SECTION 536
GUARDRAIL

536-1 Description.

Construct metal guardrail on posts of timber, steel, or as specified in accordance with the Contract Documents and the Design Standards.

Also, remove existing guardrail, construct guardrail anchorages, and replace guardrail posts, as specified in the plans.

536-2 Materials.

536-2.1 Guardrail: Construct guardrail of the standard W-beam or thrie beam type. Use materials for the rail and rail elements meeting the steel requirements of 967-1.

536-2.2 Posts:

536-2.2.1 General: Unless the Contract Documents designate a particular type of post, the Contractor may choose the type of post to use. Use posts of either timber, or steel, and of the sizes and dimensions shown in the plans. Use the particular type selected throughout a run of rail, except where special steel posts are required.

536-2.2.2 Timber Posts: Meet the requirements of the latest edition of the Southern Pine Inspection Bureau's Standard Grading Rules for Southern Pine Lumber, for No.1 grade timber, and treat the posts in accordance with the requirements for posts in 955-5.3. Ensure that penetration of preservative is in accordance with requirements for round piles and fence posts in 955-6.2. Shape and drill the posts prior to treatment, and ensure that they do not vary more than 1 inch [±25 mm] from the specified length. Dress all timber posts on all four sides (S4S).

536-2.2.3 Steel Posts: Use steel posts meeting the requirements of ASTM A36 [ASTM A 36M] steel. Galvanize the posts in accordance with the requirements of ASTM A 123 [ASTM A 123M], with 2 oz/ft^2 [600 g/m^2] of zinc coating. Drill the posts prior to galvanizing. Ensure that the manufacturer furnishes certification showing physical and chemical properties of each heat, the amount of spelter coating, and conformance ASTM A 123 [ASTM A 123M].

The Contractor may use steel guardrail posts of either a rolled section or a welded structural shape with nominal dimensions as shown in the Design Standards.

For welded structural shapes, meet the following requirements:

(1) Ensure that the design properties of the shape meet or exceed the design properties for a W 6 x 9 [W 150 x 14] shape as contained in the AISC Manual of Steel Construction.

(2) Weld in accordance with the requirements of ASTM A 769 [ASTM A 769M].

(3) After cutting posts to length, place a weld to seal the spaces between the web plate and flange plates.

(4) Galvanize as specified above after completing all drilling and welding.

536-2.3 Anchor Blocks: Use anchor blocks of Class I concrete, and construct and place them in accordance with the requirements shown in the plans or as directed by the Engineer.

536-2.4 Offset Blocks: Use guardrail offset blocks of either timber, steel, recycled plastic, or rubber, and of the sizes specified in the Design Standards.

Treat timber blocks in accordance with the requirements for posts in 955-5.3. Ensure that penetration of preservative is in accordance with requirements for round piles and fence posts in 955-6.2. For timber offset blocks, meet the requirements of the latest edition of the Southern Pine Inspection Bureau's Standard Grading Rules for Southern Pine Lumber, for No. 1 grade timber. Dress all timber offset blocks on all four sides (S4S). Ensure that timber offset blocks do not vary more than 0.25 inch [6 mm] from the specified length.

Use rubber blocks that have a minimum Durometer hardness of 50 (ASTM D 2240), show no cracking at the end of an ozone exposure of 100 ± 10 pphm for 15 hours at 100ºF [38ºC] (ASTM D 1149 mounting type A), do not exceed 15 points change in Durometer hardness in oven ageing for 70 hours at 158ºF [70ºC] (ASTM D 573), and show no cutting or tearing under a 6,500 lb [29 kN] load applied through a guardrail section. Ensure that the blocks present a neat appearance and have plane surfaces. Provide rubber blocks that are 6 inches [150 mm] wide, 8 inches [200 mm] deep and 14 inches [360 mm] high. Allow dimensional tolerances of ±5/8 inch [16 mm] in height, ±3/8 inch [10 mm] in width, and ±3/8 inch [10 mm] in depth.

For Recycled Plastic offset blocks, meet the requirements of Section 972.

536-2.5 Reflector Elements: Mount acrylic plastic reflectors on the guardrail in accordance with the details shown in the plans. Provide reflectors that meet the requirements of 993-5 and are colorless or amber, in accordance with the locations of use for each, as specified in the plans.

536-2.6 Certification: Provide the Engineer a certification from the manufacturer confirming that all materials (timber or steel posts, anchor and offset blocks, reflector elements, and all other accessories) meet the requirements of this Section, Section 6 and the Design Standards. Provide the Engineer a copy of the certification at least ten days prior to guardrail construction.

Also furnish the Engineer a Certificate of Compliance certifying that the guardrail system, materials and construction practices comply with applicable Design Standards and Specifications.

Acceptance of furnished material will be based on the Certificate of Compliance, material certification and visual inspection by the Engineer.

536-3 Setting Posts.

Set standard length posts vertically to the depth shown in the Design Standards. Set special length posts vertically to the depth shown in the plans. Align and realign posts as necessary, until final acceptance. Where the posts are not set in concrete or mounted on structures, backfill the post holes with suitable thoroughly tamped material. As an alternate method, the Contractor may use a post-driving machine, meeting the approval of the Engineer and capable of driving the posts without damaging them.

For guardrail post replacement, backfill and compact the existing hole prior to setting the new post.

If driving posts through asphalt pavement, the Contractor may either block out holes for the posts during the paving operation or cut holes through the mat prior to the post installation. Either block-out or cut through an area that is at least 50% larger than the area of the post being driven. After completing installation of the posts and compaction of the backfill material, patch the area around each post with fresh hot bituminous mixture.

536-4 Erection of Rail.

Erect the guardrail panels, supports, anchors, etc., as shown in the Design Standards.

536-5 Existing Guardrail.

Stockpile guardrail, so specified, within the right-of-way at a location approved by the Engineer. Dispose of all remaining guardrail not specified for stockpiling.

536-6 Method of Measurement.

536-6.1 Guardrail: The quantity to be paid for will be the plan quantity, in feet [meters], constructed, in place and accepted.

The plan length of a run of guardrail will be determined as a multiple of the nominal panel lengths plus the nominal lengths of terminal sections, unless payment for the terminal sections are included in the end anchorage or bridge anchorage assemblies.

536-6.2 End Anchorage Assemblies: The quantity to be paid for will be the number of each type as designated, constructed, in place and accepted.

536-6.3 Special Guardrail Posts: The quantity to be paid for will be the number of each, constructed, in place and accepted.

The designation "Special Guardrail Posts" will include only such posts as require special fabrication, for installation at locations where the normal setting would conflict with concrete structures, such as approach slabs, culvert slabs, footings, inlets, etc. Special posts, however, will not include posts for double-face median guardrail, regardless of whether they are embedded in or attached to concrete.

536-6.4 Bridge Anchorage Assemblies: The quantity to be paid for will be the number of each, constructed, in place and accepted.

536-6.5 Guardrail Anchorage (Concrete Barrier Wall): The quantity to be paid for will be the number of each, constructed, in place and accepted.

536-6.6 Guardrail Post Replacement: The quantity to be paid for will be the number of each, replaced.

536-6.7 Removal of Existing Guardrail: The quantity to be paid for will be the length, in feet [meters], measured prior to removal.

536-6.8 Special Steel Guardrail Posts: The quantity to be paid for will be the number of each, constructed, in place and accepted.

536-7 Basis of Payment.

536-7.1 Guardrail: Price and payment will be full compensation for all work specified under this Section, including the furnishing and installing of the acrylic plastic reflectors and all other materials as specified. Payment will be made under the items as follows:

a. Where the Contractor furnishes all materials for the guardrail, and the Engineer does not require shop-bent rails, payment will be made under the basic item of Guardrail.

b. Where the radius of the guardrail installation is such as to require shop bending of the guardrail panels, payment will be made under the item of Guardrail (Shop-bent Panels).

All component parts of the complete guardrail installation will be included in the price per foot [meter] for the above items except for the separate payments to be made under the special items listed below.

536-7.2 End Anchorage Assemblies: Price and payment will include all components specified on the plans and Design Standards.

536-7.3 Special Guardrail Posts: Price and payment will include all costs for furnishing and installing the special posts that are over and above the costs for the normal posts, which are replaced by such special posts.

536-7.4 Bridge Anchorage Assemblies: When the plans provide for direct payment for Bridge Anchorage Assemblies, price and payment will include furnishing and installing the special End Shoes, Wood Blocks or Retrofit Wing Posts, Concrete Anchor Posts and necessary hardware.

When the plans do not provide for direct payment for Bridge Anchorage Assemblies, the Contractor shall include the cost for the assemblies in the Contract price per foot [meter] for the guardrail.

536-7.5 Guardrail Anchorage (Concrete Barrier Wall): Price and payment will include installing connections to concrete barrier walls, as shown on the Design Standards, Index No. 400 and 410.

536-7.6 Guardrail Post Replacement: Price and payment will include all labor, materials, and equipment required for removal and disposal of existing posts in areas provided by the Contractor, backfilling and compacting existing holes, and replacement with new posts.

536-7.7 Removal of Existing Guardrail: Price and payment will be full compensation for all work specified in this Section, including all labor and equipment required for removal and disposition of the existing guardrail, as specified in the plans.

536-7.8 Special Steel Guardrail Posts with Accessories: Price and payment will include all components specified on the plans and Design Standards.

536-7.9 Payment Items: Payment will be made under:

Item No.	536- 1-	Guardrail - per foot
Item No.	2536- 1-	Guardrail - per meter.
Item No.	536- 2-	Guardrail (Shop-Bent Panels) - per foot.
Item No.	2536- 2-	Guardrail (Shop-Bent Panels) - per meter.
Item No.	536- 7-	Special Guardrail Post - each.
Item No.	2536- 7-	Special Guardrail Post - each.
Item No.	536- 8-	Bridge Anchorage Assemblies - each.
Item No.	2536- 8-	Bridge Anchorage Assemblies - each.
Item No.	536- 73-	Removal of Existing Guardrail - per foot.
Item No.	2536- 73-	Removal of Existing Guardrail - per meter.
Item No.	536- 75-	Special Steel Guardrail Posts with Accessories - each.
Item No.	2536- 75-	Special Steel Guardrail Posts with Accessories - each.
Item No.	536- 76-	Special Length Guardrail Posts - each.
Item No.	2536- 76-	Special Length Guardrail Posts - each.
Item No.	536- 82-	Guardrail Anchorage (Concrete Barrier Wall)- each.
Item No.	2536- 82-	Guardrail Anchorage (Concrete Barrier Wall)- each.
Item No.	536- 83-	Guardrail Post Replacement- each.
Item No.	2536- 83-	Guardrail Post Replacement- each.
Item No.	536- 85-	Guardrail, End Anchorage Assembly - each.
Item No.	2536- 85-	Guardrail, End Anchorage Assembly - each.