July 17, 2018

REVISION OF SECTION 606

GUARDRAIL

**NOTICE**

This is a standard special provision that revises or modifies CDOT’s *Standard Specifications for Road and Bridge Construction.* It has gone through a formal review and approval process and has been issued by CDOT’s Project Development Branch with formal instructions for its use on CDOT construction projects. It is to be used as written without change. Do not use modified versions of this special provision on CDOT construction projects, and do not use this special provision on CDOT projects in a manner other than that specified in the instructions unless such use is first approved by CDOT’s Standards and Specifications Unit. The instructions for use on CDOT construction projects appear below.

Other agencies which use the *Standard Specifications for Road and Bridge Construction* to administer construction projects may use this special provision as appropriate and at their own risk.

**Instructions for use on CDOT construction projects:**

Use on projects having Guardrail.

Section 606 of the Standard Specifications is hereby deleted for this project and replaced with the following:

DESCRIPTION

606.01

 This work consists of the construction of guardrail in accordance with these specifications and in conformity with the lines and grades shown on the plans or established.

The construction of the various types of guardrail shall include the assembly and erection of all component parts and materials complete at the locations shown on the plans or as directed.

The types of guardrail are designated as follows:

 Type 3 Guardrail - Midwest Guardrail System (MGS) W Beam 31 Inches

 Type 6 Guardrail - Thrie Beam

 Type 7 Guardrail - F-Shape Concrete Barrier (Precast) (Temporary)

 Type 9 Guardrail – Single Slope Concrete Barrier

Use of Type 4 Precast Concrete Barrier is not permitted.

MATERIALS

606.02

 Materials shall meet the requirements specified in the following subsections:

 “W” Beam Rail and Thrie Beam Rail 710.05

 Guardrail Hardware 710.09

 Guardrail Posts 710.08

Paint for field painting of guardrail shall conform to subsection 708.03, Structural Steel Bridge Paint.

Concrete for precast or cast-in-place barrier shall conform to the requirements of Section 601. Reinforcing steel, unless otherwise noted, shall conform to the requirements of Section 602.

Concrete for bridge rail shall be Macro Fiber-Reinforced Class D Concrete and conform to the requirements of Section 601.

The Contractor may furnish either wood or steel posts and wood or FHWA approved synthetic material blocks for guardrail as shown on the plans. Except as designated on the plans, only one type of posts and blocks shall be furnished for the project.

Components on which the spelter coating has been burned by welding or otherwise damaged shall be regalvanized, recoated in accordance with AASHTO M 36, or painted with one full brush coat of zinc rich paint meeting Military Specification DOD-P-21035A.

CONSTRUCTION REQUIREMENTS

606.03

 Post and Rail Elements.

1. *Posts.* Posts shall be set firm and aligned with a tolerance of plus or minus ¼ inch from plumb, grades and lines as staked. All fittings and metal plates shall be placed securely in position to conform to designated dimensions and requirements.

Posts shall be set by one of the following methods:

1. Driven in place.
2. Set in dug holes.
3. Set in concrete base.
4. Posts on bridges shall be as shown on the plans.

Driving of posts shall be accomplished by methods and equipment that will leave the posts in their final position free from any distortion, burring or any other damage.

Excavated post holes shall have a firm bottom and be backfilled with acceptable material placed in layers and thoroughly compacted.

Dissimilar metal-to-metal or aluminum-to-concrete post or rail installations shall have contact surfaces separated by an approved protective coating.

Wood posts cut in the field shall have the cut surfaces protected with two coats of an approved preservative. When the cut surface is above ground, the treating solution to be used shall be the same type as was used in the original treatment.

1. *Rail.* Rail elements shall be erected in a manner resulting in a smooth, continuous installation. All bolts in the finished rail shall be drawn tight. Bolts shall be of sufficient length to extend beyond the nuts. Rail shall be shop bent for installations on horizontal curves having a radius of 150 feet or less.
2. *Temporary End Treatment.* In construction zones not closed to traffic, installation of rail element shall closely follow the setting of posts to keep the number of posts without rail at a minimum. When necessary to minimize potential hazards, the Engineer will specify the direction in which the rail installation is to advance and the number of posts installed ahead of rail installation. At the end of the Contractor’s work day, the Contractor shall treat the ends of installed guardrail as follows:
3. If the end is at the location of a planned end section, install the end section.
4. If the end is not at the location of a planned end section, the last rail section shall be installed with one end attached to the rail already in place and the free end resting on the ground. The free end on the ground shall be restrained by tying the rail to the posts by ropes or cables. Guardrail shall not be left in this configuration more than 24 hours unless protected by an approved attenuating device.

606.04 Concrete.

 Where paving is removed or damaged due to the Contractor’s operations, the Contractor shall furnish an approved mix and shall repair the paving as required, at the Contractor’s expense.

In construction zones not closed to traffic, the Contractor shall treat the ends of installed concrete guardrail at the end of the work day as follows:

1. If the end is at the location of a planned end section, install the end section.
2. If the end is not at the location of a planned end section, install a temporary impact attenuator or provide treatment as shown in the Contract.
3. *Permanent Concrete Barrier.* Permanent concrete barrier shall be Type 9 constructed by cast-in-place or slipform methods. The trench for the base of the cast-in-place reinforced barrier end anchorages shall be excavated to the lines and grades shown on the plans or established. The bottom of the trench

shall be compacted to the density specified in subsection 203.07(a). The

compacted trench bottom shall be watered and approved before placing concrete.

Concrete finish for all cast-in-place barriers shall be Class 1 in accordance with subsection 601.14. Slipform barriers shall not receive additional finishing unless permitted by the Engineer. Exposed vertical surfaces of slipformed barrier shall receive a vertical broom finish. When hand finishing is allowed, it shall be performed in conformance with subsection 601.12(a).

The Engineer may determine that the exposed surfaces of the guardrail shall be tested with a 10 foot straightedge laid along the exposed surface in a longitudinal direction. The Contractor shall furnish an approved 10 foot straightedge and provide an operator to aid the Engineer in testing the exposed surfaces. All surface tolerances shall be measured in a longitudinal direction. Deviation of any exposed surface in excess of the tolerance specified shall be corrected at the Contractor’s expense.

Longitudinal surface tolerances for the top of the barrier and the sides of the barrier from the top to a line 7 inches below the top of the barrier are:

1. On tangent roadway alignments and curves with radius greater than 1000 feet: 0.25 inch from the edge of the straightedge.
2. On sharp vertical curves and horizontal curves with radius of 1000 feet or less: 0.25 inch from the edge of the straightedge with allowance made for curve deflection.

Longitudinal surface tolerances for the remaining surfaces of the barrier are:

1. On tangent roadway alignments and curves with radius greater than 1000 feet: 0.75 inch from the edge of the straightedge.
2. On sharp vertical curves and horizontal curves with radius of 1000 feet or less: 0.75 inch from the edge of the straightedge with allowance made for curve deflection.

The Contractor will be allowed a maximum of three days of slipform production if barrier being placed does not meet the specified tolerances. After the third day of placement of out of tolerance slipform barrier the Contractor shall stop production. The Contractor shall submit a corrective action plan to the Engineer for review. The plan shall address corrective actions to the equipment and materials and a time frame for completion of the corrective actions. The plan shall address methods and materials to be used to correct out of tolerance barrier. Patching will not be allowed to correct out of tolerance barrier. Further placement of barrier will not be allowed until all previously placed barrier which failed to meet tolerances is corrected or removed. Each occurrence of out of tolerance slipform barrier shall be subject to the same corrective cycle.

1. *Temporary Precast Type 7 Concrete Barrier.* Precast Type 7 Concrete Barrier (conforming to Standard Plan M-606-14) may be formed upside down to minimize air pockets and improve surface finish. Concrete finish for precast barriers shall be Class 1 in accordance with subsection 601.14. Each segment of the precast barrier shall not have spalls, corner breaks, and bottom spalls totaling more than 5 square feet of surface area which includes the base. All required hand finishing shall be performed in conformance with subsection 601.12(a).

Connecting loops shall not be frayed, stretched, or deformed. Gaps between units shall not exceed the dimensions shown on the plans. Precast barrier units shall not be lifted or stressed in any way before they have developed the strength of the concrete specified. Units shall be supported at designated pickup points. Connecting loops shall not be used as pickup points. Care shall be taken during fabrication, storage, handling and transporting to prevent cracking, twisting, or other damage. Minor chips on edges may be patched with the approval of the Engineer. Breakage and chipping may be cause for rejection. Units damaged in such a way as to impair their appearance or suitability, in the opinion of the Engineer, shall be replaced at the Contractor’s expense. Units rejected by the Engineer shall be marked on both sides with an orange painted “R” approximately 12 inches high and 6 inches wide.

The base for placing precast barrier shall be prepared to the lines and grades shown on the plans or established. When it becomes necessary to connect cast-in-place barrier sections to precast barrier installations during construction, the cast-in-place sections shall be constructed complete with connecting hardware in accordance with Standard Plan M-606-14 to join the cast-in-place sections to the abutting precast sections. A FIFTEEN-foot transition section shall be provided when attaching barriers of differing shapes.

METHOD OF MEASUREMENT

606.05

 Guardrail will be measured by the linear foot along the centerline of the rail from end to end of completed and accepted rail as shown on the plans, excluding end anchorages, median terminals, and transitions.

End anchorages, median terminals and transitions will be measured by the actual number placed and accepted. Each end anchorage, median terminal, or transition shall include all concrete, reinforcing steel, anchor bolts, cable, rods, turnbuckles, backing rail, plates, bolts, nuts, washers and all other work and material necessary to complete the item.

Posts will be included in the quantities of guardrail of the specified type and not measured separately. Additional posts required for guardrail adjacent to bridges and obstructions, as shown on the plans, will not be measured and paid for separately but shall be included in the work.

BASIS OF PAYMENT

606.06

 The accepted quantities of guardrail will be paid for at the contract unit price for the type specified.

Payment will be made under:

 **Pay Item Pay Unit**

 Guardrail, Type\_\_\_ Linear Foot

 End Anchorage, Type\_\_\_ Each

 Guardrail, Type\_\_\_ (\_\_\_\_Post Spacing) Linear Foot

 Median Terminal Each

 End Anchorage (\_\_\_\_\_) Each

 Transition, Type \_\_\_\_\_ Each

All work and materials necessary and incidental to the temporary treatment of guardrail ends will not be measured and paid for separately but shall be included in the work.

Partial payments will not be made for partially completed guardrail runs that do not conform to the end treatments specified in subsections 606.03(c) or 606.04.

Polyolefin fiber reinforcement will not be measured and paid for separately, but shall be included in the work.