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:

<table>
<thead>
<tr>
<th>Material</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stud Shear Connectors</td>
<td>709-05</td>
</tr>
<tr>
<td>Mortar Sand</td>
<td>703-03</td>
</tr>
<tr>
<td>Epoxy Resin System</td>
<td>721-01</td>
</tr>
<tr>
<td>Epoxy Polysulfide Grout</td>
<td>721-03</td>
</tr>
<tr>
<td>Sandblasting Sand</td>
<td>No. 40 Boiler Slag Grit or No. 2 Sandblast Sand</td>
</tr>
</tbody>
</table>

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, 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.
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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 any 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 D.C.E.S. who shall make the final determination. The D.C.E.S. determination will be one of the following:
  - No repair is necessary.
  - Repair is necessary. In this case, the D.C.E.S. shall determine the method(s) of repair. The Contractor shall perform all repair work in strict accordance with the D.C.E.S. instructions.
  - Replacement of the structural steel member is necessary. In this case, the D.C.E.S. shall determine the material(s) and method(s) of replacement. The Contractor shall perform the replacement work in strict accordance with the D.C.E.S. instructions.

The D.C.E.S. 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 D.C.E.S. 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 M</td>
<td>Removal of Structural Concrete</td>
<td>Cubic Met:</td>
</tr>
<tr>
<td>580.02 M</td>
<td>Removal of Steel Supported Structural Slab (with shear connectors)</td>
<td>Square Met:</td>
</tr>
</tbody>
</table>
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580.03 M  Removal of Steel Supported Structural Slab (without shear connectors)  Square Meter
580.04 M  Removal of Concrete Approach Slab  Square Meter
580.11 M  Removal of Concrete Pylons  Each
580.21 M  Removal of Concrete from Structural Steel Members  Meter

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 M</td>
<td>Removal of Bituminous Concrete Overlay (Bridge)</td>
<td>Square Meter</td>
</tr>
<tr>
<td>581.02 M</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 slant 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 ordered by the Engineer will be made in accordance with the requirements of 109-05 Extra Work, Force Account Work, Dispute Compensation and Recordkeeping.
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582-3.04 Placement. Immediately prior to the placement of new material, receiving surfaces shall be air cleaned and thoroughly wetted. Surfaces receiving patching material shall also be prepared in accordance with the manufacturer's instructions. All air cleaning work shall be done by means of oil-free air. 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 and 555-3.09.

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.

Immediately prior to concrete placement, but after wetting, the receiving surfaces shall be coated with a thin coating of 1:1 mortar, or neat cement paste thoroughly brushed into the surface. It will not be necessary to brush the mortar into surfaces made inaccessible by the presence of forms, or closely spaced reinforcement.

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 §555-3.03B 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
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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 §555-3.09.

B. Vertical and Overhead Patching Material Curing. Manufacturer's recommendations for curing shall be followed for the patching material applications.

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 in accordance with 109-05. 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 in accordance with 109-05. 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 M</td>
<td>Removal of Structural Concrete - Replacement with Class A Concrete</td>
<td>Cubic Meter</td>
</tr>
<tr>
<td>582.06 M</td>
<td>Removal of Structural Concrete - Replacement with Class D Concrete</td>
<td>Square Meter</td>
</tr>
<tr>
<td>582.07 M</td>
<td>Removal of Structural Concrete - Replacement with Vertical and Overhead Patching Material</td>
<td>Square Meter</td>
</tr>
</tbody>
</table>
§583-1

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>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portland Cement, Types 1 or 2</td>
<td>701-01</td>
</tr>
<tr>
<td>Concrete Sand</td>
<td>703-07</td>
</tr>
<tr>
<td>Water</td>
<td>712-01</td>
</tr>
<tr>
<td>Wire Fabric For Concrete Reinforcing(^1)</td>
<td></td>
</tr>
<tr>
<td>Expansion Bolt Anchors</td>
<td></td>
</tr>
<tr>
<td>Hook Bolts Inserted in Expansion Bolt Anchors</td>
<td></td>
</tr>
<tr>
<td>Quilted Covers (for curing)</td>
<td>711-02</td>
</tr>
<tr>
<td>Plastic Coated Fiber Blankets</td>
<td>711-03</td>
</tr>
<tr>
<td>Membrane Curing Compound</td>
<td>711-05</td>
</tr>
<tr>
<td>GSA FF-S-325, Group III, Type 1 or</td>
<td></td>
</tr>
<tr>
<td>Group VIII, Type 1</td>
<td></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.
§583-3

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. Just prior to shotcreting, the sound surface shall be thoroughly cleaned, wetted and air blown.

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.
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TABLE 583-1 SIZE AND SPACING OF HOOK-TYPE BOLTS

<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.

Existing reinforcement which, in the Engineer’s opinion, has lost significant section shall be repaired in a manner satisfactory to the Engineer. Payment for this work will be made in accordance with §109-05, Extra & Force Account 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 555-3.06B, 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 no: 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
§583-3

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 555-3.09, 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 555-3.09A.

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 in accordance with 109-05. 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 M</td>
<td>Removal of Structural Concrete - Replacement with Shotcrete,</td>
<td>Square Meter</td>
</tr>
<tr>
<td></td>
<td>No Reinforcement Bar Encasement</td>
<td></td>
</tr>
<tr>
<td>583.03 M</td>
<td>Removal of Structural Concrete - Replacement with Shotcrete,</td>
<td>Square Meter</td>
</tr>
<tr>
<td></td>
<td>with Reinforcement Bar Encasement</td>
<td></td>
</tr>
</tbody>
</table>

5-160 NEW YORK STATE DEPARTMENT OF TRANSPORTATION
STANDARD SPECIFICATIONS of January 2, 2002
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.
§584-2

B. Microsilica Admixture

1. Use only one product from the Approved List, either a slurry or a densified powder, for each bridge deck. Provide written certification from the manufacturer that the admixture meets the Materials Bureau's procedural directives for fineness, silica content, total chloride ion content, solids content ( slurries), and moisture content (densified powders).

2. Agitate slurry to prevent separation and maintain it at a temperature above 0°C at all times.

3. The Regional Materials Engineer will take a ½ to 1 liter sample directly from the storage container, for each day’s placement, for testing by the Department.

C. Bonding Grout. 705-22, with the following: Do not add water once an acceptable consistency is achieved.

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. 501 with the following:

1. Add set retarding, water reducing admixture to Class DP concrete at the batch plant. The Regional Materials Engineer may allow a maximum of 2 additions at the work site. Do not exceed the manufacturer’s recommended maximum dosage, regardless of the number of additions. For each addition of set retarding, water reducer; provide an additional 30 mixing revolutions. The maximum total number of revolutions is 190.

2. Add the total amount of mix water required at the batch plant. No further additions of water are allowed.

3. If a densified microsilica powder is used, measure cumulatively in the following order: cement, fly ash and microsilica. For each material draw mass, base the batching tolerance of ±½% on the total mass of cementitious material.

4. If a microsilica slurry is used, add the slurry using a microsilica slurry delivery system, 584-2.04A. To calculate water cement ratio, include the slurry water and free moisture content of the fine and coarse aggregates as mix water.

<table>
<thead>
<tr>
<th>TABLE 584-1 MIX CRITERIA - CLASS DP CONCRETE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cement Content (kg/m³)</td>
</tr>
<tr>
<td>Fly Ash Content (kg/m³)</td>
</tr>
<tr>
<td>Microsilica Content (kg/m³)</td>
</tr>
<tr>
<td>Sand Percent Total Aggregate (solid volume)</td>
</tr>
<tr>
<td>Designed Water/Total Cementitious Content</td>
</tr>
<tr>
<td>Desired Air Content (%)</td>
</tr>
<tr>
<td>Allowable Air Content (%)</td>
</tr>
<tr>
<td>Desired Slump (mm)</td>
</tr>
<tr>
<td>Allowable Slump (mm)</td>
</tr>
<tr>
<td>Type of Coarse Aggregate Gradation</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 - MICRO SILICA CONCRETE

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cement Content (kg/m³)</td>
<td>390</td>
</tr>
<tr>
<td>Microsilica Content (kg/m³)</td>
<td>36</td>
</tr>
<tr>
<td>Sand Percent Total Aggregate (solid volume)</td>
<td>53</td>
</tr>
<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. 584-2.02B - 2, 3, and 4 with the following: Add high range water reducing admixture to Microsilica concrete at the batch plant. The Regional Materials Engineer may allow a maximum of 2 additions at the work site. Do not exceed the manufacturer's recommended maximum dosage, regardless of the number of additions. For each addition of high range water reducer, provide an additional 30 mixing revolutions. The maximum total number of revolutions is 190.

584-2.04 Equipment

A. Micro silica Admixture Slurry Delivery System. A permanently installed automation system or a two stop, off-line, automated batching system, which has been approved by the Regional Materials Engineer and meets the following requirements:

- Meter accuracy¹: ±1%, by volume
- Program quantity: liters, nearest tenth
- Batching tolerance¹: ±2.0%, by volume
- System interlocks: Required
- Print requirements: 1. Date and time
  2. Truck number (or alternate method relating microsilica to batch ticket)
  3. Delivered quantity (liters, nearest tenth)

NOTE: ¹. Based on volume of microsilica slurry.

Locate the control box/printer for a two stop, off-line batching system at the batch plant operator's work station, unless otherwise approved by the Regional Materials Engineer.

Calibrate the system in accordance with the procedures approved by the Regional Materials Engineer. Recalibrate the system if any part, or all, of the system is moved.

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
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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°C to 38°C for a minimum of 24 hours. Include the cost of calibration in the unit price bid.

D. Bonding Grout Mixer. A mortar mixer with a minimum capacity of 0.10 cubic meters, subject to approval by the Engineer, prior to use.

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 bonding grout 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 when placing bonding grout.

584-3.04 Bonding Grout Placement

A. After structural slab wetting and immediately before placing concrete, use stiff, nylon-bristle brooms to brush a thin (approximately 3 mm) coating of grout into the prepared surfaces, including any slabs, curbs, longitudinal and transverse joints and reinforcing steel. Do not allow the grout to puddle.

B. Apply the grout with straight handled stiff, nylon-bristle brooms around reinforcing steel, and at joints.

C. Limit the application of grout, according to atmospheric conditions, to that area which will be covered with new concrete before the grout begins to dry. Dry bonding grout appears light grey in color and has a chalky texture. Do not place concrete on dry bonding grout. Concrete placement
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operations must be interrupted if dry bonding grout is encountered. Install construction dams, wait at least 48 hours, remove dry grout by blast cleaning and place new grout and concrete, all in accordance with this specification.

584-3.05 Handling and Placing Concrete. 557-3.06 and 557-3.07 with the following:

A. Place concrete only when the ambient air temperature and deck surface temperature (after wetting) will be below 30°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 and any unacceptable area, as when bonding grout has dried out. 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. 557-3.11 and 557-3.12 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. 557-3.09 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 D concrete with wet burlap for 7 days. The wet burlap and curing cover option is not allowed.
§584-3

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. §557-3.13 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.

584-4 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.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>584.20mn M</td>
<td>Overlay Concrete, Microsilica Concrete</td>
<td>Square Meter</td>
</tr>
<tr>
<td>584.21mn M</td>
<td>Overlay Concrete, Class DP</td>
<td>Square Meter</td>
</tr>
<tr>
<td>584.22mn M</td>
<td>Slab Reconstruction Concrete, Class D, DP or Microsilica Concrete</td>
<td>Square Meter</td>
</tr>
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</table>

nn denotes a serialized pay item. Refer to §101-02 Definitions of Terms under "Specifications".