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>
<td>Concrete Repair Material</td>
<td>701-04</td>
<td>(Aluminum)</td>
<td></td>
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<tr>
<td>Vertical Overhead Patching Material</td>
<td>701-08</td>
<td>Corrugated Aluminum Pipe</td>
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</tr>
<tr>
<td>Grout Sand</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>
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<tr>
<td>PVC Pipe (relining)</td>
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<td>Anchor Bolts for Corrugated</td>
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<td></td>
<td></td>
<td>Culverts</td>
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<td></td>
<td></td>
<td>Zinc Chromate Primer</td>
<td>708-04</td>
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<td>Membrane Curing Compound</td>
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<td>Coal Tar Epoxy Paint</td>
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<tr>
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<td>(Polymer Coated)</td>
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</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

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 needlefelt 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:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
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<tbody>
<tr>
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<td>Paving Inverts with Portland Cement Concrete</td>
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<tr>
<td>602.2101 M</td>
<td>Lining Culvert with Shotcrete</td>
<td>Square Meter</td>
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<td>602.25xx M</td>
<td>Lining with High Density Polyethylene Pipe</td>
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<td>602.30xx M</td>
<td>Lining with Polyvinyl Chloride Pipe</td>
<td>Meter</td>
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<td>602.35xx M</td>
<td>Lining with Polyester Formed in Place Pipe Liner</td>
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<td>602.40xx M</td>
<td>Lining with Corrugated Aluminum Pipe Type IR</td>
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<td>Lining with Aluminum Coated (Type 2) CSP Type IR, 12 gauge</td>
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<td>Lining with Aluminum Structural Plate Pipe (230x65)</td>
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<td>602.550101 M</td>
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<td>602.550102 M</td>
<td>Lining with Steel Tunnel Liner Plate 4.17 mm thick</td>
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<td>602.550103 M</td>
<td>Lining with Steel Tunnel Liner Plate 4.55 mm thick</td>
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<td>602.550104 M</td>
<td>Lining with Steel Tunnel Liner Plate 5.31 mm thick</td>
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<td>602.550105 M</td>
<td>Lining with Steel Tunnel Liner Plate 6.07 mm thick</td>
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<td>602.600102 M</td>
<td>Lining with Aluminum Tunnel Liner Plate 3.81 mm thick</td>
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<td>602.600201 M</td>
<td>Lining with Aluminum Tunnel Liner Plate 4.45 mm thick</td>
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<td>602.600202 M</td>
<td>Lining with Aluminum Tunnel Liner Plate 5.08 mm thick</td>
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<td>602.600301 M</td>
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<td>602.65xx M</td>
<td>Lining with Concrete-Lined CSP (68x13)</td>
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602.70xx M  Lining with Concrete-Lined CSP (125x25)  Meter
602.75xx M  Lining with Polymer Coated CSP 12ga, 68x13  Meter
602.80xx M  Lining with Polymer Coated CSP 12ga, (75x25) or (125x25)  Meter

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.

603-2 MATERIALS

603-2.01 General. Materials requirements are specified in the following subsections:

<table>
<thead>
<tr>
<th>Material</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geotextile</td>
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</tr>
<tr>
<td>Portland Cement Concrete</td>
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<td>Portland Cement</td>
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<tr>
<td>Masonry Cement</td>
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<td>Non-Reinforced Concrete Pipe</td>
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<tr>
<td>Reinforced Concrete Pipe</td>
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<tr>
<td>Reinforced Concrete Elliptical Pipe</td>
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<tr>
<td>Reinforced Concrete End Sections</td>
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<td>Smooth Interior Corrugated Polystyrene Pipe</td>
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<td>Corrugated Steel Pipe</td>
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<td>Ductile Iron Pipe (Non-Pressure)</td>
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<td>Corrugated Structural Steel Plate for Pipe</td>
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<td>Pipe-Arches and Underpasses</td>
<td>707-09</td>
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<tr>
<td>Galvanized Steel End Sections</td>
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<td>Aluminum End Sections</td>
<td>707-11</td>
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<td>Corrugated Aluminum Pipe</td>
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<td>Corrugated Aluminum Structural</td>
<td>707-14</td>
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<tr>
<td>Plate for Pipe and Pipe-Arches</td>
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<tr>
<td>Anchor Bolts for Corrugated Culverts</td>
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<tr>
<td>Zinc Chromate Primer</td>
<td>708-04</td>
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<tr>
<td>Wire Fabric for Concrete</td>
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<td>Reinforcement</td>
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<td>Plastic Coated Fiber Blankets</td>
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<tr>
<td>Membrane Curing Compound</td>
<td>711-05</td>
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<tr>
<td>Water</td>
<td>712-01</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 Contractor's expense.

**603.05 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 additional 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.

**603.06 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 no 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 Section §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 caulkling 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 caulkling 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 A.A.S.H.T.O. 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
§603-3

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 §555-3.06, Provisions for Concreting in Cold Weather, shall apply.

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.

**603-5.03 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:**

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>603.02xx M</td>
<td>Non-Reinforced Concrete Pipe</td>
<td>Meter</td>
</tr>
<tr>
<td>603.05xx M</td>
<td>Corrugated Steel Pipe (68 x 13)</td>
<td>Meter</td>
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<td>603.06xx M</td>
<td>Corrugated Steel Pipe Paved Invert (68 x 13)</td>
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<td>603.07xx M</td>
<td>Corrugated Steel Pipe Fully Paved (68 x 13)</td>
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<td>603.08xx M</td>
<td>Corrugated Steel Pipe Arch (68 x 13)</td>
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<td>603.09xx M</td>
<td>Corrugated Steel Pipe Arch, Paved Invert (68 x 13)</td>
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<td>603.11xx M</td>
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<td>Galvanized Steel End Sections Pipe (68 x 13)</td>
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<td>603.18xx M</td>
<td>Galvanized Steel End Sections Pipe Arch (68 x 13)</td>
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<td>603.19xx M</td>
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<td>Galvanized Steel End Sections Pipe Arch (75 x 25) or (125 x 25)</td>
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<td>Corrugated Structural Steel Plate Pipe (2895 - 4115 Diam.)</td>
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<td>Corrugated Structural Steel Plate Pipe (5640 - 6400 Diam.)</td>
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<td>603.27xx M</td>
<td>Corrugated Structural Steel Plate Pipe PCC Paved Invert (1525 - 2745 Diam.)</td>
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<td>Corrugated Structural Steel Plate Pipe PCC Paved Invert</td>
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603.30xx M  Corrugated Structural Steel Plate Pipe PCC Paved Invert
(5640 - 6400 Diam.)  Meter

603.31xx M  Corrugated Structural Steel Plate Pipe Arch
(1780 - 6225 span, 9PI, Corner Plate)  Meter 5

603.32xx M  Corrugated Structural Steel Plate Pipe Arch, PCC Paved Invert
(1780 - 6225 span, 9PI, Corner Plate)  Meter

603.35xx M  Corrugated Structural Steel Plate Underpass  Meter

603.40xx M  Round Corrugated Aluminum Pipe (68 x 13) (300 -750 Diam.)  Meter

603.41xx M  Round Corrugated Aluminum Pipe (75 x 25) (900-2400 Diam.)  Meter 10

603.44xx M  Corrugated Aluminum Structural Plate Pipe
(230 x 65)(1525-2895 Diam.)  Meter

603.46xx M  Corrugated Aluminum Structural Plate Pipe
(230 x 65)(3050 - 4570 Diam.)  Meter

603.48xx M  Corrugated Aluminum Structural Plate Pipe-Arch
(68 x 13)(430 Span, 330 Rise) to (1440 Span, 970 Rise), and
(75 x 25) (1520 span, 1170 Rise to 2400 Span, 1720 Rise)  Meter 15

603.50xx M  Corrugated Aluminum Structural Plate Pipe-Arch (230 x 65)
(1850 Span, 1500 Rise to 3353 Span, 2160 Rise)  Meter

603.52xx M  Corrugated Aluminum Structural Plate Pipe-Arch
(230 x 65) (3734 Span, 2210 Rise to 5920 Span, 3630 Rise)  Meter 20

603.53xx M  Corrugated Aluminum Pipe, Type IIR  Meter

603.54xx M  Corrugated Aluminum End Sections Pipe  Each

603.55xx M  Corrugated Aluminum End Sections, Pipe Arch  Each

603.56xx M  Corrugated Steel Pipe- Type IR  Meter 25

603.58xx M  Corrugated Aluminum Pipe- Type IR  Meter

603.59xx M  Corrugated Steel Pipe- Type IIR  Meter

603.60xx M  Reinforced Concrete Pipe Class III  Meter

603.61xx M  Reinforced Concrete Pipe Class IV  Meter

603.62xx M  Reinforced Concrete Pipe Class V  Meter 30

603.66xx M  Reinforced Concrete Horizontal Elliptical Pipe Class HE II  Meter

603.67xx M  Reinforced Concrete Horizontal Elliptical Pipe, Class HE III  Meter

603.68xx M  Reinforced Concrete Horizontal Elliptical Pipe, Class HE IV  Meter

603.69xx M  Reinforced Concrete Vertical Elliptical Pipe, Class VE IV  Meter

603.70xx M  Reinforced Concrete Vertical Elliptical Pipe, Class VE V  Meter 35

603.71xx M  Reinforced Concrete Vertical Elliptical Pipe, Class VE VI  Meter

603.72xx M  Reinforced Concrete Cattle Pass  Meter

603.73xx M  Reinforced Concrete Pipe End Sections  Each

603.74xx M  Reinforced Concrete Pipe Class II  Meter

603.77 M  Concrete Collars  Each 40

603.79xx M  Galvanized Steel Pipe End Sections
(Options) (68 x 13) or (75 x 25) or (125 x 25)  Each

603.80xx M  Corrugated Steel Pipe-Polymer Coated (68x13)  Meter

603.81xx M  Corrugated Steel Pipe-Polymer Coated Paved Invert (68x13)  Meter

603.82xx M  Corrugated Steel Pipe-Arch Polymer Coated (68x13)  Meter 45

603.83xx M  Corrugated Steel Pipe-Arch Polymer Coated Paved Invert (68x13)  Meter

603.84xx M  Corrugated Steel Pipe-Polymer Coated (75x25) or (125x25)  Meter

603.85xx M  Corrugated Steel Pipe-Polymer Coated Paved Invert
(75x25) or (125x25)  Meter

603.86xx M  Corrugated Steel Pipe-Arch Polymer Coated (75x25) or (125x25)  Meter 50

603.87xx M  Corrugated Steel Pipe-Arch Polymer Coated Paved Invert

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NEW YORK STATE DEPARTMENT OF TRANSPORTATION
STANDARD SPECIFICATIONS of January 2, 2002
603.88xx M  Corrugated Steel Pipe-Aluminum Coated (Type II) (68x13)  Meter
603.89xx M  Corrugated Steel Pipe-Arch Aluminum Coated (Type I) (68x13)  Meter
603.90xx M  Corrugated Steel Pipe-Aluminum Coated (Type II)
(75x25) or (125x25)  Meter
603.91xx M  Corrugated Steel Pipe-Arch Aluminum Coated (Type II)
(75x25) or (125x25)  Meter
603.92xx M  Corrugated Steel Pipe-Aluminum Coated (Type II) Type IR  Meter
603.93xx M  Corrugated Steel Pipe-Arch Aluminum Coated (Type II) Type IIR  Meter
603.95xx M  Ductile Iron Pipe  Meter
603.96xx M  Smooth Lined Corrugated Aluminum Pipe (68 x 13)  Meter
603.97xx M  Smooth Lined Corrugated Aluminum Pipe (75 x 25)  Meter
603.98xx M  Smooth Interior Corrugated Polyethylene Culvert and
Storm Drain Pipe  Meter
603.99xx M  Relaying Pipe  Meter

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 gates 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:

<table>
<thead>
<tr>
<th>Material Description</th>
<th>Item Number</th>
</tr>
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<tbody>
<tr>
<td>Cast-in-Place Concrete - Class A</td>
<td>501</td>
</tr>
<tr>
<td>Frames and Grates</td>
<td>655</td>
</tr>
<tr>
<td>Concrete Repair Material</td>
<td>701-04</td>
</tr>
<tr>
<td>Concrete Grouting Material</td>
<td>701-05</td>
</tr>
<tr>
<td>Precast Concrete Pavers</td>
<td>704-13</td>
</tr>
<tr>
<td>Premolded Resilient Joint Filler</td>
<td>705-07</td>
</tr>
<tr>
<td>Mortar for Concrete Masonry</td>
<td>705-21</td>
</tr>
<tr>
<td>Reinforced Concrete Pipe</td>
<td>706 02</td>
</tr>
<tr>
<td>Precast Concrete Drainage Units</td>
<td>706-04</td>
</tr>
<tr>
<td>Bar Reinforcement, Grade 420</td>
<td>709-01</td>
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<tr>
<td>Wire Fabric for Concrete Reinforcement</td>
<td>709-02</td>
</tr>
<tr>
<td>Cold Drawn Wire for Concrete Reinforcement</td>
<td>709-09</td>
</tr>
<tr>
<td>Steps for Manholes</td>
<td>725-02</td>
</tr>
</tbody>
</table>

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.
§604-2

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 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.
§604-3

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:**

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
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</thead>
<tbody>
<tr>
<td>604.01 M</td>
<td>Leaching Basin</td>
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<tr>
<td>604.06 M</td>
<td>Transverse Drainage Interceptors</td>
<td>Meter</td>
</tr>
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<td>604.07XXYY M</td>
<td>Altering Drainage Structures, Leaching Basins and Manholes</td>
<td>Each XX = Region (01 through 11) YY = Serialized 01 to 99 *</td>
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<tr>
<td>604.10 M</td>
<td>Prefabricated Adjustment Rings for Manholes</td>
<td>Each</td>
</tr>
<tr>
<td>604.11 M</td>
<td>Prefabricated Adjustment Frames for Drainage Structures</td>
<td>Each</td>
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<td>604.30XXYY M</td>
<td>Rectangular Drainage Structure</td>
<td>Meter</td>
</tr>
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<td></td>
<td>XX = Structure Type **</td>
<td></td>
</tr>
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<td></td>
<td>YY = Frame No. **</td>
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</tr>
<tr>
<td></td>
<td>YY = Serialized 01 to 99 *</td>
<td></td>
</tr>
</tbody>
</table>

* 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:

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<tr>
<th>Sieve Designation</th>
<th>Percent Passing by Weight</th>
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</thead>
<tbody>
<tr>
<td>25.0 mm</td>
<td>100</td>
</tr>
<tr>
<td>12.5 mm</td>
<td>30 - 100</td>
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<tr>
<td>6.3 mm</td>
<td>0 - 30</td>
</tr>
<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:

<table>
<thead>
<tr>
<th>Sieve Designation</th>
<th>Percent Passing by Weight</th>
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</thead>
<tbody>
<tr>
<td>12.5 mm</td>
<td>100</td>
</tr>
<tr>
<td>6.3 mm</td>
<td>20 - 100</td>
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<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.
§605-3

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 m², 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:

<table>
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<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
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<tbody>
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<tr>
<th>Item</th>
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<td>Optional Underdrain Pipe</td>
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</table>

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
- Preformed Closed Cell Foam Material, Type II Joint Filler 705-08
- 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

NEW YORK STATE DEPARTMENT OF TRANSPORTATION
STANDARD SPECIFICATIONS of January 2, 2002

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