

# Section 550

## STRUCTURES

### SECTION 551 - PILES AND PILE DRIVING EQUIPMENT

#### 551-1 DESCRIPTION

**551-1.01 Piles.** Under this work, the Contractor shall furnish and place piles of the type and size and at the locations indicated on the Plans, or where ordered by the Engineer. The Contractor shall furnish equipment and personnel for dynamic pile tests as required. Timber piles are not covered under this specification.

**551-1.02 Splices for Steel Bearing Piles.** This is a contingent item and shall apply only when the Engineer directs the Contractor to drive a pile more than one and one-half meters beyond the estimated length provided in the Contract Plans. Pile splices shall be constructed as shown on the Plans, or as approved by the DCES.

**551-1.03 Furnishing Equipment for Driving Piles.** Under this work, the Contractor shall furnish equipment at the site for driving piles. The Contractor shall submit to the DCES, Form BD 138, "Pile Driving Equipment Data," for approval. The DCES shall be allowed 15 working days upon receipt for review. Each separate combination of pile and pile driving equipment proposed by the Contractor shall require the submission of a corresponding Form BD 138.

**551-2 MATERIALS.** Materials for piling shall conform to the requirements of the following Subsections:

Bar Reinforcement, Grade 420	709-01
Casings for Cast-In-Place Concrete Piles	720-03
Steel Bearing Piles	720-04
Pile Shoes	720-05

In addition to the requirements specified in the preceding Subsections, the following shall apply:

#### 551-2.01 Cast-In-Place Concrete Piles

**A. Concrete for Cast-In-Place Piles.** Concrete placed in the Cast-In-Place Piles shall comply with requirements specified for Class A Concrete in Section 501, Portland Cement Concrete.

**B. Paint for Exposed Piles and Pile Casings.** The paint shall be in accordance with the Contract Documents. The color shall be as specified on the Plans and Proposal, or as required by the Engineer.

**C. Cast-In-Place Concrete Pile Dimensions.** Pile dimensions, including the rate of taper for tapered piles, shall be as shown on the Plans, or as approved by the DCES. In no case, however, shall the outside diameter at the toe be less than 200 mm nor shall the outside diameter at the section to be cut off be less than 300 mm.

The Contractor shall furnish the particular type of pile casing shown on the Contract Plans. No used pipe or shell will be permitted.

Pile casings which do not hold their original form during driving, which fracture, or fail during driving, due to manufacturer defect, fabrication, or Contractor's operations, unless otherwise directed, shall be withdrawn and removed from the site at the Contractor's expense. If, at any time during the driving or placing of the pile casings, the DCES determines from the results of the driving that the

pile casings of the type or thickness being used cannot be satisfactorily placed, the Contractor shall remove same from the site and furnish casings of a different type or greater thickness at the expense of the State.

## 551-3 CONSTRUCTION DETAILS

### 551-3.01 General

**A. Storage, Handling and Inspection.** The method of storing and handling of piles shall be such as to avoid damage to the piles.

**B. Site Preparation.** Piles shall not be driven until after the excavation is completed to the elevation required for the bottom of the footing or bottom of tremie. Unless otherwise shown on the Plans, any material forced up or depressions made by the driving shall be removed or filled and the correct elevation of foundation established before any concrete is placed.

### C. Preparation Of Piles

#### 1. Shoes

*a. Steel Bearing Piles.* Steel Bearing Piles shall be furnished with a shoe. These shall be fabricated as detailed on the Plans, or as approved by the DCES. Substitution of commercial shoes for those detailed on the Plans may be permitted subject to the approval of the DCES. Unless shown on the Plans, the shoes shall be attached by a NYSDOT Certified Welder with a 8 mm thick minimum fillet weld along the entire outside edge of the flanges.

*b. Cast-In-Place Concrete Piles.* The ends of all pile casings shall be perpendicular to the longitudinal axis of the casings. All pile casings for "Cast-In-Place Concrete Piles" shall be equipped with a round plate with a diameter of not more than 15 mm larger than the diameter of the pile, and a minimum thickness of 18 mm, unless otherwise indicated on the Plans.

#### 2. Splices

*a. General.* Full length piles shall always be used where practicable. Where splices are unavoidable, their number, locations, and details shall be subject to the approval of the DCES.

Splices to steel piles, and steel pile casings shall be welded in conformance with the provisions of the S.C.M. These requirements include, but are not limited to, a NYS certified welder and a DCES approved welding procedure.

*b. Cast-In-Place Concrete Piles.* Where design considerations and soil characteristics permit, the DCES may approve the use of mechanical splices in lieu of the welded splice herein specified under §551-3.01.C.2.a. The mechanical couplings used for such splices shall be subject to the provisions of §715-01, Structural Steel. A seal weld shall be provided completely around the pile casing.

### D. Equipment for Driving Piles

**1. General.** Piles shall be driven only with equipment which has the prior approval of the DCES in accordance with §551-1.03. All malfunctioning equipment, as determined by the Engineer, shall be removed from the site and be replaced with equipment which is satisfactory to the DCES. The minimum rated striking energy of the hammer to be used in driving Steel Bearing Piles and Cast-In-Place Concrete Piles shall be 17.6 KJ per blow.

Hammers having greater striking energy may be used upon approval by the DCES. These hammers shall produce a minimum of 20 blows/300 mm and a maximum of 120 blows/300 mm at the Ultimate Pile Resistance shown on the Contract Plans. However, if, in the opinion of the

DCES, satisfactory results are not obtained with the hammer furnished by the Contractor, a hammer meeting the approval of the DCES shall be furnished and used.

**2. Air/Steam Hammers.** Sufficient boiler or compressor capacity shall be provided at all times to maintain the rated speed of air/steam hammers during the full time of pile driving. The valve mechanism and other parts of a single or double-acting hammer shall be maintained such that the number of blows per minute for which the hammer is designated, is satisfied.

**3. Diesel Hammers.** The valves, pumps, ports, rings, and other hammer parts shall be maintained such that the following condition for which the hammer is designated is satisfied:

Hammer Type	Designated Condition
Single Acting	Length Of Stroke Or Blows Per Minute
Double Acting	Bounce Chamber Pressure

All Diesel Hammers shall be provided with an acceptable means of measuring hammer energy. When pressure gages are included as normal equipment, they shall be furnished and maintained in operable condition. Manufacturer's Charts and Graphs, required to calibrate hammer energy, shall be furnished to the Engineer by the Contractor. The Contractor shall also arrange easy access to the pressure gages so that readings may be conveniently taken by the Engineer.

A double acting hammer not operating at the required bounce chamber pressure shall be removed promptly from the work site. It shall be replaced by a hammer acceptable to the Engineer at no cost to the State.

**4.** An approved hammer cushion block shall be used to transfer pile hammer energy to the pile. Each hammer shall be equipped with a helmet/drive head to fit the type of pile to be driven.

**5.** Pile driver leads shall be constructed in such a manner as to afford freedom of movement of the hammer. The use of either swinging or hanging leads will be permitted provided the pile or leads are properly supported during driving and the required final position and batter of pile is achieved. In the event the Engineer determines that the use of swinging or hanging leads is producing unsatisfactory results, the Engineer may require the Contractor to hold the leads in position with guys or braces to give the required support. The Contractor may, as an alternative, replace the unsatisfactory equipment with equipment having fixed leads.

Pile driving leads shall be of sufficient length so that the use of a follower will not be necessary. The driving of piles with followers will generally not be permitted and shall be done only with written permission and direction of the DCES.

When directed by the Engineer, either approved steel or wooden spuds shall be used to penetrate consolidated material or obstructions in the upper three meters in order to assist in driving the piles to the required depth and resistance. Augers may be used for this purpose when written permission is obtained from the DCES.

**6.** Water jets and vibratory hammers shall not be used in driving any pile, unless written approval is given by the DCES. Piles installed with a water jet or vibratory hammer shall be impact driven to secure the final penetration.

**E. Methods of Driving.** The driving of piles shall be done with an air/steam, diesel, or hydraulic hammer. Piles shall be driven starting from the center of the foundation and proceeding outward from this point, or starting at the outside row and driving progressively across the foundation.

**F. Length of Piles.** The length of piles will be determined in the field by driving to the driving criteria determined by the DCES. Piles may be completely driven in one operation or, if directed by the DCES, be partially driven and allowed to set from 2 to 24 hours (or as indicated on the Plans) before driving is resumed.

**G. Allowable Variation in Pile Alignment.** Piles shall be truly vertical or accurately battered as indicated on the Contract Plans. The top of any pile driven its full length into the ground shall not vary from the plan location by more than 100 mm, unless otherwise shown on the Plans. The top of any pile partially exposed or included in an integral abutment shall not vary from the plan location by more than 25 mm, unless otherwise shown on the Plans. In addition, piles may have a variation at their tip of not more than 20 mm per meter from the vertical or from the batter shown on the Plans or permitted by the DCES.

**H. Defective Piles.** All piles forced up by any cause shall be driven again, as directed by the Engineer.

The following shall be causes for rejection of a pile:

- Pile location or batter is incorrect.
- Pile damaged from any cause whatsoever.
- Pile fails to attain the driving resistance determined by the DCES, or the driving resistance set forth in the Contract Documents.
- Pile tip elevation is not within the limits called for on the Plans, or specified by the Engineer.
- Pile is determined by the Engineer to be unserviceable for other reasons related to the furnishing and installing of the pile.
- Cast-In-Place Concrete Pile Casing not free from water.

No footing concrete shall be placed until all piles within the footing are inspected by the Engineer. The Contractor shall remove such rejected piles, or, at the option of the Engineer, a second pile may be driven adjacent thereto, if this can be done without impairing the structure.

**I. Cutting Off Piles and Pile Casings.** The tops of all piles and pile casings shall be cut off at the elevation indicated on the Plans, or as established by the Engineer. The cut shall be clean and to a true plane, in accordance with the detail shown on the Plans.

#### **J. Included Work**

**1. Voids.** All cavities, left by the pile driving operation, shall be backfilled, as specified by the Engineer.

**2. Concrete.** Cast-In-Place Concrete Pile casings shall be inspected immediately prior to placing concrete in the casing. The Engineer may require that all casings in the footing be satisfactorily placed and dry before concrete is placed. Each casing shall be filled with a continuous pour of concrete, mixed and placed in accordance with the Specifications for Concrete for Structures Class A, Section 555, except that the slump of the concrete shall not exceed 125 mm.

Special care shall be exercised in filling the piles to prevent honeycomb and air pockets from forming in the concrete. Internal vibrators and other means shall be used to the maximum depth practicable, as determined by the Engineer, to consolidate the concrete.

**3. Reinforcement.** Cast-In-Place Concrete Piles shall be reinforced as shown on the Plans and the reinforcement secured in such a manner as to insure its proper location in the finished piles.

**K. Painting of Exposed Piles and Pile Casings.** All exposed pile or pile casing surfaces not embedded in concrete shall be painted as described in the Contract Documents.

**L. Furnishing Equipment And Personnel - Dynamic Testing Of Piles.** The Contractor shall furnish pile driving equipment, a source of electrical power, and a suitable test enclosure to perform field testing of piles and evaluate pile hammer efficiency. All incidental labor and material necessary to make the work area accessible shall also be supplied by the Contractor.

The actual tests shall be conducted by the Engineer under the direction of the DCES. The Contractor's responsibility is limited to the supplying of support services for the individual tests.

Tests shall be performed at the locations indicated on the Contract Plans and where ordered by the Engineer.

A Dynamic Testing Procedure, known as the "Impact Driving Method", will be used. This Procedure entails the following steps:

1. Prior to being struck with the pile driving hammer, each pile to be tested will be instrumented with strain and acceleration transducers by State personnel, aided by the Contractor's forces.
2. Dynamic measurements resulting from the pile hammer blows will be automatically recorded on a pile driving analyzer supplied by the State. State personnel will operate the pile driving analyzer.
3. Upon determination by the Engineer that valid data has been recorded, State personnel, assisted by the Contractor's forces, will remove the instrumentation.

The Contractor will schedule equipment movements to ensure that testing is done as part of the normal driving schedule, insofar as it is possible.

#### **551-4 METHOD OF MEASUREMENT**

**551-4.01 Piles.** The quantity of piles to be paid for under the work specified for Steel Bearing Piles or Cast-in-Place Concrete Piles, will be the number of meters of driven, acceptable piles, measured below cut off elevation, remaining in the finished structure in accordance with the Plans, Specifications, and orders of the Engineer.

The length of piles will be determined in the field by driving to the resistance required by the Plans, Specifications, or DCES at the time of driving. The pile lengths indicated on the Plans are for estimating purposes only.

**551-4.02 Splices for Steel Bearing Piles.** The quantity of splices paid for will be the number of piles that exceed the estimated length by more than one and one half meters. A second splice may be utilized at 8 m beyond the estimated length subject to DCES approval.

**551-4.03 Dynamic Pile Tests.** The quantity of Dynamic Pile Tests will be made for the number of piles tested. If the pile requires redriving within 28 hours after the initial test, this shall be considered as one Dynamic Pile Test. If redriving is more than 28 hours, this shall be considered as an additional test.

#### **551-5 BASIS OF PAYMENT.**

**551-5.01 Furnishing Equipment for Driving Piles.** The Lump Sum Price Bid shall include the cost of furnishing all labor, materials, and equipment necessary for transporting, erecting, maintaining, making any ordered equipment replacement, dismantling and removing the pile driving equipment.

The furnishing of equipment for driving sheet piling is not included in this work.

Payment will be made at the Lump Sum Price Bid for this Item, as follows: Seventy-five percent (75%) of the amount bid will be paid when the equipment for driving piles is furnished and driving of satisfactory piles has commenced. The remainder will be paid when the work of driving piles is completed.

**551-5.02 Piles.** The Unit Price Bid Per Meter for each of the respective Pile Items shall include the cost of furnishing all labor, (including the manipulation of pile driving equipment and materials), materials and equipment (excluding pile driving equipment) necessary to complete the work as prescribed in the Specifications, including the following additions:

**A. Structure Excavation.** Payment for removal of any material forced up above the foundation by the driving of piles shall be included in the cost of the pile.

**B. Defective Piles.** No payment will be made for piles rejected in accordance with requirements under §551-3.01H, Defective Piles.

**C. Backfilling.** Payment for backfilling of all cavities left by the extraction of damaged piles or from auger holes or soil deformations necessary to place piles shall be included in the work for the respective Pile Item.

**D. Redriving Piles.** The cost of driving piles that are forced up by any cause shall be included in the Unit Price Bid for the respective Pile Item.

**E. Pile Shoes, Etc.** The cost of furnishing and using pile shoes, followers, augers, or spuds shall be included in the unit price bid.

**F. Reinforcement and Splices for Cast-In-Place Concrete Piles.** Reinforcement and splices for C.I.P. Concrete Piles shall be included in the Unit Price Bid for Cast-in-Place Concrete Piles.

**G. Progress Payments for Steel Piles.** Progress payments will be made when the piles are properly installed in accordance with the Plans, Specifications, and orders of the Engineer. Payment will be made, at the Unit Price Bid, for 80% of the quantity properly installed, exclusive of cutting off piles, placing concrete in Cast-In-Place Piles and pile casings, and painting of exposed piles and pile casings. The balance of the quantity will be paid for upon completion of the work, including the cutting off, placing concrete in the pile, and painting of the pile and pile casings.

**551-5.03 Splices.** The Unit Price Bid shall include the cost of furnishing all labor, materials, and equipment necessary to complete each splice to the satisfaction of the Engineer.

**551-5.04 Dynamic Pile Test.** The cost of furnishing equipment and personnel to perform Dynamic Tests shall be included in the Unit Price Bid.

*Payment will be made under:*

Item No.	Item	Pay Unit
551.10XX	Steel Bearing Piles	Meter
551.11	Cast-In-Place Concrete Piles	Meter
551.12XX	Splices for Steel Bearing Piles	Each
551.13	Furnishing Equipment for Driving Piles	Lump Sum
551.14	Dynamic Pile Testing	Each

Refer to the Standard Contract Pay Item Catalog for full Item Number and full Description.

## SECTION 552 - SUPPORT AND PROTECTION SYSTEMS

### 552-1 DESCRIPTION

**552-1.01 Permanent Sheeting.** Under this work, the Contractor shall furnish and place permanent sheeting of the type, at the locations and to the elevation(s) shown on the plans.

All the sheeting and supports will be left in place as a finished structure unless removal of waling and bracing is called for on the plans.

**552-1.02 Temporary Sheeting.** This work shall include the requirements specified in §552-1.01 Permanent Sheeting with the following addition:

The Contractor shall be required to maintain the sheeting while in place, and remove it from the job site after its function has been accomplished or when ordered by the Engineer. It may be left in place only with the written permission of the Engineer.

**552.1.03 Interim Sheeting.** Under this work, the Contractor shall furnish and place sheeting of the type, at the locations and to the elevation(s) shown on the plans.

The Contractor shall be required to maintain the sheeting while it is serving its function.

The interim sheeting shall be cut off and removed only to the elevation shown on the plans. The remaining material shall be left in place.

**552-1.04 Excavation Protection System.** Under this work, the Contractor shall design, furnish, place, maintain and remove an excavation protection system (EPS) at locations shown on the plans or as ordered by the Engineer. Details of the EPS must conform with the requirements of 29CFR1926 and installation shall be in accordance with the State and Federal Safety Codes. A sloping (layback) option will not be allowed.

Sheeting, shoring, a shield system, i.e. trench box or trench shield or other pre-engineered protective system may be used to prevent cave-ins. The requirements of any protective system shall be as contained in 29CFR1926. It may be left in place only with the written permission of the Engineer.

**552-1.05 Alternate Design.** The Contractor may submit to the Department a construction alternate other than that presented in the contract documents as a Value Engineering Change Proposal. Slope lay back will not be allowed. Any geotechnical analysis for a flexible support system shall be done in accordance with the procedures contained in the appropriate Departmental publication, which is available upon request, from the Regional Director or the Director, Geotechnical Engineering Bureau.

## **552-2 MATERIALS**

### **552-2.01 Permanent Sheeting**

**A. Permanent Timber Sheeting.** Timber sheeting shall be new and unused and consist of any acceptable species which can be placed satisfactorily. The sheeting shall have a preservative treatment conforming to the American Wood-Preservers Association (AWPA) Standard C-2, Soil Contact. The timbers shall not be less in actual cross section or stress grade than that shown on the plans. Stress grading and acceptance shall be in accordance with the requirements and provisions of §712-14, Stress Graded Timber and Lumber. The timbers shall be sound and free from any defects which might impair its strength or tightness. The materials shall include all necessary waling and bracing required.

**B. Permanent Steel Sheeting.** Steel sheeting shall be new and unused conforming to the requirements of ASTM A328M unless otherwise indicated on the plans. Waling and bracing shall be new and unused conforming to the requirements of ASTM A36M unless otherwise indicated on the plans. The sheeting shall not have a section modulus less than that shown on the plans. Stock steel may be used. The Contractor shall furnish to the Engineer, certified copies of physical and chemical test results which shall include a sworn statement by a qualified mill representative to the effect that the subject material conforms to the requirements of the steel specified.

### **552-2.02 Temporary Sheeting**

**A. Temporary Timber Sheeting.** The provisions of §552-2.01A Permanent Timber Sheeting shall apply with the following modifications:

The timber sheeting may consist of new or used, treated or untreated material but must be in satisfactory condition and suitable for the intended use. The Engineer may disapprove and reject used materials regarded to be unsatisfactory.

**B. Temporary Steel Sheeting.** The steel sheeting, waling and bracing may consist of new or used material but must be in satisfactory condition and suitable for the intended use. The section modulus of the sheeting shall not be less than that shown on the plans. The materials shall include all necessary waling and bracing required. The Engineer may, disapprove and reject used materials regarded to be unsatisfactory.

### **552-2.03 Interim Sheeting**

**A. Interim Timber Sheeting.** The provisions of §552-2.02A Temporary Timber Sheeting shall apply.

**B. Interim Steel Sheeting.** The provisions of §552-2.02 B Temporary Steel Sheeting shall apply.

**552-2.04 Excavation Protection System.** The selection of EPS materials shall be the Contractor's option. The Engineer may disapprove and reject materials regarded to be unsatisfactory.

### 552-3 CONSTRUCTION DETAILS

**552-3.01 General.** Any material which stops the driving of sheeting within a depth of three meters from the ground surface at the time of driving, shall be removed by the Contractor. Payment for removal of such material will be made under the appropriate excavation item. If very compact material or boulders prevent the progression of the sheeting to the design tip elevation at a greater depth, the Contractor shall notify the Engineer.

**552-3.02 Temporary Sheeting.** The requirements of §552-3.01 General shall apply with the following addition:

Upon completion of the structure, the Contractor will remove the sheeting placed under this work, or with the written permission of the Engineer, leave it in place after cutting off the tops at an agreed elevation.

**552-3.03 Interim Sheeting.** The provisions of §552-3.01 General shall apply with the following modification:

The interim sheeting shall be cut off and removed only to the elevation shown on the plans. The remaining material shall be left in place.

**552-3.04 Excavation Protection System.** The EPS installed under this item shall be of sufficient size and strength to meet the requirements of Title 29, Code of Federal Regulations, Part 1926, Safety and Health Regulations for Construction (OSHA), and the Live Load requirement as contained in the Standard Specifications for Highway Bridges adopted by AASHTO. Prior to use, the Contractor shall supply the Engineer with documentation of compliance.

All damage to the adjacent pavement or ground caused by the use of the chosen EPS (e.g. Voids beneath the pavement or shoulder, pavement or shoulder cracking or subsidence, ground settlement) shall be repaired to the satisfaction of the Engineer at no additional cost to the State. Severe damage which directly affects the safety of the public shall be immediately repaired to the satisfaction of the Engineer. The operation shall be halted until a satisfactory prevention method is instituted.

### 552-4 METHOD OF MEASUREMENT

**552-4.01 Permanent Sheeting.** The quantity of sheeting to be paid for shall be the number of square meters obtained by multiplying the vertical length of sheeting measured between the payment lines herein described, by the horizontal length of sheeting shown on the plans or approved by the Engineer. The vertical length of sheeting is that length measured between the upper and lower payment lines. The upper payment line, unless otherwise specified on the plans or approved by the Engineer, shall be the original ground at the time of commencing work. The lower payment line shall be the elevation shown on the Plans as the minimum embedment depth unless otherwise authorized in writing by the Engineer.

The horizontal length shall be measured along a projection of the sheeting on a plane parallel to and midway between the front and rear face of the sheeting wall.

**552-4.02 Temporary Sheeting.** The provisions of §552-4.01 Permanent Sheeting shall apply.

**552-4.03 Interim Sheeting.** The provisions of §552-4.01 Permanent Sheeting shall apply.

**552-4.04 Excavation Protection System.** The quantity of protection system to be paid for shall be the number of square meters obtained by multiplying the vertical length measured between the payment lines herein described, by the horizontal length of EPS shown on the plans or approved by the Engineer. The vertical length is that length measured between the upper and lower payment line. Unless otherwise specified on the plans, the upper payment line shall be the ground surface existing at the site prior to the

beginning of the work, or as ordered, in writing, by the Engineer. Unless otherwise indicated on the plans or in the proposal, the lower payment line shall be the bottom of the excavation shown on the plans immediately adjacent to the protection system. The horizontal length shall be the actual length of protection system installed measured along the payment lines as shown on the contract plans. Both sides of the excavation shall be measured and computed for payment.

**552-4.05 Stage Construction.** When the support system is used in stage construction, the quantity of support system to be paid shall be the maximum number of square meters satisfactorily installed between the payment lines shown in the Contract Documents measured on either, but not both sides, of adjacent construction stages.

**552-5 BASIS OF PAYMENT**

**552-5.01 Permanent Sheeting.** The unit price bid, per square meter, for this work shall include the cost of furnishing all labor, materials and equipment necessary to complete this work, including driving equipment, waling, bracing and design services when employed. The cost of maintaining the excavated area free from earth, water, ice, and snow will be included in the price bid for the appropriate excavation item.

**552-5.02 Temporary Sheeting.** The provisions of §552-5.01 Permanent Sheeting shall apply except that estimate payments in the amount of 75% of the bid amount shall be made upon installation of the sheeting with the remainder paid upon its satisfactory removal. If the Contractor leaves all or part of the sheeting in place, it will be at their own expense and the remaining 25% of the bid amount shall be paid after its function is no longer required.

**552-5.03 Interim Sheeting.** The provisions of §552-5.01 Permanent Sheeting shall apply except that estimate payments in the amount of 75% of the bid amount shall be made upon installation of the sheeting with the remainder paid upon satisfactory removal of that portion specified in the contract documents. If the support system is to be left in place in its entirety, the remainder shall be paid after its function is no longer required. The cost of any work necessary to cut off and remove the specified portion shall be included in the unit price bid.

**552-5.04 Excavation Protection System.** The unit price bid, per square meter, for this work shall include the cost of furnishing all labor materials and equipment necessary to complete this work, including driving equipment, waling, bracing, and design services when employed.

If the Engineer directs, in writing, that the EPS be left in place, this will be classified as extra work.

*Payment will be made under:*

<b>Item No.</b>	<b>Item</b>	<b>Pay Unit</b>
552.10	Permanent Timber Sheeting	Square Meter
552.11	Permanent Steel Sheeting	Square Meter
552.12	Temporary Timber Sheeting	Square Meter
552.13	Temporary Steel Sheeting	Square Meter
552.14	Interim Timber Sheeting	Square Meter
552.15	Interim Steel Sheeting	Square Meter
552.16	Excavation Protection System	Square Meter

**SECTION 553 - COFFERDAMS AND WATERWAY DIVERSION STRUCTURES**

**553-1 DESCRIPTION**

**553-1.01 General.** All work done under this Section shall conform to all Federal, State, County and Local Regulations and permit conditions.

**553-1.02 Cofferdam.** Under this work, the Contractor shall design, furnish, place, maintain, and remove cofferdams together with all necessary waling and bracing, and dewatering equipment within the

limits shown on the plans. The Contractor shall also construct, maintain, stabilize, backfill and restore adequate sediment removal area(s) for water discharge control at location(s) shown on the plans or where allowed by the Engineer in accordance with all applicable permits.

If a waterway diversion structure is proposed as a substitution, approval of the Engineer must be obtained. A review by the appropriate permitting agency(ies) will be required. Any delay due to this review and approval process will not be a basis for an extension of time.

**553-1.03 Temporary Waterway Diversion Structure.** Under this work, the Contractor shall design, furnish, install, maintain, and remove a temporary water diversion structure at the location(s) shown on the plans or as ordered by the Engineer.

#### **553-1.04 Submittals**

**A. Cofferdams** Cofferdams shall be designed by a Professional Engineer, licensed and registered to practice in New York State. All systems submitted shall be designed for the static water pressure plus stream pressure and ice pressures as appropriate. Stresses shall not exceed the allowable given in AASHTO Standard Specifications for Highway Bridges. The Contractor shall indicate the water elevation above which the system should be flooded to avoid overloading. The Contractor's Engineer shall design the cofferdam to conform to all Federal, State, County and Local Regulations and Permits.

**1. Cofferdams (Type 1).** The Contractor shall submit the design, including computations and method of installation, to the Engineer for review by the Deputy Chief Engineer Structures (DCES). The DCES shall be allowed 20 working days for review. Permission to proceed must be received, prior to beginning construction of any cofferdam. The furnishing of such information and receipt of permission to proceed shall not serve to relieve the Contractor of its responsibility for the safety of the workers, the need to meet permit conditions, and the successful completion of the work.

**2. Cofferdams (Type 2).** Prior to beginning construction of any cofferdam, the Contractor shall submit the methods to be employed to the Engineer for review and approval. Ten working days shall be allowed for review. Construction shall not be started prior to receipt of approval.

**B. Temporary Waterway Diversion Structure.** Prior to beginning construction/installation of any temporary waterway diversion structure, the Contractor shall submit the methods to be employed to the Engineer for review and approval. Ten working days shall be allowed for review. Construction shall not be started prior to receipt of approval.

**553-2 MATERIALS.** The materials shall be timber or steel sheeting of a quality equivalent to that specified in §552-2.02 Temporary Sheeting of Support and Protection Systems, tightly sealed impermeable earth filled bags, precast concrete, a commercially designed system manufactured specifically for the control of water, or other material as indicated in the cofferdam design submitted for review.

#### **553-3 CONSTRUCTION DETAILS**

**553-3.01 Cofferdams.** Cofferdams shall be constructed so as to keep the excavations free from earth, water, ice, or snow, and to permit excavations to be carried to the depths indicated on the plans. Cofferdams, when used in conjunction with a tremie pour, shall be designed and constructed to automatically flood by non-mechanical means such as over topping or flooding ports. The automatic flooding elevation shall be as indicated by note in the plans.

In the event that permanent or temporary sheeting is required by the plans at the location of the cofferdam, the Contractor may elect to incorporate this material into the cofferdam system. Additional bracing may be required to satisfactorily perform excavation, dewatering, and other required construction operations. The permanent sheeting system shall be returned to its intended condition after all cofferdam equipment and material, including any additional bracing, has been removed. All damage done to the

temporary system, if still required, or permanent sheeting, shall be repaired at the Contractor's expense, to the satisfaction of the Engineer.

Unless otherwise indicated on the plans, cofferdams shall be maintained in a dewatered condition during foundation construction. The placement of foundation concrete shall not be impeded by water standing or flowing within the cofferdam.

If a waterway diversion structure is approved as a substitution, all of the requirements of §553-3.02 Temporary Waterway Diversion Structure shall apply.

Dewatering equipment and any additional bracing shall be of adequate quality and capacity and shall be so arranged as to permit their proper functioning in connection with the cofferdam. Dewatering equipment and bracing shall be so located to permit construction of the structure in accordance with the plans.

All damage caused by the failure of a cofferdam to perform its proper functions shall be the responsibility of the Contractor. It shall also be the Contractor's responsibility to protect all stream banks from erosion by reason of restriction of the channel caused by the erection of the cofferdam to limits greater than that shown on the plans for the Contractor's own convenience. In that situation, all material which erodes from the banks during that time the cofferdam is in place shall be replaced by the Contractor at the Contractor's own expense. The Engineer, in consultation with the regulatory permit agency(ies) representative(s), will be the sole determiner of the nature and extent of all damages and mitigation requirements. The Engineer shall approve all repair methods proposed by the Contractor prior to the Contractor beginning any remedial activities for which they are liable.

It shall be the Contractor's responsibility to place the cofferdam so that it will not interfere with any batter piles.

The Contractor shall establish and maintain a sediment removal area(s) to retain the discharge for a sufficient period of time using equivalent best management practices as approved by the Engineer, in order that the discharge entering the stream will be as clear as the flowing stream.

**553-3.02 Temporary Waterway Diversion Structure.** Waterway diversion structures shall be constructed at the location(s) as shown on the plans so as to divert the flow of water. The structure shall be continuous and constructed in accordance with any regulatory agency permit conditions.

If a system commercially designed and manufactured specifically for the control of water is used, it shall be installed and maintained in accordance with the manufacturer's recommendations.

All damage caused by the failure of the temporary water diversion structure to perform its proper function shall be repaired by the Contractor at no cost to the State.

**553-3.03 Removal.** The Contractor shall remove the temporary portion of the cofferdam installation or the waterway diversion structure, including anchor spuds if used, after such time that it is determined by the Engineer to be no longer necessary. The removal shall be sequenced to minimize turbidity and the discharge of materials into the waterway. Additional temporary erosion control measures, as determined by the Engineer, may need to be employed to facilitate removal.

## **553-4 METHOD OF MEASUREMENT**

**553-4.01 Cofferdams.** Measurement will be for each cofferdam actually established where indicated on the plans.

In those cases where approval is given to construct a waterway diversion structure in lieu of a cofferdam, the cost of the diversion will be paid at the unit price bid for the cofferdam work.

**553-4.02 Temporary Waterway Diversion Structure.** Measurement will be for each temporary waterway diversion structure actually constructed in accordance with the requirements of the contract documents and to the satisfaction of the Engineer.

## **553-5 BASIS OF PAYMENT**

**553-5.01 Cofferdams.** The unit price bid for each cofferdam shall include the cost of furnishing all labor, materials, and equipment necessary to complete the work, including pile driving equipment, waling, and bracing, anchor spudding, maintaining in a dewatered condition, and final removal. No

separate payment will be made for any additional temporary erosion control measures required to facilitate removal. In addition, all costs associated with the removal of any sediment deposited in the waterway due to the Contractor's operations shall be included. When a cofferdam is installed incorporating permanent or temporary sheeting required by the plans, payment will be made for each cofferdam established, including any miscellaneous sheeting, additional bracing, anchor spudding, or other material necessary to complete the work. The permanent or temporary sheeting, if used as part of the cofferdam, will be paid for under a separate item. The cost of establishing, maintaining, stabilizing, backfilling and restoring the sediment removal area(s) shall also be included in the price bid. No separate payment will be made for any repairs of damage required due to the failure of a cofferdam to perform its proper function.

Progress payments will be made. Seventy-five percent of the bid price will be paid after cofferdam installation, construction of the sediment removal area(s) and initial dewatering. The remaining percentage will be paid upon satisfactory removal of the cofferdam and restoration of the sediment removal area(s).

**553-5.02 Temporary Waterway Diversion Structures.** The unit price bid for each diversion structure shall include the cost of furnishing all labor, equipment, and materials necessary to satisfactorily install, maintain, and remove the diversion structure and any additional temporary erosion control measures required to facilitate removal.

No separate payment will be made for any repairs of damage required due to the failure of a waterway diversion structure to perform its proper function.

In the event that the Contractor is required to extend the temporary waterway diversion structure beyond the limits shown in the contract documents, changes to the diversion structure will be considered extra work.

When the waterway diversion structure is satisfactorily installed, seventy-five percent of the bid price will be paid. The remaining percentage will be paid when all temporary equipment and material have been removed and the waterway satisfactorily restored to its permanent location.

*Payment will be made under:*

<b>Item No.</b>	<b>Item</b>	<b>Pay Unit</b>
553.01nnnn	Cofferdams (Type 1)	Each
553.02nnnn	Cofferdams (Type 2)	Each
553.03nnnn	Temporary Waterway Diversion Structure	Each

Note: nnnn denotes serialized pay item.

**SECTION 554 - MECHANICALLY STABILIZED EARTH SYSTEM**

**554-1 DESCRIPTION.** Construct a Mechanically Stabilized Earth System (MSES) at the locations indicated on the plans. A Mechanically Stabilized Earth System is comprised of an unreinforced concrete leveling pad, facing units, earth backfill, and a reinforcing material used to stabilize the backfill.

Obtain all necessary materials, except backfill and leveling pad material, from the approved wall system designer-supplier. Approved designers-suppliers, wall systems, and the components of each wall system appear on the Department's approved list located in the office of the Director, Materials Bureau. Obtain from the designer-supplier a Mechanically Stabilized Earth System design stamped by a Professional Engineer licensed and registered to practice in New York State. Submit the MSES design package, including working drawings of the wall design, design calculations, working drawings for all job-specific facing panels not previously approved by the DCES, and the designer-supplier's Installation Manual to the DCES at least 30 working days before starting work. After receipt of all pertinent information, the DCES requires 20 working days to review the submission and reply to the Engineer. Begin work only after receiving DCES written approval.

Supply on-site technical assistance from a representative of the designated designer-supplier during the beginning of the installation until such time as the Engineer determines that outside consultation is no longer required.

**554-1.01 Definitions.** The following definitions apply:

**A. Wall System.** A marriage of a specific facing unit, a specific reinforcing and the backfill described in §554-2.09 of this specification.

**B. Facing Unit.** A precast concrete panel incorporating a means for attaching the reinforcing, forming part of the face area of the mechanically stabilized earth system. A corner unit is a facing unit having two faces.

**C. Reinforcing.** A metal strip, wire mesh, geogrid or other similar material connected to the facing unit for the purpose of fill stabilization.

**D. Attaching Devices.** Anything cast into the facing unit to provide a means for attaching reinforcing.

**E. Fastener.** Anything used to connect the reinforcing to the attaching device.

**F. Joint Filler.** Material used to fill the joints between units.

**G. Slip Joint.** A vertical joint specific to the wall system used as a stress relief at wall step locations.

**H. Identification Markers.** Signs or marking tape buried near the finished grade to identify and prohibit excavation of the reinforced backfill.

**554-2 MATERIALS.** Not all materials listed are required for each Mechanically Stabilized Earth System. Ensure that the proper materials are supplied for the chosen system design. Provide materials meeting the following requirements:

**554-2.01 Facing Units.** Fabricate in accordance with the requirements of §704-14 Precast Concrete Panel Units.

Fabricate Precast concrete coping and other incidental precast units in accordance with the requirements of §704-14 Precast Concrete Panel Units. Architectural treatment of the Precast Concrete Panels may be required by special notes shown on the plans.

**554-2.02 Reinforcing Strips.** Manufacture the reinforcing strips from recognized ASTM Designated metal grades and galvanize in accordance with the requirements of §719-01, Type I. The reinforcing strips associated with each approved wall system appear on the Department's approved list under wall system components.

**554-2.03 Reinforcing Mesh.** Shop fabricate the reinforcing mesh from cold drawn steel wire conforming to the requirements of §709-09 and weld into the finished mesh fabric in accordance with the requirements of §709-02. Galvanize in accordance with §719-01, Type I. The reinforcing mesh associated with each approved wall system appear on the Department's approved list under wall system components.

**554-2.04 Geogrid Reinforcing.** Provide geogrid reinforcing tested and certified to meet the minimum requirements for geosynthetic products in accordance with AASHTO Specifications for Highway Bridges, Section 5.8.6.1.2, Geosynthetic Reinforcement. Submit the geogrid manufacturer's certification with the material. Include in the certification: the geogrid manufacturer's name, the geogrid name, the test lot number, the minimum average roll value for Ultimate Tensile Strength, the long-term design tensile strength, and the reduction factors used to calculate the long-term design tensile strength. The grid(s) associated with each approved wall system appear on the Department's approved list under wall system components.

**554-2.05 Fasteners and Attaching Devices.** The fasteners and attaching devices are specific to each wall system and provided by the wall system supplier. The fasteners and attaching devices

associated with each approved wall system appear on the Department’s approved list under wall system components.

**554-2.06 Joint Fillers.** Fill joints with material approved by DCES and supplied by the approved wall system supplier.

**554-2.07 Slip Joints.** The type of slip joints are specific to each wall system and are designed and supplied by the wall system supplier.

**554-2.08 Leveling Pad.** Provide leveling pad material meeting the requirements of Section 501, Class A concrete.

**554-2.09 Backfill.** Provide backfill material for any Mechanically Stabilized Earth System from a single source unless prior approval for use of designated multiple sources is obtained from the Director, Geotechnical Engineering Bureau. Any mineral (inorganic) soil, blasted or broken rock, or similar materials of natural origin, including mixtures thereof, may be suitable materials subject to the following:

**A. Tests, Control and Acceptance Methods.** Perform material tests and control methods pertaining to the backfill requirements in conformance with the procedures contained in the appropriate Departmental publications in effect on the date of the advertisement for bids. These publications are available upon request to the Regional Director, or the Director, Geotechnical Engineering Bureau.

Acceptance of the backfill will be made in accordance with the procedural directives of the Geotechnical Engineering Bureau.

**B. Backfill Material.** Stockpile the backfill material in accordance with the latest “Geotechnical Control Procedures for the Control of Granular Materials”, and grade in accordance with TABLE 554-1.

<b>Sieve Size Designation</b>	<b>Percentage Passing by Weight</b>
100 mm	100
6.3 mm	30-100
425 µm	0-60
75 µm	0-15

**C. Plasticity Index.** If the State elects to test for plasticity, the Plasticity Index shall not exceed 5

**D. Durability.** If the State elects to test for durability, material having a Magnesium Sulfate Soundness loss in excess of 30 percent will be rejected and shall not be placed in the work.

**E. Corrosion Potential (Metal Reinforcing and/or Connectors Only).** The State will test for the corrosion potential of any system with exposed metal in the backfill. All stockpiled backfill materials will be tested for resistivity and pH, and may be tested for sulfides at the Department's discretion. Material failing to meet the following requirements of Table 554-2, for those tests that are performed, will be rejected except as specified below:

Material failing to meet the resistivity criterion may be tested for sulfate and chlorides. Material meeting the criteria for both sulfates and chlorides and having a resistivity greater than 10 ohm-m will be acceptable.

Resistivity $\rho \geq 30$ ohm-m	Sulfates $\leq 200$ mg/kg
$5 \leq \text{pH} \leq 10$	Chlorides $\leq 100$ mg/kg
Sulfides $\leq 300$ mg/kg	

### 554-2.10 Identification Markers

**A. Signs.** These will be 180 mm x 250 mm (minimum) fiberglass.

**B. Marking Tape.** This will be polyethylene material 75 mm wide, 100 µm thick.

Signs and marking tape are provided by the chosen designer-supplier.

### 554-2.11 Basis of Acceptance

**A. Facing Units.** Accepted in accordance with the requirements of §704-14, Precast Concrete Panel Units.

**B. Cast-in-Place Concrete.** The requirements of Section 501, Class A concrete, apply.

**C. Other Materials.** These will be accepted by certification. The State, however, reserves the right to sample, test and reject certified material in accordance with Departmental written instructions.

## 554-3 CONSTRUCTION DETAILS

**554-3.01 Excavation and Disposal.** Excavate and dispose of all excavated material in accordance with the requirements of Section 203, except as modified herein.

**A. Placement Area.** Grade the area under the Mechanically Stabilized Earth System, level for a width equal to, or in excess of, the reinforcing length. Prior to wall system construction, thoroughly compact this area to the satisfaction of the Engineer. Treat all soils found to be unsuitable, or incapable of being satisfactorily compacted because of moisture content, in a manner directed by the Engineer, in conjunction with the recommendations of the Regional Geotechnical Engineer.

**B. Rock.** Remove rock to the limits indicated on the plans.

**C. Depth of Excavation.** The depth of excavation for the leveling footing is indicated on the plans. Include the cost of this excavation in a separate excavation item.

### 554-3.02 Facing Unit Inspection, Storage, Repair and Rejection

**A. Precast Concrete Facing Units.** Precast concrete facing units will be inspected upon arrival at the work site to determine if damage occurred during shipment. An additional inspection will be made prior to installation to determine any damage which may have occurred during storage. Handle and store the units with extreme care to prevent damage.

**B. Tolerances.** Units not meeting dimensional tolerances, as determined by the Engineer, will be rejected. Replace rejected units with units acceptable to the Engineer.

**C. Damaged Units.** Repair damaged units in a manner approved by the Engineer. Units that the Engineer determines are not repairable will be rejected. Replace rejected units with units acceptable to the Engineer.

**D. Rejection Responsibility.** Responsibility for the rejection of units delivered to the job site rests solely with the Engineer.

### 554-3.03 Structure Erection

**A. Methods and Equipment.** Install units in accordance with the designer-supplier's working drawings and Installation Manual, unless otherwise modified by the Contract Documents, or the

Engineer. Prior to installation of the units, furnish the Engineer with detailed information concerning the proposed construction method, as well as the specific construction equipment planned for use. Begin work only after receiving the Engineer's written approval of the proposed construction methods.

**B. Unreinforced Concrete Leveling Pad.** Provide an unreinforced concrete leveling pad as required by the plans. Place the concrete in accordance with the requirements §555-3. The Engineer may waive any part of §555-3, that the Engineer determines is impractical.

**C. Unit Installation**

1. Place units such that, after completion of compaction, the requirements of TABLE 554-3 are not exceeded. After placement, maintain each unit in position by a method acceptable to the Engineer. If wedges are used, do not allow them to remain in place below three panel unit heights during installation, and compaction. Remove all wedges remaining in the top three panel unit heights upon completion of the Mechanically Stabilized Earth System. External braces may be required for initial placements. Install joint fillers in the manner indicated by the Installation Manual.
2. Correct all misalignments of installed units in excess of the tolerances allowed by Table 554-3, in a manner satisfactory to the Engineer at no additional cost.
3. Govern the operations and procedures to prevent misalignment of the installed panel units. Precautionary measures include, but are not limited to, keeping vehicular equipment a minimum of one meter from the panel units. Within one meter of the panel units use compaction equipment meeting the requirements of §203-3.12B6.

<b>TABLE 554-3 FACING UNIT ALIGNMENT AND JOINT OFFSET TOLERANCES</b>	
Horizontal Alignment	±7 mm/m
Joint Offset per Unit	±13 mm
Overall Vertical Plumbness (Top to Bottom of Wall System)	±4 mm/m

**D. Backfill**

1. Place backfill materials, other than rock, at a moisture content less than, or equal to, the Optimum Moisture Content. Rework or replace, as determined by the Engineer, all backfill material placed at a moisture content in excess of the Optimum Moisture content. Determine the Optimum Moisture Content in accordance with the latest Geotechnical Test Methods for compaction that incorporate moisture content determination. Rework or replace backfill material at no additional cost to the State.
2. Place granular backfill material in uniform layers not exceeding 300 mm loose lift thickness per layer. Compact each layer to a minimum of 95 percent of Standard Proctor Maximum Density in accordance with §203-3.12.
3. Place rock backfill in uniform layers not exceeding 400 mm loose lift thickness. Compact in accordance with requirements determined by the Engineer.

**E. Reinforcing**

1. Place reinforcing in accordance with the designer-supplier's recommendations or as described in the designer-supplier's Installation Manual.
2. Prior to placement of the steel reinforcing, backfill the area within one meter of the panel units horizontally to within 25 mm or less, below the required reinforcing elevation. Roughly grade

the backfill beyond the one meter line to the reinforcing elevation. Roughly grade the backfill for the geogrid reinforcing to the reinforcing elevation.

3. Before attaching the reinforcing to the panel units, repair all damage to the zinc coating in accordance with the requirements of §719-01.
4. Prior to the attachment of the reinforcing, as required, fill all openings, or attachment locations, with grease, or other protective material. Obtain the grease, or other protective materials from the chosen designer-supplier.
5. Place reinforcing normal to the panel units unless indicated otherwise by the plans. Take care to avoid breaking, distorting, or disturbing the reinforcing. Replace reinforcing which is broken, or distorted, as determined by the Engineer.
6. Connect geogrid reinforcing to the facing before placement of subsequent facing units, or as directed by the approved construction drawings.
7. Operate rubber tired equipment on top of geogrid reinforcing only at low speeds (less than 5mph) and without making sharp turns or braking sharply. Do not operate tracked equipment directly on geogrid reinforcing. Cover geogrid with a minimum 150 mm thick soil layer prior to operating tracked equipment over reinforced areas.
8. Repair or replace damaged geogrid in strict accordance with the designer-supplier's written instructions.

**554-4 METHOD OF MEASUREMENT.** Determine the quantity as the total number of square meters of face area computed from the plans using the following limits:

**A. Vertical**

1. Topmost surface of the leveling footing.
2. Topmost surface of the facing units.

**B. Horizontal.** Limits indicated on the plans.

When computing quantity, take into consideration the possible variation in the elevations of the footing and top of facing units. No field measurements will be made unless the Engineer specifies in writing a change to the limits indicated on the plans.

**554-5 BASIS OF PAYMENT**

**554-5.01 Mechanically Stabilized Earth System.** Include in the unit price bid the cost of all labor, equipment, technical representation from the designer-supplier, and materials, including backfill, reinforcing, leveling footing, joint fillers, and coping, unless otherwise modified by the Contract Documents.

**554-5.02 Excavation and Disposal.** Excavation and disposal of excavated material will be paid for under a separate item.

**554-5.03 Damaged Units.** No payment will be made for damaged units, nor for units that do not meet dimensional tolerances. Repair, or replace such units as determined by the Engineer, at no additional cost to the State.

**554-5.04 Reinforcing.** No payment will be made for reinforcing that the Engineer orders replaced. Replace such reinforcing at no additional cost.

**554-5.05 Water.** Include the cost of adding water for backfill compaction in the unit price bid for the Mechanically Stabilized Earth System, unless items for Furnishing Water Equipment and Applying Water are included in the Contract. If these items are included, include the cost of adding water in their bid prices.

*Payment will be made under:*

<b>Item No.</b>	<b>Item</b>	<b>Pay Unit</b>
554.01XX	Mechanically Stabilized Earth System, No Color	Square Meter
554.02XX	Mechanically Stabilized Earth System, Integral Color	Square Meter

<b>XX</b>	<b>Surface</b>
01	<i>Plain Concrete Surface</i>
02	<i>Textured Surface (hand tooled, raked, etc.)</i>
03	<i>Exposed Aggregate Surface</i>
04	<i>Architectural Pattern (form liner or stamped)</i>
05	<i>As Shown on Plans</i>

## **SECTION 555 - STRUCTURAL CONCRETE**

**555-1 DESCRIPTION.** This work shall consist of furnishing and placing portland cement concrete for structures as indicated in the contract documents and as directed by the Engineer.

### **555-2 MATERIALS**

**555-2.01 General.** The materials used for structural concrete shall comply with the material requirements of Section 501, Portland Cement Concrete, General.

Additional materials, listed below, required specifically for use in conjunction with structural concrete items shall meet the requirements of the following subsections:

Concrete Grout Material	701-05
Vertical and Overhead Patching Material	701-08
Rapid Hardening Concrete Repair Material	701-09
Preformed Cork Joint Filler	705-01
Preformed Rubber Joint Filler	705-03
Caulking Compound for Structures	705-06
Preformed Elastic Bridge Joint Sealer	705-09
Polyvinyl Chloride Extruded Shapes and Sheet Material	705-11
Lubricant for Preformed Elastic Joint Sealer	705-13
Bar Reinforcement, Grade 420	709-01
Wire Fabric for Concrete Reinforcement	709-02
Quilted Covers (for curing)	711-02
Plastic Coated Fiber Blankets (for curing)	711-03
Polyethylene Curing Cover (White Opaque)	711-04
Membrane Curing Compound	711-05
Burlap	711-06
Form Insulating Materials for Winter Concreting	711-07
Admixtures	711-08
Water	712-01
Asphalt Roofing Felt	712-12
Epoxy Resin System	721-01
Epoxy Polysulfide Grout	721-03
Copper Flashing	725-01
Sheet Gasket (treated both sides)	728-06
Concrete Cylinder Curing Box	735-01

**555-2.02 Concrete for Structures.** The class of concrete required for the various structural concrete items will be indicated in the contract documents. The same source of aggregates shall be used for all faces and surfaces of concrete exposed to view.

### 555-3 CONSTRUCTION DETAILS

**555-3.01 Concrete Manufacturing and Transportation.** Unless otherwise specified in the contract documents, the construction details for manufacturing and transporting concrete shall comply with §501-3, Portland Cement Concrete - Construction Details.

**555-3.02 Falsework.** Falsework plans shall be submitted by the Contractor and approved by the Engineer before falsework construction is started. Falsework or centering shall be designed for the dead load of the concrete forms, the dead load of the plastic concrete (based on 2400 kg per cubic meter) and a live load resulting from a mass of 245 kg per square meter applied to all horizontal surfaces.

Falsework which cannot be founded upon a solid footing, shall be supported by falsework piling.

Screw jacks or hardwood wedges may be required for falsework centering or to take up any slight settlement in the form work, either before or during the placing of concrete.

Falsework shall be set to give the finished structure the specified camber, plus allowance for shrinkage and settlement.

### 555-3.03 Forms.

**A. General.** All forms shall be well constructed, carefully aligned, substantial, and firm, securely braced, and fastened together in their final position. They shall be strong enough to prevent the fresh concrete from bulging the forms between supports and to withstand the action of mechanical vibrators. If required by the Engineer, form work plans shall be submitted by the Contractor and approved by the Engineer before forms can be used on the work.

Forms shall be designed to resist a dead load resulting from a mass of 2400 kg per cubic meter for the plastic concrete and a live load resulting from a mass of 245 kg per square meter on horizontal surfaces. The form and falsework design shall provide for the loads resulting from any conveyance system in addition to the live load.

When concrete is transported by buggies, conveyor belt, or other approved methods of conveyance, the forms shall be capable of supporting the distribution equipment and any concentrations of concrete which may occur during transportation and distribution. Buggy runways and other supporting platforms shall be supported directly by the forms.

Forms shall be adequately braced to resist concrete design loads. If the forms are inadequately braced concrete placement shall stop until adequate bracing has been provided.

All forms shall be set and maintained true to the line designated until the concrete is sufficiently hardened. Forms shall be maintained to eliminate the formation of joints due to shrinkage of the lumber. Forms shall be sufficiently tight to prevent leakage of mortar.

Forms may be constructed of wood, metal, or other approved materials, except when a particular material is specified in the contract documents. The use of fiber forms will be permitted for round columns only if the interior surface of the forms have been treated in such a manner as to prevent helical corrugation marks on the finished concrete surfaces. Forms shall be filleted 25 mm with forming material at all exposed corners to create a chamfer in the finished concrete unless otherwise shown in the contract documents.

When curved, patterned, or other special forms are required, the Contractor shall submit details of the form construction to the Engineer for approval prior to constructing the forms. Forms shall be so constructed that those surfaces on which finishing may be required may be stripped without disturbing the remaining forms. Premanufactured formliner panels, if used, shall be capable of imprinting the surface of the concrete with a uniform and aligned pattern and texture. The panels shall be composed of elastomeric urethane, polyvinyl chloride (PVC), ABS plastic, or other suitable material for their intended shape and number of reuses to achieve the desired effects. Formliners shall leave crisp, sharp definition of the architectural surface. Sufficient liners shall be used to minimize pattern repeat. Formliners shall not compress more than 6mm (¼ inch) when concrete is poured at a rate of 3 vertical meters per hour.

Any metal ties or anchorages within the forms shall be so constructed that the embedded portion of the ties can be removed to a depth of at least 50 mm from the surface of the concrete without damage to such surface. Wire ties shall not be used without written approval of the Engineer. In case wire ties are approved, all wires, upon removal of the forms, shall be cut back at least 6 mm from the face of the concrete with sharp chisels or nippers (nippers are necessary for green concrete). All cavities produced by the removal of metal ties shall be filled in conformance with requirements of §555-3.11, Corrective Finishing.

For walls where access to the bottom of the forms is not practicable, the lower form boards or panels shall be left loose so that the inside of the forms can be readily cleaned of all chips, dirt, sawdust, or other extraneous material, immediately prior to the placing of concrete.

Forms to be reused shall be maintained in good condition as to accuracy of shape, strength, rigidity, watertightness, and smoothness of surface. Any warped or bulged forms must be carefully resized before being re-used. Forms that are unsatisfactory in any respect shall not be used. All form surfaces that will be in contact with the concrete shall be thoroughly treated with an approved form coating in the manner, and at the rate specified by the manufacturer. Only those coatings listed on the Approved List published by the Materials Bureau are acceptable. Forms so treated shall be protected against damage or dirt prior to placing concrete.

If metal forms are used, the material shall be of such thickness that the forms will remain true to shape. All bolt and rivet heads shall be countersunk. Clamps, pins, or other connecting devices shall be designed to hold the forms rigidly together and to allow removal without damage to the concrete. Metal forms, which do not present a smooth surface or line up properly, shall not be used. Special care shall be exercised to keep metal forms free from rust, grease, or other foreign matter that would tend to discolor the concrete.

**B. Foundation Concrete.** The footings of structures shown in the contract documents shall be considered as approximate only, and when ordered in writing by the Deputy Chief Engineer (Structures), shall be changed to such dimensions as will give a satisfactory foundation. Concrete shall not be placed in any foundation form without the Engineer's approval.

#### 555-3.04 Handling and Placing Concrete.

**A. Placement Limitations.** No concrete shall be placed when the ambient air temperature is below 7°C, unless the Engineer grants approval to a written proposal from the Contractor. No concrete shall be placed during rain.

When concrete is to be placed in contact with steel members, reinforcing steel, or previously placed concrete, the temperature of the steel and concrete shall be raised to approximately 7°C. The use of enclosures and heating equipment, including but not limited to the use of forced hot air, hot water boilers, and hoses, or other methods suitable to the Engineer, may be required before concreting begins.

When concrete is to be placed in contact with earth or rock, within piles, or for tremie placements, the temperature of the earth or rock shall be 2°C or higher. The earth or rock shall not have any snow, ice, frost, or standing water on its surface. The use of insulating materials and heating equipment may be required before concreting begins.

**B. Conveyance.** Concrete shall be placed so as to avoid segregation of materials and displacement of reinforcement. All equipment used for conveying the concrete mix, from the point of delivery and material acceptance to the discharge point, shall be capable of meeting the permissible variations given in Table 555-1, Concrete Conveyance Uniformity. Prior to the actual placement of concrete, the Contractor shall demonstrate the capability of the equipment to convey the concrete mixture. Tests according to Department written instructions will be performed by, and at the discretion of the Engineer. No further verification of the equipment capability will be required unless evidence of nonuniform concrete is observed during placement.

When concrete pumps are used, the lines shall have a minimum diameter of 125 mm. The pumping operation shall be performed in such a manner as to discharge concrete horizontally a minimum distance of 1 m. Where horizontal discharge is not possible, the use of double 90-degree bends at the end of the pump hose, reducer hoses, or other equipment capable of maintaining a head

of concrete in the pump line may be allowed, subject to the approval of the Director, Materials Bureau.

All chutes, troughs, and pipes shall be kept clean and free from coatings of hardened concrete by thoroughly flushing with water after each use. Water used for flushing shall be discharged clear of the concrete already in place.

Concrete shall not come in contact with any aluminum during conveying and placing operations.

<b>TABLE 555-1 CONCRETE CONVEYANCE UNIFORMITY</b>		
<b>Test</b>		<b>Permissible Variation (Concrete samples taken at two locations in the handling process)</b>
Air Content, % by volume of Concrete		1.5%
Slump	Average slump 100 mm or less	25 mm
	Average slump greater than 100 mm	40 mm

**C. Acceptance/Testing.** The concrete mixture, prior to placement into the conveying equipment, shall meet the specified requirements for air content and slump given for the various classes and types of placement under Table 501-3, Concrete Mixtures.

**D. Placement.** All foreign matter of every kind shall be removed from the interior of the forms before placing concrete. Temporary studs or braces within the forms shall be removed when the concrete has reached an elevation rendering their further use unnecessary. Dropping concrete a distance of more than 1.5 m or depositing a large quantity at any point and running or working it along the forms shall not be permitted. Dropchutes shall be used between vertical forms unless conveyance equipment can be inserted between forms.

Special care shall be taken to fill each part of the form by depositing concrete directly into the form as near to its final position as possible, to work the coarser aggregates back from the face of the concrete and to force the concrete under and around the reinforcement without displacing the reinforcement. After the concrete has taken its initial set, care shall be exercised to avoid jarring the forms or placing any strain on the ends of the projecting reinforcement.

Concrete shall be placed in horizontal layers not more than 300 mm thick except as hereinafter provided. When less than a complete layer is placed in one operation, it shall be terminated in a vertical bulkhead. Each layer shall be placed and consolidated before the preceding layer has taken its initial set to prevent damage to the green concrete and avoid cold joints between batches. Each layer shall be consolidated using appropriate vibrating practices so as to avoid the formation of a joint with a preceding layer which has not taken initial set.

When concrete placement is temporarily discontinued, the concrete, after becoming firm enough to retain its form, shall be cleaned of laitance and other objectionable material to a depth sufficient to expose sound concrete. To avoid visible joints as far as possible upon exposed faces, the top surface of the concrete adjacent to the forms shall be smooth and level whenever concreting is discontinued. Where a “feather edge” would be produced at a construction joint, as in the sloped top surface of a wing wall, an inset form work shall be used to produce a blocked out portion in the preceding layer which shall produce an edge thickness of not less than 150 mm in the succeeding layer. Work shall be continuous from the bottom to the top of any face.

When embedding structural shapes in concrete, the placement of concrete shall be progressed on one side of the shape only until it flushes up over the bottom flange of the shape on the opposite side, after which concrete shall be placed on both sides to completion.

**E. Vibration.** During and immediately after deposition, concrete shall be thoroughly consolidated by vibrating the concrete internally with mechanical vibrating equipment. The use of external vibrators will be permitted when satisfactory surfaces cannot be obtained by internal vibration alone or when it is impossible to use internal vibrators. The use of external vibrators shall be subject to the approval of the Engineer. External vibrators shall be attached to or held on the forms in such a manner as to effectively vibrate the concrete in a horizontal plane.

Internal mechanical vibrators shall be adequately powered, capable of transmitting vibration to the concrete in frequencies of not less than 5,000 vibrations per minute while inserted in concrete and shall produce a vibration of sufficient intensity to consolidate the concrete into place without separation of the ingredients. If any of the reinforcing steel has epoxy coating, an internal mechanical vibrator shall have a rubberized or elastomeric cover to prevent damage to the epoxy coating on the reinforcing bars. The vibrators and covers shall be inspected for defects prior to use.

A sufficient number of vibrators shall be employed, so that at the required rate of placement, thorough consolidation occurs throughout the entire volume of each layer of concrete. Extra vibrators shall be on hand for emergency use and when other vibrators are being serviced.

The vibrating element shall be vertically inserted in the concrete mass at a depth sufficient to vibrate the bottom of each layer effectively inserting the vibrator into the underlying lift. It shall be withdrawn completely from the concrete before being advanced to the next point of application.

Internal vibrators shall not be placed directly on the forms or the reinforcing steel. The vibratory element shall be inserted vertically into the concrete at the point of deposit and in areas of plastic concrete at evenly spaced intervals not farther apart than the radius over which the vibration is visibly effective and at a distance close enough to the forms to effectively vibrate the surface concrete. The time of vibration shall be of sufficient duration to accomplish thorough consolidation, complete embedment of the reinforcement, produce dense, smooth surfaces free from aggregate pockets, honeycombing, and air bubbles and to work the concrete into all angles and corners of the forms however, over-vibration shall be avoided. Vibration shall be continued in one place until the concrete has become uniformly plastic, but not to the extent that pools of grout are formed.

Vibration shall be supplemented by working or spading by hand in the corners and angles of forms and along form surfaces while the concrete is plastic. Vibrators shall not be used to push or distribute the concrete laterally.

### **555-3.05 Depositing Structural Concrete Under Water.**

**A. General.** Use a tremie tube, pipeline, or similar method to place concrete under 0- 32°C water in one continuous operation. Since the tremie tube and the pipeline are both tubes, the word "tube" in this specification refers to either type, except where specific reference is made to either the tremie tube or the pipeline.

Unless noted differently on the plans, use Class G concrete as described in Table 501-3, Concrete Mixtures. Substitute Class GG Concrete when clear openings between closely spaced objects such as reinforcement bars are less than 75 mm. Pozzolan replacement may be omitted for small placements in a fresh water environment when approved by the DCES.

In addition to §555-3.03 Forms, place concrete on prepared areas cleaned of all debris, mud, or other unsuitable material.

Submit a list of equipment, including back-up, and a schedule for transporting and placing concrete, to the Engineer for review at least 20 working days prior to concrete placement. The Contractor shall be responsible to design a tremie placement, with appropriate forming, that maintains a minimum vertical rise of 0.3 meters per hour for the overall area and a minimum placement rate of 30 cubic meters per hour, unless fluid concrete pressure requires a reduced placement rate.

Place fresh concrete before stiffening and initial set of the adjacent concrete to ensure a good bond and avoid cold joints. If a delay occurs, determine stiffening and initial set by probes or other methods approved by the Engineer. Stop the operation if the placement cannot be continued before initial set of the adjacent concrete. The Engineer will then immediately contact the DCES.

**B. Methods of Placement.** The tremie tube and pump and pipeline are the most common methods. Obtain approval of the DCES for any other method.

**1. Tremie Tube Method (Open System).** This method uses a vertical tube open at the top, where concrete is delivered to the top and falls down the tube.

a. Tremie tube size shall be based on the delivery system used by the Contractor.

<b>Delivery System</b>	<b>Inside Diameter</b>
Large volume, such as crane and bucket	250 mm minimum
Small volume, such as pump line or conveyor	125 mm minimum

b. Use a sturdy hopper or funnel with a bottom opening smaller than the tremie tube diameter to transfer concrete into the tremie tube. The capacity and shape of the hopper or funnel depends on the volume and type of concrete delivery system. A device with the same size bottom opening may be used if a 40 to 50 mm diameter breather tube is installed to reach 0.3 meters or more down into the tremie tube.

c. Install a safe work platform at the top of the tremie tube.

**2. Pump and Pipeline Method (Closed System)** This method uses a vertical tube, attached to a closed tube system, where concrete is pumped to the top and falls down the tube.

a. Use pipe with a minimum inside diameter of 125 mm.

b. Install a minimum 50 mm diameter air vent or valve connection, or leave the pipe joint loose without a gasket, near the high point of the downgrade, 0.3 - 1.3 meters below the point where concrete starts falling down the pipe, to allow air displaced by concrete to escape, and admit air to prevent a siphoning effect.

c. Class G concrete, the mix noted on the plans, or a "cement-water" grout may be used for pipeline lubrication and placed in the forms. Waste any other concrete mix used to lubricate pipeline.

**C. Placement Tubes for Tremie Tube or Pump and Pipeline Method.** Clearly mark each tube in at least 0.5 meter increments (numbered every 2 meters) to show depth to the outlet. Use watertight joints. Place tubes no more than 5 meters from the forms and no more than 10 meters on center.

**1. Open end tubes** Install a separate tube at each placement point, as loss of seal occurs when the embedded end of this tube type is removed from fresh concrete under water. Once started, do not relocate or remove open end tubes until completion of the concrete placement at that location. If loss of seal occurs, remove and seal the tube with a watertight plate or plug for restarting. Restart tremie placement only if a seal can be reestablished using a dewatered tube where the outlet can be surrounded by fresh concrete.

**2. End-valve sealed tubes** Install the number of tubes based on the minimum placement rate defined in A. General, as the seal is maintained when the embedded end of this type is removed from fresh concrete under water. Raise the end of the tube to about 1 meter below the fresh concrete surface. Then, close the valve with the tube ½ full of concrete (½ the water depth), and slowly remove the tube. Reverse this procedure upon relocation in fresh concrete.

**D. Dewatering.** When necessary, proceed with dewatering at least 4 days after completion of concrete placement, unless noted differently on the Contract Plans or as ordered by the Engineer. After dewatering, continue curing and excavate one or more sumps to provide for pumping of accumulated water. Excavate sumps outside of areas which will receive new concrete, or as approved by the Engineer.

**E. Concrete Evaluation.**

**1. Nondestructive Testing.** Use as directed by the Contract, or as approved by the DCES.

**2. Cores.** Obtain cores in the presence of the Engineer at locations and to depths shown on the contract plans. Take NX size (nominal 54 mm) cores, no earlier than 7 days after concrete placement, according to §648-3.04, Rock Core Samples, B. Sampling, the 1st sentence. Use drill bits meeting the requirements of Subsection 732-06, Coring Bits.

Obtain 100% recovery from each core hole, as less is presumed to indicate defective concrete. Use a 1.5 meter nominal length of core drill run. Record core boring log data in accordance with §648-3.01B, Driller's Logs.

Label and pack all cores according to §648-3.04 C, Marking, Packaging and Transporting Samples. Deliver and store the core boxes at a site approved by the Engineer, where they become the property of the Department. Provide assistance in moving and arranging core boxes at the site to facilitate evaluation by the Department.

**F. Defects.** Obtain additional cores for further investigation from areas which contain voids, honeycombing, seams, or other defects. The DCES will determine the number and location of additional core holes. Repair defects with grout when approved by the DCES. Placements with defects determined to be unrepairable by grouting will be rejected. Alternate repair techniques require DCES approval.

**G. Grout Repairs and Grout Placements.** This section only applies for underwater grout placements limited to quickly filled areas, such as core drill holes, small piles up to 0.3 meters in diameter, and other small voids. Use materials meeting §701-05, Concrete Grout Material, for the grout proportioned as specified or as approved by the DCES.

When the DCES grants approval for repairs, the proposed grouting method shall be performed by cleaning out and filling all defects and core drill holes with grout. Position a grout tube (50 mm or less in diameter) about 25 mm off the bottom of the prepared hole until the grouting operation is complete. Start pumping (closed system) or filling a tremie tube (open system) faster than the grout can fall through water. Continue placing grout until the grout coming back out the hole is the same consistency as that going in. Then withdraw the tube.

Additional cores may be required to verify acceptable repairs.

**H. Tremie Construction Joints.** Prepare the top area of the placement receiving new concrete to within 75 mm of the elevation shown on the plans. When joining fresh concrete to concrete that has already set, the concrete in place shall have its surface scoured or abraded with a suitable tool to remove all loose and foreign materials. After the surface preparation, the concrete surface, and all porous surfaces to be in contact with new concrete shall be thoroughly wet using potable water for 12 hours with soaker hoses or the use of burlap/burlene/etc. to maintain moisture. The Contractor shall remove any puddles of free-standing water with oil-free compressed air, and protect the surfaces from drying, so the existing concrete remains in a clean, saturated, surface-dry condition until placement of the new concrete.

Fill any low areas with a leveling course of Class A concrete (or Class D for 35 to 125 mm thick placements).

Fill sumps with concrete or stone, as ordered by the Engineer.

### 555-3.06 Concrete Joints.

**A. Construction Joints.** Construction joints for the purpose of these specifications are joints used to provide for interruptions in the placement of concrete. Construction joints shall be placed only where shown in the contract documents or where approved by the Deputy Chief Engineer (Structures). Bulkheads required during placement shall be constructed at the direction of the EIC.

Unless otherwise shown in the contract documents, a shear key shall be provided at each construction joint by embedding water-saturated wooden blocks in the plastic concrete. The shear key thus provided shall be approximately a of the width of the parts joined. The key depth shall equal the thickness of standard form lumber, approximately ½ the key width. Shear keys need not exceed 140 mm in depth regardless of the key width.

On steel truss or open-spandrel, concrete arch spans, unless otherwise noted in the contract documents, the concrete in the floor system shall be placed about the center line of the span, beginning at the center and working simultaneously toward each end; or beginning at the ends, and working simultaneously toward the center. Care shall be taken to prevent the displacement of reinforcement during the placing of concrete. If, for any reason, it becomes necessary to introduce a construction joint, this shall be formed by means of a vertical bulkhead so constructed as to produce

a key joint, placed as shown in the contract documents or as permitted by the Deputy Chief Engineer (Structures).

When joining fresh concrete to concrete that has already set, the concrete in place shall have its surface scoured or abraded with a suitable tool to remove all loose and foreign materials. After the surface preparation, the concrete surface and all porous surfaces to be in contact with new concrete shall be thoroughly wetted, to achieve a saturated surface dry condition, using potable water for 12 hours with soaker hoses or the use of burlap/burlene/etc., to maintain moisture. If conditions or the situation prohibits this, then the surfaces should be wetted for as long as possible. The Contractor shall remove any puddles of free-standing water with oil-free compressed air, and protect the surfaces from drying, so the existing concrete remains in a clean, saturated surface-dry condition until placement of the new concrete. Immediately before placing the new concrete, the forms shall be drawn tightly against the concrete already in place.

Forms for female shear keys shall be beveled on four sides to facilitate their removal and shall be securely fastened to the forms to prevent displacement before the concrete has set. Key forms shall be removed in such a manner as to avoid damage to the concrete.

**B. Contraction Joints.** Contraction joints shall be placed at locations shown in the contract documents and unless otherwise specified, shall be formed the same as construction joints, except that reinforcement shall not extend through the joint.

**C. Expansion Joints.** Expansion joints shall be placed as shown in the contract documents. Expansion joints shall provide for expansion, contraction, and the transfer of shear at the joint, unless otherwise specified. When expansion joints are formed by the insertion and subsequent removal of joint templates, this work shall be done in such a manner that joint edges are not chipped or broken down in the process.

When concrete is to be placed against a joint filler, holes or joints in the filler shall be suitably filled with mastic to prevent mortar or concrete from entering the joint and restricting its movement. The face edges of all joints shall be carefully finished or formed true to line and elevation for a minimum distance of 50 mm back from all exposed surfaces.

When caulking compound is used to seal a joint containing premolded bituminous joint filler, a layer of an approved type of pressure-sensitive release tape shall be placed between these materials due to their incompatibility.

**D. Waterstops.** Waterstops shall be installed in joints to provide for expansion and contraction movements at joints. Place waterstop at all joints exposed to view, as shown in the contract documents, or as ordered by the Engineer. Waterstop shall be a polyvinyl chloride or other approved flexible material, copper strip, zinc strip or lead sheet. The waterstop shall extend at least 75 mm into the concrete on each side of the joint, shall be joined to be continuous and watertight, and shall be carefully protected from damage until covered by concrete or backfill.

### 555-3.07 Finishing.

**A. General.** All exposed unformed surfaces, whether permanent or at construction joints, shall be finished by placing an excess of material in the forms and striking off the excess with a suitable float, forcing the coarse aggregate below the level of the finished surface, and troweled to a suitable finish. The use of mortar topping for surfaces shall not be permitted.

Following the discontinuance of placing concrete, all accumulation of mortar splashed upon the reinforcing steel and the surfaces of forms shall be removed. Dried mortar chips and dust shall not be puddled into the plastic concrete.

**B. Bearing Surfaces.** The entire surface area of bridge seats or pedestals shall be floated and troweled to true grade or, at the option of the Contractor, left approximately 6 mm high and bush hammered or otherwise finished to the exact elevations indicated in the contract documents.

### 555-3.08 Curing.

**A. General.** All structural concrete shall be cured for a minimum of seven curing days unless otherwise stated. The curing period shall begin only after all curing procedures and practices for a given placement are established. A curing day is defined as any day during which the ambient air temperature at the concrete surface is 7°C or higher for the entire day.

Conditions may occur which prevent an entire day from qualifying as a curing day, but do not prevent portions of that day from reaching temperatures that qualify as curing temperatures. If these conditions occur and with the Engineer's approval, the Contractor may aggregate curing hours. A curing hour is defined as any hour during which the curing temperature remains at, or above 7°C. An aggregation of 24 curing hours will be credited as one curing day. Aggregations of less than 24 curing hours will not be credited.

Curing hours will be determined with continuous recording thermometers. The number and placement of the thermometers will be determined by the Engineer. Thermometers used to monitor curing temperatures shall consist of the following types:

**1. Continuously Recording Thermometer.** The thermometer shall be capable of continuously recording temperatures within a range of -20°C to 50°C for a minimum of 24 hours.

**2. Maximum - Minimum Recording Thermometer.** For all placements, the thermometer shall be capable of recording maximum and minimum temperatures within a range of -20°C to 50°C.

Provide all equipment, supplies, and labor necessary for calibration.

The curing temperature of concrete is the air temperature at the concrete surface, or the air temperature between the concrete surface and its protective covering. Temperatures at these locations are critical for proper concrete curing. For the purposes of this section the temperatures at the foregoing locations shall be maintained between 7°C and 30°C inclusive.

All structural concrete surfaces must be cured by any one, or a combination of, the following methods unless otherwise noted:

- Polyethylene curing covers - white opaque.
- Plastic coated fiber blankets.
- Clear (fugitive dye) membrane curing compound.
- Continuous burlap wetting.
- Wet burlap and curing covers.
- Forms left in place

Curing shall commence on all exposed surfaces no later than 30 minutes after completion of finishing. Finishing and curing operations shall progress with concrete placement. Curing covers shall be placed as soon after concrete finishing as the Engineer determines will not cause damage to the concrete surface. However, under no circumstances shall the curing be delayed beyond 30 minutes of the completion of finishing. Care shall be taken so as not to damage the finished surface or texturing. Curing covers shall be lapped a minimum of 300 mm. All lapped edges shall be sealed with pressure sensitive tape. Covers shall be protected from displacement.

Clear (fugitive dye) membrane curing compound shall be sprayed on the concrete surface immediately following the finishing operation, or form removal, whichever is applicable. The compound shall be applied by means of a pressure spraying system, or by distributing equipment, at a minimum rate of 0.285 L per m<sup>2</sup> of surface. The equipment for applying the compound shall be such that the compound is applied as a fine spray with no surface damage to the concrete. The equipment shall also provide for adequate agitation of the compound during application, and shall be approved by the Engineer before work is started. Should the application method produce a nonuniform film, or should the spraying equipment fail and back-up equipment is not immediately available, the application shall cease. Curing shall then be continued by another acceptable method. The Contractor shall provide sufficient approved covers for protection of the concrete surface in the event of rain or equipment breakdown.

If forms are removed during the curing period (refer to §555-3.09), the concrete curing shall be continued using a clear (fugitive dye) membrane curing compound applied immediately after form removal.

**B. Provisions for Curing in Hot Weather.** When forms are left in place in extremely hot weather the forms shall require wetting to reduce surface heat.

If the ambient air temperature exceeds 30°C, continuous, uniform wetting for curing shall be required until the seven (7) day curing period is complete and forms are removed. Use of plastic sheeting over the established curing is not allowed in hot weather conditions.

**C. Provisions for Curing in Cold Weather.** If the ambient air temperature falls, or is expected to fall, below 7°C, the requirements of Table 555-2 shall apply.

<b>TABLE 555-2 COLD WEATHER CURING REQUIREMENTS</b>	
<b>Ambient Temperature (AT) at time of concrete placement and as anticipated during curing duration</b>	<b>Curing requirements</b>
0°C < AT < 7°C for less than 24 consecutive hours	Contractor proposed/Engineer approved method for maintaining temperatures used
0°C < AT < 7°C for more than 24 consecutive hours	Heated enclosure required
AT < 0°C	Heated enclosure required

Prior to use, all proposed methods must meet the approval of the Engineer. If the curing temperature falls below 0°C at any time during the curing period, the concrete will be rejected.

To provide assurance of the curing temperatures, the Contractor shall supply maximum-minimum thermometers. Temperature measurements will be taken by the Engineer and a record will be maintained for the curing period. As a minimum, thermometers shall be placed adjacent to forms at the bottom, middle, and top of a placement. Additional thermometers may be placed in areas where extreme cold or heat, from external sources, can be expected.

If the existing method employed by the Contractor to maintain the curing temperature fails, the Contractor shall modify the existing method immediately to reestablish an acceptable curing temperature.

The length of the curing period will be extended until the required number of curing days are accumulated.

**1. General.** When approval is granted in writing by the Engineer for cold-weather concreting, the curing temperature shall be maintained between 7°C and 30°C for the curing durations stated by provision of external heat or utilization of heat of hydration retained by insulated forms.

**2. Provision of External Heat.** If the Contractor is required, or elects, to maintain curing temperatures by this method, the Contractor shall furnish sufficient canvas and framework, or other type of housing, to enclose and protect the structure in such a way that the air surrounding the fresh concrete on all sides be kept at a temperature between 7°C and 30°C for the specified curing period. At the end of the curing period, the heat shall be gradually reduced at a rate not to exceed 0.5 degree C per hour until the temperature within the enclosure equals the temperature outside the enclosure. Materials and equipment necessary to erect the enclosure and provide external heat shall be present on the job site and approved by the Engineer before any concrete is placed.

External heat shall be provided by means of stoves, salamanders, heated hoses, steam equipment, warmed curing water, or other equipment supplied by, operated by the Contractor. Heating appliances shall not be placed in such a manner as to endanger formwork, centering, or expose any area of concrete to drying out or damage due to excessive temperatures. Sufficient equipment shall be supplied to continuously maintain the specified temperature with a reasonable degree of uniformity in all parts of the enclosure. The enclosures shall be properly vented to prevent surface disintegration of fresh concrete due to an accumulation of carbon dioxide gas. All exposed concrete surfaces within the heated area shall be protected from drying by one of the following methods:

- Use of live steam.
- Continuous wet burlap or wet burlap used with curing covers.
- Curing compounds used with curing covers.

<b>TABLE 555-3 INSULATION REQUIREMENTS FOR CONCRETE WALLS, PIERS AND ABUTMENTS ABOVE GROUND</b>				
<b>Minimum air temperature allowable - Concrete Placed at 10°C</b>				
<b>Wall Thickness mm</b>	<b>Thicknesses of Commercial blanket or bat insulation - Deg. C.</b>			
	<b>13 mm</b>	<b>25 mm</b>	<b>40 mm</b>	<b>50mm</b>
	<b>Portland Cement Content - 300 kg/m<sup>3</sup></b>			
150	7	2	-5	-10
300	2	-9	-27	-32
450	-3	-19	-36	-54
600	-5	-23	-45	
900	-8	-29		
1200	-8	-30		
1500	-9	-32		
	<b>Portland Cement Content - 360 kg/m<sup>3</sup></b>			
150	7	0	9	-14
300	0	-13	-27	-40
450	-6	-26	-46	-67
600	-8	-30		
900	-11	-37		
1200	-12	-39		
1500	-12	-40		
	<b>Portland Cement Content - 415 kg/m<sup>3</sup></b>			
150	6	-2	-12	-18
300	-2	-17	-33	-49
450	-9	-32	-56	
600	-11	-36		
900	-14	-44		
1200	-15			
1500	-16			

**NOTES:**

1. This table is based upon the stated thickness of blanket, or bat-type insulation, having a thermal conductivity (K value) of 0.036 [W/m-K].
2. When using concrete containing pozzolans, do not consider the pozzolans as part of the cement content. Use the values given for a portland cement content that are equal to or less than the actual cement content of the mix, due to a lower heat of hydration when using pozzolans.

**3. Heat Retention by Insulated Forms.** Insulated forms may be used to maintain acceptable curing temperatures in accordance with the provisions of Table 555-2, when ambient temperatures will not drop below 0°C. If the Contractor elects to maintain curing temperatures by this method, sufficient insulation shall be furnished to protect and maintain the temperature between the insulation and formwork within the range of 7°C to 30°C for the specified curing period. Discontinuance of protection shall be accomplished in such a manner that the drop in temperature of any portion of the concrete shall be gradual. The surface temperature of concrete sections more than 600 mm in thickness shall not drop faster than 10°C in a 24-hour period. The surface temperature of concrete sections less than 600 mm in thickness shall not drop faster than 20°C in a 24 hour period.

Forms may be removed without restriction, providing the temperature difference between the air and the surface of the concrete is not more than 15°C. If possible, forms shall be removed about the middle of the day to take advantage of the generally higher afternoon temperatures.

Form insulating material shall be installed on the forms in such a manner so as to achieve the full benefit of its insulating properties and at the same time provide against the infiltration of wind and water. All portions of steel forms shall be covered by insulating material so that no steel is exposed to the air. Any tears or damaged areas in the insulating material shall be repaired. Special attention shall be given to ensure that all corners and angles are properly insulated and protected against wind damage.

Where tie rods extend through the form insulating material, a plywood washer (20 mm x 150 mm x 150 mm approx.) shall be placed over the tie rod and secured against the insulating material.

After placement of the concrete, the exposed concrete surfaces shall be covered with insulating blankets, except for areas where protruding reinforcing bars make the use of blankets impracticable. These areas may be covered with hay or other approved insulating material. Tarpaulins shall be used to protect the insulating material.

The insulating material shall be insulating blankets, bat insulation, solid foam, or sprayed foam meeting the requirements of §711-07, Form Insulating Materials for Winter Concreting. The thickness of standard blankets, or bat insulation, required for varying air temperatures, concrete thicknesses, and cement contents of the mix are listed in Table 555-3. The thickness of the insulating material used shall be determined by multiplying the equivalency factor for the insulating material by the thickness shown on Table 555-3. The equivalency factors for all approved insulating materials are given in the Department's Approved List, Insulating Materials for Winter Concrete (§711-07).

**TABLE 555-4 MINIMUM TIME FOR FORM REMOVAL/FORMING/LOADING LIMITATIONS - SUBSTRUCTURES <sup>(1)</sup>**

<b>SUBSTRUCTURE PIECE</b>	<b>STRIPPING <sup>(2)</sup></b>	<b>FORMING NEXT PLACEMENT</b>	<b>LOADING</b>
All Footings	2 days	2 days	4 days before next placement 5 days before placing backwall on stem.
Abutment stems, backwalls	2 days if less than 3.0 m (avg.). Add 1 day for each additional 1.5 m to 5 days, maximum.	2 days	7 days before backfilling, 14 days before placing superstructure loads. <sup>(3)</sup> Columns - 7 days before placing cap beam.
Pier Columns, Pier Plinths	2 days if less than 3.0 m high (avg.). Add 1 day for each additional 1.5 m.	4 days - columns 2 days if forming pedestal	Plinth- 2 days before pedestal placement. 21 days before placing superstructure loads. <sup>(3)</sup> 5 days before pedestal placement.
Pier cap beams	8 days (bottom) 3 days (sides)	2 days	21 days before placing superstructure loads. <sup>(3)</sup>
All pedestals	2 days	—	7 days (class A) 3 days (class F) <sup>(4)</sup>
Wingwalls or Retaining walls Arch centers	Same as abutment stems.	—	14 days before backfilling <sup>(3)</sup>
Centering under beams	8 days	—	14 day <sup>(3)</sup>

**NOTES:**

1 The minimum times for loading in this table are NOT applicable when using concrete that contains fly ash or ground, granulated blast furnace slag that is placed and/or cured when ambient temperatures are 16°C or less. The provisions in Note 3 are required for casting, curing, and testing of compressive strength cylinders for concrete that contains fly ash or ground, granulated blast furnace slag that is placed and/or cured when the ambient temperature is 16°C or less. The compressive strength results will be the basis of determining when loading can occur.

- 2 All concrete shall be cured for a minimum of seven curing days. A "Day" is a curing day as defined in Subsection 555-3.08A. Concrete surfaces being cured using forms, covers, or blankets from which the covers are removed for any purpose prior to the full cure period shall be sprayed with an approved clear (fugitive dye) curing compound within ten minutes of cover removal.
- 3 When early loading is requested, the minimum time requirements for loading may be reduced (or extended) based on test cylinder compressive strength results. The DCES will establish requirements for early loading upon request. The Contractor shall notify the Engineer, in writing, at least 10 days prior to placement, that early loading is being requested, so that arrangements for test cylinders can be made. Test cylinders shall be prepared in accordance with Materials Method 9.2 - Field Inspection of Portland Cement Concrete. Two test cylinders shall be prepared for each anticipated testing period. These cylinders shall be cured in the same manner as the substructure element which they represent. After the first compression test, the Engineer shall determine subsequent testing periods based on the results of the first test. No more than three tests for each substructure element shall be allowed.
- 4 Minimum time for loading pedestals shall not compromise minimum loading times specified for other placements.

**555-3.09 Form Removal.** Forms shall be removed in such a way as to permit the concrete to take the stresses uniformly and gradually. Any method of form removal likely to cause overstressing of the concrete shall not be used.

The forms for any portion of a structure shall not be removed until the concrete is strong enough to resist damage. The earliest time of form removal shall be as specified in Table 555-4, Minimum Time for Form Removal - Substructures. If the form removal causes damage, the operation must stop immediately until such time that sufficient concrete strength is achieved. All damage shall be repaired in conformance with §555-3.13, Damaged or Defective Concrete.

**555-3.10 Loading Limitations.** Forms used for substructure concrete placements shall be removed in accordance with the requirements of Table 555-4, Minimum Time for Form Removal - Substructures. The minimum times for loading in this table are NOT applicable when using concrete that contains fly ash or ground, granulated blast furnace slag that is placed and/or cured when ambient temperatures are 16°C or less. The provisions in Note 3 are required for casting, curing, and testing of compressive strength cylinders for concrete that contains fly ash or ground granulated blast furnace slag that is placed and/or cured when the ambient temperature is 16°C or less. The compressive strength results will be the basis of determining when loading can occur.

**555-3.11 Corrective Finishing.** Immediately after forms have been removed, surfaces exposed to view shall have all projections and irregularities carefully removed and all cavities greater than 25 mm in diameter and/or 6 mm in depth neatly filled with mortar of the proportion used in the concrete. The same brand of cement and the same kind of aggregate shall be used for filling cavities as was used in the original concrete mix. Plastering of surfaces shall not be allowed. The surface film (drying cement paste) of all such repaired surfaces shall be carefully removed before setting occurs.

All rust and other stains shall be removed from concrete exposed to view. Removal shall be accomplished using methods and materials approved by the Engineer. Materials used for rust stain removal shall be as listed on the Approved List published by the Department's Materials Bureau.

**555-3.12 Weep Holes.** The Contractor shall construct weep holes in all retaining walls and abutments as indicated in the contract documents.

**555-3.13 Damaged or Defective Concrete.** All defects or damaged to concrete which occurs prior to the final acceptance of the work shall be repaired or replaced at no additional expense to the State. The defects shall include but are not limited to spalling and irregular cracking at joints, edge spalls, honeycombing, and damage or other imperfections caused by traffic and/or construction operations. Any concrete requiring complete replacement shall be replaced in kind as concrete originally called for in the contract documents. Any repairs shall be performed to the methods described in these specifications unless otherwise approved by the Engineer. When a repair is made, the defective or damaged concrete shall be removed by saw cutting the perimeter to a depth of 40 mm, chipping the unsuitable material to sound concrete with light, hand held, pneumatic tools at a 45 degree angle into the patch area, and cleaning all exposed reinforcing and concrete surfaces. All surfaces to be repaired shall be thoroughly blast cleaned. Prior to placing repair concrete, all surfaces shall be wetted to a saturated surface dry condition.

Small spalls of 0.1 m<sup>3</sup> or less, and areas of 0.25 m<sup>2</sup> or less where concrete removal is required may be repaired using approved Concrete repair materials. Vertical or overhead surfaces may be patched with Vertical and Overhead Patching Material. Surface preparation for small repairs shall be according to the material manufacturer’s recommendations. After repair is complete, and curing time has elapsed, the Engineer will hammer sound all repair areas to assure proper bond has been achieved.

Concrete with surfaces misshapen by bulges or deformations caused by inadequate forms, or resulting in insufficient cover of reinforcing, shall be removed or corrected.

**555-4 METHOD OF MEASUREMENT**

**555-4.01 Concrete for Structures.** The work will be measured for payment as the number of cubic meters of concrete for structures satisfactorily placed, measured to the nearest 0.1 cubic meters within the lines of the structure as shown in the contract documents. No deductions shall be made for the volume of joint material, embedded metal reinforcement, structural shapes, chamfers, tops of piles, or pipe with an end area of less than 0.1 m<sup>2</sup>.

**555-5 BASIS OF PAYMENT**

**555-5.01 General.** When the Contractor elects to substitute an optional concrete class as permitted by Table 501-1, Concrete Class Options, payment will be made for the originally specified class of concrete using the originally specified method of measurement.

**555-5.02 Concrete for Structures.** The unit price bid per cubic meter shall include the cost of furnishing all labor, materials and equipment necessary to complete the work, except reinforcement will be paid for separately under its appropriate item. Unless otherwise provided, the unit price bid shall include the cost of furnishing and placing flashing or other metal strips, flexible water stops, sheet packing, pipe drains, bituminous material, water for wetting, joint materials, felt, tar paper, joint sealing compounds, joint fillers, and concrete curing materials.

No extra compensation for falsework or falsework piling will be paid. This work is included as part of the formwork.

No extra compensation for corrective finishing or repairs to damaged or defective concrete will be paid.

Bridge bearings, expansion joints, and anchor bolts will be paid for under their appropriate items.

Progress payments will be made, after the concrete and curing applications have been properly placed, to the extent that payment will be made at 90% of the computed quantity of each concrete placement, with the balance to be paid after completion of all curing and corrective work thereon.

*Payment will be made under:*

<b>Item No</b>	<b>Item</b>	<b>Pay Unit</b>
555.0104	Footing Concrete, Class A (No Concrete Class Substitutions Permitted, Except Class H Where Footing is 1 m Thick or Less)	Cubic Meter
555.0105	Concrete for Structures, Class A	Cubic Meter
555.05	Concrete for Structures, Class F	Cubic Meter
555.06	Concrete for Structures, Class G (Deposited Under Water)	Cubic Meter
555.07	Concrete for Structures, Class GG (Deposited Under Water)	Cubic Meter
555.08	Footing Concrete, Class HP	Cubic Meter
555.09	Concrete for Structures, Class HP	Cubic Meter
555.10	Concrete for Structures, Class D	Cubic Meter
555.11	Concrete for Structures, Class DP	Cubic Meter

**SECTION 556 - REINFORCING STEEL FOR CONCRETE STRUCTURES**

**556-1 DESCRIPTION.** The work will consist of furnishing and placing reinforcing steel for concrete structures, or stud shear connectors, in accordance with the contract documents, and in a manner satisfactory to the Engineer.

Reinforcing steel for concrete structures may be uncoated, epoxy-coated, galvanized, stainless-steel-

clad, or stainless steel, as indicated in the contract documents.

**556-2 MATERIALS.** Materials for this work shall meet the requirements of the following subsections of Section 700, Materials and Manufacturing:

Uncoated Bar Reinforcement, Grade 420	709-01
Wire Fabric for Concrete Reinforcement	709-02
Epoxy-Coated Bar Reinforcement	709-04
Stud Shear Connectors	709-05
Epoxy-Coated Wire Fabric Reinforcement	709-08
Mechanical Connectors for Reinforcing Bar Splices	709-10
Galvanized Bar Reinforcement	709-11
Stainless-Steel-Clad Bar Reinforcement	709-12
Stainless Steel Bar Reinforcement	709-13
Uncoated Bar Reinforcement, Grade 520	709-14

**556-2.01 Devices for Supporting and Tying Reinforcement.** Chairs, tie wires, and other devices used to support, position, or fasten the reinforcement shall be made of or coated with, a dielectric (electrically insulating) material. Stainless steel chairs without polyethylene tips and meeting the requirements of ASTM A493, AISI Type 430, may also be used. The specific hardware that the Contractor proposes to use shall be approved by the Engineer.

When forms are to be removed in their entirety, uncoated steel chairs equipped with snug-fitting, high-density, polyethylene tips which provide 6 mm clearance between the metal and any exposed surface may be used.

### 556-3 CONSTRUCTION DETAILS

#### 556-3.01 General

**A. Ordering.** Prior to ordering reinforcing steel, the Contractor shall carefully check all bar lists, and assume full responsibility for their accuracy. No change in the bar list shall be made by the Contractor unless approved by the DCES. If no bar list is provided in the Plans, then §557-3.16 No Bar List Provided shall apply.

#### **B. Protecting Reinforcement Coatings**

**1. Epoxy-Coated Reinforcing Steel.** All epoxy-coated reinforcement shall be stored above ground on wood or padded supports.

Epoxy-coated reinforcement stored on-site shall be protected from sunlight and moisture using opaque waterproof covers. Covers shall be placed in a manner that will permit constant air circulation so as to minimize the formation of condensation on the epoxy-coated surface.

All equipment for handling epoxy-coated steel shall have padded contact areas. All bundling bands shall be padded and all bundles shall be lifted with a strong back, multiple supports, or a platform bridge so as to prevent steel-to-steel abrasion from sags in the bundle.

Steel shall not be dropped or dragged. Care shall be taken at all times to prevent damage to the epoxy coating.

Steel that is partially embedded in concrete shall have the exposed sections protected with opaque waterproof covers prior to any winter shutdown of a project.

**2. Galvanized Bar Reinforcement.** All galvanized bar reinforcement shall be stored above ground on wood or padded supports and arranged so that rainwater drains off the bars.

**C. Placing and Fastening Reinforcing Steel.** Prior to placing reinforcement, all grease, dirt, mortar, and any other foreign substances shall be removed.

Loose rust and loose millscale on uncoated reinforcement shall be removed by wire brushing. Steel reinforcement shall be placed in the position indicated in the contract documents and within the

allowable tolerances specified. Before concrete is placed, all reinforcement shall be securely fastened and supported with approved chairs or other approved devices.

**D. Inspection.** Concrete shall not be placed until the reinforcing steel is inspected, placement of the steel meets applicable tolerances, and permission for placing concrete is granted by the Engineer. All concrete placed in violation of this provision will be rejected and removed.

### 556-3.02 Steel Fabric Reinforcement.

**A. Field Repair of Coatings.** Field repair will not be required on areas of minor damage. Minor damage is defined as any defect or break in the coating less than 6 mm x 6 mm. The maximum number of unrepaired minor damaged areas shall not exceed an average of six (6) per 300 millimeters of wire.

Reinforcing fabric having coating damage exceeding the above criteria shall be rejected and immediately removed from the work site.

**B. Placement.** Steel fabric reinforcement shall be placed as shown in the contract documents. Unless otherwise noted in the contract documents, steel fabric reinforcement shall be overlapped a minimum of the distance between adjacent wires in the panel. Overlapping panels of steel fabric reinforcement shall be wired together to ensure that the location and overlap of the mesh panels is maintained during concrete placement.

### 556-3.03 Bar Reinforcement

**A. Field-Bending.** The bar reinforcement shall be bent to the shapes shown in the contract documents. Unless shown otherwise in the contract documents or below, the radii of bends, measured to the inside face of the bend, shall be greater than, or equal to, three times the diameter of the bar. Bends in stirrups shall be greater than, or equal to, the diameter of the bar.

**1. Uncoated Bar Reinforcement.** When bars are heated for field-bending they shall not be heated to a temperature higher than that producing a dark cherry-red color. Only competent personnel shall be employed and proper equipment provided for cutting and bending.

**2. Epoxy - Coated Bar Reinforcement.** The alternatives of shop bending or field-bending of epoxy-coated bar reinforcement will be at the option of the Contractor. Field-bending shall be done by cold methods only.

Field-bending operations will be allowed only when ambient and bar temperatures are 5°C or greater. When lower temperatures prevail, the Contractor may supply, for field-bending operations, a fully enclosed space that is heated. Direct heating of the bars shall not be permitted.

Epoxy coatings damaged by field-bending work shall be evaluated and repaired or replaced, in accordance with the requirements of §556-3.03 B.1 Epoxy-Coated Bar Reinforcement.

**3. Galvanized Bar Reinforcement.** The galvanized bar reinforcement shall be shop bent before galvanizing. Up to 5% of the mass of bars may be field bent to replace missing, damaged, or incorrectly fabricated bars. Field-bending shall be done by cold methods only. When bending galvanized bar reinforcement size 22 and greater, the minimum bend radius measured to the inside face of the bend shall be increased to 4.5 times the bar diameter. For bars numbered 43 and 57, increase the bend radius to 5.5 times the bar diameter.

Field-bending operations will be allowed only when ambient and bar temperatures are 5°C or greater. When lower temperatures prevail the Contractor may supply, for field-bending operations, a fully enclosed space that is heated. Direct heating of the bars shall not be permitted.

The ends of bars cut after galvanizing shall be coated with zinc repair material following the procedures of §719-01, Galvanized Coatings and Repair Methods except that repair materials containing aluminum shall not be permitted.

Galvanizing damaged by field-bending work shall be evaluated and repaired, or replaced, in accordance with the requirements of §556-3.03 B.2 Galvanized Bar Reinforcement.

**4. Stainless-Steel-Clad Bar Reinforcement.** The stainless-steel-clad bar reinforcement shall be shop bent or field bent as shown in the contract documents. All ends of the bar reinforcement where the mild steel core is exposed shall be capped by one of the following:

- a. Heat-shrink cap applied in accordance with the cap manufacturer's instructions.
- b. Neoprene cap adhered with silicone or epoxy sealant.
- c. Stainless steel cap epoxied in place.
- d. Stainless steel seal weld.

The stainless-steel-clad bar reinforcement will be shop bent or field bent as shown in the contract documents. When shop bending is required, up to 5% of the mass of bars may be field bent to replace missing, damaged, or incorrectly fabricated bars. Field-bending shall be done by cold methods only.

**5. Stainless Steel Bar Reinforcement.** The stainless steel bar reinforcement shall be shop bent or field bent as shown in the contract documents. When shop bending is required, up to 5% of the mass of bars may be field bent to replace missing, damaged, or incorrectly fabricated bars. Field-bending shall be done by cold methods only.

## **B. Field Repair of Coatings**

**1. Epoxy-Coated Bar Reinforcement.** The Contractor will be required to field repair damaged areas of the bar coating, and to replace bars exhibiting severely damaged coatings. The material used for field repair shall be that supplied by the coating applicator.

Field repair will be required on all areas of major damage. Major damage is defined as any defect or break in the epoxy coating 6 mm x 6 mm or greater. The total number of all major damaged areas which have been repaired with patching material shall not exceed five (5) in any three-meter length of bar.

Field repair will not be required on areas of minor damage. Minor damage is defined as any defect or break in the coating less than 6 mm x 6 mm. The maximum number of unrepaired minor damaged areas shall not exceed an average of six (6) per 300 mm on any individual bar.

A reinforcing bar having coating damage determined by the Engineer to exceed the above criteria shall be rejected and immediately removed from the work site. All such bars shall be replaced, in kind, by the Contractor at no additional cost to the State.

**2. Galvanized Bar Reinforcement.** The Contractor shall field repair damaged areas of the bar coating, and replace bars exhibiting severely damaged coatings. Severe damage is defined as more than five (5) 6 mm by 6 mm or larger areas in a three-meter length. The material and procedures used for field repair shall meet the requirements of §719-01, Galvanized Coatings and Repair Methods, except that repair materials containing aluminum shall not be permitted.

**C. Splices.** Splices will be permitted only where shown in the contract documents. Should the Contractor desire to splice bars at locations other than those shown in the contract documents, written permission to do so shall first be obtained from the DCES. Such permitted splices shall be well distributed or located at points of low tensile stress. Splices shall not be permitted unless a minimum of 50 mm can be provided between the splice and the nearest adjacent bar.

Splices for bar sizes No. 36 or smaller, shall be made by means of a mechanical connector or by placing the bars in contact and wiring them together for the full length of the splice. Splices for bars larger than No. 36 shall be made by use of a mechanical connector unless welding is specifically required by the contract documents. Mechanical connectors shall be installed in accordance with the manufacturer's written requirements.

Arc-welded splices shall be made and will be inspected in accordance with the provisions of the SCM.

Prior to welding of epoxy-coated reinforcing bars, the epoxy coating shall be removed for the length to be welded plus 150 mm on each side of the weld. After welding, the spliced area shall be

cleaned in accordance with SSPC - Surface Preparation Specification No. 6 (SSPC-SP6), Commercial Blast Cleaning. The surface shall be blast cleaned to SSPC-SP6 Commercial Blast Cleaning standard.

Photographs in SSPC-VIS 1, Guide And Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning, for B SP6, C SP6, D SP6, G1 SP6, G2 SP6, or G3 SP6, can be used as a guide to identify the desired cleaning, depending on the initial condition of the steel. However, the written standard for SP6 will be the primary means to determine conformance with blast-cleaning requirements. The photographs shall not be used as a substitute for the written standards. A compatible epoxy repair material supplied by the coating applicator shall be applied to the spliced area and overlap the original coating by 150 mm. The epoxy repair material shall be applied the same day as the cleaning.

Prior to welding galvanized bar reinforcement, the zinc coating shall be removed for the length of the weld plus 50 mm on each side of the weld. Cleaning shall be the same criteria as for epoxy-coated reinforcing. Coating repair shall be in accordance with the requirements of §556-3.03 B.2 Galvanized Bar Reinforcement.

**D. Placement in Structural Slabs.** Bar supports shall be spaced no farther apart than 1.2 m center-to-center, nor shall any bar support be closer than 150 mm from the edge of any future concrete surface. Bridge slab bar reinforcement shall be placed in accordance with the following tolerances:

Vertical     ± 6 mm  
Horizontal ± 13 mm

The structural slab bar reinforcement mats (top and bottom) shall be securely connected together. This connection shall be accomplished by wiring or other means approved by the Engineer. Connections shall be placed no farther apart than 1.2 m on center. The bar supports may be utilized for this purpose. Connecting devices shall neither deflect the bar reinforcement nor interfere with the smooth flow of concrete.

Immediately prior to placement of concrete, the Engineer will verify that the reinforcing steel is positioned within the above-stated tolerances.

Subsequent to placement of concrete, the Engineer will verify, at random, that the vertical clear distance from the top of the structural slab to the top mat of main reinforcing, as shown in the contract documents, is correct within a tolerance of plus or minus 13 mm. If the allowable tolerance is exceeded, the Engineer will reject the work and so advise the Contractor and the DCES, in writing, stating the deficiencies upon which the rejection is based. The DCES will review the nature and extent of the deficiencies and shall designate one or more of the following alternatives:

1. The affected concrete placement shall be removed and replaced in whole or in part.
2. The Contractor shall provide special corrective measures as directed by the DCES.
3. The concrete placement shall be accepted without corrective action.

**556-3.04 Stud Shear Connectors for Bridges.** Stud shear connectors shall be shop or field welded to the structural steel members at the locations indicated in the contract documents. This work shall be done in accordance with the provisions of the SCM.

#### 556-4 METHOD OF MEASUREMENT

**556-4.01 Steel Fabric Reinforcement.** The quantity of steel fabric reinforcement satisfactorily installed will be measured for payment as the number of square meters of overall surface area of the deck or structure shown on the contract documents, not including clear distance to the edges, measured to the nearest whole square meter. No subtractions will be made for holes smaller than one-half of a square meter, and no additional payment will be made for overlaps.

**556-4.02 Bar Reinforcement.** These will be measured as the number of kilograms of steel bars placed. The mass of bar reinforcing will be computed by the Engineer utilizing the unit mass for each size bar as given in Table 556-1. No allowance will be made for the mass of any coating on the bars.

<b>Bar</b>	10	13	16	19	22	25	29	32	36	43	57
<b>Number</b>	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(14)	(18)
<b>Mass (kg/m)</b>	0.560	0.994	1.552	2.235	3.042	3.973	5.060	6.404	7.907	11.38	20.24

NOTE. Numbers in parenthesis are bar sizes in numbers of eighths of inches.

**556-4.03 Stud Shear Connectors for Bridges.** Stud Shear Connectors will be measured as each connector placed.

### 556-5 BASIS OF PAYMENT

**556-5.01 Steel Fabric Reinforcement.** The unit price bid per square meter will include the cost of all labor, materials, and equipment necessary to complete the work. The removal of the concrete placement and its subsequent replacement, or other corrective work which the Contractor is directed to perform, shall be accomplished at no additional cost to the State. No additional payment will be made for the replacement of defective fabric or the replacement of fabric with defective coatings.

**556-5.02 Bar Reinforcement.** The unit price bid per kilogram shall include the cost of all labor, materials, and equipment necessary to complete the work. The unit price shall also include the cost of chairs, supports, fastenings, connections, and splices not specifically shown in the contract documents. If the Engineer permits the substitution of larger bars than those specified, or the DCES permits splices not shown in the contract documents, payment will be made only for the amount of steel which would have been required if the specified size and length had been used. No additional payment will be made for enclosures constructed for bending of bars or for replacement of defective bars or for replacement of bars with defective coatings.

**556-5.03 Stud Shear Connectors for Bridges.** The unit price bid per stud shall include the cost of all labor, materials, and equipment necessary to complete the work. If the use of any stud shear connector requires payment of a royalty to the manufacturer, the royalty shall be included in the unit price bid for this work.

*Payment will be made under:*

<b>Item No.</b>	<b>Item</b>	<b>Pay Unit</b>
556.0101	Uncoated Steel Fabric Reinforcement for Structures	Square Meter
556.0102	Epoxy-Coated Steel Fabric Reinforcement	Square Meter
556.0201	Uncoated Bar Reinforcement for Concrete Structures	Kilogram
556.0202	Epoxy-Coated Bar Reinforcement for Structures	Kilogram
556.0203	Galvanized Bar Reinforcement for Structures	Kilogram
556.0204	Stainless-Steel-Clad Bar Reinforcement for Structures	Kilogram
556.0205	Stainless Steel Bar Reinforcement for Structures	Kilogram
556.03	Stud Shear Connectors for Bridges	Each

## SECTION 557 - SUPERSTRUCTURE SLABS, SIDEWALKS ON BRIDGES, AND STRUCTURAL APPROACH SLABS

**557-1 DESCRIPTION.** The work shall consist of placing high performance (Class HP) concrete to construct superstructure slabs, sidewalks, safety walks, and structural approach slabs, as required by the contract documents.

### 557-2 MATERIALS

**557-2.01 General.** The materials used for superstructure slabs, sidewalks on bridges, and structural approach slabs shall meet the material requirements of the following subsections:

Structural concrete materials	555-2.01
Reinforcing steel	556-2
Prestressed concrete form units	718-05
Permanent Corrugated Metal Forms for Bridge Slabs	736-01

**557-2.02 Concrete.** This shall meet the material requirements for Class HP in accordance with §501. Unless otherwise directed by the Engineer, all concrete shall contain a water-reducing and retarding admixture, meeting the requirements of §711-08. The quantity of the admixture shall be sufficient to achieve the minimum retardation consistent with placing conditions to keep the entire placement plastic (either one continuous placement or all sections of a sequence placement). The dosage rate used shall be determined by the Contractor in accordance with the manufacturer's recommendation and in concurrence with the Regional Materials Engineer. The dosage shall remain consistent for the duration of the concrete placement except for minor adjustments to meet changing environmental conditions.

### 557-3 CONSTRUCTION DETAILS

**557-3.01 Concrete Manufacturing and Transportation.** The requirements of §501-3 shall apply.

**557-3.02 Falsework.** The requirements of §555-3.02 shall apply.

**557-3.03 Forms.** Unless otherwise noted the contractor may use any of the following forming systems to form the underside of the superstructure slabs:

**A. Removable Forms.** The requirements of §555-3.03A shall apply.

**B. Permanent Corrugated Metal Forms for Superstructure Slabs.** Where permanent metal forms are employed, the following construction procedures shall apply.

Care and protection shall be given the metal form sheets, supports, and accessory items during handling, shipping, and storage. During loading, hoisting, and unloading operations, extra precaution and care shall be taken to prevent damage to ends, corners, and edges of the form sheets, supports, and accessory items. If the form units and accessories are to be stored prior to installation, they shall not be placed in contact with the ground and the material shall be adequately covered or protected to keep it dry.

Form supports shall be placed in direct contact with the flange of a stringer or floor beam. All attachments shall be made by permissible welds, bolts, clips, or other approved means. The welding of form supports to steel not considered weldable or to portions of flanges subject to tensile stresses shall not be permitted. Welding shall be in accordance with the provisions of the New York State Steel Construction Manual (SCM) except that 3 mm fillet welds will be permitted. All welding shall be performed by a welder certified under the SCM.

Form sheets shall not be permitted to rest directly on the flanges. They shall be securely fastened to form supports by self-tapping screws and shall have a minimum bearing length of 25 mm at each end. Transverse construction joints shall be located at the bottom of a flute and 6 mm weep holes shall be field drilled at not less than 300 mm on centers along the line of the joint.

Screed rail and pouring runway supports shall not be located directly on the form sheets, form supports, or reinforcing steel. No loose sheets or miscellaneous hardware shall be left on the structural slab at the end of the work day. Metal forms shall not be used where longitudinal slab construction joints are located between stringers, nor shall they be used on the fascia overhang.

The corrugated metal sheets shall be fabricated for the placement sequence used with the joints between sections of sheet overlapped or securely fastened to eliminate differential deflections between sections. Any exposed form metal where galvanizing has been damaged, shall be cleaned and repaired as provided for in §719-01, Galvanized Coatings and Repair Methods.

**C. Prestressed Concrete Form Units.** The applicable requirements of §555-3.03A and the Prestressed Concrete Construction Manual shall apply.

Form supports shall be placed in direct contact with the flange of the stringer. All attachments shall be made by permissible welds, bolts, or other means approved by the Engineer. The welding of

form supports to steel not considered weldable, or to portions of flanges subject to tensile stresses will not be permitted. Welds and welding shall be in accordance with those portions of the SCM concerned with fillet weld design, fillet weld details, general workmanship and technique, except that 3 mm fillet welds will be permitted. All welding shall be performed by a welder certified under the SCM.

**D. Restrictions.** The following restrictions shall apply to all forms.

1. Fascia overhangs shall be formed with removable forms to provide a flat concrete surface.
2. A bay, constructed in stages such that a longitudinal joint is required, shall only be formed with removable forms.
3. A haunch which rests upon an end diaphragm shall only be formed with removable or permanent corrugated metal forms.
4. Prestressed concrete form units shall not be used where the design span is less than 1.5 meters nor greater than 3.3 meters. The design span is equal to the beam spacing minus one-half the top flange width.
5. Prestressed concrete form units may be restricted at the ends of some skewed spans. Refer to the contract documents for details.
6. Prestressed concrete form units shall not be used on prestressed concrete box beam superstructures unless specifically allowed by the contract documents.

**557-3.04 Placing and Fastening Reinforcing Steel.** Immediately prior to placement of concrete, the Engineer will verify that the reinforcing steel is positioned within required tolerances. If the allowable tolerances are exceeded, the Contractor shall correct the position of the reinforcing steel before placing concrete. All reinforcing steel and chairs shall be anchored to prevent uplift.

**A. Permanent Corrugated Metal Forms or Removable Forms.** Except for prestressed concrete form units the requirements of §556-3.01 and §556-3.03 shall apply.

**B. Prestressed Concrete Form Units.** The requirements of §556-3.01 and §556-3.03 shall apply. The top reinforcing steel mat shall be securely connected to the forms and the stud shear connectors. Connections shall be placed no farther apart than 1.2 meters on center. Connections to the forms may be made to the form-lifting devices, reinforcing steel projecting from the forms, or devices in the form supplied for this purpose. Hold-down devices shot into the form will not be permitted. Connections shall neither deflect the reinforcing steel nor interfere with the smooth flow of concrete.

**557-3.05 Handling and Placing Concrete.** The requirements of §555- 3.04 Handling and Placing Concrete shall apply. A Preplacement Meeting is required to be held at least one week prior to the start of any concrete placement for superstructure slabs. Meeting participants besides the Contractor and Engineer should include materials suppliers, subcontractors, Regional Materials Engineer, Regional Safety Officer, and others as deemed appropriate. Participants will review all aspects of the proposed placement including, but not limited to, the following:

- Equipment proposed for use and for backup.
- Planned workforce, assigned tasks of each designated position, and experience and expertise.
- Proposed construction techniques and crew experience.
- Safety considerations.
- Concrete mix design.
- Admixtures and technical data; dosage rates will be approved by the Regional Materials Engineer.
- Proposed placement rate, curing and loading schedules.
- Curing practices to be employed as well as the workforce designated to the curing process.
- Delivery/conveyance equipment, including deck finishing machine setup and operation.
- Traffic control.

For placements between September 15th and April 1st :

- Expected environmental conditions at time of placement and during curing
- Proposed curing methods to maintain acceptable curing temperature
- Engineers permission to progress cold-weather concreting

No concrete shall be placed until all aspects of the proposed placement are approved by the Engineer. A written report of the preplacement meeting will be established by the Engineer. Modifications shall be submitted in writing to the Engineer for approval. Further, for placements between September 15th and April 1st, no concrete shall be placed until all aspects of the proposed placement are approved by the Regional Construction Engineer.

Before concrete slabs are placed on steel spans, all permanent field connections shall be completed unless otherwise noted on the contract plans, and all temporary supports and mechanisms used in steel erection shall be removed.

No concrete shall be placed until all the provisions of §555-3.04A. Placement Limitations are met, environmental conditions are deemed favorable, and satisfactory means to mitigate adverse environmental conditions exist. Favorable environmental conditions are defined as an expected weather forecast suitable for concrete placement during the entire placement duration, the evaporation rate not to exceed 1.2 kg/m<sup>2</sup>/hr, and acceptable curing temperatures expected for the duration of the curing period.

The Contractor shall provide any necessary means to mitigate adverse weather conditions and curing temperatures. Failure to maintain acceptable environmental conditions will result in the concrete placement being stopped and a bulkhead put in place.

The Contractor shall take the necessary measurements and calculate the theoretical evaporation rate. The measurements for air temperature, relative humidity, and wind speed shall be taken as near as possible to the final placement location of the concrete.

Concrete temperature will be taken from the same sample used for slump and air content tests. These measurements will be taken prior to commencement of concrete placement. If, in the Engineer's opinion, significant changes occur in atmospheric conditions, additional atmospheric measurements and calculations by the Contractor will be required. The Contractor shall supply all instruments necessary to make the required calculations. All instruments shall be approved by the Engineer, as being in good working order. The Contractor's measurements and calculations will be subject to the Engineer's approval. To determine the evaporation rate, apply the values taken for relative humidity, plastic concrete temperature, air temperature, and wind velocity to Figure 557-1 Structural Concrete Evaporation Rate.

The placing of concrete for any bridge slab shall be continuous between joints. Conveyance of concrete shall meet the requirements of §555-3.04B.

Vibrating of concrete shall be in accordance with §555-3.04E except the number of vibrators required shall be one for every 30 cubic meters of concrete placed per hour, with a minimum of two vibrators in use at all times, and equally spaced across the placement front. One additional vibrator shall be available for use as a backup.

**557-3.06 Cold Joints.** "Cold Jointing," the bonding of fresh concrete to set concrete, shall be done where indicated in the contract documents, or where approved by the DCES.

**A. Horizontal Joints.** Within 24 hours of the start of the placement, the hardened concrete shall have laitance and dirt removed by a high-pressure water wash. The high-pressure water wash shall be sufficiently strong to remove any laitance and dirt, but not damage the reinforcement or reinforcement coating. The pressure wash equipment shall be capable of providing pressure of 21 MPa to 35 MPa.

After pressure washing, the concrete shall be continuously wetted for a minimum of 12 hours immediately prior to deck placement. Before placing fresh concrete, all standing water shall be removed with oil-free compressed air. The surface shall be protected from drying to maintain a clean, saturated surface dry condition when placing the new concrete.

If the tops of precast/prestressed elements have been sealed with a penetrating sealer, pressure wash the tops a maximum of 2 hours prior to concrete placement. The requirement for prewetting is waived.

**B. Construction Joints.** The requirements of § 555-3.06 A. shall apply. Construction joints shall be placed only where shown in the contract documents or where permitted by the DCES.

In the event an ongoing placement is delayed excessively, the establishment of a bulkhead shall be required.

**557-3.07 Finishing Integral Wearing Surfaces on Superstructure Slabs.** Machine finishing shall be used throughout all superstructure concrete placement operations with the exception of areas which are inaccessible to finishing machines.

Machine finishing shall be accomplished with an approved power-driven, one-operation (strike-off and finishing) machine. The finishing machine shall have a strike-off auger set 6 mm to 13 mm above the finished surface, a power-driven roller or oscillating type screed, and a pan float.

Finishing machines shall be equipped with adjustable strike-off and finishing screeds, the bottom surfaces of which shall be adjusted to produce the required contour of the finished surface. Machines shall be kept in true adjustment. Machines out of adjustment shall not be used until proper adjustments have been made and the adjustments have been approved by the Engineer.

The specific method and equipment that the Contractor proposes to use for finishing will be supplied during the Preplacement Meeting and will be subject to approval by the Engineer based on the above listed requirements.

Finishing machine rail supports shall be accurately set and of substantial construction so that the finished deck surface will conform to the profile and transverse sections shown in the contract documents. Finishing machine rail supports shall be placed and adjusted to properly provide for the deflection of forms, falsework, and structural supporting members which will occur during the placement of the concrete. Finishing machine rail supports shall not be attached by welding to portions of flanges subject to tensile stresses. The finishing machine rail supports shall be spaced at a maximum of 600 mm on center. During stage construction, the support system shall be on the stage being placed.

Where the deck surface falls outside the fascia stringer flange, the finishing machine rail supports shall be placed on the forms. The forms shall be designed to take these loads through the use of outriggers or some other approved means.

Prior to commencing concreting operations, the finishing machine shall be given a test run over the full length of the superstructure segment to be paved, with the finishing machine adjusted to its finishing position. While operating the finishing machine during this test, the finishing machine rails shall be checked for deflection and proper adjustment, the cover on slab reinforcement measured, and the controlling dimensions of slab reinforcement and forms checked. All necessary corrections shall be made and verified by the Engineer before concreting is begun.

A sufficient amount of concrete equal to the finishing machine capacity shall be supplied at all times.

After the concrete has been placed, spread, and consolidated to provide a uniformly dense structural slab, the surface shall be struck off immediately by a single passage of the transverse finishing machine. The finishing machine shall carry sufficient concrete in front of the screed to fill low and porous places. This operation shall be done only once and shall produce a uniformly consolidated dense smooth surface of the required contour. The passage of the strike-off auger shall provide a concrete surface slightly above grade so that after settlement, if any, and the disappearance of excess water from the surface, the passage of the finishing screed will result in a uniform surface at the required grade and contour over its entire area, and provide the required cover over reinforcing.

In areas which are inaccessible to finishing machines, use of approved manual vibratory equipped power screeds may be used, with written approval of the DCES.

Hand finishing shall be allowed only in areas inaccessible to finishing machines or manually driven vibratory-equipped power screeds. Hand finishing shall be performed in the same sequence and manner as machine finishing, unless otherwise permitted by the Engineer. Hand finishing shall be performed in such a manner as to produce a concrete surface with quality and uniformity identical to that produced by the finishing machine. Hand screeds or bullfloats shall be magnesium and 250 mm, or more, in width. Care shall be taken not to overwork the concrete surface during any finishing operation.

In the event the placement is delayed as a result of equipment breakdowns or delivery problems, all concrete in place shall be protected from evaporation by covering the surface with wet burlap, curing blankets, or plastic sheets. Excessive delays shall require the establishment of a bulkhead and the ceasing of the placement.

Prior to texturing, the finished concrete surface shall be examined by the Contractor and the Engineer using a straightedge. The straight-edge shall not be less than 3 m long. It shall be furnished by the Contractor and maintained in good, usable condition at the placement site at all times. While the concrete is still plastic, surface depressions shall be filled with concrete of the same class as the placement in progress. Surface irregularities greater than 5 mm in 3 m in either the longitudinal or the transverse direction shall be corrected in a manner acceptable to the Engineer. Thin mortar or laitance, which may have accumulated ahead of the finishing machine screed, shall be removed from the work site. They shall not be used to fill depressions.

After finishing, the surface shall be given a suitable texture with an artificial turf drag made of molded polyethylene with approximately 64,000 synthetic turf blades per square meter, each approximately 13 mm long. The artificial turf drag shall be of a type and brand appearing on the Department's Approved List.

The Contractor may apply texture in a transverse direction, longitudinal direction, or parallel to the finishing machine. Once begun, the direction of texturing shall not change. All texturing shall be done from a work bridge immediately following the finishing operation. Texturing shall be done prior to the beginning of curing operations. Only one pass of the turf drag over the finished area will be permitted.

If texturing is done in a transverse or skewed direction, the Contractor shall texture by hand methods immediately after finishing machine passage.

If texturing is done in the longitudinal direction the turf drag shall be a seamless strip and shall be attached to the work bridge such that the surface of the concrete is textured immediately after finishing machine passage. Small areas, otherwise inaccessible to the attached drag, may be textured by hand methods. Texture resulting from the drag shall stop within 300 mm of curbs.

The finishing movement and resulting progress of the turf drag shall be done in a manner so as to prevent ridges or gouges forming in the concrete surface. The drag shall be weighted and the contact area changed as required to produce an acceptable texture. The drag shall be cleaned periodically to remove all hardened concrete particles.

**557-3.08 Finishing Integral Wearing Surfaces on Structural Approach Slabs.** The requirements of §557-3.07 shall apply together with the following:

The Contractor may use an approved, manually driven, vibrator-equipped power screed in lieu of a power-driven transverse finishing machine. Only screed model types appearing on the Department's Approved List shall be employed for this work. The Engineer may require the use of a power-driven finishing machine if satisfactory results are not being attained.

**557-3.09 Finishing Surfaces to be Overlaid with Portland Cement or Asphalt Concrete.**

Machine finishing shall be used throughout all superstructure concrete placement operations, with the exception of areas which are inaccessible to finishing machines. In areas which are inaccessible to finishing machines, use of approved manual vibratory equipped power screeds may be used, with written approval of the D.C. E. S.

Surfaces shall be finished to a surface tolerance of 10 mm in 3 meters. The surface tolerance shall be verified by the Engineer with an approved straightedge not less than 3 meters long. The straightedge shall be furnished by the Contractor who shall maintain it in good condition at the paving site at all times.

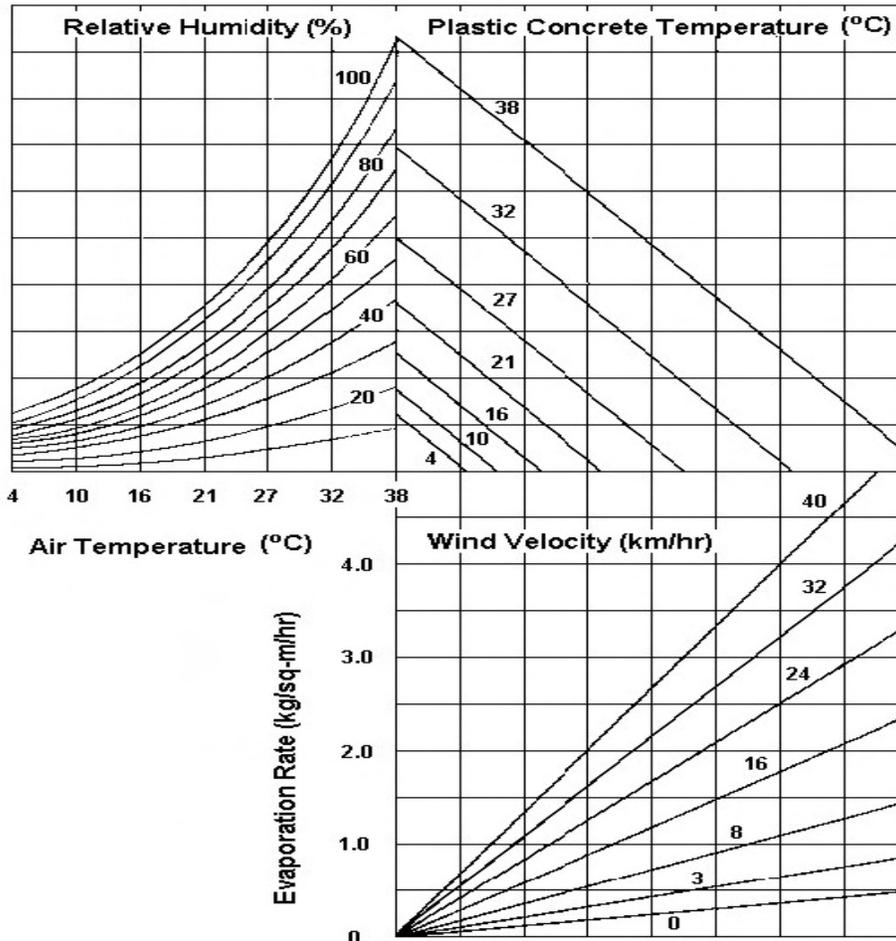
Hand finishing shall be allowed only in areas inaccessible to finishing machines or manually driven vibratory-equipped power screeds. Hand finishing shall be performed in the same sequence and manner as machine finishing, unless otherwise permitted by the Engineer. Hand finishing shall be performed in such a manner as to produce a concrete surface with quality and uniformity identical to that produced by the finishing machine. Hand screeds or bullfloats shall be magnesium and 250 mm, or more, in width. Care shall be taken not to overwork the concrete surface during any finishing operation.

Upon completion of screeding, surfaces which will be overlaid with portland cement concrete shall be textured to conform to §557-3.07.

**557-3.10 Sidewalk and Safety Walk Finish on Bridges.** Sidewalks and safety walks shall be constructed by placing concrete continuously to an elevation slightly higher than shown in the contract documents. The concrete shall then be screeded to the correct elevations and worked with a magnesium float to give uniform surface. Floating shall be kept to a minimum, consistent with the desired finish, in

order to avoid overworking the concrete. Follow floating with a broom finish. Surface scoring will not be permitted.

**FIGURE 557-1 STRUCTURAL CONCRETE EVAPORATION RATE**



To use this chart:

1. Enter with air temperature, move up to relative humidity.
2. Move right to plastic concrete temperature.
3. Move down to wind velocity.
4. Move left to read approximate rate of evaporation.

**557-3.11 Curing.** After finishing and plastic-concrete texturing operations are completed, the concrete surface shall be completely covered with clean, prewetted burlap. The allowable time period for wet burlap covering shall not exceed five minutes from the completion of texturing, and 30 minutes from the time of concrete placement. Care shall be taken so as not to damage the finished surface and texturing. The curing shall not be delayed beyond the specified period. Burlap shall be lapped a minimum of 300 mm. Lapped edges are not required to be sealed. Burlap shall be thoroughly saturated over its entire surface area and shall be drained of excess water prior to its application. Burlap shall be kept continuously wet, commencing 10 minutes from the time the wet burlap is placed, and protected from displacement. The Contractor may cover the wet burlap and soaker hoses only if it is necessary to maintain curing temperature.

The curing period shall begin only after all concrete for a given placement is complete. A curing day is defined as any day during which the ambient air temperature at the concrete surface is 7°C or higher for the entire day.

Conditions may occur which prevent an entire day from qualifying as a curing day, but do not prevent portions of that day from reaching temperatures that qualify as curing temperatures. If these conditions occur and with the Engineer's approval, the Contractor may aggregate curing hours. A curing hour is defined as any hour during which the curing temperature remains at, or above 7°C.

An aggregation of 24 curing hours will be credited as one curing day. Aggregations of less than 24 curing hours will not be credited.

Curing hours will be determined with continuous recording thermometers. The number and placement of the thermometers will be determined by the Engineer. Thermometers used to monitor curing temperatures shall consist of the following types:

1. **Continuously Recording Thermometer.** The thermometer shall be capable of continuously recording temperatures within a range of -20°C to 50°C for a minimum of 24 hours.
2. **Maximum - Minimum Recording Thermometer.** For all placements the thermometer shall be capable of recording maximum and minimum temperatures in a range of -20° C to 50° C.

The curing temperature of concrete is the air temperature at the concrete surface, or the air temperature between the concrete surface and its protective covering. Temperatures at these locations are critical for proper concrete curing. For the purposes of this section the temperatures at the foregoing locations shall be maintained between 7°C and 30°C inclusive.

**A. Superstructure Slabs.** After the burlap placement has been fully completed, the concrete surface shall be cured for 14 curing days. The Contractor may use either option listed below. After seven curing days, the Contractor may be permitted to perform incidental work on the structure under the loading limitations of §557-3.14 Loading Limitations for Superstructure Slabs. The burlap may be displaced in limited areas, for short durations, to perform items such as sawcut grooving, placement of sidewalks, safety walks, curbing, bridge rail, and fencing. The amount of burlap displaced to perform these operations shall be limited to the immediate area affected by the Contractor's operations. All concrete surfaces exposed during these operations shall be kept in a saturated condition. Immediately after the work is completed in the affected area, all burlap shall be replaced for the duration of the curing period. Removable forms shall remain in place until the minimum curing period is complete.

**1. Fourteen-Day Continuous Wetting.** Leave all burlap in place for 14 curing days. Provide continuous, uniform wetting for the entire curing period.

**2. Wet Burlap and Curing Covers.** Provide continuous uniform wetting for seven curing days. After seven curing days, either of the following methods may be used:

- a. Remove all burlap after seven curing days. Apply curing covers immediately upon burlap removal. Plastic-coated fiber blankets are not required to be laid dry. Application and maintenance of covers shall be in accordance with §555-3.08A General. Concrete cured in this manner shall not be exposed to the atmosphere for more than 10 minutes between burlap removal and curing cover placement.
- b. Apply curing covers directly over the wet burlap. Plastic-coated fiber blankets are not required to be laid dry. Application and maintenance of covers shall be in accordance with §555-3.08A General. The concrete surface shall be inspected periodically to ensure that its condition remains saturated.

The Contractor shall inform the Engineer of the intended curing procedure at the Preplacement Meeting.

**B. Structural Approach Slabs, Curbs, Sidewalks and Safety Walks on Bridges.** After the burlap placement has been fully completed, leave all burlap in place for 7 curing days. Provide continuous, uniform wetting for the entire curing period. Forms for curbs, sidewalks, and safety walks shall remain in place until the minimum curing period is complete. Forms for structural approach slabs shall remain in place until sufficient strength is achieved to avoid damage to the

concrete. After removal of approach slab forms, the formed surfaces shall be cured as per the requirements of §555-3.08A.

**557-3.12 Provisions for Concreting in Cold Weather.** When permission is granted in writing by the Regional Construction Engineer for cold-weather concreting between September 15th and April 1st, curing temperatures shall be maintained in accordance with §555-3.08C Provisions for Curing in Cold Weather, except as modified here:

- The curing duration shall be 14 days.
- The use of external heat to maintain curing temperatures is required. All concrete surfaces within the heated areas shall be protected from drying by the use of live steam or use of burlap that is continuously wetted.
- Continuously recording thermometers shall be placed on both the top and underside of the deck to monitor areas where extreme cold or heat can be expected.
- The temperature differential between any two locations within the heated enclosure shall not be more than 15°C.
- Upon completion of curing, concrete shall be air dried for 14 days before being exposed to freezing temperatures. Once the drying period is complete, temperatures shall be gradually reduced at a rate not to exceed 0.5°C/hr until the temperature within the enclosure equals the temperature outside the enclosure.

After seven (7) drying days, the Contractor may be permitted to perform incidental work on the structure, within the enclosure, to progress sawcut grooving and sealing. All concrete surfaces shall be kept reasonably dry during these operations, with use of any water kept to a minimum.

Failure to maintain acceptable curing conditions, as indicated above, shall result in all concrete of the placement being considered damaged or defective and shall be cause for rejection of all concrete of the represented placement. Acceptance may be established based on contractor evaluation and testing as directed by the Department, at no additional cost to the State.

**557-3.13 Removal of Forms.** Removal of forms for superstructure slabs shall meet the requirements of §555-3.09 Form Removal and as modified herein. The minimum curing period prior to form removal is 10 curing days, except that for cold weather concreting a minimum of 14 curing days is required unless minimum compressive strengths are achieved as determined by the D.C. E. S. A curing day is defined in §555-3.08A. Permanent field connections, if required, shall be made on the same day prior to removal of forms and falsework.

The following inspection procedures will be used as a check to insure the soundness of the concrete structural slab adjacent to the steel forms. Not less than two days after completion of a concrete structural slab pour, but prior to the next slab pour, the Contractor shall remove a section of the steel form from the most recently completed pour of each span, at a location selected by the Engineer, in order to provide visual evidence that the concrete mix or the construction procedures are obtaining the desired results. If either the concrete mix or the construction procedures are varied significantly within a pour, such as a change in the extent of vibration or change in the workability of the mix, the Contractor shall remove another section of form to verify that the new procedures yielded desirable results.

After the concrete has been placed in a span for a minimum of ten days but prior to any further work performed on the superstructure in that span, the Engineer will spot-check the underside areas of the steel forms by sounding with a suitable-weight hammer at least 50% of the area of at least 25% of the individual form panels on a random basis to determine whether any honeycomb or void areas exist. If such areas are detected, the Contractor shall remove the forms from these areas for a visual inspection of the slab.

The amount of sounding and form removal may be reduced after a substantial amount of slab has been constructed and inspected, if the Contractor's methods of construction and the results of the inspections as outlined above indicate that sound concrete is present throughout the slabs.

If, after removing a section of form, the concrete is found to be defective, additional panels shall be removed. All defective concrete shall be repaired to match the adjacent concrete in section and color.

The form sections shall be removed by a metal saw or air-carbon-arc gouging with minimum damage to the concrete. Cuts shall only be sufficiently deep to sever the form. Any other method of removal shall be submitted to the Deputy Chief Engineer (Structures) for approval. Cuts that are parallel to the

corrugations in the forms shall be located on the sloping surface midway between a crest and a valley. Cuts parallel to the supporting beams shall be made through the supporting angles taking care not to damage the structural steel beams. The Contractor will not be required to replace the removed forms.

The Contractor shall provide all the facilities required for safe, suitable and convenient means of access to the forms for the Engineer's inspection.

**557-3.14 Loading Limitations for Superstructure Slabs.** Superstructure slabs, during the curing period, may be subjected to a vehicle load not to exceed nine metric tons, or a wheel load not to exceed three metric tons no sooner than seven curing days after placement. Full legal loading may commence using either of the following options:

- A. Superstructure slabs may be subjected to full legal loads no sooner than 14 calendar days after completion of the curing period.
- B. The Contractor may subject a superstructure slab to its full legal load upon completion of the curing period, or any day thereafter provided that the procedure below is followed:
  1. The Contractor shall notify the Engineer at the Preplacement Meeting of the intention to subject the slab to full legal load prior to the 14th day after completion of curing.
  2. During the slab concrete placement, the Engineer will cast two sets (pairs) of test cylinders in addition to each set cast for record and cure the cylinders on site in the same manner as the superstructure slab.
  3. The Engineer will forward cylinders to the Materials Bureau or Regional Testing Facility. One set will be tested fourteen calendar days after placement and, if necessary, the second set will be tested twenty-one calendar days after concrete placement. Under no circumstances will cylinders be tested sooner than fourteen calendar days after the concrete placement they represent.
  4. Concrete cylinder sets (pairs) designated for advance testing shall achieve an average compressive strength of 21 MPa, or greater, with individual cylinders having a compressive strength of 19.5 MPa, or greater.
  5. Results of compression tests will be transmitted to the Engineer as soon as possible. The Engineer will inform the Contractor of the cylinder testing results and allow early loading if appropriate. If the required compressive strengths are not achieved, the requirements of §557-3.14A shall apply.

**557-3.15 Loading Limitations for Structural Approach Slabs, Sidewalks, and Safety Walks on Bridges.** The Contractor may subject structural approach slabs, sidewalks, and safety walks to their full legal load upon completion of the 7-day curing period.

**557-3.16 Damaged or Defective Concrete.** Damaged or defective concrete shall be defined by, and repaired in accordance with, the requirements of §555-3.13, Defective or Damaged Concrete.

Subsequent to placement of concrete, either before or after setting, the Engineer will verify at random that the vertical clear distance from the top of the structural slab to the top mat of main reinforcing, as shown on the contract plans, is correct within a tolerance of plus or minus 13 mm. If the allowable tolerance is exceeded, the Engineer shall reject the work so advise the Contractor and the Deputy Chief Engineer (Structures), in writing, stating the deficiencies upon which the rejection is based.

The Deputy Chief Engineer (Structures) shall review the nature and extent of the deficiencies and shall designate one or more of the following alternatives:

- The affected placement shall be removed and replaced in whole or in part.
- The Contractor shall provide special corrective measures as directed by the Deputy Chief Engineer (Structures).
- The concrete placement shall be accepted without corrective action.

After the concrete has hardened, the Engineer will examine it using the Contractor's straightedge. Surface irregularities greater than 5 mm in 3 meters shall be corrected. Unless otherwise directed by the Regional Materials Engineer, the concrete used for repairs shall be of the same materials as that used for the original placement.

**557-3.17 No Bar list provided.** When no bar lists are provided in the contract documents the following shall apply:

1. At least thirty (30) days prior to fabrication of the reinforcement the Contractor shall submit a minimum of two copies of the bar lists and placement drawings showing the bar locations to the Engineer. The details of the bar list and placement drawings shall meet the requirements of the current edition of the Concrete Reinforcing Steel Institute's publication Reinforcing Bar Detailing. Placement drawings shall be size "B". Drawings and bar lists shall be clear and legible.
2. Requests for information or changes along with reasons shall be documented in a separate list.
3. The Engineer will transmit the documents to the designer for review for conformance with the design requirements in accordance with the Shop Drawing Approval process. The designer will not be checking lengths, number of bars, weights or bar marks. Corrections will be returned to the Contractor. When the documents are satisfactory they will be returned to the Contractor stamped "Approved In Conformance With Design Requirements".
4. Partial submissions that require coordination with other drawings will not be accepted.

**557-4 METHOD OF MEASUREMENT.** The work will be measured for payment as the number of square meters of slab, sidewalk, or safety walk satisfactorily installed, measured to the nearest 0.1 square meters.

**557-5 BASIS OF PAYMENT.** The unit price bid per square meter shall include the cost of furnishing all labor, materials, and equipment necessary to complete the work. Unless otherwise provided, the unit price bid shall include the cost of furnishing and placing bar reinforcement, wire fabric for concrete reinforcement, copper flashing, flexible water stops, mechanical connectors where specified, sheet packing, water for wetting, joint sealing compounds, joint fillers, concrete curing materials, and the cost of screed rail supports and other brackets or braces necessary to support finishing machines.

If permanent metal forms are used, the cost of furnishing all facilities required for access, removing the permanent forms for inspection or repair purposes, painting the cut edges of the forms and repairing the concrete as required herein shall be included in the price bid for this work.

No extra compensation for corrective finishing or repairs to damaged or defective concrete will be paid.

Progress payments will be made on a per-span basis as follows:

Forty (40) percent of the area will be paid for after all reinforcing is properly placed. Forty (40) percent of the area will be paid for after the concrete has been properly placed and proper curing applications have been instituted. The remainder will be paid for after completion of all curing, and necessary corrective work.

***Payment will be made under:***

<b>Item No.</b>	<b>Item</b>	<b>Pay Unit</b>
557.0101	Superstructure Slab with Integral Wearing Surface – Bottom Formwork Required – Type 1 Friction	Square Meter
557.0102	Superstructure Slab with Integral Wearing Surface – Bottom Formwork Required – Type 2 Friction	Square Meter
557.0103	Superstructure Slab with Integral Wearing Surface – Bottom Formwork Required – Type 3 Friction	Square Meter
557.0109	Superstructure Slab with Integral Wearing Surface – Bottom Formwork Required – Type 9 Friction	Square Meter
557.0501	Superstructure Slab with Integral Wearing Surface – Bottom Formwork Not Required – Type 1 Friction	Square Meter
557.0502	Superstructure Slab with Integral Wearing Surface – Bottom Formwork Not Required – Type 2 Friction	Square Meter
557.0503	Superstructure Slab with Integral Wearing Surface – Bottom Formwork Not Required – Type 3 Friction	Square Meter
557.0509	Superstructure Slab with Integral Wearing Surface - Bottom Formwork Not Required – Type 9 Friction	Square Meter
557.07	Superstructure Slab with Separate Wearing Surface – Bottom Formwork Required	Square Meter
557.09	Superstructure Slab with Separate Wearing Surface –	

	Bottom Formwork Not Required	Square Meter
557.13	Class D Concrete	Square Meter
557.2001	Structural Approach Slab with Integral Wearing Surface – Type 1 Friction	Square Meter
557.2002	Structural Approach Slab with Integral Wearing Surface – Type 2 Friction	Square Meter
557.2003	Structural Approach Slab with Integral Wearing Surface – Type 3 Friction	Square Meter
557.2009	Structural Approach Slab with Integral Wearing Surface – Type 9 Friction	Square Meter
557.22	Structural Approach Slab with Separate Wearing Surface	Square Meter
557.30	Sidewalks and Safety Walks	Square Meter

**SECTION 558 - LONGITUDINAL SAWCUT GROOVING OF STRUCTURAL SLAB SURFACE**

**558-1 DESCRIPTION.** Sawcut grooves into the surface of a portland cement concrete structural slab at the locations indicated in the contract documents.

The Contractor is hereby notified that concrete curing requirements, combined with structural slab loading restrictions, may have a significant effect upon the specific time, relative to concrete placement, at which sawcut grooving may be performed. The Contractor shall be familiar with the limits imposed by these factors and conduct operations accordingly.

**558-2 MATERIALS.** Use multibladed wet saw cutting equipment using circular saw blades. The Engineer may allow the use of single blade, circular saw equipment, where it is determined such equipment is necessary to complete the work as required. The equipment the Contractor proposes to use will be subject to the approval of the Engineer, prior to use.

Use water which meets the requirements of §712-01.

**558-3 CONSTRUCTION DETAILS.** Sawcutting concrete produces silica dust. Include sawcutting of concrete in the Health and Safety Plan in accordance with the silica safety requirements of §107-05 L.4.

Start sawcutting only after the specified curing period has elapsed, unless otherwise allowed by the applicable specification.

Cut longitudinal grooves parallel to the centerline of roadway using a single pass. Space the center-to-center of grooves at 19 mm ±2 mm. Cut all grooves rectangular in shape conforming to the following dimensions:

Width 2.5 mm (+ 0.5 mm, - 0.0 mm)                      Depth 4 mm ±2 mm

During the grooving operations, the Engineer will verify, at random, that the minimum groove depth is being achieved. Should the Engineer determine that minimum groove depth is not being achieved, the Contractor shall stop grooving operations and make all adjustments necessary to achieve the minimum depth.

Supply the Engineer with two (2) accurate, easily readable gauges with which to verify groove depth. Deliver the gauges and applicable manufacturer’s instructions for use, if necessary, no later than one week prior to the anticipated beginning of grooving operations.

Terminate grooves within the following limits unless otherwise indicated on the contract documents:

<b>Location</b>	<b>Closest Allowable Distance</b>	<b>Farthest Allowable Distance</b>
Drainage structure	100 mm	380 mm
Vertical face (curb or parapet), or face of railing (no curb)	100 mm	380 mm
Joint System (Dimension measured perpendicular to the centerline of the joint system)	100 mm	380 mm

Using a self-contained system, continuously collect any slurry or debris created by the grooving operation such that it does not accumulate on the surface.

**558-4 METHOD OF MEASUREMENT.** The quantity will be measured as the number of square meters of structural slab satisfactorily grooved, measured between the faces of barrier, curb, or rail, and between the ends of the slabs, computed to the nearest whole square meter. No deduction will be made for areas left ungrooved near curbs, barriers, rails, joints, drainage structures, or other objects embedded in the slab.

**558-5 BASIS OF PAYMENT.** The unit price bid per square meter shall include the cost of all labor, materials, and equipment necessary to complete the work.

*Payment will be made under:*

<b>Item No.</b>	<b>Item</b>	<b>Pay Unit</b>
558.02 M	Longitudinal Sawcut Grooving of Structural Slab Surface	Square Meter

**SECTION 559 (VACANT)**

**SECTION 560 - MASONRY**

**560-1 DESCRIPTION.** Under this work the Contractor shall furnish and place masonry, with or without coping, of the type, shape, size, color and location indicated in the plans, proposal or as directed by the Engineer.

**560-2 MATERIALS.** Materials shall meet the requirements specified in the following subsections of 700 - Materials:

Split Faced Concrete Brick	704-10
Precast Concrete Coping	704-11
Caulking Compound for Structures	705-06
Premolded Resilient Joint Filler	705-07
Masonry Mortar	705-21
Bar Reinforcement - Grade 420	709-01
Wire Fabric for Concrete Reinforcement	709-02
Admixtures	711-08

**560-2.01 Dimension Stone Masonry.** All stone shall be sound, durable, free from reeds, rifts, seams, laminations and minerals which would cause discoloration or deterioration from weathering. The stone shall be of size, quality and color acceptable to the Regional Director. Duplicate samples of stone showing the complete color range shall be submitted to the Regional Director for approval. Stone shall be quarried so the stratification will be radial or parallel to the bed when set in place except where split face or seam face finish is called for on the plans. All beds and joints shall have a "Fine Point or Sawn Finish" for at least 50 mm from the arris lines. The balance shall not fall off from a straight line for more than 1/6 of the stone's minimum dimension. When stones project beyond adjoining faces, the fine pointing shall be carried at least 50 mm in from the adjoining surfaces (arris lines of stone or face of concrete).

Soffits of ring stones shall be cut to the curve of the arch and shall have a "Fine Point or Sawn Finish" unless otherwise shown on the plans. All other showing surfaces shall be finished as indicated on the plans.

On square bridges and on bridges where the skew is 30 degrees or less, the ring stones shall be cut so the joint sides are parallel to the faces of the abutments. On bridges with a skew greater than 30 degrees the ring stones shall be cut so the joint sides of each stone will be at right angles with the face. Soffit joints shall lie in a horizontal plane.

"Fine Point or Sawn Finish" shall be as described in §560-2.07, Definition of Finishes.

**560-2.02 Split Faced Concrete Masonry.** Split faced concrete masonry units shall be new, sound, durable, true to size, free from laminations and cracks, and uniform quality which complies with the requirements of §704-10. All split face concrete masonry units delivered to the site shall be of the sizes necessary to produce the wall pattern as indicated on the plans.

An approved mechanical self-leveling splitting machine with two steel knives, one directly above the other will be used for all field splitting. Four samples of each thickness of each split faced concrete masonry unit shall be submitted to the Engineer for tentative approval. They shall be labeled with the contract title and number, the Contractor's name, and manufacturer's name. The split faced concrete masonry units used in the work shall be equal in all respects, color, quality, texture and surface to the approved samples.

Anchors shall be a metal slot formed from sheet zinc not less than 0.5 mm in thickness, bent to form a dovetail channel 16 mm wide at the front, 25 mm wide at the rear, 25 mm deep and with wings 3 mm to 6 mm wide. The slots shall be provided with a felt insert to prevent the entrance of fresh concrete. These inserts shall be removed just prior to the insertion of the ties. Ties shall be formed of zinc not less than 2 mm thick, 25 mm wide with one end designed to fit snugly into the anchor slots and shall be crimped with corrugations 3 mm deep, but no less than 2 mm deep.

The ties shall be at least 100 mm long. The Contractor shall submit to the Engineer for tentative approval four samples of the material used to fabricate the ties, i.e. anchors, felt and ties.

**560-2.03 Stone Masonry.** All stone shall be sound, durable, properly quarried, free from reeds, rifts, seams, laminations and minerals which would cause discoloration from weathering. Samples of stone shall be submitted to and be approved by the Regional Director prior to the beginning of any work on this masonry. The size, color and quality of the stone delivered to the site shall be substantially in accordance with the approved samples.

The stones may have an average variation of 1/6 of the thickness shown on the plans, however, they shall have a minimum thickness of at least 2/3 that shown on the plans and a maximum thickness of 1/6 over the maximum thickness shown on the plans.

**560-2.04 Rubble Stone Masonry.** All stones shall be clean, free from structural defects and acceptable to the Engineer. Selected stones, roughly squared and pitched to line, shall be used at all angles and ends of walls.

**560-2.05 Precast Concrete Coping.** Precast concrete coping units shall be new, sound, durable, true to size, free from laminations and cracks and of uniform quality which complies with the requirements of §704-11.

**560-2.06 Mortar.** Use 705-21 Masonry Mortar.

**560-2.07 Definition of Finishes.** Finishes of stone or manufactured masonry units shall be defined as shown in Table 560-1.

### 560-3 CONSTRUCTION DETAILS

**560-3.01 General.** Masonry or precast concrete coping shall not be constructed when the ambient temperature is 5°C or below, or when the stone or masonry units contain frost, except by written permission of the Engineer and subject to any conditions the Engineer may require.

Stone, masonry units or coping units shall not be dropped upon or slid over existing masonry, nor shall hammering or turning of stones, masonry units or coping on the masonry be allowed. Stones, masonry unit or coping units shall be carefully set without jarring masonry already laid, and they shall be handled in a manner so as not to cause disfigurement.

<b>TABLE 560-1 MASONRY UNITS, SURFACE FINISH</b>	
<b>Finish Name</b>	<b>Maximum Surface Projection Beyond Pitch Lines</b>
Smooth Finish	2 mm
Fine Point or Sawn Finish	6 mm
Rough Finish	13 mm
Scabbed Finish	20 mm
Seam and Split Face	25 mm
Rock Face	1/10 the vertical height of the individual stone
Thermal Finish	6 mm

**NOTE:** All faces of Dimension Masonry shall extend to the pitch lines shown on the plans.

**560-3.02 Dimension Stone Masonry.** The provisions of §560-3.01 shall apply with the following additional requirements:

**A. Preparation of Stone and Bed.** Each stone shall be cleaned and thoroughly saturated with water before being set. The bed which is to receive the masonry shall also be cleaned and moistened.

**B. Bedding of Stone.** All stone shall be well bedded in mortar and settled in place with a suitable wooden maul before the setting of the mortar.

**C. Spalls not Permitted in Mortar Beds.** No pinning up of stones with spalls will be permitted, and no spalls will be permitted in beds.

**D. Expansion Joints.** All surfaces of stone in contact with expansion joint material shall be made smooth, unless otherwise shown on the plans. The joints shall be filled with premolded resilient joint filler and sealed with an approved joint sealer as shown on the plans, or as ordered by the Engineer.

All joints in concrete backing shall be protected against intrusion of water into or through the joint by the installation of an approved water stop. The water stop shall be embedded into the concrete at least 75 mm on each side of the joint and shall be installed as near to the inside face of the concrete backing as practicable. The water stop may be of ASTM B370, 568 gram preformed copper strip, 0.655 mm minimum thickness, soldered to be water tight and continuous, or may be approved flexible water stop as shown on the plans. Water stops shall be manufactured and installed so as to provide for the expansion and contraction movements present at the joint.

In case any stone is moved or the joint broken, the stone shall be taken up, the mortar thoroughly cleaned from beds and joints, and the stone reset in fresh mortar.

Joints shall not be filled by pouring in a thin or liquid mortar.

**E. Pointing (new construction) and Tuck Pointing (raking out and repointing).**

**1. Pointing.** Tool the face joints with a pointing tool before the mortar sets, as approved by the Engineer. Avoid smearing the masonry surfaces with excess mortar forced out of the joints. For joints not pointed when the masonry is laid, prepare the joints for pointing by following the tuck pointing procedures. There will be no separate payment for this work.

**2. Tuck Pointing (Repointing).** Repoint the joints in masonry where indicated on the Contract plans or directed by the Engineer. Use an Item 705-21 Type M, S or N masonry or mortar cement, tuck pointing mortar (or a specially designed one) with the same or weaker strength than the original mortar, as approved by the Engineer.

Remove soft, loose, cracked and deteriorated mortar to a minimum depth (measured from the wall face) of twice the average joint width, and remove all deteriorated mortar beyond the minimum depth, as ordered by the Engineer. Do not damage the masonry during the removal process. Clean all contamination from the prepared joints.

Prior to repointing, flush with water and leave all surfaces to be re-mortared in a dampened, surface dry state. Pack the prepared joints in layers with mortar that closely matches the original

color and texture, allowing each layer to become thumb-print hard before the next. Use at least two layers when the joint depth is twice the joint width. Apply a final layer thickness that does not exceed the joint width. When the final layer is thumb-print hard, finish with a pointing tool that recreates the original joint shape, or as approved by the Engineer.

Perform pointing when the ambient temperature is 5°C or above, and the masonry is frost free. Avoid recessed joints that hold water.

After the mortar sets, clean all mortar and cement stains from other surfaces. In direct sunlight, keep the newly pointed masonry moist for at least 3 days. In shade, moisten 2 to 3 times a day for at least 3 days.

**F. Drawings.** The contract plans show the general character of the masonry. Prior to the beginning of any work, the Contractor shall prepare and submit for the approval of the Regional Director, three sets of detail plans for all dimension masonry shown on the plans. The Contractor shall carefully check and assume full responsibility for the accuracy of this work. These detail plans will be examined and either approved or returned without approval to the Contractor, who shall check the indicated corrections and resubmit two sets of prints of revised details. When the detail plans have been approved, the Contractor shall furnish the Regional Director with three sets, one of which shall be reproducible. The drawings shall conform to the size and type of requirements for Shop Drawings set forth in the New York State Steel Construction Manual.

**560-3.03 Split Faced Concrete Masonry.** The provisions of §560-3.01 shall apply with the following additional requirements:

**A. Sample Wall.** The Contractor shall construct a split faced concrete masonry wall 2 m long and 1.2 m high of approved units and matching mortar at a location designated. This procedure shall be repeated until a sample wall is approved by the Engineer. The approved sample wall shall be maintained intact until the Engineer directs its removal.

In lieu of the field sample wall, the Contractor may show, for approval, a building constructed with units of the same type, color, texture and surface finish required. The field sample wall shall be required if the building masonry is not approved.

Upon approval of the sample wall or building, the Contractor shall furnish and lay split masonry to conform with the approved sample wall.

**B. Protection and Handling.** Split faced concrete masonry units shall be protected by a wrapping of 100 µm polyethylene, and shall be handled on pallets by mechanical means, or by hand or tongs. Dumping of the masonry units from trucks, wheel barrows or other conveyances is prohibited. Particular care shall be taken to protect all edges and the face of the masonry units. Distorted, laminated, checked or cracked masonry units will be rejected and removed from the site of construction.

On delivery to the site, the masonry units shall be neatly piled off the ground, on pallets or other approved implements, and protected from moisture by wrapping them with 100 µm polyethylene.

Masonry units which become wet, shall not be laid in the wall until their conformance with the specifications for §704-10 is shown by tests. The cost of these tests shall be borne by the Contractor.

**C. Laying.** The split faced concrete masonry shall be laid up, in the pattern shown on the plans, by skilled masons and in a first-class manner. The masonry shall be laid true to line and grade in level horizontal beds and be properly anchored. Each masonry unit shall be laid in a full mortar bed and in a manner to form a full end joint in one operation. The space between the split face masonry and the supporting concrete shall be filled with mortar and rodded until the mortar rises to the top of the masonry unit as each unit is placed.

**D. Bonding.** The split faced concrete masonry shall be bonded to the supporting concrete. Dovetail anchors shall be continuous, set vertically and spaced on centers not exceeding 300 mm on the concrete walls. Ties shall be installed in the anchor slots at a maximum vertical height of 300 mm on centers.

**E. Joints.** Joints in the exposed face shall be struck with a concave jointing unless otherwise specified. The joints shall be 10 mm wide and the concave jointing shall be 3 mm deep at the center.

**F. Protection Against Weather.** The split faced concrete masonry shall be protected against the action of the weather. The tops and at least 600 mm down the sides of all walls not completed shall be constantly protected with suitable waterproof covering properly secured in place during periods of suspended work. The facing shall be so protected until it has been bonded to the concrete wall and completely sealed against moisture. During hot dry weather, the masonry shall be protected from the sun and kept moist for at least three days after completion.

**G. Protection Against Damage.** Projections and angles exposed to damage shall be boxed or otherwise protected to prevent damage. Any units damaged during the progress of the work shall be replaced with new units at the Contractor's expense.

**H. Cleaning of Exposed Faces of Mortar and Drippings.** Exposed faces of split faced concrete masonry units shall be cleaned free of excess mortar and mortar drippings, as the work progresses, to prevent excessive rubbing during final cleaning operations.

**I. Expansion and Contraction Joints.** Expansion and contraction joints shall be constructed as shown on the plans. The surfaces of the joints shall be plumb, true to line and smooth to the caulking compound.

**J. Final Cleaning.** After the completion of adjacent work likely to soil the masonry, the split faced concrete masonry shall be thoroughly cleaned, removing all dirt, dust, mortar, stains, etc. The concrete masonry shall be brushed, while dry, with stiff fiber brushes. If this brushing does not clean the masonry to the satisfaction of the Engineer, then the Contractor shall clean the facing with soap powder in clean water applied with stiff fiber scrub brushes. After scrubbing with soap and water the Contractor shall rinse the masonry with clean water. The Contractor may, with the Engineer's approval, substitute a cleaning solution that will not harm the concrete or mortar joints. The cleaning operation shall in all cases start at the top and proceed downward.

**K. Caulking.** When the split faced concrete masonry has received the final cleaning, all expansion and contraction joints shall be filled at least 25 mm deep with caulking compound.

All surfaces to receive the caulking compound shall be clean, free of loose materials, dirt, dust, frost, moisture, oils, laitance or curing compounds and shall be primed with clear lacquer, shellac or the manufacturer's recommended primer after the surfaces have been cleaned. A bond breaker shall be used as a release material back of the caulking compound. The bond breaker may be polyethylene, specially treated bond inhibiting pressure sensitive tape or any approved equal. The caulking compound shall be tooled with a concave joint finishing tool to provide a neat smoothly finished joint of uniform width. Where solvents are required on the jointing tool, they shall be as recommended by the manufacturer of the caulking compound.

**560-3.04 Stone Masonry.** The construction provisions of §560-3.02 shall apply. The individual stones shall be trimmed, recut and dressed, as may be necessary at the site, to obtain a pattern in the finished wall which will be in character with the requirements of drawings, specifications and the approved sample wall.

The following general requirements will apply to the placing of stone masonry:

**A. Cross-Joints, Steps or Ladders.** There shall be no cross-joints, steps or ladders.

**B. Subdivision of Rectangles.** There shall be no subdivision of rectangles.

**C. Stone Shapes.** There shall be no unusually shaped stone.

**D. Clusters.** There shall be no clusters of stone of the same length and height.

**E. Horizontal Joint Length.** There shall be no continuous horizontal joint greater in length than 3 meters.

**F. Vertical Joints.** There shall be no more than five stones abutting any one vertical joint.

**G. Stone Proportions.** There shall be no stone longer than six times its height nor shorter than one and one half times its height. The length of the average stone shall be three to five times its height.

**H. Horizontal Joints.** Horizontal joints shall not have a slope varying from the horizontal by more than one percent.

**I. Color.** Where stone masonry and dimension masonry are specified, for the same structure or in close proximity to each other, there shall be no great contrast in size or color between the Stone Masonry and the Dimension Masonry.

Prior to beginning the work the Contractor shall lay up a sample wall conforming to the requirements of §560-3.03A except that the material details for the work shall conform to those for Stone Masonry.

**560-3.05 Rubble Stone Masonry.** The provision of §560-3.01 shall apply with the following additional requirements:

The stone shall be laid to form substantial masonry presenting a neat, finished appearance. The minimum size of stone to be used shall be 100 mm in depth or rise, 230 mm in width, and 300 mm long. Spalls and pinnars will not be allowed to show on the face of the work and shall be used otherwise only where necessary. All stones shall be soundly and completely bedded in the mortar. The length of stretchers shall not exceed three times their rise, and the width of stretchers shall in no case be less than one and one-half times their rise. At least one-fourth of the stones in the face shall be headers and shall be evenly distributed. The length of headers shall be not less than 810 mm nor more than the thickness of the wall, where the work is 1.2 m or less in thickness. Where the work is more than 1.2 m thick, the length of headers shall be not less than 810 mm. The width of headers shall be not less than their rise. All stones shall be laid to break joints 150 mm or more and to thoroughly bond the work. No joint in the face shall be over 25 mm in width. Backing shall be good-sized, well-shaped stones so laid as to break joints. Spaces between stones shall be filled with spalls set in mortar. The degree of roughness of exposed faces shall be measured with a two meter straight edge supported between adjacent projections on the stone face. Variations in the stone face, in excess of 100 mm, measured from the straight edge to the extreme depression in stone or mortar will not be permitted. Rear faces shall present approximately plane surfaces.

Pointing shall conform to the requirements of §560-3.02E.

**560-3.06 Rubble Stone Masonry Laid Dry.** The specifications of §560-3.05, Rubble Stone Masonry, shall apply except that no mortar shall be used and the requirements of §560-3.01 Construction Details (General), pertaining to frost shall not apply unless otherwise directed by the Engineer.

**560-3.07 Precast Concrete Coping.** The provisions of §560-3.02, Dimension Stone Masonry and §560-3.03, Split Faced Concrete Masonry, shall apply with exception of §560-3.02D, §560-3.03A, and §560-3.03D.

**560-3.08 Tuck Pointing.** Apply the provisions of §560-3.02E2 Tuck Pointing. For re-caulking work, rake out any old caulking to a minimum 25 mm depth and follow the provisions of §560-3.03K. Caulking. Do not damage masonry during the removal and cleaning process.

## 560-4 METHOD OF MEASUREMENT

**560-4.01 Dimension Masonry.** Dimension masonry will be measured as the number of square meters (including joints within the dimension masonry) measured on the plane of all the exposed surfaces of the dimension masonry incorporated in the work.

**560-4.02 Split Faced Concrete Masonry.** Split faced concrete masonry will be measured as the number of square meters (including joints within the masonry and between the split faced concrete masonry and the concrete wall, and the mortar bed for precast concrete coping), on the plane of all exposed surfaces of the masonry incorporated in the work. Split faced masonry below the finished surface of the ground or paving shall be considered as exposed in computing the area for payment. The approved, constructed, split faced concrete masonry sample wall will be paid for as split face concrete masonry.

**560-4.03 Rubble Stone Masonry.** Payment for rubble stone masonry will be made for the number of cubic meters within the payment lines shown on the plans and placed in accordance with the specifications. Concrete, mortar or any joint material within these payment lines will, for the purpose of payment, be classified as stone masonry and will not be paid for under any other item.

**560-4.04 Stone Masonry.** Payment for stone masonry will be made for the number of square meters (including joints within the stone masonry) measured on the plane of all the exposed surfaces of the stone masonry incorporated in the work. Mortar joints between concrete and stone masonry will be paid for as stone masonry.

Stone masonry shown on the plans below the finished grade or sidewalk (to prevent the possible exposure of unfaced concrete) shall be considered as exposed in computing the payment area for this item.

2.5 square meters will be used in payment for the complete accepted sample wall required in this specification.

#### **560-4.05 (Vacant)**

**560-4.06 Precast Concrete Coping.** The quantity to be paid for will be the number of meters of precast concrete coping (including the joints between the coping units) placed in accordance with the plans, specification and orders of the Engineer.

**560-4.07 Tuck Pointing.** The Engineer will measure this work in the field as the number of square or linear meters of masonry pointed and cleaned, as bid. Linear measurements will be made along the joint centerline.

### **560-5 BASIS OF PAYMENT**

**560-5.01 Dimension Stone Masonry.** The unit price bid per square meter shall include the cost of furnishing all labor, materials and equipment necessary to complete the work.

Concrete, dimension masonry, mortar or any joint material within the nominal thickness of the dimension masonry will, for the purpose of payment, be classified as dimension masonry and will not be paid for under any other item. Projections, if any, into the concrete beyond the nominal thickness of dimension masonry will be paid for as the class of concrete displaced by the stone. No deduction will be made for railing post holes.

Mortar Joints between Dimension Masonry and Concrete will be paid for as Dimension Masonry.

Mortar Joints between Dimension Masonry and Stone Masonry will be paid for as Stone Masonry.

**560-5.02 Split Faced Concrete Masonry.** The unit price bid per square meter shall include the cost of furnishing all labor, materials (including anchors, ties, premolded bituminous joint material, and caulking compound) and equipment necessary to complete the work. The payment shall also include the labor, materials and equipment necessary to remove and dispose of all constructed sample masonry panels when directed by the Engineer.

No payment shall be made to the Contractor for the submitted alternate sample walls or for any unapproved sample walls.

The cost of furnishing and placing anchoring devices shall be included in the unit price bid for this work.

The cost of erecting and disposing the sample wall shall be included in the unit price bid for this item.

**560-5.03 Stone Masonry.** The unit price bid per square meter shall include the cost of furnishing all labor, materials and equipment necessary to complete the work.

Concrete, stone masonry, mortar or any joint material within the nominal thickness of the stone masonry will, for the purpose of payment, be classified as stone masonry and will not be paid for under any other item. Projections, if any, into the concrete beyond the nominal thickness of stone masonry will be paid for as the class of concrete displaced by the stone. No deduction will be made for railing post holes.

The cost of furnishing and placing anchoring devices shall be included in the unit price for this item.

**560-5.05 Rubble Stone Masonry.** The unit price bid per cubic meter for Rubble Stone Masonry with joints or laid dry, shall include the cost of furnishing all labor, materials and equipment necessary to complete the work except excavation will be paid for under the appropriate excavation item.

**560-5.06 Precast Concrete Coping.** The unit price bid per meter shall include the cost of furnishing all labor, materials (including anchors, reinforcement, premolded resilient joint materials, and caulking compound) and equipment necessary to complete the work.

**560-5.07 Tuck Pointing.** Include all labor, material (including any re-caulking material), and equipment to complete the work in the unit bid price.

**560-5.08 Progress Payments.** Progress payments will be made, at the unit price bid, for 75% of the quantity properly placed. The balance of the quantity will be paid for upon proper cleaning and caulking of the joints.

*Payment will be made under:*

<b>Item No.</b>	<b>Item</b>	<b>Pay Unit</b>
560.01	Dimension Stone Masonry	Square Meter
560.02	Split Faced Concrete Masonry	Square Meter
560.0401	Stone Masonry	Square Meter
560.05	Rubble Stone Masonry	Cubic Meter
560.06	Rubble Stone Masonry Laid Dry	Cubic Meter
560.07	Precast Concrete Coping	Meter
560.08	Tuck Pointing	Meter
560.09	Tuck Pointing	Square Meter

**SECTIONS 561 (VACANT)**

**SECTION 562 - REINFORCED CONCRETE THREE-SIDED STRUCTURES**

**562-1 DESCRIPTION.** The work consists of designing and constructing reinforced concrete three-sided structure(s) at the location(s) indicated on the Plans.

A reinforced concrete three-sided structure is composed of some of the following discrete elements:

1. Span Unit
2. Span Unit Footing
3. Wing Wall with Footing
4. Headwall
5. Invert Slab with Cut-off Wall
6. Apron with Cut-off Wall

**NOTE:** Any of the above elements may be cast in place at no additional cost to the State.

**562-2 MATERIALS.** Materials for all precast concrete components shall meet the requirements of the PCCM. Materials for cast-in-place concrete shall be Class A concrete meeting the requirements of Section 555 and reinforcement meeting the requirements of Section 556.

**562-3 CONSTRUCTION**

**562-3.01 Design.** An appropriate structure design and all details necessary for construction meeting the Design parameters given in these specifications shall be developed and submitted to the DCES for approval. All design work, detail development, and proposed handling and installation procedure development, shall be done by a Professional Engineer. The design submittal shall conform to the requirements stated in the PCCM. The DCES reserves the right to reject a proposed design(s) if the structure type is determined to be unsuitable for the proposed application based on safety, durability, serviceability, or maintainability.

The Load Rating shall be determined in accordance with the AASHTO *"Manual for Condition Evaluation of Bridges, 1994 - Second Edition,"* with all interim provisions in effect. The contractor shall show which method (working stress or load factor) was used in load rating computations. The load rating shall be shown on the Production Note Sheet of the shop drawings. The contractor shall include all load rating computations in the design calculation submittal.

**562-3.02 Design Parameters.** The design of the structure(s) described above shall meet the following:

1. Design Specification : New York State Standard Specifications for Highway Bridges.
2. Live Load : MS 23
3. Highway Profile Section : As shown in the contract documents.
4. Soil Parameters : As shown in the contract documents.
5. Layout, Span, Rise, and Length of the Bridge Structure : As shown in the contract documents.
6. Staged Construction : Construction staging shall be as shown in the contract documents.
7. Wing Walls : As shown in the contract documents.
8. Railing or Barrier : The railing anchorages or barrier anchorages on the structure shall be designed to develop adequate global and local capacities required to resist the loads in Section 2 of the New York State Standard Specifications for Highway Bridges.
9. Hydraulics : The proposed structure shall provide hydraulic area (effective flow area) below the design high water elevation shown in the contract documents.
10. Allowable concrete stress : As per the provisions of the Standard Specifications, except that maximum tensile stress in concrete for handling and erection loads when analyzed according to the proposed handling and installation procedures, shall not exceed  $0.40 \sqrt{f'_{ci}}$ , where  $f'_{ci}$  is the concrete compressive strength at the time being considered.
11. Joints : All joints between Span Units shall be designed to be leak proof. The determination of the acceptability of the proposed joint system by the DCES shall be final.

**NOTE:** The shape(s) of the Span Unit shown in the contract documents is for illustration purposes only. Other shapes meeting the design parameters are acceptable, unless otherwise noted in the contract documents.

**562-3.03 Changes to Design Parameters.** If the Contractor wants to propose a structure not in full compliance with the design parameters in the contract, a preliminary proposal, fully explaining the changed design parameters shall be submitted to the DCES for review and approval. The Contractor is not expected to develop a detailed design until the proposed design parameters have been approved by the DCES.

**562-3.04 Design Computations, Shop Drawings/Detail Drawings.** The preparation and submission for review and approval shall be according to the PCCM. Shop drawings shall show detailed handling procedure to be used during fabrication, storage, and transportation of the precast elements. All necessary supporting calculations shall be included in the design computation package.

Fabrication of all steel components shall meet the requirements of the SCM.

Shop drawings shall show the required tolerances for the geometry of all precast components, placement of reinforcement, location of all inserts, etc. Design shall consider the effects of these tolerances.

**562-3.05 Fabrication.** Fabrication of all precast elements shall be according to the PCCM.

**562-3.06 Installation Drawings.** Installation drawings shall meet the requirements of the PCCM and the following:

- A.** Details of all joints including all materials and a step-by-step procedure for installing them shall be shown on the installation drawings.
- B.** All welding operations during installation shall be shown on the installation drawings and shall meet the requirements of the SCM.
- C.** Details for all cast-in-place concrete not detailed in the contract documents.

**562-3.07 Installation.** Installation of all precast elements shall be according to the approved installation drawings. All elements after installation and prior to backfilling will be inspected for cracks or other visible defects. All defective elements shall either be replaced or be repaired using procedures approved by the DCES and at no additional cost to the state.

**562-3.08 Erection Drawings.** A separate set of erection drawings shall be prepared and submitted for review and approval of the Department as per the provisions of Section 2.6 ERECTION DRAWINGS of the PCCM.

**562-3.09 Tolerances (After Erection)**

- A.** Joint Width:  $\pm 10$  mm
- B.** Vertical Difference Between Top of Adjacent Units:  $\pm 13$  mm
- C.** Span - Variation From Post-Pour Measurement Recorded on the Shipping Paperwork:  $\pm 8$  mm

**562-3.10 Backfilling**

**A.** Backfilling operations shall not begin until:

1. Span units to span unit footing key joints are grouted as shown on the approved installation drawings and have cured a minimum of 24 hours.
2. Transverse connections between unit segments are placed and secured (if required).
3. Joint seals are properly placed and approved by the Engineer.

**B.** Backfilling operations shall be conducted in accordance with Section 203 - Excavating and Embankment, with the following modifications:

1. Fills shall be placed and compacted in layers not exceeding 300 mm in depth.
2. Dumping for filling operations shall not be nearer than 900 mm to a plane passing vertically through the back face of any footing.
3. Backfill shall be placed as symmetrically as possible around the structure with differential depths of backfill on opposite sides of the structure span units not exceeding 450 mm.
4. Fill within 300 mm of any surface of the structure shall be compacted with hand compaction equipment.
5. Vibratory rollers shall not be used within 3.0 m of any surface of the structure.
6. Construction equipment shall not travel or rest on an uncompleted structure unless the designer of the structure span unit has evaluated the loading conditions, submitted calculations to the DCES, and has received written approval of the proposed loading. Actual conditions at the time of loading, including both the weight of the fill and the equipment, shall be part of the analysis. The Contractor shall repair any damage resulting from equipment passage at no additional cost to the State.

**562-4 METHOD OF MEASUREMENT.** Measurement for payment for the Reinforced Concrete Span Units, Wing Walls, Apron, and Invert Slabs will be computed from the payment lines shown on the plans. No field measurements will be made.

**562-5 BASIS OF PAYMENT.** The Contractor shall include the cost of all engineering, labor, materials, and equipment necessary to complete the work in the unit price bid. The Contractor shall include the costs of the footings, headwalls, and cut-off walls in the unit price bid of the element to which it is attached.

Payment will be made under:

Item No.	Item	Pay Unit
562.01nn M	Reinforced Concrete Span Units	square meter
562.02 M	Invert Slab With Cut-Off Wall	square meter
562.03 M	Wing Wall with Footing	square meter
562.04 M	Concrete Apron With Cut-off Wall	square meter

**NOTE:** Serialization for the Span Units: nn represents the specific structure identifier.

**SECTION 563 - PRESTRESSED CONCRETE UNITS (STRUCTURAL)**

**563-1 DESCRIPTION.** This work shall consist of furnishing and placing prestressed concrete units for structures, as specified in the contract documents.

The Contractor shall notify the Deputy Chief Engineer, Structures (DCES) of the name and address of the fabricator of all prestressed concrete units (structural) in accordance with §106-01 Sources of Supply.

**563-2 MATERIALS**

**563-2.01 Prestressed Units.** The Contractor shall notify the DCES of the source of prestressed units, for approval within (7) days after the award of the contract. Prestressed concrete units shall meet the requirements of the P.C.C.M.

**563-2.02 Transverse Tie Rods or Strands.** Refer to P.C.C.M., Section 4.

**563-2.03 Shear Key Material.** Refer to P.C.C.M., Section 4.

**563-2.04 Anchorage Block-Out Grout.** Refer to P.C.C.M., Section 4.

**563-2.05 Concrete.** The concrete shall meet the requirements of §718-06, High Performance Concrete For Precast and Prestressed Bridge Beams.”

**563-3 CONSTRUCTION DETAILS.** The requirements of the P.C.C.M. shall apply.

**563-4 METHOD OF MEASUREMENT**

**563-4.01 Prestressed Concrete I-Beam Units.** The quantity to be paid for under this work shall be the number of meters (horizontal length center-to-center of bearings or anchor dowels, as shown on the plans) of each unit furnished and placed in accordance with the plans and specifications.

**563-4.02 Prestressed Concrete Box-Beam Units and Hollow and Solid Slab Units.** The quantity to be paid for under this work shall be the number of square meters of plan area of each prestressed unit installed. Plan area is defined as the area bounded by the centerline of bearings and the outer edges of each prestressed unit. No deductions will be made for chamfers, shear keys, or notch cuts. Space between the units shall not be included in any measurement.

**563-5 BASIS OF PAYMENT.** The unit price bid for these units shall include all labor, materials and equipment necessary to complete the work except that bearings shall be paid for under their respective items.

Damaged units which cannot be satisfactorily repaired or which do not meet dimensional and camber tolerances shall be replaced by the Contractor at no cost to the State.

Progress payments will be made when each unit is furnished and placed in accordance with the plans and specifications exclusive of preparing and filling joints. Payment will be made at the unit price bid for 90% of the quantity properly placed. The balance of the quantity will be paid for upon completion of the work. The completion of work will include the correct preparation and filling of the joints as well as the tightening of transverse ties.

*Payment will be made under:*

<b>Item No.</b>	<b>Item</b>	<b>Pay Unit</b>
563.010X	Prestressed Concrete I-Beam Units (Types 1-6)	Meter
563.02	Prestressed Concrete Box Beam Units	Square Meter
563.03	Prestressed Concrete Hollow Slab Units	Square Meter
563.04	Prestressed Concrete Solid Slab Units	Square Meter

*X = Type Designation (1 through 6)*

**SECTION 564 - STRUCTURAL STEEL**

**564-1 DESCRIPTION.** Under this work, the Contractor shall fabricate, furnish and erect structural steel and other metal parts in accordance with the contract documents.

The Contractor shall notify the Deputy Chief Engineer, Structures (DCES) of the name and address of the fabricator of all structural steel in accordance with §106-01 Sources of Supply.

**564-2 MATERIALS.** Materials for this work shall meet the requirements of the New York State Steel Construction Manual and the following subsections of Section 700 - Materials:

Structural Steel	715-01
High Strength Bolts, Nuts and Washers	715-14
Pins and Rollers	715-15
Vertical Load Transmitting Devices	728

Certified copies of the results of tests conducted by the manufacturer shall be furnished to the Engineer in accordance with the requirements of §715-01, Structural Steel.

**564-2.01 Structural Steel Replacement - Stock Steel Option.** Stock steel may be furnished for this work. If furnished, the stock steel shall comply with the provisions of §715-01, Structural Steel. Positive heat identification will be required for all stock steel. Certified copies of the results of chemical analysis and physical tests shall be furnished to the Department. Shop inspection will be provided unless otherwise noted on the contract plans, or waived by the DCES. The provisions of this subsection shall apply only to pay items entitled “Structural Steel Replacement (kg.)” or “Structural Steel Replacement (Each).”

**564-3 CONSTRUCTION DETAILS.** All structural steel work, including, but not limited to fabrication inspection, transportation, and erection shall be done in accordance with the provisions of the SCM.

Shop drawings prepared for pay items titled Structural Steel Replacement (Kg.) and Structural Steel Replacement (Each) shall be prepared, approved and distributed in accordance with the provisions of the SCM, except that the term “DCES” shall be interpreted as “the Engineer.”

**564-4 METHOD OF MEASUREMENT.** Measurement will be made by one, or combinations of the following methods as indicated in the contract documents.

- Kilogram
- Each
- Lump Sum

**564-4.01 Kilogram.** Measurement will be made on a kilogram basis. The mass of each shipping unit shall be clearly shown on the approved shop drawings. For the purpose of measurement, such items as castings, anchor bolts, forgings, fasteners, cable and other metal parts used in the construction shall, unless otherwise provided, be considered to be structural steel even if made of other materials.

**A. Payment Mass.** Payment will be based on the computed mass of metal as shown on the approved shop drawings, and shall include permanent bolts and welds in the structure as erected. The mass of all erection materials including but not limited to bolts, pilot and driving nuts, temporary protective coatings, and all boxes, crates or other containers used for packing, together with sills, struts, and rods used for supporting members during transportation, shall be excluded.

The mass of all required bolt heads, nuts and washers will be estimated, making no allowance for waste, and included in the mass for which payment will be made.

The mass of all required welds will be estimated and included in the mass for which payment will be made.

**B. Computed Mass.** The mass of steel shall be assumed as 7850 kg/m<sup>3</sup>. The mass of cast iron shall be assumed as 7210 kg/m<sup>3</sup>.

The masses of rolled shapes and of plates of all dimensions shall be computed on the basis of their nominal masses as required by the dimensions shown on the approved shop drawings. If the Contractor, however, elects to use for his convenience, steel members with masses that are greater than the nominal masses specified on the approved drawings, the computations shall be based on the nominal mass values on the drawings. Deductions shall be made for copes, cuts and all holes except those holes required for high-strength bolts.

The mass of fillet welds shall be computed from the following:

<b>TABLE 564-1 MASS OF DEPOSITED METAL PER METER OF FILLET WELD</b>							
<b>Size of Fillet (mm)</b>	5	6	8	10	12	16	20
<b>Deposited Metal (kg/m)</b>	0.139	0.200	0.365	0.516	0.705	1.088	1.747

The masses of castings shall be computed from the dimensions shown on the approved shop drawings, with an addition of 10% for fillets and overrun.

The mass of high-strength bolts, nuts and washers, exclusive of grip, shall be computed from the following:

<b>TABLE 564-2 MASSES OF HIGH-STRENGTH BOLTS</b>								
<b>Bolt Diameter (mm)</b>	13	16	20	22	24	27	30	36
<b>Mass of 100 Bolts with Nut and 2 Washers (kg)<sup>1</sup></b>	10.8	16.3	28.7	38.8	51.4	71.6	91.7	143.0

NOTE 1. Measured mass will be exclusive of grips.

**564-4.02 Each Unit.** Measurement will be made for each unit of structural steel as indicated on the contract plans. The provisions of §564-4.01, concerning castings, anchor bolts, forgings, fasteners, cable, and other metal parts, shall apply.

**564.4.03 Lump Sum.** No measurement will be taken. The provisions of §564-4.01 concerning castings, anchor bolts, forgings, fasteners, cable and other metal parts, shall apply.

**564-5 BASIS OF PAYMENT**

**564-5.01 General.** The price bid shall include the cost of furnishing all labor, materials and equipment necessary to complete the work. For the purpose of payment, castings, forgings, fasteners, anchor bolts

for other than bridge bearing installation, cables and other metal parts used in the construction, will be considered to be structural steel, even if made of other materials.

**564-5.02 Additional Work.** Items that are included in the price bid and are the Contractor's responsibility are as follows:

**A. Shop Drawings, including Paper Prints and Reproducible Prints.** The cost of all shop drawings, prints, reproducible prints and microfilm required by the specifications or the Steel Construction Manual shall be included in the unit price bid for the payment item requiring the drawings.

Any prints and reproducible prints required beyond the number specified shall be furnished by the Contractor at cost.

**B. Laminar Defects at the Boundary of Tension Groove Welds.** The cost of all work and materials required for the correction or elimination of laminar defects at the boundary of tension groove welds shall be included in the price bid for structural steel.

The cost of all ultrasonic testing and repairs and the cost of replacement of defective portions of plates where partial replacement is approved shall be borne by the Contractor and included in the price bid for structural steel.

**C. Inspection of Bolted Connections.** All labor and equipment necessary for the performance of inspection of bolt tightness during structural steel fabrication and erection shall be provided by the Contractor and included in the price bid for structural steel. The State shall witness the bolt testing, but will not provide equipment or labor.

**D. Qualification Test for Welders, Welding Procedures and Electrode and Flux Combinations.** The cost of tests required to qualify welders, welding procedures and electrode and flux combinations shall be included in the unit price bid for the steel with the exception that the State will witness tests and perform Charpy V-Notch Impact Tests without cost to the Contractor.

**E. Radiographic Inspection.** The cost of radiographic inspection and of preparation for radiography, together with the cost of providing access and of furnishing adequate facilities for the review of radiographs in the shop or field, shall be included in the price bid for structural steel.

**F. Ultrasonic Inspection.** Ultrasonic inspection, when required, will be performed by the State or its representatives unless otherwise provided for in the contract documents. The cost of any required preparation and of furnishing access to the joints shall be included in the price bid for structural steel.

**G. Magnetic Particle Inspection.** The cost of magnetic particle inspection when specified or required by the inspector to verify limits of defects discovered during visual inspection shall be included in the unit price bid for structural steel.

**H. Repair of Defects in Welds and Base Metal.** The cost of repairing defects found by visual inspection or nondestructive tests shall be included in the unit price bid for structural steel.

**I. Field Inspection of Rejected Material or Material Not Offered for Shop Inspection even though Required to be Shop Inspected by the Contract Documents.** When the Department, at its discretion, permits inspection of the subject materials to be performed at the project site, all costs of this inspection shall be borne by the Contractor as a condition of the Department's approval of inspection of this material. All costs associated with the inspection of rejected material, which has been shipped to the field without approval, shall be borne by the Contractor.

**J. Straightening Bent Material and Correcting Camber Deficiencies.** All corrective work required to straighten bent material and correct camber deficiencies, when permitted, shall be performed at no additional cost to the State.

**K. Field Repair, Reaming and Drifting of Holes.** All work permitted for the correction of unacceptable holes shall be provided at the Contractor's expense.

**L. Metal Scuppers.** Metal scuppers shall be paid for as structural steel unless otherwise noted on the plans.

**M. Adjustment and Alignment of Bearings.** All labor, materials and equipment required for adjustment and alignment of bearings shall be included in the unit price bid for structural steel.

**N. Field Splices.** When the specific location for a bolted or welded field splice in stringers and girders is not shown on the plans, the Contractor will be permitted to introduce splices at locations of his choice. The splices shall be made in accordance with the provisions of the SCM. No payment will be made for labor, material, and equipment required to make a splice if the splice is not shown on the contract plans. Also, payment will not be made for increases in the thickness of webs or flanges made necessary by the requested splice.

**O. Photographs.** Photographs requested by the DCES in accordance with the provisions of the SCM, shall be furnished at no additional cost.

**P. Testing of Stock Steel.** All labor, materials and equipment necessary to perform chemical and physical tests on stock steel when such tests are required shall be furnished by the Contractor and included in the price bid for structural steel.

**Q. Heat-Curving and Cambering.** All costs of nondestructive testing, repairs or replacement of material damaged due to over stressing or destructive heating during heat-curving or cambering shall be borne by the Contractor.

**564-5.03 Progress Payments for Fabricated Steel.** Upon application by the contractor, payments for some of the cost of fabricated steel will be made to the contractor prior to shipping and incorporation of such material in the permanent work, subject to the following:

A. To be eligible for progress payment, the steel must meet all of the following conditions:

1. Include all the structural steel required for one or more spans of the bridge. If stage construction of the bridge is required by the Contract this will be interpreted as all the steel required for one or more stages of one or more spans of the bridge. The mass of steel extending beyond the end of the span to a splice point will be included for payment.
2. Have a minimum mass of 10,000 kg.
3. Be materials which will be incorporated into permanent work.
- 4.a. For unpainted (weathering) steel, be in a condition which is ready for on-site installation without further fabrication.
- 4.b. For steel that will be coated or painted, be completely fabricated, inspected and ready for shipment to a coating shop.

B. With application for progress payments, the contractor shall provide documentation as follows:

1. Bill of sale or vouchers indicating the actual dollar value paid by the contractor for the materials as stored;
2. Certification of Title showing that title to the materials, without encumbrances, is in the name of the contractor and that title is warranted to the Department of Transportation;
3. Documented evidence of acceptability of the materials;
4. A release and waiver covering such materials, and providing access to the storage site, which release and waiver shall be executed by the property owner in favor of the New York State Department of Transportation or its agents.

C. For rolled beam and plate girder bridges, the amount of progress payments shall not exceed the total invoice amount for stored materials, nor shall the partial payment exceed eighty five percent (85%) of the pro rata value of the lump sum bid. The pro rata values shall be calculated by multiplying the lump sum

price bid by the ratio which represents the structural steel members fabricated and stored during the payment period in question. The ratio will be computed by dividing the mass of the steel by the Total Mass for Progress Payments for the appropriate item. See §564-5.04.

D. For truss bridges, arches, or other construction identified in the Contract Documents, the amount of progress payments shall not exceed the total invoice amount for stored materials, nor shall the partial payment exceed seventy five percent (75%) of the pro rata value of the lump sum bid. The pro rata values shall be calculated by multiplying the lump sum price bid by the ratio which represents the structural steel members fabricated and stored during the payment period in question. The ratio will be computed by dividing the mass of the steel by the Total Mass for Progress Payments for the appropriate item. See §564-5.04.

E. When progress payments are made in accordance with this subsection, no application for partial payment will be considered by the Department.

The making of progress payments shall not be deemed to be a final acceptance of materials, nor shall it relieve the contractor of responsibility for such materials. The contractor shall be responsible for assuring that only those materials which comply with the specifications are incorporated into the project.

**564-5.04 Progress Payments - Lump Sum.** Progress payments shall be calculated by multiplying the lump sum price bid by the ratio which represents the structural steel members erected during the payment period in question and then subtracting any partial and progress payments made. The ratio will be computed by dividing the shipping mass of the erected steel by the Total Mass for Progress Payments for the appropriate item indicated in the contract documents.

**564-5.05 Other Work.** Work not included in the unit price bid for the structural steel item is as follows:

**A. Setting Anchor Bolts for Bridge Bearings.** The pipe sleeves, anchor bolts and work required to furnish, set and grout the anchor bolts, shall be included in the price bid for the respective bearing item.

**B. Vertical Load Transmitting Devices.** The furnishing and installing of vertical load transmitting devices, such as; rubber impregnated random fiber pad, and plain rubber pad, shall be included in the price bid for the respective item.

*Payment will be made under:*

Item No.	Item	Pay Unit
564.05XX	Structural Steel (Type 1-22)	Lump Sum
564.10nnnn	Structural Steel Replacement	Kilogram
564.51nnnn	Structural Steel	Kilogram
564.70nnnn	Structural Steel Replacement	Each

NOTE: nn denotes a serialized pay item.

**SECTION 565 - BRIDGE BEARINGS**

**565-1 DESCRIPTION.** The work shall consist of furnishing, placing and setting bridge bearings at the locations indicated on the plans.

The Contractor shall notify the Deputy Chief Engineer, Structures (DCES) of the name and address of the fabricator of all bridge bearings in accordance with §106-01 Sources of Supply.

**565-1.01 Bearing Types.** There are various types of bearings. The specific type required will be indicated on the plans. Bearing types are:

**A. Type S.R. - Steel Rocker Bearings.** These accommodate rotation by pivoting around a pinned joint. They are fabricated in fixed and expansion versions. The expansion version accommodates longitudinal movement by means of a curved rocker rotating on the bearing surface. Steel rocker bearings do not allow for transverse movement. This type of bearing shall only be used in rehabilitation situations where only one or two bearings are to be replaced on a bridge.

**B. Type S.S. - Steel Sliding Bearings.** These accommodate rotation by means of a rocker. They are fabricated in fixed and expansion versions. The expansion version accommodates movement with a sliding element. Steel sliding bearings do not allow for transverse movement. This type of bearing shall only be used in rehabilitation situations where only one or two bearings are to be replaced on a bridge.

**C. Type M.R. - Multi-Rotational Bearings.** These accommodate rotation by the deformation of a confined elastomeric element, or an unconfined urethane disc. Multi-rotational bearings are fabricated in fixed and expansion versions. The expansion version accommodates movement by means of sliding elements. Expansion versions may be guided, allowing movement in only one direction, or non-guided, allowing multi-directional movement.

**D. Type E.P. - Plain Elastomeric Bearings.** These accommodate rotation by the deformation of a plain elastomeric pad. They may be used for both fixed and expansion applications without changes in details. The bearings will accommodate longitudinal, transverse, and rotational movements.

**E. Type E.L. - Steel Laminated Elastomeric Bearings.** These accommodate rotation by the deformation of a laminated elastomeric and steel pad. They may be used for both fixed and expansion applications without changes in details. The bearings will accommodate longitudinal, transverse, and rotational movements.

**F. Type E.B. - Elastomeric Bearings with External Load Plates.** These accommodate rotation by the deformation of a plain or steel laminated elastomeric pad. Elastomeric bearings with external load plates are fabricated in fixed and expansion versions. The fixed version will accommodate rotational movements. The expansion bearings will accommodate longitudinal, transverse, and rotational movements.

## 565-2 MATERIALS

**565-2.01 General.** Materials shall meet the following requirements:

Concrete Grouting Material	701-05
Steel Anchor Dowel	709-01 <sup>a</sup>
Disc-Design Structural Bridge Bearings	716-06
Pot-Design Structural Bridge Bearings	716-07
Plain Elastomeric Bridge Bearings	716-10
Steel-Laminated Elastomeric Bridge Bearings	716-11
Elastomeric Bridge Bearings with External Load Plates	716-12
Rubber-Impregnated Woven Cotton Fabric	728-01
Rubber-Impregnated Random Fiber Pad	728-02
Plain Rubber Pad	728-03
Nuts	ASTM A563 M
Washers	ASTM F436 M
Anchor Studs	ASTM F568 M, class 8.8 or 8.8.3
Cap Screws	ASTM F835M or A574M
Structural Steel Paint Class 1	708-01

**NOTE a.** Steel anchor dowels shall meet the requirements of §709-01 - Bar Reinforcement.

**565-2.02 Fabrication.** Steel components of bridge bearings shall be fabricated in accordance with the applicable requirements of the NYS Steel Construction Manual (SCM). In addition, component parts of individual bearings shall meet fabrication details as shown in the contract documents.

**A. Type S.R. Bearings.** These shall conform to the plans and other contract documents.

**B. Type S.S. Bearings.** These shall conform to the plans and other contract documents.

**C. Type M.R. Bearings.** These shall conform to the requirements of either §716-06.01 or §716-07.01 as applicable, and other contract documents. When type M.R. bearings are specified, the Contractor may supply either disc design or pot design bearings. Only one bearing design, disc or pot, shall be supplied for any one bridge.

**D. Type E.P. Bearings.** These shall conform to the requirements of §716-10 and other contract documents.

**E. Type E.L. Bearings.** These shall conform to the requirements of §716-11 and other contract documents.

**F. Type E.B. Bearings.** These shall conform to the requirements of §716-12 and other contract documents.

**565-2.03 Drawings.** Shop drawings shall meet the requirements specified in the following:

Type S.R. and S.S. Bearings	SCM
Type M.R. Bearings	716-06.01 or 717-07.01
Type E.L. Bearings	716-11
Type E.B. Bearings	716-12

**565-2.04 Protective Coatings**

A. Machine finished surfaces in contact, including pins, pin holes, surfaces in sockets at the top of rocker bearings, and bronze or copper plates in sliding contact shall receive one coat of automotive grease as soon as machining is complete. None of these surfaces shall be painted.

B. Stainless steel and polytetrafluoroethylene surfaces shall not be painted or otherwise coated.

C. Metal to metal surfaces to be field welded shall be given a coat of clear lacquer or other protective coating approved by the Engineer, or Inspector, if exposure is to exceed three months prior to welding. The coating shall be removed at the time of welding. Painting, if required, will be done only after the completion of welding. Surfaces to be painted shall be primed and painted in accordance with §565-2.04D.

D. All other metal surfaces shall be cleaned to meet SSPC-SP10, “Near-White Metal Blast Cleaning” and painted in accordance with section 572, Structural Paint System: Shop Applied. The paint shall be selected from the Department’s Approved List, Structural Steel Paints – Class 1. For bearings used in conjunction with unpainted steel, the color of the finish coat shall Weathered Brown as defined by §708-05.

**565-2.05 Shipping.** Each bearing shall be shipped as an assembled unit, except for elastomeric bearings. Elastomeric bearings may be shipped in packages containing more than one bearing, provided the package can be handled with normal construction equipment. Bearings shall be packaged in such a manner to protect all rotating and sliding surfaces from the intrusion of outside material. Bearings shall be packaged securely to prevent separation of the elements during shipping.

**565-3 CONSTRUCTION DETAILS**

**565-3.01 Concrete Bearing Surface Elevations**

**A. General.** The elevation of the concrete bearing surface for all types of bearings, except Type M.R. bearings, shall be as given on the plans.

**B. Type M.R. Bearings.** The elevation of the concrete bearing surface may vary from that given on the plans depending on the vertical dimension of the actual bearing supplied. The Contractor shall notify the Engineer of all required elevation changes. Changes to the roadway profile will not be allowed. All elevation adjustments necessary to maintain the profile shall be made to the concrete bearing surfaces. Any adjustments, including changes to the reinforcement, will be made at no additional cost to the State.

**565-3.02 Concrete Bearing Surface Preparation.** No bearing shall be placed upon a concrete bearing surface which is deformed, irregular, or poorly finished. The entire bearing surface area shall be floated and troweled.

**565-3.03 Setting Anchor Studs.** Anchor studs shall be set as shown on the plans unless changes are permitted by the DCES. If anchor studs are cast in substructure concrete, templates, or other suitable means, shall be used to keep the studs vertical at the required embedment and in the correct horizontal position during concrete placement. If the Contractor elects to drill the finished, cured concrete in order to set the anchor studs, the reinforcing steel shall be positioned prior to casting the concrete so that it will not be damaged during drilling. If anchor studs are drilled and grouted, material and construction details shall be in conformance with §586-2 and §586-3.

**565-3.04 Bearing Pad Installation.** Bearing pads placed between concrete, or other masonry, and steel masonry plates shall be located to correct alignment and elevation, and placed at the time of masonry plate installation. Bearing pads shall conform to §728-01, §728-02, or §728-03 at the Contractor's option. Each bearing pad shall be the same size in plan as the masonry plate it supports. Holes to accommodate anchor studs shall be cleanly and accurately cut prior to bearing pad placement.

### **565-3.05 Bearing Installation and Alignment**

#### **A. Type S.R. and Type S.S. Bearings**

##### **1. General**

- a. The centerline of sole plates or fixed portions of bearing assemblies attached to the structural steel shall not be offset from the centerline of bearing stiffeners or diaphragm connection plates by more than one-half the thickness of the flange at that location, or the thickness of the bearing stiffener or connection plate, whichever is the lesser distance.
- b. The bearing shall be cleaned and regreased with automotive grease at the time of installation.

**2. Fixed.** No additional requirements apply.

**3. Expansion.** These may vary from perfect alignment. Therefore, expansion bearings shall be set in accordance with the following.

##### *a. Type S. R. Bearings*

- (1) The bearing shall be set vertical under full dead load at an ambient temperature of 20°C.
- (2) The maximum variation from perfect alignment is a function of the bearing height. The bearing height is the distance between the upper and lower contact surfaces of the movable portion of the bearing. For bearings with a height of 510 mm or less, the maximum variation from perfect alignment, taking into account the effect of temperature and load at the time of measurement, shall be calculated by the following formula:

$$M = \pm (13 \text{ mm} + (L/356,000) )$$

where “M” = maximum variation from perfect alignment measured as the horizontal distance between the centerline of the cap plate and the centerline of the masonry plate in millimeters and “L” = total expansion length in millimeters between the centerline of the movable bearing being considered and the centerline of the fixed bearing, from which motion must progress. Such variations shall not exceed 25 mm offset, or a five degree rotation of the movable portion of the bearings from the required alignment, whichever is less.

The maximum variation of all bearings having a height exceeding 510 mm shall be approved on an individual basis by the DCES.

(3) No bearing adjustments shall be made until the completed structural slab has been in place for at least seven curing days. Any adjustments needed to meet the above requirements may require jacking the superstructure. All adjustments shall be accomplished according to a written procedure submitted by the Contractor for DCES approval. All adjustments shall be made at no additional cost to the State.

*b. Type S. S. Bearings*

(1) The sliding plate shall be centered on the masonry plate under full dead load at an ambient temperature of 20°C.

(2) The maximum variation from perfect alignment between the centerlines of the fixed and movable portions of the bearing device, taking into account the effect of temperature and load at the time of measurement, shall not exceed plus or minus 13 mm longitudinally. This variation shall be measured as the horizontal distance between the centerline of the sliding plate and the centerline of the masonry plate. The movable portion of the bearing device shall be fully supported by the fixed portion under all temperature and loading conditions.

(3) No bearing adjustments shall be made until the completed structural slab has been in place for at least seven curing days. Any adjustments needed to meet the above requirements may require jacking the superstructure. All adjustments shall be accomplished according to a written procedure submitted by the Contractor for DCES approval. All adjustments shall be made at no additional cost to the State.

**B. Type M.R. Bearings**

**1. General.** The centerline of sole plates or other fixed portions of bearing assemblies attached to the structural steel shall not be offset from the centerline of bearing stiffeners or diaphragm connection plates by more than one-half the thickness of the flange at that location, or the thickness of the bearing stiffener or connection plate, whichever is the lesser distance.

**2. Fixed.** No additional requirements apply.

**3. Expansion.** These may vary from perfect alignment. Therefore expansion bearings shall be set in accordance with the following:

a. The sliding plate shall be centered on the masonry plate under full dead load at an ambient temperature of 20°C.

b. The maximum variation from perfect alignment between the centerline of the fixed and movable portions of the bearing device, taking into account the effects of temperature and load at the time of measurement, shall not exceed plus or minus 25 mm longitudinally unless otherwise indicated on the plans. This variation shall be measured as the horizontal distance between the centerline of the sliding plate and the centerline of the masonry plate.

c. No bearing adjustments shall be made until the completed structural slab has been in place for at least seven curing days. Any adjustments needed to meet the above requirements may require jacking the superstructure. All adjustments shall be accomplished according to a written procedure submitted by the Contractor for DCES approval. All adjustments shall be made at no additional cost to the State.

### **C. Type E.P. and Type E.L. Bearings**

#### **1. General**

a. These bearings are designed to function properly provided that minimum distortion occurs along the beam axis under full dead load at an ambient temperature of 20°C. Elastomeric bearings shall be installed when the ambient temperature is between 5° and 26° C inclusive. The Contractor may elect to install the bearings when the ambient temperature is outside of the allowable range, provided the Contractor submits, and receives DCES approval, of an installation procedure that either resets the bearings when the temperature is in the allowable range or deforms the bearings so that they perform as if they were installed at 20°C.

b. For prestressed concrete superstructures, the bearing shall be anchored to establish the fixed end of the bridge as soon as possible after stringer erection. For adjacent prestressed box beams, or prestressed slab superstructures, the anchorage shall be completed prior to filling the shear keys. The method of anchorage shall be in accordance with the details shown on the plans. Anchor dowel holes shall be core drilled to the nominal size and depth and at the locations required by the plans. In lieu of core drilling, the Contractor may submit an installation procedure that incorporates the use of either preset anchor bolts or pipe sleeves to the DCES for approval. Prior to placing the anchor dowel, the hole shall be inspected and approved for filling by the Engineer. Fill material shall be in accordance with the details on the plans.

**2. Fixed.** No additional requirements apply.

#### **3. Expansion**

a. These may vary from perfect alignment. The maximum variation from perfect alignment under full dead load shall not exceed the value shown on the plans. This variation shall be measured as the horizontal distance between the centerline of the highest elastomer surface and the centerline of the lowest elastomer surface.

b. No bearing adjustments shall be made until the completed structural slab has been in place for at least seven curing days. Any adjustments needed to meet the above requirements may require jacking the superstructure. All adjustments shall be accomplished according to a written procedure submitted by the Contractor for DCES approval. All adjustments shall be made at no additional cost to the State.

### **D. Type E.B. Bearings**

#### **1. General**

a. The centerline of sole plate or other fixed portions of bearing assemblies, attached to steel stringers, shall not be offset from the centerline of bearing stiffeners or diaphragm connection plates by more than one-half the thickness of the flange at that location, or the thickness of the bearing stiffener or connection plate, whichever is the lesser distance.

b. These bearings are designed to function properly provided that minimal distortion occurs along the beam axis under full dead load at an ambient temperature of 20°C. Elastomeric bearings shall be installed when the ambient temperature is between 5° and 26° C inclusive. The Contractor may elect to install the bearings when the ambient temperature is outside of the allowable range, provided the Contractor submits, and receives DCES approval, of an installation procedure that either resets the bearings when the temperature is in the allowable range or deforms the bearings so that they perform as if they were installed at 20°C.

**2. Fixed.** No additional requirements shall apply.

#### **3. Expansion**

a. These may vary from perfect alignment. The maximum variation from perfect alignment under full dead load shall not exceed the value shown on the plans. This variation shall be

measured as the horizontal distance between the centerline of the highest elastomer surface and the centerline of the lowest elastomer surface.

b. No bearing adjustments shall be made until the completed structural slab has been in place for at least seven curing days. Any adjustments needed to meet the above requirements may require jacking the superstructure. All adjustments shall be accomplished according to a written procedure submitted by the Contractor for DCES approval. All adjustments shall be made at no additional cost to the State.

**565-3.06 WELDING**

**A. Type S.R. Bearings.** Bearings shall be welded permanently to the structural steel only after all necessary adjustments have been made. All welding shall be done in accordance with the requirements of the SCM. The Contractor shall submit a Welding Procedure Specification to the DCES. No welding shall be performed until the manufacturer receives an approved Welding Procedure Specification.

**B. Type S.S. Bearings.** The requirements of §565-3.06A shall apply.

**C. Type M.R. Bearings.** The requirements of §565-3.06A shall apply except that during field welding operations the temperature of the steel adjacent to the rotational element shall not exceed 90°C. Temperature shall be controlled by welding procedures and monitored using temperature indicating crayons, or other devices. Procedures, crayons, and other devices shall be acceptable to the Engineer. If the temperature limit is exceeded, the DCES and the Director, Materials Bureau shall be immediately notified. The DCES will provide the proper repair procedure, which may include complete replacement of the bearing. All repair work shall be done at no additional cost to the State.

**D. Type E.B. Bearings.** The requirements of §565-3.06A and §565-3.06C shall apply.

**565-3.07 Grouting Anchor Bolt Holes.** All slotted anchor bolt holes in masonry plates shall be filled with concrete grouting material to the top edge of the hole. All excess grout material shall be cleaned from the bearing surfaces in a manner satisfactory to the Engineer. Slotted anchor bolt holes in fixed bearings may be filled any time subsequent to stringer placement. Slotted holes in expansion bearings shall be filled only after all necessary bearing adjustments have been made.

**565-3.08 Final Verification.** Prior to final acceptance of the bridge, the Engineer will verify that all necessary adjustments have been made; that all steel bearings, or external load plates, are permanently welded or attached with cap screws to the superstructure steel as shown on the contract plans; that all slotted holes are completely filled with grout; that all anchor studs are firmly tightened; and that all other work required to make the bearings completely functional has been completed.

**565-4 METHOD OF MEASUREMENT.** Measurement will be taken as the number of bearings installed in accordance with the Contract Documents.

**565-5 BASIS OF PAYMENT.** The unit price bid for each bearing shall include the cost of all labor, materials, equipment and adjustment necessary to complete the work. All material between the bottom of the superstructure, and the top of the substructure, including anchor studs and sole plates, shall be included in the price bid for this item.

**565-5.01 Progress Payments.** Eighty percent of the quantity will be paid for after the bearing is installed. The remainder of the quantity will be paid for after the bearing is aligned.

*Payment will be made under:*

<b>Item No.</b>	<b>Item</b>	<b>Pay Unit</b>
565.1121	Type S.R. Expansion Bearing (All Load Ranges)	Each
565.1221	Type S.R. Fixed Bearing (All Load Ranges)	Each

565.1321	Type S.S. Expansion Bearing (All Load Ranges)	Each
565.1421	Type S.S. Fixed Bearing (All Load Ranges)	Each
565.1521	Type M.R. Expansion Bearing (0 to 1000 kN)	Each
565.1522	Type M.R. Expansion Bearing (1001 to 2000 kN)	Each
565.1523	Type M.R. Expansion Bearing (2001 to 3000 kN)	Each
565.1524	Type M.R. Expansion Bearing (3001 to 4000 kN)	Each
565.1525	Type M.R. Expansion Bearing (Over 4000 kN)	Each
565.1721	Type M.R. Fixed Bearing (0 to 1000 kN)	Each
565.1722	Type M.R. Fixed Bearing (1001 to 2000 kN)	Each
565.1723	Type M.R. Fixed Bearing (2001 to 3000 kN)	Each
565.1724	Type M.R. Fixed Bearing (3001 to 4000 kN)	Each
565.1725	Type M.R. Fixed Bearing (Over 4000 kN)	Each
565.1821	Type E.P. Bearing (All Load Ranges)	Each
565.1921	Type E.L. Bearing (0 to 250 kN)	Each
565.1922	Type E.L. Bearing (251 to 500 kN)	Each
565.1923	Type E.L. Bearing (501 to 750 kN)	Each
565.1924	Type E.L. Bearing (751 to 1000 kN)	Each
565.1925	Type E.L. Bearing (Over 1000 kN)	Each
565.2021	Type E.B. Fixed Bearing (0 to 250 kN)	Each
565.2022	Type E.B. Fixed Bearing (251 to 500 kN)	Each
565.2023	Type E.B. Fixed Bearing (501 to 750 kN)	Each
565.2024	Type E.B. Fixed Bearing (751 to 1000 kN)	Each
565.2025	Type E.B. Fixed Bearing (Over 1000 kN)	Each
565.2031	Type E.B. Expansion Bearing (0 to 250 kN)	Each
565.2032	Type E.B. Expansion Bearing (251 to 500 kN)	Each
565.2033	Type E.B. Expansion Bearing (501 to 750 kN)	Each
565.2034	Type E.B. Expansion Bearing (751 to 1000 kN)	Each
565.2035	Type E.B. Expansion Bearing (Over 1000 kN)	Each
565.30	Rubber Impregnated Woven Cotton-Polyester Fabric	Each

## SECTION 566 - MODULAR EXPANSION JOINT SYSTEMS

**566-1 DESCRIPTION.** The work shall consist of fabricating, furnishing, and installing a modular expansion joint system at the locations indicated on the Contract Plans.

**566-1.01 Modular Joint Systems.** Modular expansion joint systems are manufactured in various sizes, defined by their total movement capability. The correct movement capability required at any one location is indicated on the Contract Plans.

**566-1.02 Sealing Elements.** On each individual structure, all the box seals used in the modular joints shall be of the same configuration and shall be from the same manufacturer.

### 566-1.03 Modular Joint System Suppliers

**A. Multicell Modular Joint Systems.** Only firms which appear on the Department's Approved List will be acceptable suppliers. No supplier other than those listed will be considered.

**B. One Cell Modular Joint Systems.** Firms that do not appear on the Department's Approved List may supply one cell Modular Joint Systems. Firms which appear on the Department's Approved List will also be acceptable suppliers.

**566-1.04 Terminology.** The following terminology will be used throughout this section:

**A. Joint System.** This term is used to describe the installation with all of its component parts as installed in the structure slab, and if applicable in sidewalks, barriers and other bridge components.

**B. Segment.** A modular joint system manufactured at less than full roadway width. No segment shall be less than a single lane width long.

**C. Joint.** The separation between two elements of a bridge to allow for movement.

**566-2 MATERIALS.** Materials shall conform to the following requirements.

**566-2.01 Modular Joint System.** The modular joint system and all its component parts, including stiffening plates and anchorages, shall be supplied by the Manufacturer. The Manufacturer shall certify that the following components meet the listed requirements:

Hollow Beams, Steel Extrusions and Milled Steel Shapes	ASTM A588M
Box Seals	705-09a
Strip Seal	ASTM D2628b
Adhesive	567-2.02A6
Stud Shear Connectors and Threaded Studs	709-05
Connecting and Sliding Plates - 10 mm Thickness	ASTM A588M
Parapet Cover Plates - 13 mm Thickness	ASTM A36Mc

**NOTES:**

- a. Shape approval by the Director of Materials is not required. Hardness, Type A Durometer shall be 60 ± 5; ASTM Method D2240. A 1 meter sample of the seal shall be submitted for testing to the Materials Bureau. No splices shall be permitted in permanent seals for any reason whatsoever.
- b. Recovery test not required.
- c. Parapet Cover Plates shall be Galvanized in accordance with §719-01, Type I.

**566-2.02 Shop Drawings**

- A. Shop Drawings shall be required for any joint system supplied as part of this work. Shop Drawings shall be prepared and reviewed in accordance with the applicable provisions of the SCM and this Specification and submitted to the DCES for approval. All Shop Drawings shall note the name and address of the Joint System Fabricator, including the actual location (address) where the fabrication will take place.
- B. The Modular Joint System Manufacturer's instructions for the proper installation of the joint system shall be entered on the Shop Drawings. Manufacturer's instructions shall include the proper width settings for various ambient temperatures. Shop Drawings which lack Manufacturer's installation instructions shall be returned without examination.
- C. Filler metal shall be qualified in accordance with Section 7 of the SCM. Welding Procedure Specifications (WPS) shall be submitted for approval to the DCES with the Shop Drawings for each combination of joint type and welding process shown on the Shop Drawings. Shop Drawing Approval shall be withheld until this requirement has been met.

**566-2.03 Fabrication**

- A. All steel fabrication (shop and field) shall be done in accordance with the requirements of the SCM. Mill inspection of the steel will not be required.
- B. All metal surfaces to come in contact with the neoprene sealer shall be blast cleaned in accordance with the requirements of Steel Structures Painting Council Surface Preparation No. 6 (SSPC-SP6) - Commercial Blast Cleaning. After cleaning, all cleaned surfaces shall exhibit a clean quality of CSP6, or better, as defined by Steel Structures Painting Council Standard SSPC Vis 1.
- C. The cleaned metal surfaces shall be protected from rusting until such a time as the sealer, and lubricant adhesive are placed against the metal surface. Any cleaned metal surface upon which rusting appears shall be recleaned in accordance with the foregoing, at no additional expense to the State.
- D. The curb and parapet sliding plates, if required, shall be shop assembled to fit the modular joint system. The plates may be disassembled from the joint system for shipment to the project site.
- E. Unless otherwise noted, each modular expansion joint system shall be fabricated as a single entity. It shall fit the full width of the structure as indicated on the Contract Plans. The system shall be preset by

the Manufacturer prior to shipment. Presetting shall be done in accordance with the joint opening at 20°C. The joint opening will be indicated on the Contract Plans. Should the plans indicate that segmental fabrication is permissible, or required, each segment shall be fabricated to exactly fit that portion of the superstructure under construction, including sidewalks. Segments shall be fitted with temporary seals. Temporary seals will not require lubricant adhesive.

F. Shop inspection shall be conducted at the discretion of the Department.

**566-2.04 Acceptance.** The fabricated joint system will be accepted at the work site by the Engineer after a visual inspection and upon receipt of the Manufacturer's Certification Report (MCR) that the materials and the fabricating procedures were in accordance with the Approved Shop Drawings and this Specification. The Manufacturer shall submit, with the MCR, a Certified Copy of the Mill Test Report (MTR) for all steel used to fabricate the joint system.

### 566-3 CONSTRUCTION DETAILS

**566-3.01 Manufacturer's Representative.** During the initial stages of the joint system installation the Contractor shall have present at the installation site a Representative of the Joint System Manufacturer. This person shall be competent in all respects regarding the proper installation procedures to be used. The Representative shall advise the Contractor of, and certify to the Engineer that, the proper procedures are being followed. All certifications to the Engineer shall be in writing. A Manufacturer's Representative is not required for One Cell Modular joint Systems.

**566-3.02 Field Inspection.** Immediately prior to installation, the joint system shall be inspected by the Engineer, for proper alignment, and complete bond between the neoprene sealer and the steel, and proper stud placement and effectiveness. No bends or kinks in the joint system steel shall be allowed (except as necessary to follow the roadway grades). Nor shall the straightening of such bend or kinks be allowed. Any joint system exhibiting bends or kinks shall be removed from the work site, and replaced by a new joint system, at no additional cost. Neoprene sealer not fully bonded to the steel shall be fully bonded at the expense of the Contractor. Studs shall be inspected visually, and shall be forgiven a light blow with a hammer. Any stud which does not have a complete end weld, or does not emit a ringing sound when struck a light blow with a hammer, shall be replaced. Studs located more than 25 mm, in any direction, from the location shown on the Shop Drawings, shall be carefully removed and a new stud placed in the proper location. All stud replacements shall be at no additional cost.

### 566-3.03 Installation

**A. Manufacturer's Instructions.** The modular expansion joint system shall be installed in strict accordance with the Manufacturer's instructions, and the advice of their Official Representative. Two weeks prior to the intended installation, the Engineer shall be supplied with two copies of the written instructions. The permanently installed joint system shall match exactly the finished roadway profile and grades. The words "permanently installed", shall be interpreted to mean that any work necessary to be done to any other part of the structure, in order to achieve a truly complete permanent installation, has been done. This will apply even if the other work is to be paid for under other items of the Contract.

**B. Joint System Width, Splices, and Installation Equipment.** The modular expansion joint system shall be set to the proper width for the ambient temperature at the time of setting, as indicated on the Shop Drawings. If the joint system has been fabricated in segments, they shall be field spliced to create a single unbroken system.

All mechanical devices, supplied by the Joint System manufacturer, used to set the joint system to the proper width, will remain the property of the Manufacturer. When no longer required, the devices shall be returned to the Manufacturer.

**C. Sliding Plate.** In order to perform the work of installing the joint systems in a proper manner, some portions of the curb and parapet cannot be constructed until after the sliding plates of the joint system are installed. This surface shall be scrubbed with wire brooms. After the surface preparation

has been accepted, every effort should be made to thoroughly wet the concrete surface, and all porous surfaces to be in contact with new concrete, for 12 hours. If, in the opinion of the Engineer, conditions or the situation prohibits this, then the surfaces should be wetted for as long as possible. Construction joints must be wetted by continuous spraying with hoses using potable water. The Contractor shall remove any puddles of free standing water with oil-free compressed air, and protect the surfaces from drying, so the existing concrete remains in a clean, saturated surface dry condition until placement of the new concrete.

**D. Permanent Seals.** After the joint system has been completely installed over the full width of the structure, including sidewalks, the temporary seals shall be removed and replaced with permanent seals. After the temporary seals are removed, all metal surfaces which will be in contact with the permanent seals shall be commercially blast cleaned (SSPC-SP6) to visual standard CSP6 as defined by SSPC Vis 1-89.

**E. Final Placement.** After the modular joint system has been set to its final line and grade, the recess opening shall be filled with Class E Concrete. This surface shall be scrubbed with wire brooms. After the surface preparation has been accepted, every effort should be made to thoroughly wet the concrete surface, and all porous surfaces to be in contact with new concrete, for 12 hours. If, in the opinion of the Engineer, conditions or the situation prohibits this, then the surfaces should be wetted for as long as possible. Construction joints must be wetted by continuous spraying with hoses using potable water. The Contractor shall remove any puddles of free standing water with oil-free compressed air, and protect the surfaces from drying, so the existing concrete remains in a clean, saturated surface dry condition until placement of the new concrete. The uppermost surface of the concrete placement shall be finished in accordance with the requirements of Section 557 except that machine finishing will not be required. The cost of this work shall be included in the unit price bid for the slab item(s).

**F. Watertight Integrity Test.** After the joint system is permanently installed, including plates and all concrete placements, a watertight integrity test shall be performed. The test shall be done in accordance with the requirements of §567-3.01H.

**566-4 METHOD OF MEASUREMENT.** The work will be measured as the number of meters of joint system completely installed. Measurement will be taken horizontally and vertically along the centerline of the joint system between the outer limits indicated on the Contract Plans. The words “completely installed” shall be interpreted to mean the joint system in-place with the following operations completed, where applicable:

- Nuts tightened, or retightened, as required.
- Concrete placed and finished.
- Watertight integrity tests performed.

**566-5 BASIS OF PAYMENT**

**566-5.01.** The unit price bid per meter shall include the cost of all labor, materials and equipment necessary to complete the work.

**566-5.02.** No payment will be made for any work noted to be done at the expense of the Contractor, or any work noted to be paid for under other items of the Contract.

*Payment will be made under:*

<b>Item No.</b>	<b>Item</b>	<b>Pay Unit</b>
566.01	Modular Expansion Joint System - One Cell	Meter
566.02	Modular Expansion Joint System - Two Cell	Meter
566.03	Modular Expansion Joint System - Three Cell	Meter
566.04	Modular Expansion Joint System - Four Cell	Meter
566.05	Modular Expansion Joint System - Five Cell	Meter
566.06	Modular Expansion Joint System - Six Cell	Meter

## SECTION 567 - BRIDGE JOINT SYSTEMS

**567-1 DESCRIPTION.** The work shall consist of furnishing and installing bridge joint systems. The particular bridge joint system required will be indicated on the contract plans.

The Contractor shall notify the Deputy Chief Engineer, Structures (DCES) of the name and address of the fabricator of all bridge joint systems in accordance with §106-01 Sources of Supply.

**567-1.01 Bridge Joint Systems.** There are various kinds of bridge joint systems. Those included as part of the work required by this section are:

**A. Armored Joint System with Elastomeric Sealer.** The system shall consist of armored joint segments, angles, anchor studs, threaded studs, bolts, nuts, lock washers, expansion bolt anchors, and sealant, all combined as noted in the contract documents so that a fully operational and waterproof system shall seal the joint in which it is installed.

**B. Armored Joint System with Compression Seal.** This system shall consist of angles, preformed compression seal, anchor studs, threaded studs, bolts, nuts, lock washers all combined as noted in the contract documents so that a fully operational and waterproof system shall seal the joint in which it is installed. The system shall provide for the full expansion and contraction movements of the joint.

This system is fabricated as a single entity designed to be installed across the full width of the bridge as measured along the centerline of joint. If the bridge in question has a raised median, one field splice of the joint system will be allowed at the raised median.

**Type.** Preformed compression seals are manufactured in various type sizes, defined by a literal-numerical type designation (e.g. Type A1, etc.). The type of seal to be installed in any one armored joint system will be indicated on the contract plans.

**C. Armored Joint System with Preformed Elastic Strip Seal.** This system shall consist of structural steel components, angles, anchor studs, threaded studs, bolts, nuts, washers, lock washers, anchor bolts, preformed elastic strip seal and adhesive, all combined in the manner required by the Contract Documents so that a fully operational, waterproof system will seal the joint over which it is installed. Armored joint systems of this nature are installed by various methods. The required method for a particular installation will be indicated on the Contract Plans.

**Type.** Preformed elastic strip seals are manufactured in various sizes, defined by a type number. The type of strip seal to be installed in any one joint system will be indicated on the Contract Plans.

**D. Armorless Bridge Joint System.** The system shall consist of components shown on an Approved Materials Detail Sheet for a Manufacturer and System whose name appears on the Materials Bureau Approved List. The required method of installation will be shown on the Approved Materials Detail Sheet.

**567-1.02 Terminology.** The following terminology will be used throughout this section:

**A. Armored Joint System.** This term is used to describe the installation with all of its component parts as installed in the structure slab. Terminology used to differentiate one kind of joint system from another will be found in the title of the various subsections (e.g. 567-2.01 Armored Joint System with Elastomeric Sealer, etc.)

**B. Segment.** A joint system manufactured at less than full roadway width. No segment shall be less than a single lane width long.

**C. Joint.** The separation between two elements of a bridge structure to allow for movement.

**D. Materials Detail Sheet (MDS).** A sheet approved by the DCES and containing all material requirements and installation information for Armorless Bridge Joints which are included on the Materials Bureau Approved List.

**567-2 MATERIALS.** Material and Fabrication requirements shall be as described for the various bridge joint systems.

**567-2.01 Armored Joint System with Elastomeric Sealer**

Elastomer (Polychloroprene or Natural Rubber)	Table 567-1
Structural Steel Segment Angles	ASTM A242M and 715-01, or ASTM A36M
Headed Concrete Anchor Studs and Threaded Studs (Dimensions as shown on the contract plans)	709-05
Bolts, Nuts and Washers Steel	ASTM F568 Class 4.6 or ASTM A325M
Expansion Bolt Anchor Steel	U.S. Government GSA FF-S-325 Group III, Type 1 or Group VIII, Type 1
Bonding Tape (to bond end surfaces of the preformed elastomeric joint sealer to each other)	Fed. Spec MIL C 18969a, Type II, Class B Polyisobutylene-based extrusion, with aggressive tack

**A. Physical Composition.** Armored segments shall be comprised of elastomer or natural rubber, and structural steel components in the manner indicated on the contract plans.

**B. Length.** Armored segments shall be furnished in lengths not less than a single lane width, excluding length of tongues. Shorter lengths may be used at locations requiring special treatment or to provide the closing sections.

**C. Steel Fabrication.** All steel fabrication work shall be done in accordance with the requirements of the SCM. Mill inspection will not be required. Shop inspection will be conducted at the discretion of the Department.

**D. Cleaning.** The surface of the armored joint segment, to which the preformed elastomer is to be heat bonded, shall be thoroughly cleaned of all dirt, oil, grease, scale and oxides by grinding or sandblasting immediately prior to the heat bonding process. The metal surface after cleaning, shall be defined by SSPC Vis 1-89 Pictorial Standard, and shall meet the requirements of SSPC-SPC-6, Commercial Blast Cleaning, but shall not be of a quality less than CSP6.

<b>TABLE 567-1 ELASTOMER MATERIAL REQUIREMENTS</b>			
<b>Property</b>	<b>ASTM Test</b>	<b>Polychloroprene</b>	<b>Natural Rubber</b>
Tensile Strength	D412	12.5 MPa	15.5 MPa
Tensile Elongation at break	D412	400 percent minimum	400 percent minimum
Hardness, Shore A Durometer	D2240	45 (±5)	50 (±5)
Compression Set (22 hrs at 70°C)	D395 Method B	20 percent maximum	20 percent maximum
Low Temperature	D746 Procedure B	Not brittle at -40°C	Not brittle at -54°C
Oil Deterioration (Volume increase after immersion in ASTM Oil No. 3 for 70 hrs @ 100°C)	D471	120 percent maximum	Not Applicable

**E. Basis of Acceptance.** All materials used for this item, regardless of whether they are employed for fabrication or installation, shall be accepted at the work site upon certification, by the proper manufacturer, that all of the requirements of the contract documents have been met.

**567-2.02 Armored Joint System with Compression Seal**

Compression Seal	705-091
Angles, Plates and Bars (Structural Steel)	ASTM A242M, A588M2, 715-01 and SCM
Headed Concrete Anchor Studs and Threaded Studs (Dimensions as shown on the contract plans)	709-05
Bolts, Nuts and Washers	ASTM F568 Class 4.6 or ASTM A325M
Support Bar for the compression seal	ASTM A242M, AISI 1018 or AISI 10203
Expansion Bolt Anchors	U.S. Government GSA FF-S-325 Group III, Type 1 or Group VIII, Type 1
Adhesive (to bond the preformed compression seal to the steel surfaces)	Table 567-2, Moisture Curing Urethane with hydrocarbon solvent

**NOTES:**

1. The sealer shall be applied in one piece for the full length of each joint. Splices will not be permitted if the full length of joint is less than 15 m. If the full length of joint is more than 15 m, but less than 30 m long, one shop splice in the sealer will be permitted. If the full length of joint is greater than 30 m, shop splices in the sealer will be permitted at approximately 15 m intervals.
2. Support angles may be ASTM A36M
3. If AISI 1018 or AISI 1020 steel is used it shall be painted in accordance with the requirements of the contract documents.

Average weight per liter	0.96 kg ± 10%
Solids Content	72% - 74% by Weight
Adhesive to remain fluid, from	-15°C to 50°C
Film Strength (ASTM D412)	8.5 MPA
Elongation	350%

**A. Assembly.** The joint system shall be shop assembled and delivered to the work site ready for installation.

If the Contractor desires to assemble the joint system at the work site, prior permission to do so must be obtained from the DCES.

Joint systems assembled at the work site shall have all materials certified by the respective manufacturers that the respective materials meet the requirements of §567-2.02A. Field methods of fabrication shall be in accordance with the requirements of this subsection.

**B. Procedures.** Steel fabrication shall be done in conformance with the requirements of the SCM. Mill inspection will not be required. Shop inspection will be conducted at the discretion of the Department.

**C. Cleaning.** Metal surfaces which are to be coated with adhesive shall be cleaned in accordance with Steel Structures Painting Council, Surface Preparation No. 6, Commercial Blast Cleaning (SSPC SP6) with the following modifications and additions:

1. The cleaned surfaces shall have adhesive applied before detrimental rusting occurs.
2. A commercial blast cleaned surface shall be as defined by SSPC SP6 and SSPC Vis 1-89 pictorial references BSP6 and CSP6 only.

**D. Basis of Acceptance.** The armored joint system with preformed compression seal will be accepted at the work site upon certification to the Engineer by the Contractor, that the materials used and the fabricating procedures were in accordance with this specification.

The certification shall include the name of the sealer manufacturer, the lot numbers of all sealers used in the fabrication of the armored joint system and the statement that all sealer used in the

fabrication of the armored joint system was appropriately identified as accepted materials by the presence of Department security seals when received by the fabricator.

**567-2.03 Armored Joint System with Preformed Elastic Strip Seal.** Since there are various methods of installing the joint system, all of the materials listed in this Subsection may not be applicable for a particular installation. It is the Contractor's responsibility to ensure that only those materials necessary are actually installed, where required, or as specified on the Approved Shop Drawings.

Angles, Plates, Extrusions and Milled Shapes	ASTM A588M and 715-01
Headed Concrete Anchor Studs and Threaded Studs (Dimensions indicated on the Contract Plans)	709-05
Bolts and Nuts	ASTM A307M or A325M.
Anchor Bolts	ASTM F568 Class 4.6
Anchor bolt grout	701-07
Preformed Elastic Strip Seal	ASTM D2628 modified1
Adhesive(to bond the strip seal to the steel surfaces)	Table 567-2, Moisture Curing Urethane with Hydrocarbon Solvent
Concrete <sup>2</sup>	501, Class E
Elastomeric Concrete <sup>2</sup>	Contract Documents

**NOTES:**

1. Recovery Test is not required. The sealer shall be supplied in one piece for the full length of each joint.
2. Concrete and Elastomeric Concrete, if used, shall be placed and paid under a separate item.

**A. Steel Fabrication.** Steel fabrication shall be done in conformance with the requirements of the SCM. Mill inspection will not be required. Shop inspection will be conducted at the discretion of the Department.

**B. Cleaning.** Metal surfaces which are to be coated with adhesive shall be thoroughly cleaned of all dirt, oil, grease, scale and oxides by grinding or sandblasting. Metal surfaces after cleaning shall exhibit a clean quality of CSa2, or better, as defined by the Steel Structures Painting Council Standard SSPC Vis1.

**C. Adhesive Coating.** The recess of the steel extrusions shall be thoroughly coated with adhesive. The strip seal shall be installed within the recess in such a manner that it will be completely and firmly bonded to the recess surface over the total length of the joint system.

**D. Basis of Acceptance.** The fabricated joint system will be accepted at the work site by the Engineer after a visual inspection and upon receipt of the Manufacturer's Certification Report (MCR) that the materials and the fabricating procedures were in accordance with the Approved Shop Drawings and this Specification. The Manufacturer shall submit, with the MCR, a Certified Copy of the Mill Test Report (MTR) for all steel used to fabricate the joint system.

**567-2.04 Armorless Bridge Joint.** The material requirements shall be as shown on the Approved Materials Detail Sheet corresponding to a Manufacturer and System listed on the Materials Bureau Approved List.

**567-2.05 Shop Drawings.** Shop drawings will be required for any joint system supplied as part of this work. Shop drawings shall meet the various applicable requirements of this subsection. All shop drawings shall note the name and address of the joint system (or segment) fabricator as well as the location where the joint system (or segments) are to be fabricated.

**A. General.** The applicable provisions of Section 2-Drawings, of the New York State Steel Construction Manual shall apply with the following modifications

- 1. Shop Drawings.** Shop drawings shall be submitted for review, approval and distribution in accordance with the requirements of the SCM, Section 2. The shop drawings shall indicate the

type, location and details of the mechanical devices required to compress the joint to its required width based on the ambient temperature at the time of installation. All references, within Section 2 to the DCES, shall be interpreted as the Regional Director, with the following exceptions:

- 202.7 - Distribution of Approved Shop Drawings.
- 202.8 - Disposal of Original Reproducibles.

No shop drawing approval will be issued for shop drawings unaccompanied by current WPS(s). No shop work shall begin prior to the Contractor's receipt of approved shop drawings.

**2. Welding Procedure Specifications.** The Contractor shall submit with the shop drawings a Welding Procedure Specification (WPS), approved by the DCES for each combination of joint system type and welding process shown on the shop drawings.

The WPS approval date shall be within 36 months of the joint system fabrication date. A submitted WPS showing an approval date earlier than 36 months prior to joint system fabrication will be rejected and the Contractor shall be required to submit shop drawings accompanied by a currently approved WPS(s). No extension of time, nor additional payment will be forthcoming for delays caused by the Contractor's failure to submit current WPS(s).

**567-3 CONSTRUCTION DETAILS.** The construction details shall be as required for the various joint systems and the approved shop drawings.

#### **567-3.01 Armored Joint System with Elastomeric Sealer**

**A. Manufacturer's Representative.** The joint system shall be installed in strict accordance with the manufacturer's instructions and this subsection. In the event of a conflict, the terms of this subsection shall rule. A representative of the manufacturer shall be present at the beginning of the installation. The representative shall be fully conversant in all respects with the correct installation methods. The representative shall be responsible to advise both the Engineer and the Contractor, that the proper installation method is being followed.

**B. Preparation.** The preformed recess which is to receive the joint system shall be air blown or vacuum-cleaned in order that all loose or foreign matter is removed prior to installation of the system.

**C. Storage Inspection and Handling.** The joint system shall be stored, inspected and handled in accordance with the following:

**1. Handling and Storing.** All material shall be handled and stored in a manner approved by the Engineer, and consistent with the requirements of the SCM. No material shall be dropped, thrown, or dragged upon the ground. Material shall be kept clean, properly drained and stored on proper supports above the ground. All material shall be adequately shored, braced, or clamped to resist lateral forces which might occur. Permanent distortion will be cause for rejection of material.

If the shop applied protective coating deteriorates to the point that the Engineer considers it unacceptable, the contractor shall restore the shop applied coating to a condition acceptable to the Engineer. This work shall be done before other coatings are applied. The work shall be done in accordance with the requirements of the contract documents.

**2. Field Inspection.** All installation work shall be subject to the Engineer's inspection. The Engineer shall be given all facilities required for a thorough inspection. Materials and workmanship subject to shop inspection shall be identified by the acceptance stamp of the Shop Inspector. Materials and workmanship not required to be shop inspected will be inspected by the Engineer. Certified copies of the results of tests conducted by the manufacturer shall be furnished to the Engineer in accordance with the requirements of 715-01.

**D. Installation Inspection.** Immediately prior to installation, the armored segments shall be inspected by the Engineer for proper alignment and complete bond between the polychloroprene and

the steel, and proper stud placement and effectiveness. No bends or kinks in the armoring steel shall be allowed, nor shall straightening of such bends or kinks be allowed. Armored segments exhibiting bends or kinks shall be removed from the work site, and replaced with new armored segments at the Contractor's expense. Armored segments which exhibit any separation of the polychloroprene and the armoring steel shall be removed from the work site and replaced with new armored segments at the Contractor's expense. Studs shall be inspected visually and shall be given a light blow with a hammer. Any threaded stud which does not have a complete end weld or does not emit a ringing sound when struck a light blow with a hammer shall be replaced. Studs located more than 25 mm from the location shown on the shop drawings shall be carefully removed and a new stud placed in the proper location.

**E. Mechanical Devices.** In order for the armored segments to be installed properly, they must be set at a width which is directly dependent upon the ambient temperature at the start of installation, as shown on the shop drawings. The width setting shall be accomplished through the use of mechanical devices supplied by the armored segment fabricator. After the armored segment has been set to its proper line and grade and securely attached to its supports, the mechanical devices shall be removed and returned to the armored segment manufacturer.

**F. Sealing Segment Surfaces.** The mating surfaces of the armored segments shall be scrubbed with wire brushes, or other means satisfactory to the Engineer, to remove any rust from the steel and roughen the polychloroprene. This operation shall immediately precede the application of tape to the mating surfaces.

**G. Concrete Placement and Finishing.** After the joint system has been fully installed, concrete shall be placed in accordance with the contract plans. The concrete shall be finished in accordance with 567-3.07 - Finishing Integral Wearing Surfaces on Superstructure Slabs.

**H. Watertight Integrity Test** At least five work days after the joint system has been fully installed the Contractor shall test the entire (full length) joint system for watertight integrity employing a method satisfactory to the Engineer. The entire joint system shall be covered with water, either ponded or flowing, for a minimum duration of 15 minutes. The concrete surfaces under the joint shall be inspected, during this 15 minute period and also for a minimum of 45 minutes after the supply of water has stopped, for any evidence of dripping water or moisture. Water tightness shall be interpreted to be no free dripping water on any surface on the underside of the joint. Patches of moisture shall not be cause for non-acceptance.

Should the joint system exhibit evidence of water leakage at any place whatsoever, the Contractor shall locate the place(s) of leakage and take all measures necessary to stop the leakage. This work shall be done at the Contractor's expense. A subsequent water integrity test shall be performed subject to the same conditions and consequences as the original test.

### **567-3.02 Armored Joint System with Compression Seal**

**A. Delivery.** The joint system shall be delivered to the work site ready for installation in accordance with the requirements of 567-2.02B1.

**B. Preparation.** The requirements of 567-3.01B, shall apply.

**C. Storage Inspection and Handling.** The requirements of 567-3.01C shall apply.

**D. Installation Inspection.** The armored joint system with compression seal shall be inspected in the same manner as required for armored segments under 567-3.01D. All of the requirements of 567-3.01D shall apply, except that compression seal not fully bonded to the armoring angles will not mandate replacement of the joint system. However, compression seal not fully bonded, shall be fully bonded to both armoring faces, by the Contractor, at no expense to the State.

**E. Mechanical Devices.** The requirements of 567-3.01E shall apply.

**F. Concrete Placement and Finishing.** The requirements of 567-3.01G shall apply.

**G. Watertight Integrity Test.** Not required.

### 567-3.03 Armored Joint System with Preformed Elastic Strip Seal

**A. Site Delivery.** The joint system shall be shop assembled and delivered to the work site ready for installation, unless prior permission to field assemble has been granted by the Engineer.

**B. Field Assembly.**

1. If the Contractor desires to assemble the joint system at the work site, prior permission to do so shall be obtained from the Engineer, in writing.
2. Joint systems assembled at the work site shall have all materials certified by the respective Manufacturers. The certifications shall state that the Materials requirements of this Specification have been met.

**C. Storage Inspection and Handling.** The requirements of 567-3.02C shall apply.

**D. Installation Inspection.** The requirements of 567-3.02D shall apply. The term “compression Seal” shall be interpreted as “preformed elastic strip seal.”

**E. Mechanical Devices.** The requirements of 567-3.01E shall apply.

**F. Recess Finishing.** If the joint system is installed within a preformed concrete or asphalt recess, the recess will be filled and finished to grade with either structural concrete or elastomeric concrete. The exact materials will be indicated on the Contract Plans. The respective materials will be installed in the following manner:

1. **Concrete.** Placement shall be in accordance with 555. Finishing shall be done in accordance with 557-3.07. Machine finishing will not be required.
2. **Elastomeric Concrete.** Placement shall be in accordance with the requirements of the elastomeric concrete specification.

**G. Watertight Integrity Test.** The requirements of 567-3.01H shall apply.

### 567-3.04 Armorless Bridge Joint System

**A. Manufacturer's Representative.** The joint system shall be installed in strict accordance with the manufacturer's instructions and the Approved Materials Detail Sheet. In the event of a conflict, the terms of the Approved Materials Detail Sheet shall rule. A representative of the bridge joint system manufacturer shall be present prior to placement to inspect the prepared surfaces and remain at the job during all phases of the installation. The representative shall be fully conversant in all respects with the correct installation methods. The representative shall be responsible to advise both the Engineer and the Contractor on properly installing the joint system. The representative may be excused from the project site at the discretion of the EIC.

**B. Preparation.** All surfaces shall be prepared as per the Approved MDS. At a minimum, the preformed recess which is to receive the joint system shall be air blown using air free of water and oil or vacuum-cleaned so that all loose or foreign matter is removed prior to installation of the system. The substrate shall be dry for a minimum of 24 hours prior to installation for the joint system.

**C. Storage Inspection and Handling.** The joint system shall be stored, inspected and handled in accordance with the Approved Materials Detail Sheet.

**D. Installation Inspection.** All installation work shall be subject to the Engineer's inspection.

**E. Watertight Integrity Test.** At least five work days after the joint system has been fully installed the Contractor shall test the entire (full length) joint system for watertight integrity. The entire joint system shall be covered with water, either ponded or flowing, for a minimum duration of 15 minutes.

The concrete surfaces under the joint shall be inspected during this 15 minute period, and also for a minimum of 45 minutes after the supply of water has stopped, for any evidence of dripping water or moisture. Water tightness shall be interpreted to be no free dripping water on any surface on the underside of the joint. Patches of moisture shall not be cause for non-acceptance.

Should the joint system exhibit evidence of water leakage at any place whatsoever, the Contractor shall locate the place(s) of leakage and take all measures necessary to seal the leak. A subsequent water integrity test shall be performed subject to the same conditions and consequences as the original test.

**567-4 METHOD OF MEASUREMENT.** Measurement will be made as the number of meters of joint system completely installed, measured horizontally and vertically along the centerline of joint system between the outer limits as indicated on the contract plans.

The words “completely installed” shall be interpreted to mean the joint system in place with the following operations completed where applicable:

- All sealant in its proper position.
- All nuts tightened or retightened as required.
- Concrete placed and finished.
- Elastomeric concrete placed and finished.
- Water-tight integrity tests.

**567-5 BASIS OF PAYMENT.** The unit price bid per meter shall include all labor, materials and equipment necessary to complete the work. No additional payment will be made for corrective actions.

*Payment will be made under:*

<b>Item No.</b>	<b>Item</b>	<b>Pay Unit</b>
567.31	Armored Joint System with Compression Seal-Type A1	Meter
567.32	Armored Joint System with Compression Seal-Type A2	Meter
567.33	Armored Joint System with Compression Seal-Type A3	Meter
567.34	Armored Joint System with Compression Seal-Type A4	Meter
567.35	Armored Joint System with Compression Seal-Type A5	Meter
567.36	Armored Joint System with Compression Seal-Type A6	Meter
567.37	Armored Joint System with Compression Seal-Type A7	Meter
567.50	Armored Joint System with Preformed Elastic Strip Seal - Type as Noted	Meter
567.60	Armorless Bridge Joint System	Meter

**SECTION 568 - BRIDGE RAILING**

**568-1 DESCRIPTION.** This work shall consist of furnishing and erecting bridge railing as shown on the contract plans and in accordance with the specifications.

The Contractor shall notify the Deputy Chief Engineer, Structures (DCES) of the name and address of the fabricator of all bridge railing in accordance with §106-01 Sources of Supply.

As soon as the Contract is awarded, the Contractor shall notify the DCES of the name and address of the Fabricator of all bridge railing. This notification shall list the specific shop or shops in which the railing will be fabricated.

**568-2 MATERIALS.** Materials shall meet the requirements of the following subsections:

Concrete Grouting Material	701-05
Steel Bridge Railing	710-23

Stainless Steel Connecting Products	715-16
Rubber Impregnated Random Fiber Pad	728-02

When Steel Bridge Railing - Rustic is specified, the Contractor shall supply all unpainted, weathering steel railing or all galvanized and painted steel railing, unless the Contract Documents require a particular method of obtaining the rustic appearance. A combination of unpainted weathering steel and galvanized, painted steel will not be permitted.

## 568-3 CONSTRUCTION DETAILS

### 568-3.01 Erection of Railing

**A. Inspection of Railing.** Immediately prior to erection, the railing shall be inspected for damage. Significant bends or kinks in the railing not specifically called for in the contract documents shall constitute sufficient cause for rejection. Straightening of such bends or kinks shall not be allowed.

Bending or curving rails in the field in order to fit alignment requirements, shall not be permitted. The Engineer may order some bending or curving to allow for necessary minor adjustments.

**B. Inspection of Galvanizing.** Damage to galvanizing of steel bridge railing shall constitute sufficient cause for rejection except for the following conditions:

1. If the damaged area is not required to be repaired under the provisions of 710-23, Steel Bridge Railing.
2. If the total damaged area of a single piece (i.e. post or rail) is 4000 mm<sup>2</sup> or less. Total damaged area is exclusive of the damaged area as described under 568-3.01B1.

**C. Field Galvanizing for Repair.** Field galvanizing repair shall be allowed to be performed upon damaged areas meeting the requirements of 568-3.01B2.

Field galvanizing repair shall be made by painting zinc repair material onto the damaged area in accordance with the requirements of 719-01, Galvanized Coatings and Repair Methods.

All finished surfaces of welds and adjacent surfaces of rails and posts upon which galvanizing has been removed, due to any field welding operation, shall be field galvanized.

**D. Field Welding.** Field welding shall not be permitted unless noted in the contract documents or ordered by the Engineer.

**E. Erection.** All railing shall be erected in accordance with the contract documents or, when required, the approved shop drawings prepared and submitted as specified in the New York State Steel Construction Manual.

**F. Positioning Railing.** Railing shall be erected so that the rails are parallel to each other and to the top of parapet, sidewalk or structural slab.

**G. Positioning Posts.** Posts shall be set vertical.

**H. Base Plates.** Post base plates shall be perpendicular to the post, unless otherwise noted. When the railing is to be placed on a preformed surface, the base plate may be placed parallel to the grade or may be perpendicular to the post and made level by the use of beveled shims conforming to the applicable requirements of 710-23, Steel Bridge Railing.

**I. Non-Metallic Pads.** Posts which are to be placed on a preformed surface shall be mounted on a non-metallic pad conforming to the requirements of 728-02. Beveled Shims, if required, shall be inserted between the non-metallic pad and the post base plate.

**J. Jacking Nuts.** For railings set on jacking nuts, the railing posts shall be erected to proper line and grade before concrete under the post and in back of the granite curb is placed or before the mortar pad is placed.

**K. Rail Span.** The rails of railings shall span the following minimum number of posts:

Railing Type	Number of Posts
Two-Rail, Steel	3*
Four-Rail, Steel	3
Five-Rail Steel	3

**NOTE:** \* If this is not possible, the absolute minimum shall be 2 posts if approved by the DCES.

**L. Anchor Studs.** After the anchor stud nuts have been tightened in a manner satisfactory to the Engineer, the studs shall be flame cut 25 mm above the nut. The first thread of the stud above the nut shall be damaged. The cut end of the anchor stud shall be coated in conformance with the requirements of §719-01, Galvanized coating and Repair Methods.

**M. Touch-Up Painting.** Any damage to the paint on a railing system shall be repaired in accordance with §657 Painting Galvanized Surfaces.

**N. Inspection.** All erection shall be subject to the inspection of the Engineer who shall be given all facilities required for a visual inspection of workmanship and materials.

Any single piece of the railing system with a total damaged area in excess of the amount specified in 568-3.01B2 shall be rejected and replaced.

**568-3.02 Cement Mortar Pads**

**A. Proportioning.** Cement mortar pads shall consist of a concrete grouting material.

The concrete grouting material shall meet the requirements of §701-05, Concrete Grouting Material. The grouting material shall be mixed with water, in the ratio recommended by the manufacturer, to produce a trowelable mix.

**B. Mixing.** Mixing shall be carried out in strict accordance with the manufacturers recommendations or the following as determined by the Engineer.

- All necessary mixing equipment shall be present and in good working order prior to the start of mixing.
- Mixing time shall not exceed three minutes unless otherwise permitted. No mixing shall be started until all preparations have been made to place the mortar.
- All mortar in any individual batch shall be used within 25 minutes after the start of mixing.
- Retempering will not be allowed.

**C. Surface Preparation.** All concrete surfaces to receive the mortar shall be free from laitance, oil, grease, paint, dust, loose particles or other foreign material.

The concrete surface shall be cleaned by sandblasting to the satisfaction of the Engineer, followed by a thorough vacuum cleaning.

The bottom surfaces of the base plates shall be free of oil, dirt and other foreign matter.

The concrete surface shall be lightly moistened with water.

**D. Form Preparation.** The forms shall be positioned about the base plate as shown in the plans or as directed by the Engineer. If the forms are to be coated with a release agent, it shall not be deleterious to the physical properties of the mortar system being used as determined by the Engineer.

**E. Application.** After the concrete surfaces and the base plates surfaces have been properly prepared the mortar shall be placed within the limits of the forms and tamped into place to assure that there are no voids in the completed pad. Exposed surfaces of the mortar shall be screeded and

troweled to the level of the bottom of the base plate. The mortar pads shall be protected from rain for at least 24 hours.

**F. General.** In all cases, the installation of the mortar pads shall be made when the concrete and ambient air temperatures are above 10°C.

#### 568-4 METHOD OF MEASUREMENT

**568-4.01 Bridge Railing.** The quantity to be paid for bridge railing shall be the number of meters measured along the centerline of railing anchorage between the extreme outer limits indicated on the contract plans.

**568-4.02 Transition Bridge Railing.** The quantity to be paid for transition railing shall be the number of meters measured along the axis of the top rail between the limits shown on the plans.

#### 568-5 BASIS OF PAYMENT

**568-5.01 Bridge Railing.** The unit price bid shall include the cost of furnishing all labor, materials and equipment necessary to complete the work. All pads (including Mortar Pads), shims, splices with their hardware, railing anchor studs with nuts, washers and anchor plates, and hand rails when specified shall also be included in the price bid.

No payment shall be made for those railing pieces which are replacements for those railing pieces that have been rejected.

Progress payments will be made when the railing is erected in accordance with the contract documents as specified in the New York State Steel Construction Manual exclusive of the cutting, peening and galvanizing of studs. Payment will be made at the unit bid price for 90% of the quantity erected. The balance of the quantity will be paid for upon proper completion of the work.

*Payment will be made under:*

Item No.	Item	Pay Unit
568.50	Steel Bridge Railing (Two-Rail)	Meter
568.51	Steel Bridge Railing (Four-Rail)	Meter
568.52	Steel Bridge Railing (Five-Rail)	Meter
568.53	Steel Bridge Railing (Two-Rail) with Handrail	Meter
568.54	Steel Bridge Railing (Three-Rail)	Meter
568.60	Steel Bridge Railing - Rustic (Two-Rail)	Meter
568.61	Steel Bridge Railing - Rustic (Four-Rail)	Meter
568.62	Steel Bridge Railing - Rustic (Five-Rail)	Meter
568.63	Steel Bridge Railing-Rustic (Two-Rail) with Handrail	Meter
568.64	Steel Bridge Railing-Rustic (Three-Rail)	Meter
568.70	Transition Bridge Railing	Meter
568.71	Transition Bridge Railing-Rustic	Meter
568.80	Pedestrian and Bicycle Railing (One-Rail)	Meter
568.81	Pedestrian and Bicycle Railing (Two-Rail)	Meter
568.82	Pedestrian and Bicycle Railing (Three-Rail)	Meter
568.83	Pedestrian and Bicycle Railing (Four-Rail)	Meter
568.84	Pedestrian and Bicycle Railing (Five-Rail)	Meter
568.85	Pedestrian and Bicycle Railing-Rustic (One-Rail)	Meter
568.86	Pedestrian and Bicycle Railing-Rustic (Two-Rail)	Meter
568.87	Pedestrian and Bicycle Railing-Rustic (Three-Rail)	Meter
568.88	Pedestrian and Bicycle Railing-Rustic (Four-Rail)	Meter
568.89	Pedestrian and Bicycle Railing-Rustic (Five-Rail)	Meter
568.90	Bicycle Railing (Two-Rail)	Meter
568.91	Bicycle Railing - Rustic (Two-Rail)	Meter
568.92	Bicycle Railing (Four-Rail)	Meter
568.93	Bicycle Railing -Rustic (Four-Rail)	Meter

**SECTION 569 - PERMANENT CONCRETE TRAFFIC BARRIER FOR STRUCTURES**

**569-1 DESCRIPTION**

**569-1.01 Work.** The work shall consist of constructing concrete traffic barrier, of the configuration and at the locations indicated on the Contract Plans.

**569-1.02 Methods.** Construction of the barrier shall be accomplished by cast-in-place or precast methods. Slip forming will be allowed as an acceptable cast-in-place method, unless the plans show anchor bolts projecting beyond concrete limits; in this instance slipforming procedures will require the approval of the DCES.

**569-1.03 Shape Modification.** The barrier shape indicated on the plans shall not be altered. Minor modifications, to allow slip-forming, will be submitted to the Regional Construction Engineer for approval.

**569-1.04 Approvals.** For approval requirements and procedures refer to the Construction Details.

**569-2 MATERIALS**

**569-2.01 Fabrication.** Materials used for traffic barrier fabrication shall meet the following requirements:

Precast Concrete Barrier	704-03 and 704-05
Cast-In-Place Concrete (Constructed Forms)	501, Class A Concrete
Cast-In-Place Concrete (Slip Formed)	501, Class J
Epoxy Coated Reinforcing Bars	709-04
Steel Tubes	ASTM A500M, Grade B
Steel Plates, or Bars	ASTM A36M or A588M (A709M Grade 250 or 345W)
Anchor Bolts (Fully Threaded)	ASTM F568M, Class 8.8
Nuts	ASTM F563M, Class 10S HH
Washers	ASTM F436M, Type 1 or 3
Concrete Grouting Material	701-05
Concrete Repair Material	701-04
Joint Filler	ASTM D 1056, Grade 2B1 or 2B2.
Curing Compound	711-05
Locking and anchoring devices for precast units	715-01 and 709-04, as applicable
Galvanizing	719-01

All steel, except reinforcing steel, shall be galvanized.

**569-2.02 Fabrication Tolerances.** All cast-in-place concrete barrier, regardless of the method of construction, shall conform to the following finished tolerances:

Bar Reinforcement Cover	-0 , +13 mm
Width (Top)	-0 , + 6 mm
Width (Bottom)	-0 , +13 mm
Surface Straightness (Deviation from theoretical centerline)	13 mm in 6 meters
Vertical Alignment (Deviation from a line parallel to the theoretical grade line)	13 mm in 6 meters
Horizontal and Vertical Misalignment (between adjacent precast units)	4 mm

All precast concrete barrier shall conform to the tolerances contained in §704-03, §704-05 and to the foregoing misalignment tolerance.

Reinforcement cover shall be verified while the concrete is still plastic, except in the case of cured precast units. In that case, cover will be verified in accordance with established Department procedures.

These procedures may include coring.

### 569-3 CONSTRUCTION DETAILS

#### 569-3.01 Approvals

**A. Cast-In-Place Concrete - Modifications to Contract Plans.** The DCES shall be supplied with three copies of pertinent details and necessary design computations. Every effort will be made to render a decision, in a timely manner, after all pertinent information has been received. However, the time required to render a determination will not be taken into account should the Contractor request an extension of time.

**B. Precast Concrete.** Precast barrier systems shall be approved by the DCES prior to the contract award in order to be used in the contract.

#### 569-3.02 General: Cast In Place Concrete

**A. Cleaning.** Surfaces against which barrier is to be placed shall be thoroughly cleaned and vacuumed to remove any dirt or other foreign substances, laitance or partially loose chips of concrete.

**B. Defects.** Defects are divided into two categories: minor defects and major defects. Minor defects in the barrier shall be repaired. Major defects shall be cause for rejection of the section. Such rejected sections shall be removed and replaced or, upon approval of the Engineer, the section shall be repaired to the satisfaction of the Engineer.

**1. Minor Defects.** Minor defects are defined as holes, honeycombing or spalls which are 150 mm or less, in diameter, and which do not expose the outermost surface of the steel reinforcement. Surface voids 15 mm, or less, in diameter, and 6 mm, or less in depth are not considered defects. They do not require repair.

**2. Major Defects.** Major defects are defined as:

- a. Any defect, except as noted in §569-3.02 B.1. above which does not meet the definition of a minor defect.
- b. Minor defects which, in aggregate, comprise more than five percent (5%) of the surface of the barrier section.

**C. Repair.** Repair shall be made with a material acceptable under §701-04. Methods of repair shall be acceptable to the Engineer. The color of the repaired portion shall match, as nearly as practicable, the color of the surrounding concrete. Repaired portions shall exactly match shape requirements. The repaired portion shall withstand a moderate blow from a .5 kg hammer. Repair shall be done at no cost to the State.

**569-3.03 General: Precast Concrete.** The definition of defects and the repair requirements contained in 704-03 shall apply.

**569-3.04 Cast-In-Place Concrete - Constructed Forms.** The requirements of 555 and 556 shall apply with the following modification:

Thoroughly wet the structural slab surface and all porous surfaces to be in contact with new concrete for at least 12 hours immediately prior to placement. Remove all standing water with oil-free compressed air, and protect the surfaces from drying, so the concrete remains in a saturated surface dry condition until

placement of the new concrete. If the forms are removed before seven curing days have passed, the concrete shall be cured by means of a clear curing compound. No curing blankets will be required.

Curing compound shall be sprayed on the concrete surface immediately following the slipforming and hand finishing operations. The compound shall be applied by means of pressure spraying or distributing equipment at the rate directed by the Engineer, but not less than 1 L per 3.5 square meters of surface. The equipment for applying the compound shall be such that the compound is applied as a fine spray with no surface damage to the concrete. The equipment shall also provide adequate agitation of the compound during application, and shall be approved by the Engineer before work is started. Should the method of applying the compound produce a non-uniform film, or should the spraying equipment fail and duplicate equipment not be immediately available, the application of curing compound shall be discontinued immediately and the curing shall be accomplished by another method acceptable to the Engineer. The Contractor shall stockpile sufficient approved coverings for protection of the concrete in the event of rain, non-uniform film application, or breakdown of spray equipment.

**569-3.05 Cast-In-Place Concrete - Slipformed.** The requirements of Section 555, Section 556 and the following, shall apply:

**A.** The forming of the barrier shall be accomplished by self-propelled equipment approved by the Engineer. The requirements of 555-3.03 shall not apply. Thoroughly wet the structural slab surface and all porous surfaces to be in contact with new concrete for at least 12 hours immediately prior to placement. Remove all standing water with oil-free compressed air, and protect the surfaces from drying, so the concrete remains in a saturated surface dry condition until placement of the new concrete.

**B.** After all reinforcing bars have been placed, all bridge joints installed, and all other hardware placed in the area of the barrier, the Contractor shall perform a "dry run" over the entire length of the barrier installation location. It is necessary only to "dry run" a single day's placement during any given day; however, the entire barrier length shall be traversed.

The "dry run" may be made with either the actual slip forming equipment, or with an exact "mock-up" of the equipment. The "mock-up"; if utilized, shall be the exact size, shape and dimensions of the slip forming equipment. It shall be a minimum of 1.2 m long. Its movement shall be able to be correlated with a string, or survey, line indicating the correct offset location of the barrier.

**C.** After the "dry run" portion of the work has been completed and all obstructions have been cleared, the slip-forming equipment shall be demonstrated for capability. The demonstration shall be done in the presence of the Engineer. The Contractor shall make all adjustments, or alterations, to ensure that the equipment has the capability to produce an acceptable product. No work shall be done without the Engineer's approval. The capability demonstration will be required only once for each piece of forming equipment used on the project.

**D.** The Engineer's approval is for equipment capability only. The Contractor shall be entirely responsible for meeting the tolerances given under MATERIALS, 569-2.03. Fabrication Tolerances. Sections which do not meet tolerance requirements are subject to removal and replacement at no cost to the State, at the discretion of the Engineer.

**E. Central and Transit Mixed Concrete.** The provisions of 501-3.03 C and D shall apply for Central Mixed and Transit Mixed Concrete respectively, except that water may be added to the mixture one additional time at the point of deposition to maintain the desired slump. The water addition may be made anytime after the beginning of discharge until approximately two-thirds of the load, as determined by the Engineer, has been discharged. After the water addition, the concrete shall be mixed at least 30 revolutions in the mixing range. When the water addition is made after discharge the total number of revolutions shall not be more than 190.

Truck Mixed Concrete. The provisions of 501-3.03 E shall apply except that after initial slump has been achieved, water may be added to the mixture one additional time to maintain the desired slump. The water addition may be made anytime after the beginning of discharge until approximately

two-thirds of the load, as determined by the Engineer, has been discharged. After the water addition, the concrete shall be mixed at least 30 revolutions in the mixing range.

**F.** Concrete supply shall be sufficient to produce a continuous, completely shaped barrier. If concrete placement is interrupted, for any reason, the placement shall be protected from drying by several layers of wet burlap. A construction dam, or bulkhead, shall be installed if the interruption exceeds 30 minutes. If the interruption exceeds 90 minutes, further placement shall be discontinued. Concrete placement at this location may then resume only after 12 hours, measured from the time of delay, has elapsed.

**G.** Concrete placement may begin at the joint beyond the bulkhead without time constraints. If the length of placement between the bulkhead and the next joint is such that, in the opinion of the Engineer, it may not be slipformed, the Contractor shall form the section by methods other than slipforming.

**H.** Cold joints in the barrier, that is, joints formed due to the attachment of fresh concrete to set concrete, shall be made in the following manner. The set concrete shall have its surface cut to remove all loose, and otherwise unsatisfactory materials. Tools used for this purpose shall be approved by the Engineer, prior to use. The surface shall be scrubbed with wire brooms and shall be kept wet until new concrete is placed.

**I.** The Contractor shall make provisions to allow hand finishing, should it be necessary, on all surfaces. Hand finishing, if done, shall be done immediately after the passage of the slipforming equipment. Curing compound shall be applied only after hand finishing has been completed at any particular location.

**J.** Concrete shall be cured by means of a clear curing compound in accordance with the requirements of 569-3.04.

**K.** Joints and construction grooves shall be introduced at the locations indicated on the Contract Plans. If sawcutting methods are employed the following requirements shall apply:

1. The equipment shall be demonstrated, for capability, to the Engineer.
2. No sawcuts, for any purpose, shall be made in the structural slab.
3. In order to avoid sawcuts in the structural slab, the portion of the joint 75 mm directly above the structural slab shall be hand tooled immediately after finishing.
4. All sawcuts shall be made normal to the structural slab surface. The joints shall be sawcut as soon as no damage to the concrete will result with a maximum time of 8 hours. The clear curing compound shall be reapplied at the sawcut.

### **569-3.06 Precast Concrete**

**A.** Immediately prior to installation, the barrier units shall be inspected for defects. Defects which conform to the definition of minor defects as given in §704-03 shall be repaired in accordance with the requirements of that subsection.

After the inspection for defects has been completed, the contact surface of all precast barrier shall be sandblast cleaned in accordance with the requirements of §584-3.02A, and §584-3.02C. After sandblasting operations are completed the surfaces shall be thoroughly vacuum cleaned.

**B.** After the cleaned surface has been accepted, thoroughly wet the surface over which the precast barrier will be placed for at least 12 hours immediately prior to placing the grout bed. Remove all standing water with oil-free compressed air, and protect the surface from drying, so the surface remains in a saturated surface dry condition when placing the grout bed. All precast barrier shall be installed on grout beds conforming to the requirements of §701-05 as modified herein. The exact bedding placement requirements shall be established by the barrier system manufacturer. However,

no grout bed shall be greater than 13 mm in thickness after the barrier has been installed in its permanent position. All grout bedding material shall be tooled flush with the barrier edge.

Care shall be taken to prevent grout from setting prior to barrier unit installation. If, in the opinion of the Engineer, the grout has set, or has begun to set, it shall be removed. No retempering will be permitted. The affected installation area shall be thoroughly cleaned of grout, by methods acceptable to the Engineer, and new grout shall be placed, all at no additional cost. All vertical adjustments shall be made by the addition, or removal, of grout. No wedges will be permitted.

Lifting of the barrier which, in the Engineer's opinion, will result in permanent voids occurring between the barrier unit and the grout bed, will not be permitted.

**C.** Unless otherwise noted joints between units shall utilize materials required by ASTM D 1056, Grade 2B1 or 2B2 and shall be installed in the manner indicated on the approved precast barrier system drawings.

**D.** Units which are damaged during installation, due to the Contractor's operations, shall be repaired, or replaced, as determined by the Engineer. Repair or replacement shall be done at no cost to the State.

**E.** Precast barrier anchored to the underlying support by means of drilled-in-bolts, may be anchored by one of two methods:

**1. Bolts chemically anchored to the underlying support.** Holes drilled for this method will not go completely through the underlying support. Bolt installations will be subjected to load testing acceptance requirements.

**2. Bolts mechanically anchored to the bottom of the underlying support.** Holes drilled for this method will go completely through the underlying support. Bolt installations will not be load tested.

**569-3.07 Requirements for Method permitted under §569-3.06E1**

A. Drilling shall be done by means of a rotary impact drill. Hole diameter shall be in strict accordance with the grout manufacturer's instructions. If reinforcing steel is encountered, the reinforcing shall be cut and removed by means of a core drill. If approved by the Engineer, hole locations may be moved to avoid encountering reinforcing steel. The remainder of the drilling shall be done by rotary impact drill.

Drilling with a lubricant will not be permitted. Water use is permissible. Concrete spalled, or otherwise damaged by the contractor's operations shall be repaired, in a manner approved by and, to the satisfaction of the Engineer, at no additional cost.

B. Unless otherwise specified in the Contract Documents, the minimum depth of embedment of the anchor bolt shall be in accordance with Table 569-1.

The Contractor may increase the embedment length beyond that shown on the Plans or specified in the above table provided 1) the increase is done at no additional cost to the State and 2) the hole stops at least 50 mm from the bottom of the structural slab.

<b>Nominal Anchor Bolt Diameter (mm)</b>	13	14	16	19	22	25	29	32
<b>Embedment Length (mm)</b>	140	150	165	200	215	250	300	380
<b>Test Load (kN)</b>	48	62	77	114	157	206	226	287

C. Grouting material shall be a non-metallic, non-shrink grout, or polymer resin. It shall contain no products which promote the corrosion of steel. When cured, the material shall exhibit a maximum loss of four percent (4%) when tested for freeze-thaw resistance. Freeze-thaw testing will be done in accordance

with Materials Test Method 502-3P, except that the material will be subjected to 50 cycles of testing. Cured material shall not be reactive with salt water, portland cement, or petroleum products.

The contractor shall supply the Engineer with two copies of the grout manufacturer's certification that the material meets the foregoing requirements.

D. All anchor bolts shall be inserted at least the specified depth into the hole. After insertion of the bolt, all excess grout shall be struck-off flush with the concrete face. Should the grout fail to fill the hole, additional grout shall be added to the hole to allow a flush strike-off.

E. A portion of each lot of grouted-in anchor bolts shall be designated by the Engineer for load testing. The first lot shall consist of the first 10 grouted in anchor bolts. The remaining lots shall be defined by the Contractor subject to the following:

- The lot size shall not exceed 600 anchor bolts.
- A lot shall only include anchor bolts installed during a single construction season.
- A lot shall only include anchor bolts grouted with the same grout or resin.

Unless otherwise specified in the Contract Documents, the minimum load applied during the load testing shall be in accordance with Table 569-1.

Table 569-2 shows the lot size (column L), the initial number of anchor bolts selected for testing (column N1) and the number of anchor bolts selected for additional testing (column N2).

<b>TABLE 569-2 SAMPLING PLAN FOR ANCHOR BOLT PROOF LOAD TESTING</b>		
<b>Lot Size</b>	<b>Initial Sample Size</b>	<b>Additional Test Sample Size</b>
<b>L</b>	<b>N1</b>	<b>N2</b>
1-30	All the bolts in the lot	---
31-50	30	---
51-75	38	---
76-100	44	21
101-200	49	26
201-300	50	30
301-600	55	30

**NOTES:**

1. If all of the N1 anchor bolts selected for testing pass the load test, then the lot shall be accepted.
2. If the lot size is 75 or less and one or more of the N1 anchor bolts fail the load test, then all the anchor bolts in the lot shall be tested.
3. If the lot size is 76 or greater and only 1 of the N1 anchor bolts fails the load test, the Engineer shall designate an additional N2 anchor bolts for testing. If none of the N2 anchor bolts fail the load test, the lot shall be accepted. If any of the N2 anchor bolts fails the load tests all of the anchor bolts in the lot shall be tested.
4. If the lot size is 76 or greater, and more than one of the N1 anchor bolts fail the load testing then all the anchor bolts in the lot shall be tested.

Anchor bolts shall be deemed to pass if the specified test load is attained without permanently displacing the anchor bolts. **THIS LOAD TESTING SHOULD BE NON-DESTRUCTIVE. LOADING SHOULD BE STOPPED AS SOON AS THE MINIMUM ACCEPTABLE PULL-OUT RESISTANCE IS ATTAINED.**

F. The testing equipment shall consist of a calibrated jack system, a frame to distribute the jack load, couplers to connect the jack to the anchor bolts, and safety devices. Prior to starting the testing, the Contractor shall supply the Engineer with a certificate of calibration for the jack less than 6 months old.

Supports for the frame used to distribute the jack load shall be located outside a circle centered at the anchor bolt and of a diameter equal to 50 mm plus twice the anchor bolt embedment length but need not exceed 600 mm. The frame and jack shall be positioned so that the load is applied along the centerline of the anchor bolt. Chains or cables shall be used to connect the various pieces of the tensioning system so that free projectiles will not be created by a failure of an anchor bolt anchorage, coupling or other portion of the tensioning system.

G. All anchor bolts which fail load testing shall be replaced and load tested in accordance with the foregoing requirements at no additional cost.

**569-3.08 Requirements for Method permitted under §569-3.06E2**

- A. The requirements of §569-3.07A shall apply.
- B. Grouting material shall meet the requirements of §701-05. It shall be mixed and placed in strict accordance with the grout manufacturer's instructions unless otherwise modified by the contract documents.
- C. Both hole and bolt shall be clean and dry at the time of bolt insertion. The bolt shall be held in place such that it will remain vertical during subsequent grout placement. The method of bolt retention shall be such that the grout will be held within the hole until setting is complete.

Barrier units mechanically anchored to the underlying support by means of bolting shall be grouted into place in accordance with the following:

- Grout shall be prepared in accordance with the grout manufacturer's written instructions. Two copies of the manufacturer's instructions shall be delivered to the Engineer a minimum of two weeks prior to the beginning of barrier installation work.
- Grout shall be placed only if the ambient air temperature is at least 10°C and is predicted to rise. No grout shall be placed if the ambient air temperature falls below 7°C, unless external heat has been provided in the manner required by §555-3.08. The underlying support may be used as the floor of the enclosure if the Engineer approves.
- External heat shall be maintained for a minimum of seven curing days. A curing day is defined by §555-3.08A. After seven curing days have passed, or the grout has reached a minimum compressive strength of 25 MPa, whichever occurs last, the enclosure may be removed. All work of providing external heat shall be done at no additional cost.

**569-4 METHOD OF MEASUREMENT.** The work will be measured as the number of meters of concrete traffic barrier installed. Measurement will be taken along the centerline of the top of the barrier. No deduction will be made for joints.

**569-5 BASIS OF PAYMENT**

- A. The unit price bid per meter shall include the cost of all labor, materials and equipment necessary to complete the work. This price shall also include the cost of bar reinforcement, drilling, and testing.
- B. In the case of barrier constructed by cast-in-place methods, 40% of the quantity will be paid for after all of the bar reinforcement has been placed and approved by the Engineer. This payment shall include the cost of chairs, supports, fastenings, connections and any splices not specifically indicated on the plans. If the Engineer permits the substitution of larger bars than those specified, or the DCES permits splices not indicated on the plans, the payment will not be increased nor will any extra compensation be considered.

*Payment will be made under:*

<b>Item No.</b>	<b>Item</b>	<b>Pay Unit</b>
569.01	Permanent Concrete Traffic Barrier for Structures (Full Section)	Meter
569.02	Permanent Concrete Traffic Barrier for Structures (Half Section)	Meter
569.03	Vertical Faced Concrete Parapet	Meter
569.04	Single Slope (Half-Section) Concrete Bridge Barrier	Meter
569.05	Single Slope (Full-Section) Concrete Bridge Barrier	Meter
569.06	F-Shaped (Half-Section) Concrete Bridge Barrier	Meter
569.07	F-Shaped (Full-Section) Concrete Bridge Barrier	Meter
569.08	Texas Aesthetic Concrete Bridge Barrier	Meter

**SECTION 570 - PAINT REMOVAL OPERATIONS**

**570-1 DESCRIPTION.** This work shall consist of providing environmental protection and developing and implementing a worker Lead Health Safety program during paint removal operations.

Whenever a structure spans over a railroad, covers shall be placed and maintained in accordance with §105-09 Work Affecting Railroads. Structures that span a navigable waterway may be subject to regulation by various agencies.

**570-1.01 Lead-Exposure Control Plan (LECP).** This work shall consist of the development and implementation of a Lead Exposure Control Plan to protect workers from the harmful effects of lead exposure in accordance with 29 CFR Subpart D. Work activities which may expose workers to health hazards include, but are not limited to abrasive blasting, paint removal, torch-cutting, welding, grinding, and rivet busting.

**570-1.02 Medical Testing.** This work shall consist of medical testing to monitor the safety of workers with lead exposures.

**570-1.03 Personal-Exposure-Monitoring Sample Analysis.** This work shall consist of monitoring the exposure levels of workers to define the hazard and/or to verify the effectiveness of control measures.

**570-1.04 Decontamination Facilities.** This work shall consist of installation, operation, maintenance, and cleaning of decontamination facilities for personnel with lead exposures.

**570-1.05 Environmental Ground Protection.** This work shall consist of the collection and removal of waste materials, including old paint chips, corrosion residues, spent abrasives, and newly applied paint that result from cleaning and painting operations as specified in the contract documents or as directed by the Engineer.

**570-1.06 Environmental Water Protection.** This work shall consist of the collection and removal of waste materials, including paint chips, corrosion residues, spent abrasives and newly applied paint that result from cleaning and painting operations as specified in the contract documents or as directed by the Engineer.

**570-1.07 Class B Containment.** This work shall consist of furnishing, installing, and removing a containment enclosure around the work area used to contain and collect debris generated during paint removal and surface preparation using vacuum shrouded power tools, vacuum blasters, and hand tools. Open abrasive blasting shall not be conducted in a Class B containment.

**570-1.08 Class A Containment.** This work shall consist of furnishing, installing, and removing a total containment enclosure around the immediate work area to contain and collect debris generated during paint removal and surface preparation operations as specified in the contract documents or as directed by the Engineer.

**570-2 MATERIALS.** A high-efficiency particulate air (HEPA) filter shall be defined as a filter that is at least 99.97% efficient against particles that are 0.3µm in diameter.

### **570-3 CONSTRUCTION DETAILS**

**570-3.01 Lead-Exposure Control Plan (LECP).** At least 20 calendar days prior to starting any work which could entail employee exposure to lead, the Contractor shall submit two copies of a written Lead-Exposure Control Plan (LECP) to the Engineer for review and acceptance. This LECP shall address all of the elements required by 29 CFR Subpart D and shall be coordinated with, and need not be repeated in, the site-specific Health and Safety Plan. The Contractor shall not begin any work which could entail lead exposure until the LECP has been accepted by the Engineer.

Submission of the LECP and its acceptance by the Engineer shall not be construed to imply approval of any particular method for addressing lead health and safety concerns, or to relieve the Contractor of the responsibility for adequately protecting the health and safety of all workers.

A competent person shall have current training as SSPC C-3, Competent Person Training for Deleading of Industrial Structures, or the SSPC C-5 refresher training class.

**A. Industrial Hygienist.** Where required, the Contractor shall engage an Industrial Hygienist (IH) meeting one or more of the following qualifications:

- Current certification by the American Board of Industrial Hygiene.
- A Bachelor's Degree in engineering, chemistry, physics, biological sciences, industrial hygiene, toxicology, the environmental sciences or a related field, and at least three years of documented full-time work as an IH, including field and sampling experience.
- A Master's Degree in one of the above fields, and at least two years of documented full-time work as an IH, including field and sampling experience.

The IH shall have the following responsibilities:

- Development of a written LECP, LECP updates, and preparation of monthly summary reports.
- Provide general oversight of all aspects of the LECP.
- Review all employee medical tests and exposure monitoring results. If required, take corrective actions.
- Intervention by the IH, consisting of an on-site investigation by the IH, implementation of corrective action, and notification of the Engineer in the next monthly report if either of the following conditions are encountered:
  - Blood Lead Level (BLL) > 40 µg/dL (micrograms/deciliter) for one or more workers.
  - BLL increase of 10 µg/dL or more between successive tests for any individual worker.
- Inspect the work site at least monthly during work which produces a potential lead exposure, except where the Contractor documents that employee lead exposure will be below the Permissible Exposure Limit (PEL).

**B. Exposure Below the Action Level.** If the Contractor can document by air monitoring or the use of appropriate historical data that lead exposure for all employees will be below the Action Level ( $\mu\text{g}/\text{m}^3$ ), then the Contractor shall develop a written LECP including, but not limited to the following:

- A description of the Contractor's lead health and safety organization, including the responsibilities and qualifications of the competent person, and the project Health and Safety Officer.
- A description of OSHA required lead training provided to both supervisors and workers.
- A description of each activity which will entail a risk for lead exposure.
- An initial assessment of anticipated exposure level(s), including any relevant historical exposure monitoring data.
- A description of arrangements for ensuring that Subcontractors will comply with the LECP.
- Plans for updating the LECP.
- Plans for keeping and maintaining records.
- Exposure monitoring.

**C. Exposure Above the Action Level and Below the Permissible Exposure Limit.** If the Contractor can document by air monitoring or the use of appropriate historical data that the highest employee lead exposure will be above the Action Level ( $30 \mu\text{g}/\text{m}^3$ ), but below the Permissible Exposure Limit ( $50 \mu\text{g}/\text{m}^3$ ), then the Contractor shall develop a written LECP under the direction of an IH, with day-to-day supervision by the competent person, including, but not limited to, the items listed under paragraph B above and the following:

- Medical surveillance and removal program.
- Notifying employees and the Engineer of the results of exposure monitoring and medical tests.
- Worker and supervisor training.
- Monthly summary reports.
- Plans for worker and supervisor lead training.
- Plans for performing exposure monitoring and for notifying employees and the Engineer of results.
- A description of the Contractor's medical surveillance and removal program, including plans for notifying employees and the Engineer of results. This description shall include the names and

addresses of the clinic(s) where testing will be performed and of the OSHA-approved laboratory where blood samples will be analyzed.

**D. Exposure At or Above the Permissible Exposure Limit.** When the highest employee lead exposure will be above the Permissible Exposure Limit ( $50 \mu\text{g}/\text{m}^3$ ), the Contractor shall develop a written LECP under the direction of an IH, with day-to-day supervision by the competent person. The LECP shall include, but not be limited to, the items listed under paragraphs B and C above and the following:

- A description of the engineering, administrative, and work practice controls which will be used to reduce exposure. All feasible engineering, administrative, and work practice controls shall be implemented before considering the use of respirators to reduce exposure.
- Decontamination facilities to be provided including a description and floor plan, a description of any hand-wash stations to be provided, and a description of mandatory hygiene practices which employees will be required to follow.
- A description of a Respirator Program including respirator-fit testing and respirator training.
- A description of Provision of Personal Protective Equipment (PPE), including required cleaning and/or replacement.
- Plans for posting and maintenance of warning signs in high-exposure areas.
- Schedule of periodic work site inspections by the IH and the competent person.

**E. Monthly Summary Reports.** Except where the Contractor can document that employee lead exposure will be below the Action Level, for each month of work which entails potential lead exposure, the Contractor shall submit a monthly summary report to the Engineer which has been reviewed and signed by the IH not later than the 15<sup>th</sup> of the following month. This report shall contain the following elements:

1. A summary of the work producing potential lead exposure completed in the past month.
2. A description of any interventions or deficiencies noted, and a summary of corrective actions.
3. A summary of exposure monitoring or medical testing results which were completed in the past month. To protect worker privacy, these results shall not include individual names; instead, workers shall be identified by trade and with an individual control number (not Social Security Number) to allow tracking of their exposure.
4. A certification that, with the exception of any deficiencies noted, the past month's work has been in compliance with the requirements of 29 CFR 1926.62 and this specification.

**570-3.02 Medical Testing.** The Contractor shall arrange for employees to receive all required medical tests. All medical tests shall be completed by, or under the supervision of, a licensed physician. Blood sampling and analysis shall meet the accuracy requirements of 29 CFR Subpart D and shall be conducted by an OSHA-approved laboratory. The Contractor shall provide the Engineer a summary of medical testing results which were completed in the past month prior to a request for payment. The Contractor shall provide documentation of any medical removals, a description of what triggered them, and the corrective measures taken. The Contractor shall provide an exit medical exam consisting of blood sampling and analysis for lead and zinc protoporphyrin (ZPP) levels for all workers who were potentially exposed within 5 work days of the time a worker completes or is removed from all work which entails a potential for lead exposure. Exit exams shall also be offered within 5 work days of seasonal shutdown or for other periods exceeding 30 calendar days in which no work involving potential lead exposure is scheduled or anticipated. The results of all medical tests shall be provided to affected workers within 5 work days of receipt, and to the Engineer in the next monthly report.

For employees who are offered an exam but choose not to participate or fail to respond, the Contractor shall provide a written declination signed by the worker or, for workers who are no longer on the payroll, a registered letter to the worker's last known address.

**570-3.03 Personal-Exposure-Monitoring Sample Analysis.** The Contractor shall conduct exposure monitoring. Exposure monitoring samples shall be obtained by the IH, a competent person under the direction of the IH, or other qualified persons as specified in the LECP. Exposure monitoring samples shall be analyzed by a laboratory selected by the Contractor, using a method which meets the accuracy requirements of 29 CFR Subpart D. The Contractor shall provide the Engineer a summary of

exposure monitoring sample test results which were completed in the past month prior to a request for payment.

**570-3.04 Decontamination Facilities.** Except where the Contractor can document that employee lead exposure will be below the PEL, a minimum of one climate-controlled decontamination facility shall be provided, and shall be utilized by all workers with potential lead exposure. The number of facilities to be provided will be dictated by site conditions and by the Contractor's sequence of operations and shall be approved by the IH and the Engineer.

Each facility shall consist of a "clean" area where workers can remove and store their street clothing when they arrive on site; a shower room with hot and cold running water, soap and clean towels; and a "dirty" area where workers can remove and store their work clothing and PPE at the end of their work shift. The "clean" area and the "dirty" area shall each have a separate entrance. Decontamination facilities shall be cleaned as required, or at least once every week of use. All waste water generated from showers or as a result of cleaning operations shall either be tested and filtered through a 5 µm filter or considered as lead contaminated, and disposed of in accordance with State and Federal regulations.

### **570-3.05 Environmental Ground Protection.**

**A. General.** Covers shall be provided on or over the ground under all structures that are to be cleaned and painted. Depositing or dropping waste materials into water and onto the ground or roadways outside the specified collection areas is not permitted.

The length of the cover shall be 3 m longer on each end than the length of the work area, and the width shall be at least 3 m wider on each side of the work area. The cover shall be positioned in such a manner as to contain and prevent the loss of waste materials.

Environmental Ground Protection shall consist of covers or other material capable of catching and holding waste materials on or over the ground under the structure in the work area. A bridge deck or a highway pavement and paved shoulder under a structure from which wastes may be collected and removed by vacuuming may be used in place of a cover providing that within that area such usage is confined to lanes and shoulders closed to traffic.

Covers on or over roadways or railroads or sidewalks or other similar areas shall not present a hazard of any kind and no cover shall remain in place overnight unless otherwise authorized by the Engineer.

**B. Containment Operations.** Cleaning or painting operations shall not be performed when the direction or velocity of prevailing winds causes waste materials to fall outside the collection area. If wind or other factors prevent collection, the Contractor may, with the approval of the Engineer, use drapes or other means to prevent drift beyond all specified collection areas.

**C. Waste Collection.** All waste materials shall be removed from the ground protection by vacuuming. Sweeping, shoveling, or other mechanical means to remove the waste materials from the ground protection is not permitted. Air exhausted from vacuuming equipment shall pass through a HEPA filtering system.

All waste materials that collect on a bridge deck, or on a highway pavement and paved shoulder under a structure or on covers shall be removed at least once a day or more frequently if directed by the Engineer. No waste material shall remain on the bridge deck, pavement, pier, pedestals, abutments, or containment covers overnight.

### **570-3.06 Environmental Waterway Protection.**

**A. General.** Covers shall be provided under all structures that span bodies of water, waterways, and stream beds, and that are to be cleaned and painted in the field. Depositing or dropping waste materials into water and onto the ground or roadways outside the specified collection areas is not permitted.

A cover shall be suspended from the structure and shall, as measured over the water, be at least 3 m greater in length and at least 3 m wider than each side of the area on which work is underway.

The cover shall be positioned in a manner so as to collect and prevent the loss of waste materials. The cover shall not remain in place overnight if it presents a hazard of any kind.

If floating waste materials form on the water surface, they shall be contained from moving upstream or downstream. Floating waste material shall be collected daily, or more frequently. Straw or screening used in the fabrication of water booms shall be replaced with clean material weekly or as otherwise directed by the Engineer.

**B. Containment Operations.** Cleaning or painting operations shall not be performed when the direction or velocity of prevailing winds causes waste materials to fall outside the collection area. If wind or other factors prevent collection the Contractor may, with the approval of the Engineer, use drapes or other means to prevent drift beyond all specified collection areas.

**C. Waste Collection.** All waste materials shall be removed from the waterway protection by vacuuming. Sweeping, shoveling, or other mechanical means to remove the waste materials from the waterway protection is not permitted. Air exhausted from vacuuming equipment shall pass through a HEPA filtering system.

All waste materials that collect on a bridge deck, or on a highway pavement and paved shoulder under a structure or on covers shall be removed at least once a day or more frequently if directed by the Engineer. No waste material shall remain on the bridge deck, pavement, pier, pedestals, abutments, or containment covers overnight.

### 570-3.07 Class B Containment.

**A. General.** The containment system includes the cover panels, screens, tarps, scaffolds, supports, and shrouds used to enclose an entire work area. The purpose of the containment is to prevent debris generated during surface preparation from entering the environment and to facilitate the controlled collection of the debris for disposal.

The containment shall meet the requirements of SSPC-Guide 6, Class 2P. The containment may have either air penetrable or impenetrable walls, rigid or flexible framing, shall have fully sealed joints, and shall have overlapping entry ways. Flexible covers for flooring shall be impermeable and will be allowed only if the ground or paved surfaces are smooth enough to vacuum debris. If a smooth surface is not available, rigid materials shall be used for the floor of the enclosure.

**B. Containment Operations.** All cleaning and paint removal work and all work associated with the collection of paint waste debris, including the subsequent air blow-down or vacuuming of debris from the steel surfaces on the structure in preparation for painting, shall be performed inside the containment enclosure.

The Contractor shall make every attempt to limit workers from entering or exiting the containment enclosure when paint removal operations are being performed.

**C. Waste Collection.** Following paint removal work, all steel surfaces inside containment shall be vacuumed of debris. All waste material that results from paint removal operations shall be cleaned up and collected from the floor, walls, and other surfaces inside of the containment enclosure by vacuuming. Sweeping, shoveling, or other mechanical means to remove the waste materials will not be allowed. Cleanup operations shall be performed daily, prior to inspection, before new paint is applied or before a prolonged work stoppage, such as for weather interruptions.

Prior to disassembly or moving of the containment enclosure, the inside surfaces of the enclosure shall be cleaned of dust and other spent material by vacuuming. The Contractor shall take all measures necessary to prevent the release of waste material during moving or removal of the containment.

All vacuum equipment that is used for collection and clean up work shall be equipped with HEPA filters. All used filters from dust collectors, vacuums, and straw and screening from dam devices, shall be disposed of in accordance with all applicable local, State, and Federal Laws, regulations, and codes. The cost for disposing of these materials shall be included in the lump sum price bid for this item.

**D. Ventilation.** Ventilation inside the enclosure is not specifically required and may be by natural means. It may be necessary to provide mechanical ventilation to meet OSHA requirements for worker exposure to lead and other provisions. If mechanical ventilation is provided to address these requirements, filtration of exit air is not required.

**E. Lighting.** Light intensity by natural or artificial means inside the containment enclosure shall be maintained at a minimum of 535 lux on the steel surface. During inspection activities, light shall be maintained at a minimum of 1075 lux. Auxiliary lighting shall be provided as necessary. The Contractor shall provide the Engineer with one portable light meter with a scale of 0 to 1075 lux. This meter will be returned to the Contractor at the completion of work. All lighting used in the containment shall be explosion-proof.

**F. Containment Performance.** The effectiveness of the containment enclosure shall be determined by visual inspection for dust plumes or other visible evidence of emissions materials into the environment. Throughout the duration of work there shall be no visible discharges. If there is a visible discharge the Contractor shall immediately stop work and perform necessary repairs to the containment enclosure or modifications to cleaning operations to the Engineer's satisfaction.

The Engineer may direct the Contractor to stop all work activities and immediately clean up all waste materials within the enclosure when threatening weather conditions exist or are predicted. This measure may be exercised when an apparent threat exists that could cause the release of waste material to the surrounding environment, such as high winds or heavy rain.

If the wind velocity causes the containment enclosure to billow, or to emit dust, or to otherwise be a hazard in the opinion of the Engineer, the Contractor shall immediately cease work and clean up all the debris. Under severe conditions the Contractor shall disassemble the containment enclosure.

**G. Releases From the Containment.** For structures that are located over or adjacent to water, if floating waste materials form on the water surface, they shall be contained from moving upstream or downstream by the use of floating water booms. Floating waste material shall be collected daily, or more frequently.

Any waste material that is released outside the containment enclosure shall be immediately cleaned up using vacuums. Care shall be taken on pavement and other surfaces to collect all waste material so as to prevent it from being redistributed into the air and environment by traffic or other means.

All used filters from dust collectors, vacuums, and straw and screening from dam devices, shall be disposed of in accordance with all applicable Local, State, and Federal Laws, regulations and codes. The cost for disposing of these materials shall be included in the lump sum price bid for this item.

**570-3.08 Class A Containment.** Fifteen (15) days prior to the start of any abrasive-blast cleaning or paint removal work, the Contractor shall submit for approval detailed working drawing(s) of the Class A containment system that is to be supplied for each structure. The drawings shall be prepared and stamped by a Professional Engineer. Six (6) complete copies of the working drawings shall be submitted for approval.

The working drawings shall detail the proposed containment enclosure and include the following information at a minimum:

- Plan and elevation of the containment enclosure in relation to the structure.
- The type of solid or rigid floor and working platform with appropriate safety and fall protection measures. A description of worker access to the enclosure and the procedures and equipment that will be used to provide fall-protection. If a barge or another type of floating platform is used, include details regarding its construction, such as materials and dimensions, how the platform will be tied-off, how the debris will be collected and off-loaded, etc.
- A description of how the existing drainage will be routed through the enclosure.
- A description of the type of material(s) for the containment walls, floor, and ceiling.
- The type of support structure that will be used for the floor, walls, and ceiling, including the attachment of the enclosure materials to the support structure.

- The method by which the enclosure will be supported or attached to the bridge, i.e., rollers, clamps. Welding, bolting, or similar connections will not be allowed.
- The method that will be used to seal the joints (seams) formed when fabricating the containment enclosure, and the method that will be used to seal the mating joints between the containment enclosure and the bridge structure.
- The method that will be used to seal the entryway. At a minimum, the use of multiple overlapping door tarps shall be provided to minimize dust escape through the entryway.
- The ventilation system including open-air make-up points, dust collector and exhaust fan(s), location, type of equipment, manufacturer's data sheets, and airflow capacities.
- The type, size, and configuration of auxiliary lighting provided inside the containment enclosure. All lighting must be explosion proof.
- A design analysis of the loads on the structure due to the containment enclosure including: maximum dead and live loads of the enclosure, the workers, blast abrasive, and equipment; maximum allowable load for the floor and working platform; wind loads imposed on the structure by the enclosure; and maximum wind velocity that the containment enclosure is designed to withstand.
- If the containment system is supported by the structure, the working drawing submittal shall include certification by the Professional Engineer that the loads imposed do not cause the overall stress level of any element of the bridge to exceed the Operating Rating Allowable Stresses defined in AASHTO Manual for Maintenance Inspection of Bridges.
- The analysis shall account for all loads on the structure, including the enclosure dead load, worker live load, blast-abrasive load, equipment load, wind load, structure dead load, and highway live load using M18 loading unless other-wise specified plus impact. The highway live load used for analysis purposes shall be either an MS18 truck or equivalent lane loading, whichever is greater, unless a different highway live load is shown in the contract documents. Except as noted, the analysis shall use the loadings and design assumptions in the NYSDOT Standard Specifications for Highway Bridges.
- Details on how the enclosure is assembled, disassembled and moved to a new location on the structure as surface preparation work progresses. Indicate how the dust collector will be included in the containment enclosure. All other pertinent details relating to the containment enclosure shall be included with the working drawings as notes or as written narrative.
- Details on how the use of the enclosure will be coordinated with the maintenance and protection of traffic. Encroachments onto roadways and clearances over waterways and railroads shall be clearly identified.

**A. General.** The containment system includes the cover panels, screens, tarps, scaffolds, supports, and shrouds used to enclose an entire work area. The purpose of the containment is to prevent all debris generated during surface preparation from entering the environment and to facilitate the controlled collection of the debris for disposal.

The containment shall meet the requirements of SSPC-Guide 6, Class 1A. The containment shall have air impenetrable-walls, rigid or flexible framing, fully sealed joints, and resealable entry ways. Negative air shall be achieved by forced air flow. Exhaust air shall be filtered.

Flexible covers for flooring shall be impermeable and will be allowed only if the ground or paved surfaces are smooth enough to vacuum debris. If a smooth surface is not available, rigid materials shall be used for the floor of the enclosure.

**B. Containment Operations.** All abrasive-blast cleaning and paint removal work, and all work associated with the collection of paint waste debris, including the subsequent air blow-down or vacuuming of debris from the steel surfaces on the structure in preparation for painting and inspection, shall be performed inside the containment enclosure.

The Contractor shall attempt to limit workers from entering or exiting the containment enclosure when blast cleaning and paint removal operations are being performed.

**C. Waste Collection.** All waste material that results from abrasive blasting and paint removal operations shall be cleaned up and collected from the floor, walls, and other surfaces inside of the containment enclosure by vacuuming. Sweeping, shoveling, or other mechanical means to remove the waste materials will not be allowed unless the containment is intact and the vacuuming system is

operating. Clean up operations shall be performed daily, prior to inspection, before new paint is applied or before a prolonged work stoppage, such as for weather interruptions.

Prior to disassembly or moving of the paint enclosure, the inside surfaces of the enclosure (walls, floors, ceiling, etc.) shall be cleaned of dust and other spent material by vacuuming. The Contractor shall take all measures necessary to prevent the release of waste material during moving or removal of the containment.

All vacuum equipment that is used for collection and cleanup work shall be equipped with HEPA filters. All used filters from dust collectors, vacuums, and straw and screening from dam devices, shall be disposed of in accordance with all applicable local, State, and Federal Laws, regulations, and codes. The cost for disposing of these materials shall be included in the lump sum price bid for this item.

**D. Ventilation.** The size of the exhaust-fan system supplied shall be designed to produce an average minimum cross-draft air velocity or an average minimum downdraft air velocity inside the containment enclosure. For enclosures designed with horizontal air flow, the exhaust fan shall have the capacity to produce an average minimum cross-draft velocity of 0.5 m/s, based on theoretical calculations. For enclosures designed with vertical air flow, the exhaust fan shall have the capacity to produce an average minimum downdraft velocity of 0.25 m/s, based on theoretical calculations. Forced exhaust air shall flow into dust collectors. The dust collectors shall be used and appropriately sized for the type, size of particulate matter, volume, and velocity of air moved through the containment. All air exhausted from the containment enclosure shall pass through the dust collection system.

Proper operation of the ventilation system shall be maintained after each assembly of the containment and during all phases of work.

**E. Lighting.** Light intensity by natural or artificial means inside the containment enclosure shall be maintained at a minimum of 535 lux on the steel surface. During inspection activities, light shall be maintained at a minimum of 1075 lux. Auxiliary lighting shall be provided as necessary. The Contractor shall provide the Engineer with one portable light meter with a scale of 0 to 1075 lux. This meter will be returned to the Contractor at the completion of work. All lighting used in the containment shall be explosion-proof.

**F. Containment Performance.** NYSDOT will perform air quality monitoring (AQM) for ambient particulate and lead during abrasive blasting/cleanup. Real-time AQM will be used for all Class A containments. High-volume AQM may be used in addition to real-time AQM. The effectiveness of the containment and accessory equipment in preventing unacceptable levels of particulate and lead emissions will be assessed based on established AQM criteria for both the real-time and high-volume monitoring. Throughout the duration of work, there shall be no visible discharges. If the Engineer observes a visible discharge, the Contractor shall immediately stop work and perform necessary repairs to the containment enclosure or modifications to blast cleaning operations to the Engineer's satisfaction.

The Engineer may direct the Contractor to stop all work activities and require the Contractor to immediately clean up all waste materials within the enclosure when severe weather conditions exist or are predicted. This measure may be exercised when an apparent threat exists that could cause the release of waste material to the surrounding environment, such as high winds or heavy rain.

If the wind velocity causes the containment enclosure to billow or to emit dust, or to otherwise be a hazard in the opinion of the Engineer, the Contractor shall immediately cease work and cleanup all the debris. If severe conditions are predicted, the Contractor shall disassemble the containment enclosure.

**G. Releases From the Containment.** For structures that are located over or adjacent to water, if floating waste materials form on the water surface, they shall be contained from moving upstream or downstream by the use of floating water booms. Floating waste material shall be collected daily, or more frequently.

Any waste material that is released outside the containment enclosure shall be immediately cleaned up using vacuums. Care shall be taken on pavement and other surfaces to collect all waste

material so as to prevent it from being redistributed into the air and environment by traffic or other means.

All used filters from dust collectors, vacuums, and straw and screening from dam devices, shall be disposed of in accordance with all applicable Local, State, and Federal Laws, regulations and codes. The cost for disposing of these materials shall be included in the lump sum price bid for this item.

#### **570-4 METHOD OF MEASUREMENT.**

**570-4.01 Lead-Exposure Control Plan (LECP).** The work under the Lead Exposure Control Plan will be measured for payment on a lump sum basis.

**570-4.02 Medical Testing.** The work under medical testing will be measured for payment on a dollars-cents basis.

The amount shown in the itemized proposal for this work will be considered the price bid even though payment will be made for actual work performed. This amount is not to be altered in any manner by the bidder. Should the bidder alter the amount shown, the altered figure will be disregarded, and the original price will be used to determine the total amount bid.

**570-4.03 Personal-Exposure-Monitoring Sample Analysis.** The work under the personal exposure monitoring sample analysis will be measured for payment on a dollars-cents basis.

The amount shown in the itemized proposal for this work will be considered the price bid even though payment will be made for actual work performed. This amount is not to be altered in any manner by the bidder. Should the bidder alter the amount shown, the altered figure will be disregarded, and the original price will be used to determine the total amount bid.

**570-4.04 Decontamination Facilities.** The quantity to be measured for payment will be in calendar weeks.

**570-4.05 Environmental Ground Protection.** This work will be measured for payment on a lump sum basis.

**570-4.06 Environmental Water Protection.** This work will be measured for payment on a lump sum basis.

**570-4.07 Class B Containment.** This work will be measured for payment on a lump sum basis.

**570-4.08 Class A Containment.** This work will be measured for payment on a lump sum basis.

#### **570-5 BASIS OF PAYMENT.**

**570-5.01 Lead-Exposure Control Plan (LECP).** The lump sum price bid shall include the cost of all labor, materials and equipment necessary to satisfactorily complete the work.

**570-5.02 Medical Testing.** Payment shall include all reasonable and customary costs incurred (based on receipted bills submitted to the Engineer, plus 5% overhead and profit).

No payments shall be made for additional medical tests or laboratory analyses required due to an increase in the blood lead level of any employee above the OSHA threshold.

**570-5.03 Personal-Exposure-Monitoring Sample Analysis.** Payment shall include all reasonable and customary costs incurred (based on receipted bills submitted to the Engineer, plus 5% overhead and profit), for laboratory analysis of exposure monitoring samples.

**570-5.04 Decontamination Facilities.** The unit price bid per week for each facility shall include the cost of all labor, materials, equipment, utility, and disposal charges necessary to satisfactorily complete the work.

**570-5.05 Environmental Ground Protection.** The lump sum price bid shall include the cost of all labor, materials and equipment necessary to complete the work.

**570-5.06 Environmental Water Protection.** The lump sum price bid shall include the cost of all labor, materials and equipment necessary to complete the work.

**570-5.07 Class B Containment.** The lump sum price bid shall include the cost of all labor, materials and equipment necessary to complete the work.

Progress payments will be made based upon the amount of work completed using a daily rate of payment determined from the estimate of work days of cleaning and painting shown in the Contractor’s approved progress schedule and the lump sum price bid.

Should the Engineer request a revised progress schedule and use that schedule to establish a new daily rate, the lump sum price bid shall be reduced by the total of the amounts previously authorized for payment, prior to the establishment of the new daily rate.

**570-5.08 Class A Containment.** The lump sum price bid shall include the cost of all labor, materials and equipment necessary to complete the work.

No payment will be made for each calendar day during which there are substantial deficiencies. Substantial deficiencies are defined as: (1) The second occurrence of a visible emission for a cause which has been previously identified and corrected, or (2) air quality monitoring produces unacceptable results as defined in the Department’s Air Quality Monitoring (AQM) Protocols.

The nonpayment will be calculated as follows:

$(\text{Lump Sum Price Bid/Actual \# of Work Days}) \times (\# \text{ of Days with Substantial Deficiencies})$

In addition to the non payment for substantial deficiencies, the costs of any extension of the Air Quality Monitoring beyond the basic monitoring program or random audits defined in the AQM Protocol, which are necessitated by unacceptable AQM results, will also be charged to the Contractor.

Both of these amounts will be deducted from monies due to the Contractor.

***Payment will be made under:***

<b>Item No.</b>	<b>Item</b>	<b>Pay Unit</b>
570.01	Lead-Exposure Control Plan	Lump Sum
570.02	Medical Testing	Dollars-Cents
570.03	Personal-Exposure-Monitoring Sample Analysis	Dollars-Cents
570.04	Decontamination Facilities	Calendar Week
570.09nnnn	Environmental Ground Protection	Lump Sum (each structure)
570.10nnnn	Environmental Waterway Protection	Lump Sum (each structure)
570.15nnnn	Class A Containment	Lump Sum (each structure)
570.16nnnn	Class B Containment	Lump Sum (each structure)

**NOTE:** nnnn denotes serialized pay item.

**SECTION 571 - TREATMENT AND DISPOSAL OF PAINT REMOVAL WASTE**

**571-1 DESCRIPTION.** The work shall consist of accumulating, packaging, labeling, loading, transporting, treating, and disposing paint removal waste declared to be a hazardous waste containing lead.

**571-1.01 Hazardous Waste Disposal Facility.** Prior to generating any paint removal waste, the Contractor shall supply the Engineer with a letter from a legally permitted Hazardous Waste Disposal Facility, stating that the Facility has agreed to accept the paint removal waste generated by the work requirements of this project; is authorized to accept paint removal waste under the laws of the State of residence; has the required capacity to treat and dispose of the material; and will provide, or assure the ultimate disposal method indicated on the Uniform Hazardous Waste Manifest. The letter shall be signed by a representative of the Disposal Facility who is legally authorized to sign such an agreement. The Engineer shall be given an original, signed letter. Facsimile copies will not be acceptable.

**571-1.02 Waste Transporter.** The Contractor shall present evidence that they have a 6NYCRR Part 364 Waste Transporter Permit to haul to the selected facility, or have contracted with a permitted Hazardous Waste Transporter to remove the waste to the selected facility.

**571-1.03 Paint Removal Waste.** For purposes of this item, paint removal waste is defined as removed paint particles combined with any material used to remove the paint. Paint removal waste will be referred to throughout the item text as 'waste'. Declaration of the waste as 'hazardous' is based on the Department's knowledge that the waste contains lead.

**571-1.04 Waste Transport.** All waste resulting from paint removal operations shall be in transit to the disposal site no later than 45 calendar days subsequent to 1000 kilograms of waste accumulated at the site, or two weeks following demobilization of the site, whichever occurs first. Waste shall be accumulated, handled, packaged, loaded, transported, treated and disposed in accordance with all applicable Federal, State and local laws, rules, regulations, and codes. The Contractor's failure to comply with the aforementioned deadlines may result in the actions described under §571-5 Basis of Payment.

**571-1.05 Minimum Work Requirements.** The Contractor is hereby notified that this work requires the following as a minimum:

Waste transporter identification number issued by USEPA.

Disposal facility identification number issued by USEPA. (This will be supplied by the Disposal Facility).

Generator site identification number issued by USEPA. (This will be supplied by the State through the Engineer).

Conformance to 6NYCRR364. Part 364 governs waste transporters. The Contractor shall furnish a copy of the Part 364 permit to the Engineer.

Conformance to 6NYCRR372. Part 372 governs manifest requirements.

Conformance to 6NYCRR373. Part 373 governs treatment, storage and disposal facilities and contains specific generator requirements.

Conformance to 40 CFR 268 promulgated by the Environmental Protection Agency pursuant to the Hazardous and Solid Waste Amendments to the Resource Conservation and Recovery Act. That law prohibits the land disposal of hazardous wastes unless they are treated to diminish the toxicity of the migration of hazardous constituents from the waste.

**NOTE:** NYCRR regulations are administered by the NYS Department of Environmental Conservation, Albany, N.Y. EPA regulations are administered by the US Environmental Protection Agency, Region II, New York, N.Y.

**571-1.06 Bridge Washing Waste.** For the purposes of this item, bridge washing waste is defined as paint chips and any organic or inorganic materials dislodged from bridge surfaces by bridge washing operations. The paint chips are known to contain lead, the combined waste stream may therefore be hazardous waste. The Department has presumed that the waste will test as hazardous. Bridge washing waste shall be kept segregated from bridge paint removal waste and shall be placed in containers or roll-offs with additional labeling identifying it as "Bridge Washing Waste".

**571-2 MATERIALS.** The waste shall be accumulated in clean, dry, weatherproof, watertight containers or roll-offs furnished by the Contractor. The Contractor shall furnish the Engineer with a signed statement from the Disposal Facility that the containers or roll-offs proposed for use by the Contractor are acceptable to the Facility. The dry volume capacity of the container, in cubic meters, shall be clearly marked upon each container, in a location easily readable by the Engineer.

All equipment and containers or roll-offs shall be approved by the Engineer prior to use.

### **571-3 CONSTRUCTION DETAILS**

**571-3.01 Containers.** All generated waste shall be deposited and sealed, in containers or roll-offs concurrent with generation. No container or roll-off shall be filled to a capacity in excess of that marked

on the container or roll-off as the maximum dry volume capacity. No waste shall be left exposed to the elements at the end of the working day.

All containers or roll-offs shall be located in a place secured from traffic and in a manner acceptable to the Engineer.

Each container or roll-off shall be labeled in accordance with US Department of Transportation regulations. Each container or roll-off shall be permanently labeled in the following manner:

**HAZARDOUS WASTE.** Federal law prohibits improper disposal. If found, contact the nearest police, or public safety authority, or the US Environmental Protection Agency.

Generator's Name: NYSDOT

Manifest Document No. \_\_\_\_\_.

Date: \_\_\_\_\_.

BIN: \_\_\_\_\_.

**Note:** The date shall be the generation date. It shall be entered by the Engineer using permanent marking material supplied by the Contractor.

**571-3.02 Labeling.** All labeling, marking (except date mark), and placarding shall be the responsibility of the Contractor and shall be done under the supervision of the Engineer. This work shall be completed to the Engineer's satisfaction prior to the filling or transportation of any particular container or roll-off. All label markings shall be permanent, printed in English, displayed on a background of contrasting color un-obscured by other labels, or attachments. Labeling shall be located away from other markings that could substantially reduce its effectiveness.

**571-3.03 Document Preparation.** All document preparation and distribution, including the Uniform Hazardous Waste Manifest, shall be the responsibility of the Contractor. The Engineer will sign the Generator's Certification on the Uniform Hazardous Waste Manifest. The LDR (Land Disposal Restricted) certification shall be completed and attached to the manifest, as required by 40 CFR Part 268, "Land Disposal Restrictions."

All waste shall be documented, transported, treated, and disposed as required by the current Federal, State and local laws, rules and codes.

**571-3.04 Multiple Collection.** It is permissible for the transporting vehicle to pick up paint waste debris, in bulk, from one or more bridge sites for delivery to an authorized treatment, storage and disposal facility (TSDF) if the following conditions are met:

The materials picked up at each site must be essentially identical in physical and chemical characteristics. No materials, other than paint waste debris, may be included if wastes from several individual generating sites are to be combined on the same truck.

All of the component shipments are presumed to be D008 hazardous wastes, and disposed as such.

A manifest is prepared for each generating bridge site. Each manifest must reflect a bulk shipment, and all manifests being carried by the same transporting vehicle must express the quantity in cubic meters. In sum total, the manifests accompanying the shipment must account for the entire volume transported.

All component shipments are intended to be conveyed to the same TSDF, and the TSDF has agreed to accept consolidated bulk loads.

All component shipments must have originated at sites that are under the authority of DOT. No loads may be included that were generated at a site for which another agency is responsible.

Measures must be taken to prevent the blowing or dispersion of the waste during each loading operation and while being transported.

**571-3.05 Paint Waste Composition.** The Contractor is responsible to ensure that only dry paint removal waste is deposited into the containers or roll-offs.

Provided in the proposal is a note entitled “Typical Paint Removal Waste Composition” which provides typical chemical composition of paint removal waste based on previous chemical testing. The determination has been made that such waste contains less than 2% by weight of organic material. The Contractor is specifically forewarned that disposal facilities perform spot tests and may refuse to accept waste in excess of 2% organic content or that is otherwise different than the Typical Paint Waste Composition. Waste contaminated in this manner will be the Contractor's responsibility. All penalties and costs associated with the refusal of a disposal facility to accept waste not meeting its requirements will be borne by the Contractor. All testing of the waste necessary to satisfy the requirements of the chosen Disposal Facility or Transporter shall be the responsibility of the Contractor.

**571-3.06 Paint Waste Stabilization.** For the purposes of this item, treatment of the paint removal and washing waste as required by Federal regulations is presumed to require stabilization of the waste such as mixing it with portland cement and water as necessary at a permitted Hazardous Waste Treatment or Disposal Facility. The stabilized waste shall meet the treatment standards of the Federal regulations prior to disposal in a permitted Hazardous Waste Disposal Facility.

**571-3.07 Bridge Washing Waste Composition.** The Contractor is responsible for ensuring that only dried bridge washing waste is deposited into the containers or roll-offs. The contractor is warned that the bridge washing waste may contain more than 2% organic content. A typical waste composition profile is not available. All testing of the waste necessary to satisfy the requirements of the Disposal Facility or Transporter shall be the responsibility of the Contractor.

**571-4 METHOD OF MEASUREMENT.** The work will be measured as the number of dry cubic meters of waste accumulated, packaged, transported, treated, and disposed in accordance with the requirements of this item. The actual quantity within a single container or roll-off will be determined by the Engineer. Once the Engineer determines the quantity within a specific container or roll-off, that container or roll-off shall be properly sealed and not thereafter be tampered with. No additional waste shall be placed in it, nor shall any be removed from it. Under no circumstances will a container or roll-off be measured as containing more than the maximum dry volume capacity marked on it.

**571-5 BASIS OF PAYMENT.** The unit price bid per cubic meter shall include the cost of all labor, materials, equipment, sampling, testing, and fees necessary to complete the work based on the assumption that treatment by stabilization will satisfy the applicable Federal regulations. Should this prove not to be the case on an industry wide basis, as opposed to an individual Treatment or Disposal Facility, the difference in cost between the cost of treatment by stabilization and the method subsequently found to be necessary shall provide the basis for an order on contract. Only waste for which manifest copies are returned to the Engineer by the Contractor and Disposal Facility will be authorized for payment.

If the Department is fined or penalized as a result of the Contractor's performance or lack thereof on this item, in addition to other remedies the Department may possess, said fine or penalty will be deducted from monies due the Contractor.

The extent of the Contractor's compliance with the provisions under timeliness of disposal will be considered as relevant in any future determination of an award to the Contractor as the lowest responsible bidder for any project under the supervision of the Department.

*Payment will be made under:*

<b>Item No.</b>	<b>Item</b>	<b>Pay Unit</b>
571.01nnnn	Treatment and Disposal of Paint Removal Waste	Cubic Meter

**NOTE:** nnnn represents numbers assigned by the designer and keyed to a particular structure. See elsewhere in these contract documents for a list of structures and the numbers assigned to nnnn.

**SECTION 572 - STRUCTURAL STEEL PAINTING: SHOP APPLIED**

**572-1 DESCRIPTION.** This work shall consist of preparing and painting new steel surfaces in a permanent facility, enclosure, or building, with four walls to grade and a roof, where surface preparation and painting activities are conducted in an environment not subject to outdoor weather conditions and/or

blowing dust. All painting work, except field touchup and bolt painting, shall be conducted inside this facility. See special note entitled “*Structural Painting Details*” for the description and requirements of serialized items.

## 572-2 MATERIALS

**572-2.01 Paints.** Paints shall meet the requirements of §708-01 Structural Steel Paints – Class 1, and shall appear on the Department’s Approved List, “Structural Steel Paints - Class 1”. All paint applied to a single structure shall be produced by the same manufacturer. Any exception must be approved by the Engineer and the Materials Bureau Director.

**A. Shelf Life.** The shelf life of all paint shall be a maximum of 12 months from the date of manufacture. Paint and thinner shall arrive at the work site in new, unopened containers. The label shall include the manufacturer’s name, batch number, color, paint name, and date of manufacture.

**B. Paint Storage.** Paint in storage shall be protected from damage and maintained in accordance with manufacturer’s recommendations. Paint will be considered in storage if it is onsite for more than 8 hours prior to application.

**C. Color.** Each single coat of paint shall be a different color and provide substantial contrast with the underlying substrate and previous coats. The colors of the primer, stripe coat, and intermediate coat will be the Contractor's option. The color of the finish coat shall be as specified in contract documents.

**D. Data Sheets.** The Contractor shall supply the Engineer with the paint manufacturer's technical data and materials safety data sheets for each paint to be applied. The data sheets will be delivered to the Engineer a minimum of five work days prior to beginning of work. Data sheets shall include all information required by §708-01 Structural Steel Paints - Class 1.

**572-2.02 Abrasive for Blast Cleaning.** Abrasive material for blast cleaning shall be selected by the Contractor. Silica sand and other types of nonmetallic abrasive containing more than one percent free silica, by weight, will not be allowed. The abrasive blasting shall produce an angular anchor profile suitable for the paint system to be applied.

**572-2.03 Paint Inspection Equipment.** Prior to the start of work, the Contractor shall supply the Engineer with the following specifications and equipment in good working order:

1. One bound copy of the Steel Structures Painting Council, surface preparation specification, SSPC-SP 10 - *Near-White Metal Blast Cleaning*.
2. One bound copy of the Steel Structures Painting Council, surface preparation specification, SSPC SP-1 - *Solvent Cleaning*.
3. One bound copy of the most current Steel Structures Painting Council Pictorial Standards, SSPC-VIS 1, *Guide and Reference photographs for steel surfaces prepared by dry-abrasive blast cleaning*.
4. One bound copy of the Steel Structures Painting Council method SSPC-PA2, Paint Application Specification No. 2 - *Measurement of Dry Film Thickness With Magnetic Gages*.
5. One copy of ASTM D 4417 Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel.
6. One copy of ASTM D 4285 Test Method for Indicating Oil or Water in Compressed Air
7. One Air Thermometer, pocket type, -10°C to +40°C.
8. One non-contact Infrared Thermometer, -10°C to +40°C.
9. One Contact Thermometer, -10°C to +40°C.
10. One Magnetic Dry-Film Thickness Gage, Type 2 (as defined per SSPC PA-2), with a display capable of measuring 1 µm to 1500 µm in 1 µm increments, with calibration shims.

11. Two Wet-Film Thickness Gages, Prong-Type, capable of measuring 25 µm to 250 µm in 25 µm increments.
12. Psychrometer and US Weather Bureau Psychrometric Tables.
13. Profile micrometer with extra coarse replica tape.

All equipment will be returned to the Contractor upon completion of the work.

**572-3 CONSTRUCTION DETAILS.** All structural steel members and other miscellaneous steel items shall be cleaned and painted as per contract documents.

The Contractor shall provide adequate access, suitable lighting, and time for inspections to be made. Any work completed while the Engineer has been restricted from access, shall be recleaned and repainted at no additional cost to the State.

**572-3.01 Quality Control Plan.** The Contractor shall provide the Engineer with a copy of the Contractor's Quality Control (QC) procedures and/or Quality Control Plan (QCP). The QCP describes the minimum QC activities that will be performed by Contractor's QC personnel to ensure compliance. The QCP shall at a minimum, include operating procedures and maintenance records for equipment on site, proof of formal QC training for the Contractor's QC personnel on site, and daily reports including the following information:

- Compressed Air Cleanliness
- Dry Film Thickness
- Air Temperature
- Humidity and Dew Point
- Surface Temperature
- Abrasive Cleanliness Checks
- Degree of Cleanliness Achieved
- Surface Profile
- Batch Numbers of Paint Used
- Batch Numbers of Thinner Used
- Mixing According to Specification

The Contractor shall provide daily reports to the Engineer upon request. The reports shall be submitted no later than 24 hours following the completion of the day's work.

### **572-3.02 SURFACE PREPARATION.**

#### **A. Abrasive Blast Cleaning.**

**1. Atmospheric Conditions.** Abrasive blast cleaning operations shall not be conducted under the following conditions:

- a. The relative humidity exceeds 85%.
- b. When the substrate is damp or covered by frost.
- c. The surface temperature is less than 3°C above the dew point.

**2. Solvent Cleaning.** Before abrasive blast cleaning begins, steel shall be solvent cleaned of all deposits of oil, grease, dirt, salt, or other contaminants by methods specified in SSPC-SP1, Solvent Cleaning.

**3. Steel Cleanliness and Profile.** All structural steel surfaces to be painted shall be abrasive-blast cleaned in accordance with SSPC-SP10, *Near-White Metal Blast Cleaning*. All abrasive blast cleaning and painting shall be performed at the same facility.

The anchor profile shall be measured in accordance with ASTM D4417, Method C. The Contractor shall ensure that the anchor profile is within the range indicated on the paint manufacturer's data sheets. The profile shall, at a minimum, be measured once per shift and three

times in various locations for every 200 square meters prepared, unless otherwise ordered by the Engineer. The anchor profile shall not exceed 75 µm.

All fins, tears, slivers, burred and sharp edges that are present or occur during the blasting operation shall be removed by grinding, and then the area shall be reblasted to provide the required profile.

**4. Equipment.** All equipment and compressors used in the cleaning operation shall be equipped with filters and traps to prevent moisture, oil, and other contaminants from being deposited on clean surfaces. The air cleanliness shall be verified by the Contractor with the white blotter test in accordance with ASTM D4285 at least once per shift for each compressed air system.

**B. Cleaning Area.** The area cleaned shall be limited to that which can be cleaned and prime coated within an 8-hour period. Cleaned areas shall be approved by the Engineer prior to priming. Areas that exhibit flash rusting within the 8-hour period shall be recleaned.

**C. Visual Standards.** After abrasive blasting is completed, cleaned surfaces shall be compared to SSPC-Vis 1, "Guide and Reference Photographs for Steel Surfaces Prepared By Dry Abrasive Blast Cleaning" Pictorial Standards as applicable. All surfaces shall be free of blasting products and other residues when blasting operations are completed. Surfaces shall be cleared of all foreign matter by means of oil-free, moisture-free, compressed air or vacuum systems.

**572-3.03 PAINTING.** The Contractor shall apply three full coats and a stripe coat of paint to all surfaces cleaned to SP-10. In addition, all cleaned steel surfaces within 2 meters from a bridge joint shall receive an additional coat of intermediate paint, resulting in four coats of paint in these areas. The paint shall be applied in the following order: primer, intermediate, stripe, and the finish coat. Damage resulting from fabrication, handling and storage in the shop shall be restored before leaving the shop.

Unless otherwise noted, the contractor shall adhere to the procedures and methods for application as described in SSPC-PA 1, Section 7.

**A. Atmospheric Conditions.** Paint shall not be applied when the receiving surface and ambient temperatures are less than 5°C or greater than 38°C. If the temperature range listed on the manufacturer's data sheets is more restrictive, the manufacturer's range shall be used. No paint shall be applied unless the receiving surface is dry.

Paint shall not be applied when the relative humidity is more than 85% unless the painting manufacturer's data sheets have a more restrictive range. Paint shall not be applied if the receiving surface is less than 3°C above the dew point temperature.

**B. Paint Mixing.** All paint shall be thoroughly mixed with mechanical mixers in accordance with the manufacturer's recommendations. After mixing, the bottom of the container shall be free of any unmixed pigment prior to use.

**C. Solvents and Thinners.** Paint may be thinned if recommended by the manufacturer and approved by the Engineer. The primer shall not be thinned such that the resulting VOC level exceeds 500 g/L. Intermediate and finish coats shall not be thinned where the resulting VOC level exceeds 340 g/L. The manufacturer's data sheets shall advise the Contractor and Engineer of the maximum amount of thinner allowed.

Use of unauthorized thinners, or using excess amounts of thinners is prohibited. Any area where unauthorized solvents or thinners are used shall recleaned and repainted at no additional cost.

**D. Paint Application.** Painting shall not begin until cleaned surfaces have been inspected and approved by the Engineer. Paint may be applied using spray, brush, or roller, unless otherwise indicated by the contract documents. All paint shall be applied so as to produce a uniform, even coating free of runs, sags, drips, ridges, or other defects. Roller nap shall be limited in accordance with the paint manufacturer's recommendation. Brushes and rollers used to apply the paint must be of a quality to produce a smooth uniform coating without leaving fibers in the coating.

All metal surfaces in contact with concrete shall not be painted. Priming shall begin only after all welding and fabrication work is completed.

**E. Stripe Coat.** A stripe coat shall extend a minimum of 25 mm away from the following surfaces: all welds, rivets, bolts, nuts, edges of plates and structural members, angles, bearings, lattice pieces or other shapes, corners, and crevices. To provide contrast, paint for stripe coating shall be a different color than the receiving surface. The stripe coat shall use the intermediate paint and be applied after the intermediate coat. The stripe coat shall be brush applied without being thinned. The stripe coat will be applied in accordance with manufacturer's recommendations, with particular attention to the film thickness, recoat window, and cure schedule. Areas near bridge joints that are to receive an additional coat of intermediate paint shall also receive a stripe coat where necessary as described above.

A stripe coat shall not be applied to any slip critical surfaces.

**F. Paint Film Thickness.** Paint shall be applied to produce the specified dry-film thickness as directed by the range listed on the paint manufacturer's data sheets. The dry-film thickness (DFT) shall be determined in accordance with SSPC-PA 2, Paint Application Specification No. 2 - *Measurement of Dry Film Thickness with Magnetic Gages*, using a Type 2 fixed probe magnetic gages. Dry film thickness gauges shall be calibrated over a blasted, approved surface.

DFTs of the intermediate and finish coats shall be determined by subtracting the average DFT readings of the previous coat(s) from the actual DFT reading. An average DFT value shall be recorded and calculated for every 100 m<sup>2</sup> prepared. The average shall be calculated using a minimum of 5 spot measurements as defined by SSPC-PA2.

Areas failing to meet the specified minimum dry-film thickness shall be top coated with the same paint to produce the total dry-film thickness required. The top coating must be performed within the paint manufacturer's specified recoat window.

The Engineer may require any area exceeding the manufacturer's recommended dry-film thickness to be blast cleaned to the SP-10 condition.

**Slip Critical Connections.** All metal to metal, slip-critical contact surfaces shall not be painted unless the paint system is identified as being 'Slip-B Approved' on the Department's Approved List, 'Structural Steel Paints - Class 1'. Painted slip-critical connection surfaces shall receive primer only.

Each painted connection shall receive a minimum of 5 spot measurements and analyzed in accordance with SSPC-PA2. DFT ranges for slip-critical surfaces can be found on the Department's Approved List, 'Structural Steel Paints - Class 1'. Slip-critical primed surfaces exceeding the listed DFT range shall be cleaned and restored to SP-10 at no additional cost to the State.

**G. Painting Schedule.** Primer shall be applied to approved, abrasive-blasted surfaces within 8 hours of the final cleaning operation. If the Contractor fails to apply primer to the surface within 8 hours of cleaning, the surface shall be restored in accordance with the SP-10 requirements, at no additional cost to the State.

To prevent intercoat adhesion failure, recoating must be performed within the manufacturer's recommended recoat window, or 14 days, whichever is shorter. If the contractor fails to recoat within the specified time period, the surface to be painted shall be cleaned and abraded, in accordance with manufacturer's recommendations, to ensure adhesion of the following coat at no additional cost.

If the steel has become dirty between coats, the Contractor shall wash the bridge at no additional cost to the State.

Manufacturer's recommendations shall be observed for cure to handle, and cure to top coat schedules.

**H. Stenciling.** The following information shall be stenciled on at least one steel element or on the inside web of a fascia member coated under this specification, unless otherwise directed by the Engineer:

1. Month and year of completion

2. Contract number
3. SP10
4. Name of Paint Manufacturer
5. Name of Shop that performed painting
6. Primer, Intermediate, and Finish coat names

The stenciled lettering should be approximately 150 mm in height and be a contrasting paint color to the top coat.

**572-3.04 Field Painting.** The only field work allowed is touch-up work after steel erection and subsequent concrete placement has been completed. All field painting shall be done at no additional cost to the State. All the requirements of this specification shall apply to field painted material with the following modifications:

**A. Hardware.** Bolt heads, washers, nuts, bolt thread extensions, and other miscellaneous steel surfaces not painted in the shop shall be cleaned as per SSPC SP-1 and painted after the bolts have been installed and accepted. Abrasive blasting of the bolts is not required. Any dye present on galvanized hardware shall be cleaned in accordance with manufacturer’s recommendation prior to painting. The Contractor shall submit the dye-cleaning procedure to the Engineer five days prior to cleaning.

**B. Surface Preparation of Damaged Areas.** All visible dirt, grease, and other foreign matter shall be removed first by pressure washing and solvent cleaning as per SSPC SP-1 as needed. Areas exhibiting damaged or deteriorated paint not extending to the steel surface shall be hand or power-tool cleaned as necessary to remove damaged or deteriorated, loosely adhered paint. Loosely adhered paint will lift when scraped with a dull putty knife. All edges of paint surrounding the repair area shall be tightly adherent and feathered. These edges and the surrounding painted surfaces to receive a (repair) topcoat(s) shall be abraded to provide a suitable anchor profile for the paint. Areas that exhibit damage of the paint system down to the steel surface shall be cleaned with power tools to SSPC SP-11 and shall exhibit a suitable anchor profile for the primer paint. All power and blasting tools will be vacuum-sealed units. All surrounding steel that has been previously painted in the shop shall be protected from damage during cleaning operations. Repairs shall be smoothly transitioned into surrounding new paint.

**C. Application.** Application shall be made by brush and roller only. Areas of steel exhibiting damage not extending down to the steel surface shall receive two coats of paint: intermediate and finish coat. Damage extending to the steel surface shall receive three coats of paint: primer, intermediate and finish coat. These coats of paint shall be applied at a dry film thickness as recommended by the paint manufacturer for such (repair) application.

**572-4 METHOD OF MEASUREMENT.** The quantity to be measured for payment will be in square meters of structural steel painted, measured to the nearest whole square meter. The total payment quantity will be the number of square meters of structural steel to be painted. Structural elements less than 1 square meter will not be included in the total payment quantity.

**572-5 BASIS OF PAYMENT.** The unit price bid shall include the cost of all labor, materials, and equipment necessary to complete the work.

Progress payments will be made for 80% of total payment quantity upon delivery. Shop-painted steel will be considered properly painted only when accompanied by the Engineer's or Inspector's written certification that the delivered steel was painted in accordance with the requirements of this Section. The remaining 20% of payment will be made upon completion of cleaning and painting all bolt heads, nuts, washers, bolt thread extensions, and damaged areas.

*Payment will be made under:*

Item No.	Item	Pay Unit
572.01nnnn	Structural Steel Painting: Shop Applied	Square Meter

NOTE: nnnn denotes a serialized pay item.

## SECTION 573 - STRUCTURAL STEEL PAINTING: FIELD APPLIED - TOTAL REMOVAL

**573-1 DESCRIPTION.** This work shall consist of pressure washing, abrasive blast cleaning to remove all paint, rust, rust scale, mill scale, corrosion producing contaminants, and other foreign matter, and painting structural steel surfaces. See Special Note entitled *Structural Painting Details* for the description and requirements for serialized items.

### 573-2 MATERIALS

**573-2.01 Paints.** Paints shall meet the requirements of §708-01 *Structural Steel Paints – Class 1*, and shall appear on the Department’s Approved List, ‘Structural Steel Paints – Class 1’. All new paint to be applied to a single structure shall be produced by the same manufacturer. Any exception shall be approved by the Engineer and the Materials Bureau Director.

**A. Shelf Life.** The shelf life of all paint shall be a maximum of 12 months from the date of manufacture. Paint and thinner shall arrive at the work site in new, unopened containers. The label shall include the manufacturer’s name, batch number, color, paint name, and date of manufacture.

**B. Paint Storage.** Paint in storage shall be protected from damage and maintained in accordance with manufacturer’s recommendations. Paint will be considered in storage if it is onsite for more than 8 hours prior to application.

**C. Color.** Each single coat of paint shall be a different color and provide substantial contrast with the underlying substrate and previous coats. The colors of the primer, stripe coat, and intermediate coat will be the Contractor's option. The color of the finish coat shall be as specified in contract documents.

**D. Technical Data.** The Contractor shall supply the Engineer with the paint manufacturer's technical data and material safety data sheets for each paint to be applied. The data sheets shall be delivered to the Engineer a minimum of five work days prior to beginning of work. Data sheets shall include all information required by §708-01 *Structural Steel Paints – Class 1*.

**573-2.02 Water for Washing.** Water for pressure washing shall be potable water. Any detergent or soluble salt remover used must receive approval by the paint manufacturer and the Materials Bureau. Water shall not be recycled.

**573-2.03 Abrasive for Blast Cleaning.** Abrasive blast media for blast cleaning shall be recyclable, ferrous metallic, abrasive grit. All new metallic abrasive shall be in compliance with the specifications of SSPC-AB 3 Ferrous Metallic Abrasive. All ferrous metallic abrasive used shall be recycled and cleaned in accordance with SSPC-AB 2. The Contractor shall select the size, blend, and hardness of the abrasive to produce an angular anchor profile of a recommended depth as indicated on the manufacturer’s data sheets.

All ferrous metallic abrasive arriving on the job site shall be new, and invoices shall be submitted for acceptance. All recycling equipment shall arrive empty and clean.

**573-2.04 Paint Inspection Equipment.** Prior to the start of work the Contractor shall supply the Engineer with the following specifications and equipment in good working order:

1. One bound copy of the Steel Structures Painting Council surface preparation specification, SSPC SP-1 – *Solvent Cleaning*.
2. One (1) bound copy of the Steel Structures Painting Council surface preparation specification, SSPC-SP 10 – *Near-White Metal Blast Cleaning*.

3. One bound copy of the most current Steel Structures Painting Council Pictorial Standards, SSPC-VIS 1, *Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning*.
4. One bound copy of the Steel Structures Painting Council specification SSPC-PA2, Paint Application Specification No. 2 - Measurement of Dry Film Thickness With Magnetic Gages.
5. One bound copy of Steel Structures Painting Council specification SSPC AB-2 *Specification for Cleanliness of Recycled Ferrous Metallic Abrasives*.
6. One bound copy of Steel Structures Painting Council specification SSPC AB-3 *Specification for Newly Manufactured or Re-Manufactured Steel Abrasive*.
7. One copy of ASTM D 4417 Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel.
8. One copy of ASTM D 4285 Test Method for Indicating Oil or Water in Compressed Air.
9. One Air Thermometer, pocket type, -10°C to +40°C.
10. One noncontact Infrared Thermometer, -10°C to +40°C.
11. One Contact Thermometer, -10°C to +40°C.
12. One Magnetic Dry-Film Thickness Gage, Type 2 (as defined per SSPC PA-2), with a display capable of measuring 1 µm to 1500 µm in 1 µm increments, with calibration shims.
13. Two Wet-Film Thickness Gages, Prong-Type, capable of measuring 25 µm to 125 µm in 25 µm increments.
14. Psychrometer and US Weather Bureau Psychrometric Tables.
15. Profile micrometer with extra coarse and extra coarse plus replica tape.

All equipment will be returned to the Contractor upon completion of the work.

**573-3 CONSTRUCTION DETAILS.** The Contractor shall clean and paint all structural steel members, railings, downspouts, and other miscellaneous steel items as indicated in the contract documents.

The Contractor shall provide adequate access, suitable lighting, and time for inspections to be made. Any work done while the Engineer has been restricted from access, shall be recleaned and repainted, at no additional cost to the State to the State.

**573-3.01 Quality Control Plan.** The Contractor shall provide the Engineer with a copy of the Contractor's Quality Control (QC) procedures and/or Quality Control Plan (QCP). The QCP describes the minimum QC activities that will be performed by Contractor's QC personnel to ensure compliance. The QCP shall minimally include operating procedures and maintenance records for equipment on site, proof of formal QC training for the Contractor's QC personnel on site, and daily reports including the following information:

- Compressed Air Cleanliness
- Dry Film Thickness
- Air Temperature
- Humidity and Dew Point
- Surface Temperature
- Abrasive Cleanliness Checks
- Degree of Cleanliness Achieved
- Surface Profile
- Batch Numbers of Paint Used
- Batch Numbers of Thinner Used
- Mixing According to Specification

The Contractor must provide daily reports to the Engineer at the conclusion of cleaning work and painting work and prior to inspection of such work by the Engineer. Reports at the conclusion of cleaning and painting work shall include all pertinent information listed above that relate to such work and shall be in a format previously agreed to under the QCP.

**573-3.02 Surface Preparation.** Steel surfaces shall be prepared for painting by a combination of pressure washing, solvent cleaning, and abrasive blast cleaning.

Pressure washing shall be performed first, followed by abrasive blast cleaning to remove all paint, rust, rust scale, and mill scale, as per SSPC SP-10, *Near-White Metal*. If heavy deposits of rust and scale are present, they shall be removed by hand or power tool prior to pressure washing. Deposits of bird droppings taller than 13 mm shall be removed prior to pressure washing.

**A. Pressure Washing and Solvent Cleaning.** All steel surfaces to be painted shall be pressure washed, using an operating pressure range of 12.5 MPa to 14 MPa, a minimum flow of 13 L/minute, and a water temperature of 85°C to 93°C. The nozzle shall be held at a distance of 150 mm to 300 mm from the steel surface. Pressure washing shall only be allowed when ambient air temperatures are greater than 4.5°C and rising. In no case will pressure washing be conducted when spent wastewater could freeze on roadway or bridge surfaces or in any other way create a hazardous situation. The washing is intended to remove contaminants from the surface, not to remove tightly adhered paint. Oil and grease shall be removed by solvent cleaning as described in SSPC SP1, *Solvent Cleaning*. The areas shall be pressure washed again following this cleaning.

When the washing is completed, the cleaned surfaces shall be free of dust, dirt, oil, grease, animal waste, salts, and other debris

A containment shall be suspended around and beneath the work area during pressure washing. The containment for pressure washing is intended to capture solid paint chips and other solid debris that may become dislodged from washing operations. Unless otherwise noted, spent wash water will not require collection and will be allowed to fall to the underlying ground or waterway, provided that the other requirements of this specification are met.

Special note, Structural Painting Details, will provide scheduling requirements for washing a structure over a body of water. Spent wash water over a public water supply or the New York City watershed shall be collected and diverted to the adjoining land mass.

If steel surfaces become contaminated or 7 calendar days elapse between washing and abrasive blasting cleaning, they shall be rewashed at no additional cost to the State.

The surface shall be allowed to dry before subsequent abrasive blast cleaning begins.

## **B. Abrasive Blast Cleaning.**

**1. Atmospheric Conditions.** Blast cleaning operations shall not be conducted under the following conditions:

- a. The relative humidity exceeds 85%.
- b. When the substrate is damp or covered by frost.
- c. The surface temperature is less than 3°C above the dew point.

**2. Steel Cleanliness and Profile.** All structural steel surfaces shall be blast cleaned to SSPC SP-10, *Near-White Metal*.

The anchor profile shall be measured in accordance with ASTM D4417, Method C. The Contractor shall ensure that the anchor profile is within the range indicated on the paint manufacturer's data sheets. The profile, at a minimum, shall be measured five times in various locations every 200 square meters prepared and once per work shift, unless otherwise ordered by the Engineer. The anchor profile shall not exceed 100 µm unless approved by the Engineer. The Engineer may approve a profile greater than 100 µm if an area is severely corroded or pitted. If the Contractor exceeds the 100 µm profile, the Contractor will be required to measure the profile using extra-coarse-plus replica tape and apply an additional mist coat of primer in accordance with manufacturer's recommendations to obtain a minimum 50µm film build over the profile peaks, at no additional cost to the State.

All fins, tears, slivers, flame-cut edges, burred and sharp edges that are present or occur during the blasting operation shall be removed by grinding, and then the area shall be reblasted to provide the required profile.

Special attention shall be given to the edges of beam flanges, angles and plates, bearings, rivets, the heads of nuts and bolts, structural steel surrounding bridge joints, and similar surfaces that are marginally accessible and difficult to clean.

Upon completion of blast cleaning and prior to inspection, the containment shall be vacuumed and the cleaned surfaces shall be free of all blasting products and paint debris.

Surfaces shall be free of all abrasive prior to inspection. Surfaces shall be cleared of all foreign matter by means of oil-free, moisture-free, compressed air or vacuum systems

All cleaned surfaces will be inspected by the Engineer prior to painting. Any areas that are painted before being inspected shall be cleaned and restored to the SP-10 standard and repainted at no additional cost to the State. If the cleaned surface begins to rust or becomes contaminated in any matter prior to applying primer, the surface shall be restored to SP-10 standard.

**3. Steel Grit.** The recyclable abrasive shall be cleaned of all paint, chips, rust, mill scale, and other foreign material after each use, prior to reuse. The cleanliness of the recycled abrasive during use shall be confirmed in accordance with SSPC-AB2. The Contractor shall execute, record, and provide the Engineer results of the nonabrasive residue test, water soluble test, and oil content test daily. The Engineer may be present during this testing. The Contractor shall also execute and provide lead content test results weekly. All equipment used for cleaning abrasive shall be specifically designed for this purpose and accepted by the Engineer.

The Contractor shall maintain a balance in the size distribution of the abrasive work mix for the duration of the abrasive blasting operations to maintain a uniform profile across the surfaces to be blasted. The work mix shall not be predominantly coarse or fine, and shall be maintained through proper removal of expended abrasive and its timely replenishment.

**4. Protection of Newly Painted Surfaces.** Throughout abrasive blast cleaning work, care shall be taken to protect newly painted surfaces from the cleaning operations. Tarps, covers, or other devices shall be used to protect new paint from contamination or damage. Contaminated areas of new paint shall be cleaned as necessary prior to the next coat of paint. Damaged paint shall be blast cleaned to the required condition, and then repainted at no additional cost to the State.

**5. Vacuuming.** After cleaning operations are completed, all debris generated by the cleaning work shall be removed by vacuuming using HEPA-filtered vacuums. A HEPA filter shall be defined as a filter that is at least 99.97% efficient for particles that are 0.3µm in diameter, or larger.

**6. Equipment.** All equipment and compressors used in the cleaning operation shall be equipped with filters and traps to prevent moisture, oil, and other contaminants from being deposited on clean surfaces. The air cleanliness shall be verified by the Contractor with the white blotter test in accordance with ASTM D4285 at least once per shift for each compressed air system.

**7. Cleaning Area.** The area cleaned shall be limited to that which can be cleaned, inspected and prime coated within a 10-hour period. Cleaned areas shall be inspected by the Engineer prior to priming. Areas that exhibit flash rusting or fail to meet the local standard prior to painting shall be re-cleaned to the approved standard at no additional cost to the State.

**C. Visual and Project Standards.** The Contractor shall prepare at least one project cleaning standard for each representative area on the structure that is being prepared for painting. Multiple standards may be required if the cleaned steel differs significantly from the photographic standards due to surface conditions, or other factors such as distance of the standard from the work area.

The prepared cleaning standard shall conform to SSPC VIS 1, *"Guide and Reference Photographs for Steel Surfaces Prepared By Dry Abrasive Blast Cleaning"* Pictorial Standard as applicable, and shall be approved by the Engineer before the start of general cleaning work. Each cleaning standard shall be at least 300 mm x 300 mm in size, and shall be located in an area of the structure that is easily accessible, and approved by the Engineer. The Contractor shall protect the work standard from corrosion and contamination throughout the duration of work by applying a clear coat of polyurethane. At the completion of cleaning work, the cleaning standard shall be cleaned and painted. If the project standard becomes deteriorated, or otherwise ineffective, it shall be

reestablished at no additional cost to the State. In case of a dispute over the visual standard, the written standard shall take precedence.

**573-3.03 PAINTING.** The Contractor shall apply three full coats of new paint and one stripe coat to all surfaces cleaned to SP-10. The paint shall be applied in the following order: primer, intermediate coat, stripe coat, and the finish coat. All steel surfaces within 2 meters of a bridge joint shall receive an additional full coat of intermediate paint.

**A. Atmospheric Conditions.** Paint shall not be applied when the receiving surface and ambient temperatures are less than 5°C or greater than 38°C, unless the manufacturer's recommendations for temperature are more restrictive. No paint shall be applied unless the receiving surface is absolutely dry.

Paint shall not be applied when the relative humidity is more than 85% unless the paint manufacturer's requirements are more restrictive. No paint shall be applied during rain or when rain is forecast to occur by the National Weather Service for the project location during painting operations. All painted surfaces shall be protected from direct exposure to rain for the time interval recommended by the paint manufacturer for proper cure. The Contractor shall observe the dew point and humidity restrictions listed on the manufacturer's data sheets.

If an epoxy coating is exposed to temperatures or humidity conditions outside of the manufacturer's recommended values prior to cure, all affected surfaces shall be visually examined for greased or oily surfaces which may have formed. The Engineer may require the Contractor to use a commercially available amine blush test kit at locations chosen by the Engineer. If testing indicates the presence of an amine blush or if there is any oily film on the surface, the surfaces shall be cleaned and prepared for topcoating in accordance with paint manufacturer's recommendations at no additional cost to the State.

**B. Paint Mixing.** All paint shall be thoroughly mixed with mechanical mixers in accordance with the manufacturer's recommendations. After mixing, the bottom of the container shall be free of any unmixed pigment prior to use.

**C. Solvents and Thinners.** Paint may be thinned if recommended by the manufacturer and approved by the Engineer. The primer shall not be thinned such that the resulting VOC exceeds 500 g/L. The intermediate and finish paints shall not be thinned such that the resulting VOC level exceeds 340 g/L. The manufacturer's data sheets shall advise the Contractor and Engineer of the maximum amount of thinner allowed.

Use of unauthorized thinners, or using excess amounts of thinners is prohibited. Any area where unauthorized or improper amounts of solvents or thinners are used shall be recleaned and repainted at no additional cost to the State. All thinning shall be performed in the presence of the Engineer.

**D. Paint Application.** Painting shall not begin until cleaned surfaces have been inspected and approved by the Engineer. Paint may be applied using spray or brush and roller, unless otherwise indicated by the contract documents. All paint shall be applied so as to produce a uniform, even coating free of runs, sags, drips, ridges, or other defects. Roller nap shall be limited in accordance with the paint manufacturer's recommendation. Brushes and rollers used to apply the paint must be of a quality to produce a smooth uniform coating without leaving fibers in the coating.

Protection against paint spatter, spillage, wind blown paint, or similar releases of paint shall be provided. Covers, tarps, mesh, and similar materials shall be placed around the work area to protect public and private property, pedestrian, vehicular or marine traffic, all portions of the bridge, highway appurtenances, waterways, and similar surrounding areas and property, upon, beneath, or adjacent to the structure. The use of spray equipment for paint application shall be allowed within containments provided that the aforementioned protection against paint release is provided, all equipment used (including tarps, mesh and similar materials) meets all safety requirements for such enclosed use with paint spraying, and all OSHA requirements for safety and ventilation are met.

**E. Stripe Coat.** A stripe coat shall extend a minimum of 25 mm away from the following surfaces: all welds, rivets, bolts, nuts, edges of plates and structural members, angles, bearings, lattice pieces or

other shapes, corners, and crevices. Areas near bridge joints that are to receive an additional coat of intermediate paint shall also receive a stripe coat where necessary as described above. To provide contrast, paint for stripe coating shall be a different color than the receiving surface. The stripe coat shall use the intermediate paint and be applied after the intermediate coat. The stripe coat shall be brush applied without being thinned. The stripe coat will be applied in accordance with the manufacturer's recommendations, with particular attention to the film thickness, recoat window and cure schedule.

**F. Paint Film Thickness.** Paint shall be applied to produce the specified dry-film thickness as directed by the range listed on the paint manufacturer's data sheets. The dry-film thickness shall be determined in accordance with SSPC-PA 2, Paint Application Specification No. 2 - *Measurement of Dry Film Thickness with Magnetic Gages*, using a Type 2 fixed probe magnetic gages. Dry-film thickness gauges shall be calibrated over a blasted, approved surface.

DFTs of the intermediate and finish coats shall be determined by subtracting the average DFT readings of the previous coat(s) from the actual DFT reading. An average DFT value shall be recorded and calculated for every 100 m<sup>2</sup> prepared. The average shall be calculated using a minimum of 5 spot measurements as defined by SSPC-PA2.

Areas failing to meet the specified minimum dry-film thickness shall be top coated with the same paint to produce the total dry film thickness required. The top coating must be performed within the paint manufacturer's specified recoat window.

The Engineer may require any area exceeding the manufacturers recommended dry-film thickness to be blast cleaned to the SP-10 condition.

**G. Painting Schedule.** Primer shall be applied to approved, abrasive-blasted surfaces according to section §573-3.02, B. 7 of this specification.

The intermediate coat shall be applied within 72 hours of the final cleaning operation. To prevent intercoat adhesion failure, the topcoat shall be applied within the manufacturer's recommended recoat window, or 14 days, whichever is shorter. If the contractor fails to topcoat within the specified time period, the surface to be painted shall be cleaned and abraded, in accordance with manufacturer's recommendations, to ensure adhesion of the following coat at no additional cost.

If the steel has become dirty between coats, the Contractor shall wash the bridge again at no additional cost to the State.

Manufacturer's recommendations shall be observed for cure to handle, and cure to top coat schedules.

**H. Stenciling.** After the finish coat of paint has cured, the Contractor shall stencil the following information on the inside web of the fascia member, near the BIN plate, unless otherwise directed by the Engineer:

1. Month and year of completion
2. Contract number
3. SP10
4. Name of Paint Manufacturer
5. Name of Contractor
6. Primer, Intermediate, and Finish coat names

The stenciled lettering should be approximately 150 mm in height and be a contrasting paint color to the top coat.

#### **573-4 METHOD OF MEASUREMENT**

The work under this item will be measured on a lump sum basis per structure.

#### **573-5 BASIS OF PAYMENT**

The lump sum price bid shall include the cost of all labor, materials, and equipment necessary to satisfactorily complete the work, including the cost of providing protection against damage to public and private property during surface preparation and paint application. Payment for the containment, collection and disposal of dust and paint waste generated by surface preparation work shall be paid for separately.

Progress payments will be based on the percentage of steel cleaned and painted. No more than 60% of the quantity will be paid for surface preparation and priming. The remaining amount will be paid following the satisfactory completion of work.

*Payment will be made under:*

Item No.	Item	Pay Unit
573.01nnnn	Structural Steel Painting Field Applied - Total Removal	Lump Sum

NOTE: nnnn denotes a serialized pay item.

**SECTION 574 - STRUCTURAL STEEL PAINTING: OVERCOATING AND LOCALIZED**

**574-1 DESCRIPTION.** This work shall consist of pressure washing and power-tool or vacuum-blast cleaning of damaged paint areas and corroded structural steel surfaces, and painting surfaces described in contract documents. See Special Note entitled *Structural Painting Details* for the description and requirements of serialized items.

**574-2 MATERIALS**

**574-2.01 Paints.** Paints shall meet the requirements of §708-02 *Structural Steel Paints Class 2* and shall appear on the Department’s Approved List, “Structural Steel Paints – Class 2”. Paints shall be approved for either localized application, overcoating application, or both.

All new paint to be applied shall be produced by the same manufacturer. Any exception must have prior approval of the director of the Materials Bureau and the Engineer.

**A. Shelf Life.** The shelf life of all paint shall be a maximum of 12 months from the date of manufacture. Paint and thinner shall arrive at the work site in new, unopened containers. The label shall include the manufacturer’s name, batch number, color, paint name, and date of manufacture.

**B. Paint Storage.** Paint in storage shall be protected from damage and maintained in accordance with manufacturer’s recommendations. Paint will be considered in storage if it is onsite for more than 8 hours prior to application.

**C. Color.** Each single coat of paint shall be a different color and provide substantial contrast with the underlying substrate and previous coats. The color of the finish coat shall be as specified in contract documents. The color of the other coats will at the Contractor’s option.

**D. Technical Data.** The Contractor shall supply the Engineer with the paint manufacturer's technical data and materials safety data sheets for each paint to be applied. The data sheets shall be delivered to the Engineer a minimum of five work days prior to beginning of work. Data sheets shall include all information required by §708-02 *Structural Steel Paints Class 2*.

**574-2.02 Water for Washing.** Water for pressure washing shall be potable water. Any detergent or soluble salt remover used must receive approval by the paint manufacturer and the Materials Bureau. Water shall not be recycled.

**574-2.03 Abrasive for Blast Cleaning.** Abrasive material for blast cleaning shall be selected by the Contractor. Silica sand and other types of nonmetallic abrasive containing more than one percent free silica, by weight, will not be allowed. The abrasive blasting shall produce an angular anchor profile suitable for the paint system to be applied.

**574-2.04 Paint Inspection Equipment.** Prior to the start of work the Contractor shall supply the Engineer with the following specifications and equipment in good working order:

1. One bound copy of the Steel Structures Painting Council surface preparation specification, SSPC SP-1 – *Solvent Cleaning*.
  2. One (1) bound copy of the Steel Structures Painting Council surface preparation specification, SSPC-SP 11 – *Power Tool Cleaning to Bare Metal*.
  3. One (1) bound copy of the Steel Structures Painting Council surface preparation specification, SSPC-SP 10 – *Near-White Metal Blast Cleaning*.
  4. One bound copy of the Steel Structures Painting Council pictorial standards, SSPC-VIS 3, *Guide and Reference Photographs for Steel Surfaces Prepared by Power and Hand Tool Cleaned Steel*.
  5. One bound copy of the most current Steel Structures Painting Council pictorial standards, SSPC-VIS 1, *Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning*.
  6. One bound copy of the Steel Structures Painting Council method SSPC-PA2, *Paint Application Specification No. 2 - Measurement of Dry Film Thickness With Magnetic Gages*.
  7. One copy of ASTM D 4417 Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel.
  8. One copy of ASTM D 4285-83 (1999) Test Method for Indicating Oil or Water in Compressed Air.
  9. One Air Thermometer, pocket type, -10°C to +40°C.
  10. One noncontact Infrared Thermometer, -10°C to +40°C.
  11. One Contact Thermometer, -10°C to +40°C.
  12. One Paint Thermometer, -10°C to +40°C.
  13. One Magnetic Dry-Film Thickness Gage, Type 2 (as defined per SSPC PA-2), with a display capable of measuring 1 µm to 1500 µm in 1 µm increments, with calibration shims.
  14. Two Wet-Film Thickness Gages, Prong Type, capable of measuring 25 µm to 125 µm in 25 µm increments.
  15. Psychrometer and US Weather Bureau Psychrometric Tables.
  16. Profile micrometer with extra coarse replica tape.
- All equipment will be returned to the Contractor upon completion of the work.

**574-3 CONSTRUCTION DETAILS.** Overcoating is defined as spot cleaning and priming corroded areas followed by applying two coats of paint to all existing painted steel surfaces. Localized cleaning and painting is defined by spot cleaning and applying three coats of paint to spot-cleaned steel only.

The Contractor shall provide adequate access, suitable lighting, and time for inspections to be made. Any work done while the Engineer has been denied, or restricted from access, shall be recleaned and repainted at no additional cost to the State.

**574-3.01 Quality Control Plan.** The Contractor shall provide the Engineer a copy of the Contractor's Quality Control (QC) procedures and/or Quality Control Plan (QCP). The QCP describes the minimum QC activities that will be performed by Contractor's QC personnel to ensure compliance. The QCP shall minimally include operating procedures and maintenance records for equipment on site, proof of formal QC training for the Contractor's QC personnel on site, and daily reports including the following information:

- Compressed Air Cleanliness
- Dry-Film Thickness
- Air Temperature
- Humidity and Dew Point
- Surface Temperature
- Abrasive Cleanliness Checks
- Degree of Cleanliness Achieved
- Surface Profile
- Batch Numbers of Paint Used
- Batch Numbers of Thinner Used
- Mixing According to Specification

The Contractor must provide daily reports to the Engineer upon request. The reports shall be submitted no later than 24 hours following the completion of the days work.

**574-3.02 Surface Preparation for Overcoating.** Steel surfaces shall be prepared for painting by a combination of pressure washing and power-tool or vacuum-shrouded blast cleaning. Pressure washing of all areas to be painted shall be performed first, followed by power-tool cleaning of areas demonstrating corrosion of the steel substrate to remove all paint, rust, rust scale, and mill scale, as per SSPC SP-11, *Power Tool Cleaning to Bare Metal* or *SSPC SP-10, Near-White Metal Blast Cleaning* as applicable. If heavy deposits of rust and scale are present, they shall be removed by hand or power tool prior to pressure washing. Areas of tightly adhered coating to remain shall be abraded to provide an anchor profile for overcoat paint. Large deposits of bird droppings shall be removed prior to pressure washing.

**A. Pressure Washing and Solvent Cleaning.** All steel surfaces to be painted shall be pressure washed, using an operating pressure range of 12.5 MPa to 14 MPa, a minimum flow of 13 L/minute, and a water temperature of 85°C to 93°C. The nozzle shall be held at a distance of 150 mm to 300 mm from the steel surface. Pressure washing shall only be allowed when ambient air temperatures are greater than 4.5°C and rising. In no case will pressure washing be conducted when spent wastewater could freeze on roadway or bridge surfaces or in any other way create a hazardous situation. The washing is intended to remove contaminants from the surface, not to remove tightly adhered paint. Oil and grease shall be removed by solvent cleaning as described in SSPC SP1, *Solvent Cleaning*. The areas shall be pressure washed again following this cleaning.

When the washing is completed, the cleaned surfaces shall be free of dust, dirt, oil, grease, animal waste, salts, and other debris

A containment shall be suspended around and beneath the work area during pressure washing. The containment for pressure washing is intended to capture solid paint chips and other solid debris that may become dislodged from washing operations. Unless otherwise noted, spent wash water will not require collection and will be allowed to fall to the underlying ground or waterway, provided that the other requirements of this specification are met.

Special note, Structural Painting Details, will provide scheduling requirements for washing a structure over a body of water. Spent wash water over a public water supply or the New York City watershed shall be collected and diverted to the adjoining land mass.

If steel surfaces become contaminated or 7 calendar days elapse between washing and abrasive blasting cleaning, they shall be rewashed at no additional cost to the State.

**B. Power Tool Cleaning.** Power tools as described in SSPC-SP 11 shall be used to clean corroded steel. Vacuum-shrouded abrasive blasting may be allowed. Steel cleaned using vacuum-shrouded blasters shall be cleaned to SSPC-SP 10.

**1. Atmospheric Conditions.** No cleaning operations will be conducted under the following conditions:

The relative humidity exceeds 85%.

When the substrate is damp or covered by frost.

The surface temperature is less than 3°C above the dew point.

**2. Steel Cleanliness and Profile.** Surfaces which have become visibly corroded shall be cleaned in accordance with SSPC-SP 11 or SSPC-SP 10, as applicable. Areas where the existing paint has peeled, flaked, blistered, or otherwise become deteriorated shall be cleaned until only sound paint, tightly adherent paint remains. These areas need not be cleaned to SP-11 or SP-10 if the damage does not extend to the steel surface and corrosion of the steel substrate or the mill scale is not evident.

Equipment used shall produce an anchor profile meeting the manufacturer's requirements as reported on the manufacturer's data sheets.

Special attention shall be given to the edges of beam flanges, angles and plates, bearings, rivets, the heads of nuts and bolts, structural steel surrounding bridge joints, and similar surfaces that are marginally accessible and difficult to clean.

The edges of intact paint shall be feathered back and the adjoining paint must be tightly adhered. Ragged or lifting edges on adjoining paint will not be allowed. Adherence will only be considered satisfactory if the adjoining paint is smoothly feathered back, and cannot be removed by lifting with a dull putty knife.

**3. Vacuuming.** The vacuum assembly on all tools shall be capable of containing all visible dust and debris produced by the operation of the cleaning equipment. Air passing through the vacuum assembly shall be exhausted through a HEPA filter. A HEPA filter shall be defined as a filter that is at least 99.97% efficient for particles that are 0.3 µm in diameter, or larger.

**4. Preparation of Remaining Coating.** Areas exhibiting damaged or deteriorated paint not extending to the steel shall be power-tool cleaned to remove all damaged or loosely adhered paint and provide a suitable surface for top coating. Loosely adhered paint will lift when scraped with a dull putty knife.

After cleaning and feathering edges, all remaining tightly adhered coating shall be abraded. The abrading operation shall not fracture or remove a significant amount of existing coating, only provide surface profile suitable to receive additional coats of paint. The degree of abrasion shall be in accordance with the manufacturer's recommendations.

The Contractor shall choose the method of abrasion. No additional payment will be made for the appropriate containment and waste collection required to abrade the surface. Open abrasive blasting to abrade the surface shall require a Class A containment, in accordance with Section 570 *Paint Removal Operations*. All other methods of abrasion shall minimally require the same level of containment as specified in contract documents for a particular structure.

If the Contractor chooses a wet-abrasive method for abrasion, the containment must meet the requirements of SSPC – Guide 6, Class 2W. All water and abrasive must be collected and disposed of as hazardous waste.

All dust, powder, or residual abrasive remaining on the surface after the abrading operation shall be thoroughly removed and the remaining surface clean prior to painting.

**5. Cleaning Area.** The area cleaned shall be limited to that which can be cleaned, inspected and prime coated within a 10 hour period. Cleaned areas shall be inspected by the Engineer prior to priming. Areas that exhibit flash rusting within the 10-hour period or fail to meet the project cleaning standard prior to painting shall be recleaned.

**C. Visual and Project Standards.** The Contractor shall prepare at least one project cleaning standard for each representative area on the structure that is being prepared for painting. Multiple standards may be required if the cleaned steel differs significantly from the photographic standards due to surface conditions, location from work area, or other factors such as distance of the standard from the work area.

The prepared standard shall generally conform to SSPC VIS 3, *Visual Standard for Power- and Hand-Tool Cleaned Steel*, and shall be approved by the Engineer before the start of general cleaning work. Each cleaning standard shall be at least 300 mm x 300 mm in size, and shall be located in an area of the structure that is accessible to, and approved by the Engineer. The Contractor shall protect the cleaning standard from corrosion and contamination throughout the duration of work by applying a clear coat of polyurethane. At the completion of cleaning work, the project standard shall be recleaned and painted. If the project cleaning standard becomes deteriorated, or otherwise ineffective, it shall be reestablished at no additional cost to the State. Corroded and deteriorated surfaces that have been cleaned using power tools shall be accepted by visual comparison to the project prepared standard(s) for each structure. In case of a dispute over the visual standard, the written standard shall take precedence.

**574-3.03 Surface Preparation for Localized Cleaning and Painting.** All of the requirements of §574-3.02 shall apply with the exception of abrading the remaining coating. Only tightly adherent existing coating within 150 mm of a power tool cleaned surface shall be abraded.

**574-3.04 Overcoat Painting.** The paint shall appear on the Department's Approved List, 'Structural Steel Paints - Class 2' and be approved for overcoating application.

The Contractor shall apply each coat of paint in the order listed on the Department's Approved List 'Structural Steel Paints - Class 2.'

**A. Atmospheric Conditions.** Paint shall not be applied when the receiving surface and ambient temperatures are less than 5°C or greater than 38°C, unless the manufacturer's recommendations for temperature are more restrictive. No paint shall be applied unless the receiving surface is absolutely dry.

Paint shall not be applied when the relative humidity is more than 95% unless the paint manufacturer's requirements are more restrictive. No paint shall be applied during rain.

The Contractor shall observe the dew point restrictions listed on the manufacturer's data sheets.

If an epoxy coating is exposed to cold temperatures or humid conditions outside of the manufacturer's recommended values prior to cure, the surface shall be visually examined for greased or oily surfaces which may have formed. The Engineer may also require the Contractor to use a commercially available amine blush test kit in various locations. If testing indicates the presence of an amine blush or if there is any oily film on the surface, the surfaces shall be cleaned in accordance with paint manufacturer's recommendations at no additional cost to the State.

**B. Paint Mixing.** All paint shall be thoroughly mixed with mechanical mixers in accordance with the manufacturer's recommendations. After mixing the bottom of the container shall have no unmixed pigment.

**C. Solvents and Thinners.** Paint may be thinned if recommended by the manufacturer and approved by the Engineer. The primer, if classified as metallic pigmented, shall not be thinned such that the resulting VOC exceeds 500 g/L. The subsequent coats of paints shall not be thinned such that the resulting VOC level exceeds 340 g/L.

Use of unauthorized thinners, or using excess amounts of thinners is prohibited. Any area where unauthorized solvents or thinners are used shall be recleaned and repainted at no additional cost to the State. All thinning shall be performed in the presence of the Engineer.

**D. Paint Application.** Painting shall not begin until cleaned surfaces have been inspected and approved by the Engineer. Paint may be applied using spray, brush, or roller, unless otherwise indicated by the contract documents or prohibited by the paint manufacturer. All paint shall be applied so as to produce a uniform, even coating, free of runs, sags, drips, ridges or other defects. Roller nap shall be limited in accordance with the paint manufacturer's recommendation. Areas exhibiting trapped fiber or bristles shall be rejected. Prepared areas that exhibited damaged paint not extending to the steel substrate shall receive two coats of paint : intermediate and finish coat.

Complete protection against paint spatter, spillage, wind-blown paint, or similar releases of paint shall be provided. Covers, tarps, mesh, and similar materials shall be placed around the work area to protect public and private property, pedestrian, vehicular, marine, or other traffic, all portions of the bridge, highway appurtenances, waterways, and similar surrounding areas and property, upon, beneath, or adjacent to the structure. The use of spray equipment for paint application shall be allowed within containments provided that the aforementioned protection against paint release is provided, all equipment used (including tarps, mesh and similar materials) meets all safety requirements for such enclosed use with paint spraying, and all OSHA requirements for safety and ventilation are met.

**E. Paint Film Thickness.** Paint shall be applied to produce the specified dry-film thickness (DFT) as directed by the range listed on the paint manufacturer's data sheets. The dry-film thickness shall be determined in accordance with SSPC-PA 2, Paint Application Specification No. 2 - *Measurement of Dry Film Thickness with Magnetic Gages*, using a Type 2, fixed-probe magnetic gages. Dry-film thickness gauges shall be calibrated over a cleaned, approved surface.

DFTs of the all coats applied subsequent to the primer shall be determined by subtracting the average DFT readings of the previous coat(s) from the actual DFT readings. An average DFT value shall minimally be recorded and calculated for every 100 m<sup>2</sup> prepared. The average shall be calculated using a minimum of 5 spot measurements as defined by SSPC-PA2.

Areas failing to meet the specified minimum dry-film thickness shall be top coated with the same paint to produce the total dry film thickness required. The top coating must be performed within the paint manufacturer's specified recoat window.

The Engineer may require any area exceeding the manufacturers recommended dry film thickness to be cleaned to the SSPC-SP 11 or SSPC-SP 10 condition.

**F. Painting Schedule.** Primer shall be applied as per §574-3.02, B.5 of this specification.

The second coat shall be applied within 72 hours of the final cleaning operation.

To prevent intercoat adhesion failure, recoating must be performed within the manufacturer’s recommended recoat window, or 14 days, whichever is shorter. If the contractor fails to recoat within the specified time period, the surface to be painted shall be cleaned and abraded in accordance with manufacturer’s recommendations. This work shall be done at no additional cost to the State.

If the steel has become dirty between coats, the Contractor shall wash the bridge again at no additional cost to the State.

**574-3.05 Painting for Localized Cleaning and Painting.** The paint shall appear on the Department’s Approved List, ‘Structural Steel Paints - Class 2’ and be approved for localized application.

The Contractor shall apply each coat of paint in the order listed on the Department’s Approved List “Structural Steel Paints - Class 2”.

All of the requirements of §574-3.04 shall apply with the exception of area painted. Only areas that have been cleaned shall be painted. Paint shall not extend more than 150 mm beyond all power-cleaned areas.

**574-4 METHOD OF MEASUREMENT**

**574-4.01 Overcoating - Lump Sum.** The work under this item will be measured on a lump sum basis, per structure.

**574-4.02 Overcoating - Square Meter.** The measurement of this item will include the area requiring overcoating, measured to the nearest whole square meter.

**574-4.03 Localized - Square Meter.** The quantity to be measured will be in square meters of area of steel cleaned and painted, measured the nearest whole square meter.

**574-5 BASIS OF PAYMENT**

The lump sum price bid shall include the cost of all labor, materials, and equipment necessary to complete the work, including the cost of providing protection against damage to public and private property during pressure washing and paint application. Payment for the containment, collection and disposal of dust and paint waste generated by surface preparation work shall be paid for separately.

Progress payments will be based on the percentage of steel cleaned and painted. 60% of the quantity will be paid for surface preparation and priming. The remaining amount will be paid following the satisfactory completion of work.

*Payment will be made under:*

<b>Item No.</b>	<b>Item</b>	<b>Pay Unit</b>
574.01nnnn	Structural Steel Painting: Overcoating	Lump Sum
574.02nnnn	Structural Steel Painting: Overcoating	Square Meter
574.03nnnn	Structural Steel Painting: Localized	Square Meter

NOTE: nnnn denotes a serialized pay item.

**SECTION 575 (VACANT)**

**SECTION 576 - BRIDGE DRAINAGE SYSTEM**

**576-1 DESCRIPTION.** This work shall consist of furnishing and placing scuppers, drainage troughs and downspout systems for bridge drainage as shown on the plans and in accordance with the specifications.

**576-2 MATERIALS**

Cast Iron Scuppers	ASTM A48M, Class 30 and 715-05
Fabricated Steel Scuppers (Except Gratings)	
Plates or Bars	ASTM A36M and 715-011
Tubes	ASTM A500, Grade B1
Headed Concrete Anchor Studs	ASTM A108, Grade 1015 or 1020
Grating Plates and Bars	ASTM A36M, A242M, or A572M, and 715-011
Bolts and Cap Screws	ASTM F568, Class 4.6
Drainage Troughs (PVC)	705-11
Steel For Erection of Trough	
Bars <sup>2</sup> (A1, A2) and Plates <sup>2</sup> (B1, B2, C1 and C2)	ASTM A575, Grades 1015 and 1020
Rods (fully threaded) and Bolts <sup>4</sup>	ASTM A307 or F568 Class 4.6
Clamps, Malleable Iron	ASTM A47/A47M, Grade 32510 and 715-09
Ductile Iron Downspout Pipe and Pipe Fittings	ASTM A377 (ANSI 21.51)5
Pipe Couplings (Ductile Iron or Malleable Iron)	ASTM A536 or A47/A47M Grade 32510
Hoppers <sup>7</sup>	ASTM A36M and 715-01
Pipe Brackets and Supports	ASTM A575, Grade 1015 and 1020
Anchors	GSA FS-S-325 Group I, Type I, Class I
Nuts and Bolts <sup>7</sup>	ASTM A307 or F568 Class 4.6.
PVC Downspout Pipe, Fittings and Solvent Cement	706-15
Protective Cover (Cellular Polystyrene)	706-16

**NOTES:**

1. In addition to the requirements of 715-01, Structural Steel, the Contractor will be required to furnish the Deputy Chief Engineer (Structures), two (2) certified copies of the records of the chemical analysis of the steel.
2. Bars shall be 16 mm diameter. Plates shall be 50 mm x 6 mm.
3. Bolts shall be Slotted Button Head Machine Bolts.
4. All pipe shall be groove cut around the full pipe circumference at both ends. The grooves shall be radius cut in accordance with AWWA C606. The grooves shall be such that a keyed housing clamp coupling shall fit into them. The grooves shall be such that a keyed housing clamp coupling shall fit into them. Unless otherwise approved, all pipe bends (elbows) shall be of the long radius type.
5. All couplings shall be gasketed, double keyed, housing clamps designed to lock and seal the joint between two grooved pipes, or fittings, when the housing clamp is bolted and tightened in place. The gasket shall be a molded or extruded compound of Butyl or EDPM, suitable for water service.
6. Galvanized in accordance with the requirements of 719-01. Nuts and bolts shall be galvanized in accordance with 719-01, Type II.

**576-3 CONSTRUCTION DETAILS****576-3.01 Fabrication**

**A. Shop Drawings.** Shop drawings will not be required for scuppers, drainage troughs or downspout systems.

**B. Welding**

**1. Fabricated Steel Scuppers, Gratings.** Welding shall conform to the provisions of the SCM. Weld inspection shall be done in accordance with the requirements of the SCM but radiographic testing will not be required. All groove welds shall be complete joint penetration groove welds unless otherwise approved by the DCES.

**2. Drainage Troughs.** Field Welding (by heat) of the polyvinyl chloride trough material shall not be allowed without written permission of the Deputy Chief Engineer (Structures).

**C. Galvanizing**

**1. Scuppers and Troughs.** Galvanizing shall conform to the requirements of §719-01, Galvanized Coatings and Repair Methods. Galvanizing shall be done after all welding and fabrication is completed.

**2. Bolts, Fully Threaded Rods and Nuts.** All bolts and rods shall have a ANSI B1.13M Class 6H thread. All galvanized nuts shall have a standard oversize tap to allow for the galvanizing on the bolts, rods and nuts.

**D. Gratings.** Gratings for Types B1 and B2 scuppers shall have a full and even bearing on the underlying surface.

**E. Basis of Acceptance.** Scuppers, drainage troughs and downspouts shall be accepted at the work site by the Engineer-in-Charge upon certification of the manufacturer that the materials used and fabrication procedure employed conform to the requirements of section 576. The Engineer may reject any scupper, drainage trough or downspout system which, in his opinion, exhibits poor quality or workmanship.

## 576-3.02 Erection of Downspout Systems

### A. General

**1. Pipe Installation.** The pipe shall be laid true to line and grade as shown on the plans or as directed by the Engineer, with joints close and even, so that a true and even surface of invert will be made over the joints throughout its entire length. Horizontal pipe shall be installed so that the minimum slope shall not be less than 1:50. Pipe shall be placed in accordance with the requirements of this specification unless special methods are called for on the plans or in the itemized proposal.

**2. Field Testing.** Prior to the acceptance of the structure by the Department, the downspout system should be flushed out and tested to insure that it is flowing at full capacity. Any obstruction in the downspout system preventing the free flow of drainage or its operation at full capacity shall be removed to the complete satisfaction of the Engineer.

### B. Ductile Iron Downspouts

**1. Pipe Supports.** Supports for horizontal piping shall be spaced 1.5 m maximum. Supports for vertical piping shall be spaced 1.8 m maximum.

**2. Pipe Joints.** All joints in pipe, except when encased in concrete, shall be made with groove type couplings. Pipes encased in concrete shall have joints formed in accordance with the pipe manufacturer's recommendations.

**3. Painting.** All metal embedded in concrete shall not be painted. All other metallic portions of the downspout system shall be painted in the field in accordance with the requirements of the contract documents. Color shall be as shown on the plans.

### C. PVC Downspouts and Protective Insulator

**1. Pipe Joints.** PVC pipe joints shall be sealed in the following manner: All necessary cuts shall be square and clean from burrs. Mating surfaces of pipe and fittings shall be cleaned with methyl ethyl ketone or acetone prior to solvent cement application. The solvent cement shall be applied as recommended by the manufacturer. The pipe and fitting should be joined with a twisting motion to distribute cement uniformly. The solvent cement manufacturer's recommendations for cure time shall be followed.

**2. Protective Insulator.** The protective insulator shall be attached to the pipe in such a manner so as to prevent its dislodgement as the concrete is placed. Suitable methods would include taping the joints with a weather resistant tape or bonding with a non-metallic substance.

**3. Form Wire.** The PVC pipe and its protective insulator shall be held in place by form wire in such a manner as to provide sufficient lateral support to prevent movement as the concrete is placed.

**4. Vibrator.** Particular caution shall be taken to prevent the vibrator from striking the pipe and its protective insulator during the placing of concrete.

**576-4 METHOD OF MEASUREMENT**

**576-4.01 Scuppers.** Payment will be made at the unit price bid for each type of scupper furnished and placed as shown on the plans and in accordance with the specifications.

**576-4.02 Drainage Troughs.** The trough shall be measured as the number of meters measured along the center line of each polyvinyl chloride section, furnished and placed as shown on the plans and in accordance with the specifications.

**576-4.03 Downspout System.** The downspouts will be measured as the number of meters measured along the center line of pipe between the extreme outer limits of downspouts, including hoppers, furnished and placed as shown on the plans and in accordance with the specifications.

**576-5 BASIS OF PAYMENT**

**576-5.01 Scuppers.** The unit price bid for each type of scupper shall include the cost of furnishing all labor, equipment and materials necessary to set the scupper to its proper line and grade. No additional payment will be made for furnishing and placing the grating for the Type B1 or B2 scupper.

**576-5.02 Drainage Troughs.** The unit price bid per meter shall include the cost of furnishing all labor, materials and equipment necessary to erect the trough and its threaded rod supports as indicated on the plans.

**576-5.03 Downspout System**

**A. General.** The unit price bid per meter shall include the cost of furnishing all labor, materials and equipment necessary to erect the pipe and pipe fittings, pipe supports, hoppers, nuts, bolts, washers, to provide cleanouts if indicated on the plans, straps to cap and plug the pipe if necessary, and to replace cracked or otherwise defective material necessary to complete the work.

**B. Ductile Iron Downspouts.** The unit price bid per meter shall also include the cost of furnishing and placing pipe hangers and brackets, grooved type couplings and paint.

**C. PVC Downspouts and Protective Insulator.** The unit price bid per meter shall also include the cost of furnishing and placing the protective insulator and all adaptor fittings required at the juncture of PVC Pipe and Ductile Iron Pipe.

**D. Excavation.** All required excavation will be paid for under pay item 206.02 M Trench and Culvert Excavation and 206.04 M Trench and Culvert Excavation - O.G.

*Payment will be made under:*

<b>Item No.</b>	<b>Item</b>	<b>Pay Unit</b>
576.01	Scuppers (Type A)	Each
576.02	Scuppers (Type B)	Each
576.10	Drainage Trough	Meter

576.2001	Downspout System (Ductile Iron)	Meter
576.21	Downspout System (PVC)	Meter
576.2201	Downspout System (Ductile Iron and PVC)	Meter

## SECTION 577 (VACANT)

## SECTION 578 - BONDED CONCRETE OVERLAY FOR STRUCTURAL SLABS

**578-1 DESCRIPTION.** Prepare the surfaces that will be in contact with slab reconstruction concrete and place slab reconstruction concrete. Prepare the structural slab surface and place a Class E, bonded concrete overlay.

**578-1.01 Scope.** Concrete removal work will be paid for under the appropriate item(s). Minimum thickness of the overlay concrete is 75 mm. Include the cost of any grade changes necessitated by this requirement in the unit bid price for overlay concrete.

### 578-1.02 Definitions

**A. Overlay Concrete.** Class E Concrete placed over existing and slab reconstruction concrete.

**B. Slab Reconstruction Concrete.** Concrete placed completely around the exposed top mat of bar reinforcement. Slab reconstruction concrete will be Class D for Method 1 and Class E for Method 2, as described in §578-1.03 Placement Methods.

### 578-1.03 Placement Methods.

**A. Method 1 - Separate Placement.** Place Class D slab reconstruction concrete and Class E overlay concrete separately.

**B. Method 2 - Integral Placement (Optional).** When 100% of the top mat of bar reinforcement is exposed or when all of the following conditions are satisfied, Class E overlay concrete and Class E slab reconstruction concrete may be placed in a single lift.

1. The area of the exposed top mat of bar reinforcement is 5% or less of the placement area, per span.
2. No individual area of the exposed top mat of bar reinforcement exceeds 2.5 square meters.
3. No dimension of any area of the exposed top mat of bar reinforcement exceeds 2 meters.

**578-2 MATERIALS.** All material listed under §557-2.

### 578-3 CONSTRUCTION DETAILS .

**578-3.01 Blast Cleaning.** §584-3.02

**578-3.02 Preplacement Wetting.** §584-3.03

**578-3.03 Vacant**

**578-3.04 Handling and Placing Concrete.** §584-3.05

**578-3.05 Construction Joints.** §584-3.07

**578-3.06 Finishing and Curing Slab Reconstruction Concrete - Separate Placement.** §584-3.09

**578-3.07 Finishing Bonded Concrete Overlay.** §557-3.07

**578-3.08 Curing Bonded Concrete Overlay.** §557-3.11 with the following: Cure concrete with wet burlap for 7 days. Provide uniform continuous wetting until concrete curing is complete. The wet burlap and curing cover option is not allowed.

**578-3.09 Opening to Traffic.** Traffic is allowed only after completion of the required curing period.

**578-3.10 Defective or Damaged Concrete.** §584-3.08

**578-4 METHOD OF MEASUREMENT.** For placements with 100% exposure of the top mat of bar reinforcement, the number of square meters of slab reconstruction concrete will be equal to the number of square meters of overlay concrete.

For placements with less than 100% exposure of the top mat of bar reinforcement, measure slab reconstruction concrete prior to overlay concrete placement.

**A. Method 1- Separate Placement.** Measure slab reconstruction concrete as the number of square meters of Class D slab reconstruction concrete placed. Measure overlay concrete as the number of square meters of plan area of Class E overlay concrete placed.

**B. Method 2- Integral Placement (Optional).** Measure slab reconstruction concrete as the number of square meters of Class E slab reconstruction concrete placed. Measure overlay concrete as the number of square meters of plan area of Class E overlay concrete placed.

**578-5 BASIS OF PAYMENT.** Include the cost of all labor, materials and equipment necessary to complete the work in the unit bid price.

*Payment will be made under:*

Item No.	Item	Pay Unit
578.1201nn	Overlay Concrete, Class E – Type 1 Friction	Square Meter
578.1202nn	Overlay Concrete, Class E – Type 2 Friction	Square Meter
578.1203nn	Overlay Concrete, Class E – Type 3 Friction	Square Meter
578.1209nn	Overlay Concrete, Class E – Type 9 Friction	Square Meter
578.1300nn	Slab Reconstruction Concrete, Class D or E	Square Meter

NOTE: nn denotes a serialized pay item.

**SECTION 579 - STRUCTURAL SLAB RECONSTRUCTION PREPARATION**

**579-1 DESCRIPTION.** The work shall consist of initially preparing an existing structural slab for reconstruction. Generally, this work shall entail the removal of concrete to the depths, and at the locations, required by the contract documents.

**579-1.01 Structural Slab Scarification**

A. This work shall consist of removing the top surface of structural slab concrete. Removal shall be done by scarification to the following limits, unless a greater depth is indicated on the plans:

- Minimum of 6 mm
- Maximum of 13 mm

B. After scarification, if a structural slab survey is required, the surface to be surveyed shall be cleaned sufficiently to allow the survey to be taken. The Engineer will determine if the surface is cleaned sufficiently to allow performance of the necessary delamination and potential survey tests.

C. All removed materials shall be transported from the work site and disposed of or disposed of in an area on the job site approved by the Engineer.

**579-1.02 Exposure of Reinforcing Bars**

**A. Definitions**

**1. Bar Mat.** That combination of transverse and longitudinal reinforcing steel placed with the structural slab to absorb stresses. Structural slabs generally contain two bar mats; an upper mat and a lower mat.

**2. Upper Mat.** That bar mat closest to the existing top surface of the structural slab. Only the upper mat is relevant to this work, except in localized areas.

**3. Localized Area.** An area where full depth removal and subsequent patching will be done as part of this work. For the work of this section a localized area shall not exceed 2.5m<sup>2</sup>. The sum of the localized areas shall comprise no more than five percent (5%) of the structural slab area to be prepared.

**B.** The work shall consist of structural concrete removal from the periphery of the upper mat reinforcing bars to provide a minimum clearance of 25 mm between the reinforcing bar surface and the remaining concrete surface. In addition, the Engineer may order the removal of other concrete. (Refer to 579-3, Construction Details).

**C.** All work performed under the requirements of this subsection shall not extend beyond a plane which is 125 mm below the original top of slab, except for localized areas.

**D.** Removed materials shall be disposed of in accordance with 579-1.01B.

**579-2 MATERIALS**

Class A Concrete	5012
Quilted Covers (for curing concrete)	711-02
Plastic-Coated Fiber Blankets (for curing)	711-03

**NOTES:**

1. 501, Class D Concrete, may be substituted at no extra cost.
2. For quantities of four cubic meters of total project placement, or less, automatic batching equipment will not be required.

**579-2.01 Equipment**

**A. Power Operated Scarifier.** The specific equipment the Contractor proposes to use shall be approved by the Engineer prior to use. Power bush hammers, or other impact type devices which indent or pulverize the surface shall not be allowed under any circumstances.

**B. Pneumatic Hammers and other equipment.** These shall be subject to the Engineer's approval prior to use. Pneumatic hammers shall meet the requirements of §580-3.02

**C. Other Equipment.** All other equipment proposed for use shall be approved by the Engineer prior to actual employment in the work.

**579-3 CONSTRUCTION DETAILS.** The Contractor shall exercise care during the execution of the work to avoid damaging or loosening material that is to remain. All damage caused by the Contractor's operations to material that is to remain shall be repaired, or the material replaced as determined by the Engineer. All repair and replacement work shall be done in a manner satisfactory to the Engineer.

**579-3.01 Structural Slab Scarification.** Scarification of designated areas shall be accomplished with a power operated scarifier. Inaccessible areas will be scarified with pneumatic hammers.

**579-3.02 Reinforcing Bar Exposure**

A. Concrete shall be removed from the uppermost reinforcing bars of the structural slab to the limits designated by §579-1.02B. The Contractor may remove concrete, to the designated minimums, from around both sets of bars in the upper mat.

B. If concrete is removed only from the periphery of the uppermost bar, removal shall be done in accordance with those details indicated on the plans.

C. If the Contractor chooses to remove concrete from the periphery of both bars of the upper mat, or if the Engineer determines that:

- The lower bar is corroded; OR
- The concrete around the lower bar is deteriorated; OR
- Delamination extends to the level of, or below, the lower bar; OR
- The lower bar is debonded;

then the concrete shall be removed from the periphery of the lower bar in accordance with the details indicated on the plans.

D. At locations where deteriorated concrete extends beyond the minimum removal limits, the Engineer will order its removal. The Engineer will be the sole determiner of what constitutes deteriorated concrete. This ordered removal shall be part of this work, except that removal of deteriorated concrete below the limit established by §579-1.02C, shall be part of this work only within the limits of localized areas.

Locations where concrete is removed beyond minimum limits, lacking specific orders from the Engineer directing such removal, will be designated as damage locations. All damage locations shall be repaired in a manner satisfactory to the Engineer, at no additional cost to the State.

E. At localized areas, the Engineer may order concrete removal below the plane established by 579-1.02C. When such removal reaches the uppermost bar of the lower reinforcing bar mat, removal shall be continued until full depth removal is achieved.

F. Care shall be exercised when removing concrete to avoid damaging reinforcement, or other materials, which are to remain in place. Reinforcing steel damaged by the Contractor's operations shall be replaced with new reinforcing steel of the same size, appropriately spliced. Reinforcing steel splices shall be made in accordance with the details shown on the plans. Other materials designated to remain in place, which are damaged by the Contractor's operations, shall also be replaced.

**579-3.03 Full Depth Patches.** Refer to the details indicated on the plans.

A. Immediately prior to placing new concrete, the reinforcing bars and the edges of the existing structural slab, which will be in contact with new concrete, shall be blast cleaned. Forms shall be drawn tightly. Preparation and formwork shall be approved by the Engineer prior to any concrete placement. "After blast cleaning has been accepted, thoroughly wet the structural slab surface and all porous surfaces to be in contact with new concrete for at least 12 hours immediately prior to placement. Remove all standing water with oil-free compressed air, and protect the surface from drying, so the concrete remains in a saturated surface dry condition when placing bonding grout.

B. Concrete shall be placed and consolidated in accordance with the requirements of 555-3.04. The uppermost surface of the concrete patch shall be level with the highest of the surrounding prepared surfaces. The uppermost surface shall be intentionally roughened. The Engineer may require that a coarse textured drag be used on the plastic concrete surface.

C. Concrete shall be cured, in a manner approved by the Engineer, for a minimum of 72 curing hours prior to any other concrete placement work in contact with the curing concrete. A curing hour is defined as any hour, starting from the hour of placement, during which the ambient air temperature at the concrete surface remains at, or above 7°C as measured by a recording thermometer. Curing shall be done by means of quilted covers (711-02), or plastic coated fiber blankets (711-03). Quilted covers, if used, shall be kept wet during the entire curing period. The use of curing compounds shall not be allowed.

**579-3.04 Hydrodemolition Equipment.** Hydrodemolition equipment, if approved by the Engineer, shall be subject to the following:

**A. Water Filtration and Disposal.** At least two weeks prior to the employment of any hydrodemolition equipment, the Contractor shall submit to the Engineer, for approval, a comprehensive plan for the filtration and disposal of hydrodemolition water.

This plan shall ensure, to the extent practical, that all debris particles will be removed from hydrodemolition water, prior to its being introduced into any lake, river, stream, or any drainage system which empties into a lake, river or stream.

The Contractor is specifically notified that use of the existing bridge drainage system for hydrodemolition water disposal will not be permitted.

**B. Water Retention.** Hydrodemolition water shall be prevented from running onto, or over all portions of the project site not immediately subject to hydrodemolition work. In addition, the Contractor shall provide shielding, acceptable to the Engineer, that protects traffic and prevents all debris from escaping the immediate work location. A comprehensive plan for accomplishing these requirements shall be submitted to the Engineer, for approval, at least two weeks prior to the beginning of any hydrodemolition work.

The Contractor is specifically notified that use of the existing bridge drainage system, for this purpose, will not be permitted.

The plan for this work may be submitted as part of the requirements of §579-3.04A.

**C. Adherence.** Once approved, the water filtration and disposal, as well as the water retention plans shall be strictly adhered to by the Contractor. Should the Engineer determine that these plans are not being followed as approved, the Contractor will be required to immediately cease work until the conditions are rectified in a manner satisfactory to the Engineer.

Should the Contractor fail to rectify the situations to the Engineer's satisfaction, the Engineer may, with the concurrence of the D.C.E.C., require the Contractor to use equipment other than hydrodemolition equipment.

No extension of time will be granted, nor will any additional compensation be granted, for either the ceasing of work, or the substitution of equipment, if either one is required as a result of the Contractor's failure to follow the approved plans.

**D. Debris Removal.** All debris shall be removed quickly enough to prevent rebonding of the debris to the concrete surface. All debris which rebonds shall be removed in a manner satisfactory to the Engineer at no cost to the State.

Material designated to be left in place, which is damaged by rebonded debris removal work, shall be repaired in a manner satisfactory to the Engineer at no cost to the State.

## 579-4 METHOD OF MEASUREMENT

**579-4.01 Structural Slab Scarification.** The work will be measured as the number of square meters stated in the Estimate of Quantities shown on the plans. Except to allow for progress payments, no field measurements will be taken. Field measurements for progress payments shall not exceed the Estimate of Quantities figure.

**579-4.02 Reinforcing Bar Exposure.** The work will be measured as the number of square meters of concrete removed. Quantities will be determined from field measurements.

**579-5 BASIS OF PAYMENT.** The unit price bid per square meter shall include the cost of all labor, materials and equipment necessary to complete the work. No additional payment will be made for removals, repairs or replacements made necessary due to the Contractor's operations.

**579-5.01 Reinforcing Bar Exposure.** The unit price bid per square meter shall include the cost of all labor, material and equipment necessary to perform full depth patching in localized areas. Full depth concrete removal, and full depth patching, in excess of the limits established for localized areas will be paid for as extra work.

*Payment will be made under:*

Item No.	Item	Pay Unit
579.01	Structural Slab Scarification	Square Meter
579.02	Reinforcing Bar Exposure	Square Meter

**SECTION 580 - STRUCTURAL CONCRETE REMOVAL**

**580-1 DESCRIPTION.** The work shall consist of removal of structural concrete from structural concrete elements, steel supported structural slabs (with and without shear connectors), concrete approach slabs, concrete bridge pylons, concrete from structural steel members, and other concrete removal indicated on the plans or ordered by the Engineer. All removed material shall become the property of the Contractor and shall be removed from the work site. All work shall be done where indicated on the contract plans or where ordered by the Engineer.

**580-1.01 Removal of Structural Concrete.** All concrete shall be removed to a pay line shown on the plans, or to sound surface as determined by the Engineer.

Reinforcing bars and miscellaneous material shall be removed as part of this work unless the contract plans or the Engineer specifically direct otherwise. Surfaces from which structural concrete has been removed shall be cleaned, except that surfaces not designated to come in contact with new concrete placements, need not be cleaned.

**580-1.02 Removal of Concrete Bridge Pylons.** Reinforcement left exposed due to the removal of the pylon shall also be removed. Surfaces exposed by the removal of the pylon shall be brought even with the neat lines of the structure, and repaired.

**580-1.03 Removal of Steel Supported Structural Slab (with and without Shear Connectors).** All materials, carried by the supporting steel members of the superstructure, shall be removed unless the plans specifically indicate removal under another item or that the material is to remain in place.

In the case of structural slab removal where shear connectors are present the Contractor has the following options:

- Retain and reuse the existing shear connectors. OR
- Remove existing shear connectors; replace with new stud shear connectors.

**580-1.04 Removal of Concrete from Structural Steel Members.** Concrete removed as part of this work shall be understood to be portland cement concrete of any nature (e.g. shotcrete), as well as portland cement mortar. In addition, any material used directly or indirectly to anchor the concrete in place shall also be understood to be concrete as it pertains to this work.

**580-2 MATERIALS.** Materials used in this work shall conform to the following requirements:

Stud Shear Connectors	709-05
Mortar Sand	703-03
Epoxy Resin System	721-01
Epoxy Polysulfide Grout	721-03
Sandblasting Sand	No. 40 Boiler Slag Grit or No. 2 Sandblast Sand

**580-3 CONSTRUCTION DETAILS**

**580-3.01 General.** Care shall be exercised in removing concrete so as not to damage material designated to remain in place. Reinforcement designated to remain in place shall be cleaned in a manner satisfactory to the Engineer.

Saw cutting of concrete shall be performed only where indicated on the contract plans or where ordered by the Engineer.

All concrete surfaces which require cleaning, after the concrete removal has been performed, shall be thoroughly blast cleaned, or abraded by other mechanical means satisfactory to the Engineer. After blast

cleaning, the surface shall be air-blown or vacuum cleaned. Air-blowing may be used on vertical or overhead surfaces. Vacuum cleaning will be required for all other surfaces.

For any structural concrete removal item, where a hammer size limitation is specified on the plans or in the specification, the Engineer-in-Charge may order the Contractor to use a lighter hammer than that specified, if, in his opinion, the hammer being used is destroying concrete that should remain. A hammer heavier than that specified may be used if written permission is secured from the Deputy Chief Engineer (Structures).

**580-3.02 Removal of Structural Concrete.** Chipping hammers shall weigh no more than 20 kg with the bit and muffler removed. The hammer shall deliver no more than 1600 blows per minute. The Contractor shall provide the Engineer information from the hammer manufacturer that these requirements are not exceeded. The air pressure used to power the hammer shall not exceed 0.75 MPa measured at the air compressor. An air pressure gauge in proper working condition shall be provided. Only sharp chisel point bits, a minimum of 50 mm wide, shall be used. All bits determined by the Engineer to be dull shall be sharpened or replaced. If the Engineer determines that the Contractor's operations are resulting in damage to concrete that is to remain, the Contractor shall make immediate corrections. These corrections shall include the use of a lighter chipping hammer if so ordered by the Engineer.

**580-3.03 Removal of Concrete Bridge Pylons.** Pylons shall be removed to a plane approximately 6 mm above the supporting concrete surface. All reinforcement, exposed by the pylon removal, shall be removed to the depth shown on the contract plans. However, the depth shall be a minimum of 25 mm below the final finished concrete surface. The remainder of the pylon shall be brought flush with the supporting concrete surface either by bush hammer or other finishing methods approved by the Engineer.

All holes in the final finished concrete surface, left as a result of reinforcement removal, as well as any other depressions shall be filled with epoxy mortar. The epoxy mortar shall be comprised of three parts mortar sand to one part of 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 DCES who shall make the final determination. The DCES determination will be one of the following:

No repair is necessary.

Repair is necessary. In this case, the DCES shall determine the method(s) of repair. The Contractor shall perform all repair work in strict accordance with the DCES instructions.

Replacement of the structural steel member is necessary. In this case, the DCES shall determine the material(s) and method(s) of replacement. The Contractor shall perform the replacement work in strict accordance with the DCES instructions.

The DCES will make every effort to render the necessary determinations without appreciable delay. However, all expenses caused by any delay attributable to the time required for the DCES to render those determinations, shall be borne by the Contractor.

Any required repair, or replacement of structural steel members performed under the terms of this subsection, shall be done at the expense of the Contractor.

Chipping hammers shall meet the requirements of §580-3.02.

**580-4 METHOD OF MEASUREMENT**

**580-4.01 Removal of Structural Concrete.** The work shall be measured as the actual number of cubic meters of concrete removed and disposed of.

**580-4.02 Removal of Concrete Bridge Pylons.** The work shall be measured as the number of concrete bridge pylons removed and disposed of.

**580-4.03 Removal of Steel Supported Structural Slab (with and without shear connectors); Removal of Concrete Approach Slabs.** The work will be measured as the number of square meters of structural slab removed and disposed of. Measurement will be taken in the field without any deductions for openings unless otherwise indicated on the contract plans.

**580-4.04 Removal of Concrete from Structural Steel Members.** The work will be measured as the number of meters of structural steel member from which all the concrete indicated to be removed by the plans, has been removed. The distance shall be measured along the longitudinal axis of the member.

**580-5 BASIS OF PAYMENT**

**580-5.01 Removal of Structural Concrete.** The unit price bid per cubic meter shall include the cost of all labor, materials and equipment necessary to complete the work.

**580-5.02 Removal of Concrete Bridge Pylons.** The unit price bid for removal of each concrete bridge pylon shall include the cost of all labor, materials and equipment necessary to complete the work.

**580-5.03 Removal of Steel Supported Structural Slab (with and without shear connectors); Removal of Concrete Approach Slabs.** The unit price bid per square meter shall include the cost of all labor, materials and equipment necessary to complete the work.

**580-5.04 Removal of Concrete from Structural Steel Members.** The unit price bid per linear meter shall include the cost of all labor, material and equipment necessary to complete the work.

Conditions and work for which compensation will not be made, are noted under §580-3.04.

*Payment will be made under:*

<b>Item No.</b>	<b>Item</b>	<b>Pay Unit</b>
580.01	Removal of Structural Concrete	Cubic Meter
580.02	Removal of Steel Supported Structural Slab (with shear connectors)	Square Meter
580.03	Removal of Steel Supported Structural Slab (without shear connectors)	Square Meter
580.04	Removal of Concrete Approach Slab	Square Meter
580.11	Removal of Concrete Pylons	Each
580.21	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:*

<b>Item No.</b>	<b>Item</b>	<b>Pay Unit</b>
581.01	Removal of Bituminous Concrete Overlay (Bridge)	Square Meter
581.02	Removal of Cement Concrete Overlay (Bridge)	Square Meter

**SECTION 582 - REMOVAL AND REPLACEMENT OF STRUCTURAL CONCRETE**

**582-1 DESCRIPTION.** The work shall consist of the removal and disposal of unsound structural concrete from an existing structure and its replacement with new structural concrete, or an approved patching material, as indicated on the contract plans, or as ordered by the Engineer. All work shall be done at the locations indicated on the contract plans, or where ordered by the Engineer.

All miscellaneous materials, not including bar reinforcement, encountered during the removal of unsound structural concrete, shall be removed and disposed of unless otherwise indicated on the contract plans, or ordered by the Engineer.

**582-2 MATERIALS.** Materials used in this work shall conform to the following requirements:

Vertical and Overhead Patching Material	701-08
Water	712-01
Quilted Covers (for curing)	711-02
Plastic Coated Fiber Blankets (for curing)	711-03
Membrane Curing Compound	711-05
Admixtures	711-08

**582-2.01 Replacement Concrete.** Concrete shall be Class A or Class D concrete for structures. It shall conform to the requirements of Section 501 - Portland Cement Concrete - General.

**582-2.02 Vertical and Overhead Patching Material.** The patching material used shall be a brand that appears on the Department's Approved List.

**582-3 CONSTRUCTION DETAILS**

**582-3.01 Repair Determinations.** The choice of replacement material will be indicated on the plans, determined by the Engineer, or determined by the contractor. The Contractor's determinations shall be made in accordance with the criteria of this subsection, and only in the absence of directions from the plans, or the Engineer. The Contractor's determinations shall be approved by the Engineer prior to the actual performance of the work.

**A. Horizontal or Essentially Horizontal Locations.** Class A or Class D concrete shall be used. Class A concrete shall be placed only at locations where removal depths average greater than 125 mm. Class D concrete shall be placed only at locations where removal depths average between

40 mm and 125 mm. Average depths shall be determined by a measurement procedure acceptable to the Engineer.

**B. Vertical or Essentially Vertical Locations.** Class A concrete, Class D concrete, or approved patching material shall be used. Concrete classes shall be restricted to the depth limitations noted for horizontal locations. Patching material shall be placed at locations where removal depths average between 13 mm and 40 mm. Average depths shall be determined by a measurement procedure acceptable to the Engineer.

**C. Overhead.** Approved patching material shall be used. Lift thicknesses shall not exceed 25 mm, unless formwork or anchoring devices are employed.

**D. Pockets.** Locations, within locations of 40 mm in average depth or less, which exceed this average depth, shall be filled with Class A, or Class D, concrete in accordance with the limitations outlined under horizontal locations.

**582-3.02 Removal of Unsound Concrete.** All unsound concrete shall be removed to a sound surface as determined by the Engineer. If called for on the plans, the existing concrete shall be saw-cut to obtain a straight joint between the existing concrete and the new material. Care shall be exercised while removing the unsound concrete so as not to damage materials which are to remain in place. Exposed reinforcement remaining in place shall be cleaned in accordance with the requirements of 584-3.02A. Chipping hammers shall meet the requirements of 580-3.02.

**A. Removal for Concrete Replacement.** The minimum depth of removal shall be the greater of the following:

- A depth no less than 40 mm from the rear most point of reinforcement to sound concrete.
- The depth necessary to reach sound concrete.

Should the removal depth exceed 150 mm, the Engineer may order supplementary anchoring as part of the replacement procedure. The sides of the cavity shall be made at a slight angle, so that the width of the base of the cavity is greater than the opening at the surface, thereby providing a key.

**B. Removal for Patching material Replacement.** Feather edges shall not be permitted. The minimum patch depth shall be 13 mm as measured from the theoretical plane of the original concrete surface.

### 582-3.03 Preparation of Surface

- A. All surfaces receiving new material shall be blast cleaned in accordance with the requirements of 584-3.02.
- B. Bar reinforcement shall be placed at the location indicated on the plans, and at all additional locations determined by the Engineer.
- C. Existing reinforcement, which, in the Engineer's opinion, has lost significant section, shall be repaired in a manner satisfactory to the Engineer.
- D. Bar placement, and bar repair work directed by the Engineer will be paid for separately.

**582-3.04 Placement.** Air clean the surface with oil-free compressed air. After the surface preparation has been accepted, every effort should be made to thoroughly wet the concrete surface, and all porous surfaces to be in contact with new concrete, for 12 hours. This may be accomplished by continuous wetting with soaker hoses or the use of burlap/burlene/etc. where moisture can be maintained. If, in the opinion of the Engineer, conditions or the situation prohibits this, then the surfaces should be wetted for as long as possible. Surfaces must be wetted by a means acceptable to the Engineer using potable water.

The Contractor shall remove any puddles of free standing water with oil-free compressed air, and protect the surfaces from drying, so the existing concrete remains in a clean, saturated surface dry condition until placement of the new concrete. No material shall be placed if the ambient air, or concrete surface temperature is at, or below 7°C.

**A. Concrete Placement.** All concrete placements shall be in accordance with the applicable requirements of the following subsections:

555-3.02, 555-3.03A, 555-3.04, 555-3.06, 555-3.07, 555-3.08.

If formwork configuration, or clearances between formwork, steel and existing concrete are such that Class A, or D, concrete cannot be placed without voids, or honeycombing, the Contractor may, with the Engineer's permission, use an approved high range water reducer to increase the concrete's workability. Approved high range water reducers appear on the Department's Approved List.

The high range water reducer shall be added at the work site only and shall be dispersed uniformly throughout the plastic concrete. The Engineer shall approve the Contractor's dispersal methods and devices prior to their actual use.

The high range water reducer shall be added only after the concrete has reached the proper slump and contains the required quantity of air. No more than two additions of the admixture shall be made, and the manufacturer's maximum dosage rate shall not be exceeded. After the admixture has been added, the concrete shall be mixed an additional 30 revolutions. The second admixture addition shall be made only after the 30 revolutions required for the first addition have been completed. It is the responsibility of the Contractor to ensure that concrete slump does not exceed 230 mm, and air content remains within specification requirements. Plastic concrete mixes failing to meet the foregoing requirements will be subject to rejection. Replacement will be done at the Contractor's expense.

The Engineer may allow high range water reducer to be added at the concrete batching facilities. Consideration for this procedure will be undertaken only after the Contractor has clearly demonstrated the capability of providing concrete which meets the requirements of this subsection.

**B. Vertical and Overhead Patching Material Placement.** Patching material shall be prepared in accordance with the directions provided by the manufacturer. The Engineer shall be given two copies of the manufacturer's printed instruction at least two weeks prior to the start of all patching work. This shall include the mixing proportions and the mixing method. The manufacturer's literature shall be consulted for surface preparation and priming instructions. The material shall be troweled on in layers, the thickness of which depends on the material consistency and the location and profile of the surface to which it is applied. However, lift thickness in excess of 25 mm will not be permitted without the use of anchoring devices or formwork at overhead locations. Special curing procedures are generally not required, except under conditions of high heat, low humidity, or strong winds, as defined by the manufacturer. The manufacturer should be consulted for specific curing procedures under these adverse conditions.

**582-3.05 Form Removal.** Form removal shall be in accordance with §555-3.09 with the following exception:

Forms shall be removed from thin concrete placements 24 curing hours after placement has been completed unless the Engineer determines the concrete is not strong enough to withstand damage. For purposes of this subsection, a thin concrete placement begins at the outermost surface of the new concrete and generally terminates at, or before, the midpoint of the main reinforcing steel. Concrete may be removed and replaced completely around one or two main reinforcing steel members to a depth no greater than 25 mm from the innermost surface of those members and still be considered a thin concrete placement. Main reinforcing steel members include reinforcing bars, but not spiral reinforcement or stirrups. Curing procedures shall be implemented immediately upon form removal.

**582-3.06 Curing.** Curing shall be performed according to the following:

**A. Concrete.** This shall be done in accordance with §555-3.08.

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

**582-4 METHOD OF MEASUREMENT**

**582-4.01 Removal of Structural Concrete - Replacement with Class A Concrete.**

Measurement shall be made as the number of cubic meters of concrete placed where indicated on the contract plans, or where ordered or approved by the Engineer.

**582-4.02 Removal of Structural Concrete - Replacement with Class D Concrete.**

Measurement shall be made as the number of square meters repaired as indicated on the contract plans, or where ordered or approved by the Engineer.

**582-4.03 Removal of Structural Concrete - Replacement with Vertical and Overhead Patching Material.** Measurement shall be made as the number of square meters of the plane projection of the repaired area as indicated on the contract plans, or where ordered or approved by the Engineer. Measurement shall be made prior to the placement of patching material.

**582-5 BASIS OF PAYMENT**

**582-5.01 Removal of Structural Concrete - Replacement with Class A Concrete.** The unit price bid per cubic meter shall include the cost of furnishing all labor, materials and equipment necessary to complete the work, except that bar reinforcement removal and replacement shall be paid for separately. Progress payments will be made in accordance with §582-5.04.

**582-5.02 Removal of Structural Concrete - Replacement with Class D Concrete.** The unit price bid per square meter shall include the cost of furnishing all labor, materials and equipment necessary to complete the work, except that bar reinforcement removal and replacement shall be paid for separately. Progress payments will be made in accordance with §582-5.04.

**582-5.03 Removal of Structural Concrete - Replacement with Vertical and Overhead Patching Material.** The unit price bid per square meter shall include all labor, materials and equipment necessary to complete the work. Progress payments will be made in accordance with §582-5.04.

**582-5.04 Progress Payments.** Progress payments will be made when the concrete removal is completed. Payment will be made at the unit price bid for 50% of the quantity removed. The balance of the quantity will be paid upon completion of the work.

*Payment will be made under:*

<b>Item No.</b>	<b>Item</b>	<b>Pay Unit</b>
582.05	Removal of Structural Concrete - Replacement with Class A Concrete	Cubic Meter
582.06	Removal of Structural Concrete -Replacement with Class D Concrete	Square Meter
582.07	Removal of Structural Concrete -Replacement with Vertical and Overhead Patching Material	Square Meter

**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:

Portland Cement, Types 1 or 2	701-01	Quilted Covers (for curing)	711-02
Concrete Sand	703-07	Plastic Coated Fiber Blankets	711-03
Water	712-01	Membrane Curing Compound	711-05
Wire Fabric For Concrete Reinforcing1	709-02		
Expansion Bolt Anchors	GSA FF-S-325,Group III,Type 1 or Group VIII,Type 1		
Hook Bolts Inserted in Expansion Bolt Anchors	ASTM F568 Class 4.6		

**NOTE.** The wire fabric shall be galvanized in accordance with ASTM A641M regular coatings. The wire fabric shall be fabricated from No. 12 wire spaced 50 mm (nominal) in each direction or No. 10 wire spaced 75 mm (nominal) in each direction. Wire used shall have a minimum yield strength of 240 MPA.

**583-2.01 Equipment**

**A. Batching and Mixing Equipment.** The mixing equipment shall be capable of thoroughly mixing the materials in sufficient quantity to maintain placing continuity.

**B. Air Supply.** The compressor shall be of adequate capacity to maintain a sufficient, constant nozzle velocity for all parts of the work while simultaneously operating a blow pipe for cleaning away rebound. The air hose shall be equipped with a filter to prevent any oil or grease from contaminating the shotcrete.

**C. Delivery Equipment**

**1. Dry Mix Process.** The delivery equipment shall be capable of delivering a continuous, smooth, uniformly mixed material to the nozzle. The nozzle shall be equipped with a water ring and valve to permit adjustment of the water. The water added to the dry mix material at the nozzle shall be maintained at a pressure at least 110 KPa greater than the air pressure. The nozzle shall be capable of delivering a conical discharge stream.

**2. Wet Mix Process.** Only pneumatic-feed type of delivery equipment will be allowed. Positive displacement type of equipment will be allowed pending a qualification test prior to the beginning of the work, which will also be the qualification test for the operator. The nozzle shall be equipped with an air ring for injecting compressed air into the material flow.

**583-2.02 Qualification Test.** If encasement of reinforcing bars is required, this test shall be performed to qualify the shotcrete operator and the equipment, prior to beginning work. Each shotcrete operator shall be qualified by constructing a 600 mm x 600 mm test panel fabricated to duplicate the project shotcreting. Reinforcement shall be placed in the panel to provide a minimum 25 mm (front and rear) embedment and be of the same size and spacing encountered in the structure. Panels shall be shot in the vertical, horizontal, and overhead positions as expected to be encountered. After setting, the test panel shall be broken open in a manner approved by and in the presence of the Engineer, to verify the reinforcement embedment. If voids are discovered, the work shall not proceed; additional panels shall be constructed until results acceptable to the Engineer are achieved. Small non-interconnected voids, as determined by the Engineer, shall not constitute failure.

Additional qualification panels will be required whenever, in the opinion of the Engineer, the shotcrete operation significantly changes.

### 583-3 CONSTRUCTION DETAILS

**583-3.01 Preparation of Surfaces.** All unsound concrete shall be removed until there are no offsets in the cavity which would cause an abrupt change in thickness, except for a transition from above to below reinforcement. Minimum 13 mm square shoulders shall be left at the perimeter of the cavity. The final cut surface shall be sound and properly shaped. The sound surface shall be blast cleaned. Abrasive material used for blastcleaning shall contain no more than one percent free silica by weight. Air clean the surface with oil-free compressed air. After the surface preparation has been accepted, every effort should be made to thoroughly wet the concrete surface and all porous surfaces to be in contact with new concrete for 12 hours. This may be accomplished by continuous wetting with soaker hoses or the use of burlap/burlene/etc. where moisture can be maintained. If in the opinion of the Engineer conditions or the situation prohibits this then the surfaces should be wetted for as long as possible. Surfaces must be wetted by a means acceptable to the Engineer using potable water. The Contractor shall remove any puddles of free standing water with oil-free compressed air, and protect the surfaces from drying, so the existing concrete remains in a clean, saturated surface dry condition until placement of the new concrete.

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

<b>Thickness of Placement</b>	<b>Underside &amp; Vertical Surfaces Nominal Size and Spacing<sup>1</sup></b>	<b>Topside Nominal Size and Spacing<sup>1</sup></b>
50 mm	6 mm dia. @ 450 mm ctrs.	6 mm dia. @ ctrs. 600 mm
100 mm	10 mm dia. @ 600 mm ctrs.	10 mm dia. @ ctrs. 900 mm
125 mm	10 mm dia. @ 530 mm ctrs.	10 mm dia. @ ctrs. 900 mm
150 mm	10 mm dia. @ 500 mm ctrs.	10 mm dia. @ ctrs. 900 mm
175 mm	10 mm dia. @ 450 mm ctrs.	10 mm dia. @ ctrs. 900 mm
200 mm	14 mm dia. @ 580 mm ctrs.	14 mm dia. @ ctrs. 900 mm
225 mm	14 mm dia. @ 550 mm ctrs.	14 mm dia. @ ctrs. 900 mm
250 mm	14 mm dia. @ 530 mm ctrs.	20 mm dia. @ ctrs. 600 mm
275 mm	14 mm dia. @ 500 mm ctrs.	20 mm dia. @ ctrs. 600 mm
300 mm	14 mm dia. @ 450 mm ctrs.	20 mm dia. @ ctrs. 600 mm

**NOTE:** 1. Bolt diameters may be increased but not decreased. Spacing may be decreased but not increased.

No material shall be placed if the ambient air, or concrete surface temperature is at, or below 7°C.

Reinforcement may consist of either existing reinforcing bars or welded galvanized wire fabric, depending on the conditions and shall be clean and free from loose mill scale, loose rust, oil or other coatings that interfere with bonding.

Chipping hammers shall meet the requirements of §580-3.02.

Sufficient clearance shall be provided around the reinforcement to permit complete encasement with sound shotcrete. The minimum clearance between the reinforcement and the form or other backup material shall be 25 mm.

Where the chipped area is equal to or less than 50 mm in depth, the use of wire fabric or mechanical concrete anchors will not be required except for overhead surfaces. Where the chipped areas are overhead, and are 25 mm in depth or greater, galvanized wire fabric and mechanical concrete anchors shall be used. Mechanical concrete anchors shall be placed as required by Table 583-1.

Where the chipped area is over 50 mm in depth and existing bar reinforcement is available, galvanized wire fabric shall be attached to the bars with tie wires. If existing bar reinforcement is not available, wire fabric shall be installed by means of mechanical concrete anchors in accordance with the requirements of Table 583-1.

Wire fabric shall be cut in sheets of the proper size and shall be carefully bent in such a manner as to follow closely the contours of the areas to be repaired. The wire fabric shall be securely tied to the hook-type bolts or the reinforcing bars.

Where sheets meet, they shall be lapped a minimum of 100 mm and shall be securely fastened together.

Expansion bolt anchors shall be placed in holes drilled in the existing concrete surface to the diameter and depth recommended by the manufacturer of the expansion bolt anchors. Hook-type bolts of the proper length shall be inserted and securely attached to the expansion bolt anchors so as to provide a positive connection to sound concrete.

Where the chipped area is 150 mm or greater in depth, the Contractor shall place galvanized wire fabric in layers 100 mm apart.

Where it is necessary to place more than one layer of galvanized wire fabric in an area to be repaired, the innermost layer shall be covered by a shotcreting prior to the installation of the next outermost layer.

Existing reinforcement which has lost significant section shall be repaired in a manner satisfactory to the Engineer as extra work.

### 583-3.02 Preparation of Materials

**A. General.** The sand shall be measured either by volume or weight, by means of batch boxes approved by the Engineer, or in a proportioning plant approved in accordance with section 501, Portland Cement Concrete - General. Wheelbarrows or shovels will not be permitted for measuring. The same source of sand shall be used throughout each structure.

**B. Dry Mix Process.** Dry mix shotcrete shall be composed of one part of cement to three to four and one-half parts of sand.

Prior to mixing, the moisture content of the sand shall be between 3 and 6%. The sand shall be dampened or dried as required to bring the moisture within these limits.

A wetting agent approved by the Engineer may be used at the Contractor's option in the dry mix process.

Sand-cement mixtures shall be applied within 75 minutes of the time the sand initially contacts the cement. Sand-cement mixtures which exceed the 75 minute limit shall not be incorporated in the work. They shall be disposed of in a manner acceptable to the engineer.

**C. Wet Mix Process.** Wet mix shotcrete shall be composed of one part of cement to three parts of sand. The cement, sand and water shall be premixed to a desired consistency and in accordance with 501-3.03, Handling, Measuring and Batching Materials, and 501-3.04, Concrete Mixing, Transporting and Discharges - General Requirements.

### 583-3.03 Placement

**A. Weather.** Shotcrete shall not be applied during any precipitation which is of sufficient intensity to cause the placed shotcrete to run. Shotcrete shall not be placed during a wind that disrupts the nozzle spray.

Shotcrete shall not be applied when the ambient air temperature is below 7°C unless it is placed in accordance with 555-3.08C.2., Provision of External Heat. Receiving surfaces shall be heated to, and maintained at, approximately 7°C by a method approved by the Engineer before shotcreting operations begin. Under no conditions shall shotcrete be applied against surfaces upon which any frost adheres.

**B. Application.** Before starting to shoot, precautions shall be taken to protect property in the area. Adjacent construction, openings, shrubbery, and all areas that might be discolored or damaged by rebound, cement, water or dust must be covered with tarpaulins or plastic sheets to protect them from damage.

When projecting the shotcrete, the stream of flowing materials shall be directed from the nozzle as nearly at a right angle as possible to the surface being treated, and shall be held uniformly at the same distance, less than 1.5 m away from the surface at all times. Manufacturer's recommendations shall be followed. The size of the nozzle shall be consistent with the manufacturer's recommendation for the maximum size of the sand used. The use of rebound material shall not be permitted.

Shotcrete on vertical and overhead surfaces shall be built up in 20 mm maximum layers to prevent sloughing in heavy applications. Succeeding layers shall be applied just prior to the initial set to maintain a good bond.

When encasing reinforcing steel, the stream from the nozzle shall be directed at an angle so as to fill the space behind the bars. An air jet shall be used to blow out any rebound ahead of the application of shotcrete. Should any such deposit of sand rebound be covered with shotcrete, it shall be cut out and removed by the Contractor without compensation.

Ground wires may be installed to establish the thickness and surface planes of the shotcrete build up. Both horizontal and vertical ground wires may be installed at corners and offsets not clearly established by exterior corners of walls, column or beam corners, and other locations. They may also be used as screed guides. Eighteen or 20 gage hard steel piano wire is recommended for this purpose. Ground wires shall be tight and true to line, and placed in such a manner that they may be further tightened.

### **C. Quality Control**

**1. Test Panels.** This test shall be used to determine the physical quality of the shotcrete and shall be performed immediately before shotcreting operations begin, after each additional 10 square meters, and immediately after operations are ended.

The test panels shall be 300 mm square, 20 mm thick plywood boards with galvanized mesh (13 mm square openings) strips projecting 100 mm attached around the perimeter of the board. The boards shall be erected horizontally, vertically, or overhead, depending on the anticipated shooting positions. The shotcrete operator shall completely fill the test panel, after which it shall be screeded or cut with a trowel such that it contains a 100 mm uniform depth of shotcrete. The test panels shall then be covered with wet quilted covers or wet polyethylene-coated blankets; put in a shaded, protected place; kept wet and cured for a minimum of seven days. The test panels shall be sent to the Department of Transportation's Materials Bureau for testing at fourteen days. Cores will be drilled from the panels and compressive strengths at fourteen days will be reported to the Engineer. Additional information on the conditions of the shotcrete such as sand pockets, voids, and laminations will also be reported with the strength results.

**2. Coring.** The Contractor shall take a core, at a location determined by the Engineer, from each structural element, such as pier, abutment, arch, etc., to verify acceptability of reinforcement encasement. Cores which do not contain reinforcing bars will not be used to determine encasement acceptability. If interconnected voids are found, the structural element represented by that core shall be rejected. All rejected shotcrete shall be repaired or replaced at the Contractor's expense. Repair methods shall be proposed by the Contractor for approval by the Engineer. The Contractor may take additional cores at locations approved by the Engineer to establish the limits of rejected work. The additional coring shall not jeopardize the design integrity of the structural element. If additional cores are not taken, all work on that structural element shall remain rejected. Core holes shall be patched with an applicable concrete repair material from the Approved List.

**D. Finishing.** The natural gun finish will be sufficient unless the plans call for one of the following finishes:

**1. Screed Finish.** After the surface has taken its initial set, excess material outside the forms and ground wires shall be sliced off with a sharp-edged cutting screed. After screeding, the ground wires shall be removed.

**2. Broom Finish.** This type of finish may be applied after screeding.

**3. Flash Coat Finish.** This is a thin surface coating containing finer sand than normal, and the application nozzle is held well back from the work. This finish shall be applied to the surface as soon as possible after screeding.

Any of the remaining three types of finish may be applied following flash coat:

a. *Wood Float Finish.* This gives a granular finish.

b. *Rubber Float Finish.* This gives a coarse finish.

c. *Steel Trowel Finish.* This gives a very smooth finish.

**E. Curing.** Curing shall be in accordance with 555-3.08, Curing, and the following modifications:

- All curing covers shall be pre-wet and kept wet during the entire curing period in a manner satisfactory to the Engineer.
- Curing compounds shall be applied twice. The second application shall be done when the first application has become tacky. The second application shall be done at a right angle to the first application. The rate of each application shall be that given in 555-3.08A.

**583-4 METHOD OF MEASUREMENT.** The quantity to be paid for under this item will be the number of square meters of finished shotcrete installed. Measurement will be taken as the plane projection of the finished surface. Measurement shall be made prior to the placement of shotcrete.

**583-5 BASIS OF PAYMENT.** The unit price bid per square meter shall include the cost of furnishing all labor, materials and equipment necessary to complete the work.

**583-5.01 Removal of Structural Concrete - Replacement with Shotcrete.** No Reinforcement Bar Encasement. The unit price bid per square meter shall include the cost of furnishing all labor, materials and equipment necessary to complete the work.

**583-5.02 Removal of Structural Concrete - Replacement with Shotcrete, Reinforcement Bar Encasement.** The unit price bid per square meter shall include the cost of furnishing all labor, materials and equipment necessary to complete the work, except that replacement of deteriorated reinforcement shall be paid for separately. Payment shall not be made until cores verify acceptability.

*Payment will be made under:*

<b>Item No.</b>	<b>Item</b>	<b>Pay Unit</b>
583.02	Removal of Structural Concrete - Replacement with Shotcrete, No Reinforcement Bar Encasement	Square Meter
583.03	Removal of Structural Concrete - Replacement with Shotcrete, with Reinforcement Bar Encasement	Square Meter

**SECTION 584 - SPECIALIZED OVERLAYS FOR STRUCTURAL SLABS**

**584-1 DESCRIPTION.** Prepare the surfaces that will be in contact with slab reconstruction concrete and place slab reconstruction concrete. Prepare the structural slab surface and place a specialized concrete overlay.

**584-1.01 Scope.** Concrete removal work will be paid for under the appropriate item(s). Minimum thickness of overlay concrete is 40 mm. Include the cost of any grade changes necessitated by this requirement in the unit bid price for overlay concrete. Use only one type of overlay concrete on any one structure.

**584-1.02 Definitions**

**A. Class DP Concrete.** A homogeneous mixture of portland cement, fly ash, microsilica admixture, fine and coarse aggregates, air entraining agent, set retarding water reducing admixture and water.

**B. Microsilica Concrete.** A homogeneous mixture of portland cement, microsilica admixture, fine and coarse aggregates, air entraining agent, high range water reducing admixture and water.

**C. Overlay Concrete.** Concrete placed over existing and slab reconstruction concrete. Overlay concrete will be Microsilica concrete for Method 1 and Method 2, and Class DP concrete for Method 3, as described in 584-1.03 Placement Methods.

**D. Slab Reconstruction Concrete.** Concrete placed completely around the exposed top mat of bar reinforcement. Slab reconstruction concrete will be Class D or Class DP concrete for Method 1, Microsilica concrete for Method 2, and Class DP concrete for Method 3, as described in 584-1.03 Placement Methods.

**E. Positive-tie-downs.** Anchors drilled into the structural slab and connected to reinforcing steel.

### 584-1.03 Placement Methods.

**A. Method 1 - Separate Placement.** Place Class D or Class DP slab reconstruction concrete and Microsilica overlay concrete separately. Use only one type of slab reconstruction concrete on each placement.

**B. Method 2 - Integral Placement of Microsilica Concrete (Optional).** When all of the following conditions are satisfied, Microsilica overlay concrete and Microsilica slab reconstruction concrete may be placed in a single lift:

- The area of the exposed top mat of bar reinforcement is 5% or less of the placement area, per span.
- No individual area of the exposed top mat of bar reinforcement exceeds 2.5 square meters.
- No dimension of any area of the exposed top mat of bar reinforcement exceeds 2 meters.

**C. Method 3 - Integral Placement of Class DP Concrete (Optional).** When 100% of the top mat of bar reinforcement is exposed, Class DP overlay concrete and Class DP slab reconstruction concrete may be placed in a single lift.

## 584-2 MATERIALS

**584-2.01 General.** All materials listed in 557-2 with the following:

**A. Air Entraining Admixture.** 711-08 with the following: For Microsilica concrete, use only a vinsol resin-based air entraining agent.

### **B. Microsilica Admixture**

1. Follow the requirements of §501-2 and §501-3.01.
2. Samples will be taken in accordance with Materials Method 9.1M and Materials Procedure 90.1.
3. Blended Portland Cement, §701-03 (Type SF) may also be used for the Portland cement/microsilica portion of the Class DP and the Microsilica Concrete designed mix.

### **C. Vacant**

### 584-2.02 Manufacture of Class DP Concrete

**A. Proportioning.** The initial ingredient proportions, except for admixtures, are given in TABLE 584-1.

**B. Handling, Measuring and Batching.** Follow the requirements of §501-3.02 and §501-3.03, except that water reduction must be accomplished using only a water-reducing and retarding admixture (§711-08, ASTM Type D). If a microsilica slurry is used, include the slurry water as mix water.

Cement Content (kg/m <sup>3</sup> )	318
Fly Ash Content (kg/m <sup>3</sup> )	86
Microsilica Content (kg/m <sup>3</sup> )	26
Sand Percent Total Aggregate (solid volume)	45.8
Designed Water/Total Cementitious Content	0.4
Desired Air Content (%)	7.5
Allowable Air Content (%)	6.0 - 9.0
Desired Slump (mm)	100
Allowable Slump (mm)	50 - 125
Type of Coarse Aggregate Gradation	CA 1

**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.

Cement Content (kg/m <sup>3</sup> )	390
Microsilica Content (kg/m <sup>3</sup> )	36
Sand Percent Total Aggregate (solid volume)	53
Designed Water/Total Cementitious Content	0.37
Desired Air Content (%)	6.5
Allowable Air Content (%)	5.0 - 8.0
Desired Slump (mm)	100
Allowable Slump (mm)	50 - 150
Type of Coarse Aggregate Gradation	CA 1

**NOTE:** The criteria are given for design information and the data is based on a fine aggregate modulus of 2.80 and a CA1 coarse aggregate gradation. Adjust the mixture proportions using actual fineness modulus and bulk specific gravities (saturated surface dry for aggregates). Compute the adjustments according to Department instructions.

**B. Handling, Measuring and Batching.** Follow the requirements of Subsection 501-3.02 and - 3.03, except that water reduction must be accomplished using only a High-Range Water-Reducing Admixture (§711-08, ASTM Type F). Add the High-Range Water Reducer at the batching facility.

The Regional Materials Engineer may allow a maximum of two additions of water and/or admixture at the work site. Provide an additional 30 mixing revolutions for each addition of water and/or admixture. However, once the concrete has reached the desired slump, only the High-Range Water Reducer may be used to adjust the concrete slump. The maximum total mixing revolutions is 200. Observe the Manufacturer's maximum dosage rate for the admixture, regardless of where the admixture is added. If a microsilica slurry is used, include the slurry water as mix water.

### 584-2.04 Equipment

**A. Microsilica Admixture.** Follow Subsection 584-2.01B.

**B. Finishing Machine.** A finishing machine capable of self propulsion in forward and reverse, raising the screeds above the screeded surface when traveling in reverse, and meeting one of the two sets of requirements below.

**1. Roller Screed.** Must be equipped with a power driven strike-off auger, power driven finishing roller, vibrating pan or roller producing 3000 to 7000 vpm, and pan float.

**2. Dual Oscillating Screed.** Must be equipped with at least 2 oscillating screeds producing between 3000 and 7000 vpm, strike-off auger, and control of each screed's vertical position and tilt angle.

The specific method and equipment used for finishing will be approved by the Regional Construction Engineer before use. Provide access to the machine at the work site for one working day, for inspection by the Engineer. Have a qualified Finishing Machine Operator present at the time of inspection. Two weeks prior to the inspection date, provide the Engineer with a copy of the operating manual for their exclusive use.

Use supporting rails with no bends or kinks. Support the rails with fully adjustable supports (no shims), spaced a maximum of 300 mm on center. When placing concrete adjacent to a completed placement, set the supporting rails for one side of the finishing machine on the completed placement.

**C. Recording Thermometer.** A continuous recording thermometer capable of measuring temperatures in the range of  $-1^{\circ}\text{C}$  to  $38^{\circ}\text{C}$  for a minimum of 24 hours. Include the cost of calibration in the unit price bid.

**D. Vacant.**

## 584-3 CONSTRUCTION DETAILS

### 584-3.01 Limitation of Operations

- A. No structural concrete removal work is permitted in areas adjoining new concrete during the new concrete's specified curing period.
- B. No loads, other than construction loads which are less than 1800 kg and approved by the Engineer, are permitted on areas of the structural slab where concrete has been removed.
- C. No loads are permitted on concrete until completion of the specified curing period.

### 584-3.02 Blast Cleaning

- A. Blast clean all surfaces to be in contact with new concrete. Remove all grease and dirt. Remove all rust and mortar which is not firmly bonded to the surface being cleaned. Rust and concrete deposits which are firmly bonded and cannot be removed by blast cleaning may remain. A light coating of orange rust, that forms on steel surfaces after blast cleaning, is not considered detrimental to bond and may remain. Remove all debris created by blast cleaning.
- B. Place reinforcing steel supports and positive-tie-downs at a maximum spacing of 1.2 m.
- C. Repeat blast cleaning if more than 48 hours pass before concrete placement begins.

**584-3.03 Preplacement Wetting.** After blast cleaning has been accepted, thoroughly wet the structural slab surface and all porous surfaces to be in contact with new concrete for at least 12 hours immediately prior to placement. Remove all standing water with oil-free compressed air, and protect the deck from drying, so the concrete remains in a saturated surface dry condition.

**584-3.04 Vacant.**

**584-3.05 Handling and Placing Concrete.** 557-3.05 and 557-3.12 with the following:

- A. Place concrete only when the ambient air temperature and deck surface temperature (after wetting) will be below  $30^{\circ}\text{C}$  during the entire placement.
- B. Place overlay concrete only if preplacement wetting has been completed on an area large enough to require one working day for placement, at least one span length.
- C. When using concrete transporting devices on a prepared surface, protect exposed reinforcing steel from deformation and prevent contamination of the surface.

D. If operations are delayed for more than 30 minutes, install a construction dam or bulkhead. If placement operations are delayed for more than 60 minutes or if the concrete attains initial set, discontinue placement for at least 48 hours. This restriction does not prohibit continuation of the placement provided a gap is left in the placement. This gap is to be sufficient in length to allow the finishing machine to clear the previously placed concrete. Prepare the gap area for concrete placement in accordance with this specification, after the previously placed concrete, on both sides of the gap, has cured for 48 hours.

### **584-3.06 Finishing and Curing**

**A. Slab Reconstruction Concrete - Separate Placement.** 557-3.09 and 557-3.11 with the following:

1. For areas less than 2.5 square meters, hand finishing of slab reconstruction concrete is acceptable. For areas greater than 2.5 square meters, use either a manually driven vibrator equipped power screed from the Department's Approved List or the same machine to be used to finish the overlay.
2. Screed to the level of the surrounding concrete. When 100% of the reinforcing steel is exposed, screed to a minimum 10 millimeters above the reinforcing steel. Roughen the screeded surface with a tining rake or similar device.
3. Cure concrete with wet burlap for 3 days. Provide uniform continuous wetting until concrete curing is complete. The wet burlap and curing cover option is not allowed.
4. Blastclean the surface, according to 584-3.02, after the curing period is over, but prior to wetting. Expose approximately 50% of the surface coarse aggregate, and leave an irregular texture.

**B. Overlay Concrete.** 557-3.08, 557-3.11, and 557-3.12 with the following:

1. Finish overlay concrete to a minimum depth of 40 mm and a minimum total cover over top mat of bar reinforcement of 60 mm. Use a finishing machine meeting the requirements of this specification.
2. Machine finish the concrete within 10 minutes of its deposition onto the deck. If the machine cannot finish the concrete within the 10 minute time limit, stop all further placement, immediately cover the fresh concrete with plastic curing covers, and keep the unfinished concrete covered until it is machine finished. Once concrete being placed can be machine finished within the 10 minute time limit, resume placing concrete.
3. Apply curing within 10 minutes after machine finishing. Provide uniform continuous wetting until concrete curing is complete. Cure Microsilica concrete with wet burlap for 4 days. Cure Class DP concrete with wet burlap for 7 days. The wet burlap and curing cover option is not allowed.

**584-3.07 Construction Joints.** For the purpose of this specification, construction joints provide for interruptions in overlay concrete placement.

At transverse and longitudinal construction joints, place the overlay concrete a distance at least equal to the depth of the overlay, beyond the intended joint location. After the overlay concrete has cured for 48 hours, sawcut along the joint to a depth of  $20 \pm 3$  mm. Chip the extra overlay concrete to the level of the original prepared surface at a  $45^\circ$  angle. Do not undercut existing concrete.

**584-3.08 Defective or Damaged Concrete.** 557-3.16 with the following:

- A. Defects and damage, for the purposes of this specification, are imperfections caused by the Contractor's operations, including, but not limited to: cracking, tearing, and open areas. Repair all defective or damaged concrete at no cost to the Department, using the same class of concrete originally placed.
- B. Make all repairs rectangular in plan shape and as close to square as possible. Sawcut the perimeter of the repair to a depth of  $20 \text{ mm} \pm 3 \text{ mm}$ . Chip out the damaged or defective concrete to the level of the original prepared surface. Angle the walls of the repair cavity at  $45^\circ$  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:*

Item No.	Item	Pay Unit
584.3001nn	Overlay Concrete, Microsilica Concrete – Type 1 Friction	Square Meter
584.3002nn	Overlay Concrete, Microsilica Concrete – Type 2 Friction	Square Meter
584.3003nn	Overlay Concrete, Microsilica Concrete – Type 3 Friction	Square Meter
584.3009nn	Overlay Concrete, Microsilica Concrete – Type 9 Friction	Square Meter
584.3101nn	Overlay Concrete, Class DP – Type 1 Friction	Square Meter
584.3102nn	Overlay Concrete, Class DP – Type 2 Friction	Square Meter
584.3103nn	Overlay Concrete, Class DP – Type 3 Friction	Square Meter
584.3109nn	Overlay Concrete, Class DP – Type 9 Friction	Square Meter
584.3200nn	Slab Reconstruction Concrete, Class D, DP or Microsilica Concrete	Square Meter

NOTE: nn denotes a serialized pay item.

## SECTION 585 - STRUCTURAL LIFTING OPERATIONS

**585-1 DESCRIPTION.** The work shall consist of raising, supporting and lowering each bearing point designated on the plans in order to perform the work to be done under other items.

**585-1.01 Bearing Point.** For purposes of this specification the term bearing point is defined as a point on the structure, designated on the plans, to be raised in order to perform other work.

**585-1.02 Lift Point.** For purposes of this specification, the term lift point is defined as a point on the structure where the lifting force is applied.

**585-1.03 Type.** Some bearing point locations may require different methods of accomplishing the work. Such situations will be noted on the contract plans. They will be defined by a type designation. The type designation will be reflected in the pay item title (e.g., 585.01 Structural Lifting Operations - Type A, etc.).

## 585-2 MATERIALS

**585-2.01 Used Materials.** Used materials will be allowed, except that materials that are permanently attached to the structure shall be in conformance with the current New York State Department of Transportation Standard Specifications.

**585-2.02 Lifting Equipment.** Unless otherwise specified on the plans, the choice of lifting equipment shall be at the Contractor's option, subject to the following provisions:

If jacks are used for the lifting operations, each jack shall have the rated capacity clearly shown on the manufacturer's name plate attached to each jack. Jacks or other lifting equipment shall have a rated capacity of at least one and a half times the calculated lifting force. The Engineer may require that any lifting equipment deemed to be inadequate or faulty be removed from the project site.

Jacks or other lifting equipment shall be equipped with pressure gages or other load measuring devices that will enable the applied lifting force to be monitored at all times.

**585-3.01 General.** The plans designate, by type, the bearing points that must be raised in order to perform the work. The loads at each bearing point are shown on the plans.

The Contractor shall select the location of the lift points, subject to the approval of the Deputy Chief Engineer (Structures), and calculate the required lifting force.

Unless a specific distance is shown on the plans, each designated bearing point shall be raised the minimum distance that will allow the work to be completed.

The Contractor shall engage the services of a New York State Licensed Professional Engineer (PE) to design and detail the structural lifting system. The PE shall be available for consultation in interpreting his plans and in the resolution of problems which may arise during the performance of the work.

All design and details shall be in conformance with the current New York State Department of Transportation Standard Specifications for Highway Bridge and the current New York State Steel Construction Manual.

**585-3.02 Working Drawings.** The Contractor shall furnish working drawings, prepared, stamped and signed by a New York State Licensed Professional Engineer, for the system proposed to raise, support and lower each designated bearing point. The working drawings shall not alter the number or location of designated bearing points.

The drawings shall include, but need not be limited to the following:

- Lift point locations.
- Calculated lifting forces.
- Details for all lifting equipment and support systems.
- Type and grade of all materials.
- Distance that each bearing point is to be raised.
- Schematic hydraulic layout.
- All disconnections, reconnections or adjustments that are necessary to properly complete the lifting operations. This includes but is not limited to railings, joints, power lines, gas lines, water lines, etc.

Three legible, standard sized (560 mm x 910 mm nominal, 530 mm x 850 mm working area) prints of each drawing, together with three copies of all design computations shall be submitted to the Deputy Chief Engineer (Structures) for approval. Failure to submit drawings of the required size will be cause for their return without examination.

The Deputy Chief Engineer (Structures) shall be allowed the longest of the following time durations to examine design computations and working drawings:

- Fifteen working days.
- Two working days for each drawing of a set of working drawings.
- One working day for every four (4) design computation sheets. Any design computation sheet written on both sides will be considered as two design computation sheets.

All time for examination shall begin upon receipt of all pertinent information by the Deputy Chief Engineer (Structures).

The Deputy Chief Engineer (Structures) comments shall be indicated on the returned copies. Should the proposed system not be approved, the reasons shall be indicated with the return of the material. The

Contractor shall then submit revised drawings for approval, subject to the same terms as the first submission. Resubmission shall not be considered a legitimate reason to request an extension of time.

All work shall be done in accordance with the approved working drawings. The Contractor must have approved working drawings prior to the start of any structural lifting operations.

The Contractor shall bear all costs and/or damages which may result from the ordering of any materials, or equipment; or the use of any preparatory labor prior to the approval of the working drawings.

**585-3.03 Lifting Operations.** The Contractor shall raise each designated bearing point by applying the necessary lifting force at each lift point. At no time will the Contractor be allowed to apply a lifting force in excess of one and a half times the calculated lifting force.

During all phases of the operation, the differential lift between any two adjacent bearings on a common centerline of bearing shall not exceed 15 mm unless otherwise noted on the Plans.

The Contractor shall, at the earliest possible moment during or after each lift, safely secure the structure with shims, cribbings, bolsters or other suitable supports. Details to be used shall be shown on the working drawings.

Unless otherwise indicated on the plans, vehicular traffic or construction equipment shall not be permitted on the lifted span until shims, cribbing, bolsters or other suitable supports are in their required position.

The lifting operation shall be conducted such that the distance between the structure and the shims, cribbing, bolsters or other suitable supports do not exceed 10 mm at any time.

Any replacement, repair, or adjustments to the superstructure steel shall be performed in conformance with the current New York State Steel Construction Manual.

All welding shall comply with the requirements specified in the current New York State Steel Construction Manual.

All materials required for temporary support of the structure shall remain the property of the Contractor and shall be removed from the site after the work is completed, unless otherwise agreed to.

**585-4 METHOD OF MEASUREMENT.** The quantity to be paid for under this item shall be the number of bearing points designated on the plans, actually raised, supported and lowered. Payment will be made only once at each bearing point regardless of the number of times the bearing point is raised, supported and lowered during the course of the planned work.

**585-5 BASIS OF PAYMENT.** Payment will be made at the unit price bid for each bearing point actually raised, supported and lowered. The unit price bid per bearing point shall include the cost of all labor, materials and equipment necessary to complete this work.

For payment purposes each bearing point will be considered a separate unit. After all lifting has been performed and all temporary supports have been installed for any one bearing point, payment will be made for seventy percent of that particular unit. The remainder of the unit will be paid for after the bearing point has been lowered to its final permanent position and the lifting equipment and temporary supports have been removed.

*Payment will be made under:*

<b>Item No.</b>	<b>Item</b>	<b>Pay Unit</b>
585.XX	Structural Lifting Operations - (Types A - K)	Each
	<i>XX (01 through 11) = Type Designation (A through K)</i>	

**SECTION 586 - MISCELLANEOUS STRUCTURAL RECONSTRUCTION**

**586-1 DESCRIPTION.** The work of this section shall consist of the following:

- Drilling and Grouting Bolts, or Reinforcing Bars.
- Removal of Rivets-Replacement with High Strength Bolts.
- Field Drill Holes in Existing Structural Steel.

**586-1.01 Drilling and Grouting Bolts, or Reinforcing Bars.** For the purposes of this section the terms bolts and reinforcing bars are identical.

**586-1.02 Field Drill Holes in Existing Structural Steel.** Existing structural steel is that structural steel in service prior to the beginning of construction.

## **586-2 MATERIALS**

**586-2.01 Drilling and Grouting Bolts.** Grout material shall conform to §701-07; Anchoring Materials - Chemically Curing.

**586-2.02 Removal of Rivets - Replacement with High Strength Bolts.** High strength bolts, nuts and washers shall meet the requirements of §715-14.

If paint color is not specified, the color selected shall match the existing paint. Paint shall be selected from the Department's Approved List for Structural Steel Paint - Class 2.

## **586-3 CONSTRUCTION DETAILS**

**586-3.01 Equipment - General.** All equipment proposed for use shall be approved by the Engineer prior to actually performing the work.

### **586-3.02 Drilling and Grouting Bolts**

A. All holes shall be drilled by means of a rotary impact drill. If reinforcing steel is encountered, the reinforcing steel shall be cut and removed by means of a core drill. The remainder of the drilling shall be done with the rotary impact drill.

B. Drilling with a lubricant will not be permitted. Water is not considered a lubricant. Drilling methods shall not cause spalling, or other damage to concrete. Concrete spalled, or otherwise damaged by the Contractor's operations shall be repaired in a manner satisfactory to the Engineer. Such repair shall be done at the expense of the Contractor.

C. Holes shall be surface dry and shall have had all foreign and loose material removed immediately prior to grout placement.

D. Grout shall be mixed and placed in strict accordance with the manufacturer's instructions, unless modified here, or elsewhere, in the contract documents. No grout shall be placed at a temperature below that recommended by the grout manufacturer.

E. Prior to bolt placement in the grouted hole, all material which might interfere with bond between the bolt and the grout shall have been removed. This includes, but is not limited to: moisture, grease, dirt, mill scale and rust. Rust which cannot be removed even by vigorous scrubbing with a wire brush is considered firmly bonded and may remain. The hole diameter shall be in accordance with the grout manufacturer's recommendation. The bolts shall be inserted full depth into the hole and shall be manipulated to ensure complete coverage by the grout. After insertion of the bolt, all excess grout shall be struck-off flush with the concrete face. Should the grout fail to fill the hole after bolt insertion, additional grout shall be added to the hole to allow a flush strike-off.

F. If the bolt is inserted in a hole with an axis predominantly horizontal to the ground surface, care shall be taken to prevent grout from running down the face of the concrete. These precautions shall be done in a manner satisfactory to the Engineer.

### **586-3.03 Removal of Rivets-Replacement with High Strength Bolts**

**A. Paint Removal.** If the steel is painted, then prior to the beginning of any other work operations, the paint shall be removed for a minimum distance of 100 mm on each side of the centerline of work location. The paint removal work shall be done in accordance with the requirements of Section 574 *Structural Steel Painting: Localized*. In cases where the contractor can clearly demonstrate through exposure monitoring that other work practices and engineering controls, under the oversight of a certified industrial hygienist, can effectively maintain actual worker exposure below the permissible exposure level, exceptions to this requirement may be granted by the Engineer.

**B.** Unless otherwise noted in the contract documents, all bolts shall be the same diameter as the rivets they replace.

**C.** Rivets shall be removed by one of the following methods:

1. Shear rivet head using a pneumatic rivet breaker (helldog), and drive out rivet shank with a pneumatic punch.
2. Flame cut rivet head 2 mm above the base metal using a rivet scarfing tip, and drive out shank using a pneumatic punch.

If, in the Engineer's opinion, punching will damage the base metal, the shank shall be removed by drilling.

**D.** High strength bolts shall be installed after the nicks, burrs and foreign substances that might interfere with seating of the bolt head and nut washers are removed. Light grinding may be ordered by the Engineer.

**E.** Installation and inspection of high strength bolts shall be done in accordance with the New York State Steel Construction Manual requirements.

**F.** If it becomes necessary to disconnect, or adjust, steel remaining as part of the structure to complete the work the Contractor shall obtain the Engineer's approval prior to performing disconnections or adjustments.

**G.** If the bolt will not fit the rivet hole, the hole may be reamed sufficiently to accommodate the bolt.

**H.** If the contract does not include an item(s) for cleaning, priming and painting of structural steel, cleaning and painting of the bolt and immediate surrounding area shall be done as part of this work.

Cleaning and painting shall be done in accordance with the requirements of Section 574 *Structural Steel Painting: Localized*. All steel exposed by the cleaning operations shall be painted. However, at least 50 mm in every direction, measured from the washer's edge, shall be painted.

#### **586-3.04 Field Drill Holes in Existing Structural Steel**

- A. The requirements of §586-3.03A shall apply.
- B. The required hole diameter will be indicated on the plans.
- C. No flame cutting, or flame drilling will be permitted.
- D. All damage to existing steel, as determined by the Engineer, shall be repaired by the Contractor, at no cost to the State. All repair shall be done in a manner satisfactory to the Engineer.

#### **586-4 METHOD OF MEASUREMENT**

**586-4.01 Drilling and Grouting Bolts.** Measurement will be taken as the number of millimeters of holes into which grout and bolts have been inserted. Measurement will be taken to the nearest one-hundredth of a meter.

**586-4.02 Removal of Rivets - Replacement with High Strength Bolts.** Measurement will be taken as the number of high strength bolts installed.

**586-4.03 Field Drill Holes in Existing Structural Steel.** Measurement will be taken as each hole drilled. No allowances will be made for holes drilled through different thicknesses of steel, or different numbers of plates.

#### **586-5 BASIS OF PAYMENT**

##### **586-5.01 Drilling and Grouting Bolts**

- A. The unit price bid per millimeter shall include the cost of all labor, materials, and equipment necessary to complete the work.
- B. Payment will not be made for holes which do not contain both grout and bolts.
- C. The cost of the bolts will be paid for under a separate, appropriate item.

**586-5.02 Removal of Rivets - Replacement with High Strength Bolts**

- A. The unit price bid for each installed bolt shall include the cost of all labor, material and equipment necessary to complete the work including paint removal and when appropriate painting.
- B. Payment will be made for each installed bolt regardless of whether or not, a rivet had been removed from the location in question.

**586-5.03 Field Drill Holes in Existing Steel**

- A. The unit price bid for each hole drilled shall include the cost of all labor, equipment and materials necessary to complete the work, including paint removal when required.
- B. No extra compensation will be paid for holes drilled through different thicknesses, or through different numbers of plates.

*Payment will be made under:*

<b>Item No.</b>	<b>Item</b>	<b>Pay Unit</b>
586.01	Drilling and Grouting Bolts, or Reinforcing Bars	Millimeter
586.05	Removal of Rivets-Replacement with High Strength Bolts	Each
586.10	Field Drill Holes in Existing Structural Steel	Each

**SECTION 587 - BRIDGE RAILING RECONSTRUCTION**

**587-1 DESCRIPTION.** The work shall consist of the following:

- The removal and disposal of bridge railing.
- The Removal and storage of bridge railing.
- The installation of stored bridge railing.
- The furnishing and installing of box beam bridge railing.
- The furnishing and installing of thrie beam bridge railing.

**587-1.01 Bridge Railing Removed and Disposed; and Stored Bridge Railing Installed.**

Material removed for disposal and material not used for installation shall become the property of the Contractor and shall be removed from the work site.

**587-1.02 Bridge Railing Removed and Stored.**

All bridge railing removed shall remain the property of the State and shall be transported to a location within the project site designated by the Engineer.

**587-2 MATERIALS**

**587-2.01 New Material.** Materials shall meet the requirements of §710-23, Steel Bridge Railing and the following:

<b>Component</b>	<b>ASTM Designation or Standard Specification</b>
S75 x 8.5 Post	A36M
Post Plate	A36M
Spacer Brackets	A36M
Rail Connection Angles	A36M
Rail Plates	A36M
“U” Bolts, Nuts and Washers	F568 Class 4.6 or A307
Anchor Bolts, Nuts and Washers	A325M

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Thrie Beam	710-201
W150 x 37.1 Post	A36M
Anchor Bolts (Thrie Beam)	A449
Carriage Bolts (Thrie Beam)	F568 Class 4.6 or A307
Nuts and Washers for Carriage Bolts	A563 and F436
Attachment Plate	A36M
Concrete Grouting Material	701-05

**NOTE:** 1. Thrie Beam Bridge Railing shall be fabricated from 10 gage material.

**587-2.02 Stored Material.** The Contractor shall choose the best available material for installation, subject to the approval of the Engineer.

### 587-3 CONSTRUCTION DETAILS

**587-3.01 Bridge Railing Removal.** If so indicated on the plans, the existing anchorages shall be reused for anchoring new or stored railing. Should this be the case, the Contractor shall exercise care removing the railing so as not to damage the existing anchorages. The provisions of §589-3.01 shall apply for the removal of any painted bridge railing.

**587-3.02 Bridge Railing Storage.** The Contractor shall remove, transport, unload and store bridge railing. Care shall be taken not to damage the railing during the various operations. In the event railing is damaged it shall be repaired or replaced in kind as directed by the Engineer. Such repair or replacement shall be done at no expense to the State.

**587-3.03 Stored Bridge Railing Installation.** Installation of the railing shall be done in accordance with the following subsections of section 568, Bridge Railing:

Inspection of Railing	568-3.01A1	Non-Metallic Pads	568-3.01I
Field Welding	568-3.01D		
Positioning Railing	568-3.01F	Anchor Studs	568-3.01L
Positioning Posts	568-3.01G	Inspection	568-3.01N
Base Plates	568-3.01H		

**NOTE:** 1. Bends or kinks in the railing which were present at the place of storage will not be cause for rejection.

**587-3.04 Box Beam Bridge Railing Installation.** Erection shall be in accordance with requirements of 568-3.01, Erection of Bridge Railing.

The installation procedure shall be coordinated to provide the least disturbance of pedestrian and vehicular traffic, if such traffic is maintained during the course of the work.

### 587-3.05 Thrie Beam Installation

**A. Direct Attachment to Existing Railing.** The railing shall be installed in accordance with the following:

Inspection of Railing	568-3.01A
Field Galvanizing for Repair	568-3.01C
Inspection of Galvanizing	568-3.01B
Inspection	568-3.01N

The railing shall be installed such that the bottom edge is parallel to the roadway profile.

**B. Separate Post Installation - Concrete Support Surface.** The posts and railing shall be installed in accordance with the following:

Inspection of Railing	568.3.01A
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Positioning Posts	568-3.01G
Inspection of Galvanizing	568-3.01B
Base Plates	568-3.01H
Field Galvanizing for Repair	568-3.01C
Anchor Studs	568-3.01L
Field Welding	568-3.01D
Inspection	568-3.01N
Erection	568-3.01E

Mortar leveling courses shall be made from Concrete Grouting Material (§701-05). Manufacturer's instruction shall be strictly followed.

Railing shall be installed such that the bottom edge is parallel to the roadway profile.

**C. Separate Post Installation - Steel Support Surface.** The posts and railing shall be installed in accordance with the following:

Inspection of Railing	568-3.01A
Positioning Posts	568-3.01G
Inspection of Galvanizing	568-3.01B
Base Plates	568-3.01H
Field Galvanizing for Repair	568-3.01C
Anchor Studs	568-3.01L
Field Welding	568-3.01D
Inspection	568-3.01N
Erection	568-3.01E

Railing shall be installed such that the bottom edge is parallel to the roadway profile.

**587-4 METHOD OF MEASUREMENT**

**A. All Railing Removal and Installation Except Thrie Beam Railing Installation.**

Measurement will be taken as the number of meters of railing removed, or installed. Measurement will be taken along the centerline of the top rail, end-to-end of railing between the limits indicated on the contract plans. No deduction will be made for open joints. If there is only one rail it will be considered the top rail.

**B. Thrie Beam Railing Installation.** Measurement will be taken as the number of meters of railing installed. Measurement will be taken along the top of the thrie beam, end-to-end of railing between the limits indicated on the contract plans. No additional measurement will be taken for overlapping sections of railing. If transition sections are installed, measurement will be taken to the end of the transition section indicated on the contract plans.

**587-5 BASIS OF PAYMENT.** The unit price bid shall include the cost of all labor, materials and equipment necessary to complete the work. When required, mortar leveling courses, anchor bolts, nuts and washers shall be included in the unit price bid. The drilling and grouting of anchor bolts, when required will be paid for under a separate item.

Painting of the railing, if required, shall be paid under a separate item.

*Payment will be made under:*

Item No.	Item	Pay Unit
587.01	Bridge Railing Removal and Disposal	Meter
587.02	Bridge Railing Removal and Storage	Meter
587.03	Installation of Stored Bridge Railing	Meter
587.1001	Box Beam Bridge Rail, One Rail	Meter
587.1002	Box Beam Bridge Rail, Two Rail	Meter
587.20	Thrie Beam Bridge Rail - Attachment to Existing Bridge Rail	Meter

587.21	Thrie Beam Bridge Rail - New Post Installation Mounted on Concrete Surfaces	Meter
587.22	Thrie Beam Bridge Rail - New Post Installation Mounted on Steel Surfaces	Meter

## SECTION 588 (VACANT)

## SECTION 589 - REMOVAL OF EXISTING STEEL

**589-1 DESCRIPTION.** The work shall consist of removal and disposal of existing steel where indicated on the contract plans, or where ordered by the Engineer. Unless otherwise noted, all materials removed as part of this work shall become the property of the Contractor, and shall be removed from the work site.

**589-2 MATERIALS.** Not applicable.

**589-3 CONSTRUCTION DETAILS.** The removal of existing steel requires the submittal of a written work plan. This plan shall meet the requirements of §202-3.01; General and Safety Requirements. The work plan shall set forth all expected supports, disconnections and adjustments to steel which is to remain. If, during the course of the work it becomes necessary to support, disconnect, or adjust steel, not previously noted in the work plan, the contractor shall submit a revised work plan to the Engineer for approval. All such proposals shall be approved prior to implementation.

In addition, the requirements of §202-3.05; Demolition of Structures shall also apply.

All work performed on steel which is to remain as part of the structure shall be in accordance with the applicable requirements of the SCM.

Actual removal procedures shall conform to the following requirements:

**589-3.01 Paint.** If the steel is painted, then prior to the beginning of any steel removal operations, the paint shall be removed for a minimum distance of 100 mm on each side of the centerline of cut, bolt row, rivet row, or weld as applicable. The paint removal work shall be done in accordance with the requirements of Section 574 *Structural Steel Painting: Localized*. In cases where the contractor can clearly demonstrate through exposure monitoring that other work practices and engineering controls, under the oversight of a certified industrial hygienist, can effectively maintain actual worker exposure below the permissible exposure level, exceptions to this requirement may be granted by the Engineer.

**589-3.02 Cutting.** All cutting work shall be done in accordance with the requirements of the SCM, part 601, and when applicable, part 602.

### 589-3.03 Fastener Removals

**A. Bolts.** Nuts shall be removed with wrenches, wherever possible, and the bolts driven out with a hand held punch. Alternate removal procedures shall be set forth in the work plan.

**B. Rivets.** Rivets shall be removed by either of the following methods:

- Shear rivet head, using a pneumatic rivet breaker (helldog), and drive out rivet shank with a pneumatic punch, OR
- Flame-cut rivet head 2 mm above the base metal, using a rivet scarfing tip, and drive out shank using a pneumatic punch.

If, in the opinion of the Engineer, rivet shanks, or bolts, cannot be removed by punching, without damaging the base metal, the rivet shank, or bolt, shall be removed by drilling.

**589-3.04 Welded Connections.** Welded connections shall be disassembled in accordance with the following:

A. The affected weld shall be removed by means of air carbon arc gouging equipment. To ensure that base metal remaining in place is not damaged, at least 3 mm of weld material shall be left in place. If it is necessary to gouge into base metal to remove the weld fusion, the least critical member, as determined by

the Engineer, shall be damaged. If the damaged member is permitted to remain, it shall be repaired by procedures approved by the DCES.

B. The weld material left in place shall be ground flush with the base metal surface. No base metal shall be removed by grinding.

C. The Engineer shall perform a careful visual inspection of all weld removal locations. If damage is suspected the Engineer will direct the Contractor to perform a dye penetrant inspection in accordance with the requirements of the SCM.

If the Contractor's operations damage existing steel which is to remain in place, the damaged steel shall be repaired, or replaced, as determined by the DCES. The Contractor shall be required to repair damage, or replace damaged material, caused by the Contractor's operations, at no additional expense to the State.

**589-4 METHOD OF MEASUREMENT**

**589-4.01 Removal of Existing Steel (kg.)** Measurement will be taken as the number of kilograms of existing steel removed and disposed of.

The mass of existing steel removed shall be computed from the nominal sizes indicated on the contract plans. If the nominal size is not indicated on the contract plans, field measurements shall be used to determine the mass, using 7850 kg per cubic meter as the mass of steel. The weight of bolts, rivets and welds shall be neglected, and no deductions in mass shall be made for any rivet, or bolt holes, in the existing steel, or for any loss of steel section due to corrosion.

**589-4.02 Removal of Existing Steel (Each).** Measurement will be taken as each unit of existing steel removed, and disposed of.

**589-5 BASIS OF PAYMENT.** The unit price bid per kilogram, or per each unit, shall include the cost of all labor, materials and equipment necessary to complete the work, including the removal of fasteners, and disconnecting, supporting, or adjusting steel as necessary.

No payment will be made for repair of, or replacement of, damaged material, which was made necessary due to the Contractor's operations.

No separate payment will be made for the removal of paint.

The treatment, handling and disposal of the paint removal waste will be paid under a separate item.

*Payment will be made under:*

<b>Item No.</b>	<b>Item</b>	<b>Pay Unit</b>
589.01nnnn	Removal of Existing Steel	Kilogram
589.52nnnn	Removal of Existing Steel	Each

NOTE: nnnn denotes a serialized pay item.

**SECTION 590 - ADJUSTMENT OF BRIDGE APPURTENANCES**

**590-1 DESCRIPTION.** This work shall consist of adjusting the elevation of bridge joints and drainage devices to meet the proposed finished elevations in the manner indicated on the Contract Plans.

In order to perform the work, it may be necessary to remove structural concrete. Structural concrete removal, if performed, shall be done under its respective item.

**590-2 MATERIALS.** Materials shall meet the following requirements:

Structural Steel	ASTM A36M, A242M or A588M
Nuts, Bolts, and Washers	ASTM F568 Class 4.6
Galvanized Coatings and Repair Methods	719-01
Preformed Elastic Joint Sealer	705-09

**590-3 CONSTRUCTION DETAILS.** All steel materials, including nuts, bolts, and washers, used as a part of this work, shall be galvanized in accordance with §719-01. Any galvanized surface, either

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existing or installed as a part of this work, which is damaged by welding or abrasion, shall be repaired in accordance with §719-01.

All welding shall be done in accordance with the applicable requirements of the New York State Steel Construction Manual.

The Contractor shall take suitable precautions to prevent damage to materials designated to remain-in-place. Damage to such material, due to the Contractor's operations, shall be repaired or the damaged material replaced, as determined by the Engineer.

Dimensions shown on the plans shall be verified by the Contractor and any necessary changes approved by the Engineer prior to construction of any needed fabrications.

Preformed elastic joint sealer, where required, shall be installed in accordance with the Contract Plans.

### 590-4 METHOD OF MEASUREMENT

**590-4.01 Bridge Drainage Devices.** The work will be measured as each bridge drainage device as defined by the Contract Plans which has had its elevation adjusted in accordance with the Contract Plans.

**590-4.02 Bridge Joints.** The work will be measured as the number of meters of joint system which has had its elevations adjusted in the manner indicated on the Contract Plans.

Measurement will be taken only between curb lines. No measurements will be taken across sidewalks, or raised medians. In the event that curbs are not present, measurement will be taken only to those points where the elevations have actually been adjusted.

### 590-5 BASIS OF PAYMENT

**590-5.01 Bridge Drainage Devices.** The unit price bid for each bridge drainage device adjusted shall include the cost of all labor, materials, and equipment necessary to complete the work.

No payment will be made for work done to repair damage due to the Contractor's operations, nor for any material supplied as replaced material made necessary due to damage attributable to the Contractor's operations.

**590-5.02 Bridge Joints.** The unit price bid per meter shall include the cost of all labor, materials and equipment necessary to complete the work.

No payment will be made for work done to repair damage due to the Contractor's operations, nor for any material supplied as replacement material made necessary due to damage attributable to the Contractor's operations.

Any concrete removal or replacement will be paid for under the appropriate items.

#### *Payment will be made under:*

<b>Item No.</b>	<b>Item</b>	<b>Pay Unit</b>
590.01	Vertical Adjustment of Bridge Drainage Devices - 1	Each
590.02	Vertical Adjustment of Bridge Drainage Devices - 2	Each
590.03	Vertical Adjustment of Bridge Drainage Devices - 3	Each
590.04	Vertical Adjustment of Bridge Drainage Devices - 4	Each
590.05	Vertical Adjustment of Bridge Drainage Devices - 5	Each
590.21	Vertical Adjustment of Joint System - 1	Meter
590.22	Vertical Adjustment of Joint System - 2	Meter
590.23	Vertical Adjustment of Joint System - 3	Meter
590.24	Vertical Adjustment of Joint System - 4	Meter
590.25	Vertical Adjustment of Joint System - 5	Meter

### SECTIONS 591 THRU 593 (VACANT)

**SECTION 594 - TIMBER AND LUMBER**

**594-1 DESCRIPTION.** Under this work the Contractor shall furnish and place timber and lumber of various sizes and types as may be specified for sills or platforms beneath the road, for culverts, bridges reinforcing existing structures, and for other similar purposes as shown on the plans or specified by the Engineer.

**594-2 MATERIALS.** Materials shall meet the following requirements:

Wood Preservative - Creosote Oil, Type I	708-30
Wood Preservative - Water Borne	708-31
Wood Preservative - Oil Borne	708-32
Timber and Lumber	712-13
Stress Graded Timber and Lumber	712-14
Steel Plates as Specified	715-01

**594-2.01 Fasteners.** Fasteners such as: spikes, nails, screws, timber connectors, bolts, nuts and washers shall meet the standard industrial fastener specifications for the intended application.

**594-2.02 Approval of Order.** Prior to ordering timber and lumber, the Contractor shall submit to the Engineer for approval, a detailed statement of his proposed order. No material shall be ordered until the statement is approved.

**594-2.03 Preservative Treatment.** The preservative treatment shall be applied to stress graded lumber and timber and shall conform to the requirements of the AWPA C2, C3, and C18.

**594-2.04 Sampling and Inspection.** Sampling and inspection will be done by an accredited representative of the Department. The Inspector shall have the power to take samples of the material for analysis and to reject those materials which do not fulfill the requirements of these specifications as to either quality or workmanship. The acceptance of any materials by the Inspector shall not be a bar to their subsequent rejection if found defective. The Contractor shall furnish all facilities and equipment for the inspection and testing of materials and workmanship and the Inspector shall be allowed free access to all premises where inspections can be made.

The Contractor shall give the Department and Department's Inspection Agents ample notice relative to the location of, and time when, treating operations will take place. Inspection of all timber and lumber will be made by the Department's Inspection Agents before, during, and after pressure treatment at the treating plant. No treated timber and lumber shall be shipped which does not bear, in legible form, the Inspector's stamp of approval.

**594-3 CONSTRUCTION DETAILS**

**594-3.01 General.** Timber and lumber shall be placed or erected as shown on the plans or specified by the Engineer.

Any surface breaks resulting from storage and handling which do not warrant rejection shall be treated in accordance with AWPA M4 with the addition that at least three coats of preservative shall be applied.

Paint, where specified, shall be applied as required by the Contract Documents.

**594-3.02 Treatment after Fabrication.** All cutting, framing and boring of timber and lumber shall be done before treatment whenever practicable. Cutting and boring below high water shall be particularly avoided in material which is to be used in waters infested with marine borers.

All cut surfaces and all bolt holes bored subsequent to treatment shall be treated in accordance with AWPA M4 with the addition that at least three coats of preservative shall be applied. Any unfilled holes, after being treated with preservative shall be plugged with preservative treated plugs.

All cut surfaces and bolt holes below the high water line shall, in addition to the AWPA M4 preservative treatment, be coated with a thick application of a mixture of 30% creosote and 70% pitch.

The Contractor shall obtain all necessary permits pertaining to the purchase and field application of wood preservatives from the U.S. Environmental Protection Agency (EPA) and the New York State Department of Environmental Conservation.

**594-4 METHOD OF MEASUREMENT.** The quantity to be paid for timber and lumber will be the number of cubic meters placed in the completed work. In measuring dressed timber and lumber, the cross-section of any piece will be taken as the minimum nominal commercial size of undressed material from which the piece could have been cut. When round timber is used, it shall be estimated as square timber of the smallest undressed commercial size from which the timber can be manufactured. The length of any piece will be taken as the actual length in the finished work, making no deductions for bevels, notches or splices. If the measured quantity is first computed in board feet, the conversion factor shall be 0.00235974 cubic meters per board feet.

**594-5 BASIS OF PAYMENT.** The unit price bid per cubic meter shall include the cost of furnishing all spikes, nails, screws, timber connectors, bolts, nuts, washers, hardware, preservative treatment and other required materials together with labor and equipment necessary to complete the work.

*Payment will be made under:*

<b>Item No.</b>	<b>Item</b>	<b>Pay Unit</b>
594.01 M	Timber and Lumber	Cubic Meter
594.02 M	Stress Graded Timber and Lumber	Cubic Meter
594.03 M	Treated Timber and Lumber	Cubic Meter

**SECTION 595 (VACANT)**

**SECTION 596 - OPEN STEEL FLOOR**

**596-1 DESCRIPTION.** The work shall consist of furnishing and placing open steel floor in structural slabs, at the locations indicated on the contract plans.

**596-2 MATERIALS**

**596-2.01 Steel.** All steel for the component parts shall conform to the requirements of ASTM A36M or A588M. If steel conforming to ASTM A36M is used, it shall be furnished with a minimum copper content of 0.20 percent.

The Contractor shall furnish the Department with two certified copies of the record of physical tests and chemical analysis of the steel used.

**596-2.02 Fabrication.** All the requirements and provisions of the SCM shall apply.

**596-2.03 Shop Painting.** The open steel floor shall be painted in accordance with the contract documents. Surfaces which are to be welded shall not be painted until all welding is completed.

**596-3 CONSTRUCTION DETAILS**

**596-3.01 Placement.** Open steel floor shall be placed true to line and grade and shall make full and even bearing on the underlying surface.

**596-3.02 Field Welding.** All the requirements and provisions of the SCM shall apply.

**596-3.03 Field Painting.** The requirements of §596-2.03 shop painting, shall apply.

**596-4 METHOD OF MEASUREMENT.** The quantity to be measured will be the actual area, in square meters, of open steel floor furnished and installed, including any portions that are filled with concrete.

**596-5 BASIS OF PAYMENT.** The unit price bid per square meter shall include the costs of all labor, material (including fabrication) and equipment necessary to complete the work.

*Payment will be made under:*

<b>Item No.</b>	<b>Item</b>	<b>Pay Unit</b>
596.01	Open Steel Floor	Square Meter

**SECTION 597 - TIMBER BRIDGE RAILING AND TRANSITIONS**

**597-1 DESCRIPTION.** The work shall consist of furnishing and erecting timber bridge railing and transitions as shown on the contract plans and in accordance with the specifications. As soon as the Contract is awarded, the Contractor shall notify the DCES of the name and address of the fabricator of all timber bridge railing. This notification shall list the specific shop or shops in which the railing will be fabricated.

**597-2 MATERIALS.** Materials for this work shall meet the following requirements:

<b>Component</b>	<b>ASTM or SAE Designation</b>
Internal Steel Plates	A36M (A709, Grade 250)
Rail Splice Plate	A36M (A709, Grade 250)
Tension Rods and Connection Bolts	F568, Class 8.8
Round Head Square Neck Threaded Bolt	F568, Class 4.6
Nuts	A563M Class 10S, Type HH
Washers	F436M, Type 1
Thrie Beam	A588M or A572M (A709, Grade 345 or 345W)
Thrie Beam to W-Beam Transition Piece	A588M or A572M (A709, Grade 345 or 345W)
Dome Head Drive Spike	Industry Standard
Split Rings	SAE 1010 Hot Rolled Carbon Steel
Shear Plates	ASTM A47/A47M, Grade 32510

The provisions of §708-31 Wood Preservative - Water Borne, §708-32 Wood Preservative - Oil Borne, §712-14 Stress Graded Timber and Lumber, and §715-01 Structural Steel, shall apply.

Glued laminated timber shall comply with the requirements of the American Institute of Timber Construction (AITC). All wood products shall be pressure treated with wood preservative in accordance with §708-31 or §708-32 except that laminations for glue laminated timbers shall be treated prior to gluing with wood preservative designated as light pentain oil as in AWWA C28 and glued with wet-use adhesives conforming to Sections 4.5.1.2 of ANSI/AITC A190.1-1983.

The bridge rail shall be horizontally laminated glued laminated timber, visually graded Western species combination No. 2 or visually graded Southern Pine Combination No. 48. Other species and grades of glued laminated timber may be substituted provided that the minimum values tabulated in the latest edition of the National Design Specification for Wood Construction (ANSI/NFoPA NDS) are not less than the following:

$$F_{b \text{ y-y}} = 12.4 \text{ MPA}$$

$$E = 12,410 \text{ MPA}$$

Posts, curbs, scuppers, and spacing blocks may be sawn lumber or glued laminated timber. When sawn lumber is used, material shall be visually graded No. 1 Southern Pine or visually graded No. 1 Douglas Fir-Larch. Other species and grades of lumber may be substituted provided that the minimum values tabulated in the latest edition of the National Design Specification for Wood Construction (ANSI/NFoPA NDS) or obtained through a Machine Stress Rated (MSR) procedure approved by the American Lumber Service (ALS) are not less than the following:

$$F_b = 9.30 \text{ MPA}$$

$$E = 10,342 \text{ MPA}$$

**597-3 CONSTRUCTION DETAILS**

**597-3.01 Fabrication.** Timber bridge railing shall be fabricated to the dimensions shown on the Contract plans and in compliance with the specifications.

**A. Shop Drawings.** Shop drawings shall be provided in accordance with the Steel Construction Manual (S.C.M.) except as follows:

- The drawings shall be submitted to the Engineer for review and approval; and
- The computed weights need not be shown.

**B. Galvanizing.** Galvanizing shall conform to the requirements of §719-01, Galvanized Coatings and Repair Methods, Type I. All steel components of the railing, including the round head square necked threaded bolts, shall be galvanized. Galvanizing of high-strength steel tension rods shall follow the recommendations of the tension rod manufacturer so as not to adversely affect the mechanical properties of the steel. All steel components shall be galvanized after welding and other fabrication.

Shop galvanizing repair of uncoated areas will be permitted on localized areas. Repair of localized areas is limited to a total of 1,300 mm<sup>2</sup> on any one component. Any component requiring more than 1,300 mm<sup>2</sup> of galvanizing repair shall be stripped and regalvanized.

Shop repair shall be in accordance with the methods given in §719-01. The following areas shall not require galvanizing repair: One 3 mm maximum dimension spot of tight flux remaining in the fusion line of any 180 mm length of weld after blast cleaning, pickling and galvanizing.

**C. Shop Wood Repair.** All cutting, framing and boring of timber shall be done before treatment whenever practicable.

All cut surfaces shall be treated in accordance with AWP A M4 with the addition that at least three coats of preservative shall be applied.

All bolt holes bored subsequent to treatment shall be treated with preservative by means of an approved pressure bolt hole treater. Any unfilled holes, after being treated with preservative shall be plugged with preservative treated plugs.

**597-3.02 Erection of Timber Bridge Railing and Transitions**

**A. Inspection of Railing.** Prior to installation, all timber and lumber shall be examined for shakes, holes, knots, checks, splits, and decay. The Materials Requirements under "Defects" of §712-17 shall apply. Any piece of timber or lumber exhibiting any one of the aforementioned defects shall be subject to rejection as determined by the Engineer.

**B. Inspection of Galvanizing.** Immediately prior to erection, the railing shall be inspected for damage. Damage to the galvanizing of steel railing components shall constitute sufficient cause for rejection except for the following conditions:

1. If a damaged area is not required to be repaired under the provisions of §710-23, Steel Bridge Railing.
2. If the total damaged area of a single piece is 4000 mm<sup>2</sup> or less. Total damaged area is exclusive of the damaged area described under §597-3.02B1.

**C. Field Wood Repair.** All cut surfaces shall be treated in accordance with AWP A M4 with the addition that at least three coats of preservative shall be applied.

All bolt holes bored subsequent to treatment shall be treated with preservative by means of an approved pressure bolt hole treater. Any unfilled holes, after being treated with preservative shall be plugged with preservative treated plugs.

The Contractor shall obtain all necessary permits pertaining to the purchase and field application of wood preservatives from the U.S. Environmental Protection Agency (EPA) and the New York State Department of Environmental Conservation.

**D. Field Galvanizing Repair.** Field galvanizing repair shall be allowed to be performed upon damaged areas meeting the requirements of §597-3.02B2.

Field galvanizing repair shall be made by painting zinc repair material onto the damaged area in accordance with the requirements of §719-01, Galvanized Coatings and Repair Methods.

All finished surfaces of welds and adjacent surfaces where galvanizing has been removed, due to any field welding operation, shall be field galvanized.

**E. Holes in Metal Plates.** Prior to galvanizing, any necessary holes in the metal plates shall be made in the shop in accordance with the requirements of the S.C.M.

**F. Installation.** The installation work shall be done by bolting methods alone. The requirements of the S.C.M. shall apply.

**G. Posts.** Bridge railing posts shall be installed as truly vertical as possible within the following tolerance limit: 8 mm in any direction as measured from the top of the deck to the top of the post.

Bridge railing transition posts shall be installed at the location and in the manner indicated on the Contract plans. The Contractor shall carefully excavate for all post holes. Post holes and post foundation structures shall be backfilled and compacted in accordance with §203-3.15, "Fill and Backfill at Structures, Culverts, Pipes, Conduits and Direct Burial Cables". Prior to acceptance, all posts shall be plumb to a tolerance of +/- 8 mm.

Posts, in their final position, shall satisfy the Material Requirements for "Defects" of §712-17.

The tops of all posts and the top of the rail splice plate kerf shall be sealed with roofing cement or otherwise protected from direct exposure to weather.

**H. Rails.** The rails of timber railings shall span a minimum of four (4) posts. Bolts on traffic face of rail shall be round head square neck threaded bolt. Railing splices shall be installed in the manner indicated on the Contract plans.

**I. Washers.** Unless otherwise noted, malleable iron washers shall be provided under bolt heads and under nuts that are in contact with wood. Washers may be omitted under heads of dome-head timber bolts when the size and strength of the head is sufficient to develop connection strength without wood crushing.

**J. Erection Inspection.** All erection shall be subject to the inspection of the Engineer who shall be given all facilities required for a visual inspection of workmanship and materials.

**597-4 METHOD OF MEASUREMENT**

**597-4.01 Timber Bridge Railing.** The quantity to be paid for timber bridge railing shall be the number of meters measured along the centerline of railing between the extreme outer limits indicated on the Contract plans.

**597-4.02 Timber Bridge Railing Transition.** The quantity to be paid for timber bridge railing transition shall be the number of transitions required.

**597-5 BASIS OF PAYMENT.** The unit price bid per linear meter of the timber railing shall include the cost of all labor, material and equipment necessary to do the work.

The price bid per timber bridge railing transition shall include the cost of all labor, material and equipment necessary to do the work.

All drilling and grouting work, if permitted, will be done at the contractor's expense.

*Payment will be made under:*

Item No.	Item	Pay Unit
597.10	Timber Railing	Meter
597.20	Timber Railing Transition	Each

**SECTIONS 598 AND 599 (VACANT)**

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