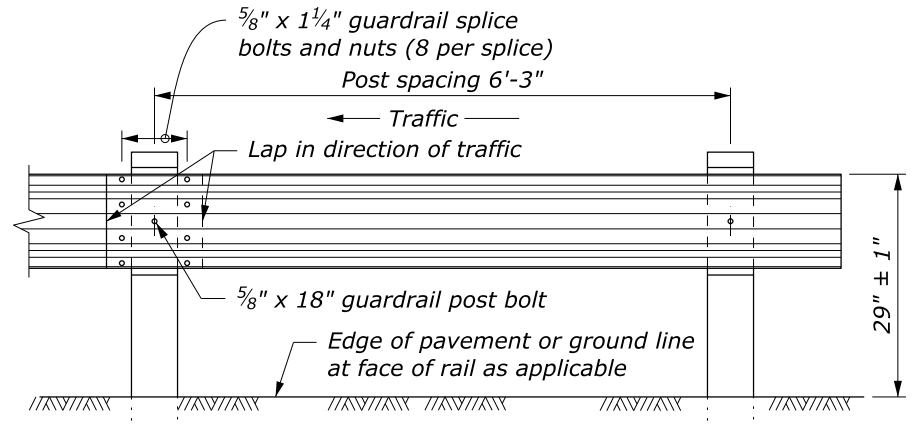
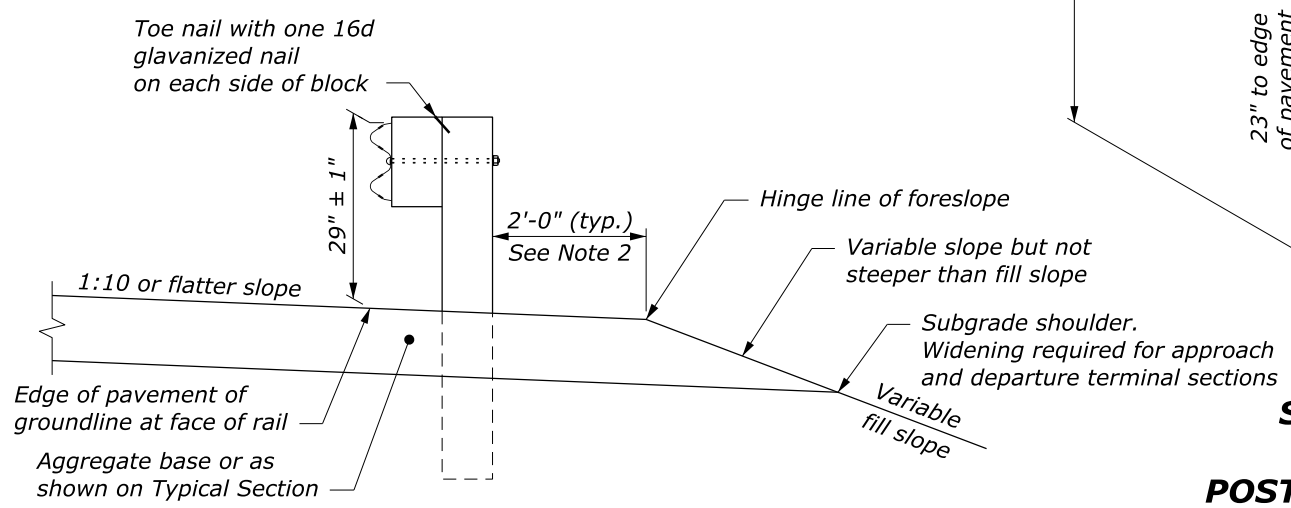


RAIL ELEVATION  
 29/32" x 1/8" splice bolt slot.  
 8 required, each end of rail  
 3/4" x 2 1/2" post bolt slot at 6'-3" spacing, center to center

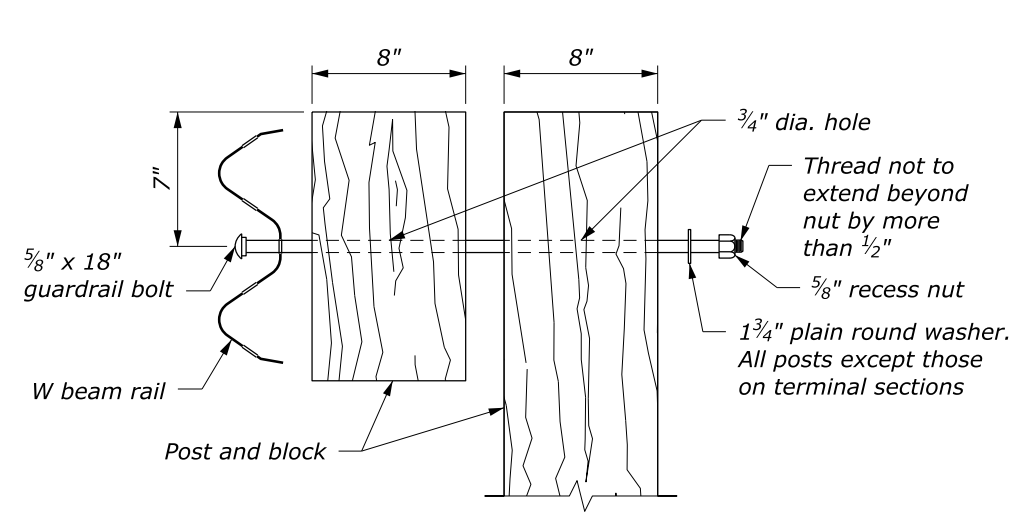
**W BEAM RAIL**



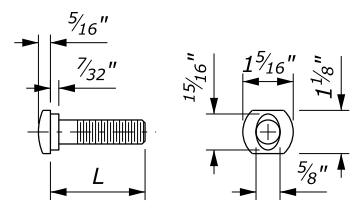
**POST SPACING STANDARD POST SECTION**



**TYPICAL GUARDRAIL CROSS SECTION**

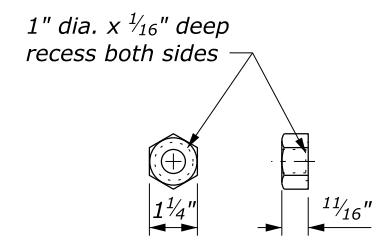


**POST BOLT ASSEMBLY**



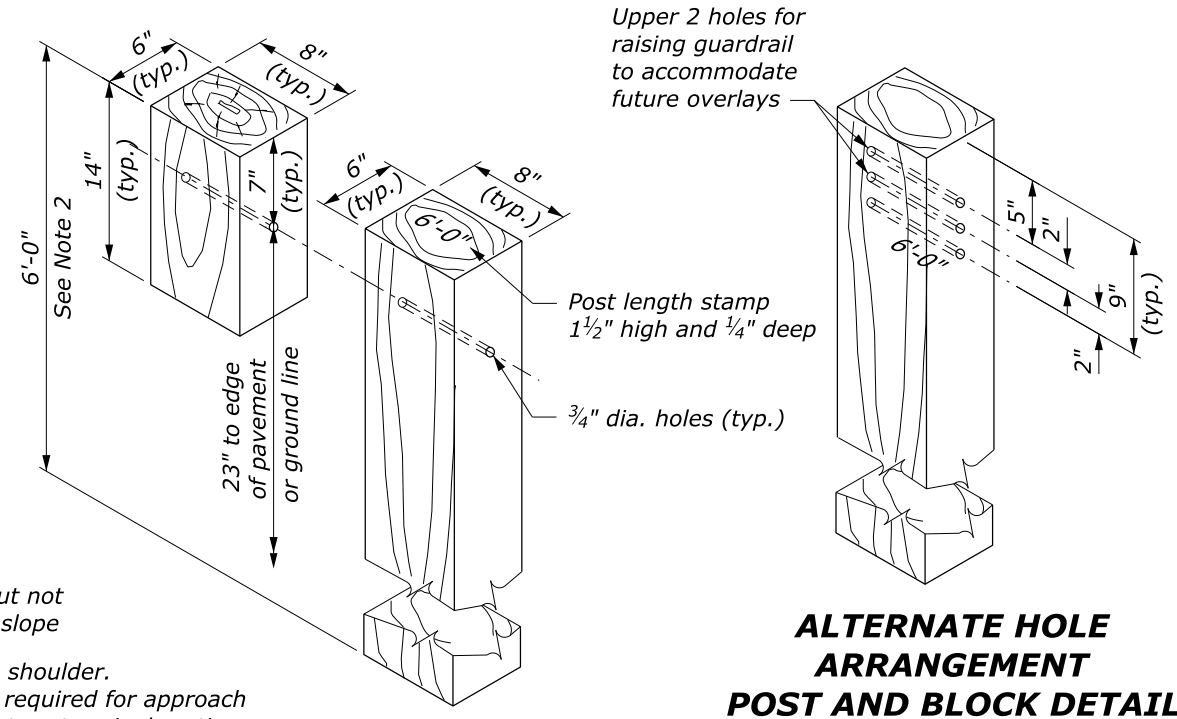
5/8" GUARDRAIL BOLT

| L      | Thread Length  |
|--------|----------------|
| 1 1/4" | 1 1/8" minimum |
| 2"     | 1 3/4" minimum |
| 10"    | 4" minimum     |
| 18"    | 4" minimum     |
| 25"    | 4" minimum     |



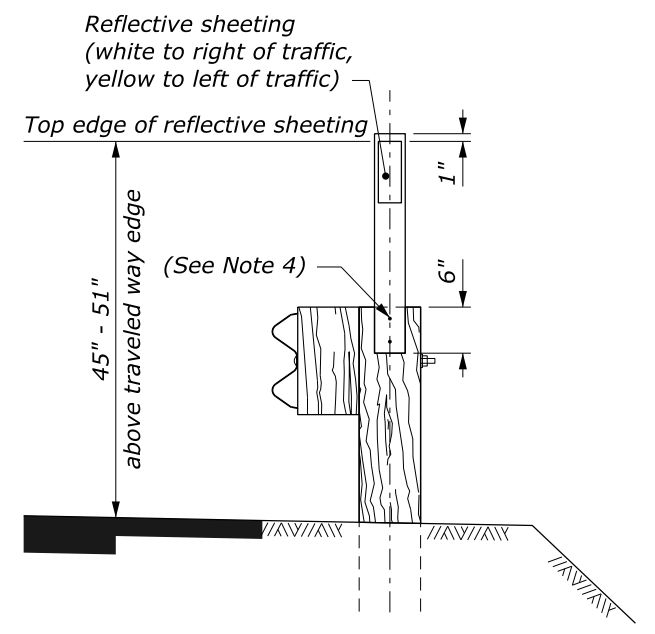
5/8" RECESS NUT

**GUARDRAIL BOLT AND RECESS NUT**



**STANDARD HOLE ARRANGEMENT POST AND BLOCK DETAIL**

**ALTERNATE HOLE ARRANGEMENT POST AND BLOCK DETAIL**



**FLEXIBLE GUIDE POST GUARDRAIL MOUNT**

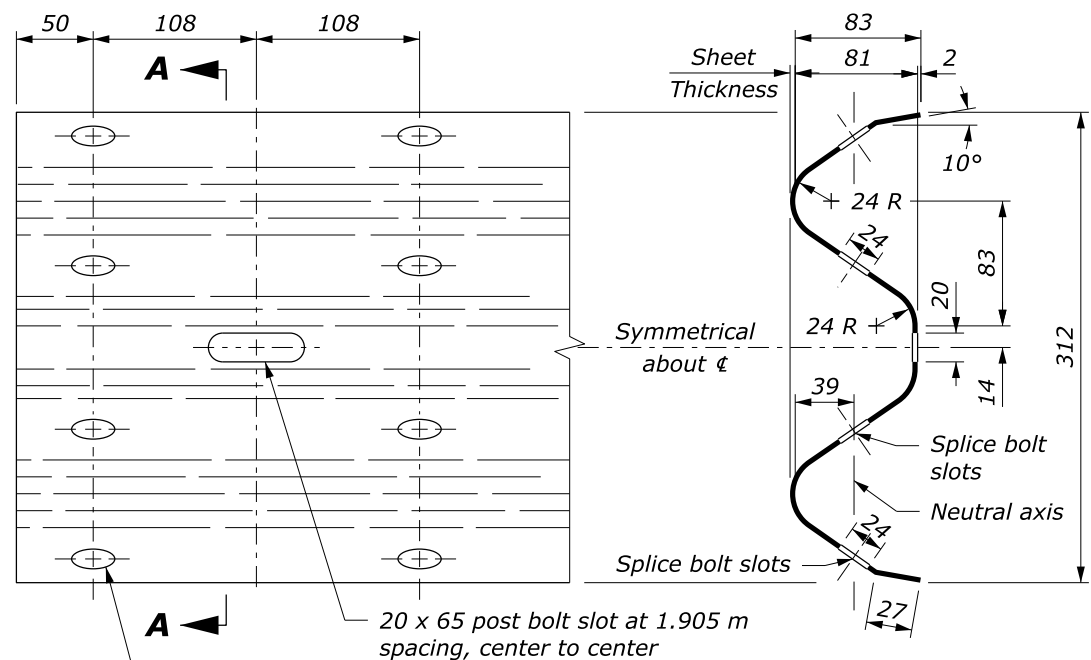
**NOTE:**

1. When encountering impenetrable material, see Standard 617-13.
2. See Special Contract Requirements when 7 foot or longer posts are specified.
3. See Special Contract Requirements when the alternate hole arrangement is specified.
4. Install delineator every fourth post. Fasten delineator to post using two 2" x 3/8" lag screws with washers, along centerline of post; or fasten as specified by the manufacturer. Alternate delineator types may be used if approved.
5. Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

NO SCALE

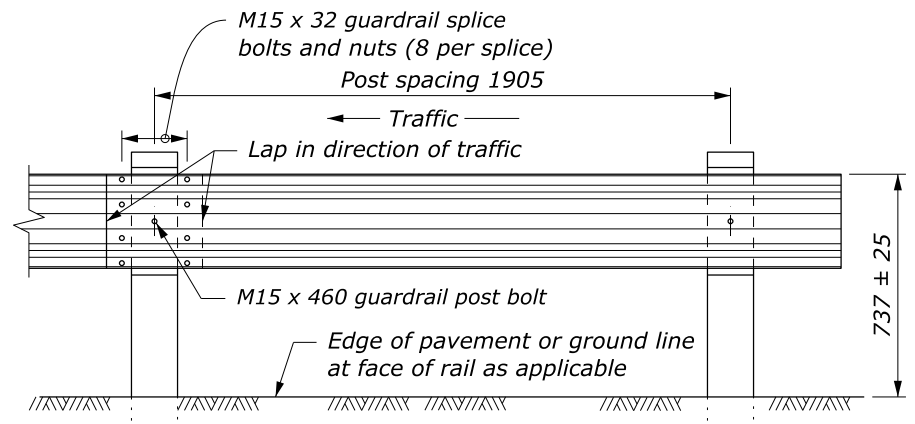
|  |                            |
|--|----------------------------|
| U.S. DEPARTMENT OF TRANSPORTATION, FHWA<br>OFFICE OF FEDERAL LANDS HIGHWAY | FLH STANDARD<br>617-10     |
| <b>G4 W-BEAM GUARDRAIL<br/>WOOD POSTS</b>                                  | SPECIFICATION<br>FP-14     |
|  | APPROVED FOR USE<br>1/2024 |

c:\pwwork\0419223\Std617-10\p14.dgn [Std 617-10] 15 July 2024 3:03 PM

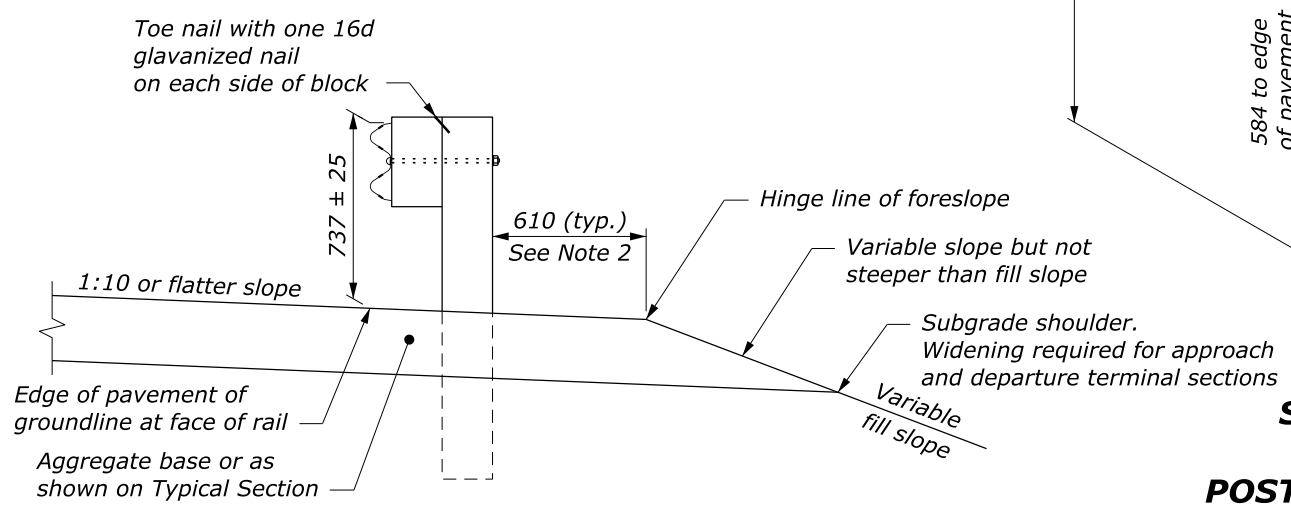


20 x 65 post bolt slot at 1.905 m spacing, center to center  
24 x 30 splice bolt slot. 8 required, each end of rail  
RAIL ELEVATION

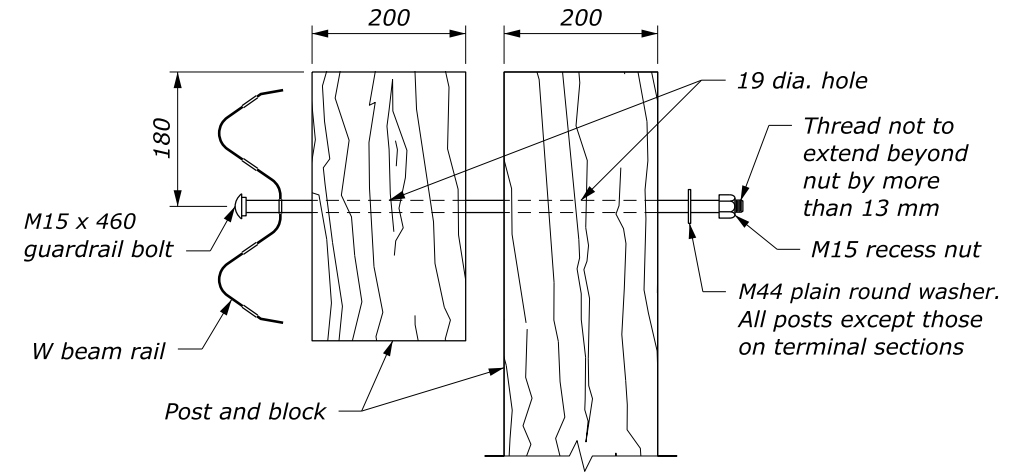
**W BEAM RAIL**



**POST SPACING STANDARD POST SECTION**

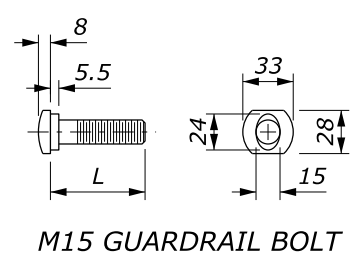


**TYPICAL GUARDRAIL CROSS SECTION**

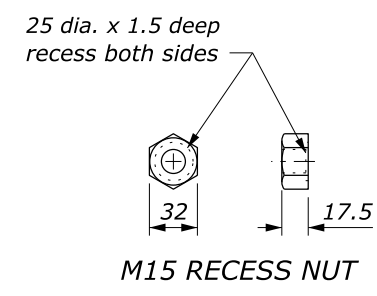


**POST BOLT ASSEMBLY**

| L   | Thread Length |
|-----|---------------|
| 32  | 30 minimum    |
| 50  | 45 minimum    |
| 255 | 100 minimum   |
| 460 | 100 minimum   |
| 640 | 100 minimum   |

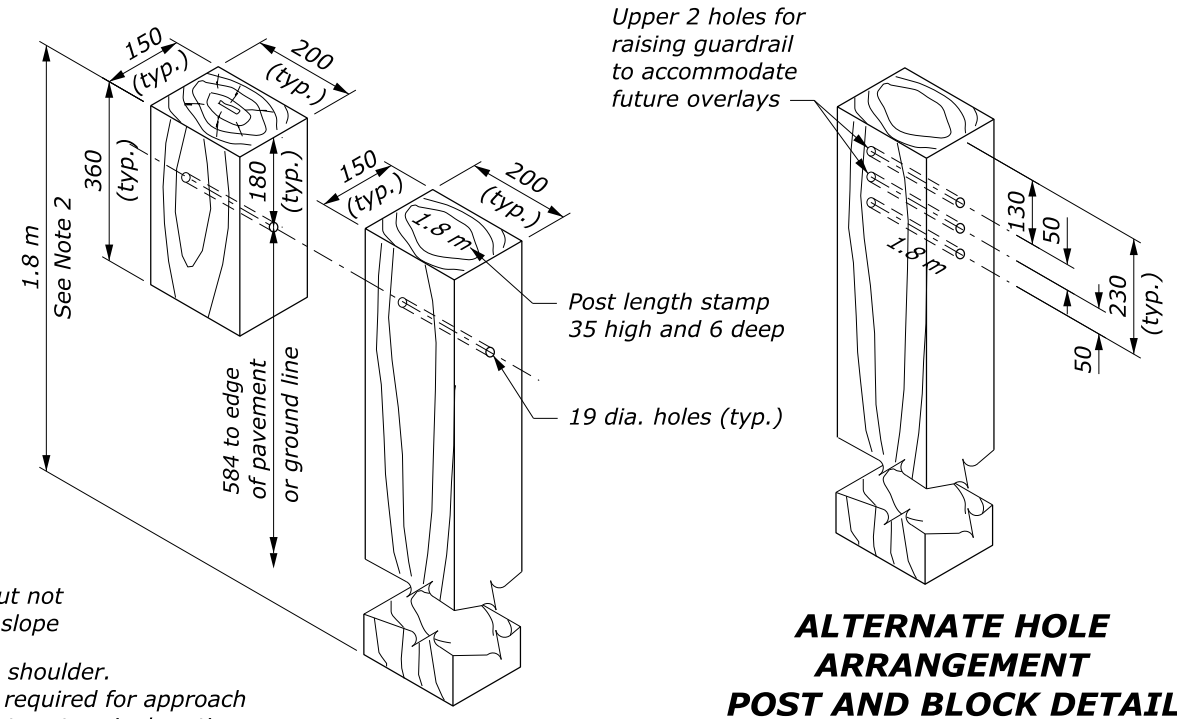


M15 GUARDRAIL BOLT



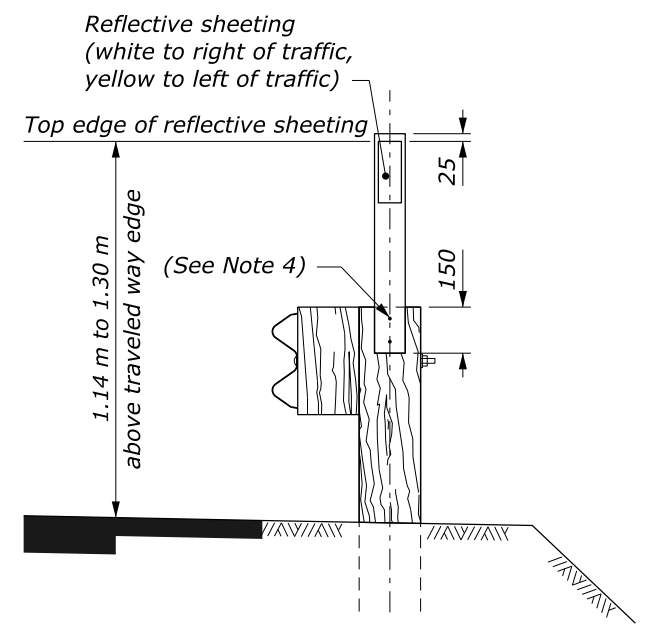
M15 RECESS NUT

**GUARDRAIL BOLT AND RECESS NUT**



**STANDARD HOLE ARRANGEMENT POST AND BLOCK DETAIL**

**ALTERNATE HOLE ARRANGEMENT POST AND BLOCK DETAIL**



**FLEXIBLE GUIDE POST GUARDRAIL MOUNT**

This drawing contains **Metric** units of measure. Dimensions without units are millimeters.

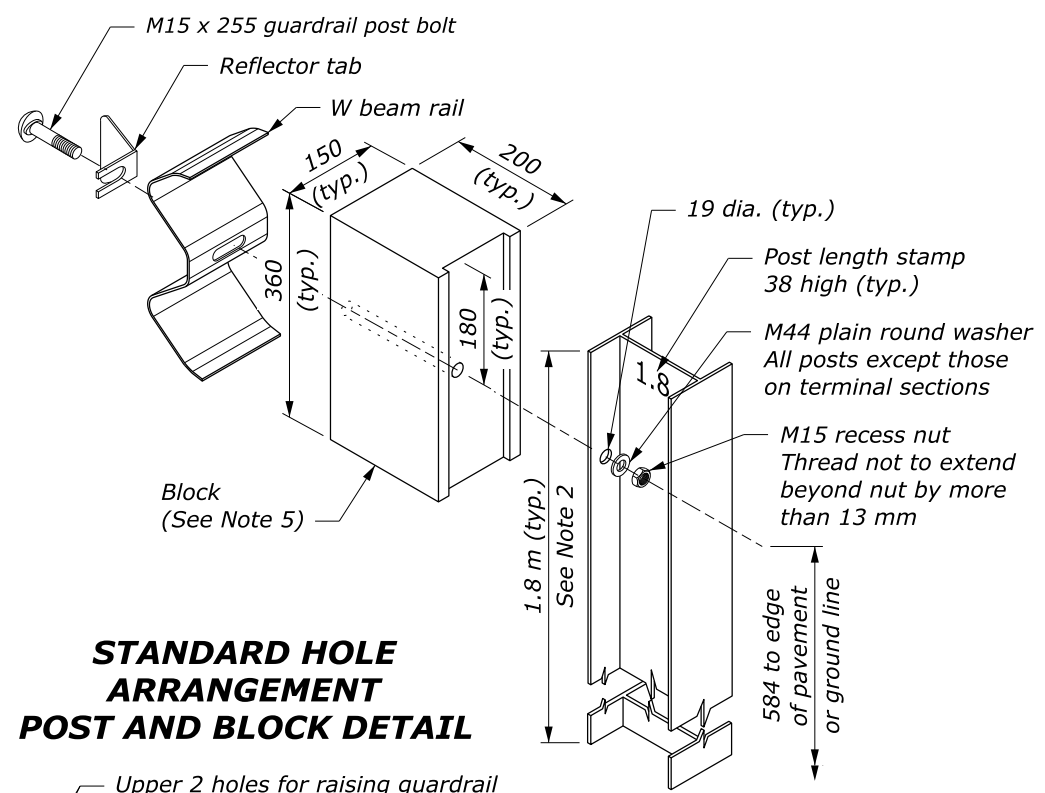
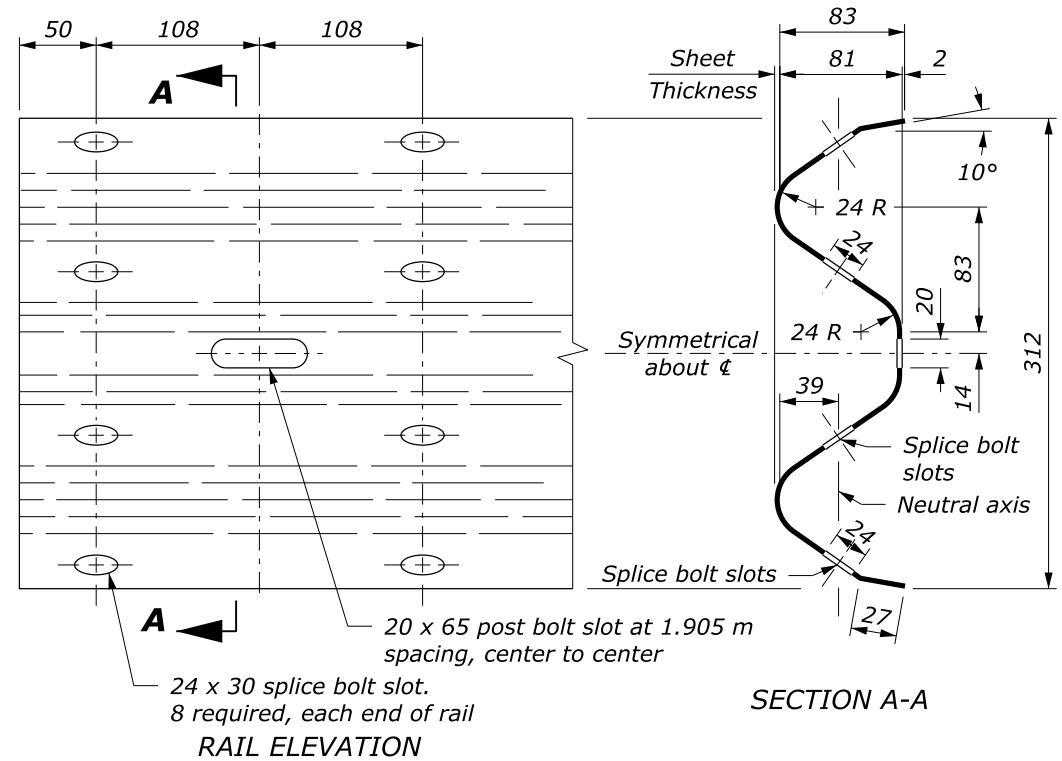
- NOTE:**
- When encountering impenetrable material, see Standard M617-13.
  - See Special Contract Requirements when 2 m or longer posts are specified.
  - See Special Contract Requirements when the alternate hole arrangement is specified.
  - Install delineator every fourth post. Fasten delineator to post using two 50 mm x 10 mm lag screws with washers, along centerline of post; or fasten as specified by the manufacturer. Alternate delineator types may be used if approved.
  - Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.
  - Furnish hardware in the metric sizes shown. Equivalent US Customary sizes may be used when metric sizes are unavailable.

|  |                            |
|--|----------------------------|
| U.S. DEPARTMENT OF TRANSPORTATION, FHWA<br>OFFICE OF FEDERAL LANDS HIGHWAY | FLH STANDARD<br>M617-10    |
| <b>G4 W-BEAM GUARDRAIL<br/>WOOD POSTS</b>                                  | SPECIFICATION<br>FP-14     |
|  | APPROVED FOR USE<br>1/2024 |

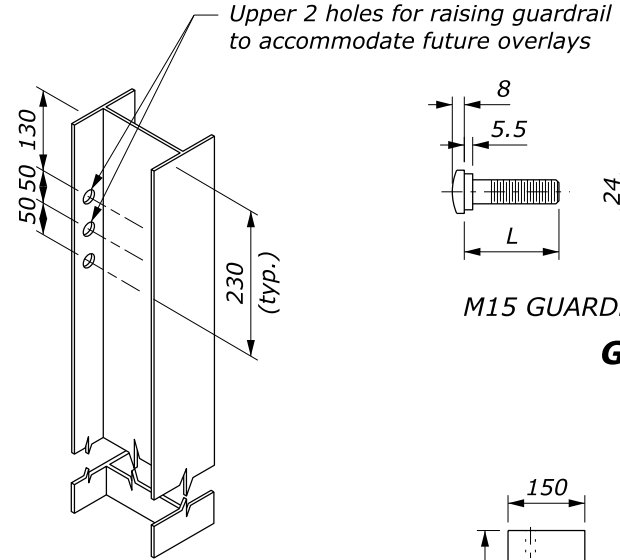
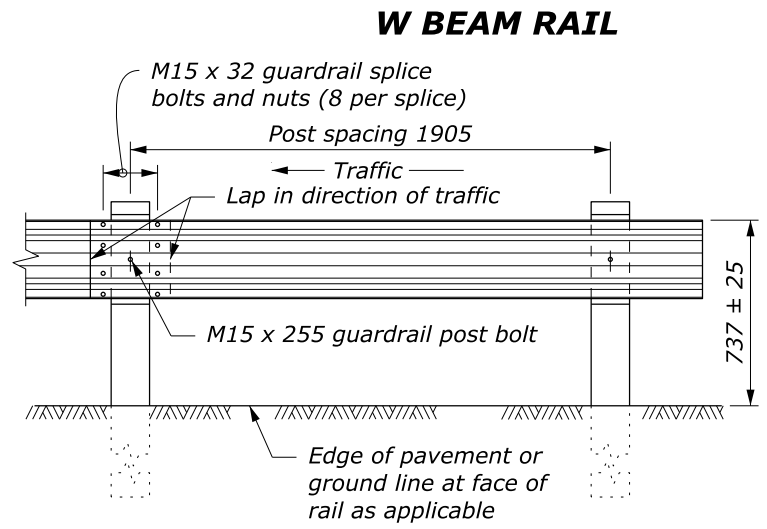
NO SCALE

15 July 2024 2:54 PM c:\pwwork\0419223\Std617-10fp14.dgn [Std M617-10]





- NOTE:**
- When encountering impenetrable material, see Standard M617-13.
  - See Special Contract Requirements when 2 m or longer posts are specified.
  - See Special Contract Requirements when the alternate hole arrangement is specified.
  - Install delineator every fourth post. Fasten delineator to post using two galvanized 50 mm x 9.5 mm bolts with a washer on both sides, a lock washer, and nut; or fasten as specified by the manufacturer. Alternate delineator types may be used if approved.
  - Block may be wood, plastic, or composite material. Use consistent material throughout the length of guardrail run.
  - Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.
  - Furnish hardware in the metric sizes shown. Equivalent US Customary sizes may be used when metric sizes are unavailable.



**M15 GUARDRAIL BOLT**

| L   | Thread Length |
|-----|---------------|
| 32  | 30 minimum    |
| 50  | 45 minimum    |
| 255 | 100 minimum   |
| 460 | 100 minimum   |
| 640 | 100 minimum   |

**M15 RECESS NUT**

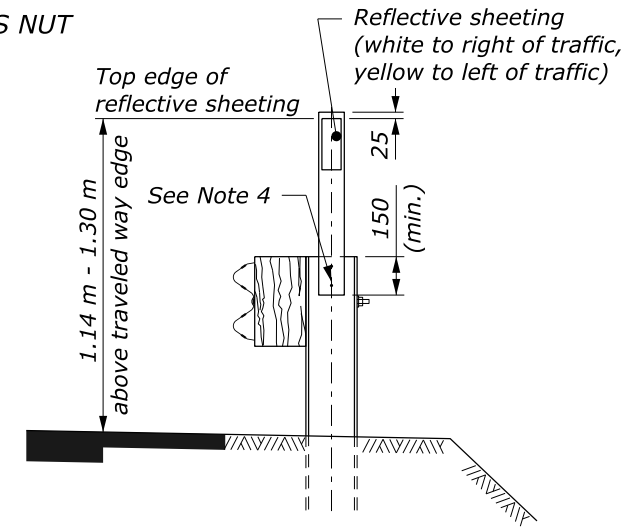
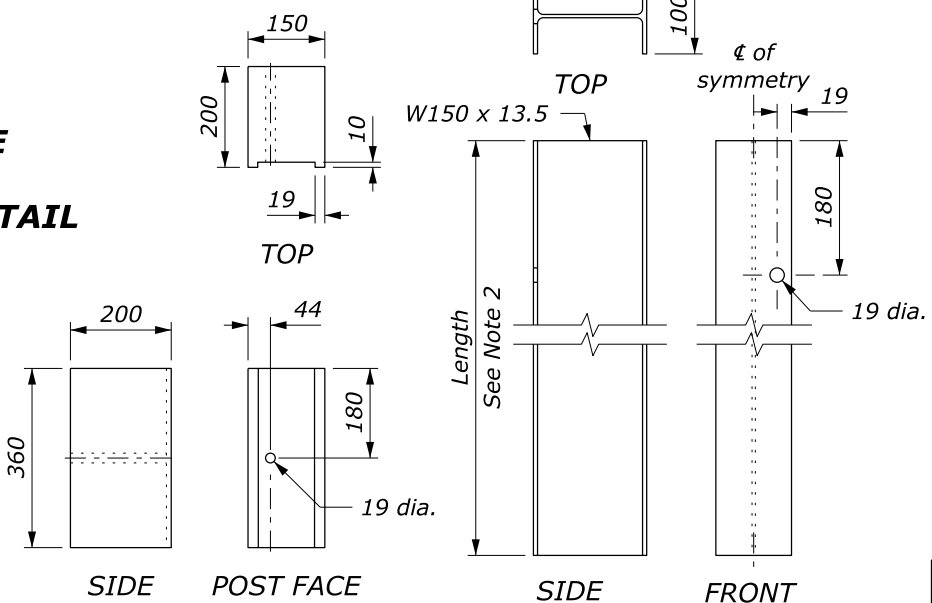
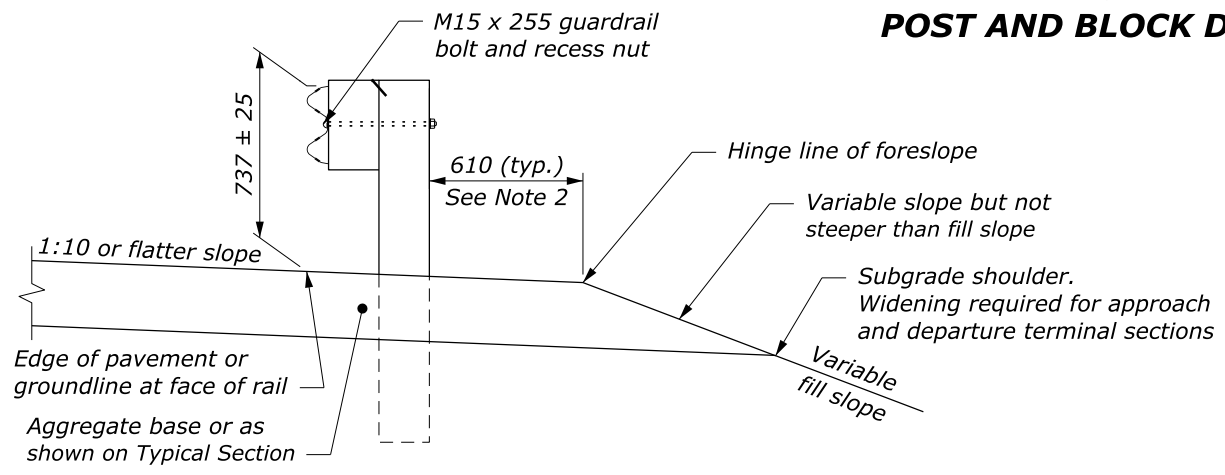
25 dia. x 1.5 deep recess both sides

32 17.5

**GUARDRAIL BOLT AND RECESS NUT**

**POST SPACING STANDARD POST SECTION**

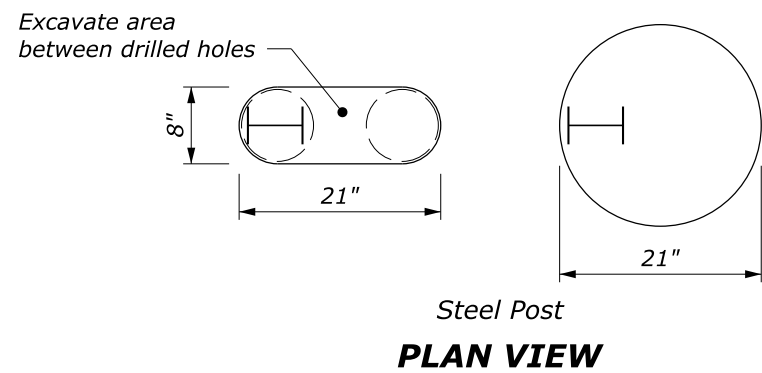
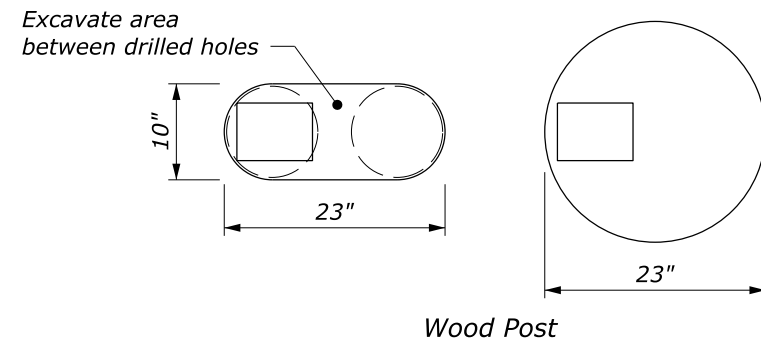
**ALTERNATE HOLE ARRANGEMENT POST AND BLOCK DETAIL**



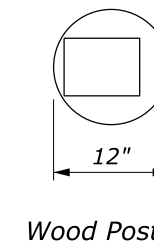
This drawing contains **Metric** units of measure. Dimensions without units are millimeters.

|  |                            |
|--|----------------------------|
| U.S. DEPARTMENT OF TRANSPORTATION, FHWA<br>OFFICE OF FEDERAL LANDS HIGHWAY | FLH STANDARD<br>M617-11    |
| <b>G4 W-BEAM GUARDRAIL STEEL POSTS</b>                                     | SPECIFICATION<br>FP-14     |
|  | APPROVED FOR USE<br>1/2024 |

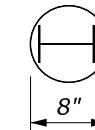
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**PLAN VIEW**



Wood Post

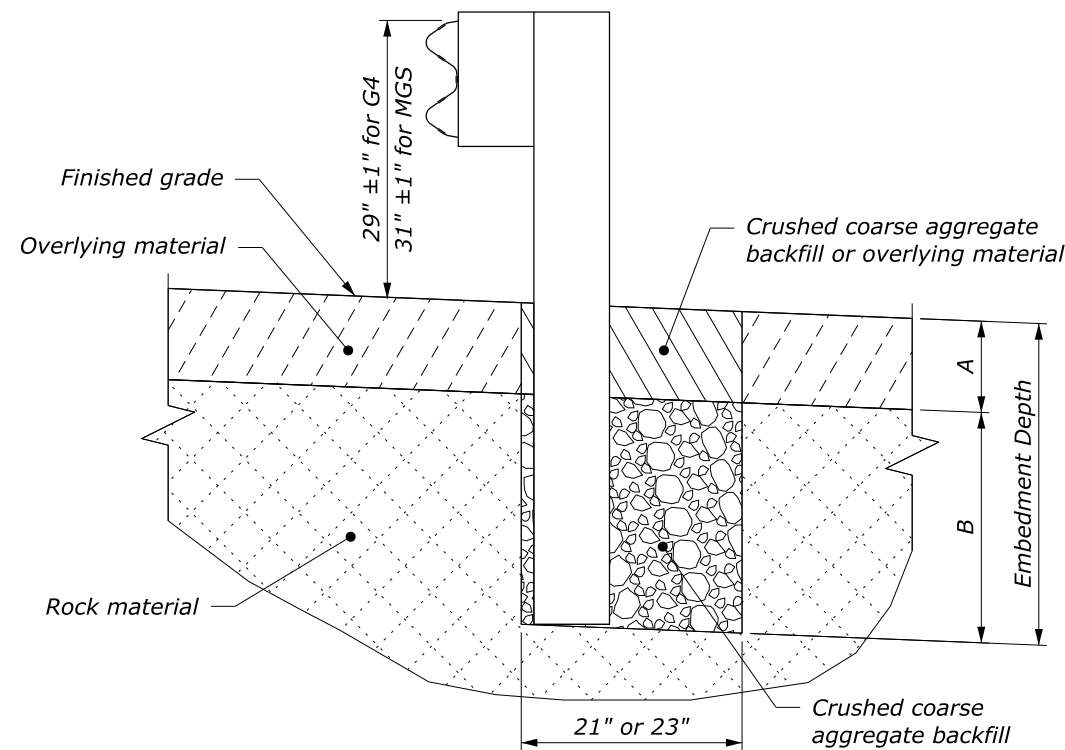


Steel Post

**PLAN VIEW**

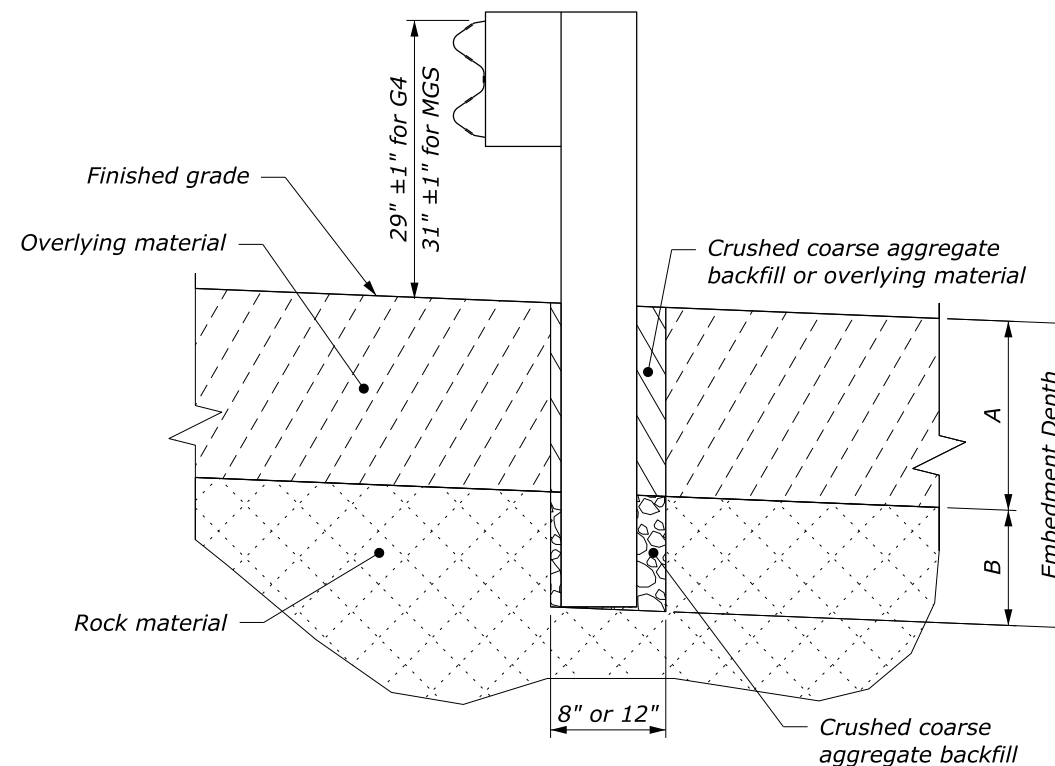
**NOTE:**

1. Use this standard when posts cannot be embedded to the minimum depth shown on Standard 617-10, 617-11, 617-31 or 617-32.
2. Unless otherwise specified, use either the circular or the oblong hole configuration for Case 1 conditions.
3. Use crushed coarse aggregate conforming to Section 703 "Coarse aggregate for concrete" or granular backfill for "Underdrain pipe with geotextile".
4. Place crushed coarse aggregate according to the post requirements in Section 617.
5. Treat field cut galvanized steel post surfaces that expose the base metal with two coats of zinc-oxide paint.



**ELEVATION**

Case 1: Overlying material depth (A) is 18" or less



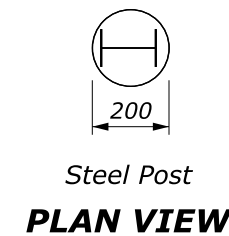
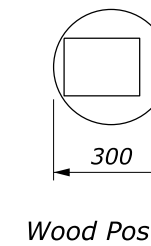
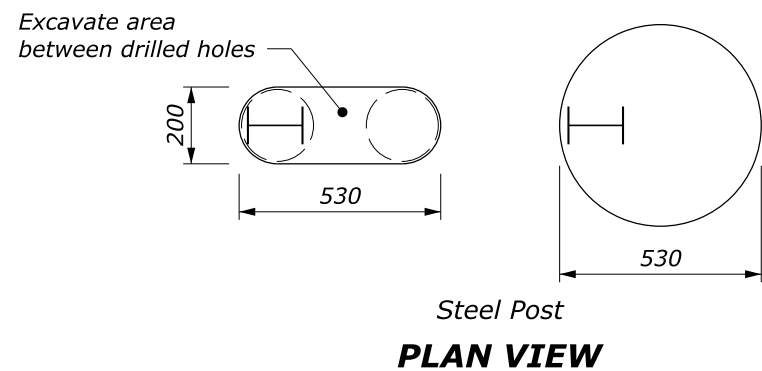
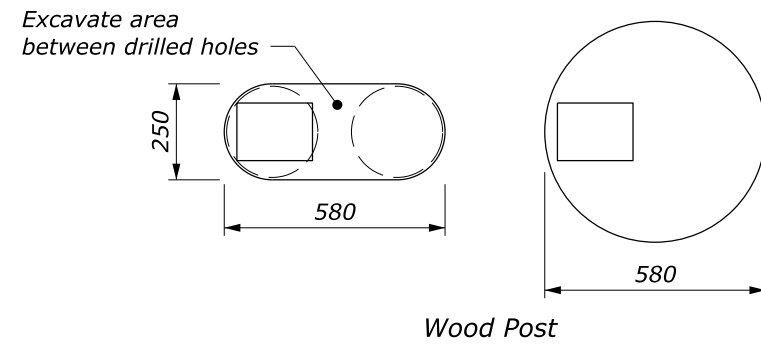
**ELEVATION**

Case 2: Overlying material depth (A) is greater than 18"

| POST EMBEDMENT DIMENSIONS |                 |                        |                    |
|---------------------------|-----------------|------------------------|--------------------|
| HOLE TYPE                 | EMBEDMENT DEPTH | OVERLYING MATERIAL (A) | DRILLING DEPTH (B) |
| Case 1                    | 24" to 42"      | 0 to 18"               | 24"                |
| Case 2                    | 30" to 42"      | > 18" to 30"           | 12"                |
|                           | 42"             | > 30"                  | 42" - A            |

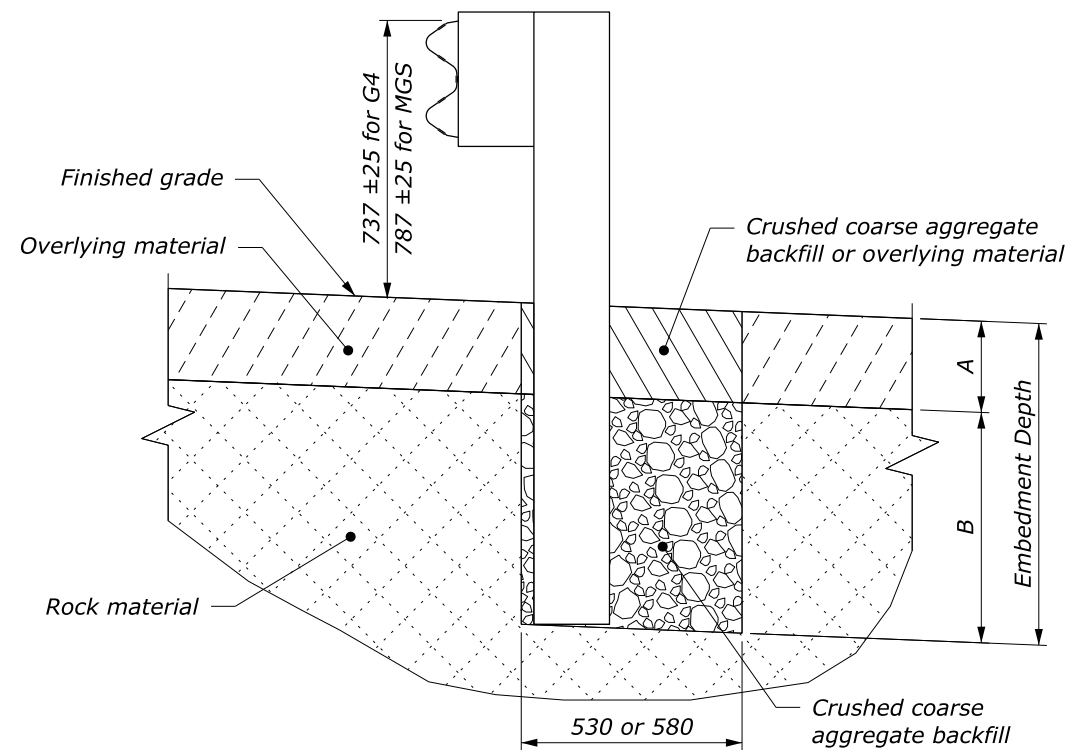
NO SCALE

|  |                               |
|--|-------------------------------|
| U.S. DEPARTMENT OF TRANSPORTATION, FHWA<br>OFFICE OF FEDERAL LANDS HIGHWAY | FLH STANDARD<br><b>617-13</b> |
| <b>MGS AND G4<br/>W-BEAM GUARDRAIL<br/>INSTALLATION IN ROCK</b>            |                               |
| SPECIFICATION<br>FP-24, FP-14<br>APPROVED FOR USE<br>1/2024                |                               |

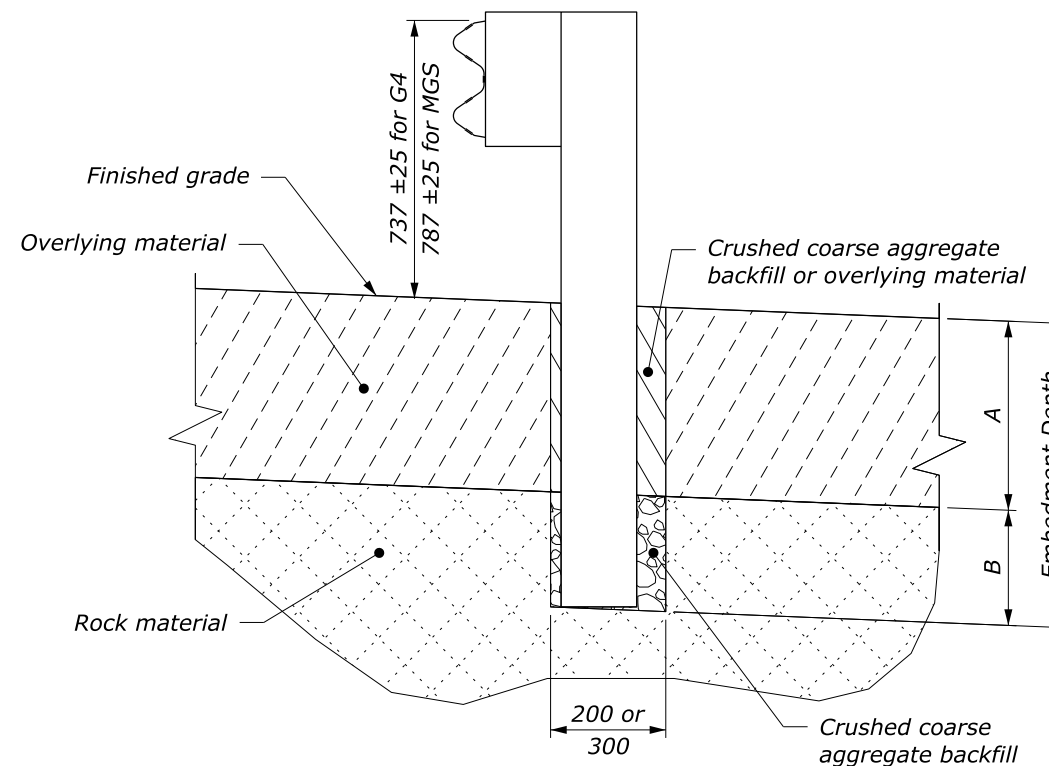


**NOTE:**

1. Use this standard when posts cannot be embedded to the minimum depth shown on Standard M617-10, M617-11, M617-31 or M617-32.
2. Unless otherwise specified, use either the circular or the oblong hole configuration for Case 1 conditions.
3. Use crushed coarse aggregate conforming to Section 703 "Coarse aggregate for concrete" or granular backfill for "Underdrain pipe with geotextile".
4. Place crushed coarse aggregate according to the post requirements in Section 617.
5. Treat field cut galvanized steel post surfaces that expose the base metal with two coats of zinc-oxide paint.



Case 1: Overlying material depth (A) is 460 or less



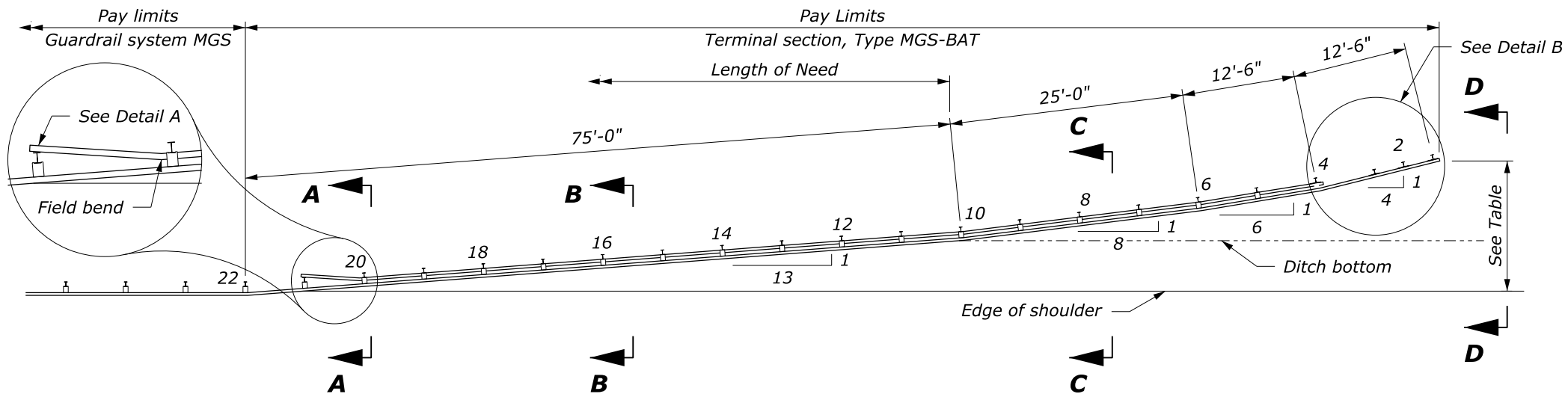
Case 2: Overlying material depth (A) is greater than 460

| POST EMBEDMENT DIMENSIONS |                 |                        |                    |
|---------------------------|-----------------|------------------------|--------------------|
| HOLE TYPE                 | EMBEDMENT DEPTH | OVERLYING MATERIAL (A) | DRILLING DEPTH (B) |
| Case 1                    | 610 to 1070     | 0 to 460               | 610                |
| Case 2                    | 760 to 1070     | > 460 to 760           | 300                |
|                           | 1070            | > 760                  | 1070 - A           |

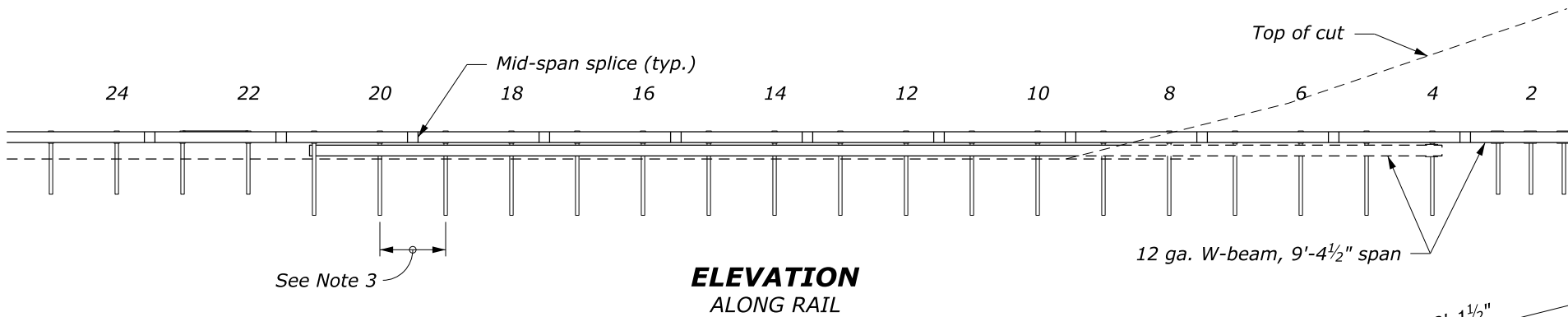
This drawing contains **Metric** units of measure. Dimensions without units are millimeters.

NO SCALE

|  |                               |
|--|-------------------------------|
| U.S. DEPARTMENT OF TRANSPORTATION, FHWA<br>OFFICE OF FEDERAL LANDS HIGHWAY | FLH STANDARD<br>M617-13       |
| <b>MGS AND G4<br/>W-BEAM GUARDRAIL<br/>INSTALLATION IN ROCK</b>            | SPECIFICATION<br>FP-24, FP-14 |
|  | APPROVED FOR USE<br>1/2024    |

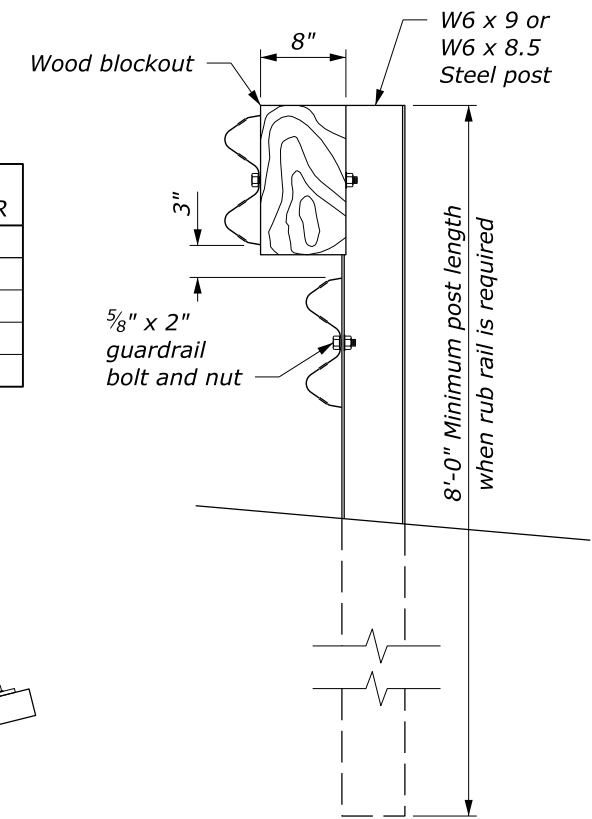


**PLAN**

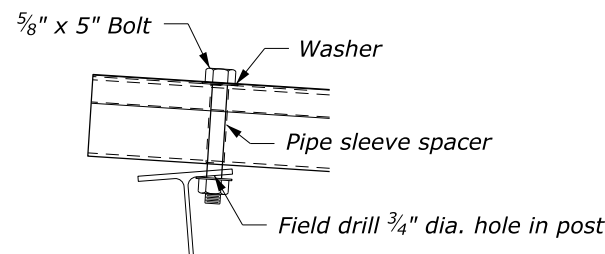


**ELEVATION  
ALONG RAIL**

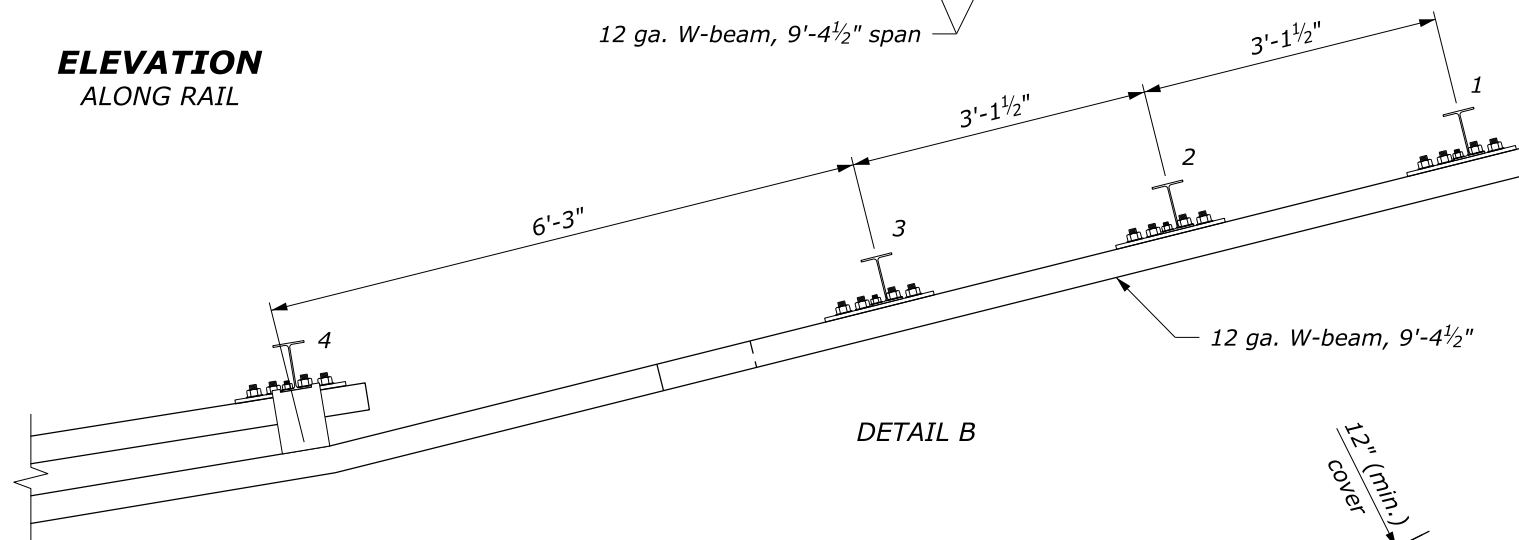
| POST OFFSETS FROM EDGE OF SHOULDER |             |
|------------------------------------|-------------|
| POST                               | DISTANCE    |
| 1                                  | 13'-11 3/4" |
| 4                                  | 10'-11"     |
| 6                                  | 8'-10 1/4"  |
| 10                                 | 5'-9"       |



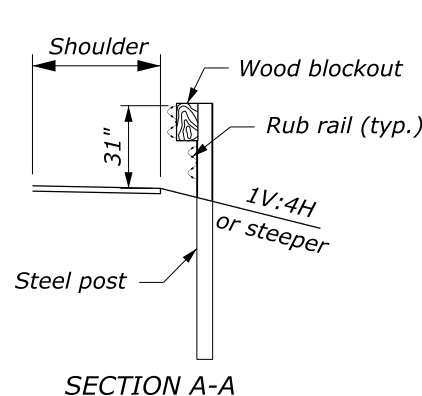
**ELEVATION  
STEEL POST  
AND BLOCK DETAIL**



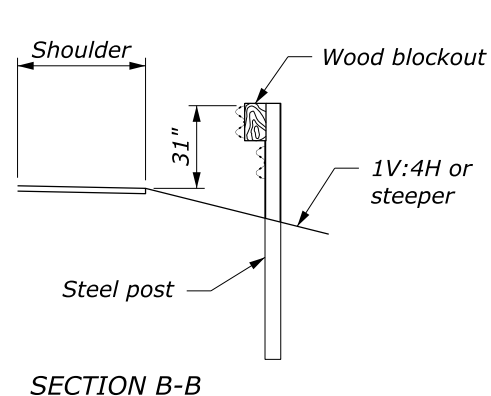
**DETAIL A**



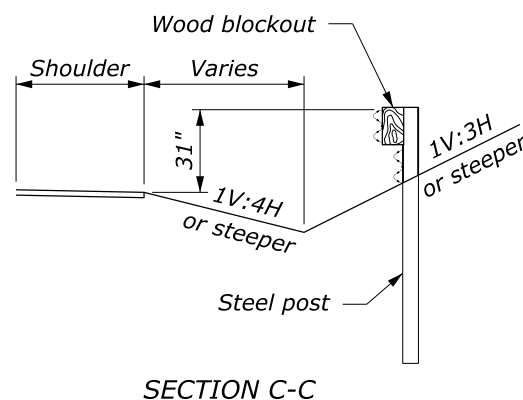
**DETAIL B**



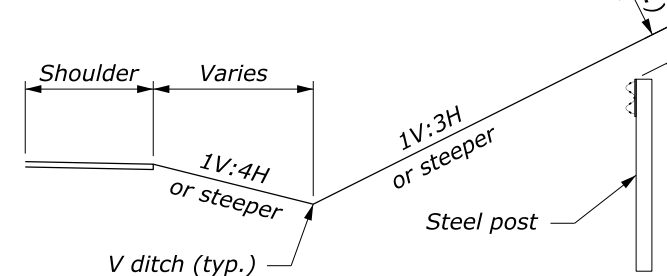
**SECTION A-A**



**SECTION B-B**



**SECTION C-C**



**SECTION D-D**

NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION, FHWA  
OFFICE OF FEDERAL LANDS HIGHWAY

**MGS W-BEAM GUARDRAIL  
BACK SLOPE ANCHOR TERMINAL  
TYPE MGS-BAT**

Sheet 1 of 2

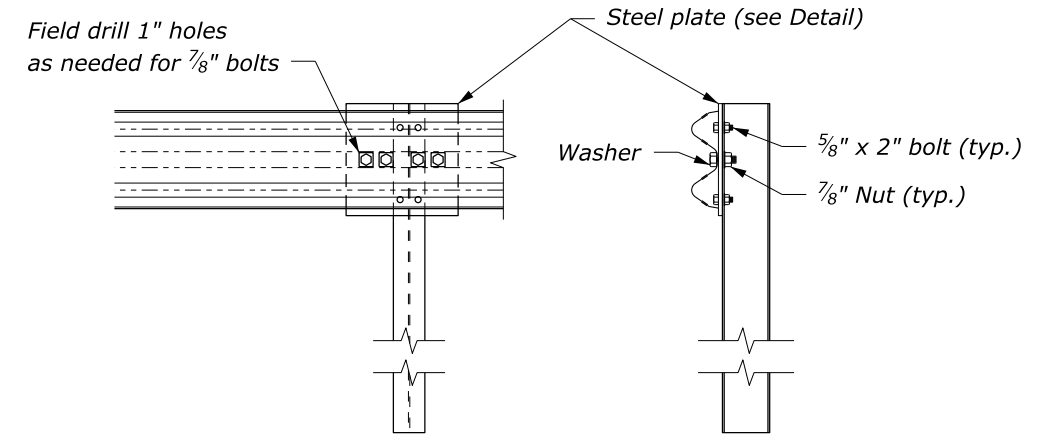
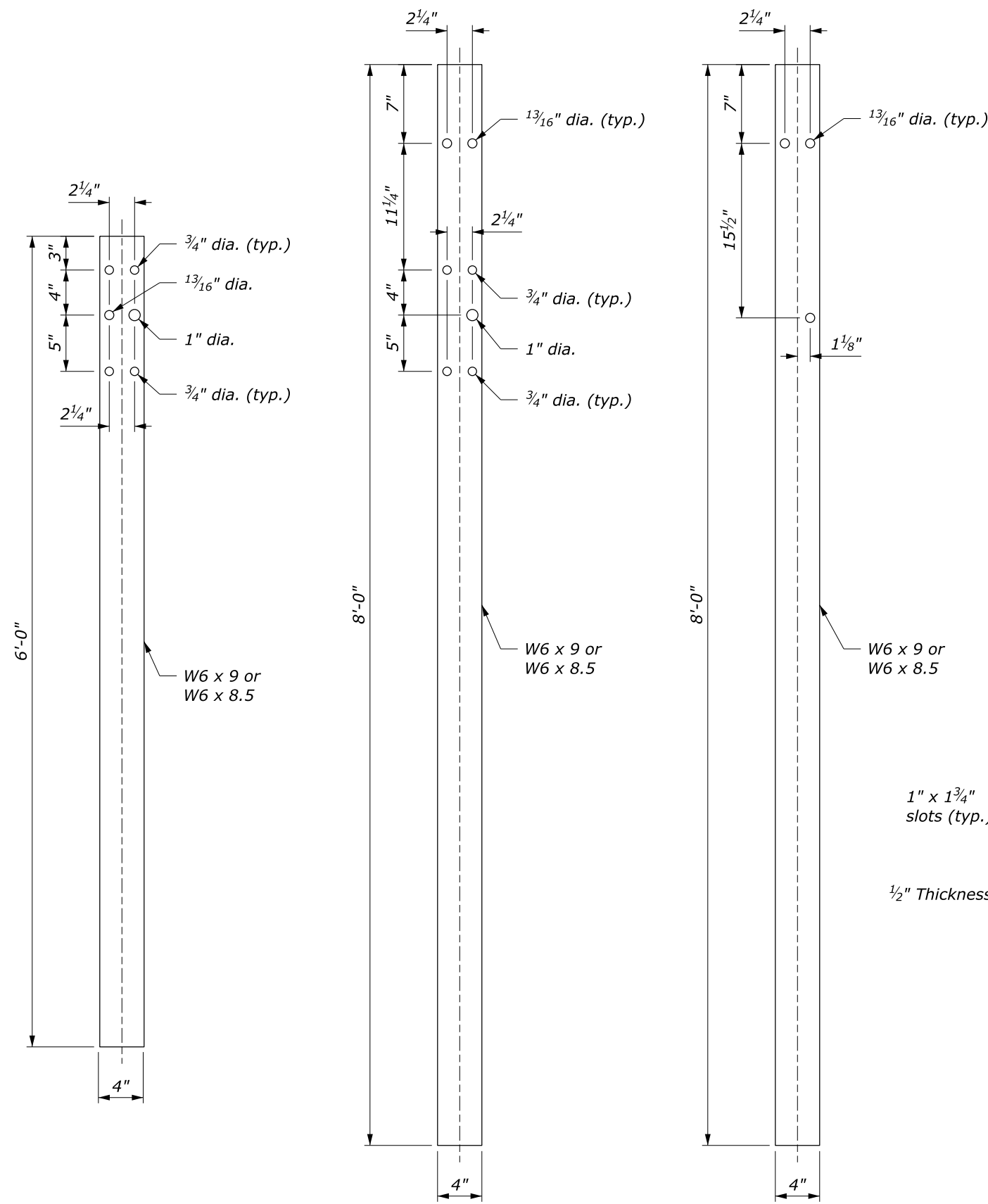
FLH STANDARD  
**617-18**

SPECIFICATION  
FP-14

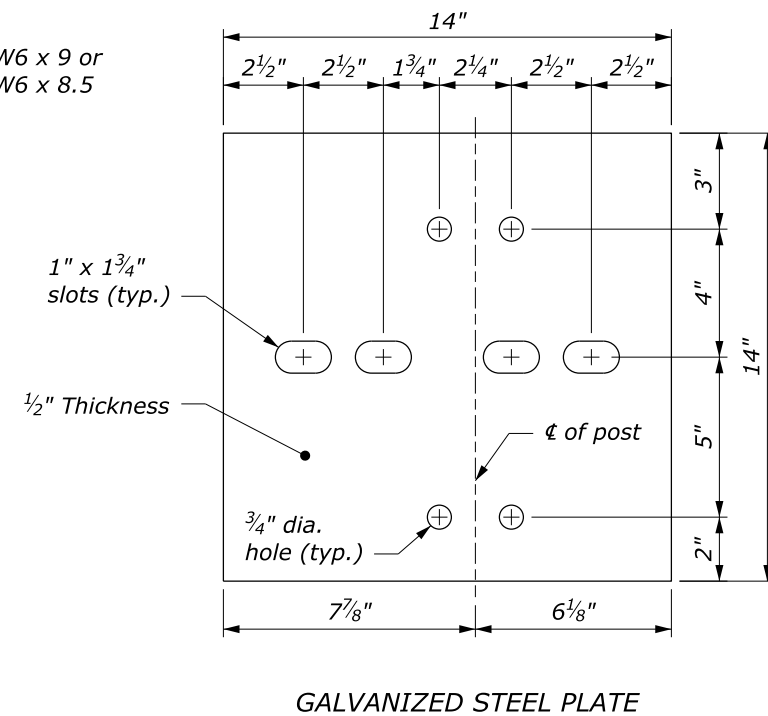
APPROVED FOR USE  
2/2024

**NOTE:**

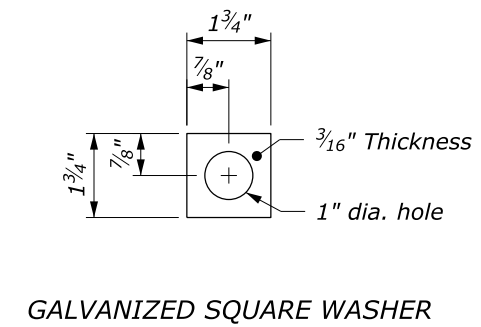
1. See Sheet 1 of 2 for terminal layout.
2. Use zinc rich paint to coat field drilled holes.
3. Anchor plate and hardware are typical on top rail of Posts 1 -3 and rub rail at Post 4.



**SPECIAL RAIL TO POST CONNECTION AT POSTS 1, 2, AND 3**



**STEEL PLATE AND WASHER**  
See Note 3



GALVANIZED SQUARE WASHER

**POSTS 1-3**

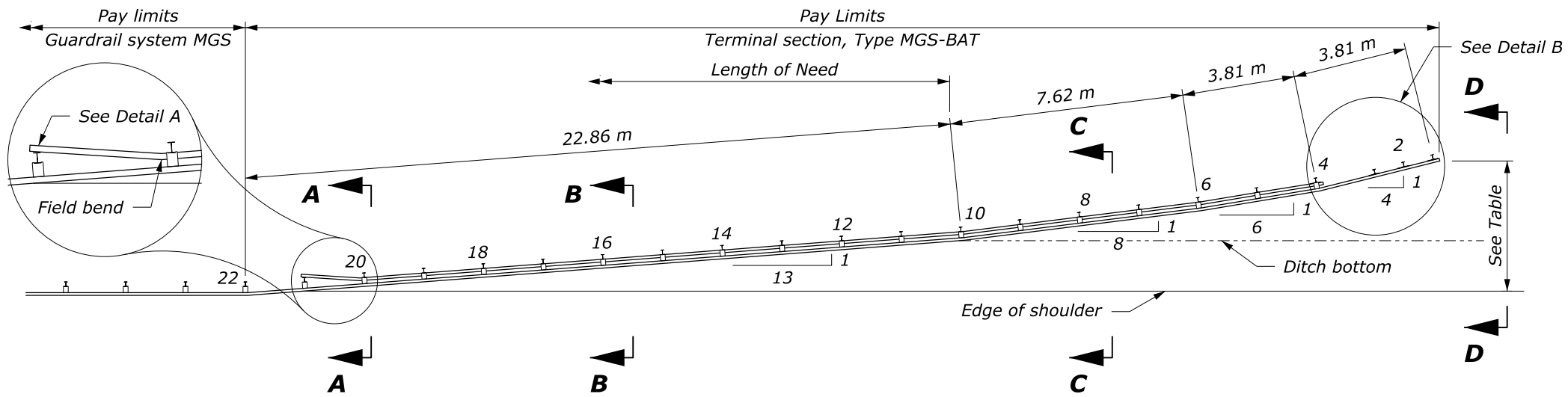
**POST 4**

**POSTS 5-21**

NO SCALE

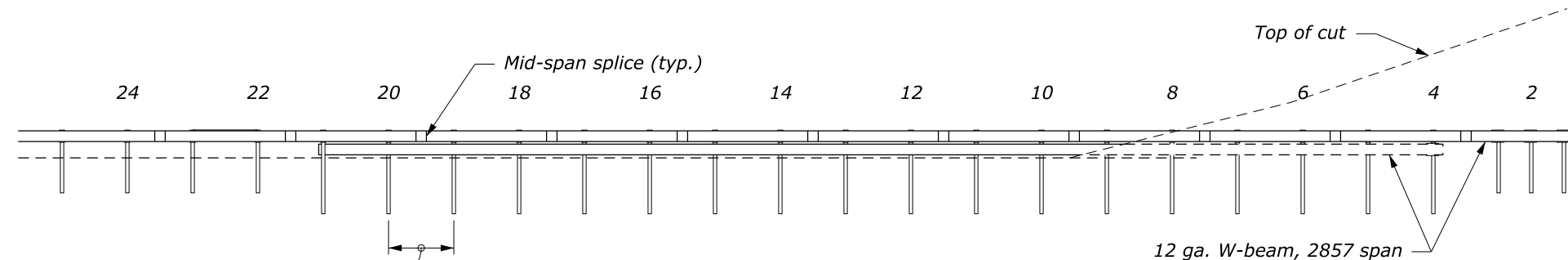
|   |  |                            |
|---|--|----------------------------|
| U.S. DEPARTMENT OF TRANSPORTATION, FHWA<br>OFFICE OF FEDERAL LANDS HIGHWAY  |  | FLH STANDARD<br>617-18     |
| <b>MGS W-BEAM GUARDRAIL<br/>BACK SLOPE ANCHOR TERMINAL<br/>TYPE MGS-BAT</b> |  | SPECIFICATION<br>FP-14     |
| Sheet 2 of 2  |  | APPROVED FOR USE<br>2/2024 |



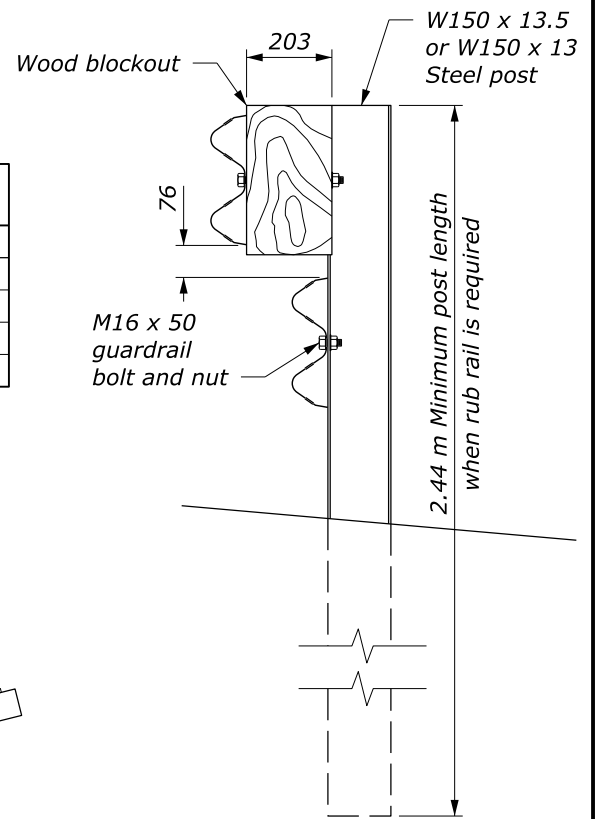


**PLAN**

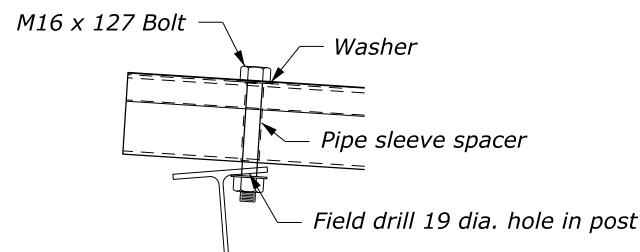
| POST OFFSETS FROM EDGE OF SHOULDER |          |
|------------------------------------|----------|
| POST                               | DISTANCE |
| 1                                  | 4.26 m   |
| 4                                  | 3.33 m   |
| 6                                  | 2.70 m   |
| 10                                 | 1.56 m   |



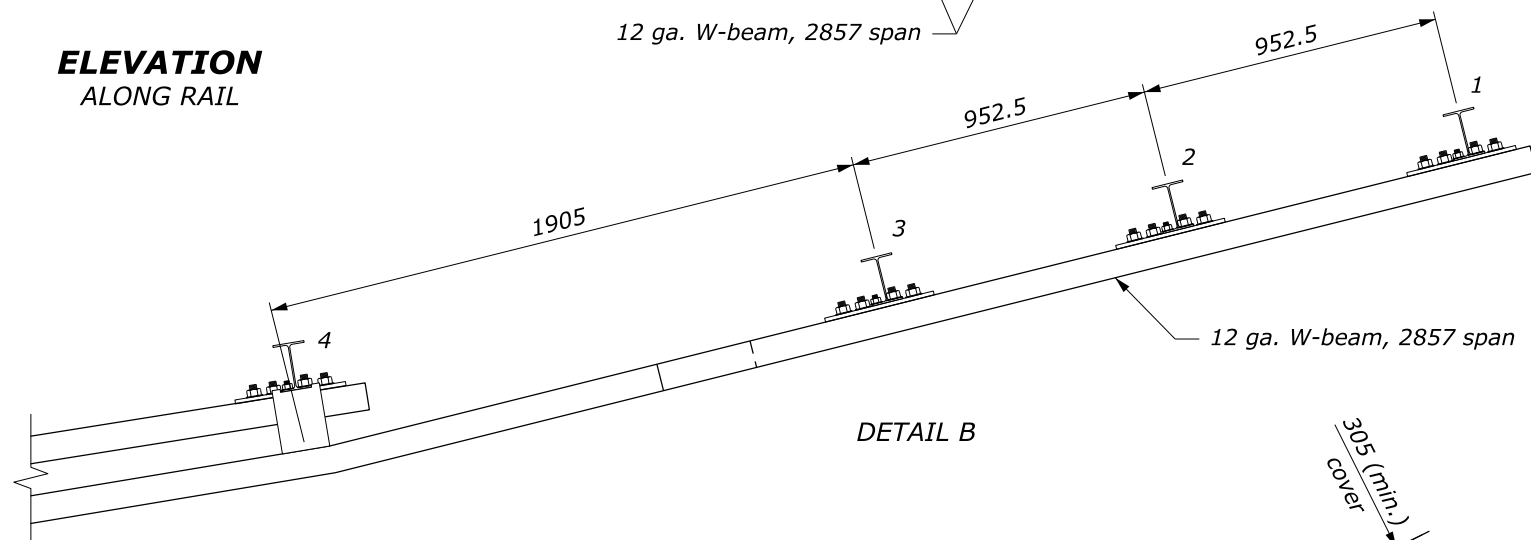
**ELEVATION ALONG RAIL**



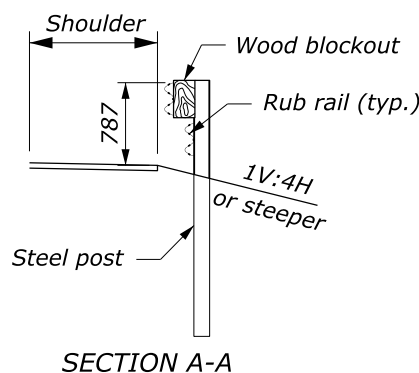
**ELEVATION STEEL POST AND BLOCK DETAIL**



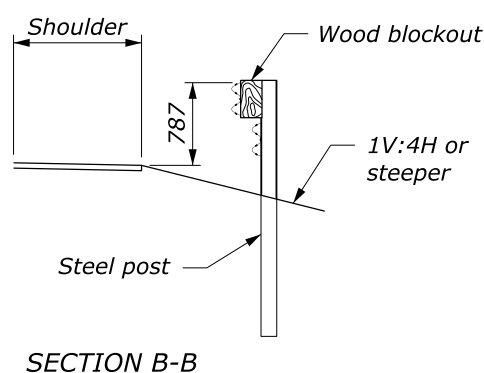
**DETAIL A**



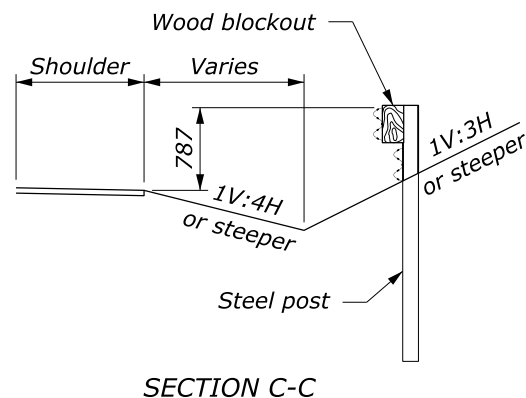
**DETAIL B**



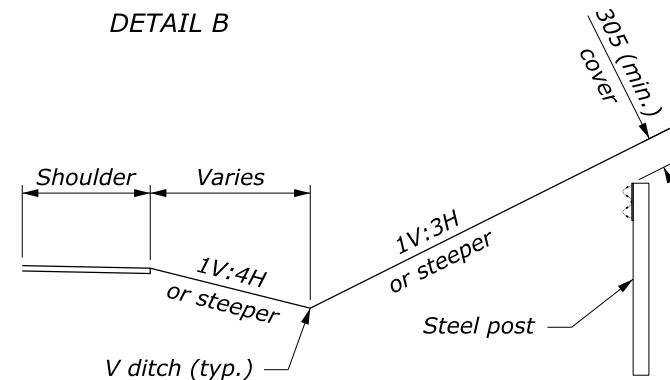
**SECTION A-A**



**SECTION B-B**



**SECTION C-C**



**SECTION D-D**

NO SCALE

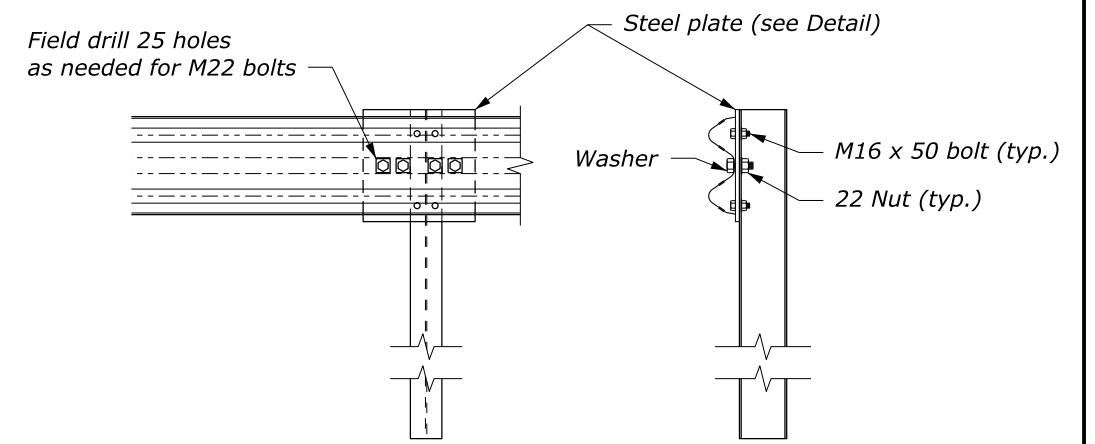
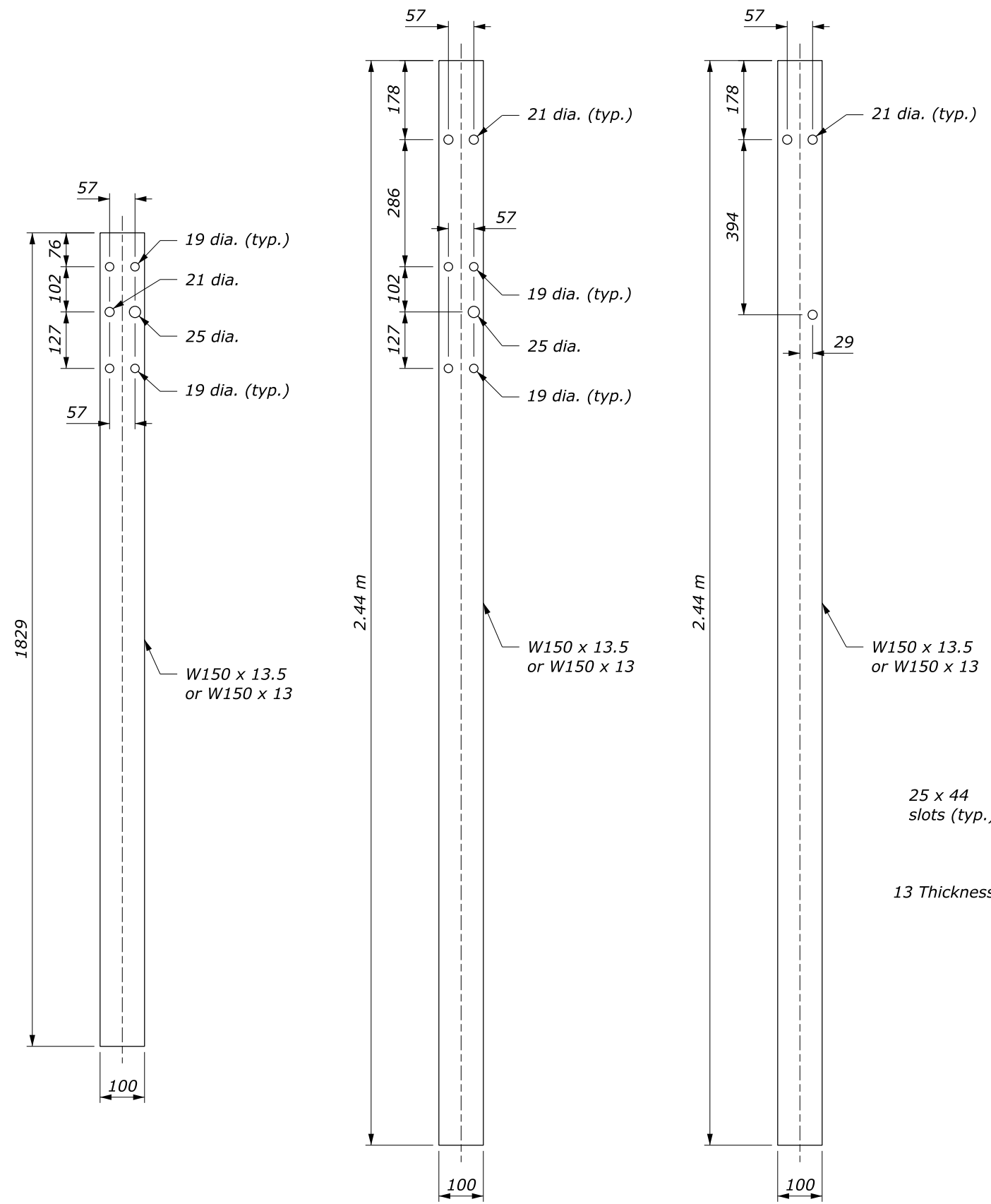
This drawing contains **Metric** units of measure. Dimensions without units are millimeters.

|   |                            |
|---|----------------------------|
| U.S. DEPARTMENT OF TRANSPORTATION, FHWA<br>OFFICE OF FEDERAL LANDS HIGHWAY  | FLH STANDARD<br>M617-18    |
| <b>MGS W-BEAM GUARDRAIL<br/>BACK SLOPE ANCHOR TERMINAL<br/>TYPE MGS-BAT</b> | SPECIFICATION<br>FP-14     |
| Sheet 1 of 2  | APPROVED FOR USE<br>2/2024 |

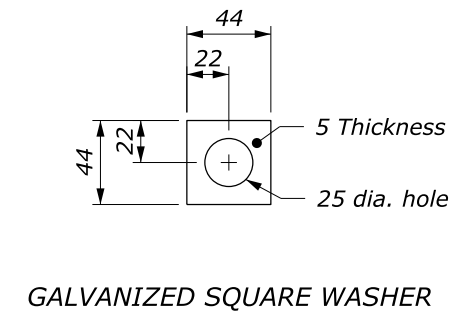
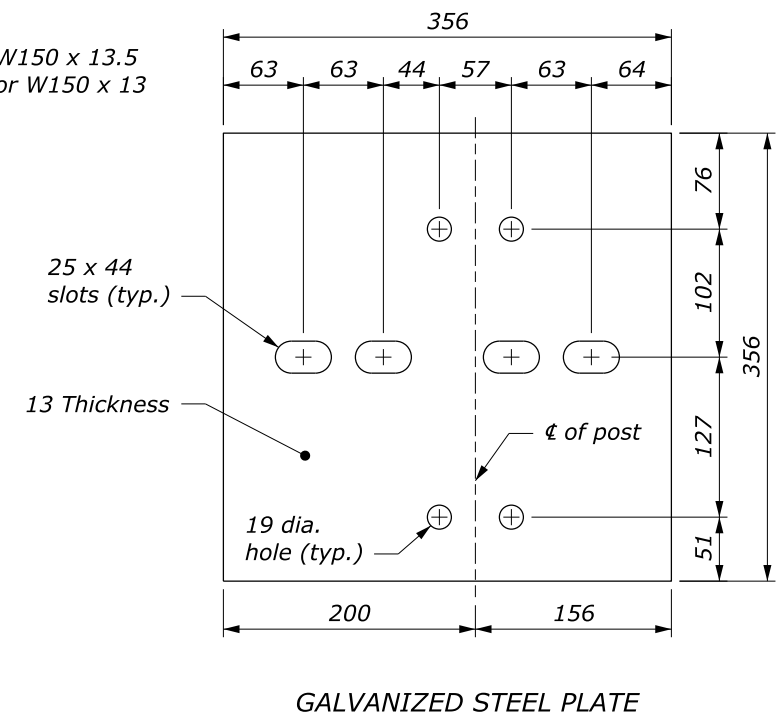
c:\pwwork\0419223\Std617-18fp14.dgn [Std M617-18a] 11 July 2024 11:55 AM

**NOTE:**

1. See Sheet 1 of 2 for terminal layout.
2. Use zinc rich paint to coat field drilled holes.
3. Anchor plate and hardware are typical on top rail of Posts 1 -3 and rub rail at Post 4.



**SPECIAL RAIL TO POST CONNECTION AT POSTS 1, 2, AND 3**



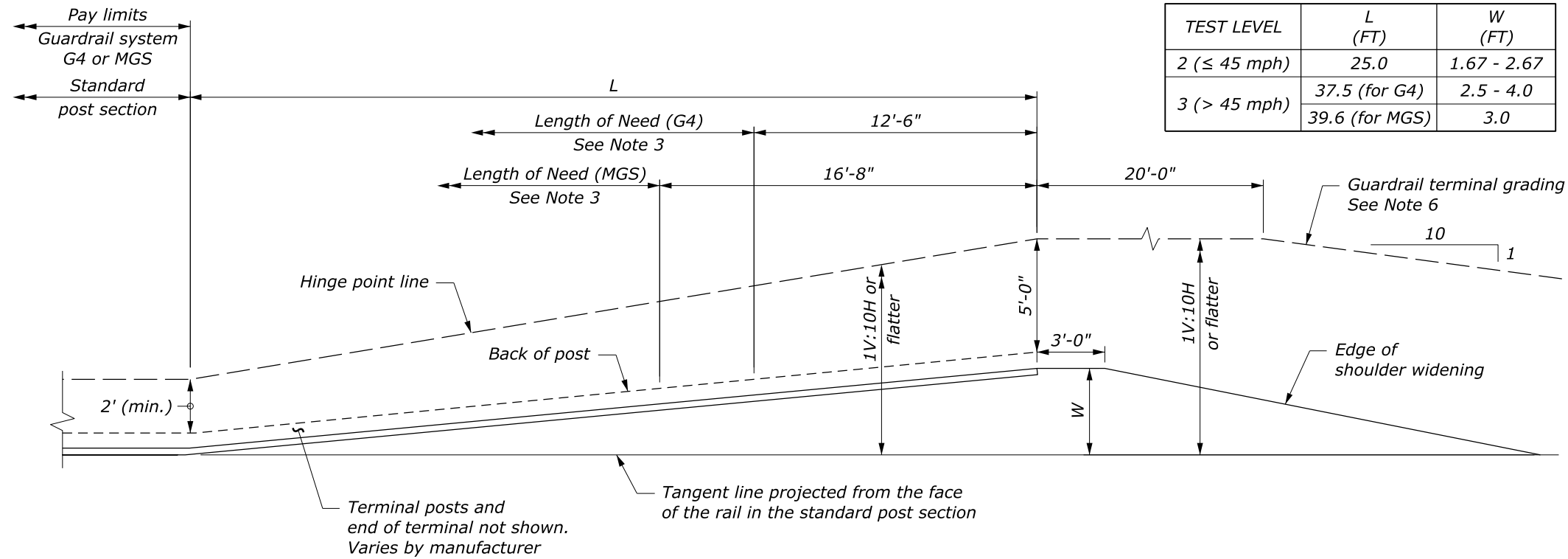
**STEEL PLATE AND WASHER**  
See Note 3

This drawing contains **Metric** units of measure. Dimensions without units are millimeters.

|   |                            |
|---|----------------------------|
| U.S. DEPARTMENT OF TRANSPORTATION, FHWA<br>OFFICE OF FEDERAL LANDS HIGHWAY  | FLH STANDARD<br>M617-18    |
| <b>MGS W-BEAM GUARDRAIL<br/>BACK SLOPE ANCHOR TERMINAL<br/>TYPE MGS-BAT</b> | SPECIFICATION<br>FP-14     |
| Sheet 2 of 2  | APPROVED FOR USE<br>2/2024 |

NO SCALE

c:\pwwork\0419223\Std617-18fp14.dgn [Std M617-18b] 1.1 July 2024 12:27 PM

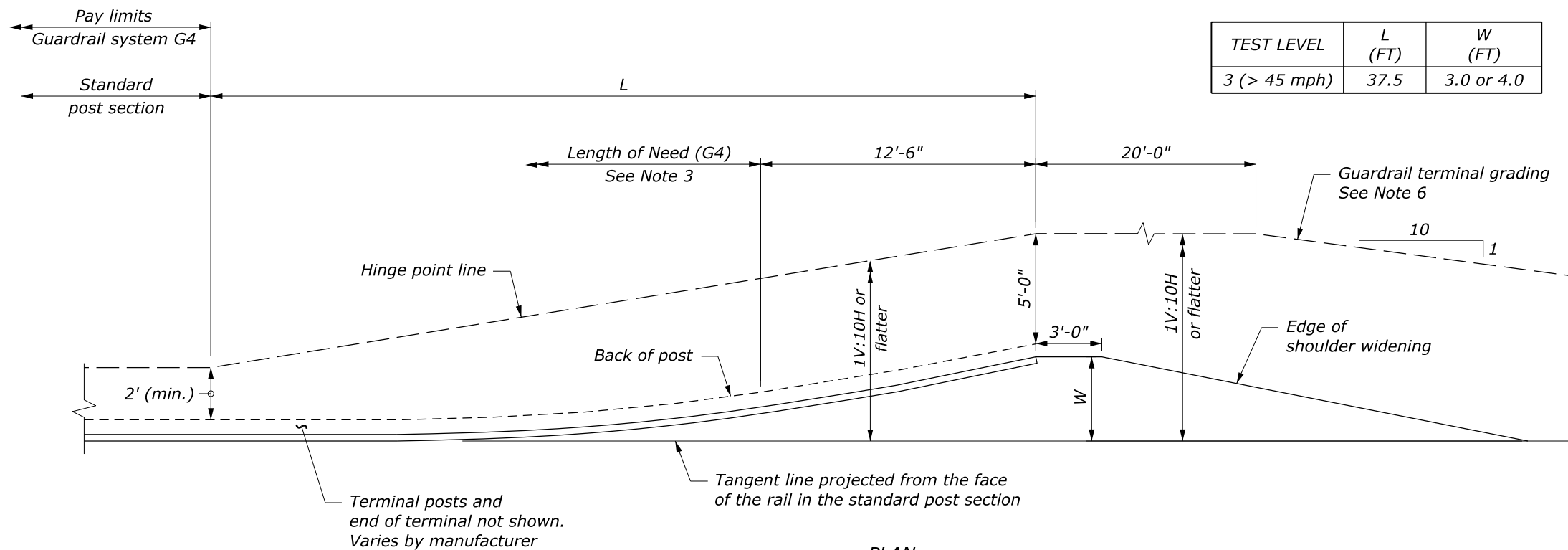


| TEST LEVEL         | L (FT)         | W (FT)      |
|--------------------|----------------|-------------|
| 2 ( $\leq 45$ mph) | 25.0           | 1.67 - 2.67 |
| 3 ( $> 45$ mph)    | 37.5 (for G4)  | 2.5 - 4.0   |
|                    | 39.6 (for MGS) | 3.0         |

**NOTE:**

1. Install a flared W-beam guardrail terminal according to the manufacturer's recommendations. See manufacturer's drawings for other details.
2. Construct the terminal grading as shown in the staking notes or model. If no staking notes or model is provided, construct grading as shown on this sheet and as recommended by the manufacturer.
3. For design purposes, the length of need is assumed to begin as shown on the drawing. Verify the length of need with the manufacturer of a specific product. Adjust grading as necessary to install the flared terminal according to the manufacturer's recommendations.
4. Pave widened shoulder on both ends of guardrail runs when indicated on the plans.
5. Install a reflectorized object marker on the end of the terminal.
6. Construct a 1V:4H or flatter slope outside of the guardrail terminal grading extents where practical.

PLAN  
**STRAIGHT FLARED OPTION**  
**MGS AND G4 W-BEAM GUARDRAIL**

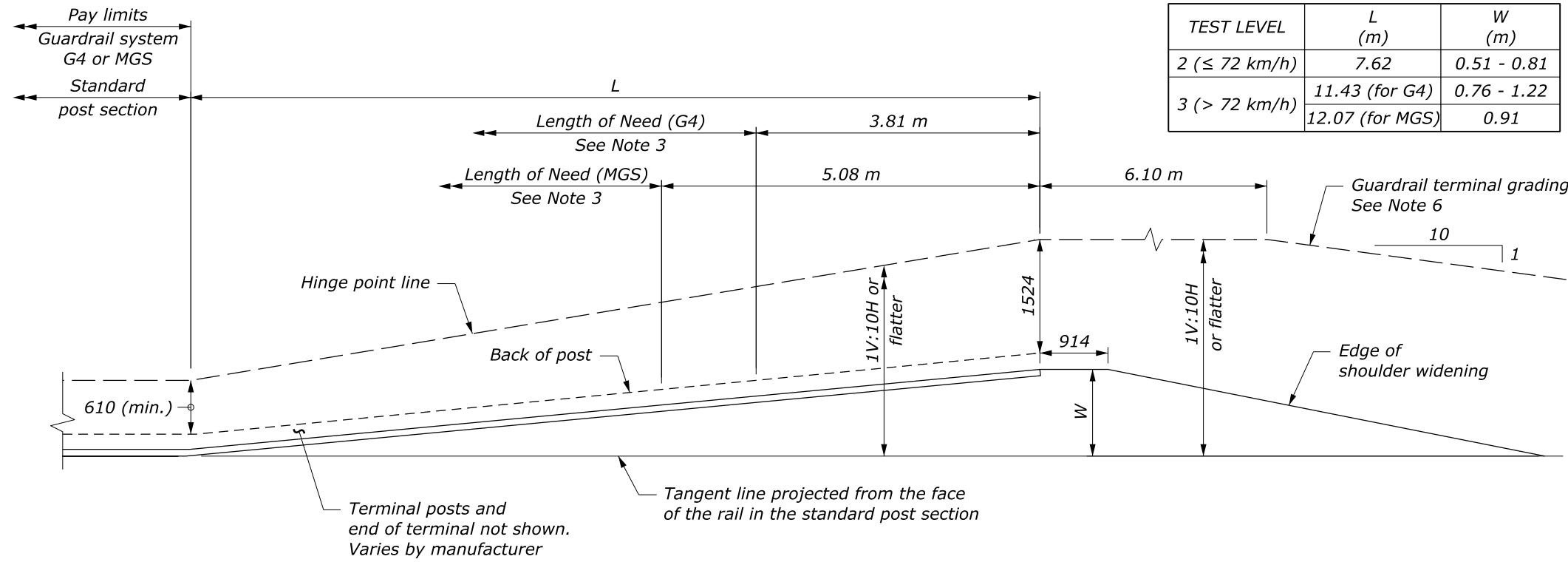


| TEST LEVEL      | L (FT) | W (FT)     |
|-----------------|--------|------------|
| 3 ( $> 45$ mph) | 37.5   | 3.0 or 4.0 |

PLAN  
**PARABOLIC FLARED OPTION**  
**G4 W-BEAM GUARDRAIL**

NO SCALE

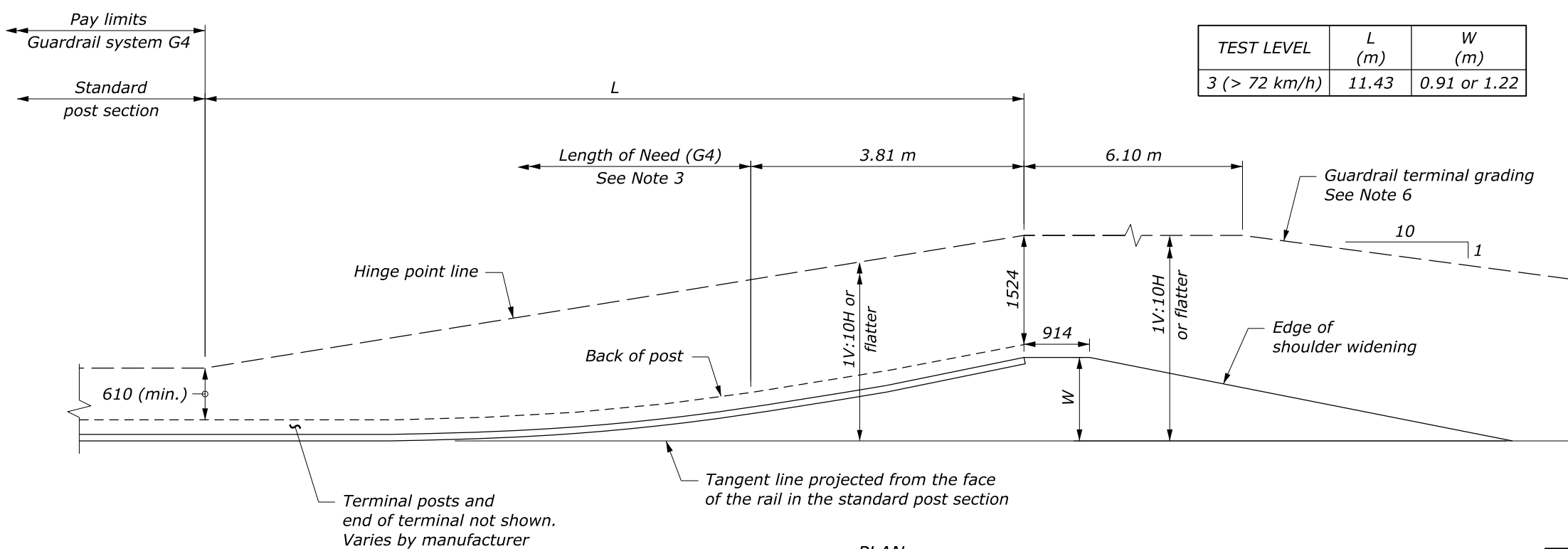
|   |   |
|---|---|
| U.S. DEPARTMENT OF TRANSPORTATION, FHWA<br>OFFICE OF FEDERAL LANDS HIGHWAY      | FLH STANDARD<br>617-19                                      |
| <b>MGS AND G4<br/>W-BEAM GUARDRAIL<br/>TYPE FLARED TERMINAL<br/>AND GRADING</b> | SPECIFICATION<br>FP-24, FP-14<br>APPROVED FOR USE<br>1/2024 |



| TEST LEVEL          | L (m)           | W (m)       |
|---------------------|-----------------|-------------|
| 2 ( $\leq 72$ km/h) | 7.62            | 0.51 - 0.81 |
| 3 ( $> 72$ km/h)    | 11.43 (for G4)  | 0.76 - 1.22 |
|                     | 12.07 (for MGS) | 0.91        |

- NOTE:**
1. Install a flared W-beam guardrail terminal according to the manufacturer's recommendations. See manufacturer's drawings for other details.
  2. Construct the terminal grading as shown in the staking notes or model. If no staking notes or model is provided, construct grading as shown on this sheet and as recommended by the manufacturer.
  3. For design purposes, the length of need is assumed to begin as shown on the drawing. Verify the length of need with the manufacturer of a specific product. Adjust grading as necessary to install the flared terminal according to the manufacturer's recommendations.
  4. Pave widened shoulder on both ends of guardrail runs when indicated on the plans.
  5. Install a reflectorized object marker on the end of the terminal.
  6. Construct a 1V:4H or flatter slope outside of the guardrail terminal grading extents where practical.

PLAN  
**STRAIGHT FLARED OPTION**  
**MGS AND G4 W-BEAM GUARDRAIL**



| TEST LEVEL       | L (m) | W (m)        |
|------------------|-------|--------------|
| 3 ( $> 72$ km/h) | 11.43 | 0.91 or 1.22 |

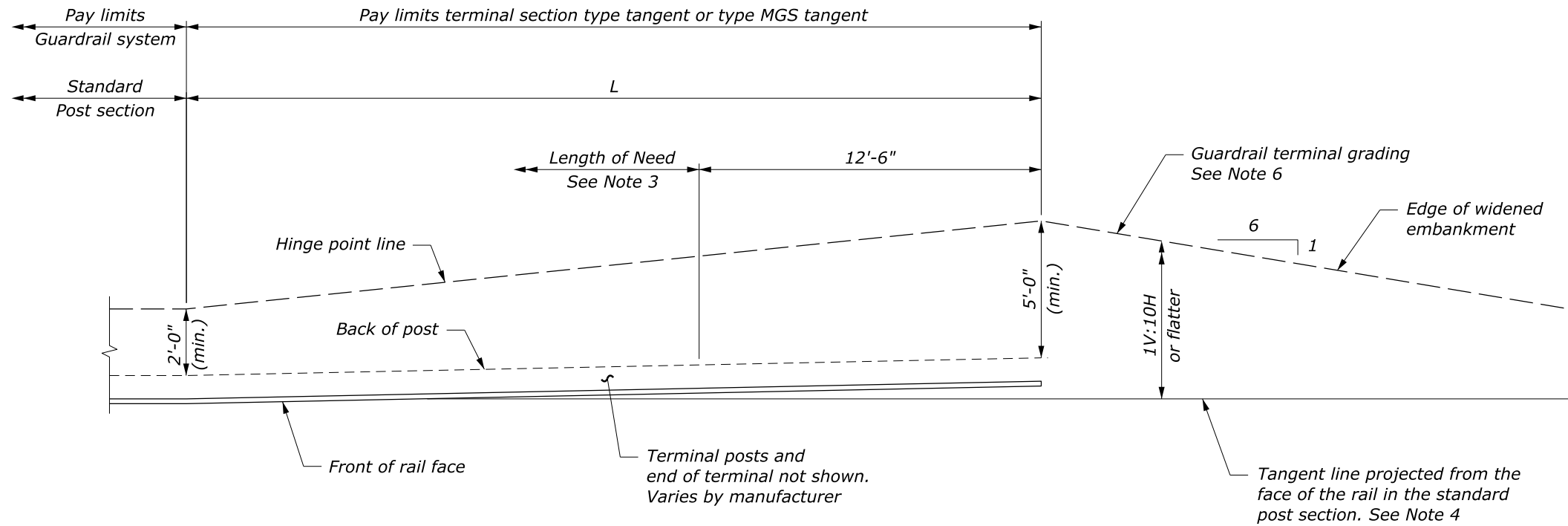
This drawing contains **Metric** units of measure. Dimensions without units are millimeters.

PLAN  
**PARABOLIC FLARED OPTION**  
**G4 W-BEAM GUARDRAIL**

NO SCALE

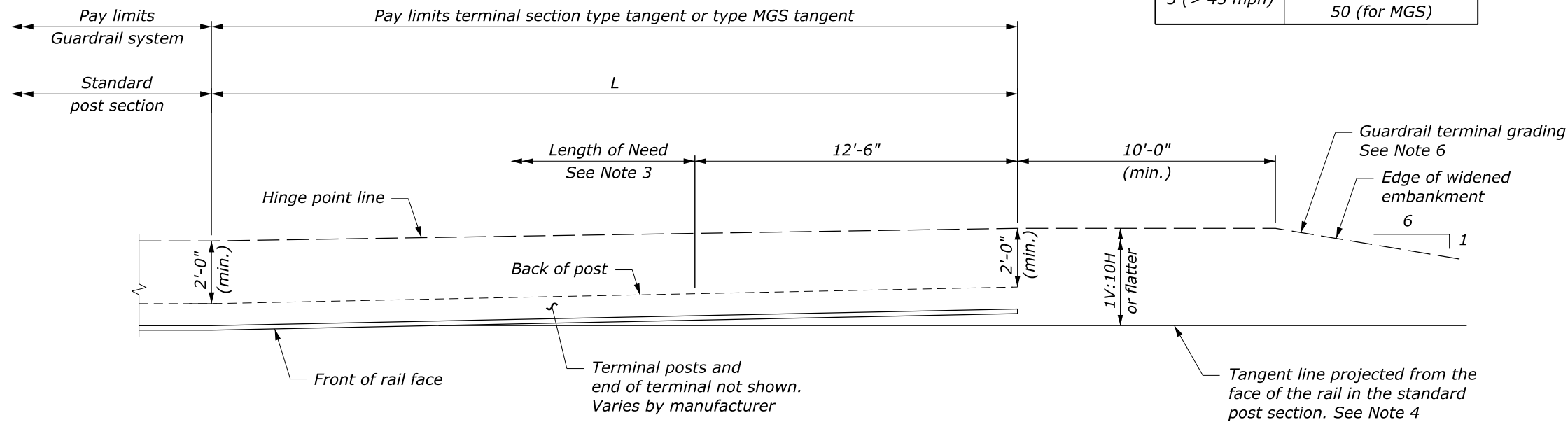
|   |                               |
|---|-------------------------------|
| U.S. DEPARTMENT OF TRANSPORTATION, FHWA<br>OFFICE OF FEDERAL LANDS HIGHWAY      | FLH STANDARD<br>M617-19       |
| <b>MGS AND G4<br/>W-BEAM GUARDRAIL<br/>TYPE FLARED TERMINAL<br/>AND GRADING</b> | SPECIFICATION<br>FP-24, FP-14 |
|   | APPROVED FOR USE<br>1/2024    |

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PLAN  
**PREFERRED GRADING**

| TEST LEVEL         | L (FT)              |
|--------------------|---------------------|
| 2 ( $\leq 45$ mph) | 25                  |
| 3 ( $> 45$ mph)    | 37.5 or 50 (for G4) |
|                    | 50 (for MGS)        |



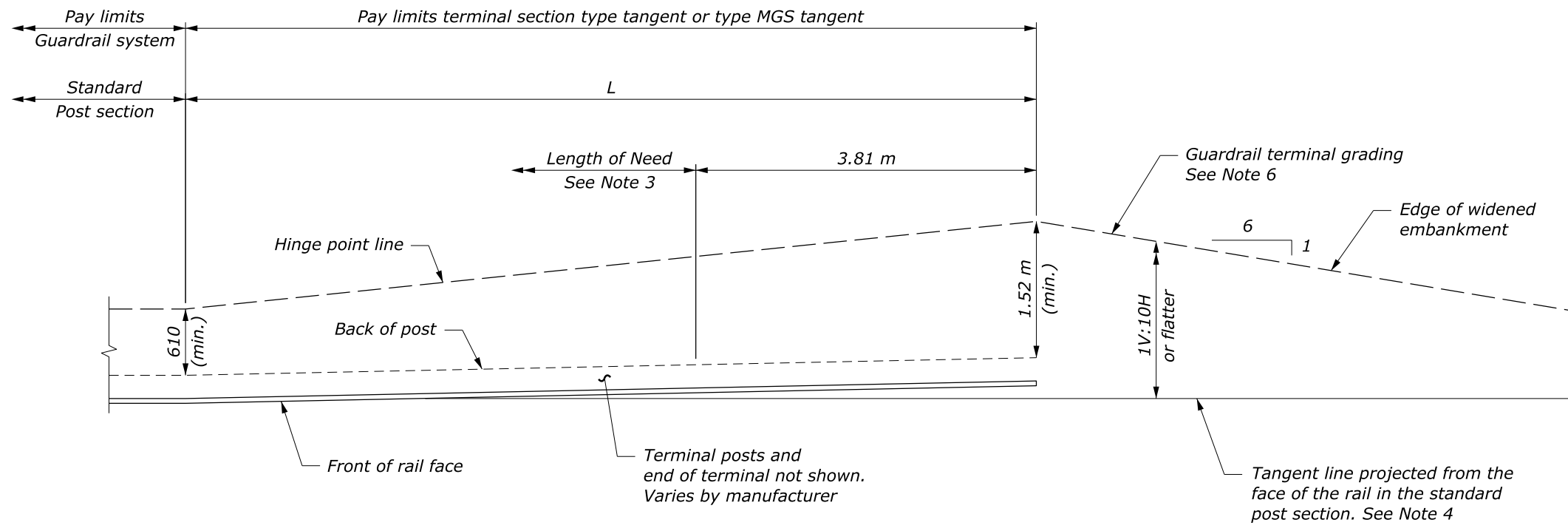
PLAN  
**ALTERNATIVE GRADING**

**NOTE:**

1. Install tangent terminal according to the manufacturer's recommendations. See manufacturer's drawings for other details.
2. Construct the terminal grading layout as shown in the staking notes or model. If no staking notes or model are provided, use the preferred grading layout as much as practical within site constraints. If necessary because of site limitations, use the alternative grading layout.
3. For design purposes, the length of need is assumed to begin at post 3. Verify the length of need with the manufacturer for a specific product. Adjust grading as necessary to install the tangent terminal according to the manufacturer's recommendations.
4. Install terminal at a 1:25 taper or flatter to position the end farther from the edge of shoulder, or use a taper according to the manufacturer's recommendations.
5. Install a reflectorized object marker on the end of the terminal.
6. Construct a 1V:4H slope outside of the guardrail terminal grading extents where practical.

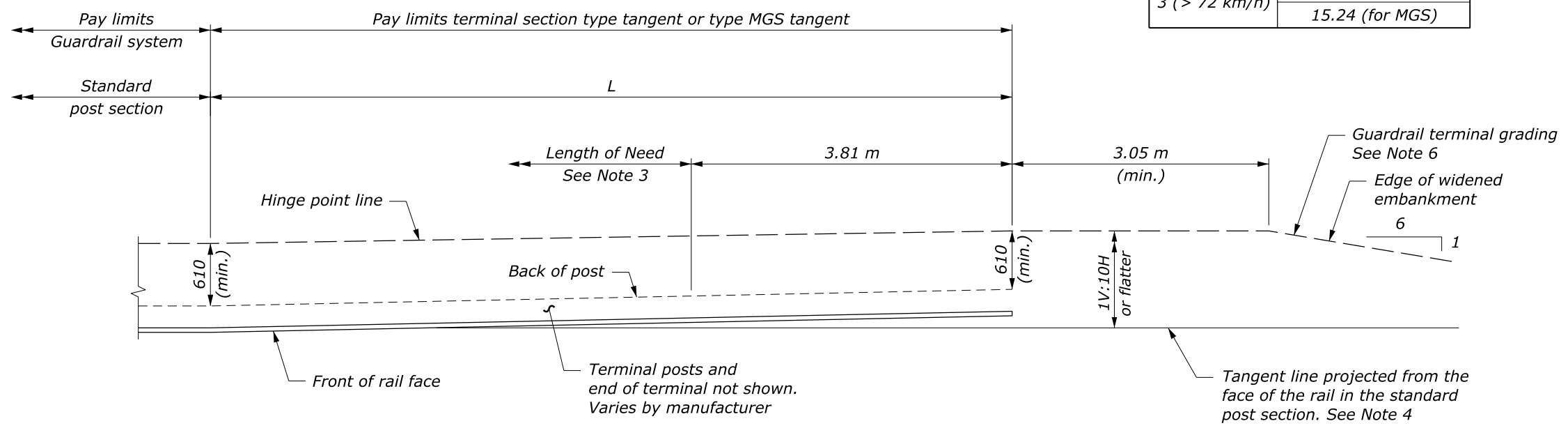
NO SCALE

|  |                            |
|--|----------------------------|
| U.S. DEPARTMENT OF TRANSPORTATION, FHWA<br>OFFICE OF FEDERAL LANDS HIGHWAY       | FLH STANDARD<br>617-20     |
| <b>MGS AND G4<br/>W-BEAM GUARDRAIL<br/>TYPE TANGENT TERMINAL<br/>AND GRADING</b> | SPECIFICATION<br>FP-14     |
|  | APPROVED FOR USE<br>1/2024 |



PLAN  
**PREFERRED GRADING**

| TEST LEVEL          | L (m)                   |
|---------------------|-------------------------|
| 2 ( $\leq 72$ km/h) | 7.62                    |
| 3 ( $> 72$ km/h)    | 11.43 or 15.24 (for G4) |
|                     | 15.24 (for MGS)         |



PLAN  
**ALTERNATIVE GRADING**

**NOTE:**

1. Install tangent terminal according to the manufacturer's recommendations. See manufacturer's drawings for other details.
2. Construct the terminal grading layout as shown in the staking notes or model. If no staking notes or model are provided, use the preferred grading layout as much as practical within site constraints. If necessary because of site limitations, use the alternative grading layout.
3. For design purposes, the length of need is assumed to begin at post 3. Verify the length of need with the manufacturer for a specific product. Adjust grading as necessary to install the tangent terminal according to the manufacturer's recommendations.
4. Install terminal at a 1:25 taper or flatter to position the end farther from the edge of shoulder, or use a taper according to the manufacturer's recommendations.
5. Install a reflectorized object marker on the end of the terminal.
6. Construct a 1V:4H slope outside of the guardrail terminal grading extents where practical.

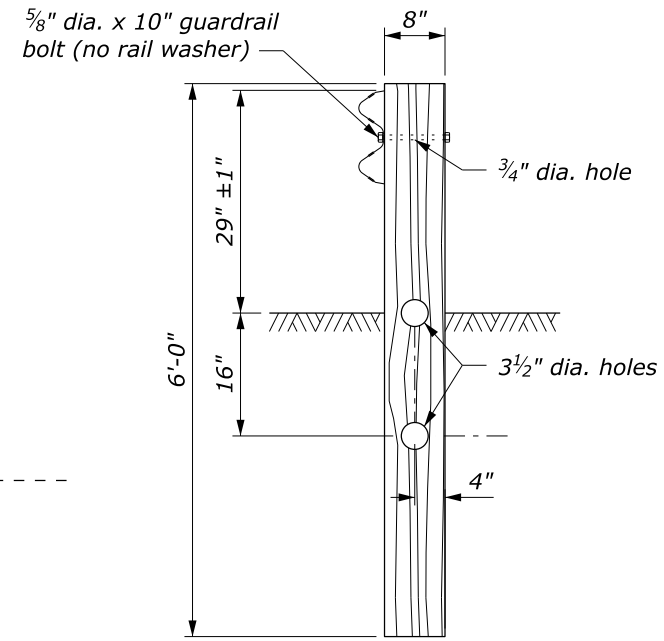
This drawing contains **Metric** units of measure. Dimensions without units are millimeters.

|  |                            |
|--|----------------------------|
| U.S. DEPARTMENT OF TRANSPORTATION, FHWA<br>OFFICE OF FEDERAL LANDS HIGHWAY       | FLH STANDARD<br>M617-20    |
| <b>MGS AND G4<br/>W-BEAM GUARDRAIL<br/>TYPE TANGENT TERMINAL<br/>AND GRADING</b> | SPECIFICATION<br>FP-14     |
|  | APPROVED FOR USE<br>1/2024 |

NO SCALE

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11 July 2024 11:13 AM

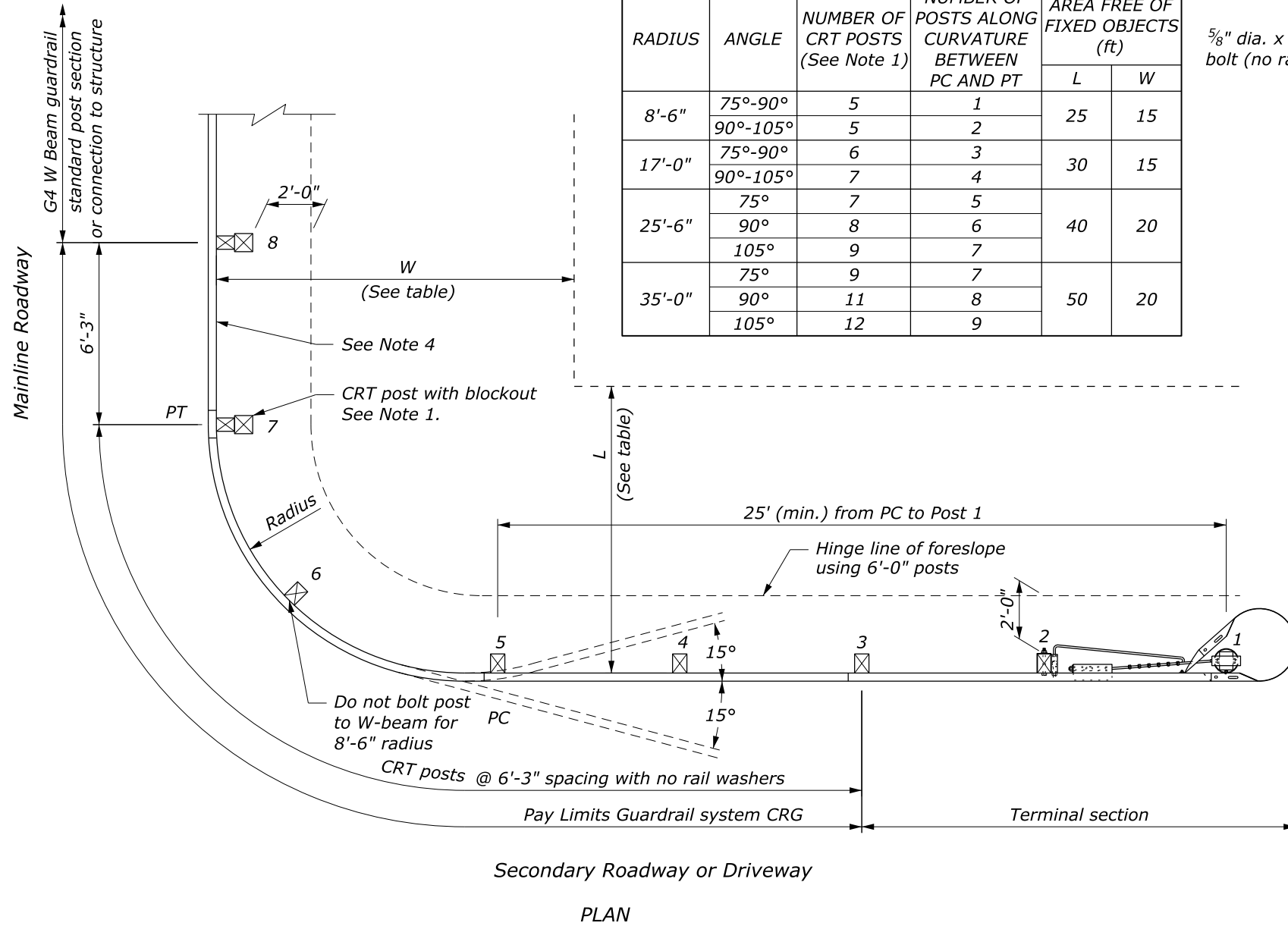
| RADIUS | ANGLE    | NUMBER OF CRT POSTS (See Note 1) | NUMBER OF POSTS ALONG CURVATURE BETWEEN PC AND PT | AREA FREE OF FIXED OBJECTS (ft) |    |
|--------|----------|----------------------------------|---|---------------------------------|----|
|        |          |                                  |   | L                               | W  |
| 8'-6"  | 75°-90°  | 5                                | 1   | 25                              | 15 |
|        | 90°-105° | 5                                | 2   |                                 |    |
| 17'-0" | 75°-90°  | 6                                | 3   | 30                              | 15 |
|        | 90°-105° | 7                                | 4   |                                 |    |
| 25'-6" | 75°      | 7                                | 5   | 40                              | 20 |
|        | 90°      | 8                                | 6   |                                 |    |
|        | 105°     | 9                                | 7   |                                 |    |
| 35'-0" | 75°      | 9                                | 7   | 50                              | 20 |
|        | 90°      | 11                               | 8   |                                 |    |
|        | 105°     | 12                               | 9   |                                 |    |



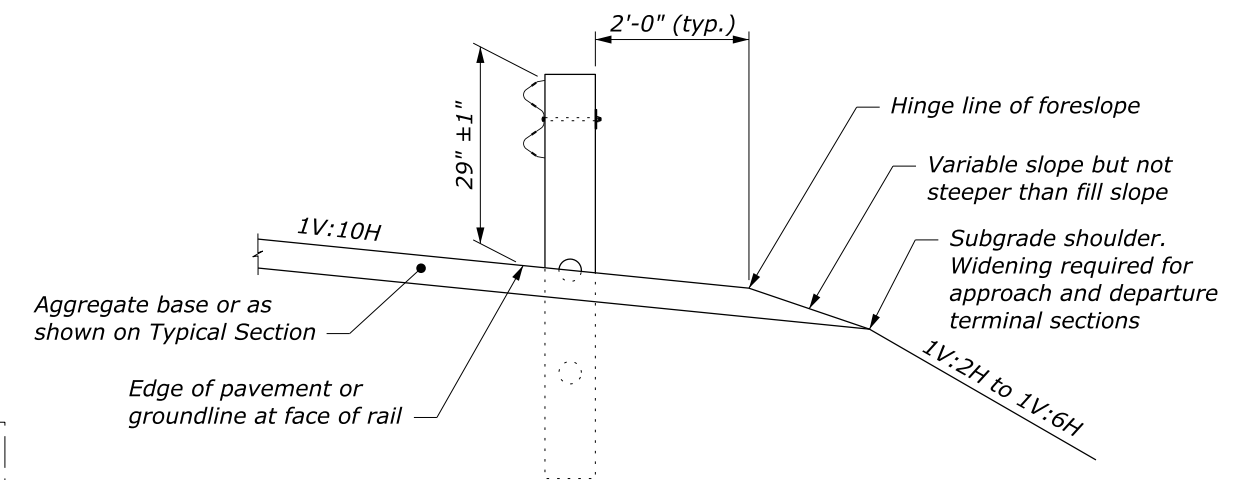
**CRT POST DETAIL**  
POSTS #3 - #7  
See Note 1

**NOTE:**

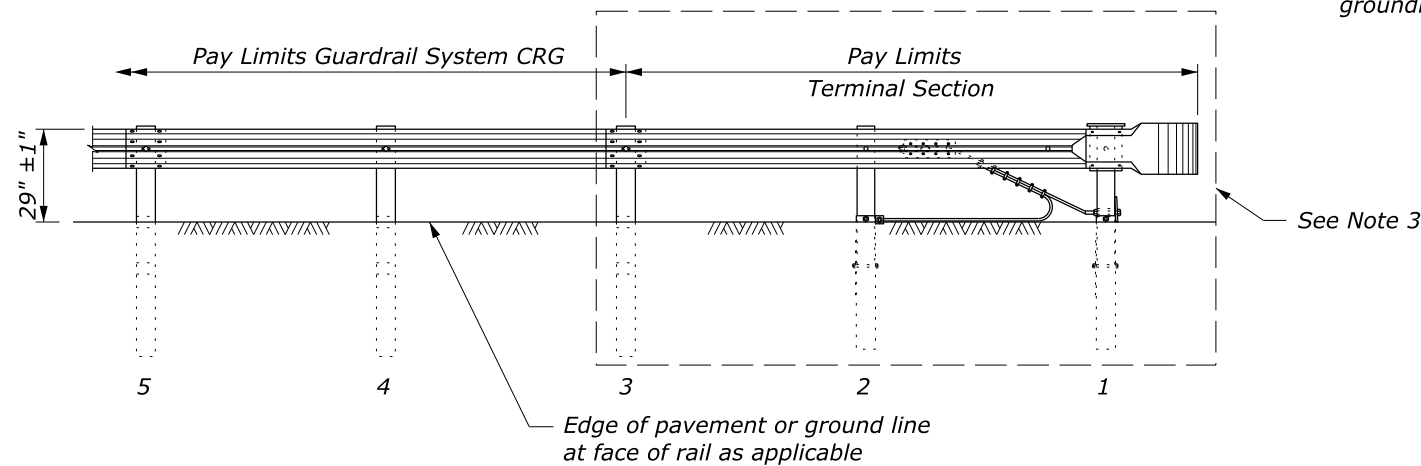
1. CRT posts include those posts between the terminal and PT, plus the post with block at Post #7.
2. Do not use this layout when speeds are in excess of 45 mph.
3. See Standard 617-22 for terminal section shown. The use of the Type CRT terminal is limited to driveways, service roads, and low speed minor road approaches. Use the appropriate TL-2 or TL-3 terminal on all other roadway approaches.
4. If the CRG will be connected to transition rail at Post 8, add a standard post and block midway between Posts 7 and 8.
5. Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.



PLAN



**TYPICAL GUARDRAIL CROSS SECTION**



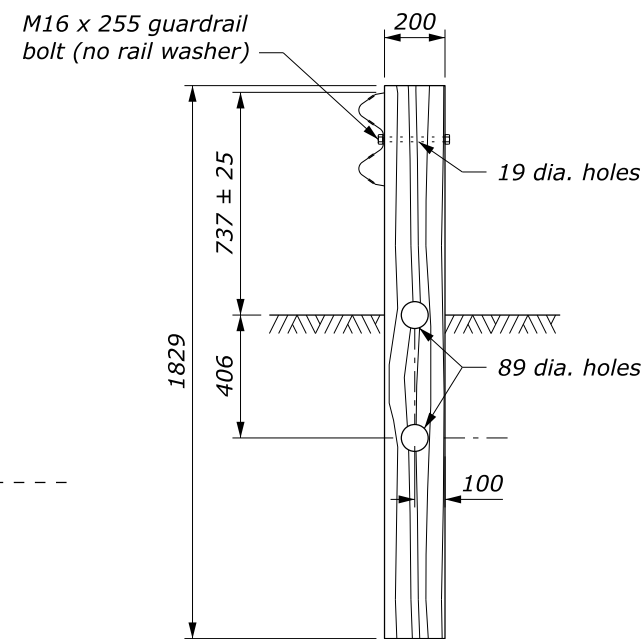
ELEVATION

**GUARDRAIL SYSTEM CRG WITH CRT POSTS**

NO SCALE

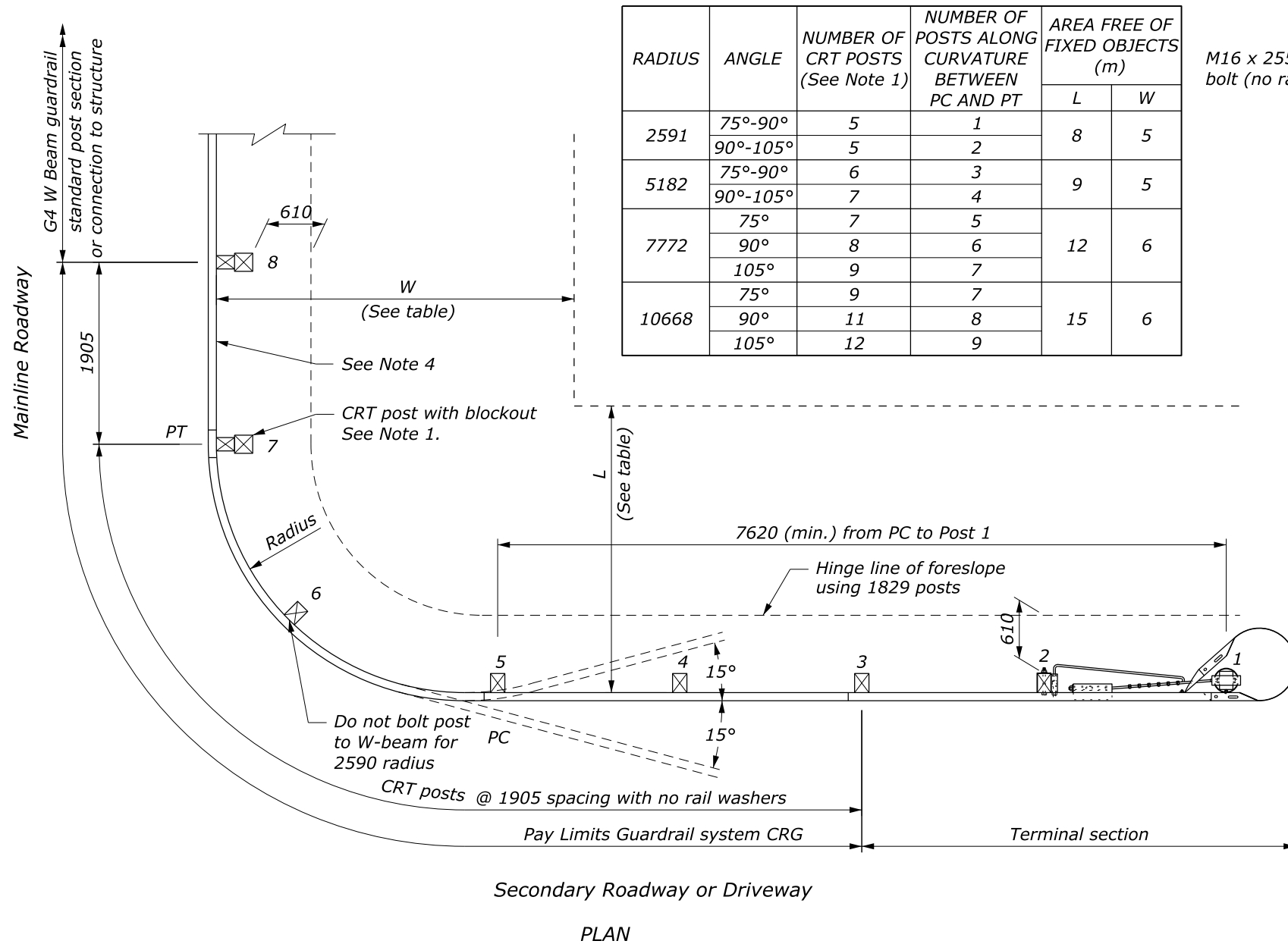
|  |                            |
|--|----------------------------|
| U.S. DEPARTMENT OF TRANSPORTATION, FHWA<br>OFFICE OF FEDERAL LANDS HIGHWAY | FLH STANDARD<br>617-21     |
| <b>CRG W-BEAM GUARDRAIL<br/>WOOD POSTS</b>                                 | SPECIFICATION<br>FP-14     |
|  | APPROVED FOR USE<br>1/2024 |

| RADIUS | ANGLE    | NUMBER OF CRT POSTS (See Note 1) | NUMBER OF POSTS ALONG CURVATURE BETWEEN PC AND PT | AREA FREE OF FIXED OBJECTS (m) |   |
|--------|----------|----------------------------------|---|--------------------------------|---|
|        |          |                                  |   | L                              | W |
| 2591   | 75°-90°  | 5                                | 1   | 8                              | 5 |
|        | 90°-105° | 5                                | 2   |                                |   |
| 5182   | 75°-90°  | 6                                | 3   | 9                              | 5 |
|        | 90°-105° | 7                                | 4   |                                |   |
| 7772   | 75°      | 7                                | 5   | 12                             | 6 |
|        | 90°      | 8                                | 6   |                                |   |
|        | 105°     | 9                                | 7   |                                |   |
| 10668  | 75°      | 9                                | 7   | 15                             | 6 |
|        | 90°      | 11                               | 8   |                                |   |
|        | 105°     | 12                               | 9   |                                |   |

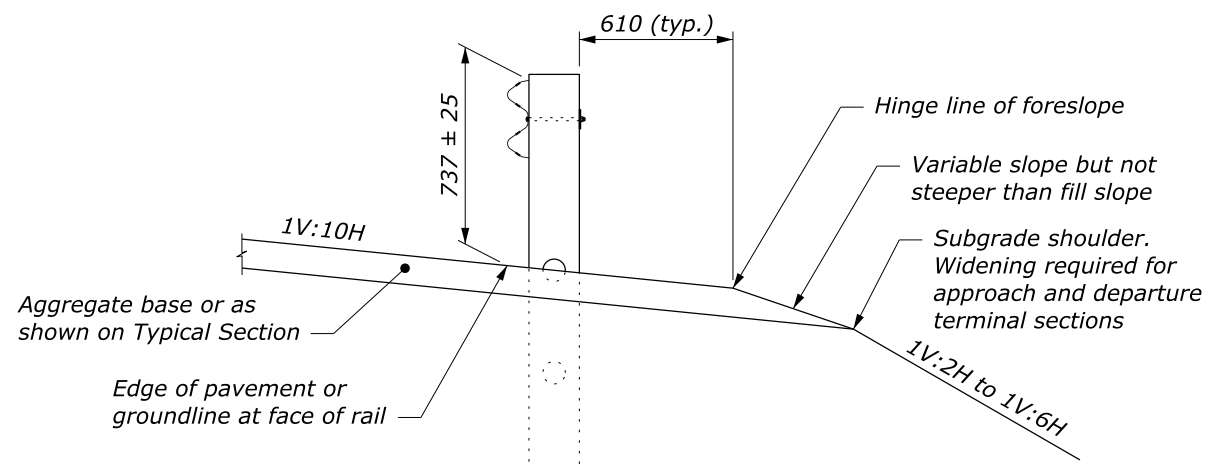


**CRT POST DETAIL**  
POSTS #3 - #7  
See Note 1

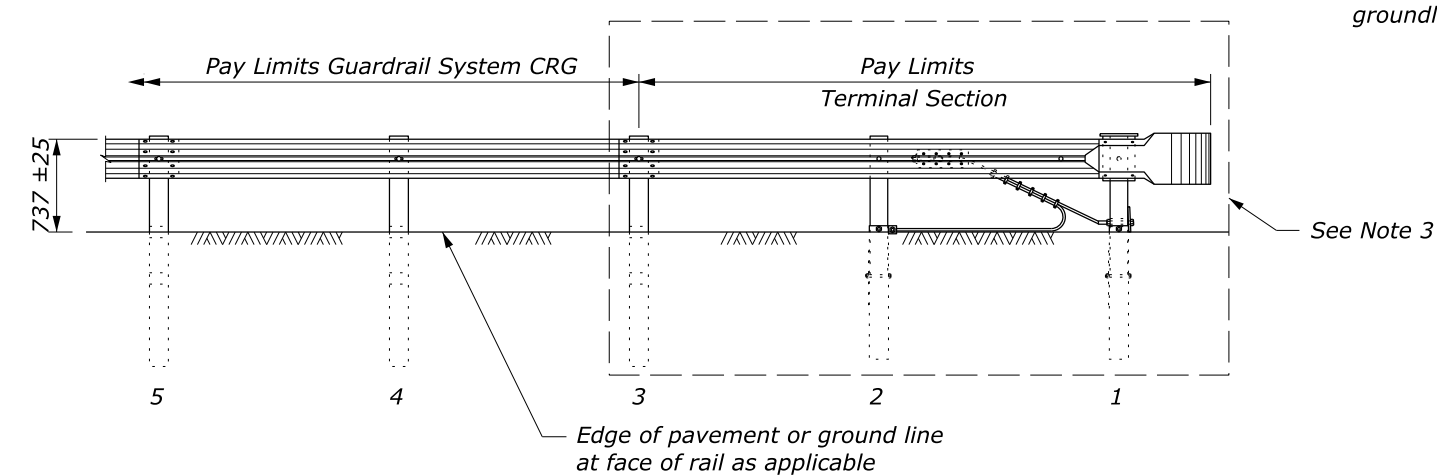
- NOTE:**
- CRT posts include those posts between the terminal and PT, plus the post with block at Post #7.
  - Do not use this layout when speeds are in excess of 72 km/h.
  - See Standard M617-22 for terminal section shown. The use of the Type CRT terminal is limited to driveways, service roads, and low speed minor road approaches. Use the appropriate TL-2 or TL-3 terminal on all other roadway approaches.
  - If the CRG will be connected to transition rail at Post 8, add a standard post and block midway between Posts 7 and 8.
  - Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.



PLAN



**TYPICAL GUARDRAIL CROSS SECTION**



ELEVATION  
**GUARDRAIL SYSTEM CRG WITH CRT POSTS**

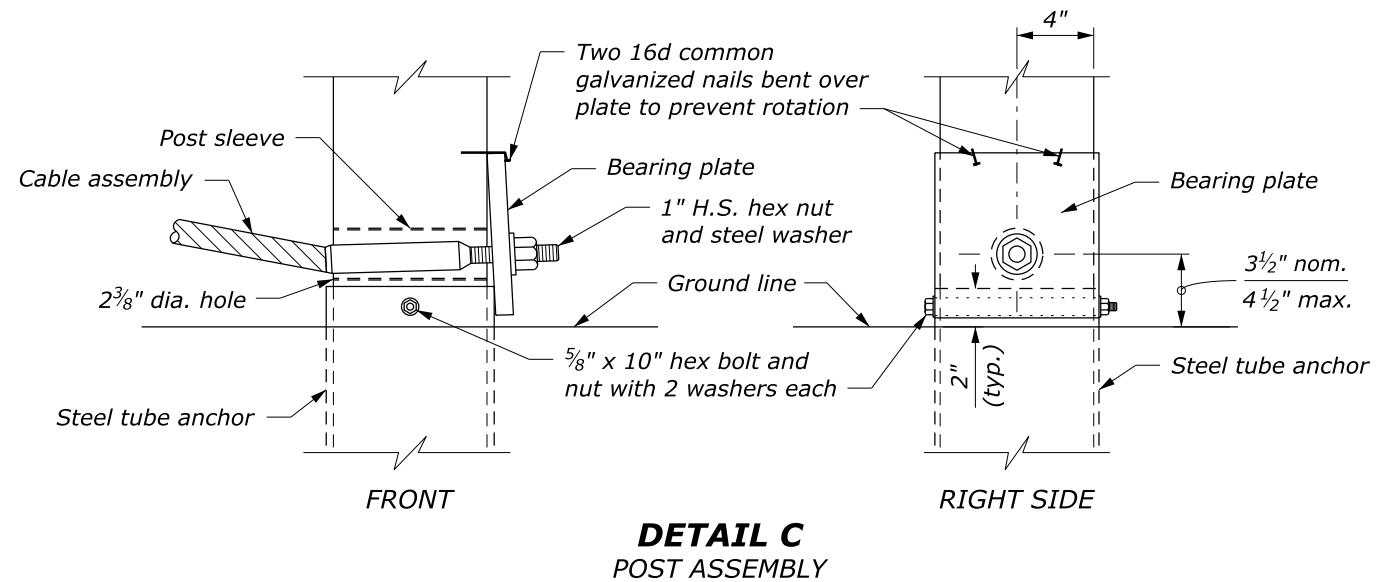
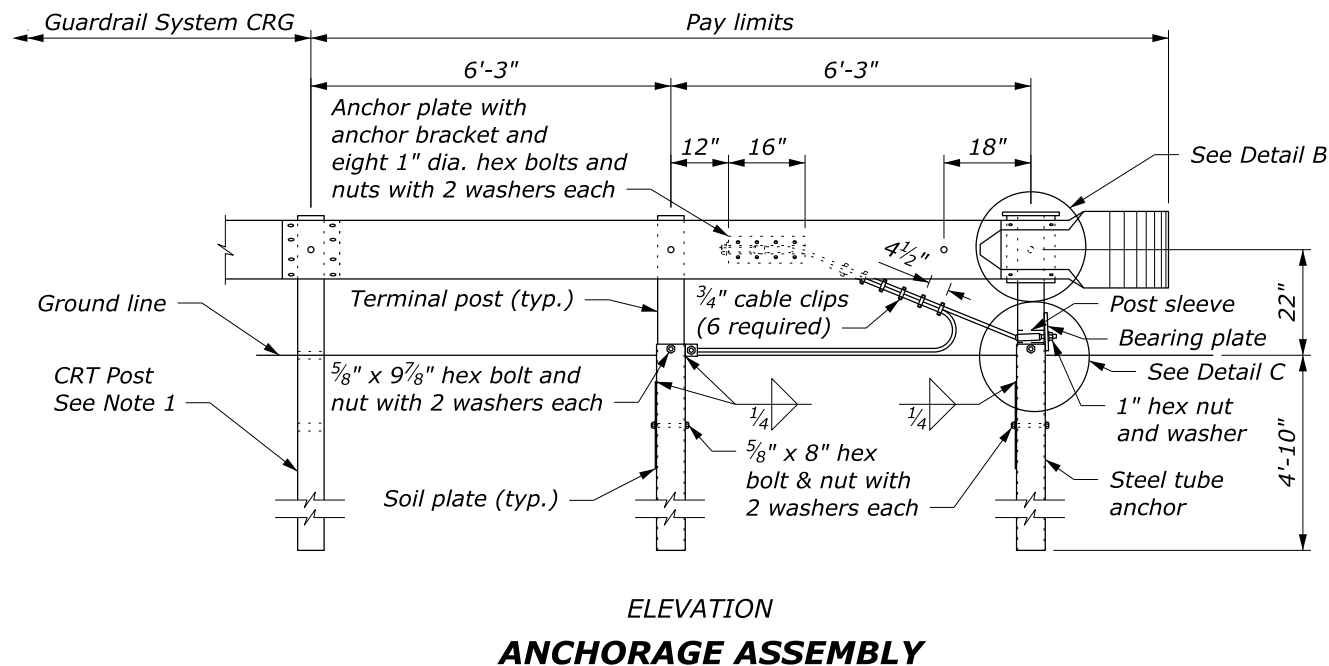
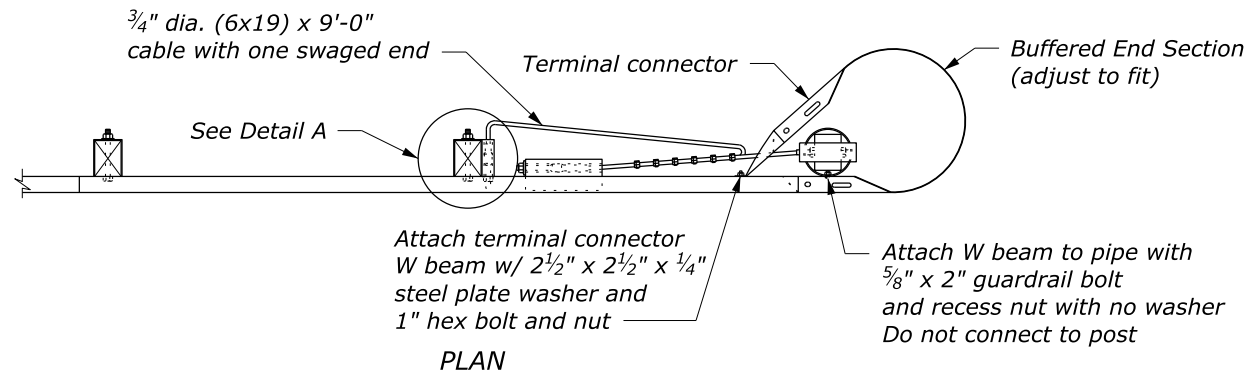
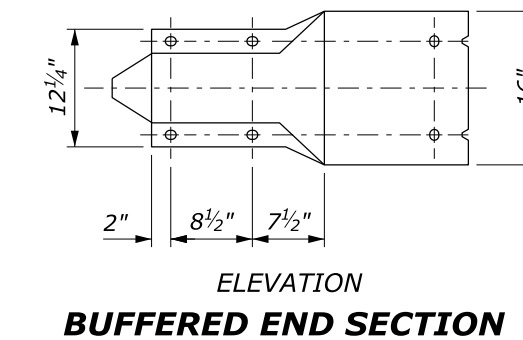
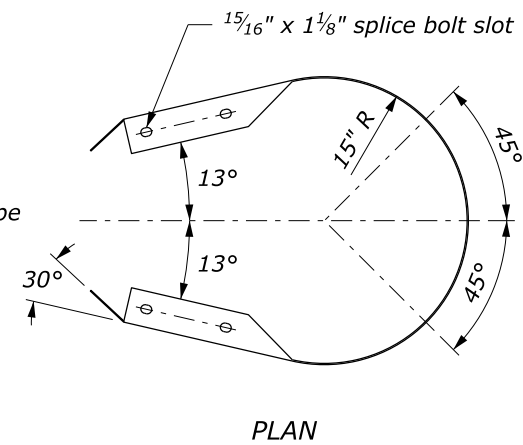
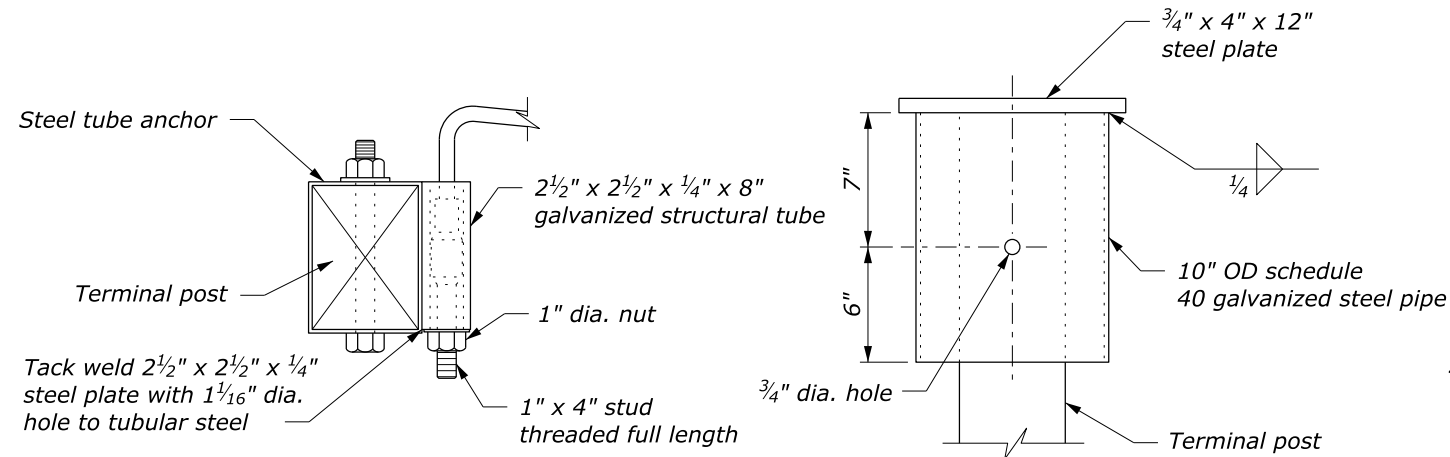
This drawing contains **Metric** units of measure. Dimensions without units are millimeters.

|  |                            |
|--|----------------------------|
| U.S. DEPARTMENT OF TRANSPORTATION, FHWA<br>OFFICE OF FEDERAL LANDS HIGHWAY | FLH STANDARD<br>M617-21    |
| <b>CRG W-BEAM GUARDRAIL WOOD POSTS</b>                                     | SPECIFICATION<br>FP-14     |
|  | APPROVED FOR USE<br>1/2024 |

NO SCALE

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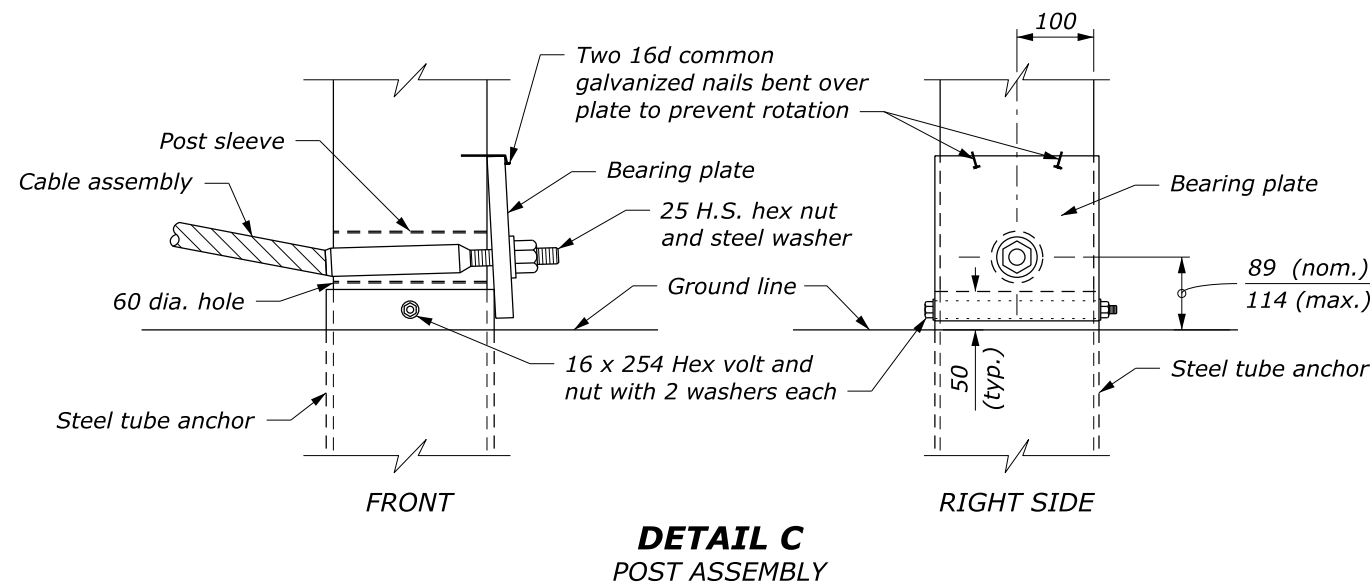
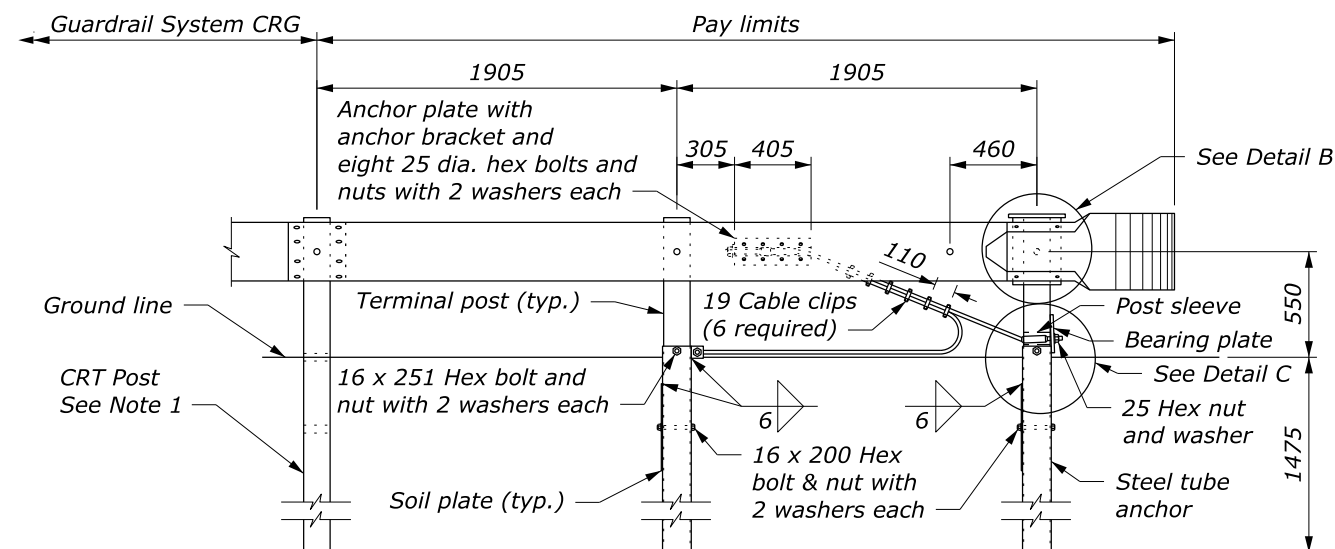
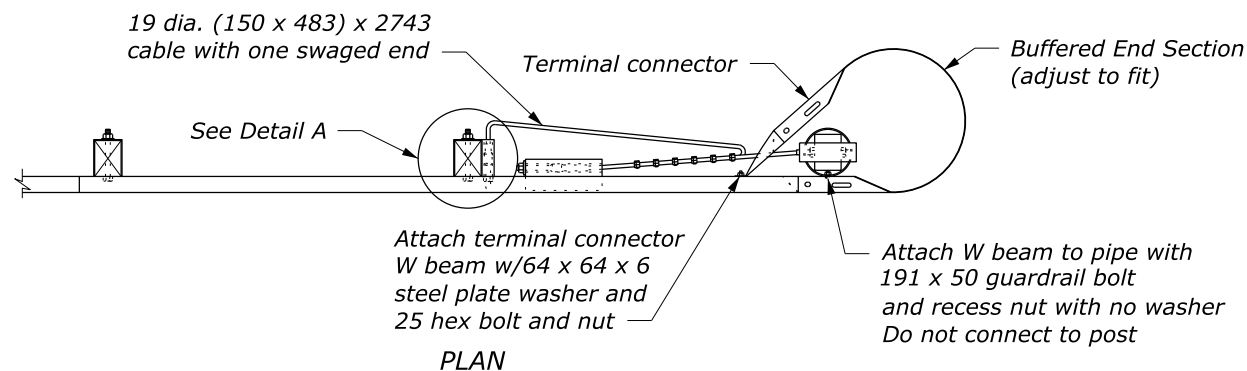
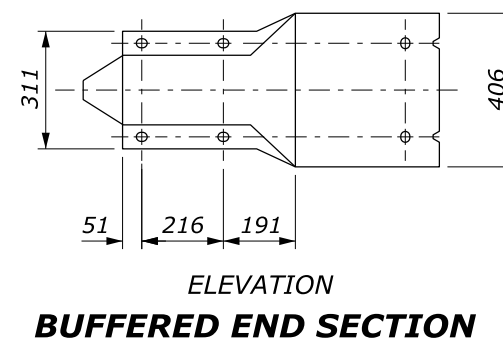
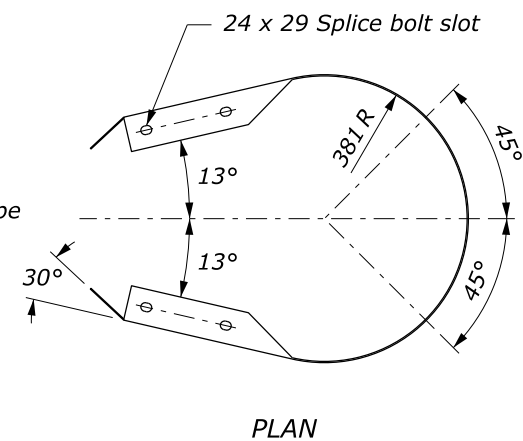
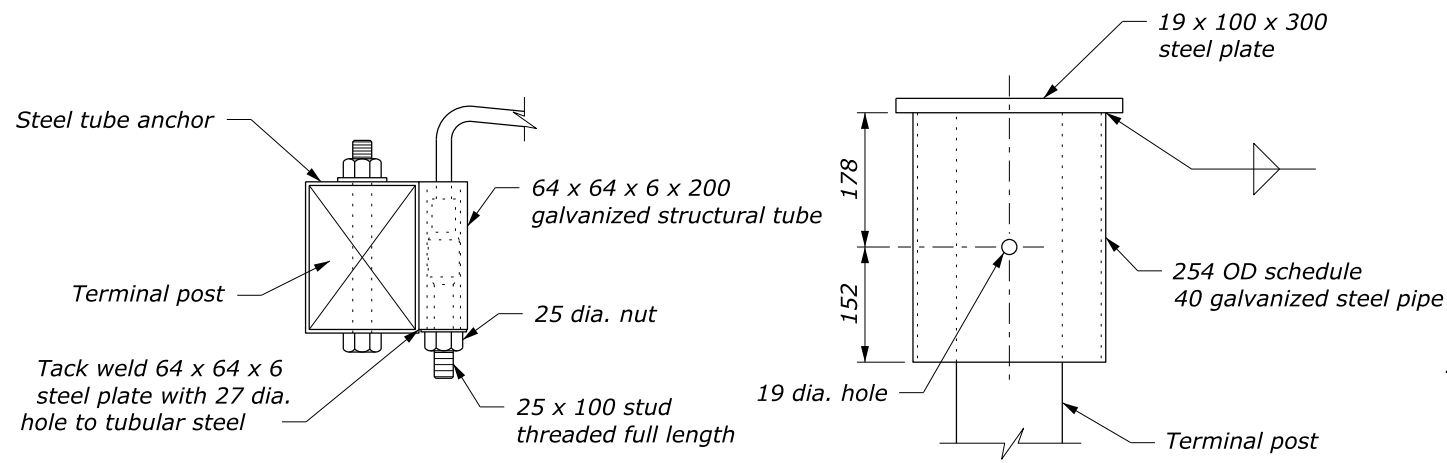


**NOTE:**

1. See Standard 617-21 and 617-23 for other details.
2. Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

NO SCALE

|  |   |
|--|---|
| U.S. DEPARTMENT OF TRANSPORTATION, FHWA<br>OFFICE OF FEDERAL LANDS HIGHWAY | FLH STANDARD<br>617-22                                      |
| <b>G4 W-BEAM GUARDRAIL<br/>CABLE RELEASING TERMINAL<br/>TYPE G4-CRT</b>    | SPECIFICATION<br>FP-24, FP-14<br>APPROVED FOR USE<br>1/2024 |



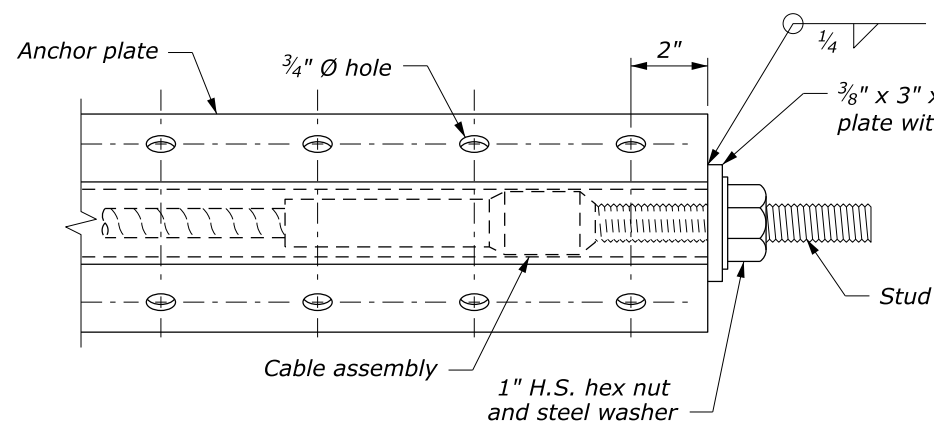
- NOTE:**
- See Standard M617-21 and M617-23 for details.
  - Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

This drawing contains **Metric** units of measure. Dimensions without units are millimeters.

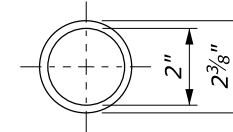
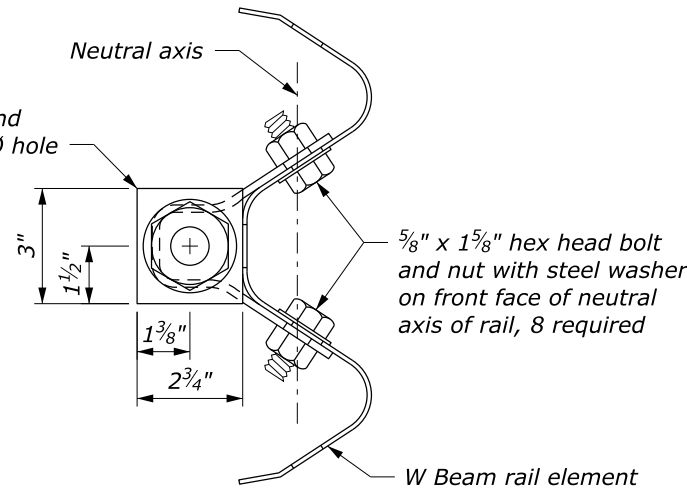
|  |                               |
|--|-------------------------------|
| U.S. DEPARTMENT OF TRANSPORTATION, FHWA<br>OFFICE OF FEDERAL LANDS HIGHWAY | FLH STANDARD<br>M617-22       |
| <b>G4 W-BEAM GUARDRAIL<br/>CABLE RELEASING TERMINAL<br/>TYPE G4-CRT</b>    | SPECIFICATION<br>FP-24, FP-14 |
|  | APPROVED FOR USE<br>1/2024    |

NO SCALE

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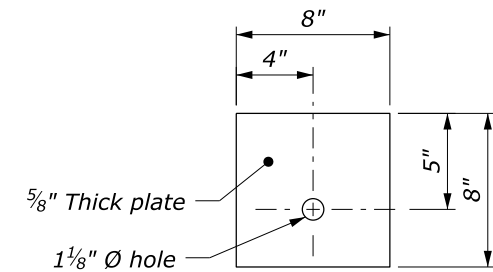


**CABLE ANCHOR PLATE DETAILS**

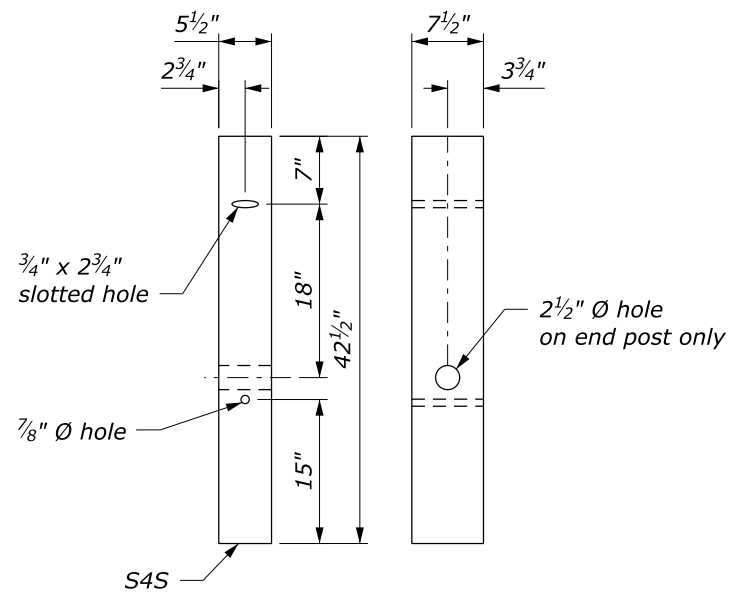


**POST SLEEVE**

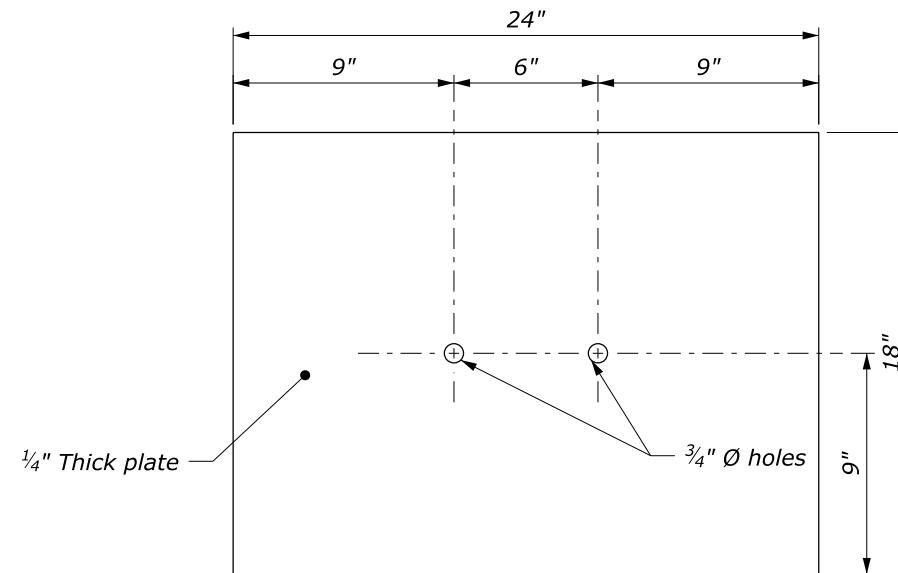
**NOTE:**  
 1. Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.



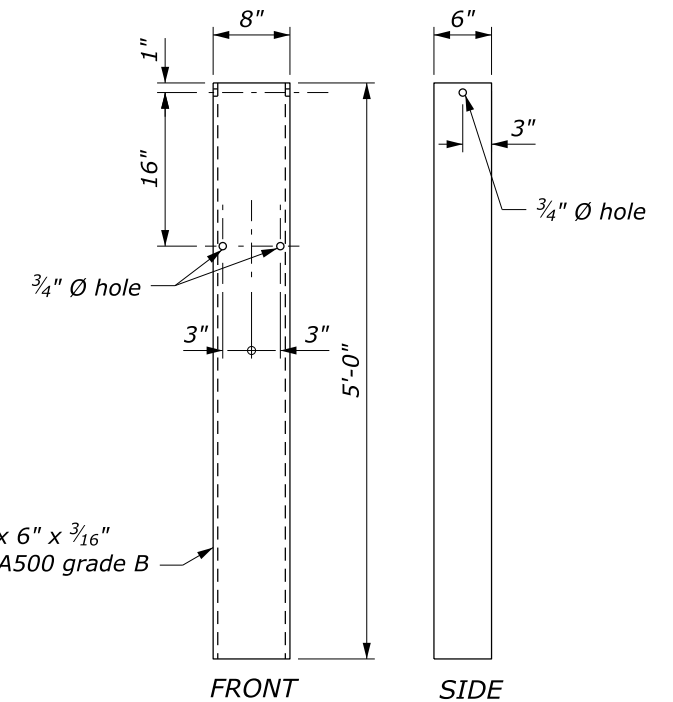
**BEARING PLATE**



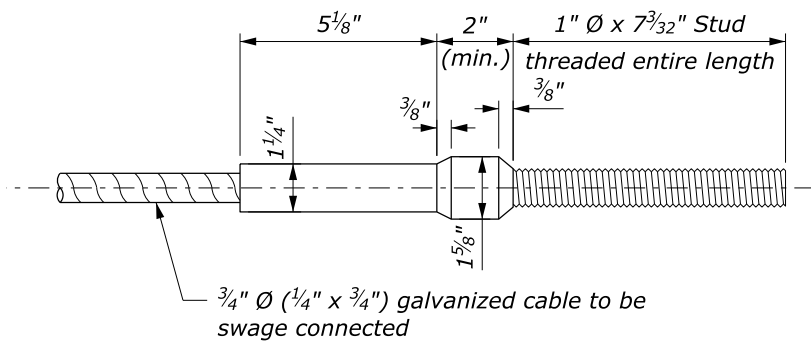
**TERMINAL POST**



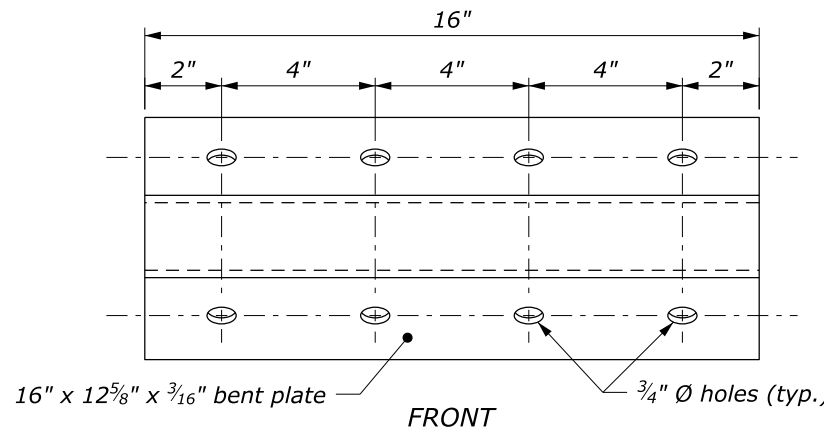
**SOIL PLATE  
(2 REQUIRED)**



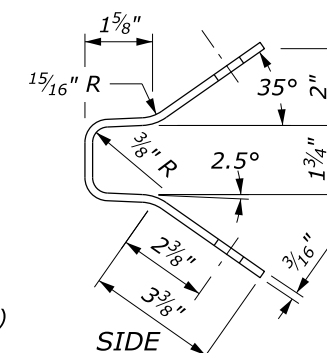
**STEEL TUBE ANCHOR**



**CABLE ANCHOR ASSEMBLY  
(Standard swaged fitting and stud)**

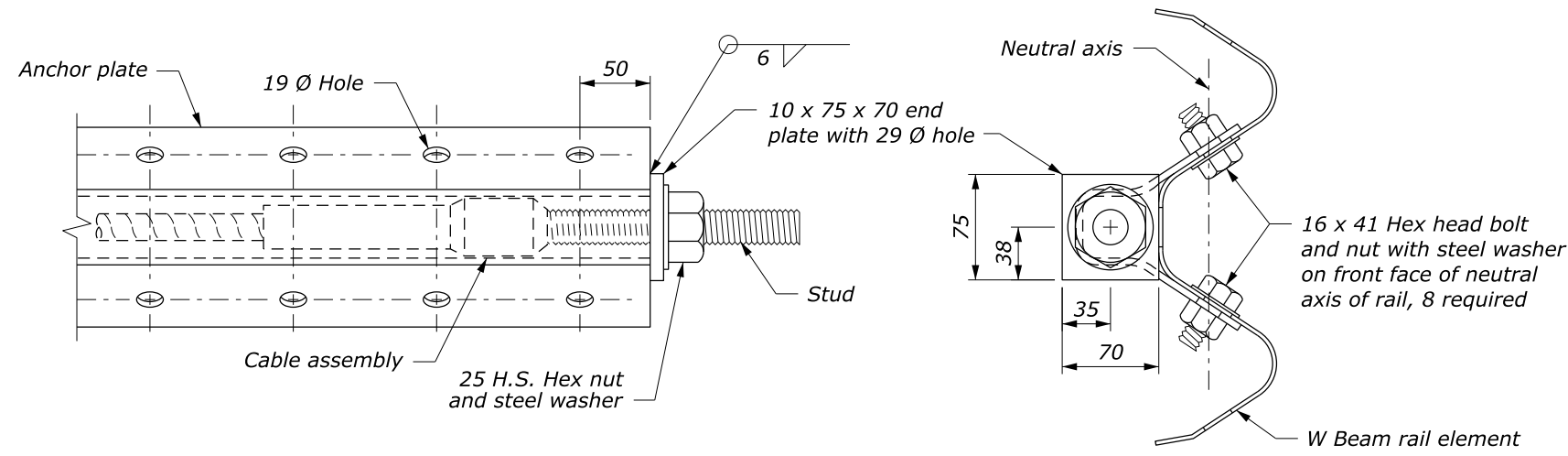


**GUARDRAIL ANCHOR BRACKET**

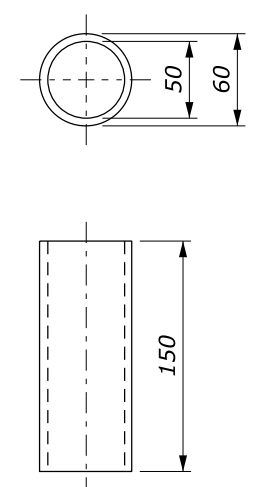


NO SCALE

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|--|-------------------------------|
| U.S. DEPARTMENT OF TRANSPORTATION, FHWA<br>OFFICE OF FEDERAL LANDS HIGHWAY | FLH STANDARD<br>617-23        |
| <b>G4 W-BEAM GUARDRAIL<br/>CRT ANCHORAGE ASSEMBLY<br/>DETAILS</b>          | SPECIFICATION<br>FP-24, FP-14 |
|  | APPROVED FOR USE<br>1/2024    |

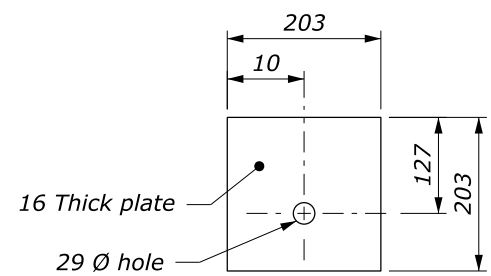


**CABLE ANCHOR PLATE DETAILS**

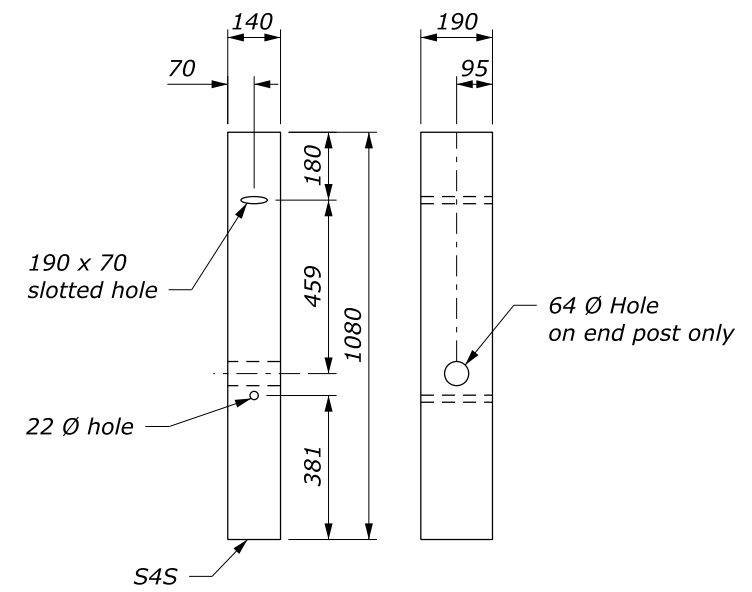


**POST SLEEVE**

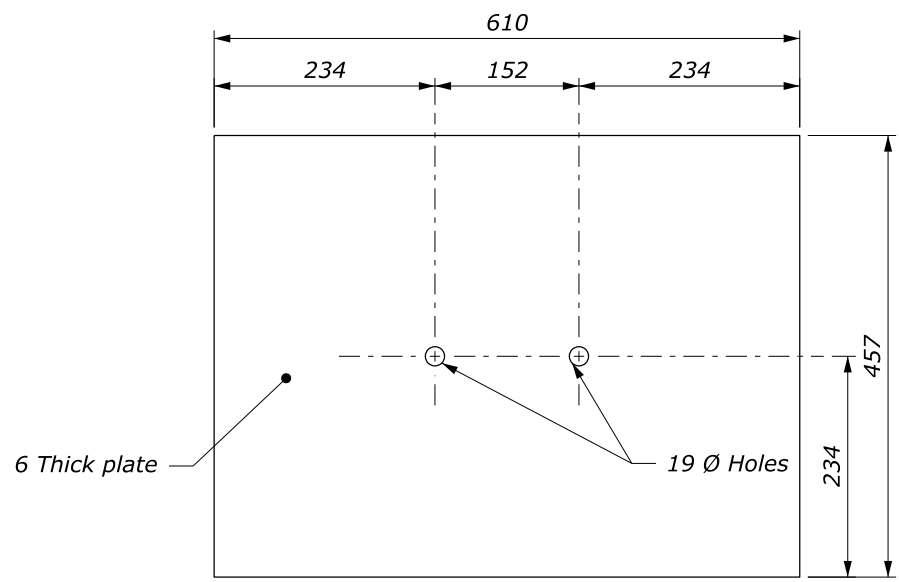
**NOTE:**  
 1. Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.



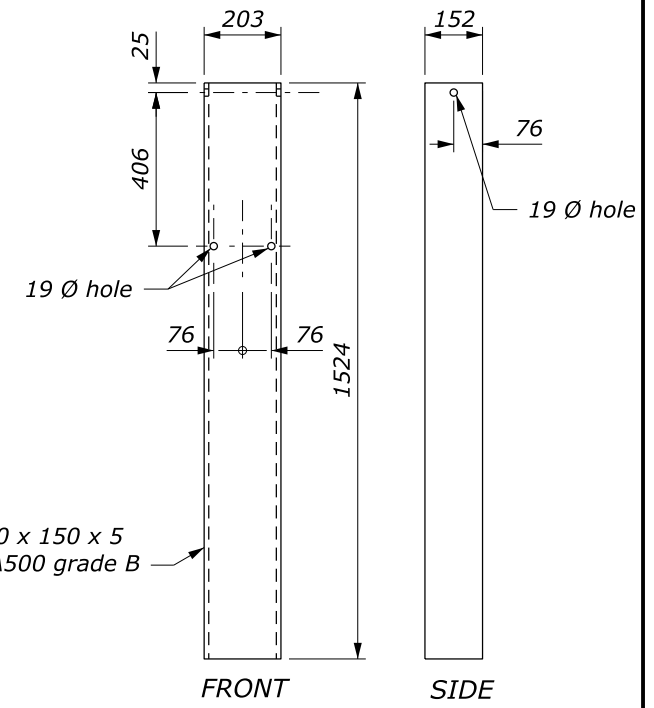
**BEARING PLATE**



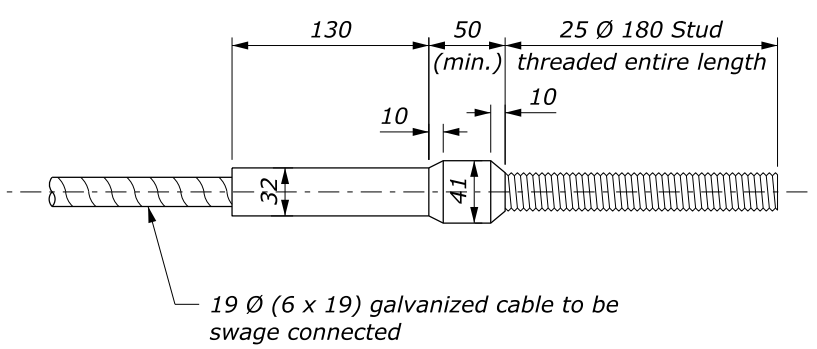
**TERMINAL POST**



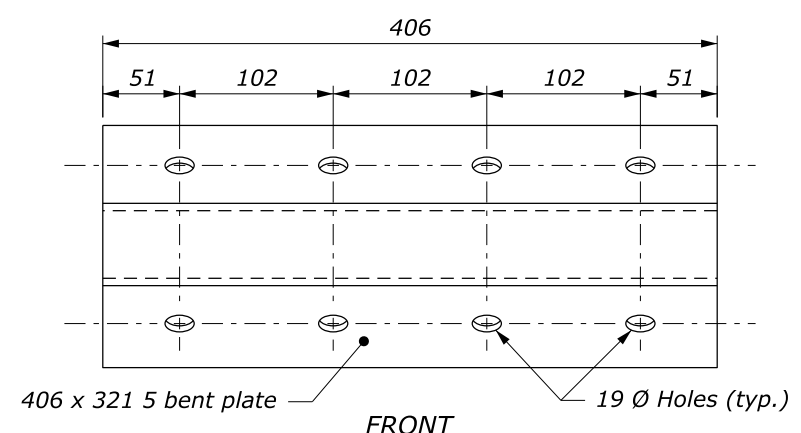
**SOIL PLATE  
(2 REQUIRED)**



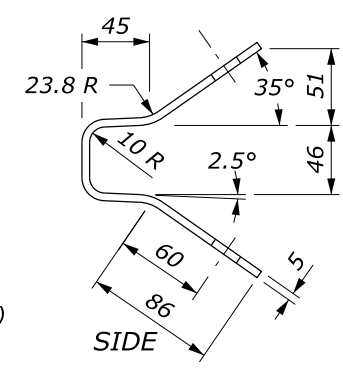
**STEEL TUBE ANCHOR**



**CABLE ANCHOR ASSEMBLY  
(Standard swaged fitting and stud)**



**GUARDRAIL ANCHOR BRACKET**

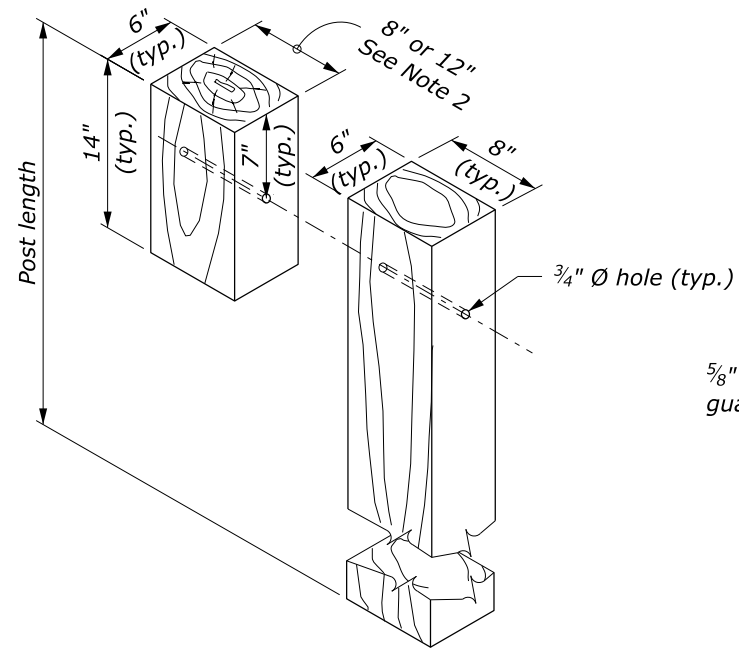


NO SCALE

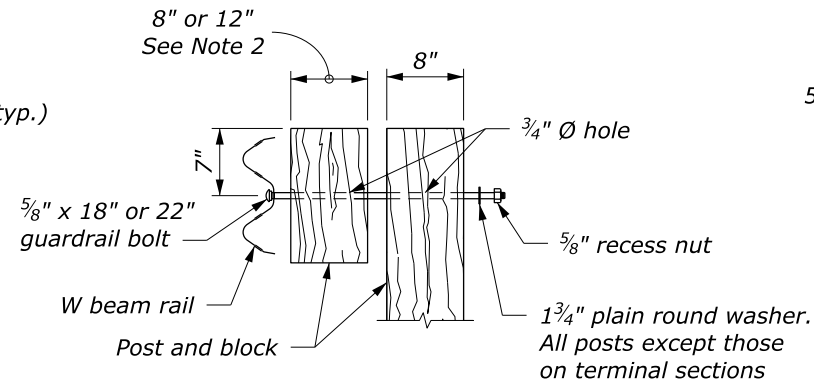
This drawing contains **Metric** units of measure. Dimensions without units are millimeters.

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| U.S. DEPARTMENT OF TRANSPORTATION, FHWA<br>OFFICE OF FEDERAL LANDS HIGHWAY | FLH STANDARD<br>M617-23       |
| <b>G4 W-BEAM GUARDRAIL<br/>CRT ANCHORAGE ASSEMBLY<br/>DETAILS</b>          | SPECIFICATION<br>FP-24, FP-14 |
|  | APPROVED FOR USE<br>1/2024    |

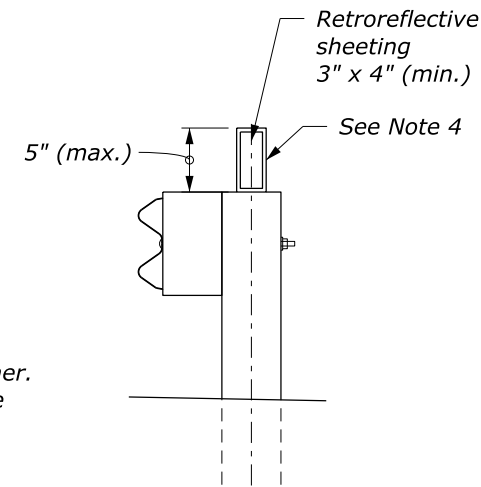
c:\pwwork\0419223\Std617-23.dgn [Std M617-23] 1.1 July 2024 9:27 AM



**POST AND BLOCK**



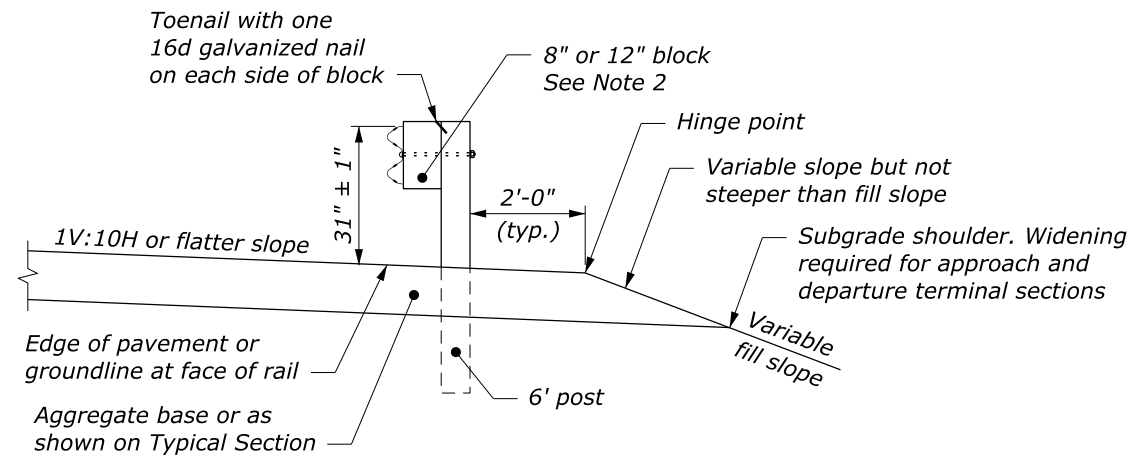
**POST BOLT ASSEMBLY**



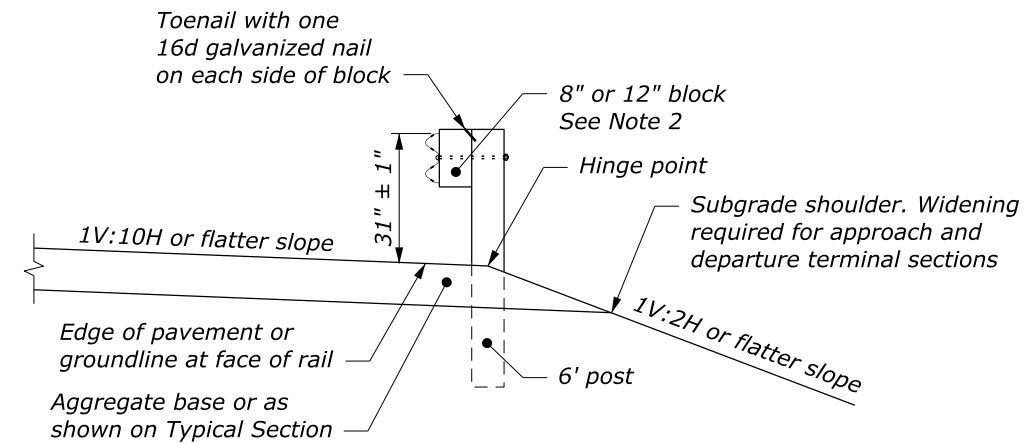
**FLEXIBLE DELINEATOR GUARDRAIL MOUNT**

**NOTE:**

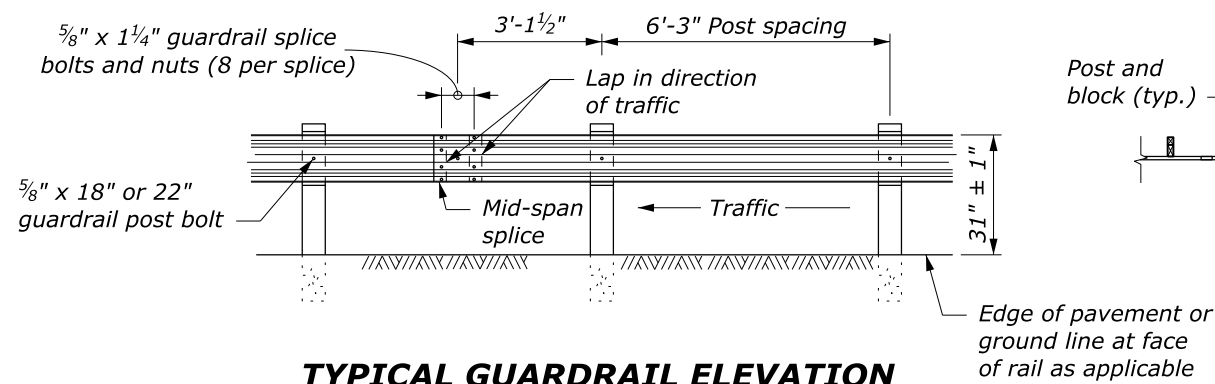
1. When encountering impenetrable material, one post may be omitted in locations where the typical guardrail cross section includes 2-feet (min.) between the back of the guardrail post and the hinge point. For all other locations, see Section 617 and Standard 617-13 or 617-37.
2. Size of block shown elsewhere in the plans. Use a single block or combination of blocks (no more than two) to achieve the actual 8-inch or 12-inch offset. Secure wood blocks to the posts with anti-rotation nails. If combination blocks are used, toenail the adjacent blocks with two 16d galvanized nails to prevent block rotation.
3. Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.
4. Install a flexible hinged delineator every fourth post. Fasten delineator to the top of the wood post using either an adhesive or mechanical means according to the manufacturer's recommendations.



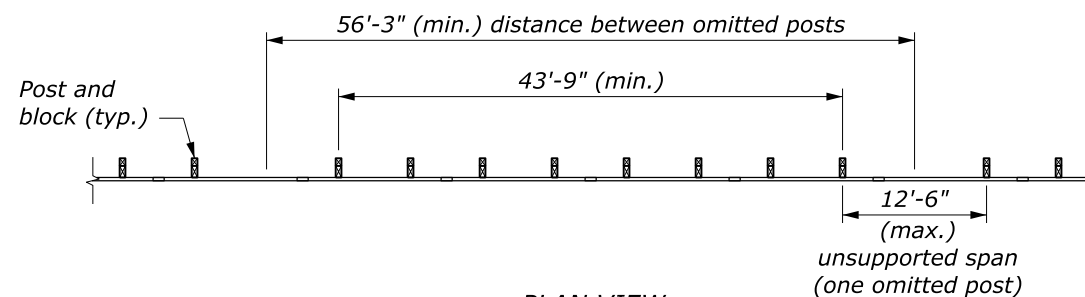
**TYPICAL GUARDRAIL CROSS SECTION 6' POST, 8" OR 12" BLOCK**



**TYPICAL GUARDRAIL CROSS SECTION 6' POST CENTERED ON HINGE, 8" OR 12" BLOCK**



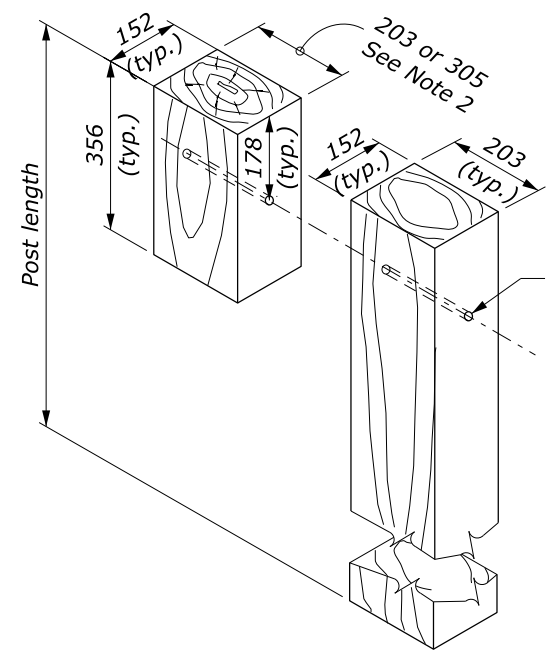
**TYPICAL GUARDRAIL ELEVATION**



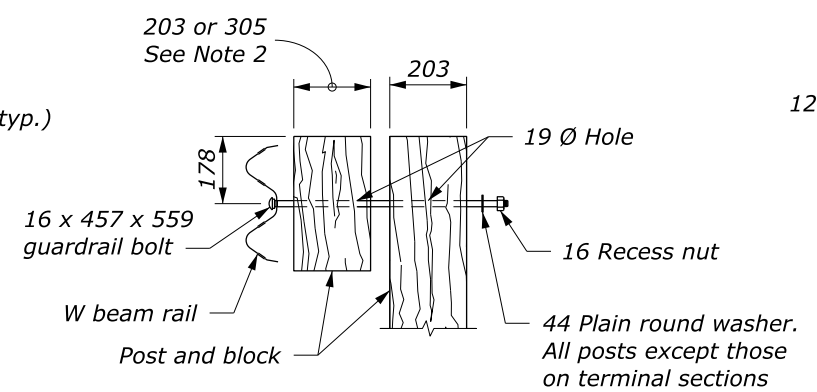
**PLAN VIEW OMITTED POST DETAIL**  
See Note 1

NO SCALE

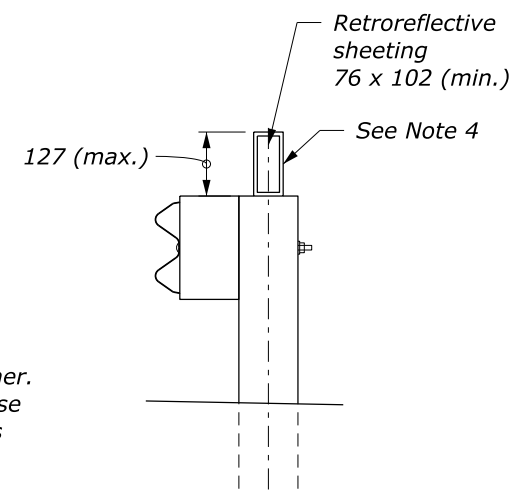
|  |                            |
|--|----------------------------|
| U.S. DEPARTMENT OF TRANSPORTATION, FHWA<br>OFFICE OF FEDERAL LANDS HIGHWAY | FLH STANDARD<br>617-31     |
| <b>MGS W-BEAM GUARDRAIL<br/>WOOD POSTS</b>                                 | SPECIFICATION<br>FP-14     |
|  | APPROVED FOR USE<br>1/2024 |



**POST AND BLOCK**



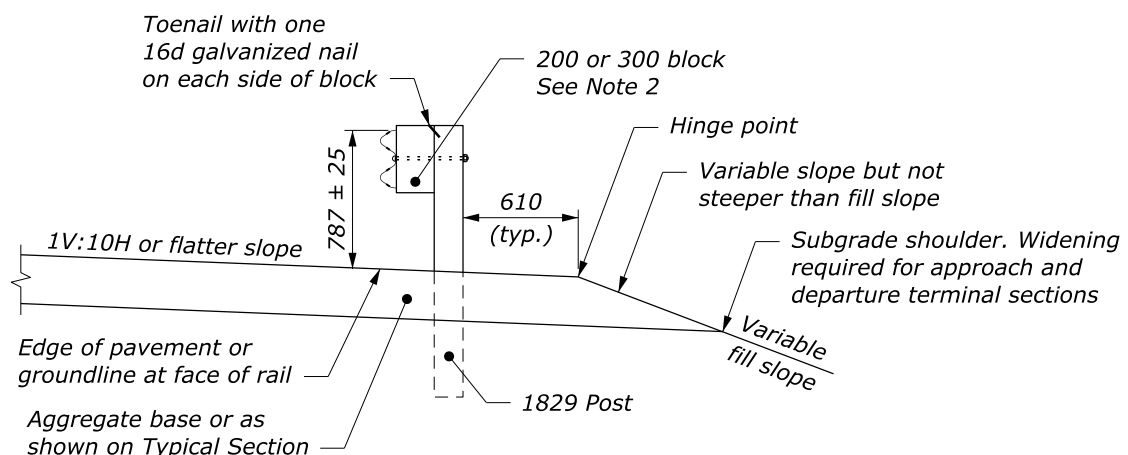
**POST BOLT ASSEMBLY**



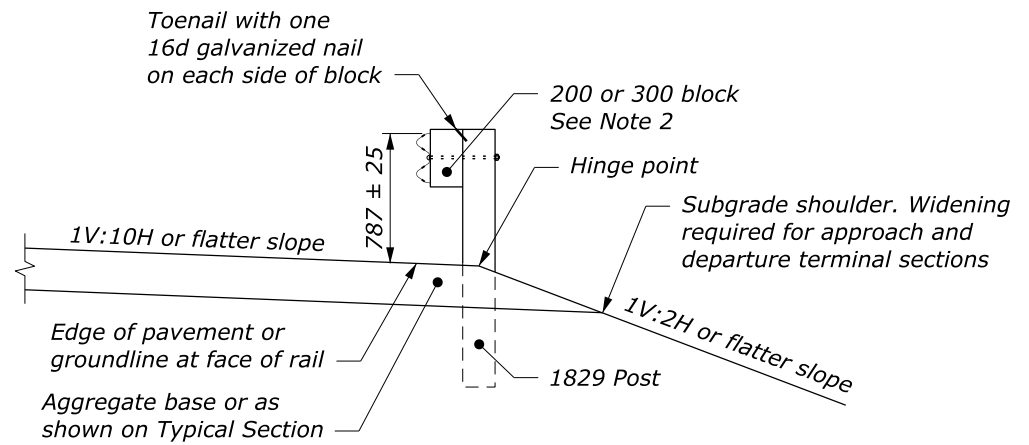
**FLEXIBLE DELINEATOR GUARDRAIL MOUNT**

**NOTE:**

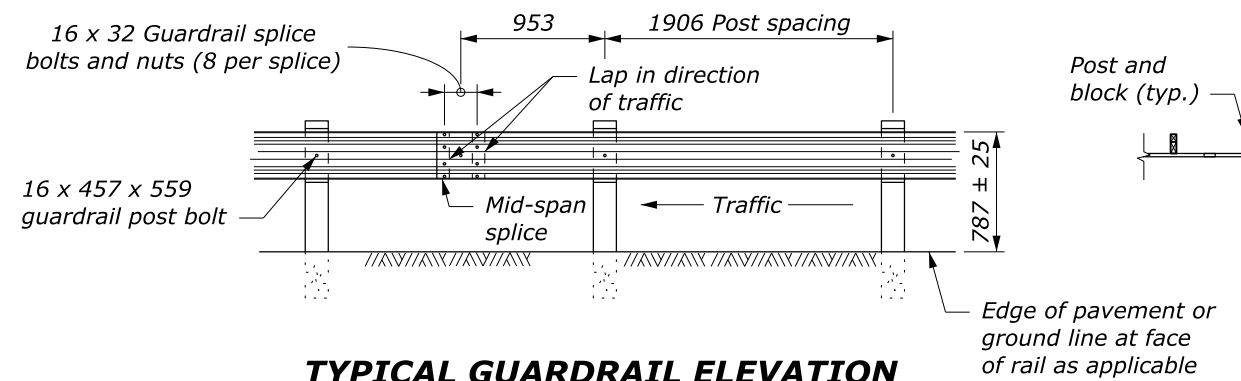
1. When encountering impenetrable material, one post may be omitted in locations where the typical guardrail cross section includes 610 mm (min.) between the back of the guardrail post and the hinge point. For all other locations, see Section 617 and Standard M617-13 or M617-37.
2. Size of block shown elsewhere in the plans. Use a single block or combination of blocks (no more than two) to achieve the actual 200 or 300 mm offset secure good blocks to the posts with anti-rotation nails. If combination blocks are used, toenail the adjacent blocks with two 16d galvanized nails to prevent block rotation.
3. Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.
4. Install a flexible hinged delineator every fourth post. Fasten delineator to the top of the wood post using either an adhesive or mechanical means according to the manufacturer's recommendations.



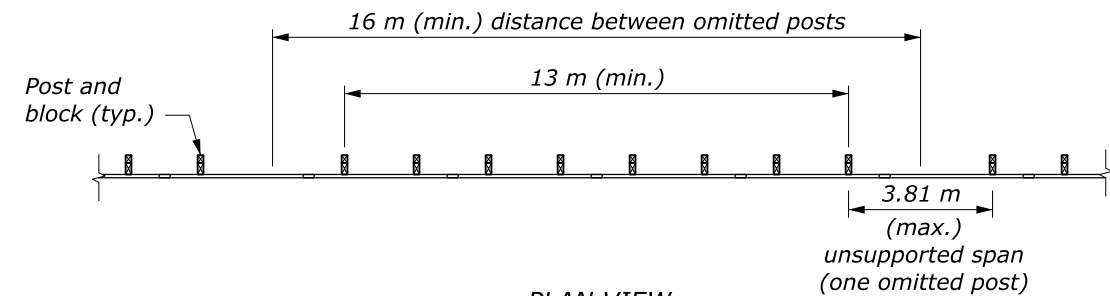
**TYPICAL GUARDRAIL CROSS SECTION 1830 POST, 200 OR 300 BLOCK**



**TYPICAL GUARDRAIL CROSS SECTION 1830 POST CENTERED ON HINGE, 200 OR 300 BLOCK**



**TYPICAL GUARDRAIL ELEVATION**



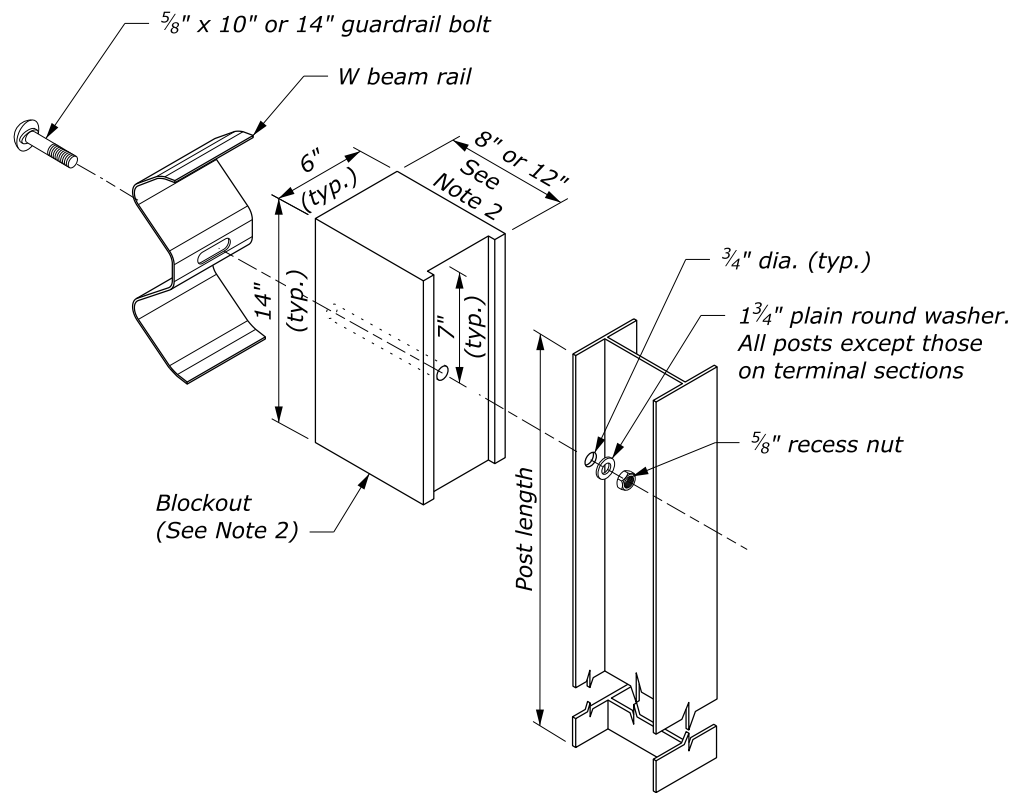
**PLAN VIEW OMITTED POST DETAIL**  
See Note 1

This drawing contains **Metric** units of measure. Dimensions without units are millimeters.

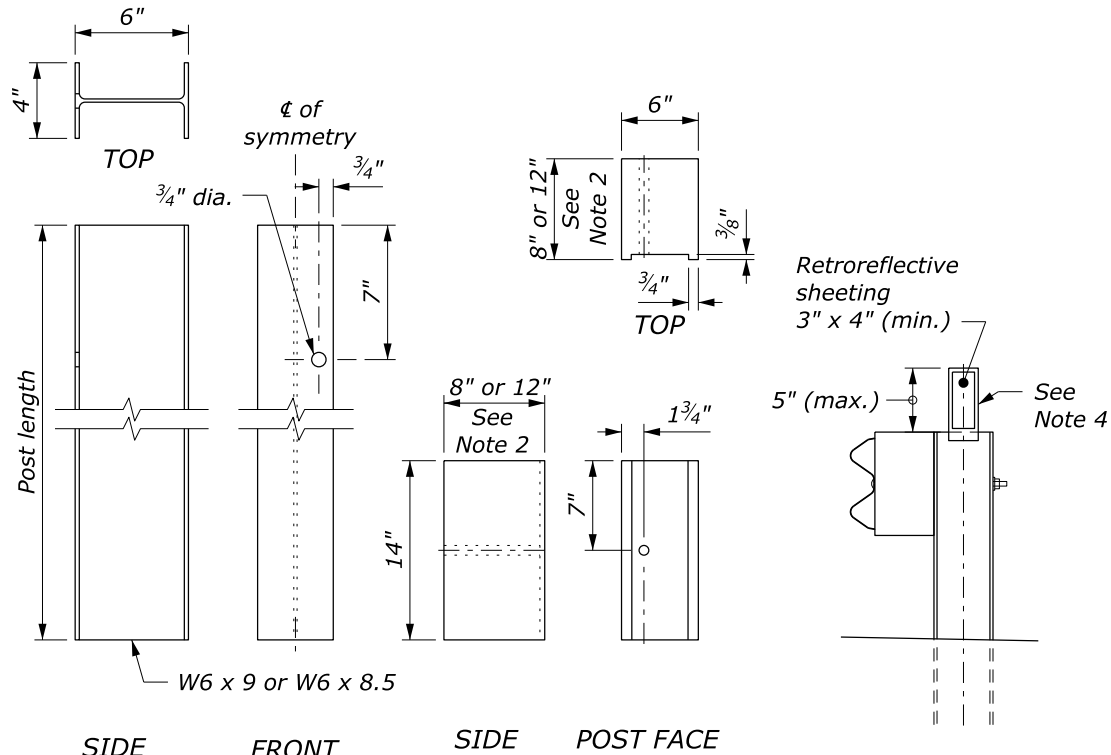
NO SCALE

|  |                            |
|--|----------------------------|
| U.S. DEPARTMENT OF TRANSPORTATION, FHWA<br>OFFICE OF FEDERAL LANDS HIGHWAY | FLH STANDARD<br>M617-31    |
| <b>MGS W-BEAM GUARDRAIL<br/>WOOD POSTS</b>                                 | SPECIFICATION<br>FP-14     |
|  | APPROVED FOR USE<br>1/2024 |

c:\pwwork\0419223\Std617-31fp14.dgn [Std M617-31] 10 July 2024 11:36 AM



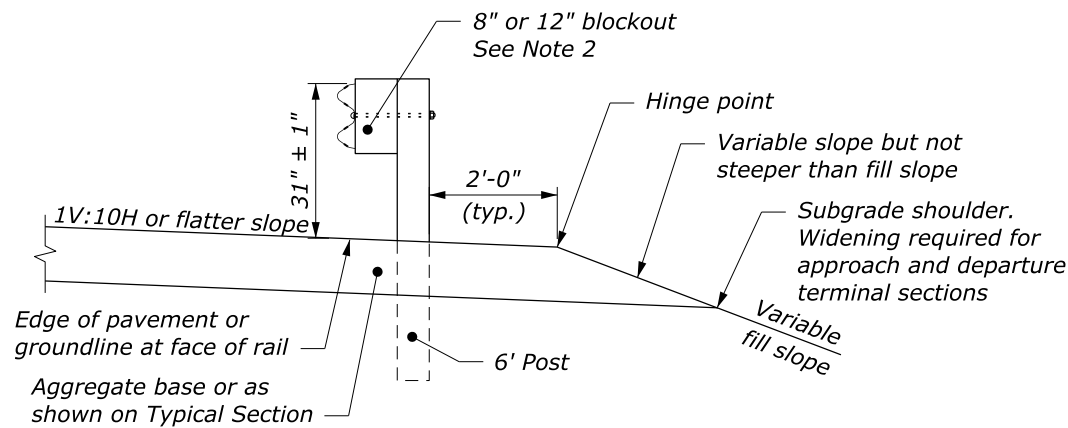
**POST AND BLOCKOUT DETAIL**



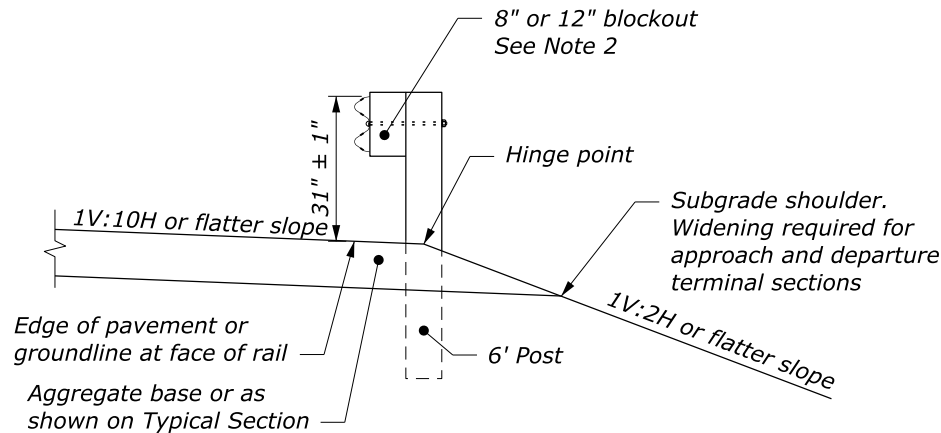
**STRUCTURAL SHAPE POST**      **BLOCKOUT**      **FLEXIBLE DELINEATOR GUARDRAIL MOUNT**

**NOTE:**

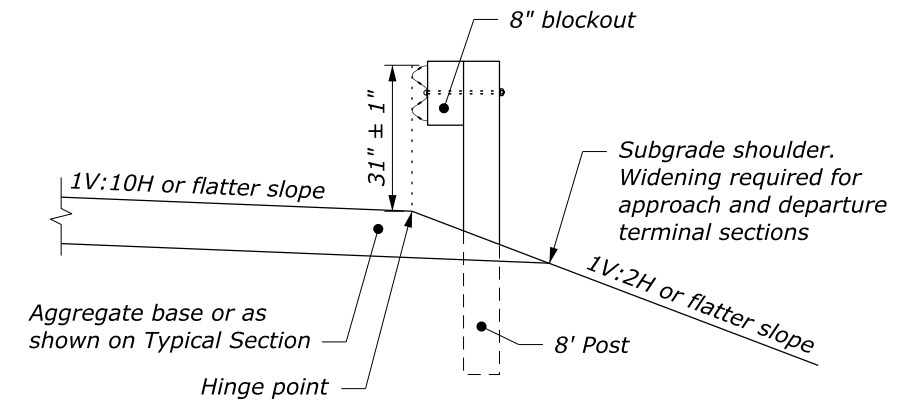
1. When encountering impenetrable material, one post may be omitted in locations where the typical guardrail cross section includes 2-feet (min.) between the back of the guardrail post and the hinge point. For all other locations, see Section 617 and Standard 617-13 or 617-37.
2. Size of blockout shown elsewhere in the plans. Blockout may be wood, plastic, or composite material. Use consistent material throughout the length of guardrail run.
3. Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.
4. Install a flexible hinged delineator every fourth post. Fasten delineator to the web of the steel post using either an adhesive or mechanical means according to the manufacturer's recommendations.



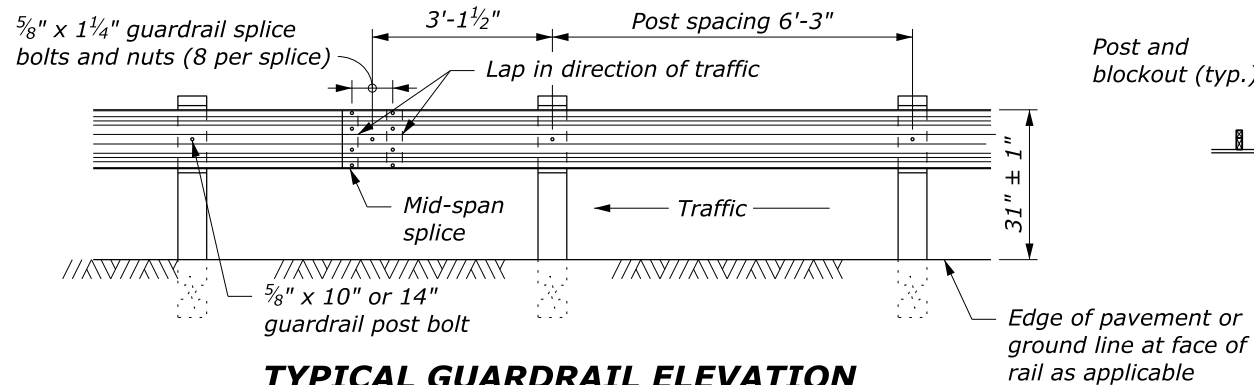
**TYPICAL GUARDRAIL CROSS SECTION 6' POST, 8" OR 12" BLOCKOUT**



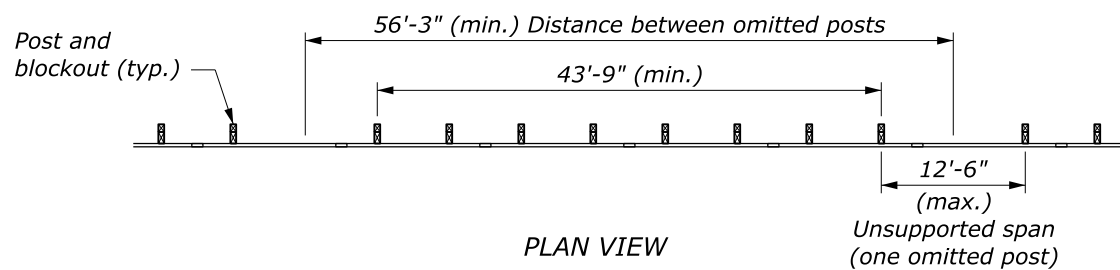
**TYPICAL GUARDRAIL CROSS SECTION 6' POST CENTERED ON HINGE, 8" OR 12" BLOCKOUT**



**TYPICAL GUARDRAIL CROSS SECTION 8' POST ON SLOPE, 8" BLOCKOUT**



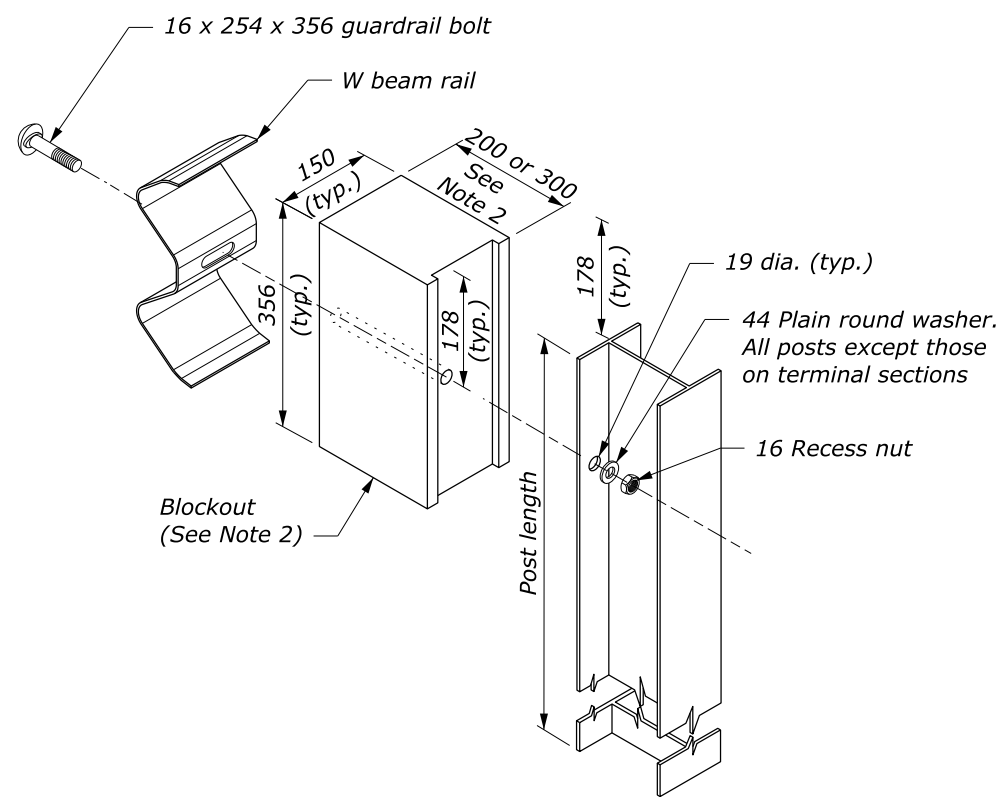
**TYPICAL GUARDRAIL ELEVATION**



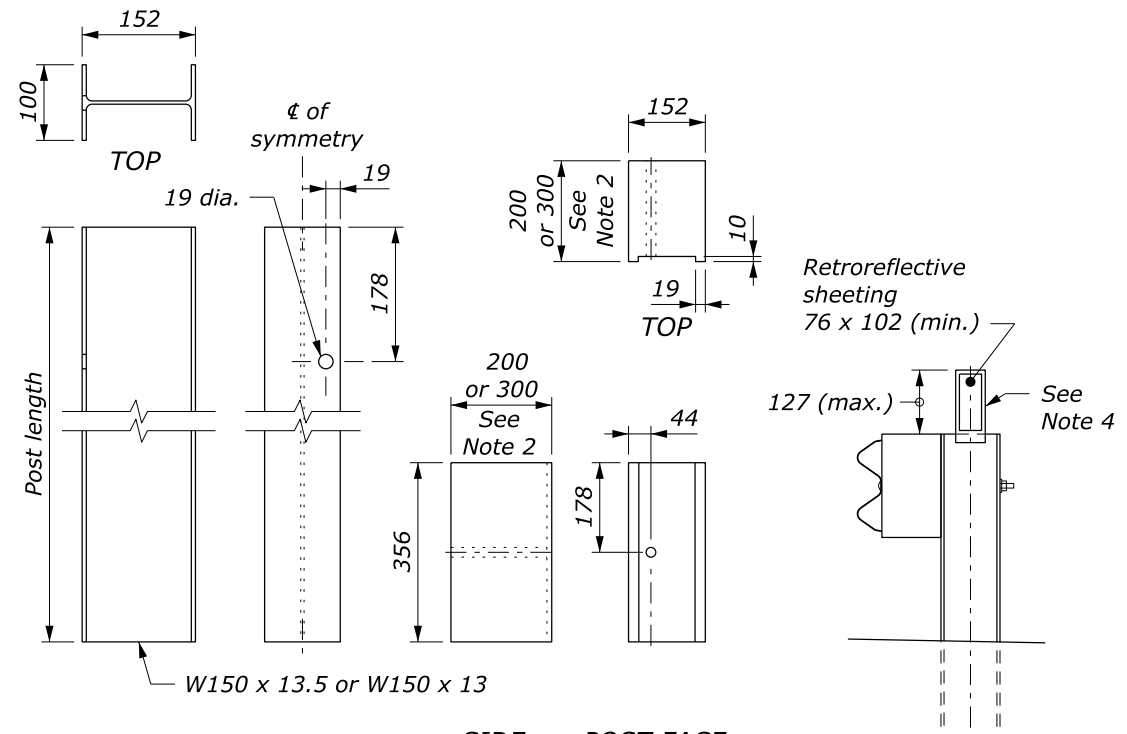
**OMITTED POST DETAIL**  
See Note 1

NO SCALE

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|--|----------------------------|
| U.S. DEPARTMENT OF TRANSPORTATION, FHWA<br>OFFICE OF FEDERAL LANDS HIGHWAY | FLH STANDARD<br>617-32     |
| <b>MGS W-BEAM GUARDRAIL<br/>STEEL POSTS</b>                                | SPECIFICATION<br>FP-14     |
|  | APPROVED FOR USE<br>2/2024 |

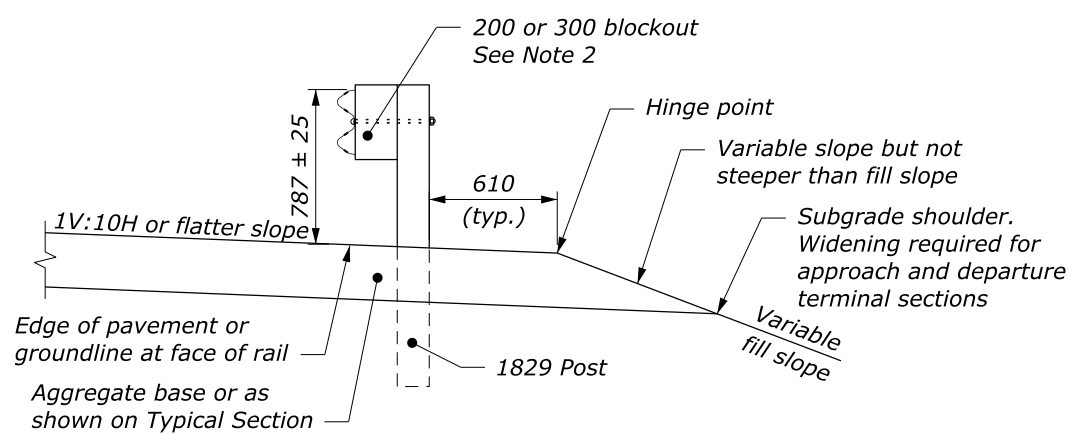


**POST AND BLOCKOUT DETAIL**

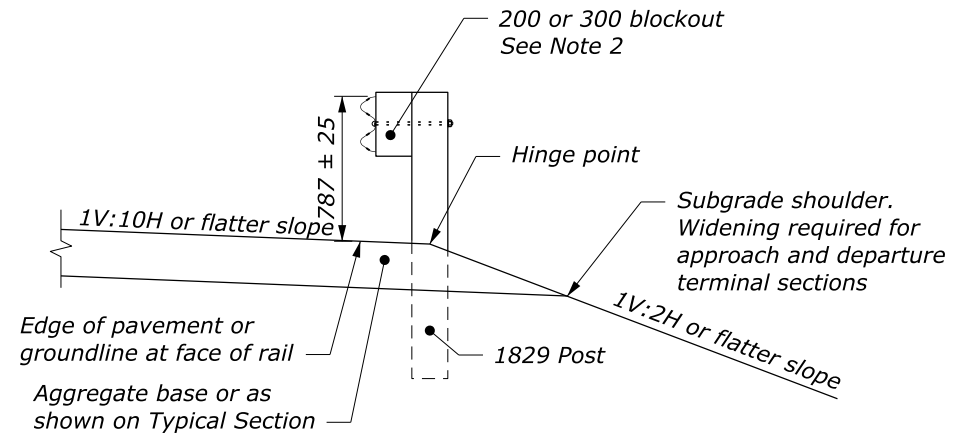


**STRUCTURAL SHAPE POST      BLOCKOUT      FLEXIBLE DELINEATOR GUARDRAIL MOUNT**

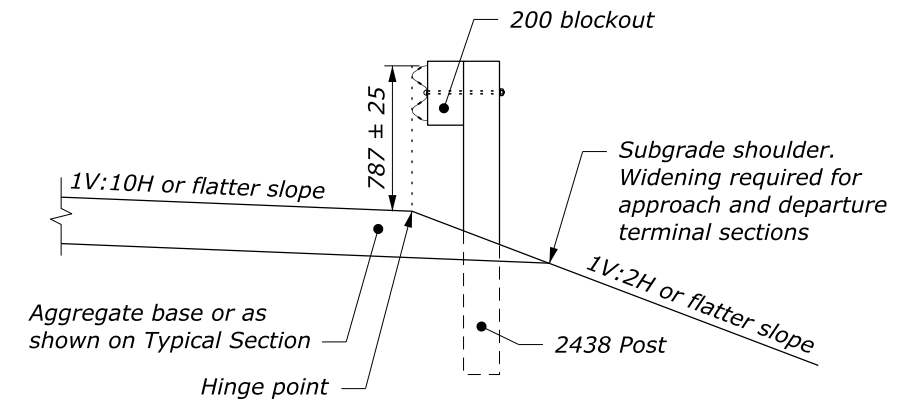
- NOTE:**
1. When encountering impenetrable material, one post may be omitted in locations where the typical guardrail cross section includes 609 mm (min.) between the back of the guardrail post and the hinge point. For all other locations, see Section 617 and Standard M617-13 or M617-37.
  2. Size of blockout shown elsewhere in the plans. Blockout may be wood, plastic, or composite material. Use consistent material throughout the length of guardrail run.
  3. Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.
  4. Install a flexible hinged delineator every fourth post. Fasten delineator to the web of the steel post using either an adhesive or mechanical means according to the manufacturer's recommendations.



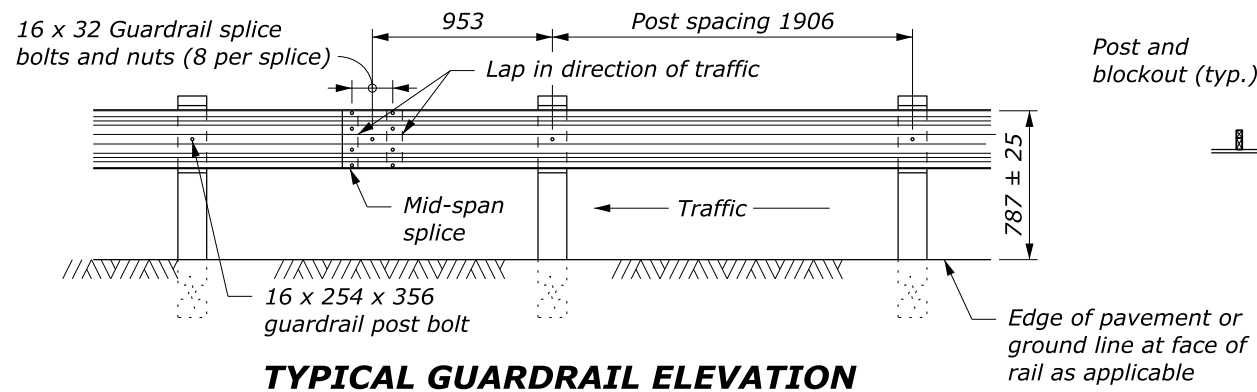
**TYPICAL GUARDRAIL CROSS SECTION 1829 POST, 200 OR 300 BLOCKOUT**



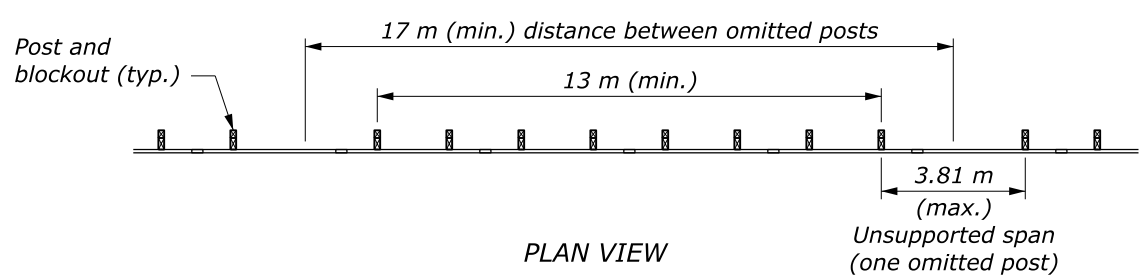
**TYPICAL GUARDRAIL CROSS SECTION 1829 POST CENTERED ON HINGE, 200 OR 300 BLOCKOUT**



**TYPICAL GUARDRAIL CROSS SECTION 2438 POST ON SLOPE, 200 BLOCKOUT**



**TYPICAL GUARDRAIL ELEVATION**



**PLAN VIEW OMITTED POST DETAIL**  
See Note 1

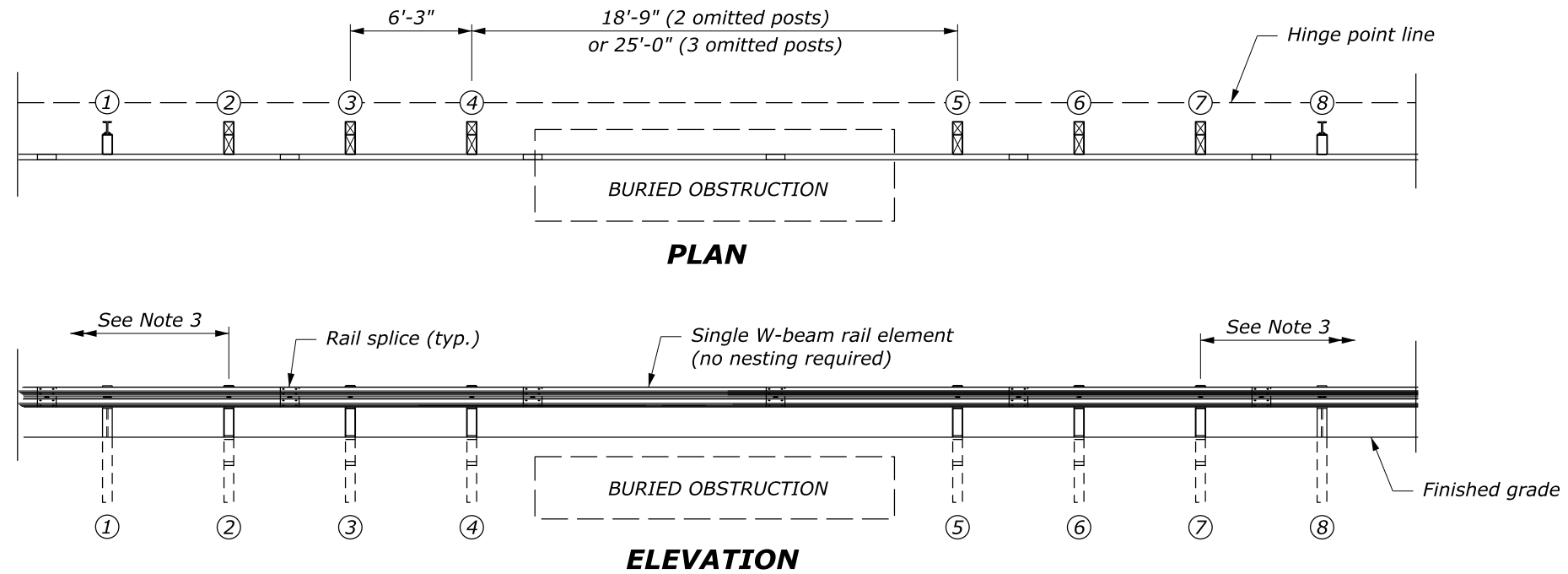
This drawing contains **Metric** units of measure. Dimensions without units are millimeters.

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| U.S. DEPARTMENT OF TRANSPORTATION, FHWA<br>OFFICE OF FEDERAL LANDS HIGHWAY | FLH STANDARD<br>M617-32    |
| <b>MGS W-BEAM GUARDRAIL STEEL POSTS</b>                                    | SPECIFICATION<br>FP-14     |
|  | APPROVED FOR USE<br>2/2024 |

NO SCALE

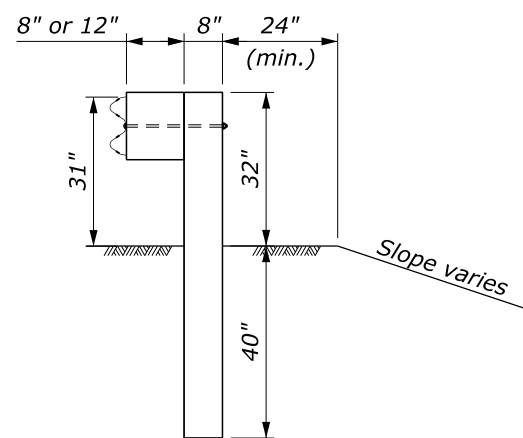
c:\pwwork\0419223\Std617-32fp14.dwg [Std M617-32] 10 July 2024 9:35 AM



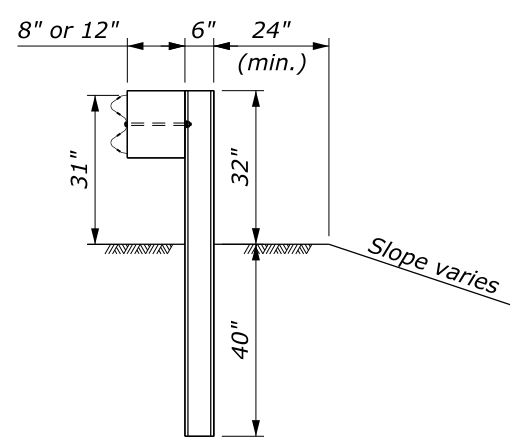


**NOTE:**

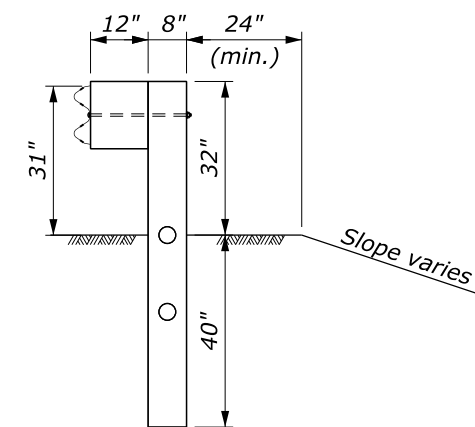
1. Posts ① and ⑧ may be wood or steel.
2. Use wood posts for CRT posts.
3. The minimum length of guardrail, including the end terminals, upstream and downstream of posts ② and ⑦ is 62.5 feet.
4. In locations where the culvert headwall extends above the finished grade to act as a vertical roadway curb, the maximum height of the culvert headwall above the finished grade is 2 inches.
5. See Standard 617-31 or 617-32 for other assembly details.



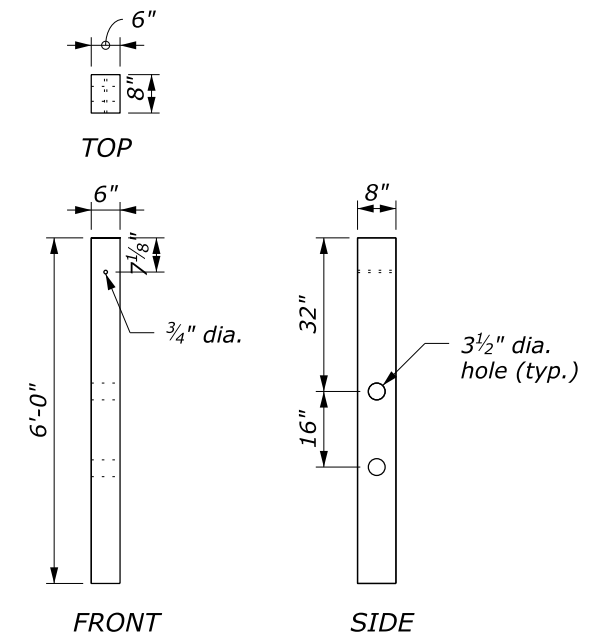
**WOOD POST DETAIL**  
POST ① AND ⑧  
See Note 1



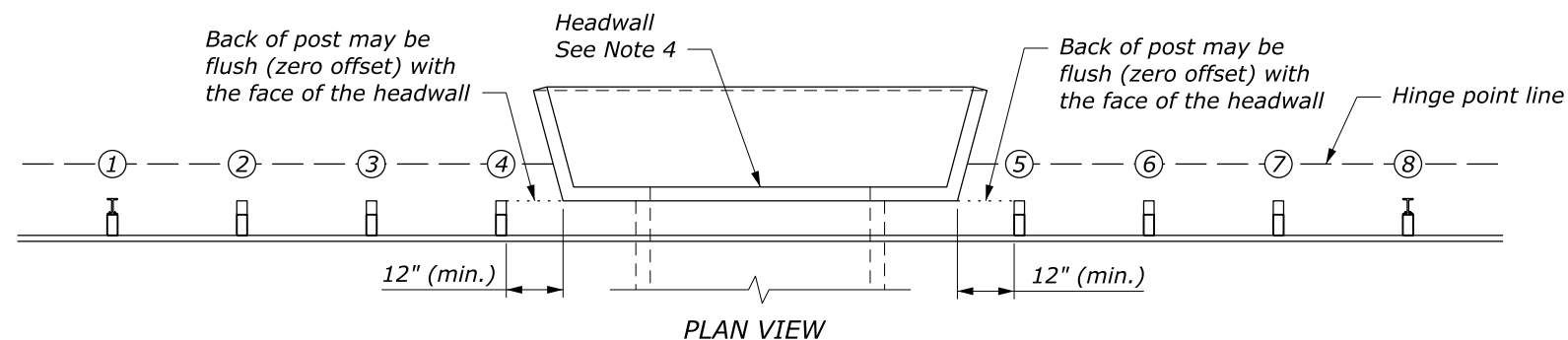
**STEEL POST DETAIL**  
POST ① AND ⑧  
See Note 1



**CRT POST DETAIL**  
POST ② THRU ⑦  
See Note 2



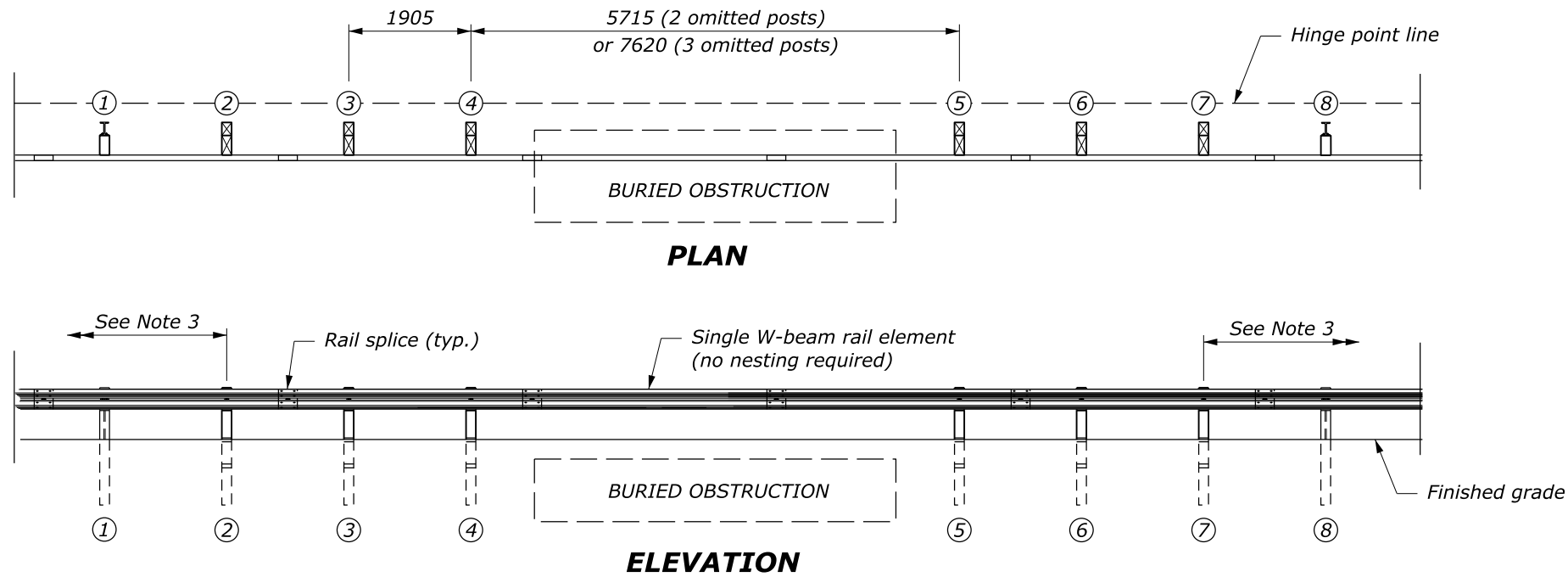
**CRT WOOD POST**



**SPAN WITH HEADWALL DETAIL**

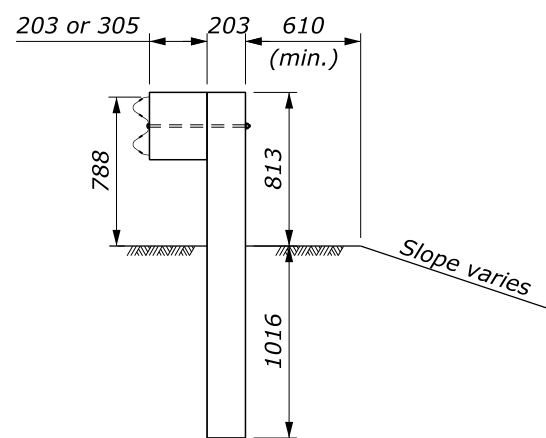
NO SCALE

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| U.S. DEPARTMENT OF TRANSPORTATION, FHWA<br>OFFICE OF FEDERAL LANDS HIGHWAY | FLH STANDARD<br>617-37        |
| <b>MGS W-BEAM GUARDRAIL<br/>LONG-SPAN SYSTEM</b>                           | SPECIFICATION<br>FP-24, FP-14 |
|  | APPROVED FOR USE<br>1/2024    |

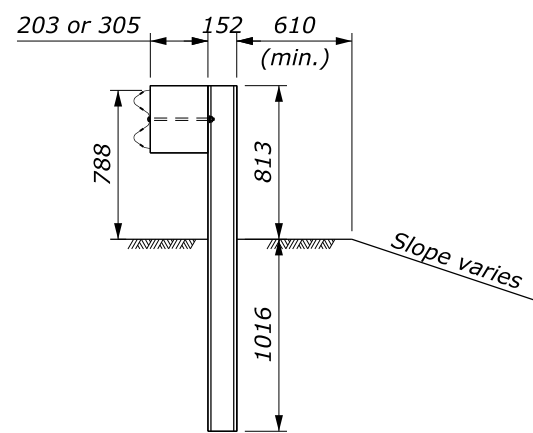


**NOTE:**

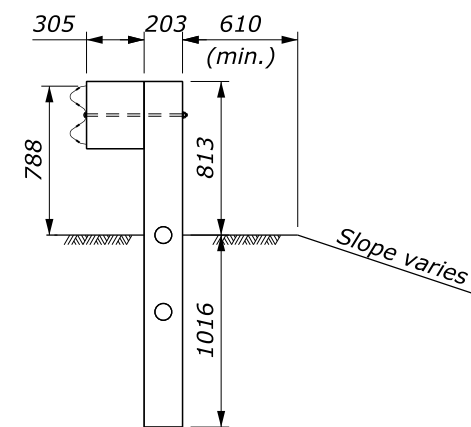
- Posts ① and ⑧ may be wood or steel.
- Use wood posts for CRT posts.
- The minimum length of guardrail, including the end terminals, upstream and downstream of posts ② and ⑦ is 19.05 m.
- In locations where the culvert headwall extends above the finished grade to act as a vertical roadway curb, the maximum height of the culvert headwall above the finished grade is 50 mm.
- See Standard M617-31 or M617-32 for other assembly details.



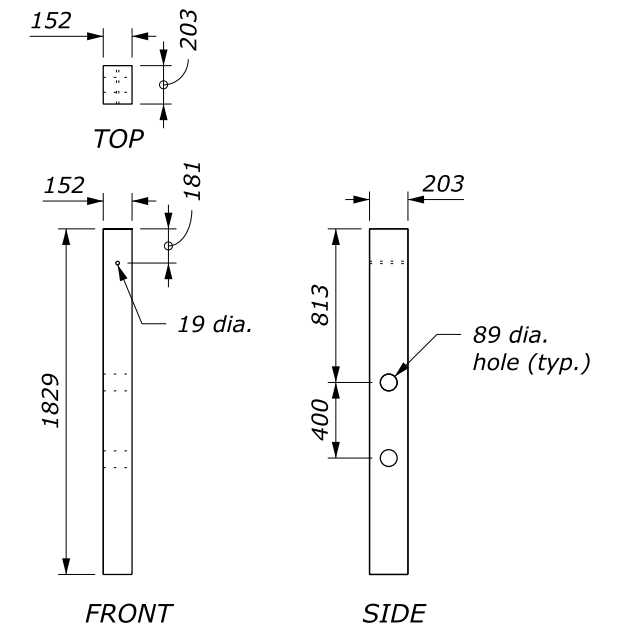
**WOOD POST DETAIL**  
POST ① AND ⑧  
See Note 1



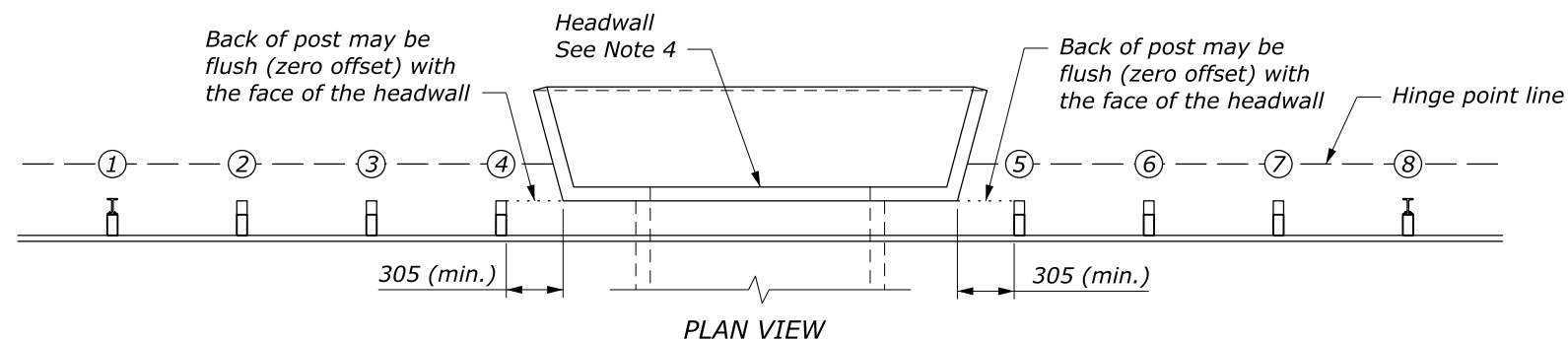
**STEEL POST DETAIL**  
POST ① AND ⑧  
See Note 1



**CRT POST DETAIL**  
POST ② THRU ⑦  
See Note 2



**CRT WOOD POST**

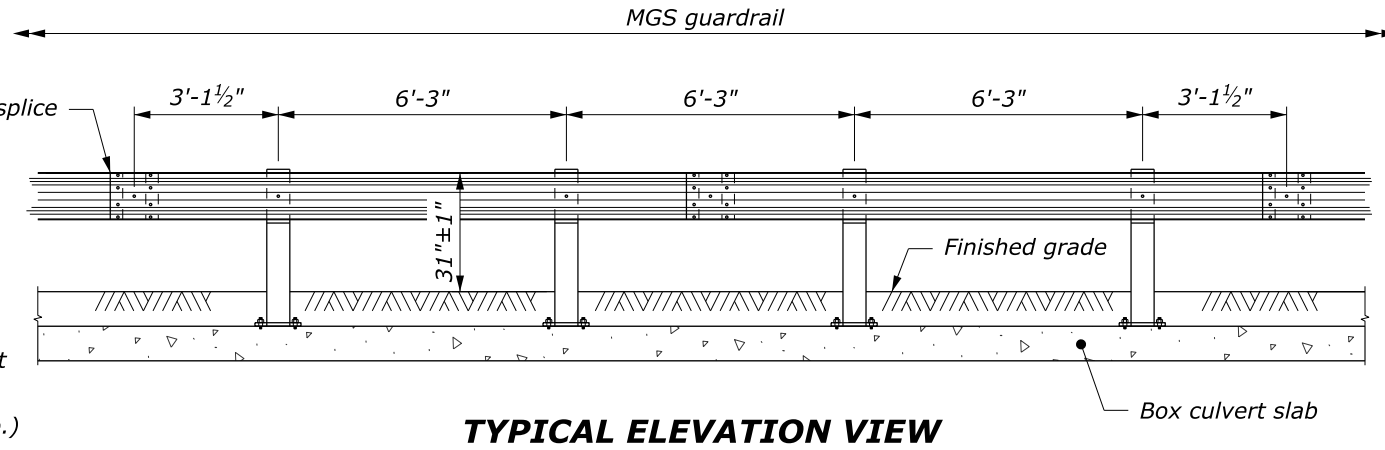
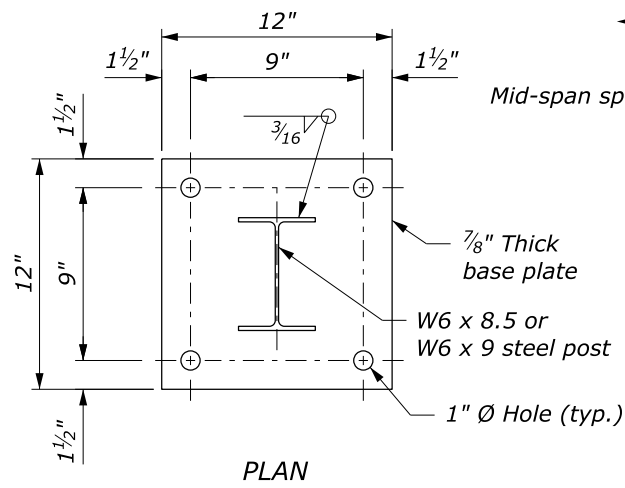


**SPAN WITH HEADWALL DETAIL**

This drawing contains **Metric** units of measure. Dimensions without units are millimeters.

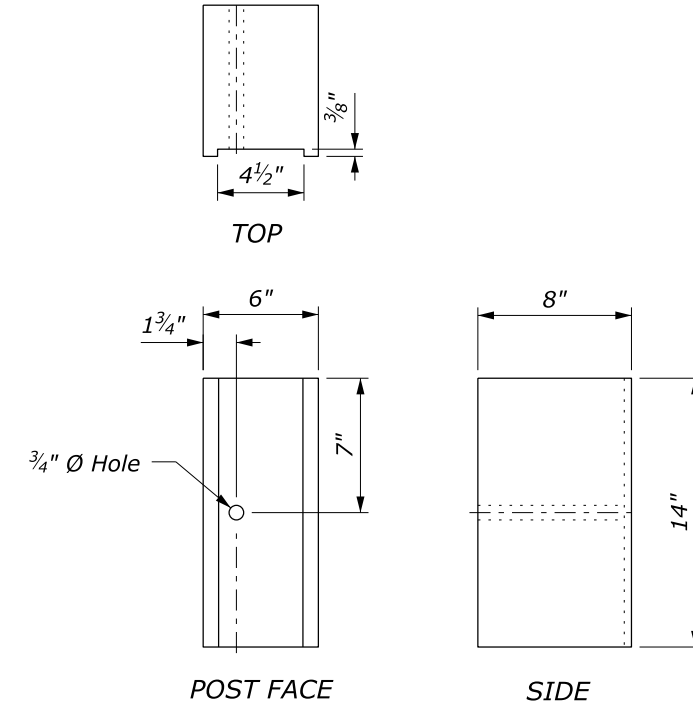
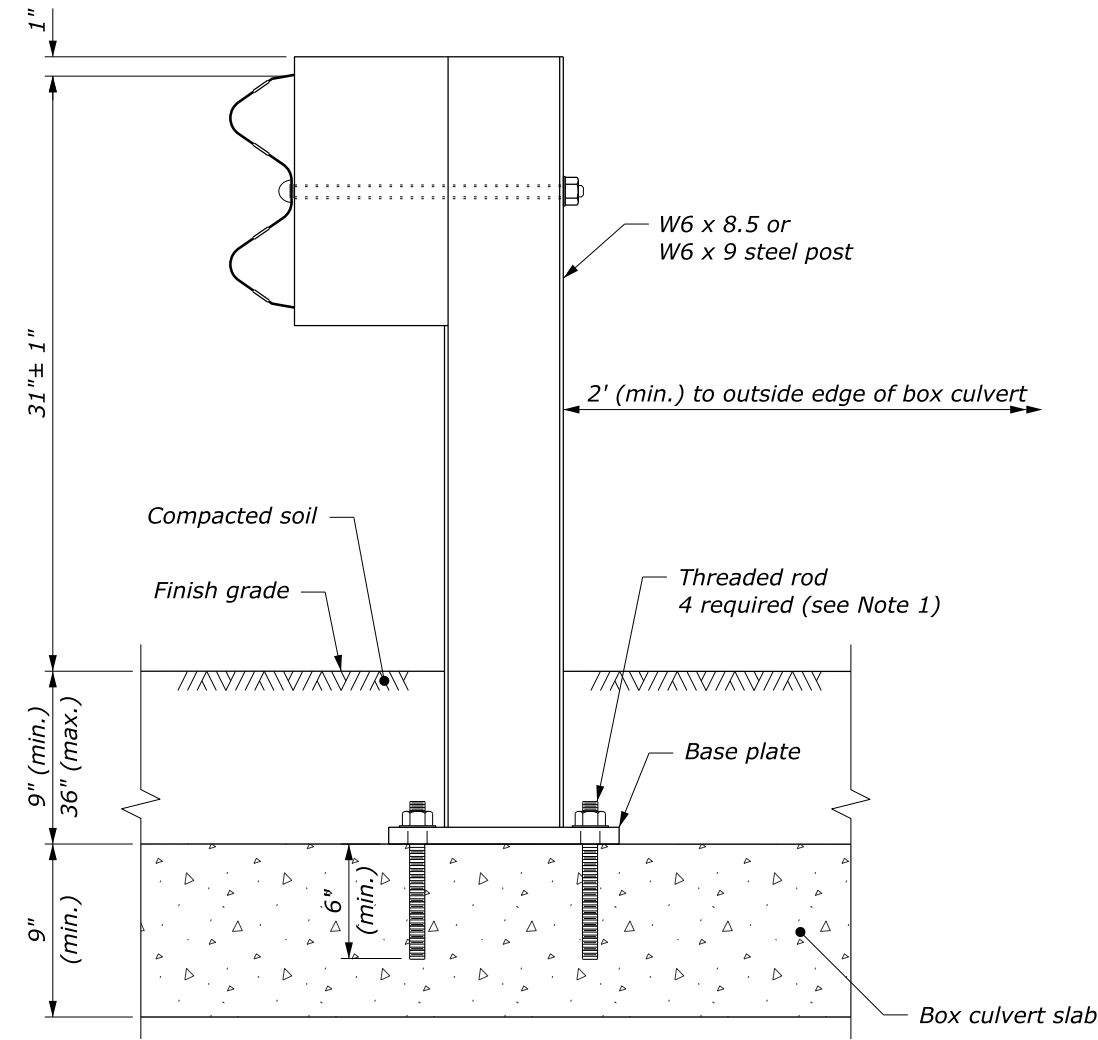
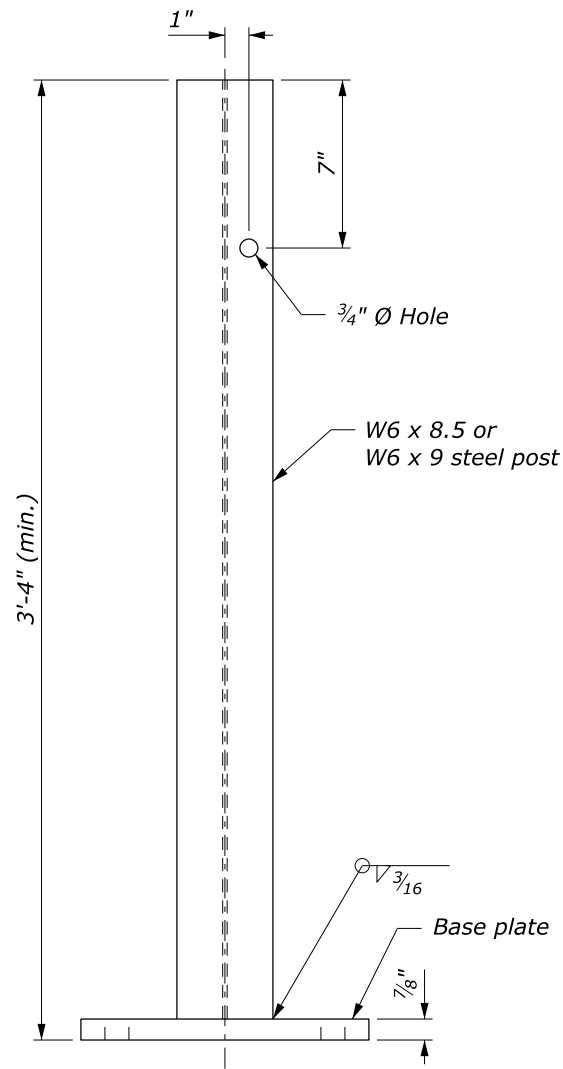
NO SCALE

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| U.S. DEPARTMENT OF TRANSPORTATION, FHWA<br>OFFICE OF FEDERAL LANDS HIGHWAY | FLH STANDARD<br>M617-37       |
| <b>MGS W-BEAM GUARDRAIL<br/>LONG-SPAN SYSTEM</b>                           | SPECIFICATION<br>FP-24, FP-14 |
|  | APPROVED FOR USE<br>1/2024    |



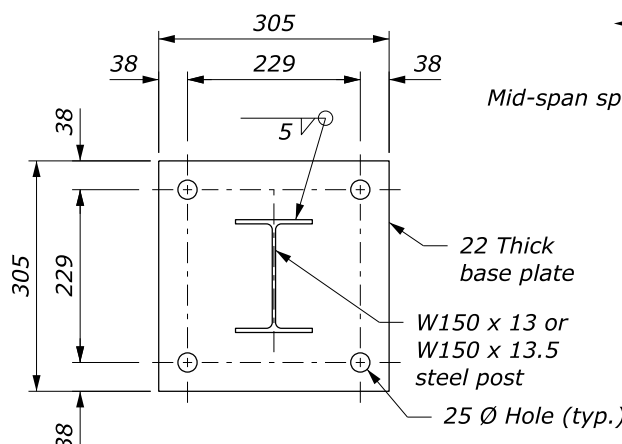
**NOTE:**

1. Attach guardrail post to box culvert with  $\frac{7}{8}$  inch diameter high-strength threaded rods  $8\frac{1}{2}$  inch in length with resin-bonded anchors. Use carbon steel rods with a minimum strength of 125 ksi and a minimum yield strength of 105 ksi. Rods, nuts, and washers have an electroplated zinc coating.
2. Wood blocks are shown. Blocks of an approved alternative may be used.
3. See Standard 617-32 for other details.

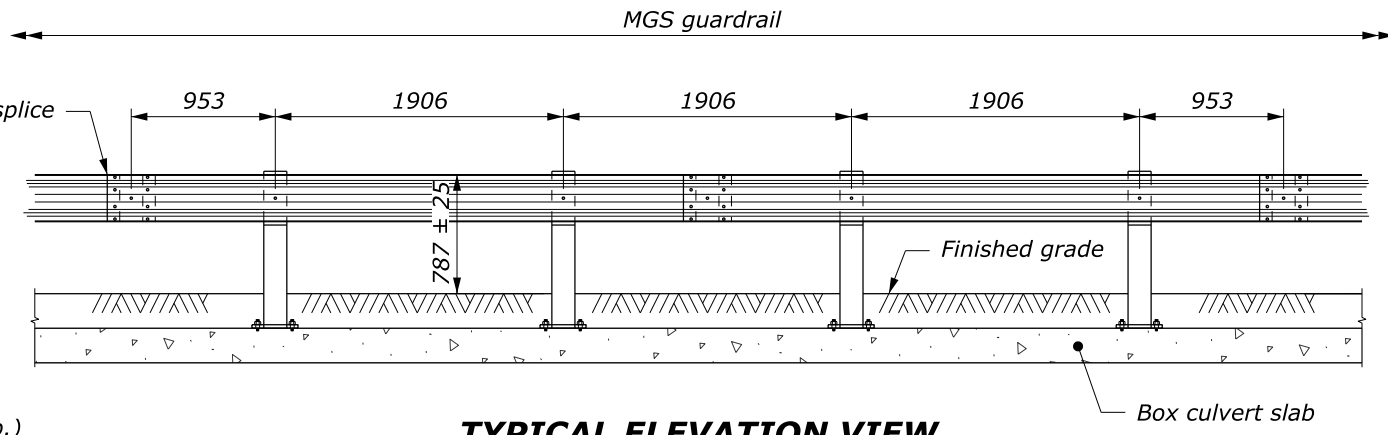


NO SCALE

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| U.S. DEPARTMENT OF TRANSPORTATION, FHWA<br>OFFICE OF FEDERAL LANDS HIGHWAY | FLH STANDARD<br>617-38     |
| <b>MGS W-BEAM GUARDRAIL<br/>STEEL POSTS<br/>ATTACHED TO BOX CULVERT</b>    | SPECIFICATION<br>FP-14     |
|  | APPROVED FOR USE<br>1/2024 |



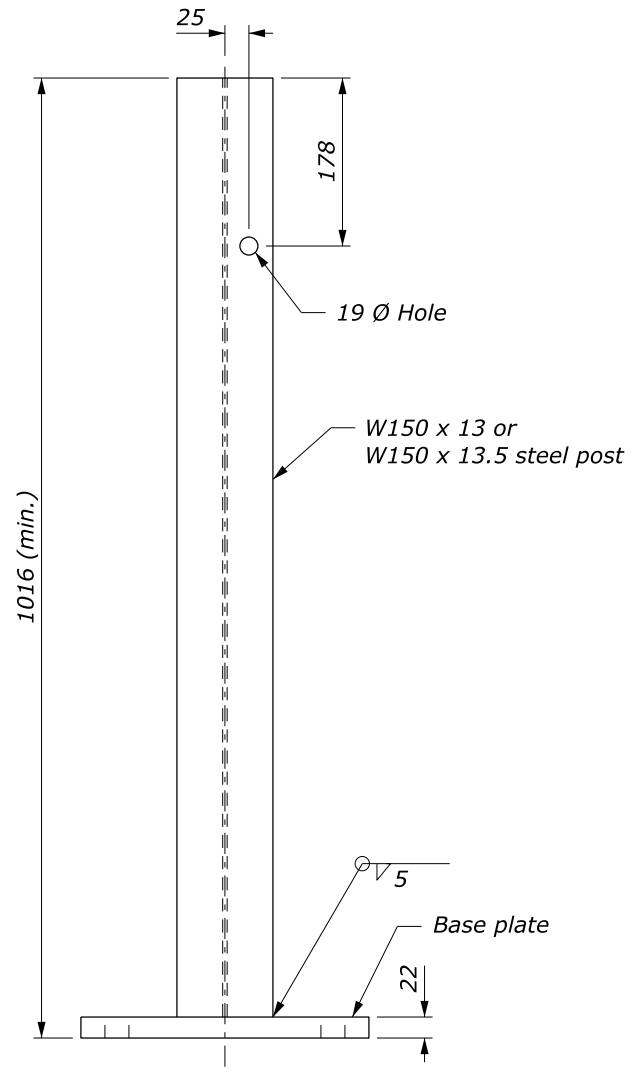
PLAN



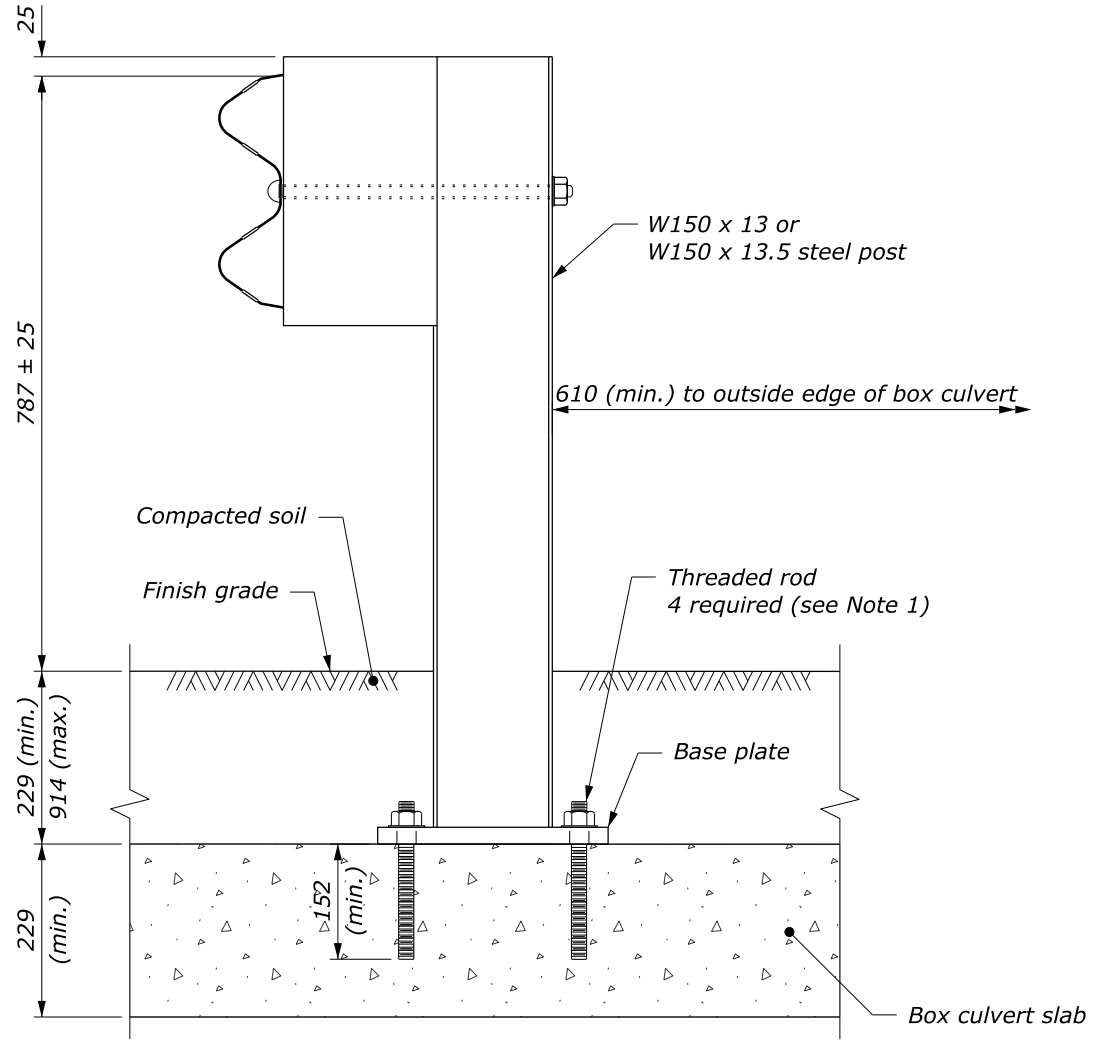
TYPICAL ELEVATION VIEW

**NOTE:**

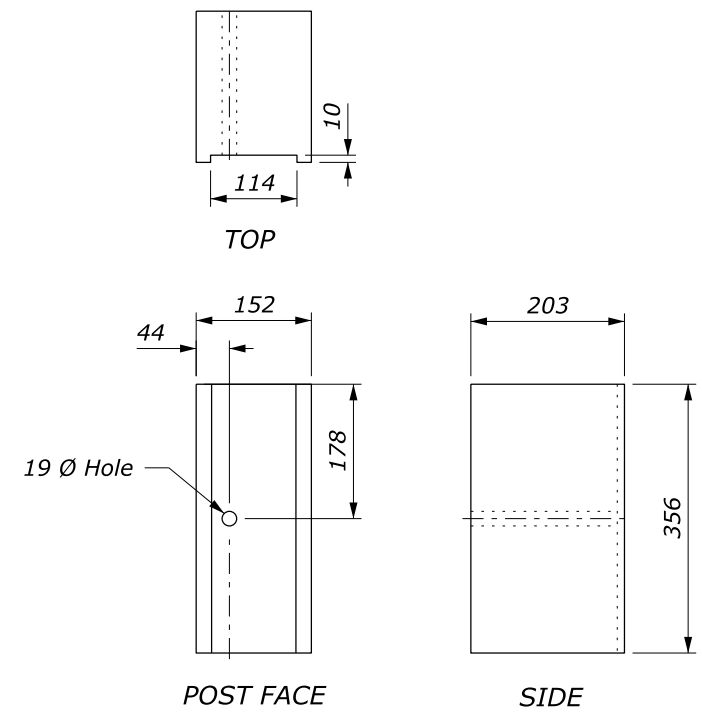
1. Attach guardrail post to box culvert with 22 mm diameter high-strength threaded rods 216 mm in length with resin-bonded anchors. Use carbon steel rods with a minimum strength of 862 MPa and a minimum yield strength of 724 MPa. Rods, nuts, and washers have an electroplated zinc coating.
2. Wood blocks are shown. Blocks of an approved alternative may be used.
3. See Standard M617-32 for other details.



ELEVATION  
BOX CULVERT POST



BOX CULVERT MGS GUARDRAIL  
STEEL POST



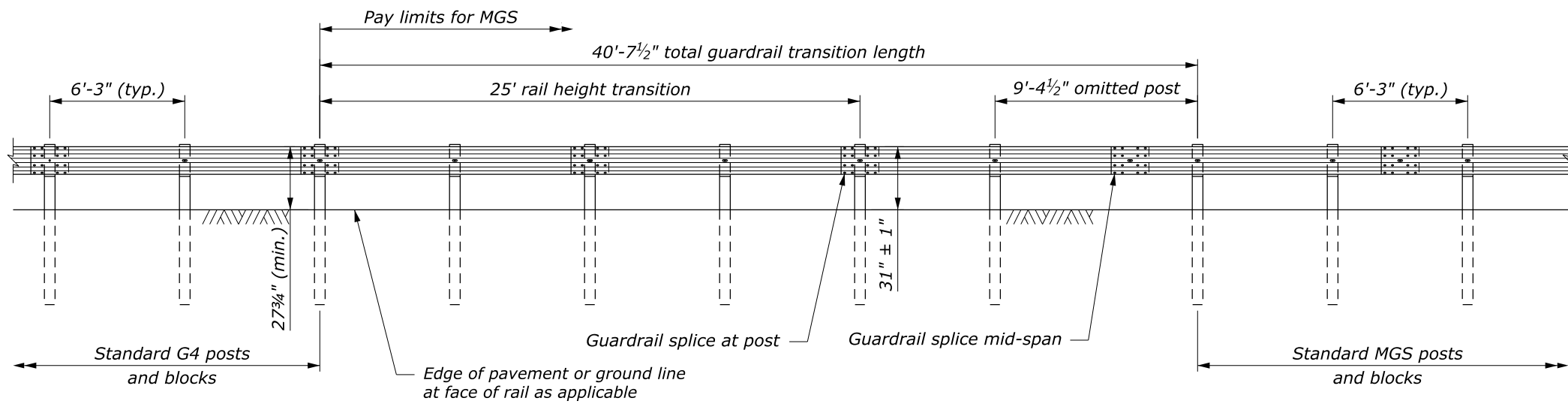
**BLOCK**  
See Note 2

This drawing contains **Metric** units of measure.  
Dimensions without units are millimeters.

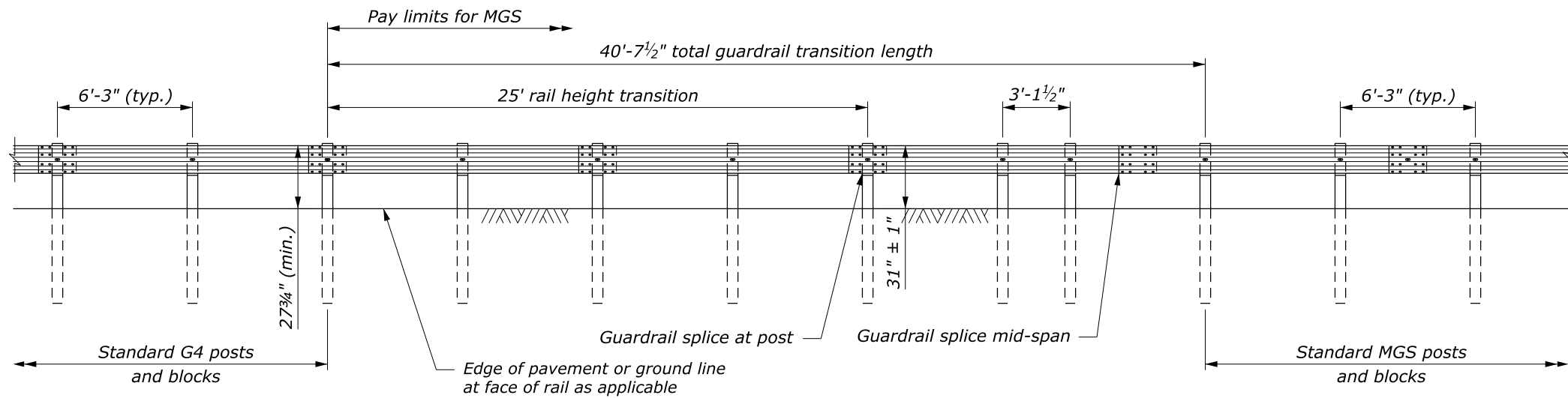
NO SCALE

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|--|----------------------------|
| U.S. DEPARTMENT OF TRANSPORTATION, FHWA<br>OFFICE OF FEDERAL LANDS HIGHWAY | FLH STANDARD<br>M617-38    |
| <b>MGS W-BEAM GUARDRAIL<br/>STEEL POSTS<br/>ATTACHED TO BOX CULVERT</b>    | SPECIFICATION<br>FP-14     |
|  | APPROVED FOR USE<br>1/2024 |

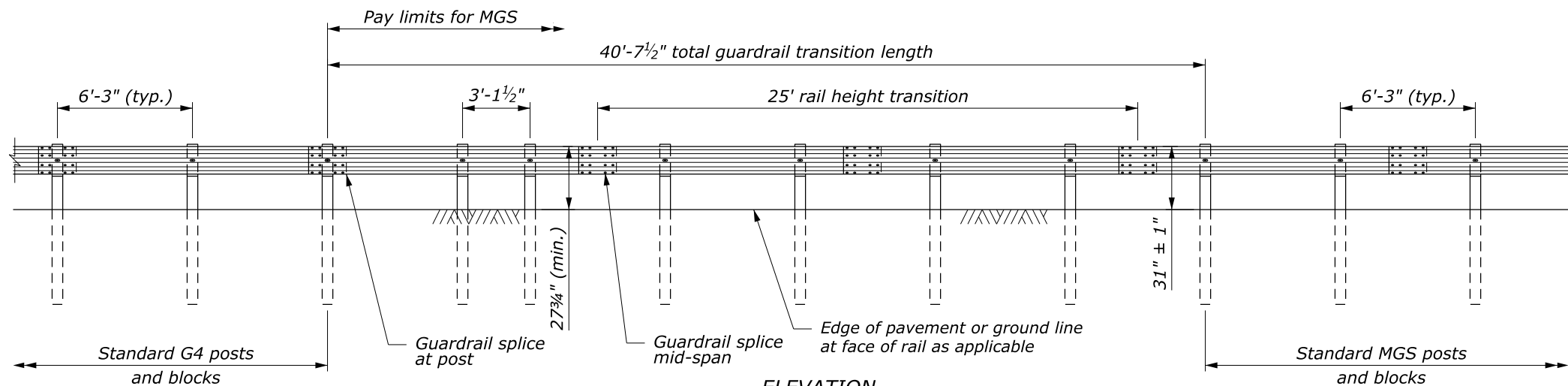
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ELEVATION  
**OMITTED POST OPTION**



ELEVATION  
**HALF-POST SPACING IN MGS OPTION**



ELEVATION  
**HALF-POST SPACING IN G4 OPTION**

**NOTE:**

1. Unless otherwise specified, use any of the options shown as required to meet project-specific conditions.
2. Use consistent guardrail post material throughout the length of the guardrail run.
3. If applicable, conversion of the 8-inch wide G4 blackout to the 12-inch wide MGS blackout may occur anywhere within the length of the G4 to MGS transition shown on this sheet.
4. See Standards 617-10, 617-11, 617-31, or 617-32 for other assembly details.

NO SCALE

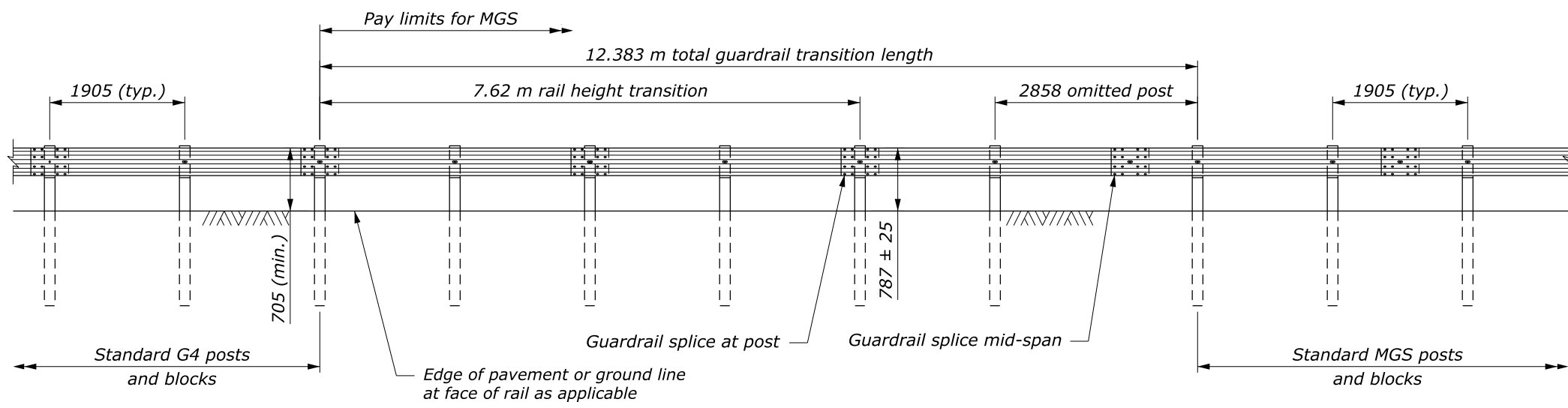
U.S. DEPARTMENT OF TRANSPORTATION, FHWA  
OFFICE OF FEDERAL LANDS HIGHWAY

FLH STANDARD  
**617-39**

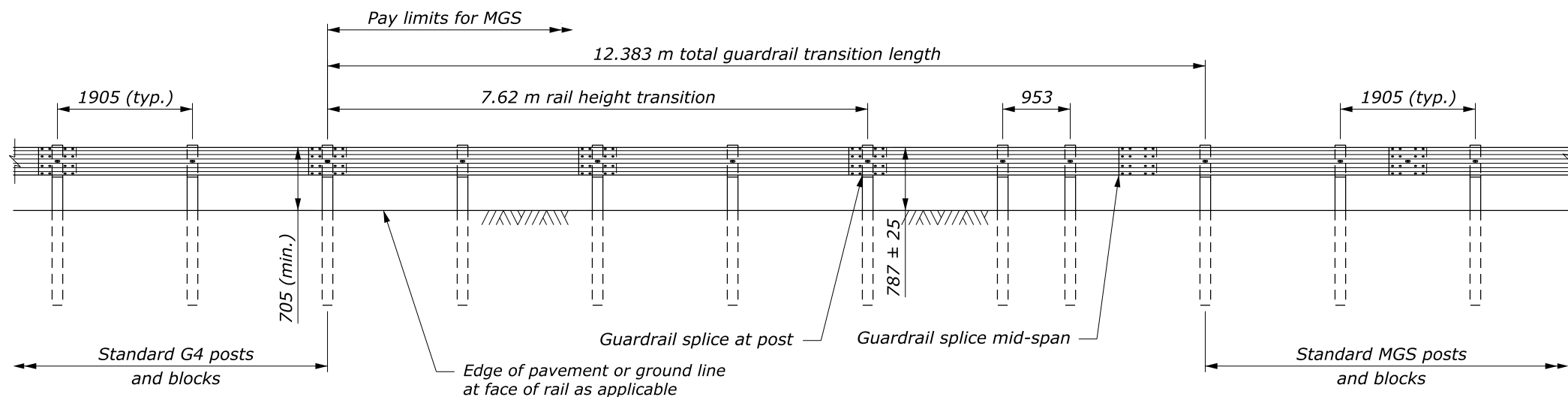
**G4 TO MGS  
W-BEAM GUARDRAIL  
TRANSITION**

SPECIFICATION  
FP-14

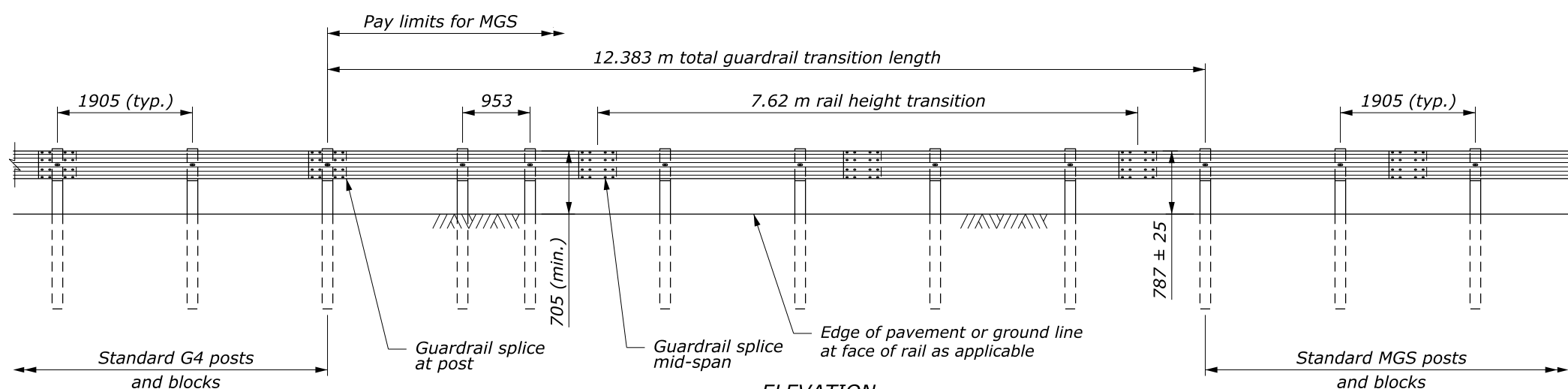
APPROVED FOR USE  
1/2024



ELEVATION  
**OMITTED POST OPTION**



ELEVATION  
**HALF-POST SPACING IN MGS OPTION**



ELEVATION  
**HALF-POST SPACING IN G4 OPTION**

**NOTE:**

1. Unless otherwise specified, use any of the options shown as required to meet project-specific conditions.
2. Use consistent guardrail post material throughout the length of the guardrail run.
3. If applicable, conversion of the 203 mm wide G4 blockout to the 305 mm wide MGS blockout may occur anywhere within the length of the G4 to MGS transition shown on this sheet.
4. See Standards M617-10, M617-11, M617-31, or M617-32 for other assembly details.

This drawing contains **Metric** units of measure.  
Dimensions without units are millimeters.

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| U.S. DEPARTMENT OF TRANSPORTATION, FHWA<br>OFFICE OF FEDERAL LANDS HIGHWAY | FLH STANDARD<br>M617-39    |
| <b>G4 TO MGS<br/>W-BEAM GUARDRAIL<br/>TRANSITION</b>                       | SPECIFICATION<br>FP-14     |
|  | APPROVED FOR USE<br>1/2024 |

NO SCALE

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