

706S.1 Description

This item shall govern the construction of concrete, steel, or pipe railing or a combination of these materials on bridges, walls or incidental structures as indicated on the Drawings.

In general, the railing shall include that portion of the structure erected on and above the roadway curb or along the edges of walks, curbs and/or slabs for the protection of traffic and pedestrians and the tie in anchorage to the approach railing erected on the embankment.

The railing, including the necessary anchorage, shall be constructed in accordance with the details indicated on the Drawings.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text, inch-pound units are given preference with SI units shown within parentheses.

706S.2 Submittals

The submittal requirements of this specification item include:

- A. Shop fabrication details/drawings for metal railings.
- B. Splice locations and details.
- C. Radiographic results for castings.
- D. Mill test reports for each casting lot (chemical composition, tensile strength, elongation, etc.).

706S.3 Materials

All materials shall conform to Class H, Item No. 403S, "Concrete for Structures", Item No. 406, "Reinforcing Steel" and Item No. 720, "Metal for Structures" as appropriate.

706S.4 Construction Methods

The railing shall meet the classification and type specified, conform with the requirements herein and be constructed in accordance with details indicated on the Drawings. It shall be constructed to the alignment, grade and camber indicated on the Drawings. Shop fabricated railing shall be uniform in configuration to insure good joints and continuous lines after erection on the structure.

Any appreciable amount of cutting, bending or filling required during erection to produce a reasonable fit would be cause for rejection of the rail. Unless otherwise provided, the railing shall not be placed until falsework, if any, for the span has been released. During construction, care shall be exercised to insure proper functioning of expansion joints.

Unless otherwise indicated on the Drawings, the rail posts shall be vertical. Fabrication and erection of metal for railing shall conform to Item No. 721, "Steel Structures" and to the requirements of this specification.

Splicing of members will be permitted only as provided by the contract Drawings . In general, splices shall be at rail posts. All splice locations and details shall be as indicated on the Drawings.

For metal railings, shop drawings shall be prepared and forwarded for review in accordance with Item No. 720, "Metal for Structures".

Welding shall conform to Item No. 723, "Structural Welding" and with applicable American Welding Society requirements.

Railing materials shall be stored above the ground on platforms, skids or other supports and kept free from grease, dirt and contact with dissimilar metals. Care shall be taken at all times to avoid scratching, marring, denting, discoloring or otherwise damaging the railing. Unpacking and storing of rail members at the job site shall be in accordance with manufacturer's recommendations.

A Concrete Railing

For Portland cement concrete portions of railings, the construction and removal of forms and the placement, curing and surface finishing shall conform to Standard Specification Item No. 410, "Concrete Structures" and to the requirements specified herein. Provisions shall be made in the construction of forms to provide for checking and correction of railing lines and grades after concrete has been placed, but before initial set. The finish floating of the railing tops shall not disturb the form alignment after the final check. Particular care shall be exercised in other construction operations to avoid disturbing or vibrating the span with the newly placed railing.

Construction joints at the bottom of rail posts or rail parapet shall conform to Standard Specification Item No. 410, "Concrete Structures".

Precast members shall conform to TxDOT Specification Item 424, "Precast Concrete Structures (Fabrication)". Care shall be taken to preserve true and even edges and corners of precast members. Any member, which becomes marred or cracked, will be rejected and shall be removed from the work.

Material requirements and storage, splicing, bending and placement of reinforcing steel for railing shall conform to the pertinent provisions of Standard Specification Item No. 406, "Reinforcing Steel".

B. Pipe Railing

Pipe shall be fabricated from the material and to the shape and dimensions indicated on the Drawings.

Pipe rail and posts shop fabricated into panels shall be mounted in a jig clamped in their true relative positions, accurately spaced with respect to each other and while assembled shall be completely welded or bolted, as the case may be. When indicated on the Drawings, as each rail section is completely assembled and connected, the adjacent section shall be set in its proper relative positions, with the ends engaged and remain in this position until completely connected. Each pair of sections shall be matchmarked so they may be erected in the same order in which they were fabricated.

C. Metal Rail

The fabricated elements shall conform to the dimensions and cross-section indicated on the Drawings. The rail shall be straight and free from warp.

Maximum deviation from straightness of either edge of a full-length section shall be 1/4 inch per ten feet (6 millimeters per three meters).

Rail elements shall be jointed and connected to the rail posts as indicated on the Drawings. Lapped elements shall have the lap in the direction of traffic in the adjacent lane.

Unless indicated otherwise on the Drawings, bolts and nuts for the metal railing shall conform to ASTM A307 and shall be galvanized in accordance with TxDot Specification Item 445, "Galvanizing".

D. Cast Rail Posts

Castings shall be true to pattern in form and dimensions and shall be of the materials indicated on the Drawings.

Castings shall be permanent mold castings of uniform quality and condition, free from cracks and shall be free of defects such as blow holes, porosity, hard spots or shrinkage effects which are extensive enough to materially affect their suitability for the intended use. The castings shall be free of all burrs, fins, discoloration and mold marks and shall, when finished, have a smooth and uniform appearance and texture.

Castings shall be produced under radiographic control to establish and verify a product free from harmful internal defects. Radiographic examination of production castings shall be made, as necessary, to insure satisfactory quality.

When required, the castings shall be heat treated to produce material with the utmost uniformity conforming to the properties specified. The entire lot of castings shall be heat-treated to the specified temper.

All castings shall be permanently marked on the web or top of base with the lot number or the heat treat lot identification. Mill test reports shall be furnished showing the heat or lot number, chemical composition, tensile strength, elongation and number of pieces for each casting heat or lot. Such markings shall be sufficient to correlate the castings with the mill test reports.

To provide more uniform materials and to reduce the number of samples required to establish material compliance, the entire number of acceptable posts cast from each lot shall be furnished to the project, except where less than the complete lot is required or where a portion of a lot is required to complete the shipment. The mill test report shall indicate the number of posts represented by each lot and furnished to the project.

706S.5 Tests

For Metal Beam Rail, a sample of the rail and terminal may be taken from each project or from each shipment to a project. Samples of bolts and nuts may also be required. Physical tests shall be performed in accordance with TxDOT's Manual of Testing Procedures (ASTM E-8/E-8M) and tests for galvanized coatings shall be in accordance with ASTM A-90. Field testing of galvanized coating thickness shall be in accordance with TxDOT Test Method Tex-728-I.

706S.6 Protective Coating

Unless otherwise indicated on the Drawings, all portions of steel railing shall be galvanized. When painting is specified on the Drawings, the type and coating thickness shall be in accordance with the paint system shown on the Drawings and shall conform with Standard Specification Item No. 722, "Paint and Painting".

Galvanized railing shall be hot dip galvanized after fabrication. Any damaged galvanizing shall be repaired after erection. Galvanizing and repairs shall be done in accordance with TxDot Specification Item 445, "Galvanizing". Galvanized steel railing shall not require field painting. Prior to acceptance, extrusion marks, grease, dirt and grime shall be cleaned from the railing.

After erection, galvanizing on all parts of steel posts and rail elements which has become scratched, chipped or otherwise damaged shall be thoroughly cleaned, dry and free of oil, grease, welding slag or flux and corrosion products. The surface preparation shall be to near-white metal and shall extend into the undamaged galvanized coating to provide a smooth repair. Spray or brush apply the zinc-rich paint to the prepared area in accordance with the manufacturer's instructions to attain the required dry-film thickness.

After completion of the repair process, the coating thickness shall be measured in accordance with TxDOT Test Method Tex-728-I. The minimum coating thickness for repairs shall be the same, as that required for the specified galvanizing.

Where fabrication is done after galvanizing and when indicated, the cut edges and bolt holes shall be cleaned by brushing and the cleaned area shall be painted with zinc-rich paint to the prepared area in accordance with the manufacturer's instructions to attain the required dry-film thickness.

706S.7 Designation of Railing

Railing shall be designated by the general classification and type indicated on the Drawings.

706S.8 Measurement

Railing of the classification and type designated will be measured by the lineal foot (lineal meter), complete in place, in accordance with the dimensions and details indicated on the Drawings.

706S.9 Payment

The Work performed and materials furnished in accordance with this Specification Item and measured under Section 706S.7, 'Measurement', will be paid for at the unit bid price for "Railing" of the classification and type indicated on the Drawings. The unit bid price shall include full compensation for: furnishing all materials including concrete, expansion joint material, reinforcing steel, structural steel, cast steel, pipe, anchor bolts and all others required in the finished railing; all labor, tools, hardware, equipment, paint and painting, galvanizing; and all incidentals necessary to complete the work in the manner specified in this Specification Item and in accordance with the details specified in the contract Drawings.

For metal railing, the price paid shall be for the length of metal rail installed and shall not include concrete parapet walls or concrete wing terminal walls unless specifically designated on the Drawings.

Payment will be made under:

Pay Item No. 706S: Bridge and Culvert Railing, Type ____ Per Lineal Foot.
End

SPECIFIC CROSS REFERENCE MATERIALS
Specification Item 706S "Bridge and Culvert Railing"

City of Austin Standard Specifications

Designation	Description
Item No. 403S	Concrete for Structures
Item No. 406	Reinforcing Steel
Item No. 410	Concrete Structures
Item No. 720	Metal for Structures
Item No. 721	Steel Structures
Item No. 722	Paint and Painting
Item No. 723	Structural Welding

Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges

Designation	Description
Item 445	Galvanizing
Item 424,	Precast Concrete Structures (Fabrication)

Texas Department of Transportation: Manual of Testing Procedures

Designation	Description
Tex-728-I	Measurements of Dry Film Coating Thickness on Steel

American Society for Testing and Materials

Designation	Description
A-90	Test Method for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles
A-307	Specification for Carbon Steel Externally Threaded Standard Fasteners
E-8/E-8M	Methods of Tension Testing of Metallic Materials

RELATED CROSS REFERENCE MATERIALS
Specification Item 706S "Bridge and Culvert Railing"

City of Austin Standard Specifications

Designation	Description
Item No. 405	Concrete Admixtures
Item No. 409	Membrane Curing
Item No. 411	Surface Finishes for Concrete
Item No. 558	Structural Plate Structures
Item No. 559	Concrete Box Culverts
Item No. 704	Metal Beam Guard Railing
Item No. 705	Remove and Relocate Existing Metal Beam Guard Railing

City of Austin Standard Details

Designation	Description
Item No. 406S-1	Reinforced Steel Tolerances

Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges

Designation	Description
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Item 420	Concrete Structures
Item 421	Portland Cement Concrete
Item 427	Surface Finishes for Concrete
Item 437	Concrete Admixtures
Item 440	Reinforcing Steel
Item 450	Railing

American Society for Testing and Materials

Designation	Description
A-123	Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
A-153	Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Hardware
A-525	Specification for General Requirements for Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process