STANDARD MODIFICATION **05/15/13**
E 96 REPLACES E 69 AND E 74

SECTION 606

GUARDRAIL

Delete Section 606 and replace with the following:

606-1.01 DESCRIPTION. Construct new guardrail, terminal sections, and transition rail of the kind and type specified.

Remove and reconstruct or remove and dispose of existing guardrail, terminal sections, and transition rail.

606-2.01 MATERIALS. Use materials that conform to the following:

Concrete, Class A or W (or an approved, pre-mixed, sacked concrete)	Subsection 501-3.01
Guardrail Connection Plate	Section 722
Guardrail Hardware	Subsection 710-2.07
Guardrail Posts and Blocks	Subsection 710-2.06
High Strength Bolts	Section 722
Metal Beam Rail	Subsection 710-2.04
Terminals	Subsection 710-2.11
Wire Cable	Subsection 709-2.02

Terminal Markers. Single piece marker, constructed of a durable UV resistant, continuous glass fiber and marble reinforced, thermosetting composite material.

1. designed for use as road markers.
2. impact-resistant temperature range, -40°F to +140°F
3. 0.125 by 3.75 inches by 66 inches long, 18 inch burial depth

Furnish white flexible markers with a 3 inch by 12 inch retroreflective sheeting, color orange, shall meet AASHTO M 268-08 requirements for Type VIII or IX. Alternately, use 3M Diamond Grade DG3 or approved equivalent.

Fabricate guardrail reflector assembly brackets from aluminum alloy, galvanized steel, or polycarbonate.

CONSTRUCTION REQUIREMENTS

606-3.01 GENERAL. Install guardrail and terminals at the locations shown on the Plans. Conform with the Standard Drawings and these Specifications.

At locations where public traffic is adjacent to guardrail work, have all materials on site, including crashworthy terminals, that are required to completely install a segment of guardrail before beginning work on that segment.

Start guardrail installation at the “upstream” end (the end adjacent traffic will encounter first) by either installing a crashworthy terminal or connecting to an existing barrier. Continue installation in the direction of traffic. Exception: if the guardrail run will connect to existing barrier, buried in the backslope, or guardrail, existing or new bridge railing, or other existing structure at the “downstream” end, guardrail installation may be started at the point of connection.

Do not leave posts installed for guardrail within the clear zone for more than 48 hours before installing the rail. At the end of each work shift, install drums or Type II barricades with flashing warning lights to delineate incomplete sections of guardrail and terminal sections.

If guardrail runs are not completed within 10 calendar days after beginning installation, install temporary crash cushions meeting NCHRP 350 or MASH test level 3 at all non-crashworthy guardrail ends within the clear zone. Apply Traffic Price Adjustment if the Contractor does not comply with the crash cushion requirement.

When possible, proceed with construction of guardrails with the direction of traffic.

Where necessary, adjust the height of existing guardrail to provide a smooth transition to new guardrail. Use 25 linear feet of guardrail or two 12' 6" pieces of guardrail to transition to match the existing or new guardrail elements and/or end treatments.

After shaping the slopes and staking proposed guardrail terminal section locations, request the Engineer to field verify their locations. Receive approval of the staked locations before installing terminal sections.

Treat field cuts to timber posts and blocks according to AWPA standard M 4.

Install synthetic blocks according to manufacturer's recommendations.

Install side-mounted guardrail reflectors as follows:
1. At intervals noted on the Standard Drawings, starting with the first standard guardrail post
2. With the reflective sheeting facing approaching traffic
3. With both faces reflectorized, on two-way roadways
4. Not on the terminal sections

At the end of each work shift, install drums or Type II barricades with flashing warning lights to delineate incomplete sections of guardrail and terminal sections.

606-3.02 POSTS. Set posts to accommodate the line, grade, and curvature shown on the Plans.

Use either wood or steel posts when allowed by the type of guardrail specified, subject to the following:
1. Use one type of post material on the project unless extending an existing run of guardrail.
2. Match existing post material to extend an existing run of guardrail.

Set posts as follows:
1. Set posts plumb, in the location and to the depth shown on the Plans or Standard Drawings.
2. Choose an installation method that does not damage the post, adjacent pavement, structures, utility conduits, and final slopes. Repair all damage to the satisfaction of the Engineer, or replace the damaged item, as per subsection 105-1.11.
3. Set wood or steel posts in dug, drilled, or pre-punched holes. Steel posts may also be set by ramming or driving if:

    a. The underlying material is no larger than six inch; and
    b. The posts are not damaged during installation.

4. Backfill and compact around posts with material as specified in the typical section to firmly support the post laterally and vertically. Compact under and around posts to the Engineer's satisfaction.
5. In solid rock or in broken rock embankment, construct holes for posts, no ramming or driving in the rock will be allowed.
6. In new roads, install posts before final shoulder or median compaction, surfacing, and paving.

606-3.03 BEAM RAIL. Fabricate metal work in the fabricator's shop. Bend curved guardrail elements with radii less than or equal to 100 feet in the fabricator's shop or with an approved bending apparatus.

Receive approval before field punching, cutting, or welding. Repair damaged spelter coat areas on galvanized rail elements according to AASHTO M 36.

Lap rail elements so that the exposed ends face away from approaching traffic.

Use bolts long enough to extend at least 1/4 inch beyond the nuts. Except where required for adjustments, do not extend bolts more than 1 inch beyond the nuts.

Locate bolts at expansion joints at the center of the slotted holes.

Tighten bolts at expansion joints to snug-tight. Make all other bolts fully-tight.

606-3.04 CABLE RAIL. Install cable guardrail according to the Plans and Specifications. Install at the locations shown on the Plans.

606-3.05 TERMINAL SECTIONS. Install terminal sections according to the manufacturer's recommendations. Install where shown on the Plans.

Follow Section 203 for excavation and embankment requirements.

Attach flexible markers, in a vertical position, to the first post of each parallel guardrail terminal using two pipe bracket holders spaced 24 inches apart. Attach to wooden guardrail posts with wood screws and to steel guardrail posts with hex bolts. Attach flexible markers in the same manner to the "P.T." post of Controlled Release Terminals.

606-3.06 REMOVAL AND RECONSTRUCTION OF GUARDRAIL. Remove and reconstruct guardrail as specified. Replace lost or damaged materials without extra compensation.

606-3.07 REMOVAL AND DISPOSAL OF EXISTING GUARDRAIL. Remove the existing guardrail shown on the Plans, including the rail, cable elements, terminal sections, hardware, posts, concrete bases, and steel tubes. Backfill resulting holes with material in 6-inch layers that is similar to the existing embankment and compact to the same approximate density. Removed items become your property.

606-3.08 ADJUST EXISTING GUARDRAIL. When called for on the Plans, reset existing guardrail to the height shown on the applicable Standard Drawing, measured from the top of the rail to the finished shoulder surface below the rail. Raise and lower the posts several times to prevent settlement and then re-drive them to the height shown on the Plans. Use other methods if approved.

606-3.09 INSTALL NEW GUARDRAIL. Install guardrail as shown on the applicable Standard Drawings, measured from the top of the rail to the finished shoulder surface below the rail. New guardrail installed with height less than 28", or greater than 30" is unacceptable and must be adjusted according to subsection 606-3.08. Adjusting new guardrail will not be paid for separately, but is subsidiary to other 606 pay items.

606-4.01 METHOD OF MEASUREMENT. Section 109 and as follows:

1. Guardrail. Measured along the face of the rail or cable, from the center of the end posts.

   When the guardrail is connected to a terminal section, the pay limit for the rail ends where the specified terminal section begins.

2. Terminals. Per each, installed in place.

3. Transition Rail. Per each accepted connection.

606-5.01 BASIS OF PAYMENT.

Payment for temporary crash cushions installed to protect motorists from guardrail installations that have not been completed within 10 calendar days of beginning installation is subsidiary to other items.

1. Guardrail. Guardrail reflectors, flexible markers for terminal sections, posts, blocks, and associated hardware are subsidiary.

   Adjusting the height of existing guardrail as needed to extend guardrail is subsidiary.

2. Terminal Sections.

   a. Parallel Guardrail Terminal. The contract price includes rail elements, posts, blocks, pipe sleeves, cable assemblies, guardrail extruders, terminal markers, and all associated hardware required for a complete installation.

   b. Controlled Release Terminals (CRT). The contract price includes all materials from the terminal anchor to and including the modified breakaway cable terminal assembly, terminal posts, CRT posts, rail elements, terminal markers, and associated hardware required for a complete installation.

   c. Buried in Backslope Guardrail Terminal. The contract price includes rail elements, posts, blocks, concrete, rebar, anchors, and all associated hardware required for a complete installation.

3. Transition Rail. The contract price includes all brackets, beam sections, transition pieces, and all posts and associated hardware required for a complete connection of the guardrail section to a bridge rail or barrier.

All material required for embankment widening for guardrail and terminal sections is paid for under the appropriate pay items shown in the bid schedule.

Payment will be made under:

Pay Item	Pay Unit
606(1) W-Beam Guardrail	Linear Foot
606(2) Thrie Beam Guardrail	Linear Foot
606(3) Box Beam Guardrail	Linear Foot
606(4) Cable Guardrail	Linear Foot
606(5) Removing and Reconstructing Guardrail	Linear Foot
606(6) Removing and Disposing of Guardrail	Linear Foot
606(7) Raising Existing Guardrail (retired)	Linear Foot
606(8) Double-faced, W-Beam Guardrail	Linear Foot
606(9) Controlled Release Terminal (CRT)	Each
606(10) Slotted Rail Terminal (SRT-350)	Each
606(11) Extruder Terminal (ET-2000)	Each
606(12) Guardrail/Bridge Rail Connection (retired)	Each
606(15) Adjust Existing Guardrail	Linear Foot
606(16) Transition Rail	Each