

SECTION 513 RAILING

513.1 Description

- (1) This section describes furnishing and erecting railing fabricated from steel pipe, structural steel, tubular steel, steel plate beam, or aluminum.

513.2 Materials

513.2.1 General

- (1) Furnish materials conforming to the following:

Structural steel.....	section 506
Miscellaneous metals	section 506
Steel pipe.....	section 506
Pipe fittings.....	section 506
Sheet lead	section 506
Paint	section 517
Painting structures.....	section 517
Steel guardrail	section 614

- (2) Use black, round, steel pipe for the rails and posts for pipe railing.
- (3) Fabricate steel railing using structural steel shapes the plans show.
- (4) Use steel guardrail for the rails of steel railing, type W, conforming to plan details for W beam or thrie beam.
- (5) Under the Railing Tubular Type H bid item, furnish either tubular aluminum railing, or tubular steel railing, except if furnishing railings for adjacent structures on a dual highway then use the same material.
- (6) Under the Railing Tubular Type F bid item, furnish only tubular steel railing.
- (7) For tubular aluminum railing, conform to [513.2.2](#) for aluminum railing below.
- (8) For tubular steel railing, conform to [513.2.4](#) for steel railing below.
- (9) Under the Railing Tubular Screening bid items, provide chain link fence fabric with a bonded polyvinyl chloride (PVC) coating and conforming to AASHTO M181 type IV, class B. Provide fabric woven of 9-gauge wire in 2-inch diamond pattern mesh with both the top and bottom selvages knuckled. Also provide PVC-coated ties and tension bars conforming to AASHTO M181. Ensure that the color of all fencing components matches the color of the railing framework materials the plans specify.

513.2.2 Aluminum Railing

513.2.2.1 General

- (1) For all material for the various parts of the aluminum railing, except the anchor bolts, toggle bolts, and other miscellaneous hardware, use aluminum alloy and conform to the requirements specified.
- (2) If using railing from a department-approved fabricator, provide a certified report of test or analysis for the railing tubes, cast, and extruded shapes for posts, and anchor bolts to the engineer upon request.
- (3) If using railing that is not from a department-approved fabricator, furnish a certified report of test or analysis to the engineer for the railing tubes, cast and extruded shapes for posts, and anchor bolts. For miscellaneous hardware required to complete installation (toggle bolts, washers, nuts, bolts, screws, pins, clamps, shims, etc.), furnish a certificate of compliance to the engineer.
- (4) Dimensional tolerances for aluminum products shall conform to ASTM B210.

513.2.2.2 Cast Aluminum Railing Posts

- (1) Furnish material for railing posts conforming to ASTM B108, Alloy A 444.0.

513.2.2.3 Round or Square Tubular Rail and Extrusions

- (1) Furnish material for round or square aluminum tubes and other extruded shapes conforming to ASTM B221, Alloy 6061-T6 or Alloy 6351-T5.
- (2) Ensure that the extruded finish of the tubing is free from nicks, blemishes, and discoloration marks.

513.2.2.4 Shims

- (1) Use the size shims the plans show. Use material for shims conforming to ASTM B209, Alloy 1100.

513.2.2.5 Stainless Steel Nuts, Bolts, and Washers

- (1) Use nuts, bolts, and washers of the size the plans show and conforming to the following:
 - Hex nuts ASTM F594
 - Hex bolts and anchor bolts ASTM F593, any type in alloy groups 1, 2, or 3
 - Washers ASTM A240

513.2.2.6 Plates

- (1) Use material for plates conforming to ASTM B209, Alloy 6061-T6.

513.2.2.7 Standard Structural Shapes

- (1) Use material for standard aluminum structural shapes conforming to ASTM B308.

513.2.2.8 Toggle Bolts

- (1) Use toggle bolts made of steel, conforming to the plans. Make the assembly from the material specified below:
 - Toggle bolt and pin Cold finished steel heat-treated Brinell 311-363 ASTM A354.
 - Toggle washer Hot rolled steel ASTM A1011. Manufacturer's standard washer.
 - Spacer nut Grade 1213, ASTM A108. Cold finished steel heat-treated ASTM A325.
- (2) Cadmium plate the complete assembly of toggle bolts according to ASTM B766, type III, class 12.

513.2.2.9 Miscellaneous Hardware

- (1) Provide hardware conforming to the following:
 - Stainless steel clamping bars ASTM A276, any type in the 300 series
 - Stainless steel cap screws ASTM F593, any type in alloy groups 1, 2, or 3
 - Aluminum clamping bars ASTM B211, Alloy 6061-T6
 - Cast aluminum washers ASTM B26, Alloy 356.0
 - Aluminum pins ASTM B211, Alloy 6061-T6

513.2.3 Anchor Bolts

- (1) Use anchor bolts, nuts, and washers for anchoring aluminum railing to structures made of stainless steel and of the size, the plans show.
- (2) The contractor may use anchor crossbars of structural carbon steel. Use the same material requirements as well as the shape of nuts and type of threads as specified for bolts and nuts in [513.2.2.5](#).
- (3) Use anchor bolts for anchoring steel railing to structures made of the material, size, and style the plans show. Furnish them with regular hexagon nuts and standard flat washers. Hot-dip zinc coat the upper 3 1/2 inches of the anchor bolts, nuts, and washers according to ASTM A153, class C supplemented by ASTM F2329. Use only nuts and anchor bolts manufactured with sufficient clearance to allow the nuts to run freely on the bolts after coating. Apply a good grade of heavy grease to the bolt threads before applying the nuts.

513.2.4 Steel Railing

- (1) All material shall conform to the requirements the plans show or as specified below.
- (2) If the railing is from a department-approved fabricator, furnish a certified report of test or analysis for the railing pipe, plate beam and tubing, and component parts of the posts and anchor bolts upon the engineer's request.
- (3) If the railing is not from a department-approved fabricator, furnish a certified report of test or analysis to the engineer for the railing pipe, plate beam and tubing, and the component parts of the posts and anchor bolts. For miscellaneous hardware and objects required for completing the installation, submit a certificate of compliance to the engineer.

513.3 Construction

513.3.1 General

- (1) Conform to [section 506](#) for steel bridges, except as specified otherwise below. Submit shop drawings for structural steel, miscellaneous metals, or aluminum as specified in [section 506](#) before ordering or fabricating the material.

- (2) Before erecting the railing, swing the spans free from falsework. Make the railings line and grade true and do not follow any unevenness of sidewalk or wall that supports the railing. Unless the plans require otherwise, construct the railing with the posts normal to the grade of the structure.
- (3) Unless the plans provide otherwise, set the anchor bolts in the supporting concrete during concrete placement. Place the anchor bolts in a way that provides correct and true railing alignment. Set anchor bolts at the proper depth to provide for the bolt projecting through the completed work not more than 3/8 inch beyond the nut.
- (4) If required to set anchor bolts in holes drilled in concrete, use bolts with expansion sleeves of an engineer-approved type. Place the bolts and expansion sleeves in the drilled holes and the firmly anchor bolts before tightening the nuts to their final position.
- (5) Place any shims the plans require under each railing post, and end base plate of pipe, and structural steel railings.
- (6) Paint the exposed metal of pipe, structural steel, and non-zinc-coated tubular steel railing according to the epoxy system as specified in [517.2.4](#) and the following subsections. Do not paint aluminum railing, zinc coated steel plate beam, and zinc coated tubular steel railing.

513.3.2 Pipe Railing

- (1) Construct pipe railing with pipe rails and pipe posts conforming to plan details. Join the posts and rails together by screw fittings, or by welding, as the plans show. Grind the welded joints to a smooth finish. Do not splice pipe rails with screw fittings between the posts.

513.3.3 Steel Railing

- (1) Saw the vertical members of the railing to length; do not shear them. Fabricate tubular steel railing according to plan details.
- (2) After complete fabrication, zinc coat the tubular steel railing, type H, according to ASTM A123. Blast clean steel railing according to SSPC-SP 6 before applying zinc coating. Paint tubular steel railing type F specified for tubular steel railing in [513.3.1](#).
- (3) Ship, handle, and erect the zinc coated tubular steel railing in a manner to preclude scratching or marring the spelter coating. Repair damaged zinc coating as specified for its repair in [635.3.5](#).

513.3.4 Aluminum Railing

- (1) For welding aluminum railing, conform to [641.2.7.7](#) and [641.3.2.3](#). Fabricate according to the Fabrication of the Aluminum Association's Specifications for Aluminum Structures.
- (2) Do not oxygen cut materials.
- (3) Blast clean, or polish and burnish, the cast posts so that the finished castings have surfaces of uniform texture with a smooth, uniform appearance.
- (4) Before laying out or working on aluminum materials, ensure they are straight. If straightening is necessary, straighten in a way that causes no injury to the appearance or strength of the metal. The engineer will reject material with sharp kinks and bends.
- (5) Store the aluminum railing above the ground on platforms, skids, or other suitable supports. Protect the material from moisture and keep it free from oil, grease, dirt, and contact with dissimilar metals until the railing is complete.
- (6) Neatly finish those portions of work exposed to view. Handle, ship, and erect the material in a manner to preclude any scratching, denting, or other defects that may affect the railing durability or appearance.

513.3.5 Screening

- (1) Color match screen fencing components with railing framework materials before painting the framework. Install chain link screening fence fabric conforming to [616.3.3.3](#) and the plan details. Touch up painted framework surfaces marred by fencing installation.

513.3.6 Welding

- (1) Weld railing as the plans show and conforming to the following:

For steel railing: AWS D 1.5, Bridge Welding Code.

For stainless steel railing: AWS D 1.6, Structural Welding Code - Stainless Steel.

For aluminum rails: AWS D 1.2, Structural Welding Code - Aluminum.

(2) Visually inspect and certify the quality of field welds as follows:

1. Ensure that the contractor's inspector is an AWS certified welding inspector (CWI) or a department-approved individual competent to perform inspections.
2. Have the contractor's inspector complete department form [DT2320](#) for each structure and submit the form to the engineer for inclusion in the permanent project record.

513.4 Measurement

(1) The department will measure the Railing Pipe, Railing Tubular, and Railing Steel bid items as a single lump sum unit for each structure acceptably completed.

513.5 Payment

(1) The department will pay for measured quantities at the contract unit price under the following bid items:

<u>ITEM NUMBER</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
513.2000	Railing Pipe (structure)	LS
513.4000 - 4099	Railing Tubular (type) (structure)	LS
513.6000	Railing Steel (structure)	LS
513.7000 - 7099	Railing Steel (type) (structure)	LS

(2) Payment for the Railing Pipe, Railing Tubular, and Railing Steel bid items is full compensation for providing, fabricating, transporting, and erecting the railing; for painting pipe and steel railing; for zinc coating or painting steel tubular railing; for providing and placing metal shims under the bases if required; and for providing and placing the anchor bolts.