

## 513 Railing

### 513.1 Description

- (1) This section describes providing railing fabricated from structural steel, steel structural tubing, steel guardrail, or aluminum.

### 513.2 Materials

#### 513.2.1 General

- (1) Furnish railing and railing components from a department-approved fabricator. A list of approved fabricators is available on the [APL](#) for structures under fabricated bridge components - railings.
- (2) Conform to the department's certification method of acceptance, as defined in [CMM 875.4](#), for railing and railing components. Furnish a certificate of compliance for miscellaneous hardware.
- (3) Furnish chain link fence fabric with a bonded polyvinyl chloride (PVC) coating and conforming to [ASTM F668](#), class 2B. Furnish 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 [ASTM F626](#).
- (4) Furnish stainless steel nuts, bolts, anchor bolts, and washers conforming to the following:
  - Hex nuts ..... [ASTM F594](#)
  - Hex bolts and anchor bolts ..... [ASTM F593](#), type 316
  - Washers ..... [ASTM A240](#)
- (5) Furnish galvanized steel nuts, bolts, anchor bolts, and washers hot-dipped according to [ASTM F2329](#) or mechanically galvanized according to [ASTM B695](#) Class 55; ensure that the same galvanization process is used for all parts of the assembly.

#### 513.2.2 Aluminum Railing

- (1) Conform to dimensional tolerances for aluminum products according to [ASTM B210](#). Furnish aluminum railing components as follows:
  - Cast aluminum railing posts ..... [ASTM B108](#), alloy A 444.0
  - Tubular rail and extrusions ..... [ASTM B221](#), alloy 6061-T6 or alloy 6351-T5
  - Shims ..... [ASTM B209](#), alloy 1100
  - Plates ..... [ASTM B209](#), alloy 6061-T6
  - Standard aluminum structural shapes ..... [ASTM B308](#)
  - 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 Steel Railing

- (1) Furnish steel railing components as follows:
  - Structural steel ..... [506.2.2](#)
  - High strength bolts ..... [506.2.5](#)
  - Steel guardrail ..... [614.2](#)
  - Round structural steel tubing for steel pipe railing ..... [ASTM A500](#) grade B
  - Structural steel tubing used with other steel railings ..... [ASTM A500](#) grade B or C
- (2) Furnish a two-coat paint system from the [APL](#) for structure painting systems under paint - galvanized railing.

### 513.3 Construction

#### 513.3.1 General

- (1) Submit shop drawings to the engineer conforming to [105.2](#) with electronic submittal to the fabrication library under [105.2.2](#) before ordering or fabricating the material. Include the size and location of vent or drainage holes. For painted railings, state the name of the painting manufacturer and the product name of the tie-coat and top-coat used along with the color number and name on the drawings.
- (2) Before erecting the railing, swing the spans free from falsework. Make the railing's line and grade true; do not follow unevenness in supporting sidewalk or walls. 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 anchor bolts during concrete placement. Locate to provide the correct railing alignment. Ensure that bolts do not project more than 3/8 inch beyond the nut after attaching the rail. If setting anchor bolts in holes drilled in concrete for combination or pedestrian railings, use adhesive anchors conforming to [502.2.12](#) and installed conforming to [502.3.14](#).
- (4) Shim to align each railing post and end base plate as the plans show.
- (5) Galvanize, or galvanize and paint steel railings as the plans specify. Do not paint aluminum railing
- (6) Under the Railing Tubular Type H bid item, furnish either aluminum railing or steel railing, except if furnishing railings for adjacent structures on a dual highway, use the same material and finish.
- (7) Use stainless steel nuts, bolts, anchor bolts, and washers for aluminum railing. Use galvanized steel nuts, bolts, anchor bolts, and washers for steel railings unless the plans show stainless steel.

### **513.3.2 Aluminum Railing**

- (1) Fabricate according to Part 1 of the Aluminum Design Manual published by the Aluminum Association.
- (2) Do not oxygen cut materials.
- (3) Blast clean, or polish and burnish, cast posts to provide a finished surface with a uniform texture and 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 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. 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.

### **513.3.3 Steel Railing**

- (1) Saw the members of the railing to length; do not shear. Grind welded joints to a smooth finish.
- (2) Fabricate railings to meet the requirements of [ASTM A385](#). After fabrication, blast clean assemblies per SSPC-SP6 and galvanize according to [ASTM A123](#). Provide vent holes in members to facilitate galvanizing and provide drainage. Remove burrs at component edges, corners, and holes; and chamfer sharp edges before galvanizing. Condition thermal cut edges before blast cleaning by shallow grinding or other cleaning to remove hardened surface layer material. Remove steel defects according to [AASHTO M160](#) before blast cleaning. Remove lumps, projections, globules, and heavy deposits of galvanizing. Do not use water quenching; and do not use chromate or other passivating treatments.
- (3) Use a two-coat paint system if painting after galvanizing as follows:
  - Coat exterior surfaces of railing assemblies and inside of rail elements at field erection joints.
  - Coat inside of rail elements at expansion joints.
- (4) Clean galvanized surfaces before coating according to SSPC-SP1 to remove chlorides, sulfates, zinc salts, oil, dirt, organic matter, and other contaminants. Ensure tie-coat adhesion by brush blasting the cleaned surface according to SSPC-SP16 to create a slight angular surface profile according to manufacturer's recommendations of 1 mil to 1.5 mils. Remove wet storage stains before blasting according to SSPC-SP16.
- (5) Brush blast at an angle of 30 to 60 degrees at no greater than 50 psi using garnet or other engineer-approved soft abrasive. Do not use steel shot or angular iron blasting grit. Brush blast the surface to produce a matte silver appearance. Do not fracture the galvanizing finish or remove any dry film thickness. Before applying the tie-coat, remove visible deposits of oil, grease, and other contaminants according to SSPC-SP1 and remove dust, dirt, and loose residue.
- (6) After cleaning and within 8 hours of blasting, apply the tie-coat from a coating system intended for galvanized surfaces, according to manufacturer's recommendations. Apply the top-coat according to manufacturer's recommendations, matching the color the plans show. Use a top-coat that is UV resistant and suitable to a marine environment. Ensure that the tie and top-coats are of contrasting color and come from the same manufacturer.
- (7) Ensure that the coating manufacturer reviews the process for surface preparation and application of the coating system with the coating applier. The review includes a visit to the facility performing the work if the coating manufacturer requests. Provide written confirmation, from the coating manufacturer to the engineer, that the review took place and that issues raised were addressed before beginning the coating work under the contract.
- (8) The department will reject coating with bubbles, blisters, or flaking.

- (9) Handle steel railings in conforming to [517.3.1.7.4](#). Repair or replace railing assemblies if the galvanizing or the two-coat paint system is damaged. Store the material off the ground, providing proper ventilation and drainage. Do not field weld, field cut, or drill without the engineer's written approval.
- (10) For minor damage to coated surfaces caused by shipping, handling, or installation; touch-up the surface conforming to the manufacturer's recommendation for the two-coat paint system and conforming to [ASTM A780](#) for the galvanization.

**513.3.4 Screening**

- (1) 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.

**513.3.5 Welding**

- (1) Weld railing as the plans show and conforming to the following:
  - For steel railing: AWS D 1.5, Bridge Welding Code.
  - For aluminum railing: AWS D 1.2, Structural Welding Code - Aluminum.

**513.4 Measurement**

- (1) The department will measure the Railing bid items by the linear foot 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>
513.2001	Railing Pipe	LF
513.4000 - 4090	Railing Tubular (type)	LF
513.4091	Railing Tubular Screening	LF
513.7000 - 7099	Railing Steel (type)	LF
513.8000 - 8099	Railing Steel Pedestrian (type)	LF

- (2) Payment for the Railing bid items is full compensation for providing railing; for anchor bolts; and for painting.