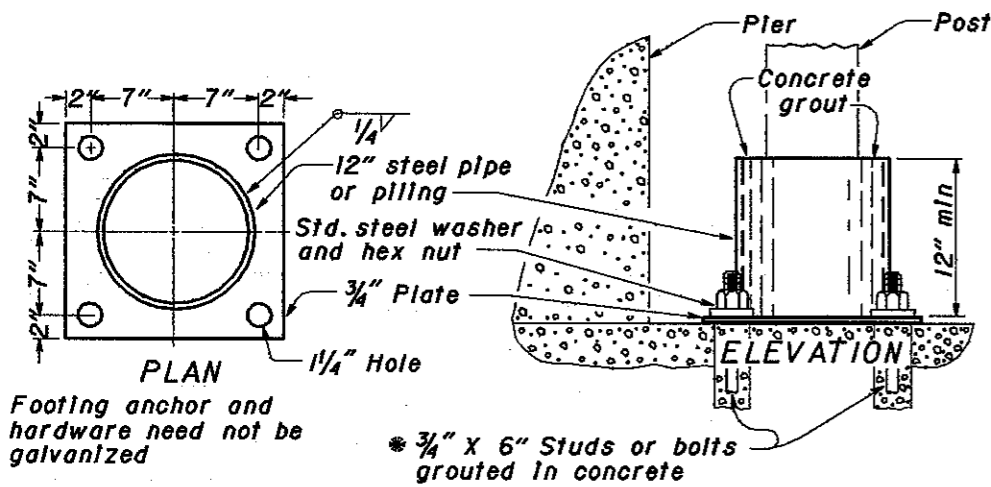
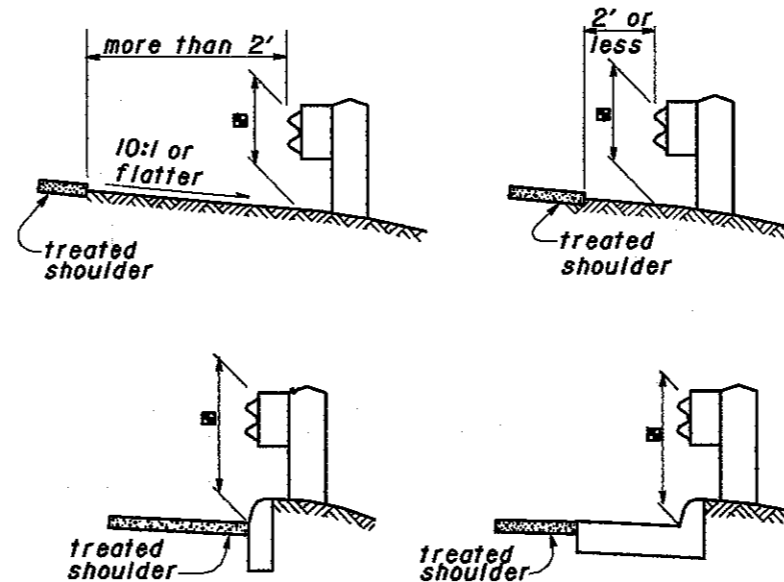
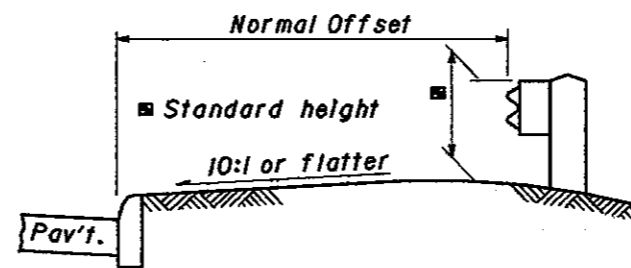


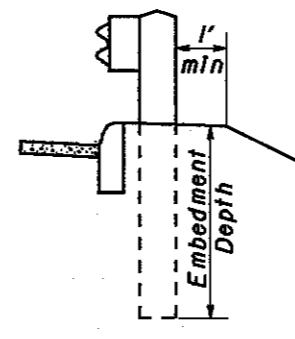
INLET MOUNTED POST



FOOTING ANCHOR



MEASURING GUARDRAIL HEIGHT



DETAIL A

NOTES

BEAM RAIL ELEMENTS shall be 12'-6" effective length, unless otherwise specified, with 3/4" x 2 1/2" post bolt slots on 6'-3" centers regardless of post spacing. Field punching or drilling of bolt holes or slots for irregularly spaced posts shall be according to 606.05.

BEAM RAIL SPLICE between two rail elements, or rail and terminal connector shall be lapped in the direction of traffic. The buffer or flared end sections shall lap on the traffic face. A 12" length of beam rail (Back-up Plate), with a 3/4" dia. bolt hole or a 3/4" x 2 1/2" slot, shall be provided at posts not having a rail splice.

EMBEDMENT DEPTH: Where less than 1' of graded shoulder width (10:1 or flatter) extends beyond posts (see Detail "A") longer posts shall be used so that a minimum of 5'-5" embedment depth is provided.

PROTECTIVE COATING: In lieu of the requirements of 710.06, expansion shields, anchors and insert anchor assemblies installed (embedded) in concrete may be coated according to good commercial practices. Any bolts screwed into these embedded devices shall meet 710.06.

STEEL POST SIZES: The W6 x 8.5 and W6 x 15 posts may be used in lieu of the W6 x 9 and W6 x 15 respectively which are shown on the various Standard Construction Drawings for guardrail.

SPECIAL POST MOUNTINGS: Inlet mounted posts are required for guardrail posts located on a drainage inlet. Footing anchors are required for guardrail posts located on footers with less than 3'-5" cover except that for footer cover of 2'-6" to 3'-5" the post may be installed by using a 4" minimum concrete encasement. The inlet mounted post may be used for footing anchors in runs with steel posts.

When standard post depth is not available due to a culvert, the guardrail posts directly over the culvert shall not be driven, but set in holes with a 4" minimum concrete encasement for the maximum post depth available.

Cost of the inlet mounted posts, footing anchors, and concrete encasement shall be included in the unit price bid for guardrail of the type required by the plan.

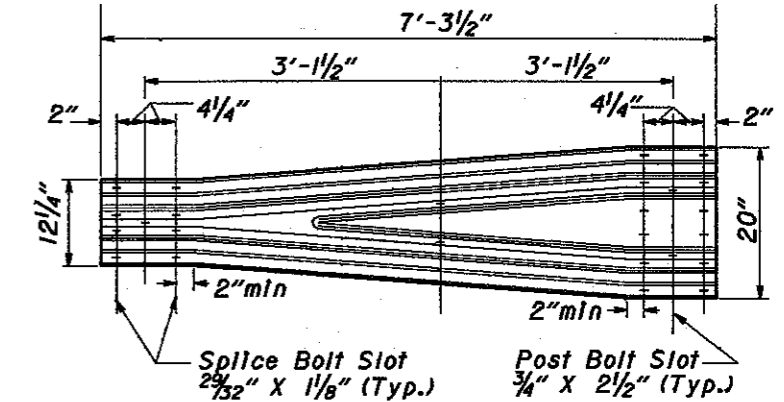
* **ANCHORS** conforming to 712.01 or anchors per FF-S-325 Group VIII, Type I with proof load certification per 712.01, may be substituted with the same bolt diameter specified.

Also, Partial Depth Resin-Bonded Anchoring Systems may be used. The anchor shall be galvanized and be the same diameter and strength as the bolts specified. 1 1/4" diameter anchor systems should resist an average ultimate tensile load of 43,700 pounds (7/8" diameter, 24,000 pounds). Test load data shall be submitted to verify manufacturers' recommended anchor, hole size, embedment depth, bonding medium, etc. to satisfy the

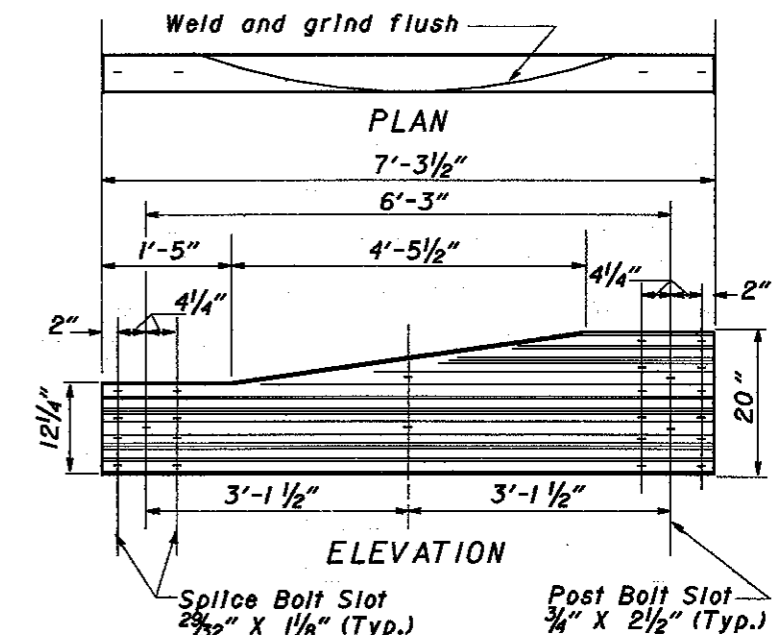
load requirements. If anchor bolts are located within a haunch with slopes flatter than 6:1 and through-bolting is used, beveled plate washers shall be used on the bottom. For haunches with slopes steeper than 6:1, partial depth resin-bonded anchors should be used.

If there is any question of deteriorated concrete, expansion anchors will not be allowed, as determined by the Engineer. Where self-drilling anchors are permitted and used for guardrail construction, the holes shall be drilled with the expansion shield (not by a drill bit) and the shield shall be installed flush with the concrete surface.

The Engineer shall visually inspect, after installation, all expansion anchors used in guardrail construction. The Engineer may require the Contractor to test load any expansion anchor to 1/4 the certified proof load in direct pull. The equipment and method used shall meet the approval of the Engineer. Each expansion anchor that fails to meet the test requirements shall be reset or removed and replaced with bolts extending through the concrete or grouted in place, as directed by the Engineer.



TYPE 1

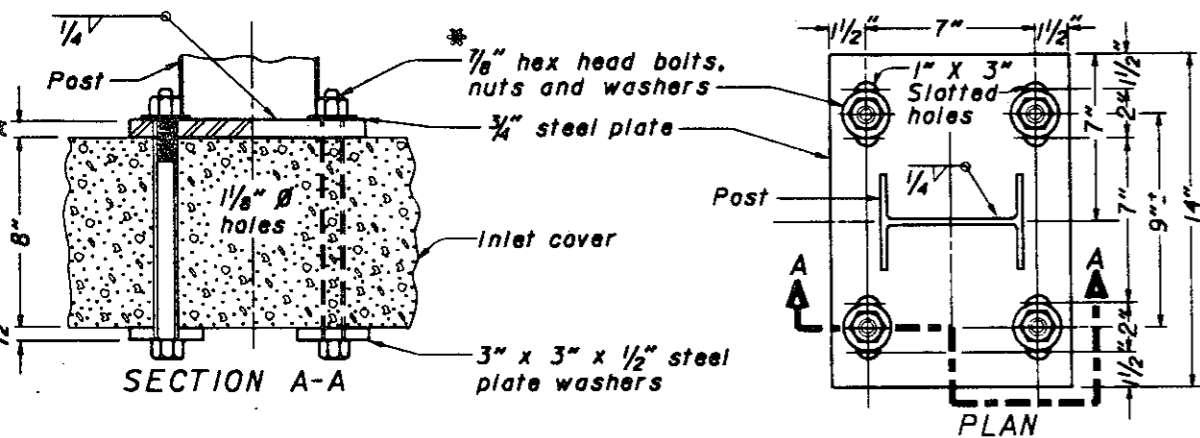


TYPE 2

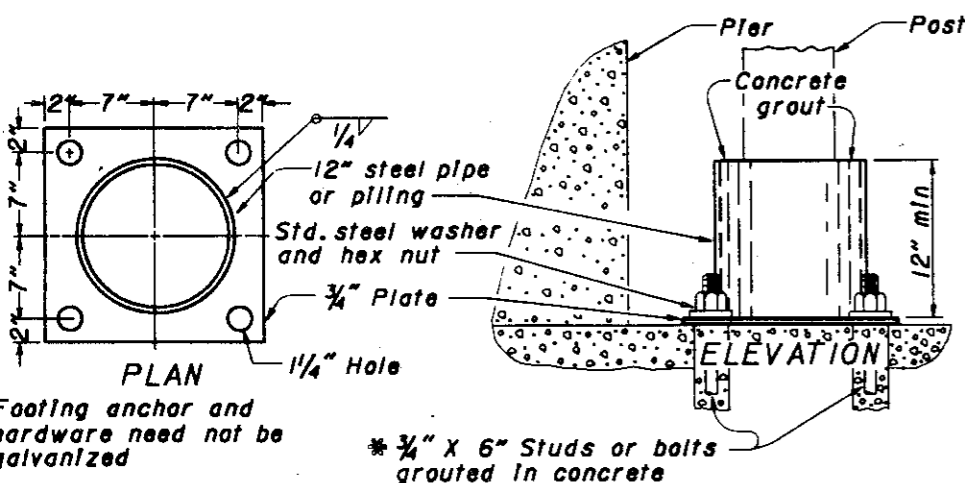
TRANSITION SECTIONS

BUREAU OF LOCATION AND DESIGN OHIO DEPARTMENT OF TRANSPORTATION	
GUARDRAIL DETAILS	
STANDARD CONSTRUCTION DRAWING	GR-1.2
APPROVED _____	ENGR., L. & D.

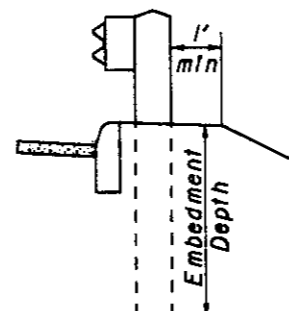
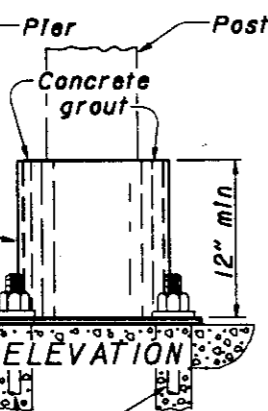
DATE
12-6-76
2-5-82
1-11-85
7-23-87



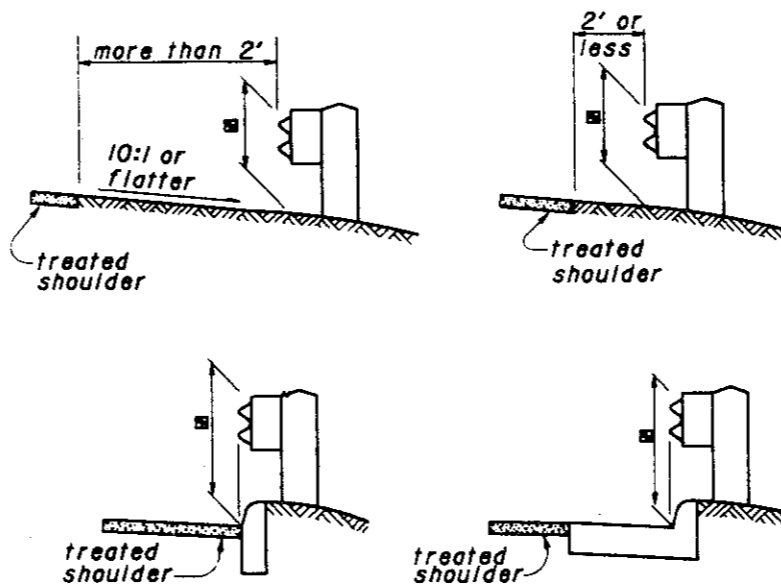
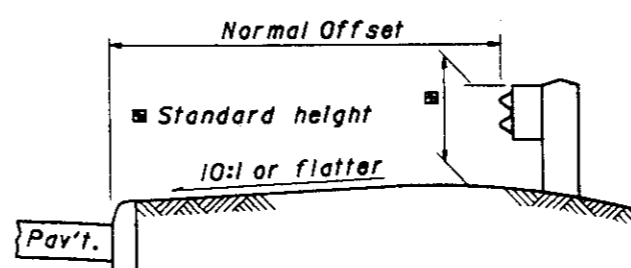
INLET MOUNTED POST



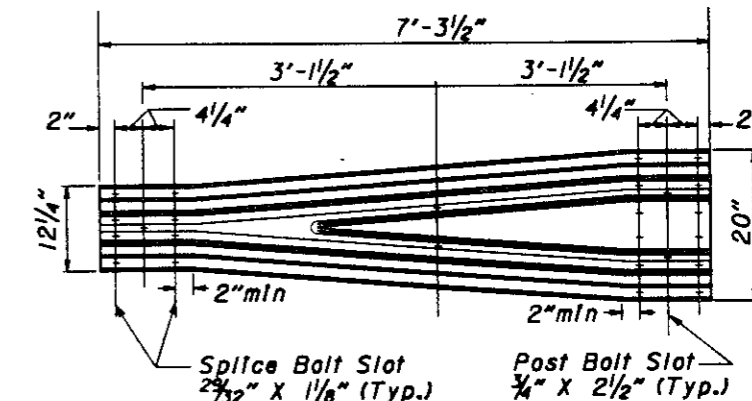
FOOTING ANCHOR



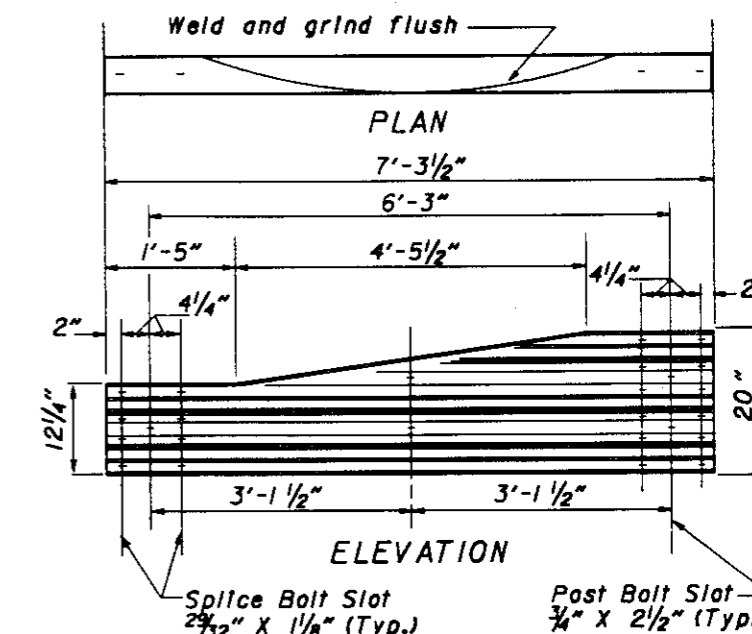
DETAIL A



MEASURING GUARDRAIL HEIGHT



TYPE 1



TYPE 2

TRANSITION SECTIONS

NOTES

BEAM RAIL ELEMENTS shall be 12'-6" effective length, unless otherwise specified, with 3/4" x 2 1/2" post bolt slots on 6'-3" centers regardless of post spacing. Field punching or drilling of bolt holes or slots for irregularly spaced posts shall be according to 606.05.

BEAM RAIL SPLICE between two rail elements, or rail and terminal connector shall be lapped in the direction of traffic. The buffer or flared end sections shall lap on the traffic face. A 12" length of beam rail (Back-up plate), with a 3/4" dia. bolt hole or a 3/4" x 2 1/2" slot, shall be provided at posts not having a rail splice.

EMBEDMENT DEPTH: Where less than 1' of graded shoulder width (10:1 or flatter) extends beyond posts (see Detail "A") longer posts shall be used so that a minimum of 5'-5" embedment depth is provided.

PROTECTIVE COATING: In lieu of the requirements of 710.06, expansion shields, anchors and insert anchor assemblies installed (embedded) in concrete shall be coated in accordance with ASTM A153 or Stainless Steel. Any bolts screwed into these embedded devices shall meet 710.06.

STEEL POST SIZES: The W6 x 8.5 posts may be used in lieu of the W6 x 9 which are shown on the various Standard Construction Drawings for guardrail.

SPECIAL POST MOUNTINGS: Inlet mounted posts are required for guardrail posts located on a drainage inlet. Footing anchors are required for guardrail posts located on footers with less than 3'-5" cover except that for footer cover of 2'-6" to 3'-5" the post may be installed by using a 4" minimum concrete encasement. The inlet mounted post may be used for footing anchors in runs with steel posts.

When standard post depth is not available due to a culvert, the guardrail posts directly over the culvert shall not be driven, but set in holes with a 4' minimum concrete encasement for the maximum post depth available.

Cost of the inlet mounted posts, footing anchors, and concrete encasement shall be included in the unit price bid for guardrail of the type required by the plan.

* **ANCHORS** conforming to 712.01 or anchors per FF-S-325 Group VIII, Type I with proof load certification per 712.01, may be substituted with the same bolt diameter specified.

Also, Partial Depth Resin-Bonded Anchoring Systems may be used. The anchor shall be galvanized and be the same diameter and strength as the bolts specified. 1/4" diameter anchor systems should resist an average ultimate tensile load of 43,700 pounds (1/8" diameter, 24,000 pounds). Test load data shall be submitted to verify manufacturers' recommended anchor, hole size, embedment depth, bonding medium, etc. to satisfy the load requirements.

If anchor bolts are located within a haunch with slopes flatter than 6:1 and through-bolting is used, beveled plate washers shall be used on the bottom. For haunches with slopes steeper than 6:1, partial depth resin-bonded anchors should be used.

If there is any question of deteriorated concrete, expansion anchors will not be allowed, as determined by the Engineer. Where self-drilling anchors are permitted and used for guardrail construction, the holes shall be drilled with the expansion shield (not by a drill bit) and the shield shall be installed flush with the concrete surface.

The Engineer shall visually inspect, after installation, all expansion anchors used in guardrail construction. The Engineer may require the Contractor to test load any expansion anchor to 1/4 the certified proof load in direct pull. The equipment and method used shall meet the approval of the Engineer. Each expansion anchor that fails to meet the test requirements shall be reset or removed and replaced with bolts extending through the concrete or grouted in place, as directed by the Engineer.

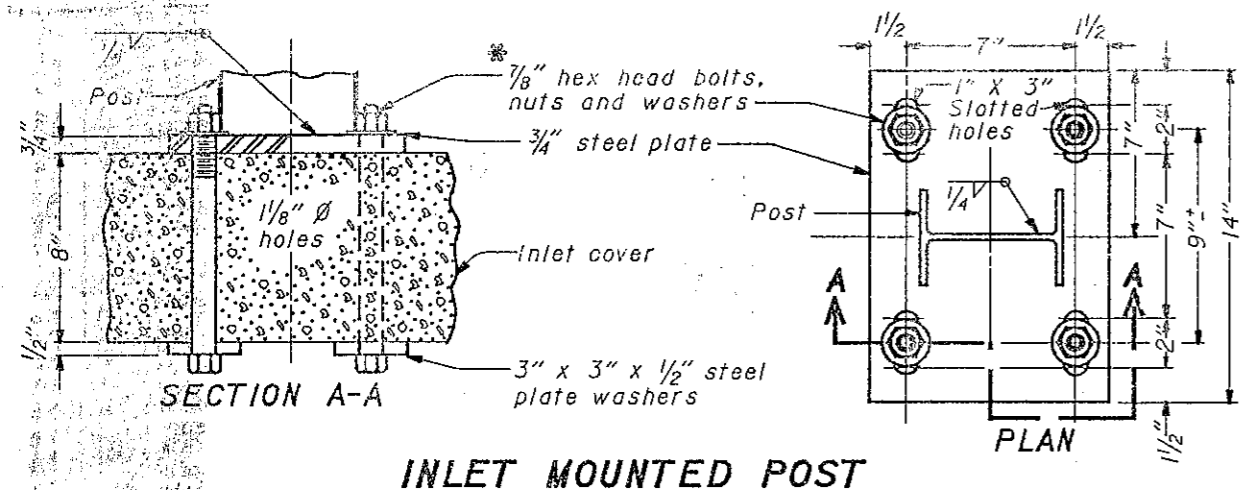
BUREAU OF LOCATION AND DESIGN
OHIO DEPARTMENT OF TRANSPORTATION

**GUARDRAIL
DETAILS**

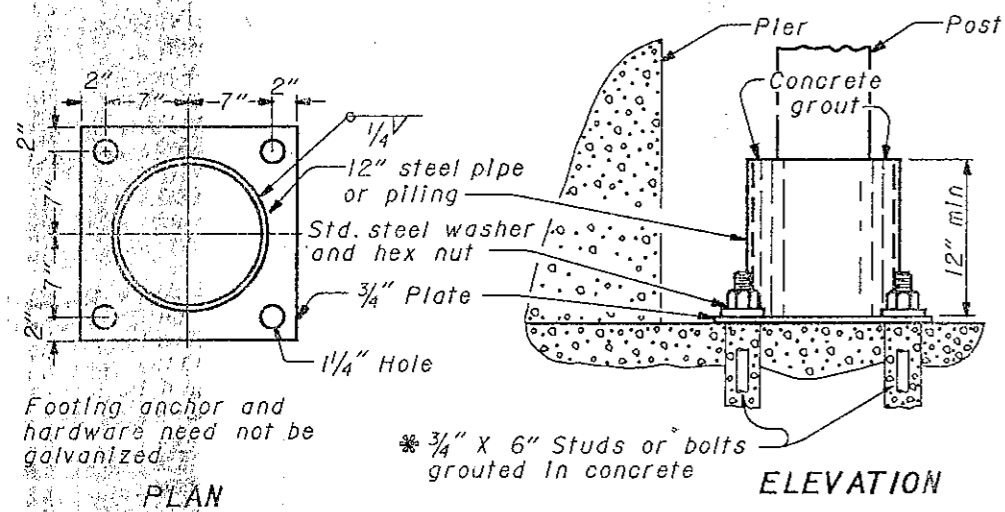
DATE
5-6-91

STANDARD
CONSTRUCTION
DRAWING
APPROVED *D.K. Hulman* ENGR., L. & D.

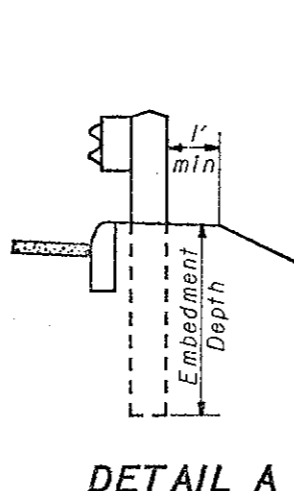
GR-1.2



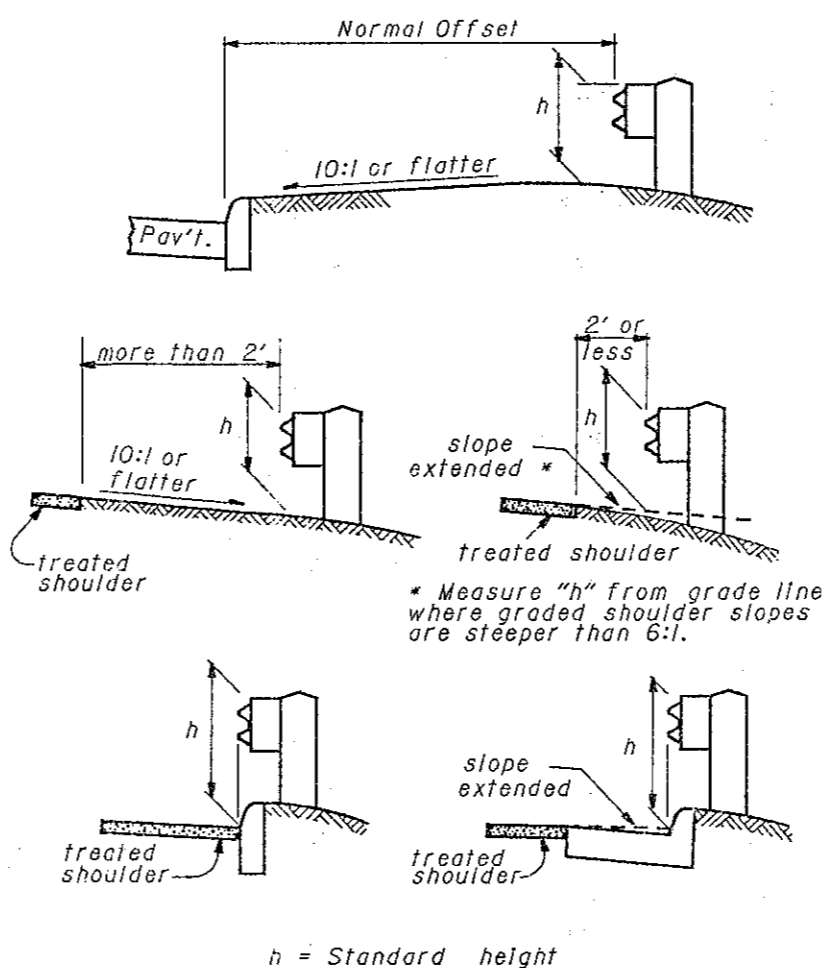
INLET MOUNTED POST



FOOTING ANCHOR



DETAIL A



MEASURING GUARDRAIL HEIGHT

NOTES

SPECIAL POST MOUNTINGS: Inlet mounted posts are required for guardrail posts located on a drainage inlet. They are to be used only in conjunction with Type 5 Guardrail. They are not to be installed with Type 5 Guardrail with Tubular Backup. For such situations refer to Std. Const. Dwg. GR-2.2.

Footing anchors are required for guardrail posts located on footers with less than 3'-5" cover except that for footer cover of 2'-6" to 3'-5" the post may be installed by using a 4" minimum concrete encasement. The inlet mounted post may be used for footing anchors in runs with steel posts.

When standard post depth is not available due to a culvert, the guardrail posts directly over the culvert shall not be driven, but set in holes with a 4' minimum concrete encasement for the maximum post depth available.

Cost of the inlet mounted posts, footing anchors, and concrete encasement shall be included in the unit price bid for guardrail of the type required by the plan.

* **ANCHORS** conforming to 712.01 or anchors per FF-S-325 Group VIII, Type I with proof load certification per 712.01, may be substituted with the same bolt diameter specified.

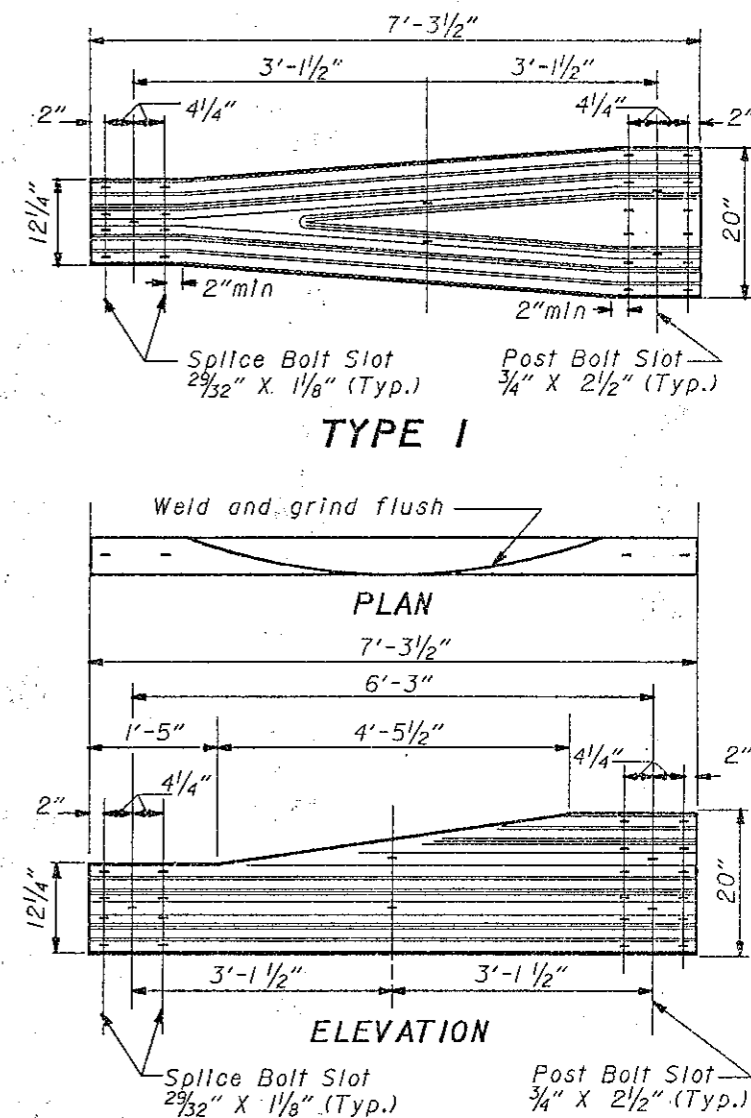
Also, Partial Depth Resin-Bonded Anchoring Systems may be used. The anchor shall be galvanized and be the same diameter and strength as the bolts specified.

1/4" diameter anchor systems should resist an average ultimate tensile load of 43,700 pounds (7/8" diameter, 24,000 pounds). Test load data shall be submitted to verify manufacturers' recommended anchor, hole size, embedment depth, bonding medium, etc. to satisfy the load requirements.

If anchor bolts are located within a haunch with slopes flatter than 6:1 and through-bolting is used, beveled plate washers shall be used on the bottom. For haunches with slopes steeper than 6:1, partial depth resin-bonded anchors should be used.

If there is any question of deteriorated concrete, expansion anchors will not be allowed, as determined by the Engineer. Where self-drilling anchors are permitted and used for guardrail construction, the holes shall be drilled with the expansion shield (not by a drill bit) and the shield shall be installed flush with the concrete surface.

The Engineer may require the Contractor to test load any expansion anchor to 1/4 the certified proof load in direct pull. The equipment and method used shall meet the approval of the Engineer. Each expansion anchor that fails to meet the test requirements shall be reset or removed and replaced with bolts extending through the concrete or grouted in place, as directed by the Engineer.



TYPE 2

TRANSITION SECTIONS
(W beam to Thrie beam)

BUREAU OF LOCATION AND DESIGN OHIO DEPARTMENT OF TRANSPORTATION	
GUARDRAIL DETAILS	DATE 5-6-91 10-30-92
STANDARD CONSTRUCTION DRAWING	GR-1.2
APPROVED <i>R.K. Hulman</i> ENGR., L & D	

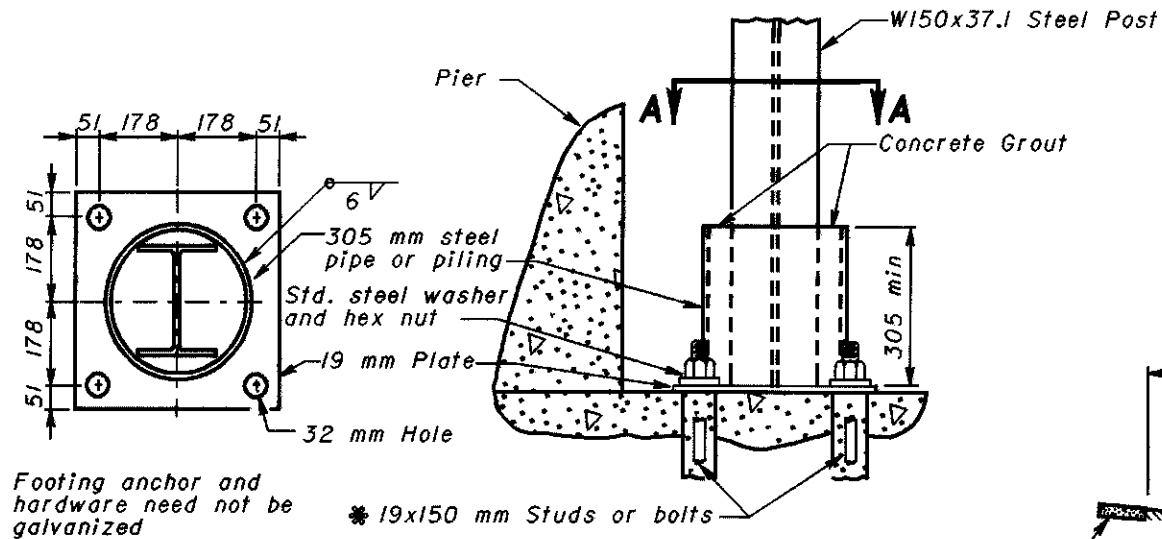
BEAM RAIL ELEMENTS shall be 12'-6" effective length, unless otherwise specified, with 3/4" x 2 1/2" post bolt slots on 6'-3" centers regardless of post spacing. Field punching or drilling of bolt holes or slots for irregularly spaced posts shall be according to 606.05.

BEAM RAIL SPLICE between two rail elements, or rail and terminal connector shall be lapped in the direction of traffic. The buffer or flared end sections shall lap on the traffic face. A 12" length of beam rail (Back-up Plate), with a 3/4" dia. bolt hole or a 3/4" x 2 1/2" slot, shall be provided at steel posts not having a rail splice.

EMBEDMENT DEPTH: Where less than 1' of graded shoulder width (10:1 or flatter) extends beyond posts (see Detail "A") longer posts shall be used so that a minimum of 5'-5" embedment depth is provided.

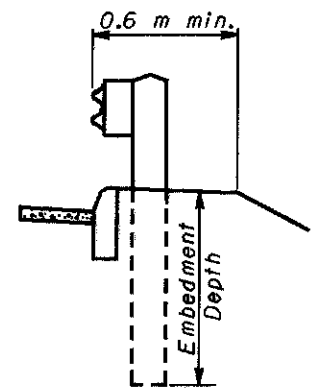
PROTECTIVE COATING: In lieu of the requirements of 710.06, expansion shields, anchors and insert anchor assemblies installed (embedded) in concrete shall be coated in accordance with ASTM A153 or Stainless Steel. Any bolts screwed into these embedded devices shall meet 710.06.

STEEL POST SIZES: The W6 x 8.5 posts may be used in lieu of the W6 x 9 which are shown on the various Standard Construction Drawings for guardrail.

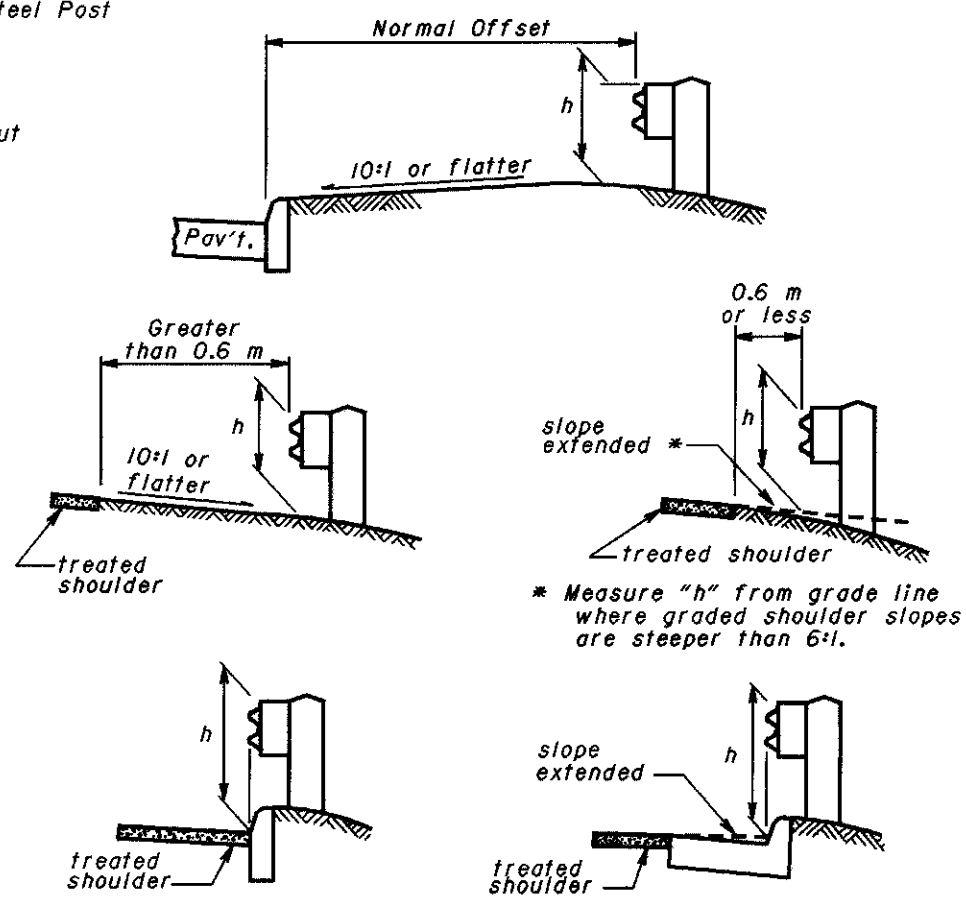


SECTION A-A ELEVATION

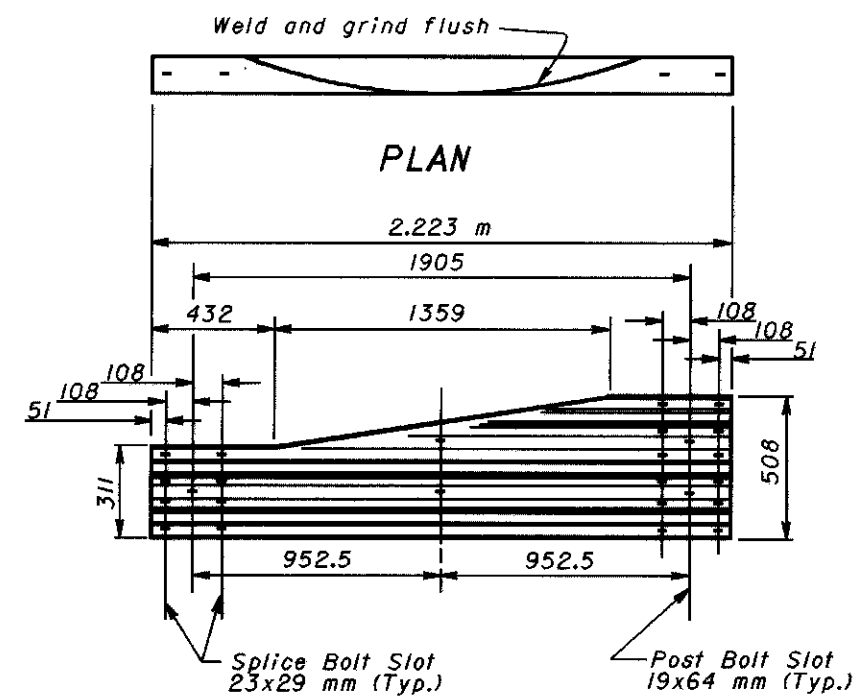
FOOTING ANCHOR



DETAIL A



MEASURING GUARDRAIL HEIGHT



TYPE 2 TRANSITION SECTION * (W-Beam to Thrie-Beam)

* For details of Type 1 Transition Section, refer to AASHTO M 180, Figure 4.

NOTES

BEAM RAIL ELEMENTS: Elements shall be 3.81 m effective length, unless otherwise specified, with 19x64 mm post bolt slots on 1,905 m centers regardless of post spacing. Field punching or drilling of bolt holes or slots for irregularly spaced posts shall be according to CMS 606.05.

BEAM RAIL SPLICE between two rail elements or between a rail and terminal connector shall be lapped in the direction of traffic. The buffer or flared end sections shall lap on the traffic face. A 305 mm length of beam rail (Back-up Plate), with a 19 mm diameter bolt hole or a 19x64 mm slot, shall be provided at steel posts not having a rail splice.

EMBEDMENT DEPTH: Where less than 0.6 m of graded shoulder width (10:1 or flatter) exists, measured from the face of the guardrail (see Detail "A"), longer posts shall be used so that a minimum of 1.65 m embedment depth is provided. Payment for the longer posts will be made at the unit price bid per Each, Item 606 - Guardrail Post, 2.75 m.

PROTECTIVE COATING: In lieu of the requirements of CMS 710.06, expansion shields, anchors and insert anchor assemblies installed (embedded) in concrete shall be coated in accordance with ASTM A 153 or be of stainless steel. Any bolts screwed into these embedded devices shall meet CMS 710.06.

SPECIAL POST MOUNTINGS: Posts located over a drainage inlet or structure shall be encased or anchored per the details shown on Standard Construction Drawing GR-2.2M.

Posts located over a footing with a cover of less than 0.75 m shall be installed with a footing anchor as detailed hereon. (A plate, as detailed on Section B-B of Standard Construction Drawing GR-2.2M, may be used as an alternate attachment method.) Where the cover is between 0.75 m and 1.04 m, the footing anchor may be omitted and the post encased instead with 100 mm (min.) of concrete.

Posts located over a culvert with less than 1.3 m of cover shall not be driven, but shall be set in drilled or dug holes. Where the available post embedment depth is less than 1.04 m, the post shall be encased with 100 mm (min.) of concrete.

All costs associated with special post mountings shall be included in the unit price bid for 606 Guardrail of the type specified in the plans.

*** ANCHORS:** Holes and grouting shall comply with CMS 510. Either cement or nonshrink, nonmetallic grout may be used.

Expansion shield anchors conforming to CMS 712.01 may be substituted except where concrete deterioration has occurred, as determined by the Engineer. The same bolt diameter specified shall be required. Where self-drilling anchors are used, the holes shall be drilled with the expansion shield (not by a drill bit) and the shield installed flush with the concrete surface.

All dimensions are in millimeters unless otherwise noted.



This Drawing Replaces GR-1.2.

OFFICE OF ROADWAY ENGINEERING OHIO DEPARTMENT OF TRANSPORTATION	
GUARDRAIL DETAILS	DATE 1-3-96
STANDARD CONSTRUCTION DRAWING GR-1.2M	
APPROVED <u>R. K. Hulman, P.E.</u> ADMINISTRATOR	