

## Section 711. BRIDGE RAILINGS

**711.01 Description.** This work consists of furnishing and placing bridge railings as covered by standard plans or as specially detailed.

**711.02 Materials.** Materials shall meet the following requirements.

Concrete, Grade D . . . . .	701
Concrete Curing Material . . . . .	903
Dowels and Bar Reinforcement . . . . .	905
Structural Steel . . . . .	906
Miscellaneous Metals . . . . .	908
Tubing, Steel Railing . . . . .	908
Hardware for Timber Construction . . . . .	908
Structural Timber and Lumber . . . . .	912
Preservative Treatments . . . . .	912
Expansion Bolts . . . . .	914
Barrier Reflector Markers . . . . .	922

The concrete for bridge railings shall be Grade D using 6AA natural aggregate with a maximum of 2.50 percent absorption according to ASTM C 127. No slag aggregate will be allowed.

Barrier marker color shall conform to reflector marking colors normally required at that location.

### 711.03 Construction.

- A. **Structural Steel, and Pipe Railings.** Railings shall be constructed according to the plans and section 707. Metal railing shall be carefully adjusted prior to bolting connections to ensure proper match at abutting joints and correct alignment throughout their length.

For steel railing components, no punching, drilling, cutting, or welding will be permitted after galvanizing. No welding shall be allowed on the rail sections except to the end cap and the longitudinal seam weld made by the manufacturer of the rail. Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

Rolling and bending of tube rail sections shall be done with a hydraulic ram. A mandrel inside the tube rail shall be used with the hydraulic ram when the radius is less than 3 feet. No mitering and cutting, welding, or heat curving is allowed. Kinks in the radius section of the tube are cause for rejection. Drop weight tear testing according to ASTM E 436 is not required on the tube sections that are to be curved. Bend rail sections prior to galvanizing. Provide a minimum distance of 24 inches between compound curves. Minimum tube thickness for curved sections shall be  $\frac{3}{8}$  inch. Mill splice pieces to fit. Ends of tube sections are to be sawed or milled. Cut ends are to be true, smooth and free from burrs or ragged edges. All open ends of the rail shall be capped. Tube railing sections shall have the longitudinal seam weld facing downward when the railing is erected.

The railing system shall be continuous, each joint shall be spliced as detailed. All rail tube sections shall be spliced in the same panel.

Before casting concrete, anchor studs for railing posts shall be set by use of a template according to subsection 706.03.L. See plans for the spacing of railing posts. Nuts for the anchor studs fasteners shall be tightened to a snug tight condition as defined in subsection 707.03.D.7.c.

All steel, anchor studs and fasteners shall be hot-dip galvanized according to subsection 707.03.C.16. Welded post assemblies shall be blast cleaned before galvanizing.

Shop plans will not be required.

**B. Concrete Railings.**

1. **Parapet Railings.** Parapet railings shall conform to section 706. Special care shall be exercised to secure smooth and tight fitting forms which can be rigidly held to line and grade and removed without injury to the concrete. All moldings, panel work, and bevel strips shall be constructed according to the details shown on the plans with neatly mitered joints. All corners in the finished work shall be true, sharp and clean-cut and shall be free from cracks, spills, or other defects. Exposed vertical and top surfaces shall be given a rubbed surface finish as specified in subsection 706.03.R.2.
2. **Bridge Barrier Railings.** Bridge barrier railings shall be constructed according to the plans using the construction methods in section 804, and the requirements for protecting concrete in subsection 706.03.J.

**C. Timber and Lumber Railings.** Railings or portions thereof which are constructed of timber and lumber shall conform to section 709.

**D. Removal of Aluminum Railing.** This work consists of complete removal of the aluminum tube and posts on the parapet railing. The anchor bolts shall remain in place. All removed material shall become the property of the Contractor.

**E. Bridge Railing, Thrie Beam Retrofit.** Drill any necessary holes or slots in thrie beam elements. Do not flame cut beam elements.

Core drill holes through existing concrete. Determine the location of existing reinforcement with a pachometer, or other nondestructive means, to avoid cutting existing reinforcement while coring. Take care during drilling, to avoid spalling concrete. Should spalling occur, remove any loose concrete before installing the bolt. Remove all concrete fragments lying on the railing, railing post, curb, or slab. Do not patch spalled areas.

Install nuts, for bolts and studs, finger-tight at 5-inch slots in thrie beam expansion sections. Nuts shall fully engage bolts with a minimum of one bolt thread extending beyond the nuts. Upset the first thread, on the outside of the nut, with a center punch or a cold chisel, to

prevent loosening. Tighten lag screws in 5 inch slots so that washers are in full contact with beam elements, but not so tight as to impede movement due to expansion.

If the thrie beam element will cover an existing structure name plate, the Contractor shall install a new name plate, near the end of the railing, on the fascia side. Attach the name plate according to Standard Plans B-103 Series, except make the attachment with 3/8 inch diameter expansion anchored bolts.

- F. **Permanent Barrier Reflective Marker.** The markers shall be installed using the manufacturer's recommended adhesive and according to manufacturer's recommendations. Any dirt or curing compound shall be removed from the bridge barrier railing or concrete barrier prior to installation of the barrier marker. Barrier markers shall be installed every 50 feet, with placement of the first marker within 50 feet of the end of the bridge barrier railing or concrete barrier. If the bridge barrier railing or concrete barrier is less than 50 feet in length, a second marker shall be placed within 3 feet of the opposite end. The markers shall be installed with the top at a height of 28 inches from the roadway surface.

**711.04 Measurement and Payment.**

<b>Contract Item (Pay Item)</b>	<b>Pay Unit</b>
Bridge Railing, Aesthetic Parapet Tube .....	Foot
Bridge Railing, Thrie Beam Retrofit .....	Foot
Bridge Railing, __ Tube .....	Foot
Bridge Barrier Railing, Type __ .....	Foot
Pipe Railing, __ .....	Foot
Reflective Marker, Permanent Barrier .....	Each

- A. **Bridge Railing** and **Bridge Barrier Railing** quantities will be based on plan quantities. The work includes placing steel reinforcement; furnishing and placing concrete; constructing joints; anchor bolts or insert sleeves; and curing and protecting the concrete. Reinforcing steel will be measured and paid for as specified in subsection 706.04.
- B. All work and materials required to attach guardrail anchorages to bridge railing end posts are included in the bid item **Bridge Railing, Thrie Beam Retrofit**. Where new name plates are required, the cost of furnishing and installing the new name plate shall not be paid for separately, but will be included in the contract unit price for **Bridge Railing, Thrie Beam Retrofit**. Reflectorized washers will be paid for separately.
- C. **Bridge Railing, Aesthetic Parapet Tube** and **Bridge Railing, \_\_ Tube** include the appropriate light standard anchor bolt assembly, handhole frame and lid, and any additional work and materials required for bending tube. Concrete and reinforcement for railing end walls used with the tube railing will be paid for separately.
- D. **Pipe Railing** quantity will be determined by length based on plan quantities.
- E. **Reflective Marker, Permanent Barrier** includes installing the marker according to this specification and the manufacturer's recommendations.