT MM 5.0</td>
<td>1 per day</td>
</tr>
<tr>
<td>Asphalt Binder Sampling</td>
<td>NYS DOT MM 8.1</td>
<td>NYS DOT MM 8.1</td>
<td>1 per day</td>
</tr>
<tr>
<td>Friction Aggregate</td>
<td>NYS DOT MM 28</td>
<td>NYS DOT MM 28</td>
<td>As outlined in MM 28</td>
</tr>
</tbody>
</table>

#### TABLE 401-4 ALLOWABLE SPECIMEN TOLERANCE RANGE

<table>
<thead>
<tr>
<th>Mix Types</th>
<th>All Mix Types except the 37.5 mm Maximum Sp.Gr.</th>
<th>37.5 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>.020</td>
<td>.011</td>
</tr>
<tr>
<td>3</td>
<td>.023</td>
<td>------</td>
</tr>
<tr>
<td>4</td>
<td>.025</td>
<td>------</td>
</tr>
</tbody>
</table>

#### TABLE 401-6 HMA HOLDING BIN ACCEPTANCE CRITERIA

<table>
<thead>
<tr>
<th>Property</th>
<th>Acceptance Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mix Temperature</td>
<td>±10°C from pugmill discharge temperature.</td>
</tr>
<tr>
<td>Aggregate Gradation</td>
<td>Within Job Mix Formula tolerances (applies to pugmill discharge mean gradation).</td>
</tr>
<tr>
<td>Asphalt Binder Content</td>
<td>±0.4% (applies to pugmill discharge mean asphalt binder content).</td>
</tr>
<tr>
<td>Asphalt Binder Recovered from Mixtures</td>
<td></td>
</tr>
<tr>
<td>Dynamic Shear (TP5)</td>
<td>G*/sin δ, min., 2.20 kPa</td>
</tr>
<tr>
<td>Specification Types</td>
<td>50 Series</td>
</tr>
<tr>
<td>---------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>Coarse Agg. Type = F1 &amp; Coarse Agg. Type = F2</td>
<td>Use</td>
</tr>
<tr>
<td>Compaction Monitoring</td>
<td>Compaction monitoring using 4 cores every day.</td>
</tr>
<tr>
<td>Coarse Agg. Type = F3</td>
<td>Use</td>
</tr>
<tr>
<td>Compaction Monitoring</td>
<td>Compaction monitoring using PTD based on average of 4 cores.</td>
</tr>
<tr>
<td>Coarse Agg. Type = F9</td>
<td>Use</td>
</tr>
<tr>
<td>Compaction Monitoring</td>
<td>Compaction monitoring using 4 cores every day.</td>
</tr>
</tbody>
</table>
**TABLE 501-3 CONCRETE MIXTURES**

Design Mix Guidelines (where sand fineness modulus = 2.80)¹

<table>
<thead>
<tr>
<th>Concrete Class</th>
<th>T.C.M.⁵ Content (kg/m³)</th>
<th>Sand % Total Agg. (solid volume)</th>
<th>Water/cementitious mat’ls (by mass)</th>
<th>Air Content % desired (Range)</th>
<th>Slump Range (mm)</th>
<th>Type of Coarse Aggregate Gradation</th>
<th>Primary Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>360</td>
<td>36.2</td>
<td>0.46</td>
<td>6.5 (5.0 - 8.0)</td>
<td>65 - 90</td>
<td>CA 2</td>
<td>general purpose structural</td>
</tr>
<tr>
<td>C6</td>
<td>359</td>
<td>35.8</td>
<td>0.44</td>
<td>6.5 (5.0 - 8.0)</td>
<td>25 - 75</td>
<td>CA 2</td>
<td>Pavement: slipform paving, form paving</td>
</tr>
<tr>
<td>D</td>
<td>430</td>
<td>45.8</td>
<td>0.44</td>
<td>7.5 (6.0 - 9.0)</td>
<td>65 - 90</td>
<td>CA 1</td>
<td>thin structural applications</td>
</tr>
<tr>
<td>DP²</td>
<td>430</td>
<td>45.8</td>
<td>0.40</td>
<td>7.5 (6.0 - 9.0)</td>
<td>75-125</td>
<td>CA 1</td>
<td>thin structural applications, overlays</td>
</tr>
<tr>
<td>E</td>
<td>384</td>
<td>35.8</td>
<td>0.44</td>
<td>6.5 (5.0 - 8.0)</td>
<td>75 - 100</td>
<td>CA 2</td>
<td>structural slabs and structural approach slabs</td>
</tr>
<tr>
<td>F</td>
<td>425</td>
<td>34.6</td>
<td>0.38</td>
<td>6.5 (5.0 - 8.0)</td>
<td>50 - 75</td>
<td>CA 2</td>
<td>high early strength for pavement or structural applications</td>
</tr>
<tr>
<td>G³</td>
<td>431</td>
<td>45.0</td>
<td>0.45</td>
<td>6.0 (4.0 - 8.0)</td>
<td>150-180</td>
<td>CA 2</td>
<td>underwater</td>
</tr>
<tr>
<td>GG³</td>
<td>475</td>
<td>45.0</td>
<td>0.45</td>
<td>6.0 (4.0 - 8.0)</td>
<td>150-180</td>
<td>CA 1</td>
<td>underwater (special)</td>
</tr>
<tr>
<td>H</td>
<td>400</td>
<td>40.0</td>
<td>0.44</td>
<td>6.5 (5.0 - 8.0)</td>
<td>75 - 100</td>
<td>CA 2</td>
<td>pumping applications</td>
</tr>
<tr>
<td>HP²</td>
<td>405</td>
<td>40.0</td>
<td>0.40</td>
<td>6.5 (5.0 - 8.0)</td>
<td>75 - 125</td>
<td>CA 2</td>
<td>pumping, structural slabs, approach slabs, substructures exposed to chlorides</td>
</tr>
<tr>
<td>I⁴</td>
<td>380</td>
<td>41.0</td>
<td>0.44</td>
<td>6.0 (4.0 - 8.0)</td>
<td>15 - 40</td>
<td>CA 2</td>
<td>slip forming highway median barriers</td>
</tr>
<tr>
<td>J⁴</td>
<td>403</td>
<td>45.8</td>
<td>0.44</td>
<td>6.0 (4.0 - 8.0)</td>
<td>15 - 40</td>
<td>CA 1</td>
<td>slip forming structural median barriers, parapet walls and curbs</td>
</tr>
</tbody>
</table>
### TABLE 501-4 BATCHING TOLERANCES

<table>
<thead>
<tr>
<th>Material</th>
<th>Permissible Variation</th>
</tr>
</thead>
</table>
| Cement, Pozzolan, or Blended Cement | ± 1% (by mass) of total cementitious materials, if no microsilica is weighed cumulatively on common scale. 
|                           | ± 0.5% (by mass) of total cementitious materials, if microsilica powder is weighed cumulatively on a common scale. |
| Microsilica Powder        | ± 0.5% (by mass) of total cementitious materials, if weighed cumulatively with cement, Type IP or SM blend, or pozzolan. 
|                           | ± 1% (by mass) if weighed on a separate scale. |
| Microsilica Slurry        | ± 2% (by volume)                                                                        |
| Aggregate                 | ±2% (by mass)                                                                            |
| Water (See Note 1)        | ± 1% (by mass or volume)                                                                  |
| Admixtures 711-08         | ± 3% (by mass or volume) or ± 1 meter pulse (see Note 3), whichever is greater.          |
| Admixture (other)         | contact Director, Materials Bureau                                                        |
| Zero - Aggregate (See Note 2) | ± 2%                                                                                     |
| Zero - Cementitious Mat’ls. (See Note 2) | ± 1%                                                                                     |
| Zero - Water (See Note 1, 2) | ± 1%                                                                                     |

### TABLE 501-5 CONCRETE UNIFORMITY

<table>
<thead>
<tr>
<th>Test</th>
<th>Permissible Variation (Concrete samples taken at two locations in the batch)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass per cubic meter calculated to an air-free basis</td>
<td>32.0 kg per m³</td>
</tr>
<tr>
<td>Air Content, % by volume of concrete</td>
<td>1.0%</td>
</tr>
<tr>
<td>Slump:</td>
<td></td>
</tr>
<tr>
<td>Average slump 100 mm or less</td>
<td>25 mm</td>
</tr>
<tr>
<td>Average slump greater than 100 mm</td>
<td>40 mm</td>
</tr>
<tr>
<td>Coarse aggregate content, portion by mass of each sample retained on a 4.75 mm sieve</td>
<td>6.0%</td>
</tr>
<tr>
<td>Unit mass of air-free mortars based on average for all comparative samples tested</td>
<td>1.6 %</td>
</tr>
<tr>
<td>Central Mixed Concrete</td>
<td>Transit Mixed Concrete</td>
</tr>
<tr>
<td>------------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td><strong>Begin Batching</strong></td>
<td><strong>Begin Batching</strong></td>
</tr>
<tr>
<td>Load mixer</td>
<td>Hatch load, or ribbon load materials through barrel hopper.</td>
</tr>
<tr>
<td><strong>End of Batching and Begin Mixing</strong></td>
<td>Add approx. 90% of design water</td>
</tr>
<tr>
<td>90 Second minimum after all materials are in the mixer.</td>
<td></td>
</tr>
<tr>
<td><strong>End of Mixing</strong></td>
<td><strong>Begin Mixing</strong></td>
</tr>
<tr>
<td>Open Haul Units</td>
<td>at plant or in transit</td>
</tr>
<tr>
<td>Rotating Drum</td>
<td><strong>Cement In Contact With Aggregates</strong></td>
</tr>
<tr>
<td>Agitate 2-6 rpm</td>
<td>5 Minutes max.</td>
</tr>
<tr>
<td>30 Minutes maximum</td>
<td><strong>Class HP or Class DP</strong></td>
</tr>
<tr>
<td>maximum</td>
<td>100 rev. minimum</td>
</tr>
<tr>
<td></td>
<td>200 rev. maximum</td>
</tr>
<tr>
<td>Completion of Discharge</td>
<td>Mix: 6-18 rpm</td>
</tr>
<tr>
<td>(When concrete is transported in units approved for mixing, see Note 1)</td>
<td>▲</td>
</tr>
<tr>
<td>90 Minutes max.</td>
<td><strong>All Other Classes</strong></td>
</tr>
<tr>
<td>(Note 2)</td>
<td>160 rev. maximum</td>
</tr>
<tr>
<td></td>
<td>Mix: 6-18 rpm</td>
</tr>
<tr>
<td>End of Mixing</td>
<td><strong>End of Mixing</strong></td>
</tr>
<tr>
<td>Agitate 2-6 rpm</td>
<td><strong>Begin Discharge</strong></td>
</tr>
<tr>
<td></td>
<td>50 Minutes maximum</td>
</tr>
</tbody>
</table>
### Table 555-4 Minimum Time for Form Removal/Forming/Loading Limitations - Substructures (1)

<table>
<thead>
<tr>
<th>Substructure Piece</th>
<th>Stripping (2)</th>
<th>Forming Next Placement</th>
<th>Loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Footings</td>
<td>2 days</td>
<td>2 days</td>
<td>4 days before next placement</td>
</tr>
<tr>
<td>Abutment stems, backwalls</td>
<td>2 days if less than 3.0 m (avg.). Add 1 day for each additional 1.5 m to 5 days, maximum.</td>
<td>2 days</td>
<td>5 days before placing backwall on stem. 7 days before backfilling, 14 days before placing superstructure loads. (3)</td>
</tr>
<tr>
<td>Pier Columns, Pier Plinths</td>
<td>2 days if less than 3.0 m high (avg.). Add 1 day for each additional 1.5 m.</td>
<td>4 days - columns 2 days if forming pedestal</td>
<td>Columns - 7 days before placing cap beam. Plinth - 2 days before pedestal placement. 21 days before placing superstructure loads. (3)</td>
</tr>
<tr>
<td>Pier cap beams</td>
<td>8 days (bottom) 3 days (sides)</td>
<td>2 days</td>
<td>5 days before pedestal placement. 21 days before placing superstructure loads. (3)</td>
</tr>
<tr>
<td>All pedestals</td>
<td>2 days</td>
<td></td>
<td>7 days (class A) 3 days (class F) (4)</td>
</tr>
<tr>
<td>Wingwalls or Retaining walls</td>
<td>Same as abutment stems.</td>
<td></td>
<td>14 days before backfilling (3)</td>
</tr>
<tr>
<td>Arch centers Centering under beams</td>
<td>8 days</td>
<td></td>
<td>14 days (3)</td>
</tr>
</tbody>
</table>

### Table 619-1 Required Treatment for Pavement Edge Drop-Offs

<table>
<thead>
<tr>
<th>Depth of Drop-off (mm.)</th>
<th>Anticipated Exposure Time (Calendar Days)</th>
<th>AADT, 7500 Operating Speed 70 km/h</th>
<th>Operating Speed &gt; 70 km/h</th>
<th>AADT, 7500 and all Freeways and Expressways Operating Speed 70 km/h</th>
<th>Operating Speed &gt; 70 km/h</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 to 150</td>
<td>≤7</td>
<td>30</td>
<td>45</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>8 to 60</td>
<td>30 / 1:1</td>
<td>60 / 1:1</td>
<td>15 / 1:1</td>
<td>30 / 1:1</td>
</tr>
<tr>
<td></td>
<td>60+</td>
<td>30 / 1:1</td>
<td>60 / 1:1</td>
<td>15 / 1:3</td>
<td>60 / 1:3</td>
</tr>
<tr>
<td>150 to 600</td>
<td>≤7</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>8 to 60</td>
<td>15</td>
<td>60 / 1:3</td>
<td>30 / 1:3</td>
<td>60 / 1:3</td>
</tr>
<tr>
<td></td>
<td>60+</td>
<td>15</td>
<td>60 / 1:3</td>
<td>30 / 1:3</td>
<td>60 / 1:3</td>
</tr>
<tr>
<td>600+</td>
<td>≤7</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>8 to 60</td>
<td>30 / 1:3</td>
<td>60 / 1:3</td>
<td>30 / 1:3</td>
<td>60 / 1:3</td>
</tr>
<tr>
<td></td>
<td>60+</td>
<td>30 / 1:3</td>
<td>60 / 1:3</td>
<td>30 / 1:3</td>
<td>Positive Barrier</td>
</tr>
</tbody>
</table>
### TABLE 619-3 GUIDERAIL & CONCRETE BARRIER DEFLECTION DISTANCES

<table>
<thead>
<tr>
<th>Guide Rail Type</th>
<th>Post Spacing</th>
<th>Deflection Distances</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable</td>
<td>4880 mm</td>
<td>3350 mm</td>
</tr>
<tr>
<td></td>
<td>3660 mm</td>
<td>2900 mm</td>
</tr>
<tr>
<td></td>
<td>2440 mm</td>
<td>2440 mm</td>
</tr>
<tr>
<td></td>
<td>1220 mm</td>
<td>2130 mm</td>
</tr>
<tr>
<td>Corrugated Beam (Weak Post)</td>
<td>3810 mm</td>
<td>2440 mm</td>
</tr>
<tr>
<td></td>
<td>1900 mm</td>
<td>1830 mm</td>
</tr>
<tr>
<td></td>
<td>1270 mm</td>
<td>1520 mm</td>
</tr>
<tr>
<td>Corrugated Beam (Heavy Post)</td>
<td>1900 mm</td>
<td>1220 mm</td>
</tr>
<tr>
<td></td>
<td>950 mm</td>
<td>610 mm</td>
</tr>
<tr>
<td>Box Beam</td>
<td>1830 mm</td>
<td>1520 mm</td>
</tr>
<tr>
<td></td>
<td>910 mm</td>
<td>1220 mm</td>
</tr>
<tr>
<td>Concrete Barrier</td>
<td>NOT APPLICABLE</td>
<td>0 mm</td>
</tr>
</tbody>
</table>

### FIGURE 620-1 STONE FILLING GRADATION REQUIREMENTS

<table>
<thead>
<tr>
<th>Stone Filling Item</th>
<th>See Notes</th>
<th>Stone Size 1</th>
<th>Percent of Total by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fine</td>
<td>2, 3, 4</td>
<td>Smaller than 200 mm</td>
<td>90 - 100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Larger than 75 mm</td>
<td>50 - 100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Smaller than 2.0 mm</td>
<td>0 - 10</td>
</tr>
<tr>
<td>Light</td>
<td>2, 3, 4</td>
<td>Lighter than 50 kg</td>
<td>90 - 100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Larger than 150 mm</td>
<td>50 - 100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Smaller than 12 mm</td>
<td>0 - 10</td>
</tr>
<tr>
<td>Medium</td>
<td>2, 4</td>
<td>Heavier than 50 kg</td>
<td>50 - 100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Smaller than 150 mm</td>
<td>0 - 10</td>
</tr>
<tr>
<td>Heavy</td>
<td>2, 4, 5</td>
<td>Heavier than 300 kg</td>
<td>50 - 100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Smaller than 150 mm</td>
<td>0 - 10</td>
</tr>
</tbody>
</table>

Page 693 under §680
### Table Errata to 2006 Standard Specifications

#### Group Number Indication Wire Color Code*

<table>
<thead>
<tr>
<th>GROUP NUMBER</th>
<th>INDICATION</th>
<th>WIRE COLOR CODE*</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Red</td>
<td>14/19C-2-R/W</td>
</tr>
<tr>
<td></td>
<td>Yellow</td>
<td>14/19C-2-BL/W</td>
</tr>
<tr>
<td></td>
<td>Green</td>
<td>14/19C-2-G/W</td>
</tr>
<tr>
<td></td>
<td>Ground Wire</td>
<td>14/19C-2-B/W</td>
</tr>
<tr>
<td>8</td>
<td>Red</td>
<td>14/19C-2-B/R</td>
</tr>
<tr>
<td></td>
<td>Yellow</td>
<td>14/19C-2-O/R</td>
</tr>
<tr>
<td></td>
<td>Green</td>
<td>14/19C-2-BL/R</td>
</tr>
<tr>
<td></td>
<td>Ground Wire</td>
<td>14/19C-2-W/R</td>
</tr>
<tr>
<td>9</td>
<td>Red</td>
<td>14/19C-3-R</td>
</tr>
<tr>
<td></td>
<td>Yellow</td>
<td>14/19C-3-O</td>
</tr>
<tr>
<td></td>
<td>Green</td>
<td>14/19C-3-G</td>
</tr>
<tr>
<td></td>
<td>Ground Wire</td>
<td>14/19C-3-W</td>
</tr>
<tr>
<td>10</td>
<td>Red</td>
<td>14/19C-3-R/B</td>
</tr>
<tr>
<td></td>
<td>Yellow</td>
<td>14/19C-3-O/B</td>
</tr>
<tr>
<td></td>
<td>Green</td>
<td>14/19C-3-G/B</td>
</tr>
<tr>
<td></td>
<td>Ground Wire</td>
<td>14/19C-3-W/B</td>
</tr>
</tbody>
</table>

#### PED Number Wire Color Code* Indication

<table>
<thead>
<tr>
<th>PED NUMBER</th>
<th>WIRE COLOR CODE*</th>
<th>INDICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>14/5C-1-P/R</td>
<td>DONT WALK</td>
</tr>
<tr>
<td></td>
<td>14/5C-1-P/G</td>
<td>WALK</td>
</tr>
<tr>
<td></td>
<td>14/5C-1-P/B</td>
<td>Switch Wire</td>
</tr>
<tr>
<td></td>
<td>14/5C-1-P/O</td>
<td>Switch Wire</td>
</tr>
<tr>
<td></td>
<td>14/5C-1-P/W</td>
<td>Ground Wire</td>
</tr>
<tr>
<td>2</td>
<td>14/5C-2-P/R</td>
<td>DONT WALK</td>
</tr>
<tr>
<td></td>
<td>14/5C-2-P/G</td>
<td>WALK</td>
</tr>
<tr>
<td></td>
<td>14/5C-2-P/B</td>
<td>Switch Wire</td>
</tr>
<tr>
<td></td>
<td>14/5C-2-P/O</td>
<td>Switch Wire</td>
</tr>
<tr>
<td></td>
<td>14/5C-2-P/W</td>
<td>Ground Wire</td>
</tr>
<tr>
<td>3</td>
<td>14/5C-3-P/R</td>
<td>DONT WALK</td>
</tr>
<tr>
<td></td>
<td>14/5C-3-P/G</td>
<td>WALK</td>
</tr>
<tr>
<td></td>
<td>14/5C-3-P/B</td>
<td>Switch Wire</td>
</tr>
<tr>
<td></td>
<td>14/5C-3-P/O</td>
<td>Switch Wire</td>
</tr>
<tr>
<td></td>
<td>14/5C-3-P/W</td>
<td>Ground Wire</td>
</tr>
<tr>
<td>4</td>
<td>14/5C-4-P/R</td>
<td>DONT WALK</td>
</tr>
<tr>
<td></td>
<td>14/5C-4-P/G</td>
<td>WALK</td>
</tr>
<tr>
<td></td>
<td>14/5C-4-P/B</td>
<td>Switch Wire</td>
</tr>
<tr>
<td></td>
<td>14/5C-4-P/O</td>
<td>Switch Wire</td>
</tr>
<tr>
<td></td>
<td>14/5C-4-P/W</td>
<td>Ground Wire</td>
</tr>
<tr>
<td>Material Designation</td>
<td>Crushed Stone 703-0201</td>
<td>Crushed Gravel 703-0202</td>
</tr>
<tr>
<td>---------------------</td>
<td>------------------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>Magnesium Sulfate Test (703-07 P,G)(^{(2)})</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. percent loss by weight at 10 cycles</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>Freezing and Thawing Test (703-08 P,G)(^{(3)})</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. percent loss by weight at 25 cycles</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Los Angeles Abrasion Test (703-11 P,G)</td>
<td>35(^{(4)})</td>
<td>45(^{(5)})</td>
</tr>
<tr>
<td>Flat Particles, Elongated Particles, or Flat and Elongated Particles (ASTM D 4791)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum percent by weight Flat and Elongated to the Degree of 5:1</td>
<td>10(^{(6)})</td>
<td>10(^{(6)})</td>
</tr>
<tr>
<td>Crushed Particles in any primary size (ASTMD 5821)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum percent by weight Larger than 12.5mm (1 fractured face)</td>
<td>-</td>
<td>75(^{(7)})</td>
</tr>
<tr>
<td>Smaller than 12.5mm (2 fractured faces)</td>
<td>--</td>
<td>85(^{(7)})</td>
</tr>
<tr>
<td>Minimum unit weight (703-10 P,G) kg/m3</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
### Table 715-04-1 Physical and Chemical Requirements

<table>
<thead>
<tr>
<th>PRODUCT</th>
<th>ALLOY &amp; TEMPERS</th>
<th>ASTM SPEC.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wire</td>
<td>1100-H38, 3003-H14, 5052-H38, 6061-T941</td>
<td>B211M, B211M</td>
</tr>
<tr>
<td>Bars and Rod</td>
<td>2024-T4, 6061-T6</td>
<td>B211M, B211M</td>
</tr>
<tr>
<td>Extruded Bars and Rods and Shapes</td>
<td>5154-0, 6061-T6, 6063-T5</td>
<td>B221M, B221M, B221M</td>
</tr>
<tr>
<td>Extruded Shapes</td>
<td>6063-T6, 6005-T5, 6351-T6</td>
<td>B211M, B211M, B211M</td>
</tr>
<tr>
<td>Drawn Seamless Tube</td>
<td>6061-T6, 6063-T832</td>
<td>B210M, B210M</td>
</tr>
<tr>
<td>Extruded Tube</td>
<td>6061-T6</td>
<td>B241M, B241M</td>
</tr>
<tr>
<td>Pipe</td>
<td>6061-T6, 6063-T6</td>
<td>B241M, B241M</td>
</tr>
<tr>
<td>Structural, Rolled or Extruded</td>
<td>6061-T6</td>
<td>B308M</td>
</tr>
<tr>
<td>Welding Rods and Bare Electrodes</td>
<td>4043-O, 5154-0</td>
<td>Not ASTM, Not ASTM</td>
</tr>
</tbody>
</table>

### Table 718-06-1 Testing Requirements for HP Concrete

<table>
<thead>
<tr>
<th>PROPERTY</th>
<th>TEST METHOD</th>
<th>ACCEPTANCE CRITERIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressive Strength (at 56 days)</td>
<td>AASHTO T22</td>
<td>&gt; 70MPa (all tests)</td>
</tr>
<tr>
<td>Freeze/Thaw Durability (x=relative dynamic modulus of elasticity after 300 cycles)</td>
<td>AASHTO T161 Procedure A</td>
<td>x ≥ 80%</td>
</tr>
<tr>
<td>Scaling Resistance (y= visual rating of surface after 50 cycles)</td>
<td>ASTM C672</td>
<td>y ≤ 3</td>
</tr>
<tr>
<td>Elasticity (E = modulus of elasticity)</td>
<td>ASTM C469 (Note C)</td>
<td>E ≥ 30GPa</td>
</tr>
<tr>
<td>Shrinkage (s= microstrain)</td>
<td>AASHTO T160-97 (at 56 days)</td>
<td>s &lt; 600</td>
</tr>
<tr>
<td>Creep (c = microstrain/pressure unit)</td>
<td>ASTM C512 (at 56 days, 40% fc')</td>
<td>c ≤ 60/ MPa</td>
</tr>
<tr>
<td>Chloride Penetration (p= increase in percent of chloride ion by weight of concrete)</td>
<td>AASHTO T259 modified (Note A)</td>
<td>p ≤ 0.025% at 25 mm</td>
</tr>
<tr>
<td>Air Content</td>
<td>AASHTO T 152</td>
<td>A = % selected by contractor, A ≥ 3%</td>
</tr>
<tr>
<td>Water/Cementitious-Materials ratio (W= mass ratio)</td>
<td>AASHTO TP23-93 (Note B)</td>
<td>Supplier selects W, W &lt; 0.40</td>
</tr>
<tr>
<td>Bolt (ASTM F568)</td>
<td>Bolt Size</td>
<td>Allowable Nuts&lt;sup&gt;1&lt;/sup&gt; (ASTM A563m)</td>
</tr>
<tr>
<td>------------------</td>
<td>-----------</td>
<td>----------------------------------------</td>
</tr>
<tr>
<td>CLASS 4.6</td>
<td>M5 to M36 M42 to M100</td>
<td>5 - H1 5 - HH</td>
</tr>
<tr>
<td>CLASS 8.8</td>
<td>M16 to M36 M42 to M100</td>
<td>9 - H2 12 - H2 9 - HH 12 - HH</td>
</tr>
<tr>
<td>CLASS 10.9</td>
<td>M5 to M36 M42 to M100</td>
<td>10 - H1 12 - HH</td>
</tr>
</tbody>
</table>