SECTION 606 - GUARDRAIL

606.01 Description. This work includes installing guardrails according to the contract. *|

The contract designates the types of guardrails as follows: *|

(1) Type 1 (Unassigned)

(2) Type 2 Cable-Chain Link Barrier Guardrail

(3) Type 3 Beam Type Guardrail

(4) Type 4 Rigid Barrier Type Guardrail

The construction of guardrails includes the assembly and erection of component parts at the locations shown in the contract or as ordered by the Engineer. *|

606.02 Materials. Materials shall conform to the following: *|

Joint Fillers	705.01
Reinforcing Steel	709.01
Wire Rope or Wire Cable	709.02
Chain Link Fencing	710.03
Metal Beam Rail	710.04
Guardrail Posts	710.07
Guardrail Hardware	710.08

Concrete for Type 4 Rigid Barrier Type Guardrail shall be Class A. Concrete for Type 4 Rigid Barrier Type Guardrail shall conform to Section 601 - Structural Concrete. *|

The Contractor shall furnish zinc-coated steel post and zinc-coated steel rail beam for the Type 3 Beam Type Guard Rail. The Contractor shall not mix the type of steel posts within the project. |

When the location of manufacturing plants allows, the Engineer may inspect the plants periodically for compliance with specified manufacturing methods. The Engineer may get samples of materials for laboratory testing for compliance with material quality requirements. This may be the basis for acceptance of manufacturing lots regarding quality. *|

The condition of materials will be subject to inspection for acceptance before or during incorporation of materials into the work. *|

606.03 Construction Requirements. The Contractor shall repair zinc-coated *| base metal surfaces that the Contractor exposes, drills, threads, cuts *| according to 501.03(G)(2) - Repairing of Damaged Zinc-coated Surfaces. *|

The Contractor shall preserve and protect existing facilities that the *| Contractor may affect by the guardrail installation. The Contractor shall *| replace the guardrails that the Contractor damages due to its operation at no *| cost to the State. |

(A) Beam Type Guard Rail

(1) Posts. The Contractor may drive steel posts, except those with *| anchors, into the ground if the Contractor uses a suitable method. *| The Contractor shall maintain an accurate vertical alignment and *| shall not deform the steel post. *|

The Contractor shall set the steel posts with anchors plumb in *| hand or mechanically dug holes. The Contractor shall backfill post *| holes with acceptable material placed in layers and compact *| thoroughly.

The Contractor shall set posts vertically in the ground to the *| approximate depth shown in the contract. The posts, after *| backfilling or driving, shall be in accurate alignment with their tops at the required grade.

The Contractor may vary the guardrail post locations shown in *| the contract to ease clearing utility lines or to produce smooth *| transitions. The Contractor shall request acceptance to the Engineer *| of such variance. *|

If the contract requires additional bolts and holes on posts, *| the Contractor shall drill the additional bolt holes and furnish the | bolts for proper installation. The Contractor shall drill, furnish, *| and install this additional bolts at no cost to the State. *|

The Contractor shall not make the additional bolt holes in *| posts by burning with a torch or other method or device. The *| Contractor shall manufacture or drill the holes in the posts. *|

(2) Rail Elements. The Contractor shall install the rail elements *| that results in a smooth, continuous installation. The Contractor *| shall draw bolts, except adjustment bolt, tight. Bolts shall be of *| sufficient length to extend beyond the nuts.

If the contract requires the Contractor to set the guardrail *| posts at non-standard spacing, the Contractor shall cut the rail *| elements and drill bolt holes as necessary for proper installation.

The Contractor shall not make the additional bolt holes by *| burning with a torch or other method or device. |

The Contractor does not require paint on zinc-coated steel railing.

(3) Existing Guardrail. The Contractor shall be responsible for verifying underground facilities such as utilities ducts, cables, and pipes in locations where the Contractor will drive guardrail posts. The Contractor shall repair damages done to the facilities despite the location or if shown in the contract at no cost to the State.

If the Contractor has removed the existing guardrails, the Contractor shall backfill and compact the holes with suitable material. The Contractor shall grade and compact the shoulder area before installing the new guardrails and posts.

Reinstallation of guardrail shall be according to Subsection 606.03(A).

If the Contractor replaces the existing guardrails with new guardrails and posts, the Contractor shall not leave an unprotected opening in the guardrail system of more than five hundred (500) linear feet at. Also, after each work day, the Contractor shall protect the areas not yet completed with physical barriers according to the latest MUTCD.

(4) Reset Existing Metal Guardrail Post. The Contractor shall adjust the height of existing guardrail post so that the guardrail element will be at the required height as specified in the contract or as ordered by the Engineer. Spacer blocks bolted to the existing post are to remain intact. The Contractor shall excavate the ground around the post, fill with suitable material, and compact as required by the post adjustment. The Contractor shall replace the guardrail that the Contractor damages due to its operation at no cost to the State.

~~(B)~~ **Cable-Chain Link Barrier Guardrail.**

(1) Post. The Contractor shall place the post at equal intervals. The Contractor may space the end post closer to adjacent posts, if ordered. The Contractor shall set the posts vertical. The Contractor shall crown the concrete portion of the post footing at the top to shed water.

(2) Chain Link and Tension Cable or top rail. The Contractor shall fasten the chain link fabric to the tension cable, top tension wires or top rail, and posts with tie wires. The Contractor shall space the tie wires at approximately:

(a) twenty-four (24) inch intervals to the tension cable, top tension wires or top rail and

(b) fifteen (15) inch intervals to the posts.

The tie wires shall start two (2) inches from the top of the fabric with tie wires. The Contractor shall give the tie wire at least one (1) complete twist. *|

The Contractor shall install the chain link fabric on the outer portion of the cables after the Contractor has clamped the cables in place and torque the u-bolts properly. The chain link fabric shall be on the "U" side of the cable clamps. *|

The Contractor shall stretch the tension wire tight with turnbuckles. The Contractor shall install the turnbuckles at the beginning and end of each continuous section of chain link fabric and at such intermediate points as may be necessary for tightness. *|

The Contractor shall provide turnbuckles between five hundred (500) feet and six hundred (600) feet intervals for each tension cable. *|

The Contractor shall stagger the turnbuckle connections for tension cables so that the Contractor may locate not more than one (1) turnbuckle in one (1) panel. When a turnbuckle assembly falls at or within six (6) inches of a post, the Contractor shall clamp only the cable on the side of the post opposite the turnbuckle assembly to the post. At these locations, the Contractor shall fasten the turnbuckle assembly or the cable on the turnbuckle side to the post with a No. 9 gage tie wire. *|

When the Contractor connects tension cables to pipe-type turnbuckles by factory swaged steel pulls, the complete turnbuckle assembly shall develop one hundred (100) percent of the breaking strength of the cable. *|

The Contractor shall furnish one (1) test sample of cable to the Engineer for each ten thousand (10,000) feet or less of cable the Contractor will install. The test sample shall be three (3) feet in total length. The Contractor shall fit the test sample properly with right-hand thread swaged pulls at both ends as specified in the above paragraph. *|

When the Contractor connects the tension cables to drop forged steel closed sockets, the complete turnbuckle assembly shall develop one hundred (100) percent of the breaking strength of the cable. The Contractor shall fill the sockets with pure zinc. *|

The Contractor shall furnish one (1) test sample of cable to the Engineer for each ten thousand (10,000) feet or less of cable the Contractor will install. The test sample shall be three (3) feet in total length. The Contractor shall fit the test sample properly socketed at both ends as specified in the above paragraph. *|

The Contractor may use preformed zinc-coated cable dead ends as an alternative method of connecting the tension cables to the turnbuckles at anchor blocks only. The installed dead ends shall develop one hundred percent (100%) of the breaking strength of the cable.

At structures where the Contractor constructs two (2) barrier fences, the Contractor shall bound or weld the exposed ends of the connecting tension cables.

The Contractor shall not overtighten the tension cables. The Contractor shall position the tension cables firmly so that between quarter (1/4) inch and half (1/2) inch sag in the cables between posts occurs.

The Contractor shall place the u-bolts of the cable clamp assemblies across the lay of the tension cables. The Contractor shall tighten the nuts on the u-bolts by applying between thirty (30) and thirty-five (35) foot-pounds of torque.

If the Contractor installs barrier on existing structures, the Contractor shall anchor the posts to the deck shown in the contract.

The Contractor shall drill anchor bolt holes in the deck without spalling or damaging the concrete surrounding the hole. The Contractor shall set the anchor bolts with a mixture of commercial quality, modified epoxy adhesive and sand. The proportions of modified epoxy shall be between one (1) adhesive to four (4) sand and one (1) adhesive to six (6) sand. The Engineer will establish the exact proportions. The cementing agent includes two (2) component mixture of modified epoxy adhesive manufactured especially for the making of epoxy-sand grouts. The Contractor shall mix two (2) components according to the manufacturer's directions for use.

(C) Rigid Barrier Type Guardrail.

(1) Preparation. The Contractor shall shape and compact the foundation to a firm even surface according to the contract. The Contractor shall remove and replace soft and yielding material with acceptable material according to Section 305 - Aggregate Subbase Course.

(2) Forms. Forms shall be according to Section 503 - Concrete Structures.

(3) Placing Concrete. The Contractor shall moisten the foundation thoroughly immediately before the Contractor places the concrete. Concrete shall be cast-in-place and the Contractor shall place the concrete according to Section 503 - Concrete Structures.

On new and existing concrete bridge deck, the Contractor shall dowel the barrier into the deck shown in the contract.

(4) Finishing. The Contractor shall finish the surface to a smooth, even surface according to Subsection 503.03(M)(2) - Class 2 Rubbed Finish.

(5) Joints. The Contractor shall construct expansion joint shown in the contract or at existing expansion joints of structures. Expansion joint filler shall be half (1/2) inch thick.

The Contractor shall provide the construction joints with keys and at intervals shown in the contract.

(6) Transition Sections. At the end of the barrier, the Contractor shall adjust or construct new and/or existing guardrail or chain link fence as ordered or shown in the contract.

606.04 Method of Measurement. The Engineer will measure guardrail by the linear foot.

The Engineer will measure from center to center of end posts. If the Contractor makes end connections to masonry or steel structures, the Engineer will measure to the face of such structures.

The Engineer will measure rigid barrier type guardrail by the linear foot from end to end of the type specified.

The Engineer may measure end anchorage, terminal section and transition section:

(1) as units of each kind when specified in the proposal or

(2) included in the quantities of guardrail of the respective type and not measured separately.

The Engineer will measure resetting existing guardrail post per each.

606.05 Basis of Payment. The Engineer will pay for the accepted quantities of guardrail at the contract unit price per linear foot for the type specified complete in place.

The price paid shall be full compensation for removing existing guardrails and posts; filling of post holes; grading and compacting the shoulder area; installing physical barrier; and furnishing labors, materials, tools, equipment, and incidentals necessary to complete the work.

When specified in the proposal, the Engineer will pay for the accepted quantities of end anchorage, terminal section and transition section at the contract unit price per each of the kind specified complete in place.

The Engineer will pay for the accepted quantities of resetting existing guardrail post at the contract unit price per each. The price paid shall be full compensation for furnishing labors, materials, tools, equipment, and incidentals necessary to complete the work.

The Engineer will make payment under:

Pay Item	Pay Unit
Guardrail Type _____	Linear Foot
End Anchorage Type _____	Each
Terminal Section Type _____	Each
Transition Section Type _____	Each
Reset Guardrail	Linear Foot