SECTION 507 - RAILINGS

507.01 Description. This section describes furnishing and installing concrete railings, zinc-coated iron pipe railings, steel bridge railings, and aluminum railings for bridges, wingwalls, retaining walls, or other locations indicated in the contract documents.

507.02 Materials.

Structural Concrete (Class A Concrete)	601
Reinforcing Steel	602
Aluminum Bridge Railing	710.09
Steel Bridge Railing	710.10
Steel Pipe for Railing	710.11
Aluminum	715.01
Contacts with Dissimilar Material	715.02

507.03 Construction. Before constructing railings, release structure centering or falsework and place required backfills.

Submit detailed shop drawings required for metal fabrications in accordance with Subsection 501.03(A) - Shop Plans.

Construct railings true to line and grade in accordance with details indicated in the contract documents. Allowance for camber may be included in each span, but unevenness in superstructure shall not be followed. Unless otherwise indicated in the contract documents, construct bridge railings vertically, whether super-elevated or not.

(A) Concrete Railing. When ordered by the Engineer, adjust height of concrete railings to compensate for camber and dead load deflection of superstructure. The Engineer will determine amount of adjustment and will order adjustment before concrete is placed.

Construct cast-in-place portion of railing or parapet in accordance with Section 503 - Concrete Structures and this subsection.

Construct expansion joints before finishing concrete. Provide Class 2 concrete finish for railing surfaces in accordance with Subsection 503.03(M)(2) - Class 2 Rubbed Finish. After completing other work, carefully

remove with a sharp chisel, loose or thin shells of mortar likely to spall under expansion joint movement.

Concrete parapet under metal bridge railing and end posts shall be considered concrete railing and shall conform to requirements of this section.

(B) Zinc-Coated Iron Pipe Railings. Weld and grind joints smooth. Welding shall comply with Subsection 501.03(D) - Shop Work and Fabrication. Provide vent holes for iron pipe galvanizing and show them in shop drawings.

Repair damaged zinc-coated surfaces in accordance with Subsection 501.03(G)(2) - Repairing Damaged Zinc-Coated Surfaces.

(C) Metal Bridge Railings.

(1) Storage of Materials. Store metal bridge railing materials at work site acceptable to the Engineer, on platforms, pallets or other aboveground supports. Keep railing materials free from grease and dirt and protected from moisture until railings are installed. Prevent aluminum railing materials from coming in contact with dissimilar metals.

(2) Condition of Materials. Rolled railing material, before being laid out or worked, shall be straight. If necessary, straighten material by methods that will not produce fracture or otherwise damage the metal. Material with sharp kinks or bends, or both, will be rejected.

Provide commercial finish for portions of work exposed to view.

(3) Layout. Space posts as indicated in the contract documents. If required, furnish and install full-sized shims to cover entire post base.

(4) Fabrication and Erection.

(a) General. Join materials as indicated in the contract documents. Match-mark sections to ensure that they will be erected in same position in which they were fabricated. Adjust railings to ensure the following: proper matching at abutting joints; and correct alignment, curvature, and camber throughout their lengths. Fabricate railings on curves or return bends by shop bending rails to fit curvature, forming smooth curve throughout their lengths. Cover exposed ends of bridge rails with terminal caps or seals acceptable to the Engineer. Installed railings shall have smooth, uniform appearance.

Shims required for aligning aluminum posts shall conform to Subsection 715.01(E) - Aluminum Shims. Where aluminum alloys come in contact with dissimilar materials, coat interface surfaces in accordance with Subsection 715.02 - Contacts With Dissimilar Material.

(b) Bending. To ease bending, aluminum may be heated to no more than 400 degrees F for a period not exceeding 30 minutes. Steel may be heated to no more than 1200 degrees F. Monitor induced temperatures with temperature-indicating crayons, liquids, bimetal thermometers, or other means acceptable to the Engineer.

(c) Cutting. Shear, saw, or mill material of 1/2-inch thickness or less. Cut edges shall be true, smooth, and free from burrs or ragged breaks. Fillet re-entrant cuts by drilling before cutting. Torch or flame cutting will not be allowed.

(d) Drilling and Punching Holes. Drill or punch bolt holes to finished size; sub-punch and ream to finished size; or sub-drill and ream to finished size. Punching holes to finished size or sub-punching and reaming to finished size will be allowed for material 3/4 inch or less in thickness. For material more than 3/4 inch in thickness, drill to finished size or sub-drill and ream to finished size.

Die diameter shall not exceed punch diameter by more than 3/32 inch.

Sub-punched or sub-drilled holes shall be smaller than finished size holes by 1/4 inch. Unless otherwise indicated in the contract documents, finished holes shall be cylindrical, perpendicular to plane of connection, and not more than 1/16 inch larger than nominal bolt diameter.

Slotted bolt holes shall have length not more than two and one-half times nominal bolt diameter, and width not more than 1/16 inch larger than nominal bolt diameter.

Finished holes shall be clean-cut, without torn or ragged edges. Remove burrs, fins, sharp edges, and hole irregularities that would prevent solid seating of parts. Poorly matched holes will be rejected.

Ream and drill with twist drills, twist reamers, or rotobroach cutters, guided mechanically, where practicable. If required, separate assembled parts for removal of burrs caused by drilling. Assemble connecting parts and hold

securely together while reaming or drilling. Match-mark connecting parts.

(e) Accuracy of Holes. Punched, subpunched, and sub-drilled holes shall meet the following accuracy standard. After assembling (before reaming), at least 75 percent of contiguous holes in same plane shall permit cylindrical pin 1/8 inch smaller in diameter than nominal size of punched, sub-punched, and sub-drilled holes, to pass through at right angles to face of member, without drifting. All holes shall permit passage of pin 3/16 inch smaller in diameter than nominal size of punched, sub-punched, and sub-drilled holes. Connection pieces that fail to meet specified accuracy standard will be rejected.

When holes are reamed or drilled, at least 85 percent of contiguous holes in same plane shall show no offset greater than 1/32 inch between adjacent thicknesses of metal.

(f) Drifting. Drifting during assembly will be allowed only to the extent that is required to bring parts into position. Drifting shall not enlarge holes or distort metal.

(g) Bolting. During concrete placement, protect exposed portions of anchor bolts above finish line of concrete by wrappings, grease, or heavy oil. Draw heads and nuts tight against work. Use beveled washers on beveled surfaces to ensure full bearing to both head and nut.

507.04 Measurement. Railing will be paid on a lump sum basis. Measurement for payment will not apply.

507.05 Payment. The Engineer will pay for accepted railing on a contract lump sum basis. Payment will be full compensation for work prescribed in this section and the contract documents.

The Engineer will pay for the following pay item when included in the proposal schedule:

Pay Item	**Pay Unit**
_____ Railing	Lump Sum

The Engineer will pay for portions of railing bars that extend into slabs or beams in accordance with and under Section 602 - Reinforcing Steel.

END OF SECTION 507