SECTION 709 - REINFORCING STEEL

709-01 BAR REINFORCEMENT, GRADE 420

SCOPE. This specification covers the material requirements for deformed billet steel and deformed rail steel reinforcing bars used in portland cement concrete. Plain and deformed steel for the fabrication of spirals is included.

MATERIALS REQUIREMENTS

A. Deformed Bar Reinforcement. Steel reinforcing bars shall be deformed billet steel bars meeting the requirements of ASTM A615, Grade 420, or deformed rail steel bars meeting the requirements of ASTM A996M, Grade 420 including Supplementary Requirement S1.

B. Spirals. Spirals shall be plain wire meeting the requirements of ASTM A82, or plain or deformed bars in coils or cut lengths, meeting the requirements of ASTM A615, Grade 420.

When specified the spirals shall be epoxy coated in accordance with the applicable requirements of §709-04 or §709-08.

C. Samples and Tests. Sampling and testing will be conducted as directed by the Materials Bureau.

BASIS OF ACCEPTANCE. Reinforcing bars and spirals will be considered for acceptance on the basis of the Manufacturer's name appearing on the Approved List, and certification, in accordance with the procedural directives of the Materials Bureau.

Alternately, reinforcing bars and spirals from a Manufacturer not appearing on the Approved List may be considered for acceptance in mill bonded, stock lot quantities at the fabricators or the epoxy coating applicators, based on sampling and testing in accordance with the procedural directives of the Materials Bureau.

709-02 WIRE FABRIC FOR CONCRETE REINFORCEMENT

SCOPE. This specification covers the material requirements for wire fabric reinforcement used in portland cement concrete pavement, precast concrete products and other concrete construction.

MATERIALS REQUIREMENTS. Wire fabric reinforcement shall conform to the requirements of either ASTM A185 or ASTM A497, exclusive of the portions pertaining to rejection, retests and rehearing, except as indicated on the plans, in the proposal or as modified herein.

The weld shear test will not be required for acceptance of wire fabric for concrete pipe.

BASIS OF ACCEPTANCE. Wire fabric reinforcement will be considered for acceptance on the basis of the Manufacturer's name appearing on the Approved List and certification in accordance with procedural directives of the Materials Bureau.

Alternately, wire fabric from a Manufacturer not appearing on the Approved List may be considered for acceptance in stock lot quantities at manufacturing locations based on sampling and testing in accordance with procedural directives of the Materials Bureau.

709-03 BAR REINFORCEMENT, GRADE 300

SCOPE. This specification covers the material requirements for deformed billet steel reinforcing bars used in portland cement concrete.

MATERIAL REQUIREMENTS. Reinforcing bars shall conform to the requirements of ASTM A615, Grade 300.
§709-03

Samples and Tests. Sampling and testing shall be conducted as directed by the Materials Bureau.

BASIS OF ACCEPTANCE. Reinforcing bars will be considered for acceptance in stock lot quantities at the manufacturing supply locations in accordance with the procedural directives of the Materials Bureau.

709-04 EPOXY-COATED BAR REINFORCEMENT, GRADE 420

SCOPE. This specification covers bar reinforcement with protective epoxy coatings applied by the electrostatic spray method.

MATERIAL REQUIREMENTS

A. Bar Reinforcement. Steel reinforcing bars shall conform to the requirements of §709-01, Bar Reinforcement, Grade 420.

B. Epoxy Coating Material. The epoxy coating material shall be an organic, powdered-epoxy resin that is applied by electrostatic methods.

Epoxy coating material shall be approved by the Materials Bureau. Detailed requirements and procedures for the acceptance of epoxy coating materials are available from the Materials Bureau. Upon approval of the product, the epoxy coating will be placed on a Department “Approved List” of materials. The epoxy coating manufacturer shall supply written certification to the coating applicator that the coating material is the same as that approved by the Materials Bureau.

C. Patching Material. Patching or repair materials shall be supplied by the epoxy coating manufacturer. The patching material shall be compatible with the epoxy coating, inert in concrete, and suitable for use in making shop or field repairs.

Coating Application

A. Coating Applicator. The coating applicator's facilities shall be approved by the Materials Bureau. Applications for approval of facilities shall be made to the Materials Bureau by the coating applicator. Upon approval, the name and address of the coating applicator will be placed on the Department’s list of “Approved Applicators.”

B. Surface Preparation

1. The surface of bars to be coated shall be blast cleaned in accordance with the Steel Structures Painting Council - Surface Preparation Specification No. 10 (SSPC-SP10), Near White Blast Cleaning. After blasting, the cleaned surface of the bar shall be defined by SSPC-Vis 1-89, Pictorial Standards A SP 10, B SP 10, or C SP 10, as applicable.

2. A suitable anchor pattern shall be produced by the cleaning media. A target profile of approximately (1/3) the coating thickness shall be considered suitable as an anchor pattern. Measurements shall be taken using a surface profile gage, or replica tape, approved by the Materials Bureau.

3. The powdered epoxy resin coating shall be applied to the cleaned surface as soon as possible after cleaning and before visible oxidation occurs. In no case shall more than 8 hours elapse between cleaning and coating.

C. Coating Application. The powdered epoxy resin coating shall be electrostatically applied to preheated bars, and cured in accordance with the recommendations of the coating manufacturer. The epoxy coating may be applied before or after fabrication (bending) of the reinforcement bars.

D. Coating Thickness

1. The epoxy coating shall be applied as a uniform, smooth coat. After curing, the coating thickness
shall be $0.25 \pm 0.05$ mm.

2. Coating thickness shall be determined by taking measurements on a minimum of five coated bars from each production lot.

Five spot measurements shall be obtained from evenly spaced locations along each side of the test bar (a minimum of 10 spot measurements per bar). A spot measurement is defined as the average of three individual readings obtained from three adjacent areas on the body, or on the deformations of the bar.

3. For acceptance purposes at least ninety (90) percent of all spot thickness measurements shall be 0.20 mm to 0.30 mm after cure, and no spot measurement of coating thickness shall be less than 0.20 mm or greater than 0.38 mm.

4. Coating thickness shall be measured by the method outlined in ASTM G12, except that the number and location of thickness measurements shall be in accordance with this specification. All magnetic gages shall be approved by the Materials Bureau.

E. Continuity of Coating

1. The coating shall be checked visually after cure for continuity. It shall be free from holes, voids, contamination, cracks and damaged areas.

2. The coating shall have not more than two holidays (pinholes not visible to the naked eye) in any 0.3 m length of the coated bar. A 67.5 volt, 80,000 ohm, d-c holiday detector shall be used in-line to check the coating for holidays at all times during the application of epoxy protective coating. Bar reinforcement that is coated when the in-line detector is inoperable shall be automatically rejected.

F. Coating Cure. The coating applicator shall check each production lot to determine that the entire production lot of coated bars is in a fully-cured condition.

G. Adhesion of Coating

1. The adhesion of the coating shall be evaluated on a minimum of two bars from each production lot. The coated bar shall be bent 120 degrees (after rebound) around a mandrel of specified size as designated in Table 709-4. The bend shall be done at a uniformly slow rate and may take up to 45 seconds to complete. The bend test specimen shall be positioned so that the two longitudinal deformations are in a plane perpendicular to the mandrel radius. The test specimens shall be between 20°C and 30°C at the time of testing.

2. No cracking, disbondment, or other coating defect shall be visible to the naked eye on the outside, or on the inside radius of the bent bar.

3. If both test specimens show evidence of cracking or disbondment, the production lot represented by the samples shall be rejected.

If only one of the two test specimens shows evidence of cracking or disbondment of coating, two additional random samples shall be tested. If the test results from both retests show no defects, the production lot represented by the samples shall be accepted. If the test results of either retest fails, the production lot represented by the samples will be rejected.

<table>
<thead>
<tr>
<th>TABLE 709-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>BEND TEST REQUIREMENTS</td>
</tr>
<tr>
<td>Bar Number</td>
</tr>
<tr>
<td>Mandrel Diam. (mm)</td>
</tr>
</tbody>
</table>

Note: Numbers in parenthesis are bar sizes marked in eighths of inches.
§709-04

SAMPLING AND TESTING

A. Lot Size. For test purposes a production lot is the smallest number of reinforcement bars of the same type, heat and size as determined by the following requirements:

1. A lot shall not exceed a single order.

2. A lot shall consist of the number of bars as defined by the coating applicator, except that it shall not exceed the number of reinforcement bars coated within a single working shift.

B. Quality Control. The coating applicator shall be responsible for performing quality control and test. This will include inspection for compliance with the requirements of Coating Thickness, Continuity of Coating, and Coating Cure, and the testing required under Adhesion of Coating.

C. Plant Inspection

1. The Department reserves the right to have its authorized representative observe the preparation, coating, and testing of the reinforcement bars. The representative shall have free access to the plant. Any work done when access has been denied shall be automatically rejected.

2. If the representative elects, lengths of coated bars may be taken from the production run, on a random basis, for test, evaluation and check purposes by the Materials Bureau.

Repair of Coated Bars

A. Repairs at the Coating Applicator's Facility

1. Repairs will not be allowed on epoxy-coated reinforcement bars that do not meet the requirements for Coating Thickness, Continuity of Coating, Coating Cure, or Adhesion of Coating. Reinforcement bars exhibiting any one of these defects shall be replaced, or stripped of epoxy coating, recleaned, and recoated in accordance with this specification.

2. All other damage that occurs from handling, or for other reasons, at the coating applicator's facility shall be repaired with patching material. All repairs shall be performed as soon as possible and before visible rust (oxidation) appears on the steel surface. All repairs shall be performed in accordance with the recommendations of the manufacturer of the patching material.

3. The coating applicator shall be responsible for repair to the coating due to damage at the coating applicator's facility.

B. Repair at the Fabrication Facility

1. The fabricator shall be responsible for repair to the coating due to damage during fabrication and handling at the fabricator's facility.

2. All coating damage due to fabrication, or handling, or for other reasons that occurs at the fabricator's facility shall be repaired with patching material.

3. Wherever bond loss or damaged areas of coating exist, they shall be cleaned and repaired. The cleaning shall remove loose or deleterious material, or both. In cases where rust is present it shall be removed by blast cleaning prior to repairs. The requirements of Surface Preparation, part 2a., shall apply.

4. Visible cracks, including hairline cracks without bond loss that occur due to fabrication of the bars, shall be repaired with patching material.

5. When coated bars are sheared, saw-cut, or cut by other means during the fabrication process, the exposed ends shall be coated with patching material.

6. All repairs shall be performed as soon as possible and before visible rust (oxidation) appears on the steel surface.
§709-07

HANDLING AND STORAGE. All systems for handling coated bars shall have padded contact areas for the bars. All bundling bands shall be padded and all bundles shall be lifted with a strong back, multiple supports or a platform bridge so as to prevent bar to bar abrasion from sags in the bar bundle. The bars or bundles shall not be dropped or dragged.

Epoxy-coated bar reinforcement shall be stored above the ground on wooden or padded supports. Epoxy-coated bar reinforcement shall not be stored unprotected outdoors. All coated bars that are stored outdoors shall be protected from sunlight and moisture, using opaque waterproof covers. The covers shall be placed in a manner that will permit constant air circulation so as to minimize the formation of condensation on the epoxy-coated bar surface.

BASIS OF ACCEPTANCE. Epoxy-Coated Bar Reinforcement, Grade 420 will be considered for acceptance in stock lot quantities at the coating applicator's facility in accordance with the procedural directives of the Department, issued by the Materials Bureau.

709-05 STUD SHEAR CONNECTORS

SCOPE. This specification covers the material requirements for stud shear connectors used in bridge structures.

MATERIALS REQUIREMENTS. Steel used for the manufacture of stud shear connectors shall conform to the Specification for Steel Bars, Carbon, Cold Finished, Standard Quality, ASTM A108, UNS Designation G10100 thru G10200, either Semi-Killed, or Killed Deoxidation.

Stud shear connectors shall be furnished in the dimension shown on the Contract Plans.

BASIS OF ACCEPTANCE. Acceptance of this material will be based on the manufacturer's certification of compliance with these specification requirements.

ASTM quality control tests shall have been made not more than six months prior to the date of manufacture of the studs.

709-06 LOW-RELAXATION PRESTRESSING STEEL, GRADE 1860

SCOPE. This specification covers the material requirements for low-relaxation prestressing steel used in the fabrication of prestressed concrete units.

MATERIAL REQUIREMENTS. Low-relaxation prestressing steel shall conform to the requirements of ASTM A416M, Grade 1860. Low-relaxation prestressing steel shall be free of dirt, oil, paint, mill scale, corrosion, coatings, lubricants, or any other foreign material that may prevent an acceptable bond between the steel and the concrete.

SAMPLES AND TEST. Sampling and testing shall be conducted as directed by the Materials Bureau.

BASIS OF ACCEPTANCE. Low-relaxation prestressing steel will be considered for acceptance based on the manufacturer's certification of compliance with these specifications, and on the appearance of the manufacturer's name on the Department's Approved List for low-relaxation prestressing steel.

Manufacturers requesting to be added to the Department's Approved List shall contact the Materials Bureau.

709-07 STONE CURB ANCHOR BARS

SCOPE. This specification covers the material requirements for stone curb bars used in bridge construction.
§709-07

MATERIAL REQUIREMENTS. Anchor bars for Types F₁, G₁, M, R₁, R₂, S and T₁ curbs shall meet the requirements of ASTM A615M, Grade 300 or Grade 420 deformed billet-steel bars shall be galvanized in accordance with §719-01, Galvanized Coatings and Field Repair Methods, Type I. As an alternate to galvanizing, the bars may be treated with a protective epoxy coating. This coating shall be applied by either the electrostatic spray method or the electrostatic fluidized bed method, as specified in §709-04 Epoxy Coated Bar Reinforcement, Grade 420; or in accordance with the applicable requirements of §705-14 Longitudinal Joint Ties.

BASIS OF ACCEPTANCE. The stone curb anchor bars will be accepted when on the basis of evaluation by the Engineer, the product complies with these specification requirements.

709-08 EPOXY COATED WIRE FABRIC REINFORCEMENT

SCOPE. This specification covers sheets of wire fabric reinforcement with protective epoxy coatings that are applied by the electrostatic spray method or electrostatic fluidized bed method.

MATERIAL REQUIREMENTS

A. Wire Fabric Reinforcement. Wire fabric reinforcement shall conform to the requirements of §709-02.

B. Epoxy Coating Material

1. The epoxy coating material shall be an organic, powered epoxy resin that is applied by electrostatic methods. Epoxy coating materials shall be approved by the Materials Bureau. Detailed requirements and procedures for the acceptance of epoxy coating materials are available from the Materials Bureau. Upon approval of the product, the epoxy coating will be placed on a Department Approved List of materials.

2. The epoxy coating manufacturer shall supply written certification to the coating applicator that the coating material is the same as that approved by the Materials Bureau.

C. Patching Material. Patching or repair materials shall be supplied by the epoxy coating manufacturer. The patching material shall be compatible with the epoxy coating, inert in concrete, and shall be suitable for use in making field repairs.

Coating Application

A. Coating Applicator. The coating applicator's facilities shall be approved by the Materials Bureau. Applications for approval of facilities shall be made to the Materials Bureau by the coating applicator. Upon approval, they will be placed on the Department's list of “Approved Applicators For Epoxy Coated Wire Fabric Reinforcement.”

B. Surface Preparation

1. The surface wire fabric to be coated shall be blast cleaned in accordance with the Steel Structures Paint Council - Surface Preparation Specification No. 10 (SSPC-SP10), near White Blast Cleaning. After blasting, the cleaned surface of the bar shall be defined by SSPC-Vis 1-89, Pictorial Standards A SP 10, B SP 10, or C SP 10, as applicable.

2. The powdered epoxy resin coating shall be applied to the cleaned surface as soon as possible after cleaning and before visible oxidation occurs. In no case shall more than 8 hours elapse between cleaning and coating.

C. Coating Application. The powdered epoxy resin coating shall be electrostatically applied in accordance with the recommendations of the coating manufacturer.
§709-08

D. Coating Thickness. The epoxy coating shall be applied as a smooth, uniform coat. After curing, the coating thickness shall be a minimum of 0.10 mm. Coating thickness shall be controlled by taking measurements on a representative sample from each production lot. Coating thickness measurements shall be conducted by the method outlined in ASTM B499.

E. Continuity of Coating

1. The coating shall be checked visually after cure for continuity. It shall be free from holes, voids, contamination, cracks and damaged areas.

2. The coating shall not have more than two holidays (pinholes visible to the naked eye) in any 0.3 m length of a coated single wire. A holiday detector shall be used, in accordance with the manufacturer’s instructions, to check the coating for holidays. Sharp edges at the welded intersection of the wires shall not be considered to be holidays.

F. Coating Cure. The coating applicator shall check each production lot to determine that the entire production lot of coated fabric is in a fully-cured condition.

G. Flexibility of Coating

1. The flexibility of the coating shall be evaluated on two representative sections of wire fabric from each production lot or two #16, Grade 420 reinforcing bars that have been coated simultaneously with the wire fabric. A representative wire from the wire fabric shall be bent 120 degrees (after rebound) around a pin or mandrel of 10 diameters or alternately, a reinforcing bar shall be bent 120 degrees around a 150 mm diameter pin or mandrel. Bending shall be done at a minimum rate and may take up to one minute to complete. The test specimens shall be a thermal equilibrium between 20° and 30°C at the time of testing.

2. When examined by the naked eye, the outside radius of the bent wire or bar shall be free of cracks in the coating.

TESTING AND SAMPLING

A. Lot Size. For test purposes a production lot is the smallest number of sheets of wire fabric of the same style (gauge, spacing size) from a given manufacturer as determined by the following requirements:

1. A lot shall not exceed a single order, or delivered load of 1500 sheets, whichever is smaller.

2. A lot shall consist of the number of sheets as defined by the coating applicator except that it shall not exceed the number of sheets coated within a single working shift.

3. A lot shall consist of the number of sheets of mesh coated with the same batch or lot of epoxy.

B. Quality Control. The coating applicator shall be responsible for performing quality control and tests. This will include inspection for compliance with the requirements of Coating Thickness, Continuity of Coating and Coating Cure and the testing required under Flexibility of Coating.

C. Plant Inspection.

1. The Department reserves the right to have its authorized representative observe the preparation, coating and testing of wire fabric. The representative shall have free access to the plant. Any work done while access was denied will be rejected.

2. If the representative elects, samples of coated fabric may be taken from the production run, on a random basis, for test, evaluation and check purposes by the Materials Bureau.
§709-08

REPAIR. Epoxy coated wire fabric reinforcement which does not meet the requirements of Coating Thickness, Continuity of Coating, Coating Cure or Flexibility of Coating shall not be repaired. Reinforcement with these defects shall be replaced or stripped of epoxy coating, recleaned and recoated in accordance with the requirements of this specification.

Any damage to the coated reinforcement, occurring at the coating applicator’s facility shall be cleaned and repaired with patching material. The cleaning shall remove loose or deleterious material or both. If rust is present, it shall be removed by blast cleaning prior to patching.

HANDLING. All systems for coated wire fabric shall have padded contact areas, wherever possible. All bundling bands shall be padded and all bundles shall be lifted with a strong back, multiple supports or a platform bridge so as to prevent sheet to sheet abrasion from sags in the bundle. The sheets or bundles shall not be dropped or dragged.

BASIS OF ACCEPTANCE. Epoxy coated wire fabric reinforcement will be considered for acceptance in stock lot quantities at manufacturing supply locations in accordance with procedural directives of the Materials Bureau.

709-09 COLD-DRAWN WIRE FOR CONCRETE REINFORCEMENT

SCOPE. This specification covers the material requirements for cold-drawn wire for concrete reinforcement used in portland cement concrete pavement, precast concrete products and other concrete construction.

MATERIAL REQUIREMENTS. Cold-drawn wire shall conform to the requirements of either ASTM A82 or ASTM A496, exclusive of the portions pertaining to rejection, retests and rehearing, except as indicated on the plans or in the proposal.

BASIS OF ACCEPTANCE. Cold-drawn wire will be considered for acceptance on the basis of the Manufacturer’s name appearing on the Approved List and certification in accordance with procedural directives of the Materials Bureau.

Alternately, cold-drawn wire from a Manufacturer not appearing on the Approved List may be considered for acceptance in stock lot quantities at manufacturing locations based on sampling and testing in accordance with procedural directives of the Materials Bureau.

709-10 MECHANICAL CONNECTORS FOR REINFORCING BAR SPLICES

SCOPE. This specification covers the material requirements for mechanical connectors for splicing reinforcing bars.

GENERAL. Mechanical connectors for use on epoxy coated reinforcing bars shall be epoxy coated. Mechanical connectors coated prior to installation shall be coated in conformance with the applicable requirements for epoxy coatings contained in §709-04, Epoxy Coated Reinforcement, Grade 420. Mechanical connectors coated after installation shall be coated with an epoxy repair material compatible with the reinforcing bar epoxy coating. The assembled connection on epoxy coated reinforcing bars shall have no exposed uncoated steel. Any damage to the epoxy on the mechanical connector or reinforcing bars shall be repaired with a compatible epoxy repair material.

MATERIAL REQUIREMENTS. Mechanical connectors will be tested for the following three parameters:

- The maximum slip, at 50% of the yield strength of the reinforcing bar, shall be 0.254 mm. At least 70% of the maximum slip shall have occurred on the first cycle.
- The maximum slip, at 90% of the yield strength of the reinforcing bar, shall be 0.457 mm.
- The tensile strength of the splice shall be at least 90% of the specified minimum tensile strength of the reinforcing bar.
§ 709-11

BASIS OF ACCEPTANCE. Application for approval of mechanical connectors shall be submitted to the Materials Bureau. Detailed requirements and procedures for approval are available from the Materials Bureau. Upon approval the name of the mechanical connector will be placed on an Approved List.

Project acceptance will be based on the manufacturer's name and type of mechanical connector appearing on the Department's Approved List titled "Mechanical Connectors for Reinforcing Bar Splices."

709-11 GALVANIZED BAR REINFORCEMENT, GRADE 420

SCOPE. This specification covers bar reinforcement with a hot dipped galvanized coating. Bar reinforcement will be coated before or after bending, as required by the payment specification.

MATERIAL REQUIREMENTS

A. Reinforcing Steel. The material for the reinforcing steel shall meet the requirements of § 709-01 Bar Reinforcement, Grade 420.

B. Galvanizing. The bar reinforcement shall be galvanized in accordance with ASTM A767 “Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement” to a Class I Coating. Chromate treatment shall not be required.

C. Embrittlement Testing. The coating applicator shall take the necessary precautions to prevent embrittlement by conforming to the requirements of STM A-143 “Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedures for Detecting Embrittlement”. The test for embrittlement shall be conducted by the coating applicator or his representative according to the bend test described in ASTM A-615 “Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement”. The coating applicator shall include one reinforcing bar test specimen at least 1 meter long for each lot for this testing. The test specimen shall have the same diameter as the lot members and shall be quenched, and galvanized in the same manner and at the same time as the bars whose characteristics it is intended to represent. If the test specimen cracks or otherwise fails the bend test, the entire lot it represents shall be rejected.

For test purposes, a lot is any one of the following:

- Reinforcing bars of the same diameter comprising a single order
- A number of reinforcing bars of the same diameter identified as a lot by the coating applicator, providing the bars are all been coated within a single production shift
- One thousand reinforcing bars of the same diameter. Notwithstanding the above two, no lot shall exceed one thousand bars.

D. Identification. The Contractor shall coordinate the tagging and identification requirements for the project and for lot identification and shall provide a non-destructive metal tag system for bent reinforcing bars.

E. Inspection. The materials Bureau shall be notified 30 days prior to the beginning of the coating application. The Materials Bureau representative and any other Department authorized representative shall have free access to the plant for inspection. Work done while any Department representative has been refused access shall be automatically rejected.

If the Department representative so elects, preparation of the bars, quenching and coating shall be done in his presence. On a random basis, lengths of coated bars may be taken by the representative from the production run at the point of coating application for test, evaluation and check purposes.

F. Zinc Rich Paint. Zinc rich paint used for field repairs of galvanized coatings shall meet the following requirements:

- One application of the material shall provide a dry film thickness of 50 mm
- The dried fill shall have a minimum zinc dust content of 94% by mass
- The paint shall be compatible with the galvanizing and shall be inert in concrete
§709-11

- The brand of material used shall be approved by the galvanizer.

**BASIS OF ACCEPTANCE.** The coating applicator shall furnish a Certificate of Compliance with each shipment of coated bars. The Certificate of compliance shall state the representative samples of the coated bars have been tested and that the test results conform to the requirements described herein. Test results shall be retained and made available, if requested. The Certificate of Compliance and the documentation required for uncoated reinforcement bars by §709-01 Bar Reinforcement, Grade 420 shall accompany each shipment to the job site.

**SECTION 710 - FENCE AND GUIDE RAIL**

**710-01 ALUMINUM FENCE FABRIC**

**SCOPE.** This specification covers the requirements for aluminum alloy, chain link fence fabric.

**MATERIAL REQUIREMENTS.** Aluminum chain link fence fabric shall conform to the requirements of AASHTO M181, Chain Link Fence, Type III, except as modified herein.

**A. Wire.** The aluminum alloy wire shall be 6061-T94 conforming to the applicable chemical composition limits of ASTM B211M.

**B. Mesh Size and Wire Diameter.** The size of the mesh and the wire diameter shall be 50 mm and 9 gage (3.759 mm) respectively unless otherwise specified in the plans or proposal.

**SHIPPING.** Fabric shall be furnished in a clean condition free of all foreign material, including oil, dust, film, etc.

**BASIS OF ACCEPTANCE.** Acceptance will be based on sampling and testing conducted by the Materials Bureau in accordance with procedural directives of the Department.

**710-02 GALVANIZED STEEL FENCE FABRIC**

**SCOPE.** This specification covers the requirements for galvanized steel chain link fence fabric.

**MATERIALS REQUIREMENTS.** Galvanized steel chain link fence fabric shall conform to the requirements of AASHTO M181, Chain Link Fence, Type I, except as modified herein.

**A. Mesh Size Coated Wire Diameter.** The size of the mesh and the coated wire diameter shall be 50 mm and 9 gage (3.759 mm) respectively unless otherwise specified in the plans or proposal.

**B. Zinc-Coating.** The 50 mm mesh shall be galvanized with a Class D coating (610 g/m²) by the hot-dip process after weaving. When 25 mm mesh is specified, it shall be galvanized with Class D Coating (610 g/m²) before weaving by the electrolytic process.

**SHIPPING.** Fabric shall be furnished in a clean condition free of all foreign material, including oil, dust, film, etc.

**BASIS OF ACCEPTANCE.** Acceptance will be based on sampling and testing conducted by the Materials Bureau in accordance with procedural directives of the Department.

**710-03 VINYL COATED STEEL FENCE FABRIC**

**SCOPE.** This specification covers the material requirements for Class A-Extruded Polyvinyl Chloride (PVC)-Coated Steel Fence Fabric, and Class B-Bonded Polyvinyl Chloride (PVC)-Coated Steel Fence Fabric.
MATERIAL REQUIREMENTS. Vinyl coated steel chain link fence fabric shall conform to the requirements of AASHTO M181, Chain Link Fence, Type IV, except as modified herein.

A. Mesh Size. The size of the mesh shall be 50 mm unless otherwise specified in the contract documents.

B. Wire Diameter. The wire diameter shall be as follows unless specified otherwise in the contract documents:

1. Class A-Extruded Polyvinyl Chloride (PVC)-Coated Steel shall have a 9-gage (3.759 mm) metallic coated core wire.

2. Class B-Bonded Polyvinyl Chloride (PVC)-Coated Steel shall have an 11-gage (3.048 mm) metallic coated core wire.

C. Vinyl Coating. The color of the vinyl coating shall be dark green unless shown otherwise in the contract documents. The Engineer shall have the option of approving an alternate color if the specified color is unavailable. An adhesion test is not required for coatings which are extruded or extruded and bonded.

SHIPPING. Fabric shall be furnished in a clean condition, free of all foreign material, including oil, dust, film, etc.

BASIS OF ACCEPTANCE. Acceptance will be based on sampling and testing conducted by the Materials Bureau in accordance with procedural directives of the Department.

710-04 ALUMINUM COATED STEEL FENCE FABRIC

SCOPE. This specification covers the requirements for Aluminum Coated Chain Link Fence Fabric.

MATERIAL REQUIREMENTS. Aluminum coated steel fabric shall conform to the requirements of AASHTO M181, Chain Link Fence, Type II, except as modified herein.

Mesh Size and Coated Wire Diameter. The size of the mesh and the coated wire diameter shall be 50 mm and 9 gage (3.759 mm) respectively unless otherwise specified in the contract documents.

SHIPPING. Fabric shall be furnished in a clean condition free of foreign material including oil, dust, film, etc. except that a methacrylate lacquer may be used to protect it under storage conditions.

BASIS OF ACCEPTANCE. Acceptance will be based on sampling and testing conducted by the Materials Bureau in accordance with procedural directives of the Department.

710-05 COATED STEEL FENCE FABRIC
(95% ZINC 5% ALUMINUM - MISCHMETAL ALLOY)

SCOPE. This specification covers the requirements for coated steel fence fabric (95% zinc 5% aluminum - mischmetal alloy).

MATERIAL REQUIREMENTS. Coated steel fence fabric (95% zinc 5% aluminum - mischmetal alloy) shall conform to the dimensional and strength requirements of AASHTO M 181 Chain Link Fence Type I, except as modified herein.

A. Mesh Size. The size of the mesh shall be 51 mm unless otherwise specified in the contract documents.

B. Coated Wire Diameter. The size of the coated wire diameter shall be 9 gage (3.759 mm) unless otherwise specified in the contract documents.
$710-05$

C. Coating. The coating shall meet the requirements of ASTM F 1345 Class 2 (305 g/m²).

SHIPPING. Fabric shall be furnished in a clean condition, free of all foreign material including oil, dust, film, etc.

BASIS OF ACCEPTANCE. Acceptance will be based on sampling and testing conducted by the Materials Bureau in accordance with procedural directives of the Department.

710-06 THROUGH 710-09 (VACANT)

710-10 STEEL AND IRON POSTS, RAILS, BRACES, AND FITTINGS FOR CHAIN LINK FENCE

SCOPE. This specification covers the requirements for steel and iron posts, rails, braces and fittings used in erecting chain link fence. The contractor shall have the option of supplying any one of the post sections shown on the Standard Sheets.

MATERIALS REQUIREMENTS. The following specifications cover the material requirements for each of the sections, fittings, and tension wires shown in the Post and Rail schedule on the Standard Sheets for Chain Link Fence:

A. Class A, Schedule 40 Pipe. Posts, rails and braces shall be standard weight Schedule 40 Pipe, manufactured in accordance with ASTM F1083, except that the protective coating system shall be as specified herein.

B. Class B, Steel Tubing. Posts, rails and braces shall be manufactured by one of the following methods with the steel conforming to ASTM A1011 or ASTM A1008 and A1011/A1011M with a minimum yield strength of 345 MPa:

- Furnace butt welded, continuous welded
- Cold rolled and electric resistance welded
- Seamless

The tubing shall conform to the following dimensions:

<table>
<thead>
<tr>
<th>Nominal Size</th>
<th>Outside Diameter, mm</th>
<th>Minimum Wall Thickness, mm</th>
<th>Mass Kg/m</th>
</tr>
</thead>
<tbody>
<tr>
<td>1¼ NPS</td>
<td>42.16</td>
<td>2.819</td>
<td>2.732</td>
</tr>
<tr>
<td>1½ NPS</td>
<td>48.26</td>
<td>3.048</td>
<td>3.394</td>
</tr>
<tr>
<td>2 NPS</td>
<td>60.32</td>
<td>3.302</td>
<td>4.639</td>
</tr>
<tr>
<td>2½ NPS</td>
<td>73.02</td>
<td>4.064</td>
<td>6.904</td>
</tr>
</tbody>
</table>

C. Class C, Rolled-Formed Shapes. Posts, rails and braces shall be roll formed shapes which meet the requirements of ASTM F1043.

D. H-Posts. H Posts shall be fabricated from hot-rolled steel sections which meet the requirements of ASTM F1043.

E. Fittings. Fittings shall be manufactured of weldable steel, malleable iron, cast steel, cast iron, or aluminum alloy.

1. Weldable Steel. Weldable steel shall be commercial quality or better, produced by one of the following processes: Open-Hearth, Electric Furnace, or Basic Oxygen.


3. Cast Iron. Cast iron shall conform to the requirements of §715-05.
4. **Cast Steel.** Cast steel shall conform to the requirements of §715-02.

5. **Aluminum Alloy.** Aluminum alloy shall meet the material requirements of §710-11.

Fittings other than aluminum fittings in contact with galvanized surfaces shall be galvanized in accordance with §719-01, Type II. Fittings in contact with aluminum surfaces shall be made of aluminum alloy or be aluminum coated in accordance with §719-03.

**F. Tension Wire.** Tension wire shall meet the requirements of ASTM A641M, as modified herein. The wire shall be a no. 7 gauge minimum 4.50 mm in diameter, having a minimum tensile strength of 550 MPa., with a minimum galvanized coating of 240 g/m² or a minimum aluminum coating of 120 g/m².

**Protective Coating Systems.** Posts, rails and braces shall be coated with a protective coating system conforming to one of the following depending on structural member.

A. **Class A Schedule 40 Pipe; Class B Steel Tubing**

1. **Galvanized Coatings.** Galvanized both inside and out in accordance with ASTM F1083.

2. **Combined Coatings**

   a. **External surfaces.** The external surfaces shall be coated with the following combined coating system:

      (1) **Hot Dip Galvanizing.** The external surface shall be hot-dip galvanized with “Special High Grade” or “High Grade” slab zinc conforming to ASTM B6. The weight of the coating shall be a minimum 275 g/m².

      (2) **Chromate Conversion Coating.** Chromate conversion coating shall be specifically designed for use as a pretreatment of galvanized surfaces. The coating shall be applied prior to the application of the thermoplastic acrylic coating at the manufacturer's recommended rate.

      (3) **Clear Coating.** A thermoplastic acrylic or cross linked polyester coating shall be applied with a minimum dry film thickness of 7.62 μm.

   b. **Internal Surfaces.** The internal surfaces of the pipe or tubing shall be coated with one of the following:

      (1) **Zinc rich coating.** The zinc rich coating shall contain not less than 87% zinc dust by weight and shall be capable of providing galvanic protection. The minimum coating thickness shall be 7.62 μm.

      (2) **Cross linked polyester coating containing a corrosion inhibitor**

      (3) **Hot-dip galvanized coating.** The hot-dipped galvanized coating shall average not less than 105 g/m² and no single specimen shall show less than 75 g/m².

B. **Class C Roll Formed Shapes and H Posts.** All surfaces shall be hot-dip galvanized in accordance with the requirements of §719-01, Type I.

C. **Class A Schedule 40 Pipe; Class B Steel Tubing; Class C Roll Formed Shapes, H-Posts.**

1. **Aluminum with Chromate Coatings.** All surfaces shall be given a hot-dipped 99% pure aluminum, Type II coating. The aluminum coating shall average 200 g/m² and no single specimen shall show less than 185 g/m² when tested in accordance with ASTM A428. The coating shall meet the adherence and quality requirements of §719-03. The aluminum coated surfaces shall be given a colorless chromate chemical treatment. The external surfaces shall be given a colorless protective
resin coating to protect the material from abrasion in shipment and storage.

2. Mischmetal Alloy Coating (95% Zinc 5% Aluminum). Coating shall meet the requirements of ASTM F 1043 Protective Coatings on Steel Framework for Fences Type C, except the coating weight shall be 305 g/m².

BASIS OF ACCEPTANCE. Acceptance will be based on the manufacturer's certification, together with supplemental inspection at the project site in accordance with the procedural directives of the Materials Bureau.

710-11 ALUMINUM POSTS, RAILS, BRACES AND FITTINGS
FOR CHAIN LINK FENCE

SCOPE. This specification covers the requirements for aluminum posts, rails, braces and fittings to be used in erecting chain link fencing.

MATERIAL REQUIREMENTS. Posts, Rails, Braces and Fittings shall conform to the following materials specifications, alloy, temper and dimensional requirements in Table below.

BASIS OF ACCEPTANCE. Acceptance will be based on manufacturer's certification, with supplementary sampling and testing at the discretion of the Materials Bureau.

<table>
<thead>
<tr>
<th>Material</th>
<th>Material Spec.</th>
<th>Alloy &amp; Temper</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fabric Ties</td>
<td>715-04</td>
<td>5052-H-38, 1100-H18 or 3003-H14</td>
<td>3.50 mm nom.dia or 12.70 mm wide X 1.5 mm thick</td>
</tr>
<tr>
<td>Top &amp; Bottom Tension Wires</td>
<td>715-04</td>
<td>6061-T94</td>
<td>4.90 mm nom. dia.</td>
</tr>
<tr>
<td>Hog Rings</td>
<td>715-04</td>
<td>6061-T94</td>
<td>2.80 mm nom. dia.</td>
</tr>
<tr>
<td>Stretcher Bars</td>
<td>715-04</td>
<td>6063-T5 or 6063-T6</td>
<td>6 mm X 19 mm</td>
</tr>
<tr>
<td>Truss Rods</td>
<td>715-04</td>
<td>6061-T6 or 6063-T6</td>
<td>9.50 mm nom. dia.</td>
</tr>
<tr>
<td>Cast Tumblers</td>
<td>715-03</td>
<td>356.0-T6</td>
<td></td>
</tr>
<tr>
<td>Wrought Tumbuckles</td>
<td>715-04</td>
<td>6061-T6 or 6063-T6</td>
<td></td>
</tr>
<tr>
<td>Brace &amp; Stretcher Bands</td>
<td>715-04</td>
<td>3003-H14 or 6063-T6</td>
<td>3.20 mm X 22.20 mm</td>
</tr>
<tr>
<td>Carriage Bolts</td>
<td>715-04</td>
<td>2024-T4</td>
<td></td>
</tr>
<tr>
<td>Brace Ends &amp; Rail Ends</td>
<td>715-03</td>
<td>356.0-T6, 360.0, D712.0, or ZG 61A-T5</td>
<td></td>
</tr>
<tr>
<td>Expansion Sleeves</td>
<td>715-04</td>
<td>6063-T6 or 6063-T832</td>
<td>See Note 1</td>
</tr>
<tr>
<td>Nuts</td>
<td>715-04</td>
<td>2024-T4 or 6061-T6</td>
<td>-</td>
</tr>
<tr>
<td>Line Posts</td>
<td>715-04</td>
<td>6063-T6</td>
<td>Sched. 40 pipe NPS 2</td>
</tr>
<tr>
<td>End, Corner &amp; Intermediate Posts</td>
<td>715-04</td>
<td>6063-T6</td>
<td>Sched. 40 pipe NPS 2 1/2</td>
</tr>
<tr>
<td>Post Tops</td>
<td>715-03</td>
<td>356.0-F, 360.0, D712.0, or ZG61A-T5</td>
<td>-</td>
</tr>
<tr>
<td>Top Rails</td>
<td>715-04</td>
<td>6063-T6</td>
<td>Sched. 40 pipe NPS 1/4</td>
</tr>
<tr>
<td>Brace Rails</td>
<td>715-04</td>
<td>6063-T6</td>
<td>Sched. 40 pipe NPS 1/4</td>
</tr>
</tbody>
</table>

Note 1: Modified Schedule 40 pipe, NPS 1 1/4, 42.9 mm Inside Diameter, 1.98 mm Minimum Wall Thickness, 152.4 mm long.
710-12 PLASTIC COATED POSTS, RAILS BRACES AND FITTINGS FOR CHAIN LINK FENCE

SCOPE. This specification covers the requirements for plastic coated posts, rails, braces and fittings used for erection of chain link fencing.

MATERIAL REQUIREMENTS. Posts, rails, braces, fittings, and accessories shall comply with the requirements of §710-10, except for the galvanized coatings. Post, rails, braces, fittings and accessories shall be resin-clad with either an epoxy modified ply (vinyl chloride), or a thermoplastic polyester resin. The coating shall have a minimum thickness of 0.178 mm and shall be of the same color as the fabric.

Fabrication Requirements. The epoxy modified poly (vinyl chloride) coating shall be chemically bonded to heated pipe, fittings, etc., or the fitting and pipe, etc., shall be clad with a heavy molecule, saturated, linear thermoplastic polyester resin applied by electrostatic spray and fusing or equal method. Each length of pipe shall be sealed with two snug-fitting polyethylene plug-type seals to prevent condensation and eliminate internal corrosion.

BASIS OF ACCEPTANCE. Acceptance will be based on manufacturer's certification, with supplementary sampling and testing at the discretion of the Materials Bureau.

710-13 WOOD AND TIMBER POSTS AND TIMBER BLOCKOUTS

SCOPE. This specification covers wood posts used as witness posts, timber posts, and blockouts used in guidrail construction.

MATERIALS REQUIREMENTS. Wood posts, timber posts, and timber blockouts shall comply with the requirements of §712-14, Stress Graded Timber and Lumber, except that not every timber blockout in the lot need be branded, provided that approximately 10% of the blockouts are branded, and that the un-branded blockouts are visually similar, as determined by the engineer, to the branded blockouts. Using the clean wood properties of ASTM D2555, the bending stress (Modulus of Rupture) shall not be less than 28 MPa. They shall be surfaced on four sides and the dimensions shall be actual or nominal as indicated on the plans. If the dimensions are indicated to be nominal, the actual dimensions provided shall be in accordance with current trade practice. Surface dried redwood, red cedar, cypress or black locust may be used untreated. Other lumber including douglas fir, pine, oak, birch, apple, and beech may also be used but shall be pressure treated in accordance with §708-31, Wood Preservative-Water Borne after all the holes have been drilled and all other woodworking operations have been performed. Bituminous preservative treatments will not be permitted. Before using, the Contractor shall submit to the Engineer, for approval, information as to the species of timber to be used and method of preservative treatment to be employed.

BASIS OF ACCEPTANCE. Acceptance will be based on the manufacturer's certification with supplementary sampling and testing at the discretion of the Materials Bureau.

710-14 GALVANIZED STEEL BARRIER POSTS

SCOPE. This specification covers galvanized steel posts used as guiderail and median barrier posts, I-beam posts for existing guide railing and median barrier, and required soil plates and slip impact bases.

MATERIAL REQUIREMENTS. Galvanized steel barrier post shall conform to the following:

Galvanizing §710-01 Galvanized Coatings and Repair Methods, Type I
Steel ASTM A36M
§710-14

**Posts.** Steel posts used as guiderail and median barrier posts or I-beam posts for existing guide railing and median barrier, shall be fabricated from steel conforming to the ASTM A6M shape specified on the standard sheet for the guide railing or median barrier being utilized.

**Soil Plates, Slip Impact Bases, and Other Post Components.** Soil plates, slip impact bases, and other post components shall be fabricated from steel conforming to the dimensions shown on the standard sheet for the guide railing or median barrier being utilized.

**FABRICATION.** Guiderail and median barrier posts or I-beam posts for existing guide railing and median barrier shall be fabricated with all required welding, punching, drilling, or cutting of the post or any component of the post completed prior to galvanizing. Welding shall be done in accordance with the requirements of the New York State Steel Construction Manual, except that radiographic inspection of shop welds will not be required.

**BASIS OF ACCEPTANCE.** Acceptance of the post shall be based on the manufacturer's certification and in accordance with the Department's directives.

710-15 THROUGH 710-19 (VACANT)

710-20 CORRUGATED BEAM GUIDE RAILING AND MEDIAN BARRIER

**SCOPE.** This specification covers corrugated beam guide railing and median barrier including corrugated beams, posts, anchorage units and accessory hardware.

**MATERIAL AND FABRICATION REQUIREMENTS**

**Posts.** Posts shall meet the requirements of §710-14 Galvanized Steel Barrier Posts

**Beams, Terminal Sections and Hardware.** Corrugated beams, terminal sections and all hardware shall be fabricated in accordance with the details shown on the standard sheets. Bolt holes in the beam at the post hole and elsewhere, as necessary, shall be enlarged or slotted to permit expansion and contraction, and to facilitate erection. The beams shall be of uniform section and straight, unless shop curved beams are required by the plans or specifications. The edges shall be rolled to eliminate sharp edges. When shop curving of corrugated beams is required the radius of curvature shall be stamped into the base metal of the beam. The stamping shall be on the back, at or near both ends of the beam, and in a location where it will be visible to a worker after erection.

Beams and terminal sections shall be rolled from 12 gage (nominal thickness 2.67 mm -0.23 mm tolerance) or heavier sheet or coil stock. The sheet or coil stock shall be new billet open hearth, electric furnace, or basic oxygen steel sheet. The minimum yield point and elongation of the steel used in the beam sections shall be 345 MPa and 12% in 50 mm gage length respectively. Terminal sections, used for finishing-off or ornamental purposes, may be of mild steel, 227 MPa yield point.

**Plates and Anchorage Units.** Plates and Anchorage Units shall be as detailed on the standard sheet for corrugated beam type guide railing and median barrier. They shall conform to ASTM A36M.

**Splices.** Splices shall be made with flat, roundheaded, grippable, galvanized bolts, nuts and washers conforming to the following unless specified otherwise in the contract documents: Bolts ASTM F568 Class 4.6, Nuts ASTM A563M Grade A or better, and Washers ASTM F844. They shall be galvanized in accordance with the requirements of §719-01 Galvanized Coatings and Repair Methods, Type II (ASTM A153) unless another coating is specified.

Post connection bolts and the grippable splice bolts shall be as detailed on the Standard Sheets.

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Fabrication Welding. Fabrication welding shall be done in accordance with the New York State Steel Construction Manual, except radiographic inspection of shop welds will not be required.

Galvanizing. The rail element shall be galvanized in accordance with §719-01, Galvanized Coatings and Repair Methods, Type I (ASTM A123) or Type IV (ASTM A525M) of the standard specifications, except that the minimum check limits for the weight of coating as determined by the triple spot and single spot tests for §719-01, Galvanized Coatings and Repair Methods, Type IV (ASTM A525M), shall be 1220 g/m² and 915 g/m² respectively, (total amount both sides of sheet). Posts, plates, and anchorage units shall be galvanized in accordance with §719-01, Galvanized Coatings and Repair Methods, Type I (ASTM A123). Hardware shall be galvanized in accordance with §719-01, Galvanized Coatings and Repair Methods, Type II (ASTM A153).

When beams are to be galvanized in accordance with §719-01, Galvanized Coatings and Repair Methods, Type I (ASTM A123), they shall be blanked to the proper shape, fabricated and ready for assembly before galvanizing. No punching, drilling, cutting or welding will be permitted after galvanizing. When galvanizing in accordance with §719-01, Galvanized Coatings and Repair Methods, Type IV (ASTM A525M), the beam may be fabricated, cut, punched or drilled from galvanized sheet or coil stock. The exposed edges resulting from this process do not have to be repaired or touched up in any way.

BASIS OF ACCEPTANCE. All components of the corrugated beam type guide railing and median barrier shall be accepted in accordance with directives issued by the Department.

710-21 BOX BEAM GUIDE RAILING AND MEDIAN BARRIER

SCOPE. This specification covers box beam guide railing and median barrier including the guide rail, posts, end assembly units and accessory hardware.

MATERIAL REQUIREMENTS

Posts. Posts shall meet the requirements of §710-14 Galvanized Steel Barrier Posts.

Rails. Rails shall be cold-formed welded and seamless structural tubing. The rails shall conform to ASTM A500, Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes, Grade B, except as modified below.

All rail shall be tested in accordance with ASTM E436 “Drop-Weight Tear Tests of Ferritic Steels” except as modified below.

The tests shall be done after all galvanizing and associated operations have been performed on the rail. The testing shall be conducted at a temperature of -18°C, without removing the galvanizing, on 51 x 229 mm specimens supported to achieve a 178 mm span.

The percent shear area will be determined by testing nine (9) specimens, three (3) from each of three (3) sides not containing a weld. The shear areas of the three specimens from the side with the lowest average shear area shall be disregarded and the final average based on the remaining six specimens. If the average percent shear area falls below 50, the material represented by these tests shall be rejected.

To facilitate acceptance and rejection of material the manufacturer of the structural shape shall, before galvanizing, identify the product with the steel heat number, or some number which is traceable to the heat number, and its own unique identification code. The identification method shall be such that it can be read after the structural shape is galvanized. The identification information shall be placed on the structural shape at intervals not to exceed 1.2m.

When shop curving of box beams is required, the radius of curvature shall be stamped into the base metal of the beam. The stamping shall be the vertical faces, at or near both ends of the beam, and in a location where it will be visible to a worker after erection.

No mill transverse welds will be permitted on the rail sections. Longitudinal welds shall be made by the
resistance, gas shielded arc, submerged arc or plasma arc welded process; shall be sound, free from defects, and shall not be repaired. The welded joint, in cold-formed welded rail, shall have a minimum tensile strength specified for the railing when tested according to the tensile strap test of ASTM Method E8M. All fabrication shall be done in accordance with the requirements of the Steel Construction Manual.

Rails shall be galvanized in accordance with §719-01, Type I, Galvanized Coatings and Repair Methods. Slots and round holes may be subsequently drilled, punched, burned, or cut and regalvanized according to the paragraph below on “Regalvanizing Iron and Steel Using a Flame Sprayed Coating System.” This repair procedure shall also apply to curved rail sections and splice plates as required.

Regalvanizing Iron and Steel Using a Flame Sprayed Coating System. Those areas to be regalvanizing shall be blasted with silica sand or crushed garnet of such gradation that sand shall be mesh size 850 μm to 425 μm (# 20 to # 40 U.S. Standard Sieve) with a minimum of 40% retained on a 600 μm mesh screen (# 30 U.S. Standard Sieve). Pressure of not less than 520 kPa shall be maintained at the blast generator.

A sample steel plate shall be blasted until the surface cannot be further cleaned or roughened. This plate shall be used for visual comparison and any areas that do not meet this standard as to roughness or cleanliness shall be reblasted.

The wire used in spraying shall be 3.2 or 4.8 mm diameter, zinc 99.0% purity. Air pressure at the Air Control Unit shall be 415 kPa and there shall be no more than 10 m of 9.5 mm I.D. hose between the Air Control Unit and the gun.

The metal coating shall be applied at a minimum thickness of 0.11 mm. At least one coating shall be applied within 4 hours of blasting and the surface shall be completely coated within 8 hours of blasting.

The specified thickness of coating shall be applied in multiple layers and in no case shall less than two passes be made over every part of the surface.

Fasteners. Fasteners shall be galvanized and conform to the following unless specified otherwise in the contract documents. Bolts ASTM F568 M Class 4.6, nuts ASTM A563M Grade A or better, and washers ASTM F844.

BASIS OF ACCEPTANCE. All components of the box beam guide railing and median barrier shall be accepted in accordance with directives issued by the Department.

710-22 CABLE GUIDE RAILING

SCOPE. This specification covers cable guide railing including cable, posts, anchorage units, and accessory hardware.

MATERIAL REQUIREMENTS. Cable Guide Railing shall conform to the following:

- Posts, Soil Plates
- Reflectors
- Reflective Sheeting
- Cable
- Anchor Angle
- Bolts
- Nuts
- Washers

Reflector. The alloy for the aluminum used for the reflectors shall be as specified on the standard sheet for cable guide railing.

Reflective Sheeting. The material designation for the reflective sheathing used for the reflectors shall be as specified on the standard sheet for cable guide railing.
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Galvanizing. The bolts, including the “J” bolt used to mount the cable, nuts, washers, anchor rods, spring compensator components, steel turnbuckle cable end assembly, and all cast steel or malleable iron hardware, except the wedge shown in “Detail X” on the standard sheet, shall be galvanized in accordance with the requirements of §719-01 Galvanized Coatings and Repair Methods, Type II, unless another coating is specified. The wedge shown in “Detail X” shall be ungalvanized (black).

The anchor angles shall be galvanized in accordance with the requirements of §719-01 Galvanized Coatings and Repair Methods, Type I.

Welding. Welding shall be performed in accordance with the requirements of the New York State Steel Construction Manual, except radiographic inspection of shop welds will not be required.

BASIS OF ACCEPTANCE. Acceptance shall be based on the manufacturer's certification and in accordance with directives issued by the Department.

710-23 STEEL BRIDGE AND CULVERT RAILING

SCOPE. This specification covers the material requirements for Steel Bridge and Culvert Railing and its component parts.

MATERIAL REQUIREMENTS. Steel Bridge and Culvert Railing materials shall conform to the following requirements:

<table>
<thead>
<tr>
<th>Piece</th>
<th>ASTM Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rail Tubes</td>
<td>A500 Grade B (^1)</td>
</tr>
<tr>
<td>Rail End Caps</td>
<td>A36M or A588M (A709 Grade 250 or 345W)</td>
</tr>
<tr>
<td>Base Plates (^2)</td>
<td>A588M or A572M Grade 345 (A709M Grade 345 or 345W)</td>
</tr>
<tr>
<td>Anchor Studs</td>
<td>F568M Class 8.8</td>
</tr>
<tr>
<td>Splice Bolts,</td>
<td>F568M Class 8.8 or Class 8.8.3</td>
</tr>
<tr>
<td>Round Head Bolts</td>
<td>F568M Class 8.8 or Class 8.8.3</td>
</tr>
<tr>
<td>Nuts (^3)</td>
<td>A563M</td>
</tr>
<tr>
<td>Washers (^3)</td>
<td>F436M</td>
</tr>
<tr>
<td>Anchor Plates</td>
<td>A36M (A709M Grade 250)</td>
</tr>
<tr>
<td>Plate Shims</td>
<td>A36M or A588M (A709M Grade 250 or 345W)</td>
</tr>
<tr>
<td>Tube Rail Splices</td>
<td>A500 Grade B</td>
</tr>
<tr>
<td>Solid Rail Splices</td>
<td>A588M or A572M Grade 345 (A709M Grade 345 or 345W)</td>
</tr>
<tr>
<td>Angle (2)</td>
<td>A588M or A572M Grade 345 (A709M Grade 345 or 345W)</td>
</tr>
<tr>
<td>Splice Plates</td>
<td>A588M or A572M Grade 345 (A709M Grade 345 or 345W)</td>
</tr>
<tr>
<td>Railing Post (^2)</td>
<td>A588M or A572M Grade 345 (A709M Grade 345 or 345W)</td>
</tr>
</tbody>
</table>

\(^1\) Where unpainted A588M (A709M Grade 345W) steel is used for the post, the tube shall be unpainted A500 Grade B with the chemical properties of either A588M (A709M Grade 345W) or A606, Type 4. Railing tube meeting the foregoing requirements will be acceptable if its elongation is a minimum of 21% in 50 mm.

\(^2\) All post material, including base plates, shall be furnished to minimum Charpy V-Notch Toughness requirements as required by §715-01, under Charpy V-Notch Impact test.

\(^3\) Use the following nut and washers for the given bolt class:

<table>
<thead>
<tr>
<th>BOLT or STUD class</th>
<th>NUT (F563M class &amp; dimension style of nut)</th>
<th>WASHER (F436M type)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.6</td>
<td>5 H1</td>
<td>1 or 3</td>
</tr>
<tr>
<td>8.8</td>
<td>10S HH</td>
<td>1 or 3</td>
</tr>
<tr>
<td>8.8.3</td>
<td>8S3 HH</td>
<td>3</td>
</tr>
</tbody>
</table>
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Beveled shims may be machined from the same type of metal as in the post base plates or may be cast from material conforming to the requirements of §715-02, Steel Castings, or §715-09, Malleable Iron Castings.

All rail shall be tested in accordance with ASTM E436 - "Drop-Weight Tear Tests of Ferritic Steels", except as modified below.

The tests shall be done after all galvanizing and associated operations have been performed on the rail. The testing shall be conducted at a temperature of -18°C, without removing the galvanizing, on 50 mm x 230 mm specimens supported to achieve a 180 mm span.

The percent shear will be determined by testing nine (9) specimens, three (3) from each of three (3) sides not containing a weld. The shear areas of the three specimens from the side with the lowest average shear area shall be disregarded and the final average based on the remaining six specimens. If the average percent shear area falls below 50 the material represented by these tests shall be rejected.

To facilitate acceptance and rejection of material, the manufacturer of the structural shape shall, before galvanizing, identify the product with the steel heat number, or some number which is traceable to the heat number, and its own unique identification code. The identification method shall be such that it can be read after the structural shape is galvanized. The identification information shall be placed on the structural shape at intervals not to exceed 1.2 m.

FABRICATION. Bridge and Culvert Railing shall be fabricated to the dimensions shown in the contract plans and in compliance with the specifications.

A. Shop Drawings. Shop drawings shall be provided in accordance with the requirements of the S.C.M., except that: 1) the drawings shall be submitted to the Engineer for review and approval and 2) the computed weights need not be shown.

B. Welding. Shop welding shall be performed only where specifically noted on the contract documents. Transverse welds shall not be permitted unless directly called for on the contract plans. All welding shall be done in accordance with the requirements of the SCM.

C. Cutting. All exposed flame cut surfaces shall have a surface roughness not to exceed 250, as defined by the ANSI standard specification B46.1. Grind all edges of Posts and Post Base Plates so that all sharp edges are removed.

D. Bending. Rails for curved structures shall be curved in the shop prior to galvanizing. To facilitate bending, rails may be heated to a temperature not exceeding 650°C.

E. Galvanizing. Galvanizing shall conform to the requirements of §719-01, Galvanized Coatings and Repair Methods, Type I. All components of the railing, including anchor studs, nuts and washers, shall be galvanized. The rails, post assemblies, splices and all hardware shall be fabricated and ready or assembly prior to galvanizing.

All galvanized bolts and galvanized anchor studs shall have a Class 6g Thread. All galvanized nuts shall have a standard oversized tap to allow for the galvanizing on the bolts and nuts.

Shop galvanizing repair of uncoated areas will be permitted on localized areas. Repair of localized areas is limited to a total of 1300 mm² on any post or rail. A post or rail which contains galvanizing defects totaling more than 1300 mm² shall be stripped and regalvanized.

Shop repair shall be made in accordance with the methods given in §719-01.

The following areas will not require galvanizing repair: One 3 mm maximum dimension spot of tight flux remaining in the fusion line of any 180 mm length of weld after blast cleaning picking and galvanizing.

F. Painting Rustic Railing. When paint is used to obtain a rustic appearance, all components of the railing system shall be galvanized and then, after erection, the visible portions of the system shall be painted with one coat of finish paint in accordance with the following:
1. The color of the finish coat shall be Weathered Brown and conform to Federal Color Standard No. 59b, Color 20059.

2. Paint shall be one of the products on the Department's Approved List: titled "Moisture-Curing Urethane Paint Systems, C. Finish Paint". Acceptance shall be based on the appearance of the paint on the Approved List.

3. All galvanized surfaces shall first be cleaned of oil, grease and similar contaminants by hand wiping with solvent in accordance with SS PC-SP1, solvent cleaning.

4. After solvent cleaning, all galvanized surfaces shall be lightly abraded by brush blast methods. The purpose of the abrasive blasting is to roughen the surface, not to remove material.

5. Apply the paint using brushes or rollers in accordance with the Manufacturer's instructions to a minimum dry film thickness as given in the approved list. Manufacturer's instructions for mixing and paint application shall be supplied to the Engineer at least one week prior to the beginning of any painting work.

**BASIS OF ACCEPTANCE.** The manufacturer shall furnish the Department with three (3) certified copies of physical test and chemical analysis of the materials used in the manufacture of the railing. Check analysis may be made by the Department from delivered material.

Inspection will be performed in accordance with the provisions of the SCM, except that mill inspection will not be done.

Materials that do not bear the Inspector’s mark of acceptance shall not be accepted at the project site.

**710-24 Box Beam End Assembly, Type III; and Box Beam Median Barrier End Assembly, Type C**

**SCOPE.** These specifications cover the material and quality requirements for Box Beam End Assembly Type III and Box Beam Median Barrier End Assembly, Type C. When specified, these end assemblies are used to terminate the ends of box beam guide rails and box beam median barriers. Box Beam End Assemblies Type III and Box Beam Median Barrier End Assembly, Type C are fabricated in accordance with these specifications, the manufacturer’s instructions, and the approved Materials Details.

**MATERIALS REQUIREMENTS.** Materials used in the fabrication of the Box Beam End Assemblies Type III and Box Beam Median Barrier End Assembly, Type C shall conform with the following requirements:

- Foundation Tubes, Nose Assembly, Outer Tube, Telescoping Section & Intermediate Spacer Block
- Wood and Timber Posts and Timber Blockouts
- Fasteners, except shear bolts on posts 6, 7, & 8
- Shear bolts on posts 6, 7, & 8
- Rubber Pad
- Steel Posts, Shelf Angles, and other metal parts
- Galvanized Coatings and Repair Methods

ASTM A500, Gr. B
§710-13
ASTM A307
SAE Grade 0
Hard Rubber Division II Sect18.2
ASTM A36M
§719-01

The Cable Assembly shall consist of galvanized steel cable, 6 X 19 mm, with 19 mm threaded rod swaged to both ends.

The composite tube shall be MMFG Extren series 500 pulltruded fiberglass structural tubes and shall exhibit the following properties:

**A.** Tube shall be manufactured using the pulltrusion process. Tubing shall be manufactured of glass fiber reinforced resin with a glass resin ratio of 50%. The resin shall be isophthalic polyester. Glass reinforcement shall include the following three varieties:
§710-24

- Surface mat shall be used on all exterior surfaces
- Continuous glass strand rovings shall be used internally
- Continuous strand mats shall be used internally

B. The composite material shall exhibit the following minimum mechanical properties:

1. **Ultimate Tensile Strength.** Ultimate Tensile strength shall be longitudinally 207 000 kPa and transversely 48 300 kPa measured from coupons. Bending strength of the full section shall be 138 000 kPa.

2. **Ultimate Compressive Strength** The ultimate compressive strength shall be as given above except Transversely shall be 105 500 kPa.

3. Ultimate Shear Strength shall be 31 050 kPa.

4. Modulus of Elasticity shall be 17 300 000 kPa

5. Barcol Hardness shall be 50.

C. The energy dissipation properties of the alternate fiberglass epoxy composite tube shall be evaluated using static compressive testing. Each test specimen shall be 610 mm long with a 102 mm long tulip shape cut into one end of the test specimen. The test specimen shall be crushed statically at a rate of 50 mm per minute and the total crush length shall be not less than 305 mm. A minimum of three static compressive tests shall be conducted. The results of each test shall meet the following static energy dissipation properties:

- **First Stage Energy Absorber**
  - Average Crush Force: 80 ± 9kN
  - Maximum Compressive Force: 115 kN
  - Allowable Compressive Force Variation: ± 11 kN

- **Second Stage Energy Absorber**
  - Average Crush Force: 182 ±13 kN
  - Maximum Compressive Force: 245 kN
  - Allowable Compressive Force Variation: ± 22.3 kN

The materials and construction requirements of Box Beam End Assemblies, Type III (Rustic) and Box Beam Median Barrier End Assembly, Type C (Rustic) shall be the same as Box Beam End Assemblies, Type III and Box Beam Median Barrier End Assembly, Type C except exposed galvanized metal surfaces shall be painted in accordance with §740-03, Painting Galvanized Surfaces.

**BASIS OF ACCEPTANCE.** Box Beam End Assembly Type III and Box Beam Median Barrier End Assembly, Type C will be accepted at the site of the work by the Engineer on the basis of the manufacturer’s name appearing on the approved list, conformance of the delivered articles with the approved Materials Details, and upon the manufacturer’s certificate of compliance with these specifications. The supplier shall provide two copies of the approved Materials Details through the Contractor to the Engineer as part of the evidence of acceptability for the material at least ten days prior to the use of the product.

**710-25 GUIDE RAIL AND MEDIAN BARRIER SYSTEMS (RUSTIC)**

**SCOPE.** This specification covers the material and quality requirements for rustic barrier systems fabricated from structural and high-strength low alloy structural steel that in a reasonable time after erection in a rural environment of average atmosphere, will develop a uniform, permanent, and tightly adhering protective oxide coating.
MATERIAL REQUIREMENTS. Except as modified herein, all requirements of §710-20-Corrugated Beam Guide Railing and Mall Barrier and §710-21 - Box Beam Guide Railing and Median Barrier shall apply including Drop Weight Tear Testing. Galvanizing shall not be required unless specifically stated otherwise in the contract documents.

A. Box Beam Rail. The base metal for the structural shape, plate and bar components of box beam guide rail and median barrier shall meet the requirements of ASTM A242M or A588M. The fabrication of structural tube shall comply with ASTM A500, Grade B. The mechanical properties of the finished tube shall conform to the requirements of ASTM A500, Grade B except that the minimum elongation in 50.8 mm shall be 21 percent. Splice plates shall be fabricated of ASTM A36M steel ready for assembly before galvanizing and galvanized in accordance with §719-01, Type 1 (ASTM A123).

B. Corrugated Beam Rail. The base metal for the corrugated beam rail shall meet the requirements of ASTM A606, Type 4.

C. Welds. All welds shall develop the strength of, and exhibit the same corrosion resistance characteristics as, the base metal used for the structural shape, plate and bar components.

D. Soil Plates. Soil plates of high strength, low alloy steel guide rail system shall be made of either ASTM A36M, ASTM A242M, ASTM A588M, or ASTM A606 Type 4 and shall be galvanized or epoxy coated in accordance with the applicable requirements in this specification.

E. Miscellaneous Hardware. The base metal of all accessory hardware of high strength, low alloy steel guide rail system including blockouts, backup plates, rail connecting angles, bolts, nuts and washers shall be fabricated from steel having corrosion resistance of approximately 4 times carbon structural steel without copper. Hardware to be excepted from this requirement is listed below and shall be supplied in conformance to the requirements as detailed on the standard sheets, and galvanized in accordance with §719-01, Type 1 (ASTM A123).
   - All bolts less than 13 mm diameter and their associated washers and nuts.
   - 44 mm x 44 mm square washers; 76 mm x 44 mm washers.
   - 20 mm diameter anchor rods, nuts and washers associated with concrete anchors.
   - Other miscellaneous nuts, bolts, washers and connectors not exposed to view.

High strength bolts, nuts and washers specified on the standard sheets as ASTM A325 shall conform to ASTM A325M, Type 3. Commercially available anti-seizing compound shall be applied to the threads of corrosion resistant bolts used in rail splices.

F. Epoxy Coating Material
   1. The epoxy coating materials shall be powdered polyamide epoxy resin suitable for fusion bonding. The finish shall not be glossy. A dull or matted finish shall be supplied.
   2. The color of the epoxy coating shall be a reasonable visual match to the brown color of Federal Color Standard 595 - plate numbers 10075, 10079, and 10091. Fifteen (15) days prior to commencement of coating operations, three (3) 100 mm x 150 mm coated metal plates shall be submitted to the Director, Materials Bureau for determination as to acceptability of the color match.
      The epoxy coating shall not fade, change color or chalk appreciably when subjected to a 30 hour exposure (20 minute cycle) in the high intensity ultra violet weatherorater model DMC-RHC. Each cycle (continuously repeating) starts with 17 minutes of light followed by 3 minutes of light and waterspray.
   3. Upon approval of the product and the color match, the epoxy coating will be placed on a Department Approved List of Materials.

G. Posts. Posts shall conform to any of the following requirements:
§710-25

1. ASTM A36M steel with a fusion bonded polyamide epoxy coating throughout meeting the epoxy requirements of this specification.

2. ASTM A588M steel with the embedded portion of the post galvanized in accordance with §719-01, Type 1 (ASTM A123). The posts shall be prepared in accordance with standard galvanizing industry practice. The lower 0.8 m of light poles and the lower 1 m of heavy posts shall be galvanized.

3. ASTM A588M steel with the embedded portion of the post having a fusion bonded polyamide epoxy coating meeting the epoxy requirements of this specification. The lower 1 m of the posts, regardless of rail type, shall be epoxy coated.

FABRICATION REQUIREMENTS

Epoxy Coating

A. Coating Applicator. The facilities of the coating applicator and method of application for the epoxy shall be subject to approval by the Director, Materials Bureau. Approval shall be obtained in accordance with the written procedures of the Materials Bureau. Upon approval, the complete name and address of the coating applicator will be placed on the Department's List of Approved Products titled “Fusion Bonded Coating Applicators.” Coating applicators on the “approved list” for Longitudinal Joint Ties and Steel Reinforcing Bars are approved applicators for epoxy coated posts as described in this specification.

B. Plant Inspection. The Department reserves the right to have its authorized representative observe the preparation coating and testing of the posts. The representative shall have free access to the plant and the right to observe any work done while access was denied will be rejected.

C. Quality Control. The coating applicator shall be responsible for performing quality control and tests. This will include inspection for compliance with the requirements of Coating Thickness, Continuity of Coating and Coating Cure.

D. Preparation. Posts shall be pickled according to accepted industry standards and then rinsed in a slightly basic solution to remove all traces of pickling residue. The cleaned surfaces shall be free of all residue and millscale. Only the portion of post to be coated needs to be cleaned. In lieu of the pickling process, posts may be blast cleaned in accordance with the Steel Structures Painting Council - Surface Preparation Specification No. 6 (SSPC-SP 6), Commercial Blast Cleaning. The cleaned surface shall be defined by SSPC-Vis 1-89, Pictorial Standards B SP 6 or C SP 6 as applicable.

E. Coating Thickness. .127 mm minimum dry film thickness. Coating thickness measurements shall be conducted by the method outlined in ASTM G12.

F. Continuity of Coating. The coating shall be checked visually after cure for continuity. It shall be free from holes, voids, contamination and damaged areas.

G. Coating Cure. The coating applicator shall check each shipment to determine that the epoxy coating is in fully-cured condition.

Field Repair of Damaged Coatings. Posts with coating breaks, due to handling, that exceed 13 mm in any dimension shall not be incorporated into the work. The Contractor shall set aside such damaged units and may effect a field repair. Coating breaks may be repaired with a patching material approved by the epoxy coating manufacturer. The patching material shall be an epoxy compatible with the epoxy coating. The patching epoxy shall be a color match to the coating epoxy.
§ 710-30

**BASIS OF ACCEPTANCE.** All components of the box beam or corrugated beam guide railing and median barrier shall be accepted in accordance with directives issued by the Department and in conformance with the standard sheets.

All epoxy coated posts shall be accepted by the Engineer at the contract site on the basis of the following:

- The epoxy coating manufacturer's certification that the coating material is identical to that approved by the Materials Bureau.
- The coating applicator's certification that the posts have been coated and that they conform to the requirements of this specification.
- The appearance of the name of the coating applicator and epoxy coating material on the Department's Approved List of Products.

The manufacturer's certification that the metal used conforms to the requirements of this specification. The ASTM designation and Grade shall be included.

710-26 PLASTIC AND SYNTHETIC BLOCK-OUTS FOR HEAVY POST GUIDERAIL SYSTEMS

**SCOPE.** This specification describes plastic and synthetic material block-outs used to provide uniform offset distance from the corrugated beam rail to the heavy post.

**GENERAL.** The block-out shall have the same general dimensions as detailed in the Department Standard Sheets. The block-out shall not contain excessive voids that would compromise its physical strength. The material shall be designed for outdoor exposure and shall include chemical additives to resist UV degradation. If the product contains recycled materials, they shall be environmentally friendly and non-hazardous. Blocks shall contain no materials that will negatively affect their field performance, such as materials that absorb moisture.

**BASIS OF ACCEPTANCE.** Manufacturers or suppliers may submit their product for evaluation to the Director of the Materials Bureau. This submission shall include copies of drawings, specifications, test reports, the quality control procedure and Federal Acceptance Letters. At the Department's discretion, the material will be evaluated for conformance to these specifications, and product samples will be tested in accordance with procedural directives of the Materials Bureau.

The product will be accepted at the job site based on its appearance on the Approved List. In addition, the contractor shall provide manufacturer certification that the supplied product has the same chemical composition, mechanical properties as the product used in the testing accepted for Federal Approval. Modifications to this product are acceptable, provided the resulting product is an equivalent or of higher level of quality, and supporting documentation is provided."

710-27 THROUGH 710-29 (VACANT)

710-30 RIGHT-OF-WAY FENCING

**SCOPE.** These specifications cover the material requirements required for the construction of right-of-way fences comprised of (a) galvanized steel or aluminum coated steel fence fabric, and (b) posts, braces and hardware designed to support and retain the fencing.

**MATERIAL REQUIREMENTS**

**Fence Fabric.** Right-of-way fencing fabric shall conform to the requirements of ASTM A116 “Zinc Coated (Galvanized) Steel Woven Wire Fence Fabric” or ASTM A584 “Aluminum-Coated Steel Woven Wire Fence Fabric.” The fabric shall be woven in accordance with Design Number 1047-6-9 or 1047-6-11 as shown in Table 1 of both ASTM A116 and ASTM A584. The weight of the coating on the Zinc-Coated (Galvanized)
§710-30

Fence Fabric shall conform to the coating weight requirements of Class 3 shown in Table 3 of ASTM A116.

Fence Posts and Braces. Posts and brace sizes shall be as indicated on the Standard Sheets. Steel line posts shall conform to the requirements of ASTM A702. Steel end, corner or intermediate post and braces shall conform to the requirements of Section 6.5 through Section 6.5.4 of ASTM A702; or the requirements for Class A, Schedule 40 Pipe or Class B, Steel Tubing of §710-10.03 of the Standard Specifications. Posts and braces conforming to the requirements of ASTM A702 shall be galvanized in accordance with the requirements of §719-01 Type I. Type A Schedule 40 Pipe and Type B Steel Tubing shall use one of the protective coating system specified in 7A of §710-10.03.

Wood posts and braces shall be seasoned southern yellow pine, red (Norway) pine, spruce, douglas fir, hemlock, larch, or redwood. All wood posts and braces shall be pressure treated with a water-borne wood preservative conforming to the requirements of §708-31. The wood posts shall be subject to inspection before and during treatment at the option of the Department. They shall be sound, free from loose knots or decay, and with no through checks on tops or butts. Posts shall be machine peeled to a smooth uniform appearance and free from all inner bark. The preservative pressure treatment shall be by the empty cell process in accordance with C5 of the American Wood-Preservers’ Association Standards.

Fittings. Fittings shall be manufactured of weldable steel, malleable iron, cast steel, cast iron, or aluminum alloy. Fittings other than aluminum shall be galvanized in accordance with the requirements of §719-01 Type II.

Fasteners. Bolts, nuts, and washers shall conform to the following, unless specified otherwise in the contract documents:

<table>
<thead>
<tr>
<th>Items</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bolts</td>
<td>ASTM F568 Class 4.6 or A307</td>
</tr>
<tr>
<td>Nuts</td>
<td>ASTM A563M or A568, Grade A or better</td>
</tr>
<tr>
<td>Washers</td>
<td>ASTM F844</td>
</tr>
</tbody>
</table>

The fasteners shall be galvanized in accordance with the requirements of §719-01 Type II.

Gates. Gates shall be constructed of Class A Schedule 40 Pipe conforming to §710-10 welded at all corners or assembled with corner fittings. The size of the pipe used to fabricate the gate shall be as shown on the Standard Sheets. When corner fittings are used the gates shall have truss rods of minimum 9.50 mm diameter to prevent sag or twist. Gate leaves shall have vertical intermediate bracing so that no vertical members are more than 2.50 m apart. Gate leaves over 3 m shall have a truss rod of minimum 9.50 mm minimum diameter even if the corners are welded. The fence fabric used on the gate shall conform to the fence fabric in the remainder of the fence.

A. Hinges. Hinges shall be weldable steel, cast steel, or malleable iron 180° offset industrial type. The hinges shall not twist or turn under the action of the gate. The gate shall be able to be opened by one person. The hinges shall be galvanized in accordance with the requirements of §719-01 Type I.

B. Latches. Latches, stops, and keepers shall be provided for all gates.

Latches for single leaf gates may be a forked latch type. Double leaf gates shall have a plunger bar type latch arranged to engage a stop. Latches shall be capable of being locked and the Contractor shall provide a lock with triplicate keys for each gate. Keepers shall consist of a mechanical device for securing the free end of a gate when in the full open position.

C. Gate Posts. Gate posts shall conform to the dimensions shown on the Standard Sheets.

Steel gate posts shall be fabricated from either Class A Schedule 40 Pipe or Class B Steel Tubing conforming to the requirements of §710-10.

Wood gate posts shall be made from wood conforming to the requirements for wood posts and braces as specified in “Fence Posts and Braces”.

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§711-02

BASIS OF ACCEPTANCE. Fabric acceptance will be based on sampling and testing conducted by the Materials Bureau, in accordance with procedural directives of the Department. The acceptance of all other materials specified in this specification for use in the construction of Right-of-Way Fencing will be based on the Manufacturer's certification with supplementary sampling and testing at the direction of the Materials Bureau.

SECTION 711 - CONCRETE CURING MATERIALS AND ADMIXTURES

711-01 (VACANT)

711-02 QUILTED COVERS (FOR CURING)

SCOPE. These specifications cover cotton mats to be used for curing Portland Cement concrete pavements and bases, and concrete structures.

GENERAL. The mats shall consist of a filling material of cotton "bat" or "bats" covered with unsized cloth, and tufted or stitched to maintain the shape and stability of the unit under job conditions of handling.

MATERIALS REQUIREMENTS

Cotton. Cotton cloth covering shall weigh not less than 213.6 grams per square meter and shall have an average of not less than 32 threads in warp and not less than 28 threads in filling, having a minimum average breaking strength (grab method) of 265 newtons in the warp and of 265 newtons in the filling. The weight of the cotton cloth covering shall not fall below the specified weight by more than 5 percent. The raw materials used in the manufacture of the cotton cloth shall be raw cotton, cotton comber waste, cotton card strip waste, or combination thereof. The other physical characteristics of the cloth shall be equal to those in such material for industrial purposes.

Burlap or Jute. Burlap or jute covering for cotton mats shall weigh not less than 227.2 grams per square meter and shall have not less than 8 threads per 25 mm of warp and not less than 8 threads per 25 mm of filling. It shall be the grade known commercially as "firsts" and shall be free from avoidable imperfections in manufacture and from defects or blemishes affecting the serviceability. A tolerance in weight of minus 5 percent will be permitted.

Filling Material. The filling material for the mats shall be cotton bat, or bats, made of raw cotton, cotton waste, cotton linters, or combinations thereof, and shall weigh not less than 406.9 grams per square meter. The batting used shall not be lower in quality than a batting made of U. S. Standard Grade No. 3 Linters.

Thread

A. Tufting. The cotton thread for tufting shall be not less than 4-cord number 12's.

B. Sewing or Stitching. The thread used for all sewing or stitching shall be at least equivalent in size and strength to standard 3-cord number 30 cotton thread.

DIMENSIONS

A. Mats. Mats shall have a filler of 1750 mm in width and shall have a flap 150 mm or more in width, consisting of an extension of two thicknesses of the covering material, extending along one longitudinal edge of the mat. The length of the mats shall be 760 mm greater than the width of pavement slab to be cured.

B. Tolerance. The length or width of the mats shall not be less than that specified by more than 2 percent.