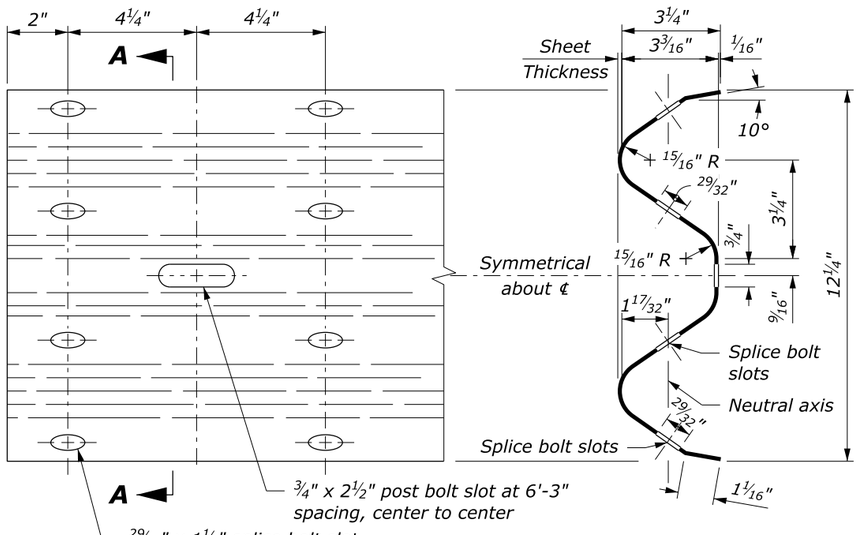
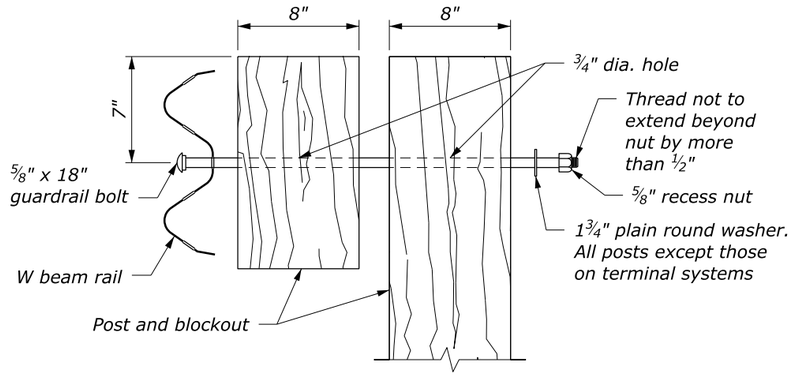
PROJECT	SHEET NUMBER



RAIL ELEVATION

SECTION A-A

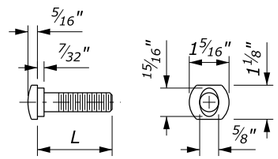
W BEAM RAIL



POST BOLT ASSEMBLY

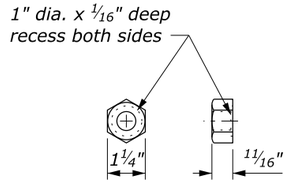
NOTE:

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 ⅜" 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.



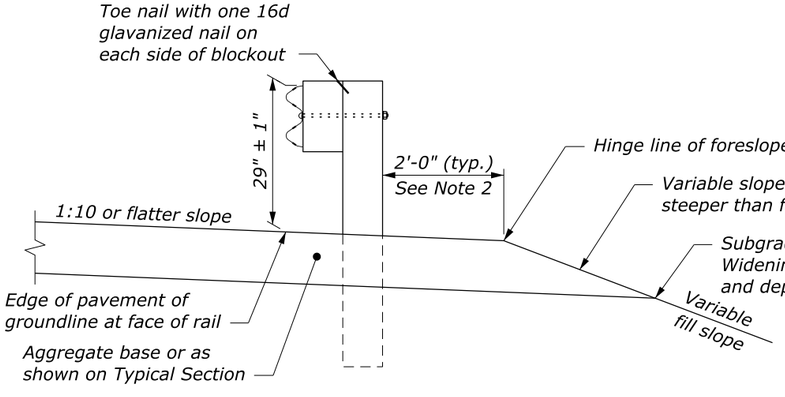
⅝" GUARDRAIL BOLT

L	Thread Length
1¼"	1⅛" minimum
2"	1¾" minimum
10"	4" minimum
18"	4" minimum
25"	4" minimum

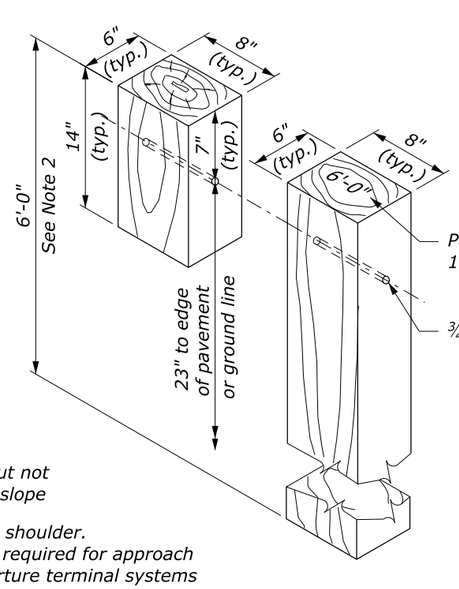


⅝" RECESS NUT

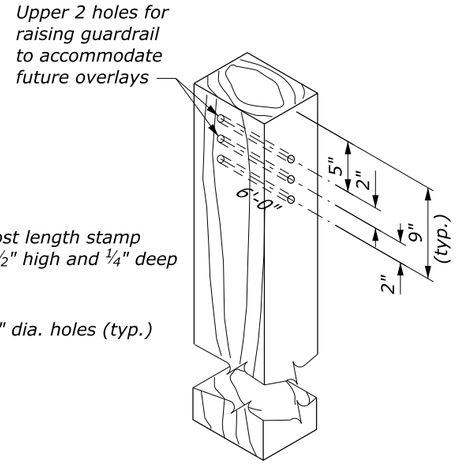
GUARDRAIL BOLT AND RECESS NUT



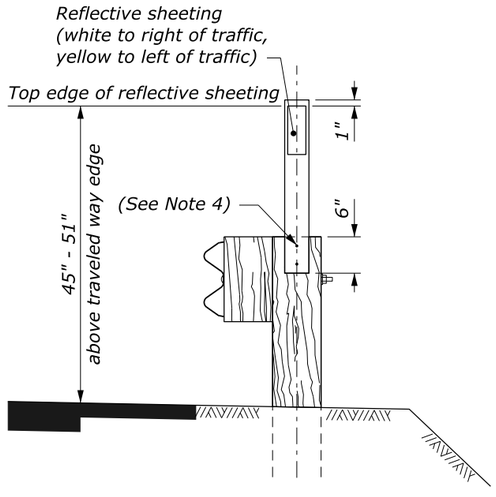
TYPICAL GUARDRAIL CROSS SECTION



STANDARD HOLE ARRANGEMENT POST AND BLOCKOUT DETAIL

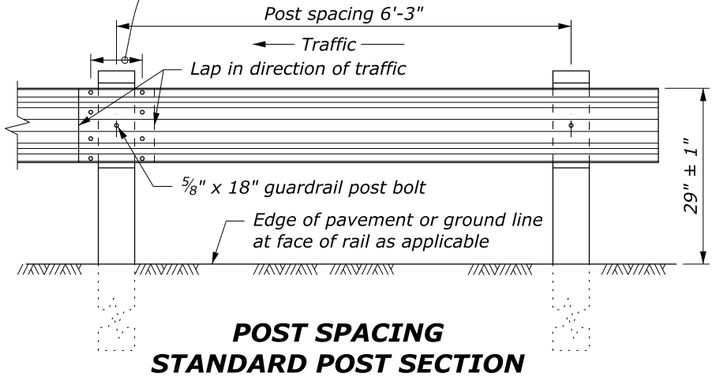


ALTERNATE HOLE ARRANGEMENT POST AND BLOCKOUT DETAIL



FLEXIBLE GUIDE POST GUARDRAIL MOUNT

POST SPACING STANDARD POST SECTION



NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION, FHWA OFFICE OF FEDERAL LANDS HIGHWAY	FLH STANDARD 617-10
G4 W-BEAM GUARDRAIL WOOD POSTS	SPECIFICATION FP-24
	APPROVED FOR USE 1/2024

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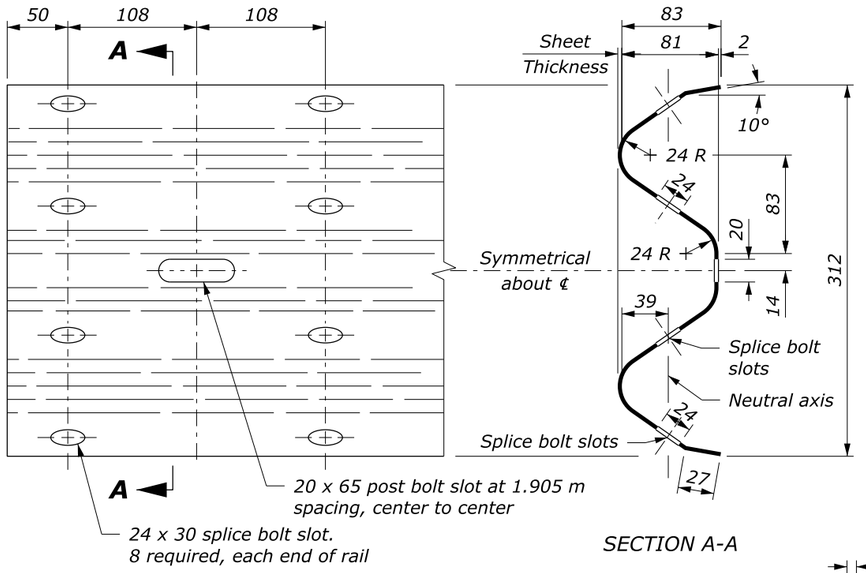
15 July 2024 3:22 PM

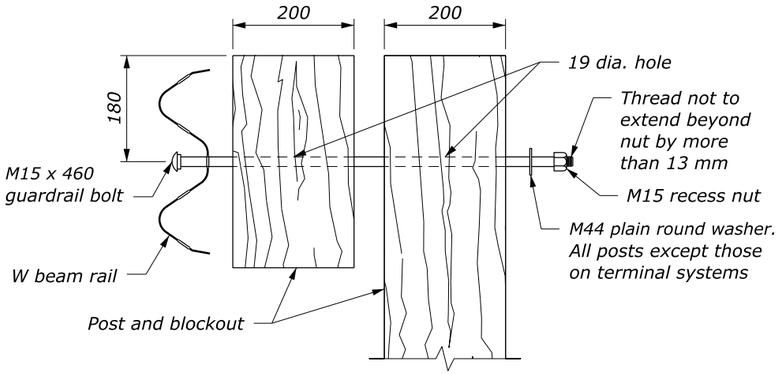
PROJECT	SHEET NUMBER



RAIL ELEVATION

SECTION A-A

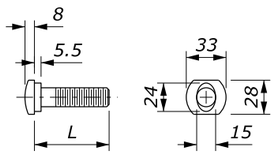
W BEAM RAIL



POST BOLT ASSEMBLY

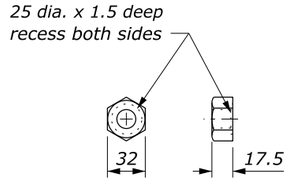
NOTE:

1. When encountering impenetrable material, see Standard M617-13.
2. See Special Contract Requirements when 2 m 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 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.
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.
6. Furnish hardware in the metric sizes shown. Equivalent US Customary sizes may be used when metric sizes are unavailable.



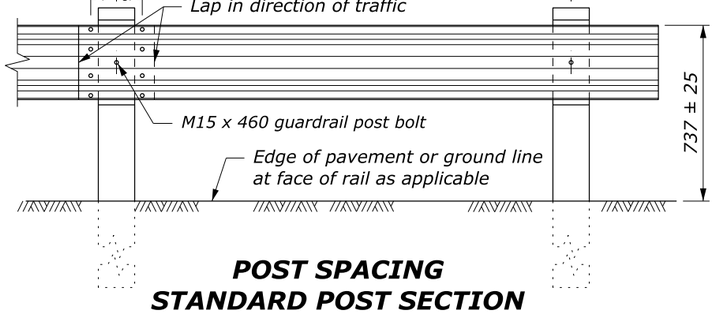
M15 GUARDRAIL BOLT

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

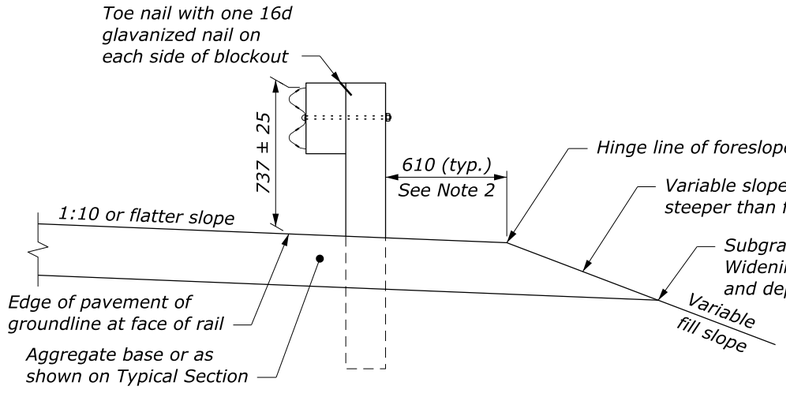


M15 RECESS NUT

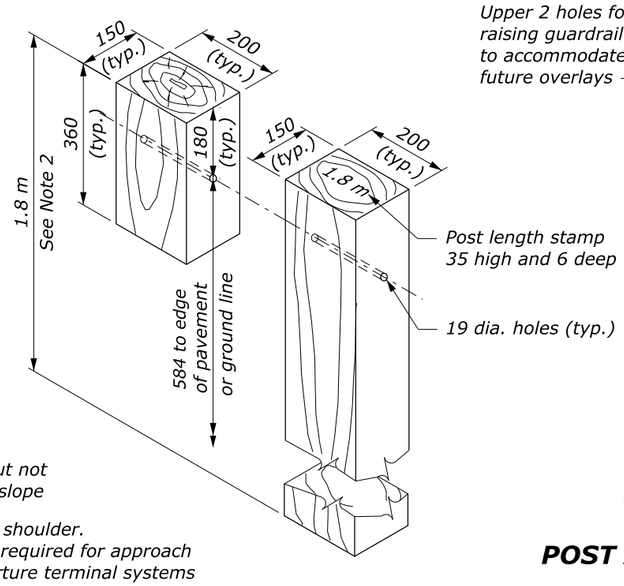
GUARDRAIL BOLT AND RECESS NUT



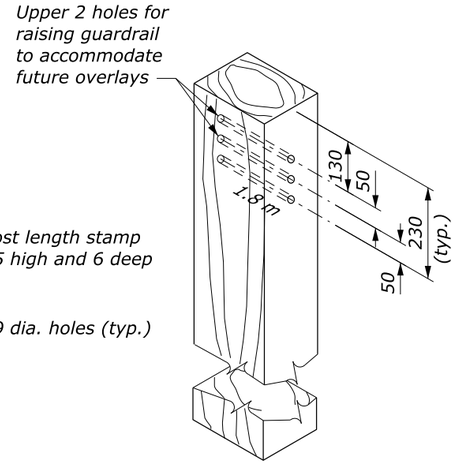
POST SPACING
STANDARD POST SECTION



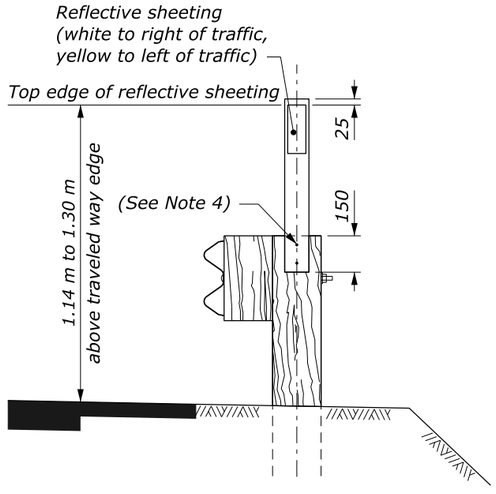
TYPICAL GUARDRAIL CROSS SECTION



STANDARD HOLE ARRANGEMENT
POST AND BLOCKOUT DETAIL



ALTERNATE HOLE ARRANGEMENT
POST AND BLOCKOUT DETAIL



FLEXIBLE GUIDE POST GUARDRAIL MOUNT

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

NO SCALE

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

G4 W-BEAM GUARDRAIL WOOD POSTS

FLH STANDARD
M617-10
SPECIFICATION
FP-24
APPROVED FOR USE
1/2024

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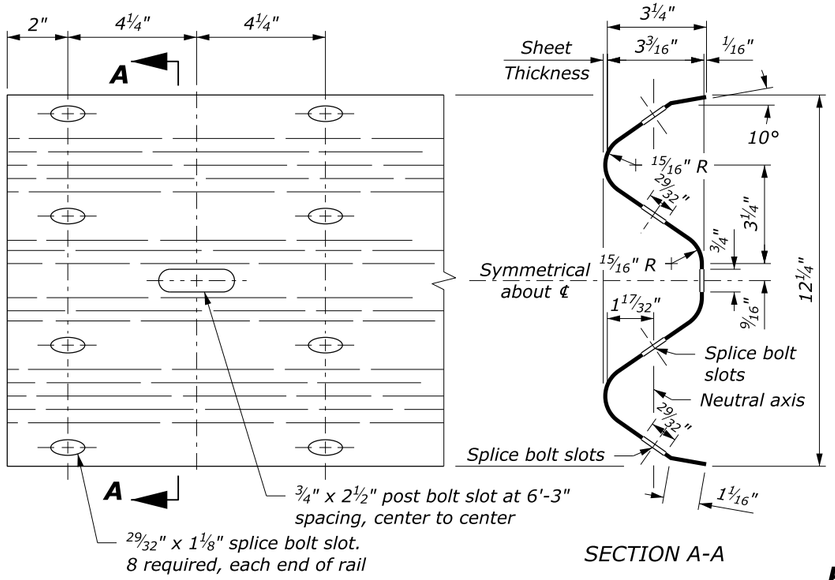
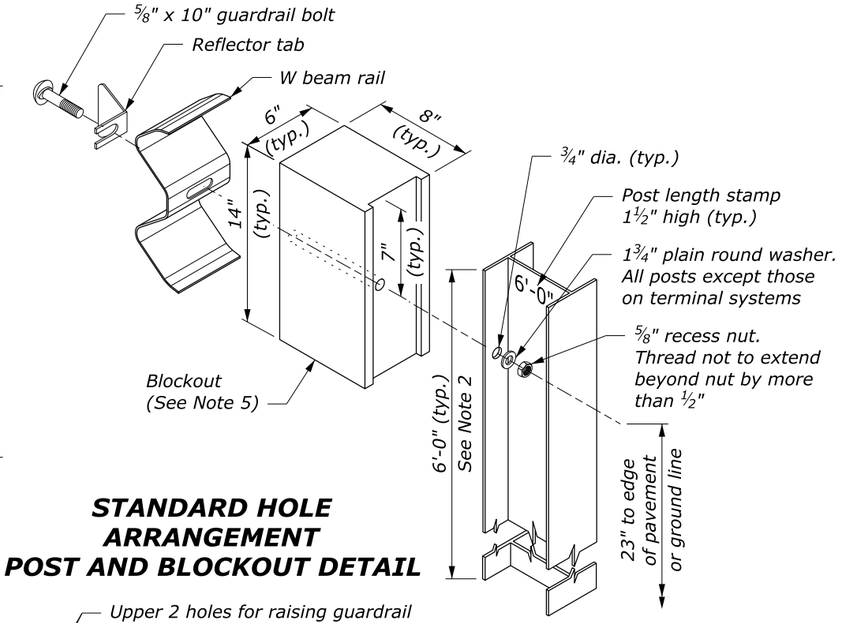
15 July 2024 3:13 PM

PROJECT	SHEET NUMBER



RAIL ELEVATION

SECTION A-A

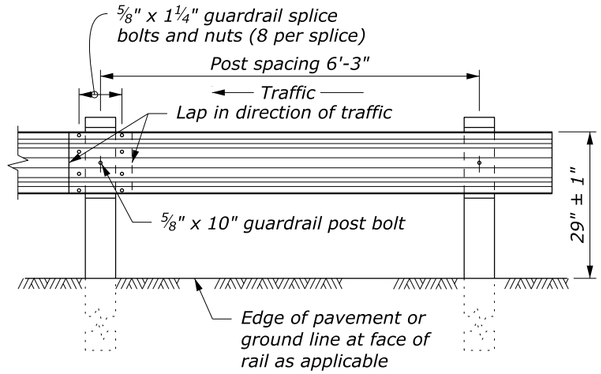


STANDARD HOLE ARRANGEMENT POST AND BLOCKOUT DETAIL

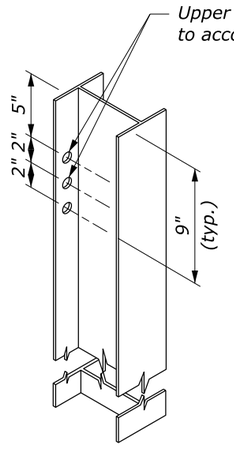
NOTE:

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 galvanized 2" x ⅜" 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.
5. Blockout may be wood, plastic, or composite material. Use consistent material throughout the length of guardrail run.
6. 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.

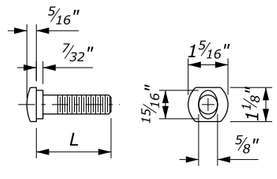
W BEAM RAIL



POST SPACING STANDARD POST SECTION

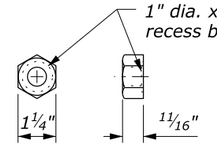


ALTERNATE HOLE ARRANGEMENT POST AND BLOCKOUT DETAIL



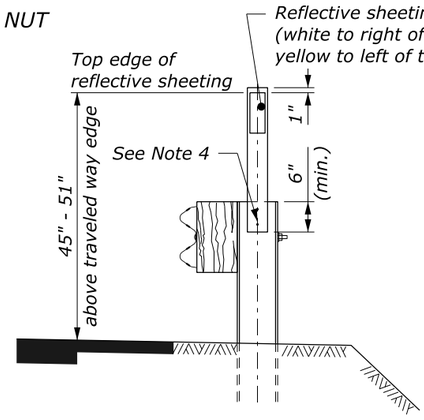
⅝" GUARDRAIL BOLT

L	Thread Length
1¼"	1⅛" minimum
2"	1¾" minimum
10"	4" minimum
18"	4" minimum
25"	4" minimum

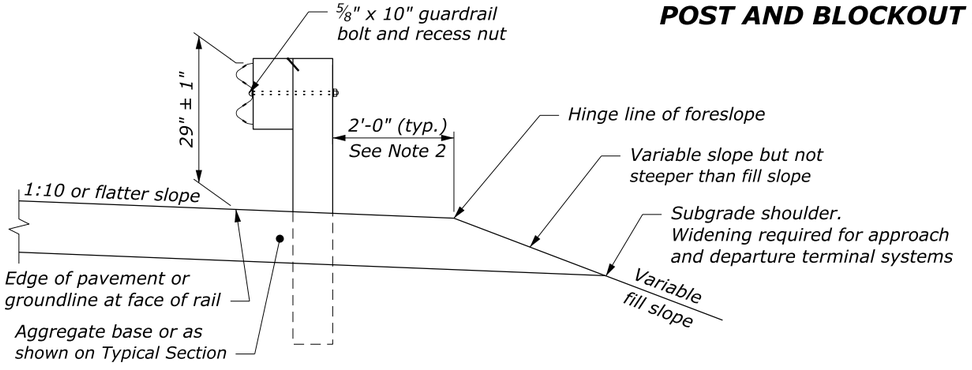


⅝" RECESS NUT

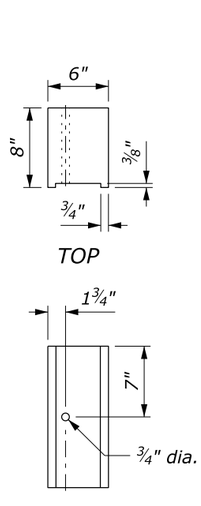
GUARDRAIL BOLT AND RECESS NUT



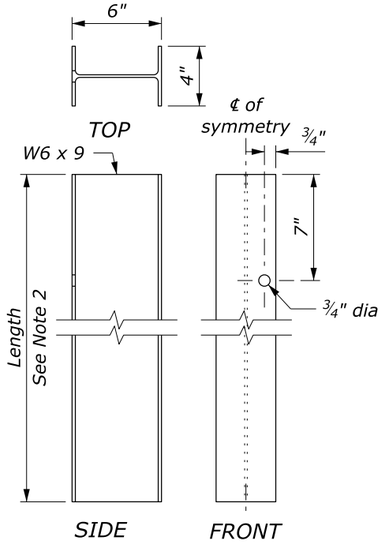
FLEXIBLE GUIDE POST GUIDRAIL MOUNT



TYPICAL GUARDRAIL CROSS SECTION



BLOCKOUT

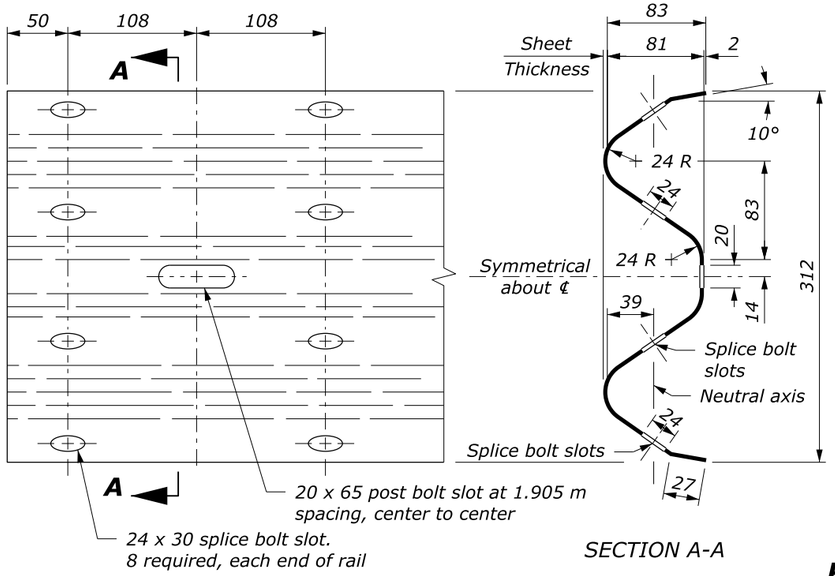


STRUCTURAL SHAPE POST (STANDARD HOLE ARRANGEMENT)

NO SCALE

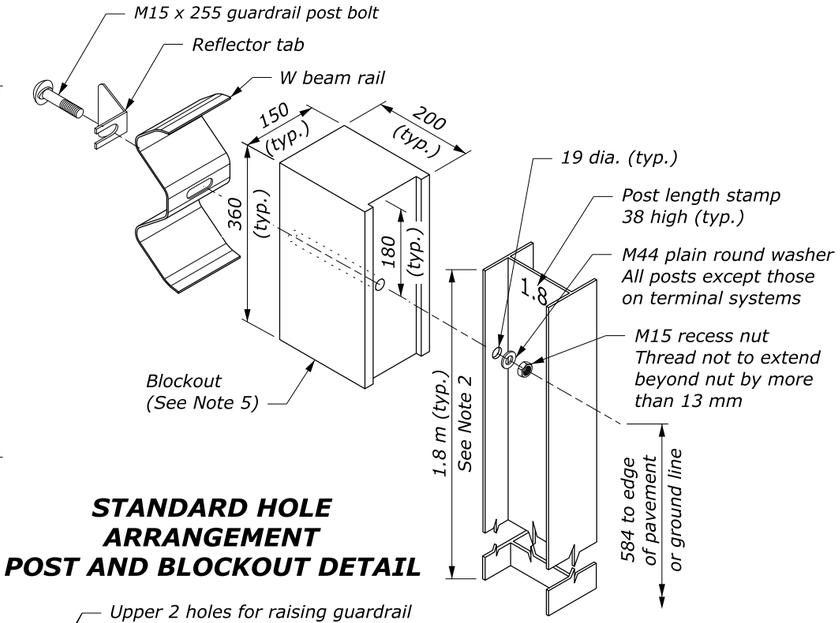
U.S. DEPARTMENT OF TRANSPORTATION, FHWA OFFICE OF FEDERAL LANDS HIGHWAY	FLH STANDARD 617-11
G4 W-BEAM GUARDRAIL STEEL POSTS	SPECIFICATION FP-24
	APPROVED FOR USE 1/2024

PROJECT	SHEET NUMBER



RAIL ELEVATION

SECTION A-A

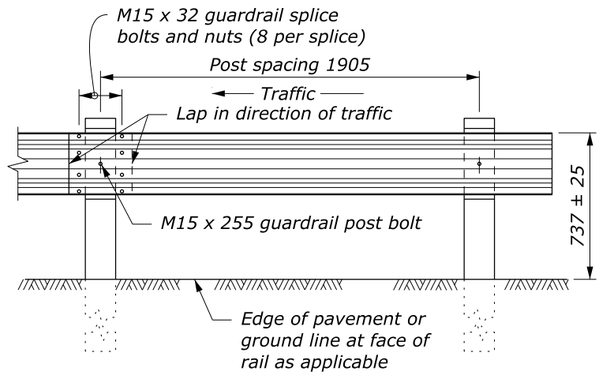


STANDARD HOLE ARRANGEMENT POST AND BLOCKOUT DETAIL

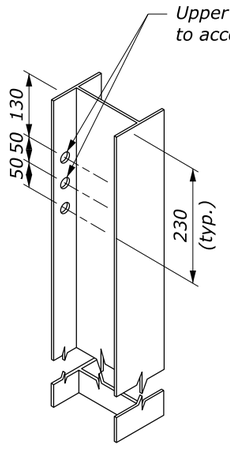
NOTE:

1. When encountering impenetrable material, see Standard M617-13.
2. See Special Contract Requirements when 2 m 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 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.
5. Blockout may be wood, plastic, or composite material. Use consistent material throughout the length of guardrail run.
6. 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.
7. Furnish hardware in the metric sizes shown. Equivalent US Customary sizes may be used when metric sizes are unavailable.

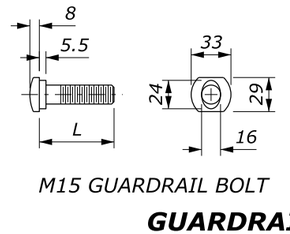
W BEAM RAIL



POST SPACING STANDARD POST SECTION

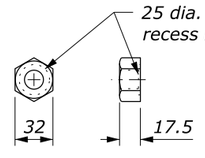


ALTERNATE HOLE ARRANGEMENT POST AND BLOCKOUT DETAIL



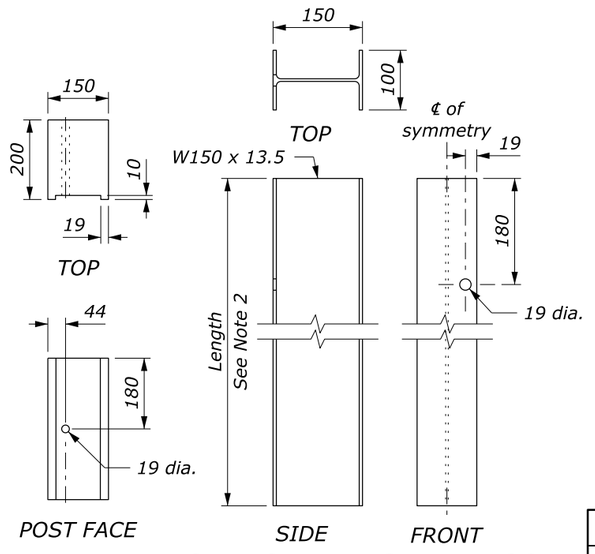
M15 GUARDRAIL BOLT

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



M15 RECESS NUT

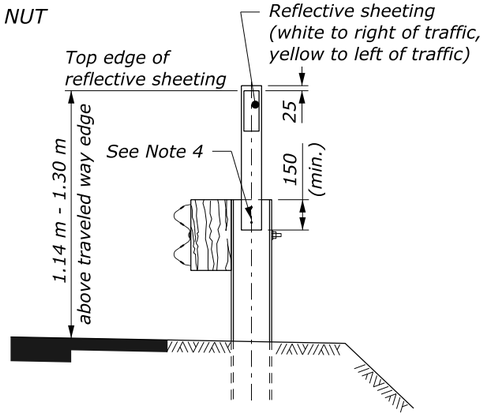
GUARDRAIL BOLT AND RECESS NUT



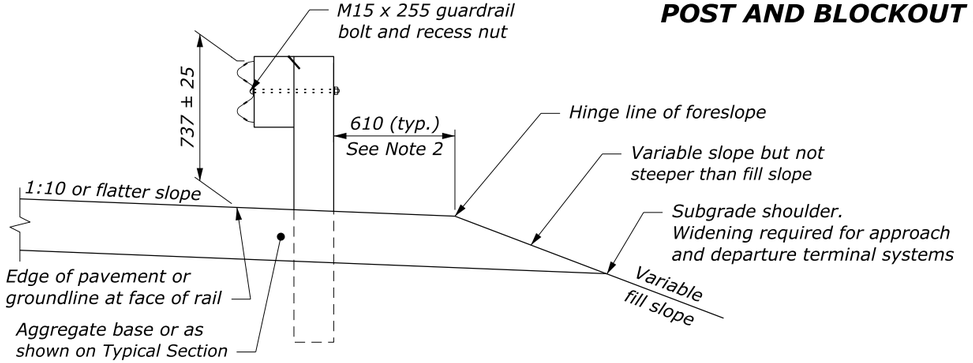
BLOCKOUT

STRUCTURAL SHAPE POST (STANDARD HOLE ARRANGEMENT)

NO SCALE



FLEXIBLE GUIDE POST GUARDRAIL MOUNT



TYPICAL GUARDRAIL CROSS SECTION

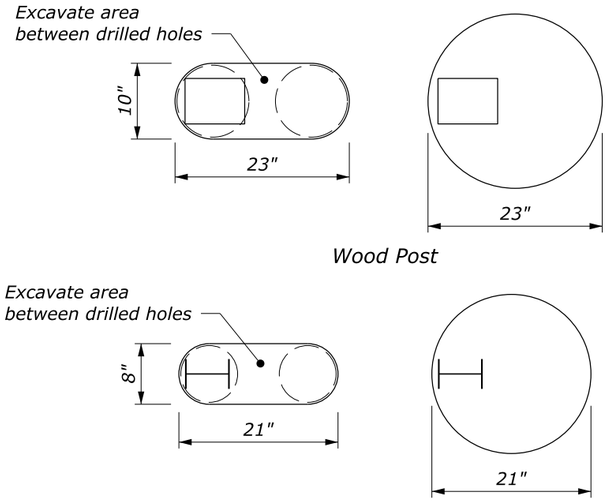
*This drawing contains **Metric** units of measure. Dimensions without units are millimeters.*

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

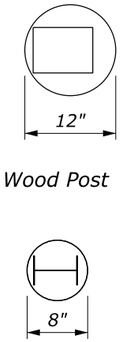
G4 W-BEAM GUARDRAIL STEEL POSTS

FLH STANDARD
M617-11
SPECIFICATION
FP-24
APPROVED FOR USE
1/2024

PROJECT	SHEET NUMBER



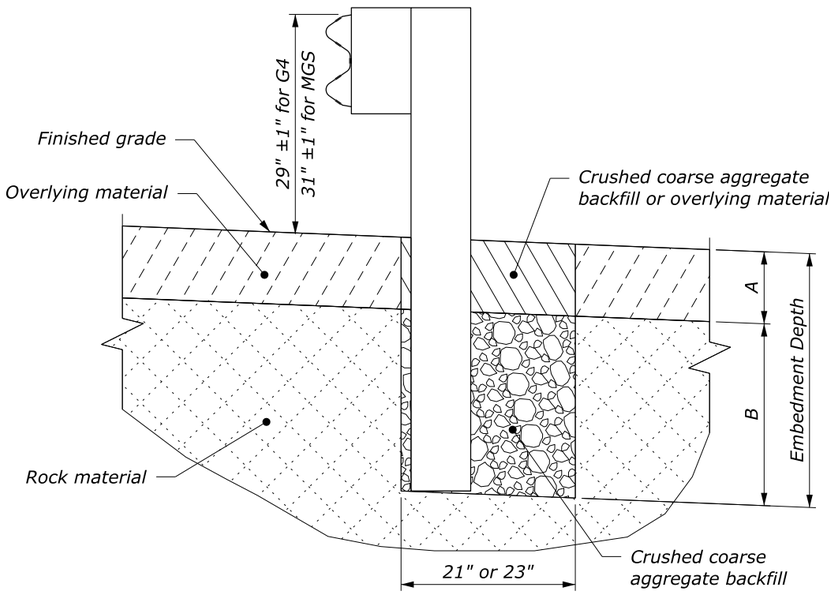
PLAN VIEW



PLAN VIEW

NOTE:

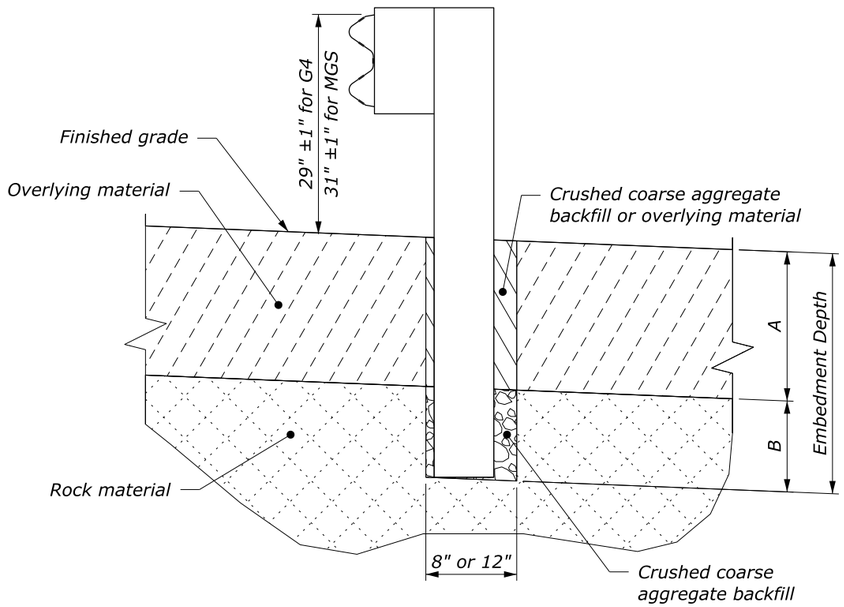
1. *Use this standard when posts cannot be embedded to the minimum depth shown on Standard 617-10, 617-11, 617-31 or 617-32.*
2. *Unless otherwise specified, use either the circular or the oblong hole configuration for Case 1 conditions.*
3. *Use crushed coarse aggregate conforming to Section 703 "Coarse 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

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



ELEVATION

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

NO SCALE

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

MGS AND G4 W-BEAM GUARDRAIL INSTALLATION IN ROCK

FLH STANDARD
617-13
SPECIFICATION
FP-24, FP-14
APPROVED FOR USE
1/2024

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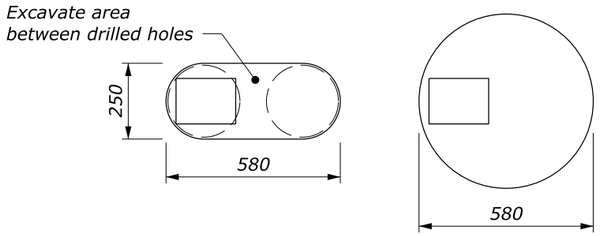
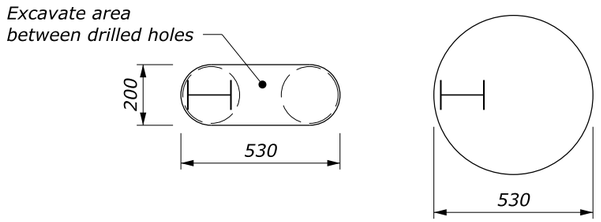
15 July 2024 1:36 PM

PROJECT	SHEET NUMBER

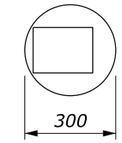


Wood Post

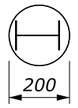


Steel Post

PLAN VIEW



Wood Post

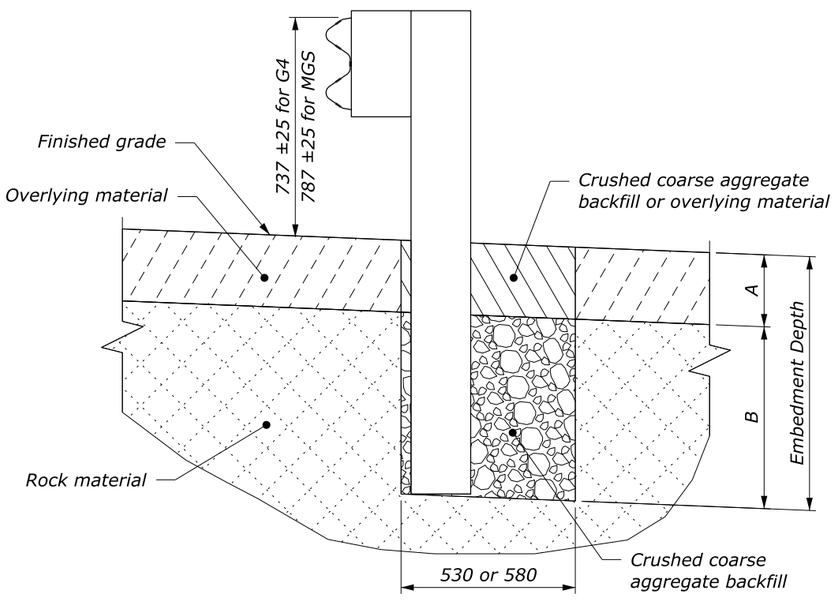


Steel Post

PLAN VIEW

NOTE:

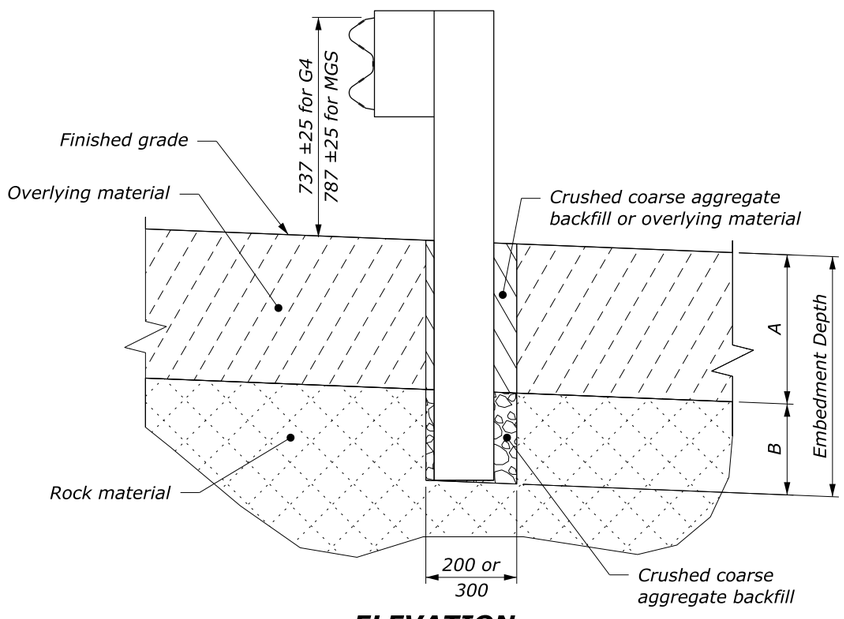
1. *Use this standard when posts cannot be embedded to the minimum depth shown on Standard M617-10, M617-11, M617-31 or M617-32.*
2. *Unless otherwise specified, use either the circular or the oblong hole configuration for Case 1 conditions.*
3. *Use crushed coarse aggregate conforming to Section 703 "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.*



ELEVATION

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

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



ELEVATION

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

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

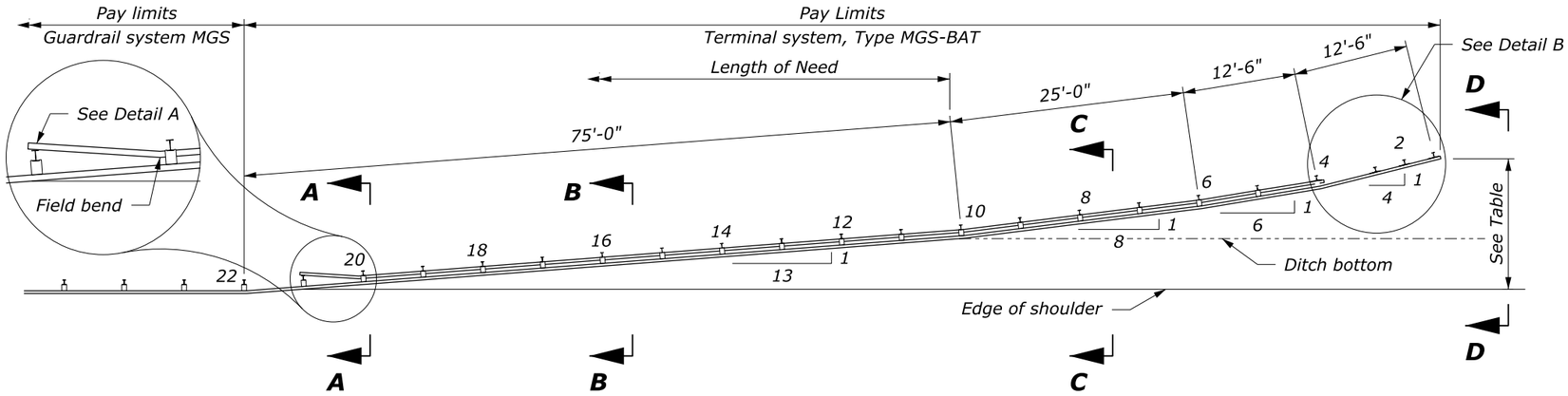
NO SCALE

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

MGS AND G4 W-BEAM GUARDRAIL INSTALLATION IN ROCK

FLH STANDARD
M617-13
SPECIFICATION
FP-24, FP-14
APPROVED FOR USE
1/2024

PROJECT	SHEET NUMBER

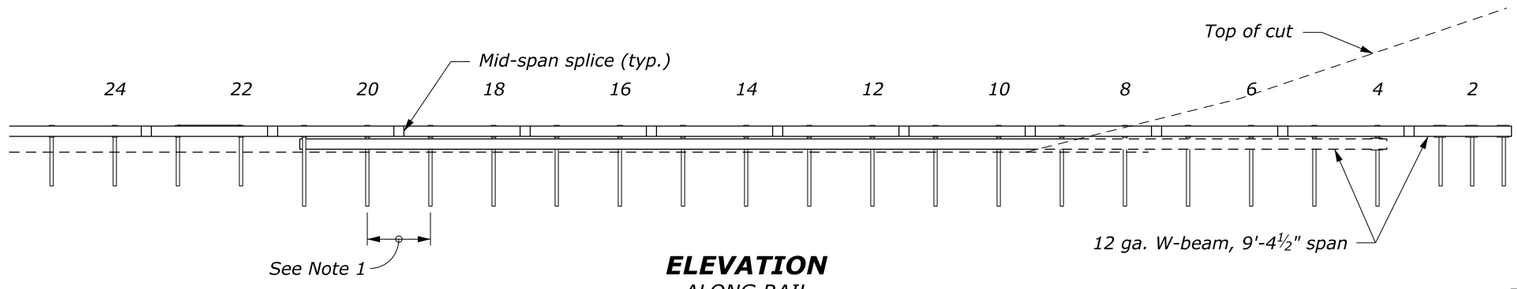


PLAN

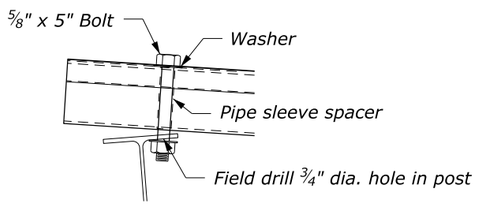
NOTE:

1. Typical post spacing is 6'-3" unless otherwise noted.
2. See Standard 617-31 (wood posts) and 617-32 (steel posts) for other details.

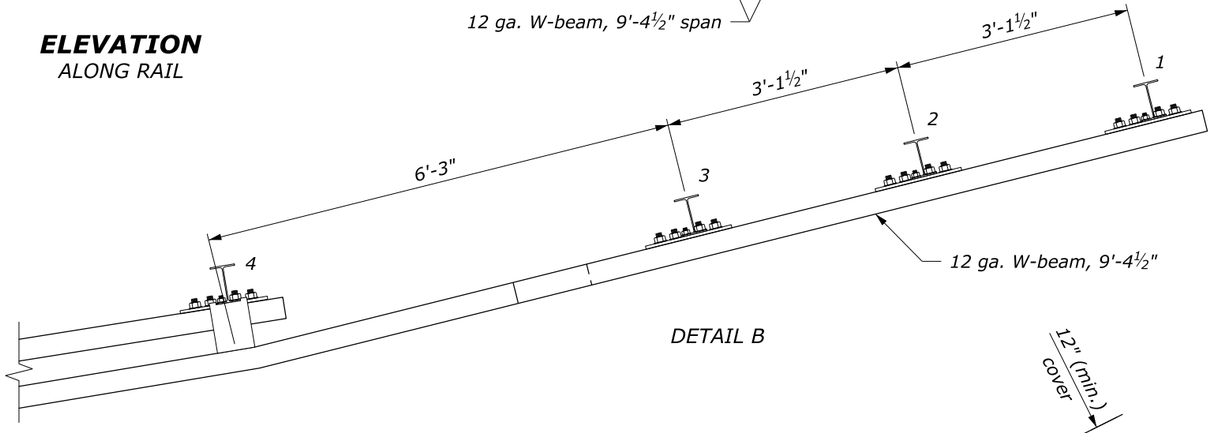
POST OFFSETS FROM EDGE OF SHOULDER	
POST	DISTANCE
1	13'-11¾"
4	10'-11"
6	8'-10¼"
10	5'-9"



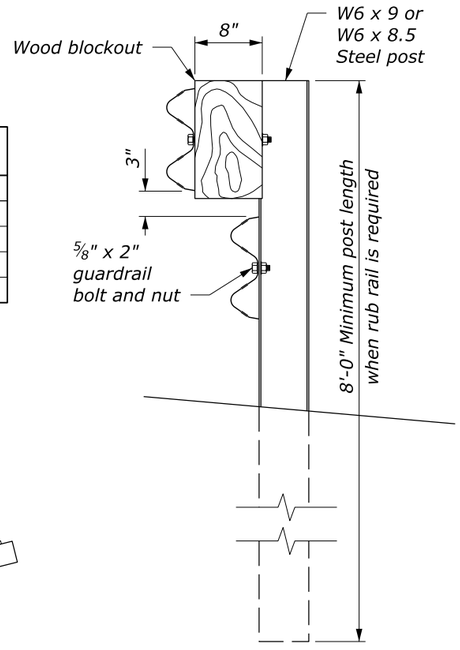
ELEVATION
ALONG RAIL



DETAIL A

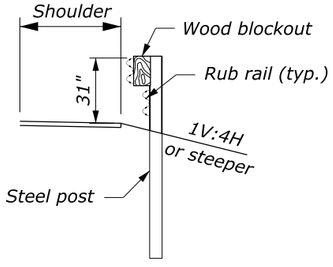


DETAIL B

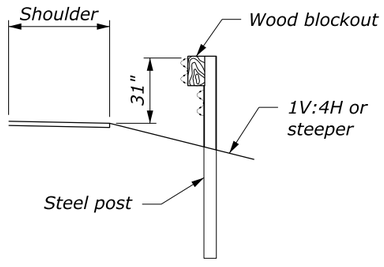


ELEVATION

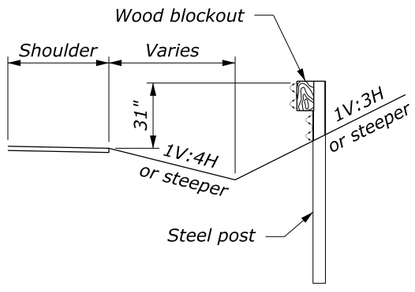
STEEL POST AND BLOCKOUT DETAIL



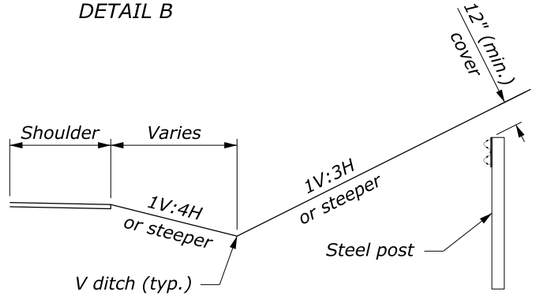
SECTION A-A



SECTION B-B



SECTION C-C

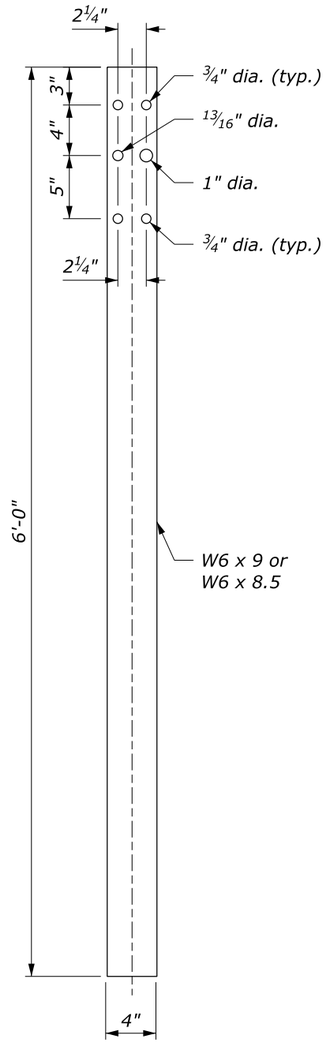


SECTION D-D

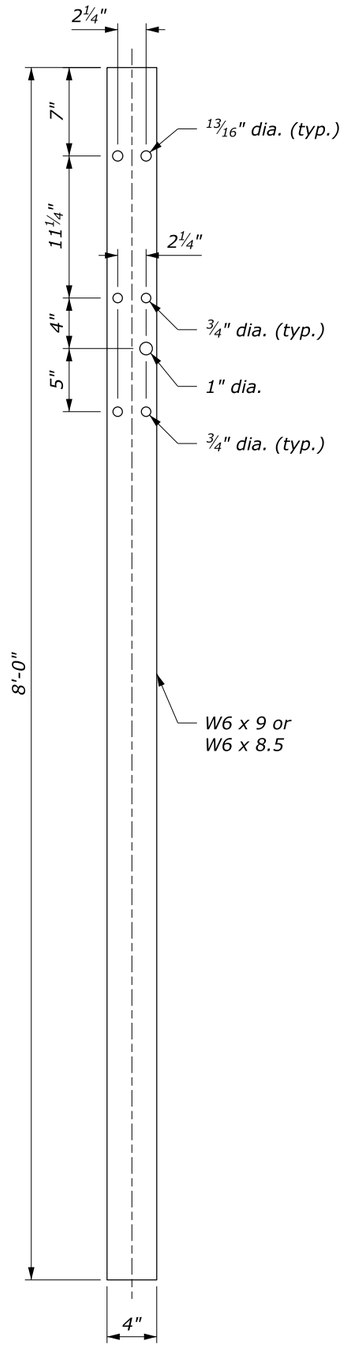
NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION, FHWA OFFICE OF FEDERAL LANDS HIGHWAY	FLH STANDARD 617-18
MGS W-BEAM GUARDRAIL BACK SLOPE ANCHOR TERMINAL TYPE MGS-BAT Sheet 1 of 2	SPECIFICATION FP-24
	APPROVED FOR USE 2/2024

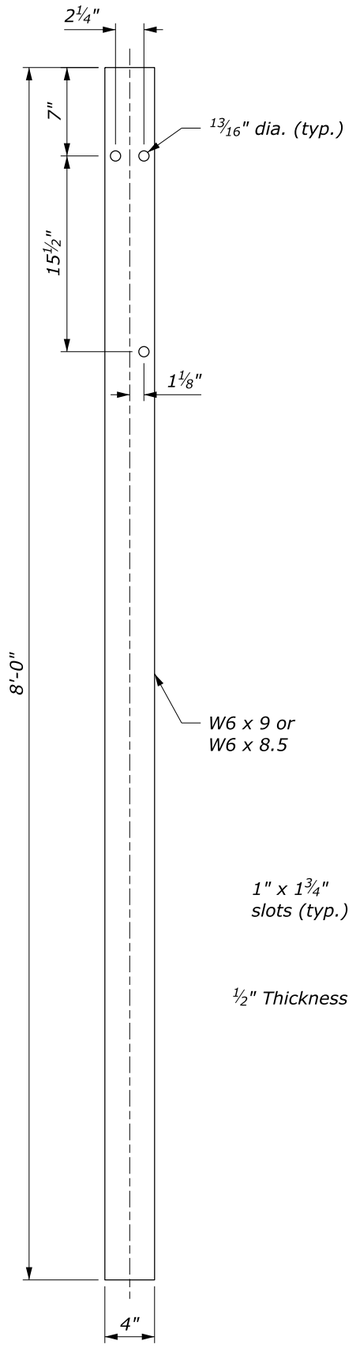
PROJECT	SHEET NUMBER



POSTS 1-3



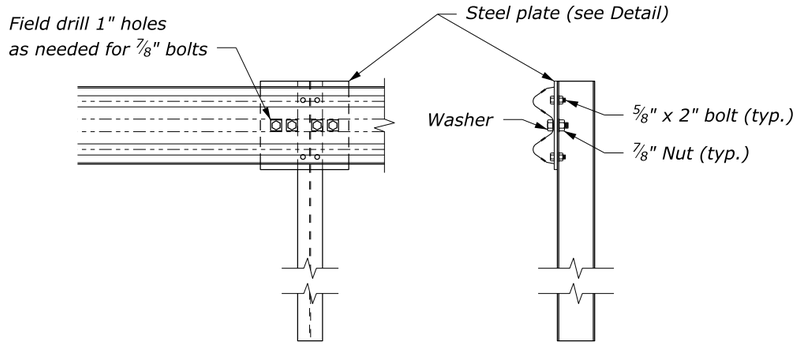
POST 4



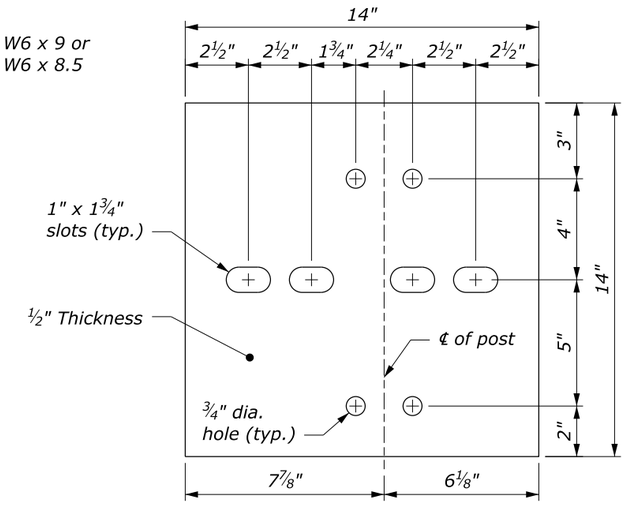
POSTS 5-21

NOTE:

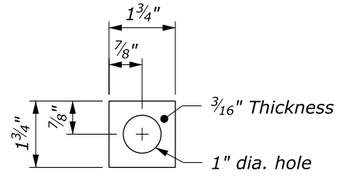
1. See Sheet 1 of 2 for terminal layout.
2. Use zinc rich paint to coat field drilled holes.
3. Anchor plate and hardware are typical on top rail of Posts 1 -3 and rub rail at Post 4.



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



GALVANIZED STEEL PLATE



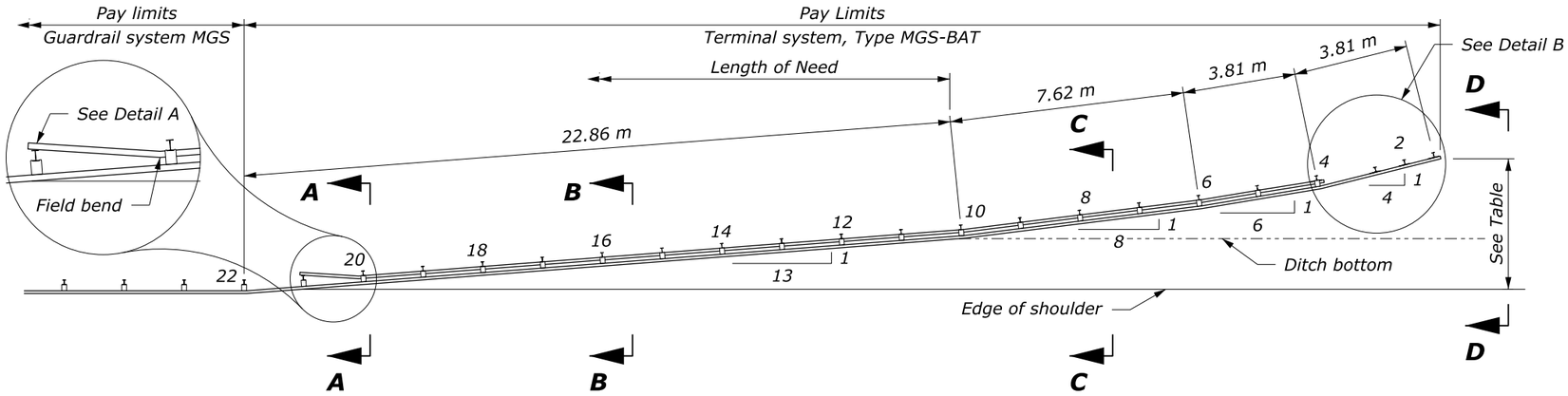
GALVANIZED SQUARE WASHER

STEEL PLATE AND WASHER
See Note 3

NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION, FHWA OFFICE OF FEDERAL LANDS HIGHWAY	FLH STANDARD 617-18
MGS W-BEAM GUARDRAIL BACK SLOPE ANCHOR TERMINAL TYPE MGS-BAT Sheet 2 of 2	SPECIFICATION FP-24
	APPROVED FOR USE 2/2024

PROJECT	SHEET NUMBER

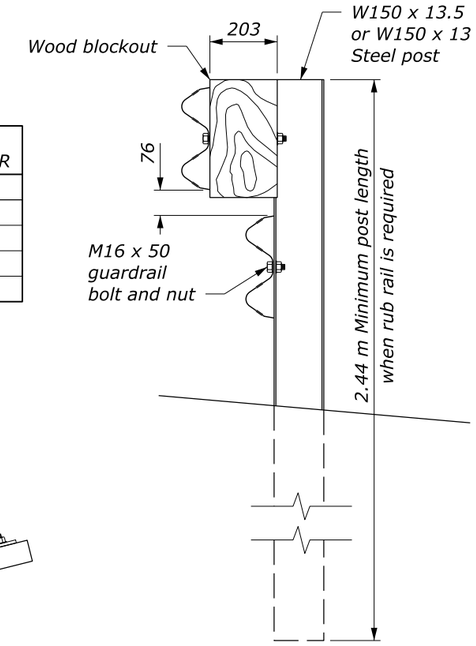


PLAN

NOTE:

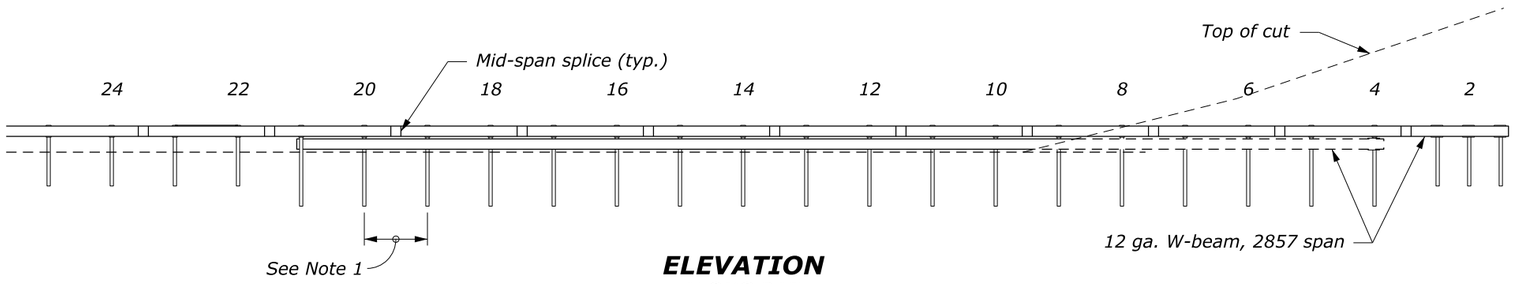
1. *Typical post spacing is 1.905 m unless otherwise noted.*
2. *See Standard M617-31 (wood posts) and M617-32 (steel posts) for other details.*

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

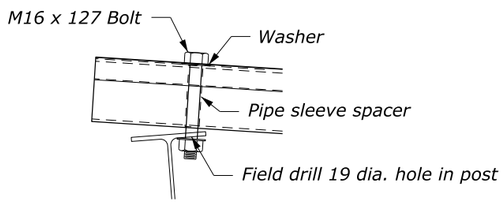


ELEVATION

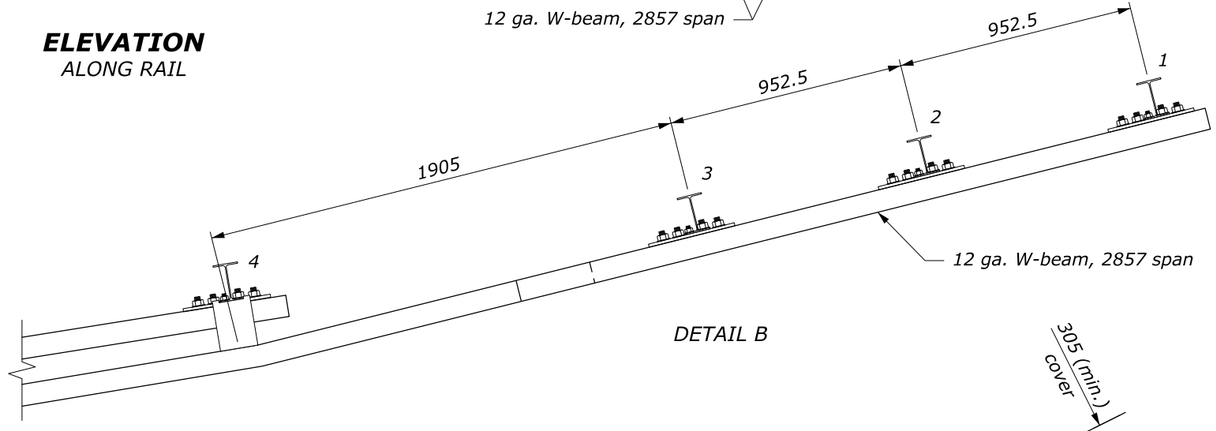
STEEL POST AND BLOCKOUT DETAIL



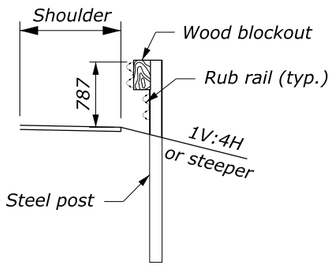
ELEVATION
ALONG RAIL



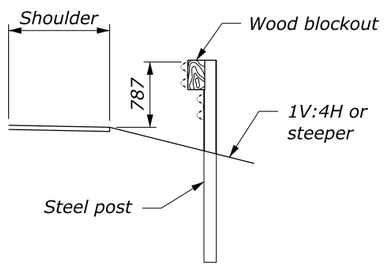
DETAIL A



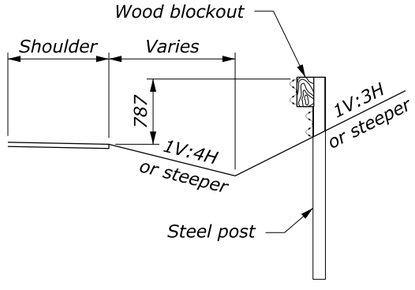
DETAIL B



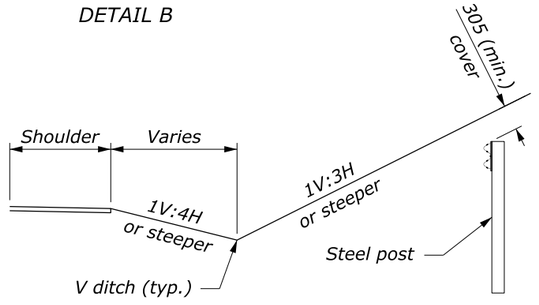
SECTION A-A



SECTION B-B



SECTION C-C



SECTION D-D

NO SCALE

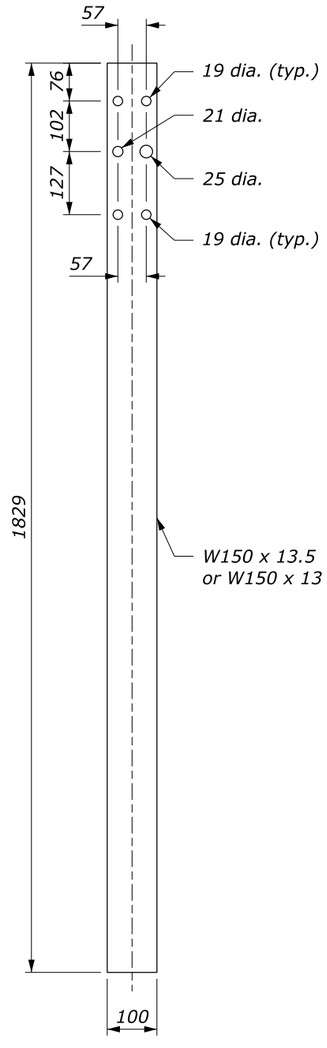
*This drawing contains **Metric** units of measure.*
Dimensions without units are millimeters.

U.S. DEPARTMENT OF TRANSPORTATION, FHWA OFFICE OF FEDERAL LANDS HIGHWAY	FLH STANDARD M617-18
MGS W-BEAM GUARDRAIL BACK SLOPE ANCHOR TERMINAL TYPE MGS-BAT Sheet 1 of 2	SPECIFICATION FP-24
	APPROVED FOR USE 2/2024

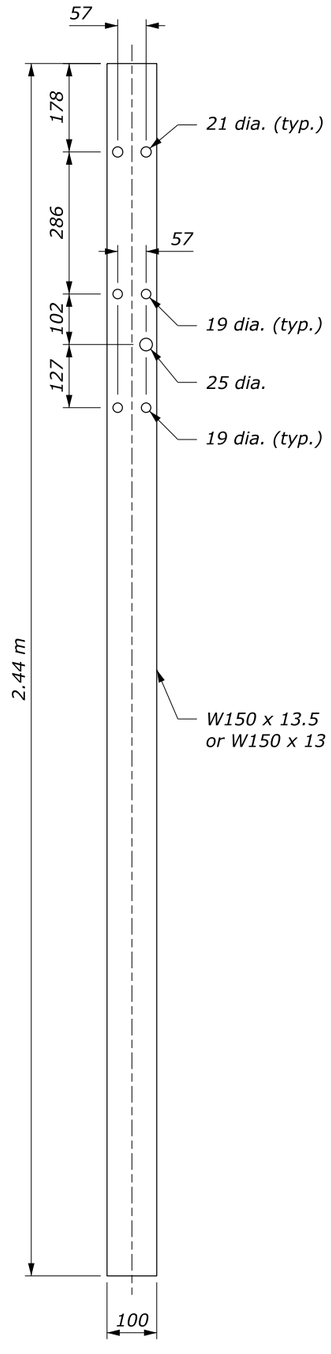
PROJECT	SHEET NUMBER

NOTE:

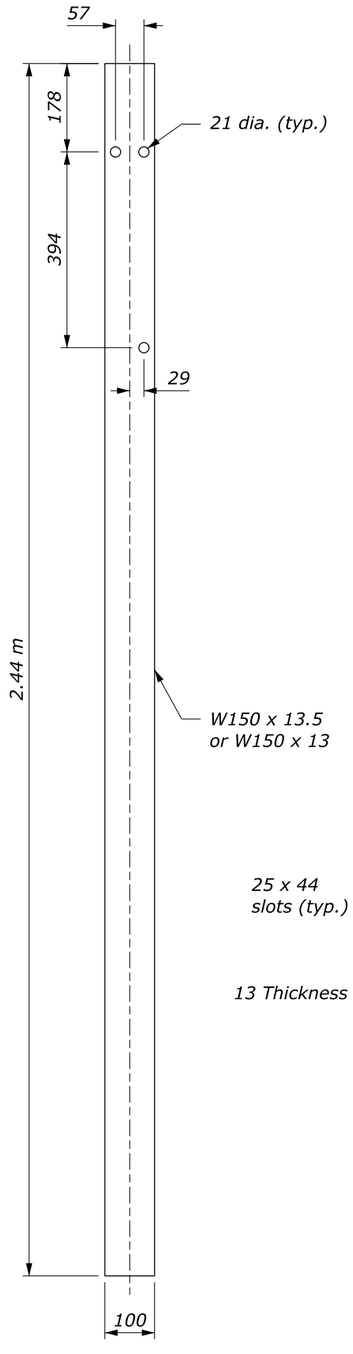
1. *See Sheet 1 of 2 for terminal layout.*
2. *Use zinc rich paint to coat field drilled holes.*
3. *Anchor plate and hardware are typical on top rail of Posts 1 -3 and rub rail at Post 4.*



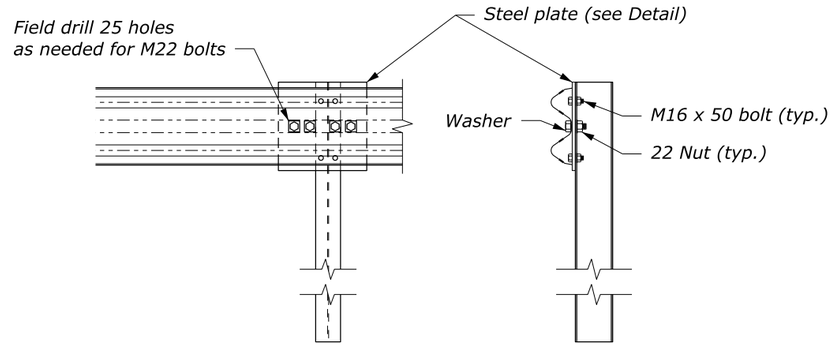
POSTS 1-3



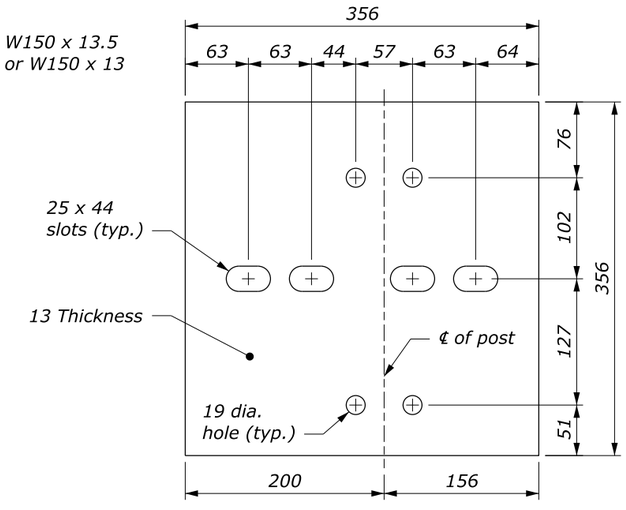
POST 4



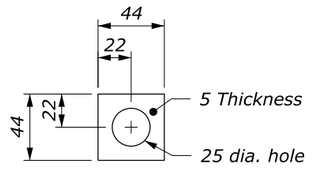
POSTS 5-21



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



GALVANIZED STEEL PLATE



GALVANIZED SQUARE WASHER

STEEL PLATE AND WASHER

See Note 3

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

NO SCALE

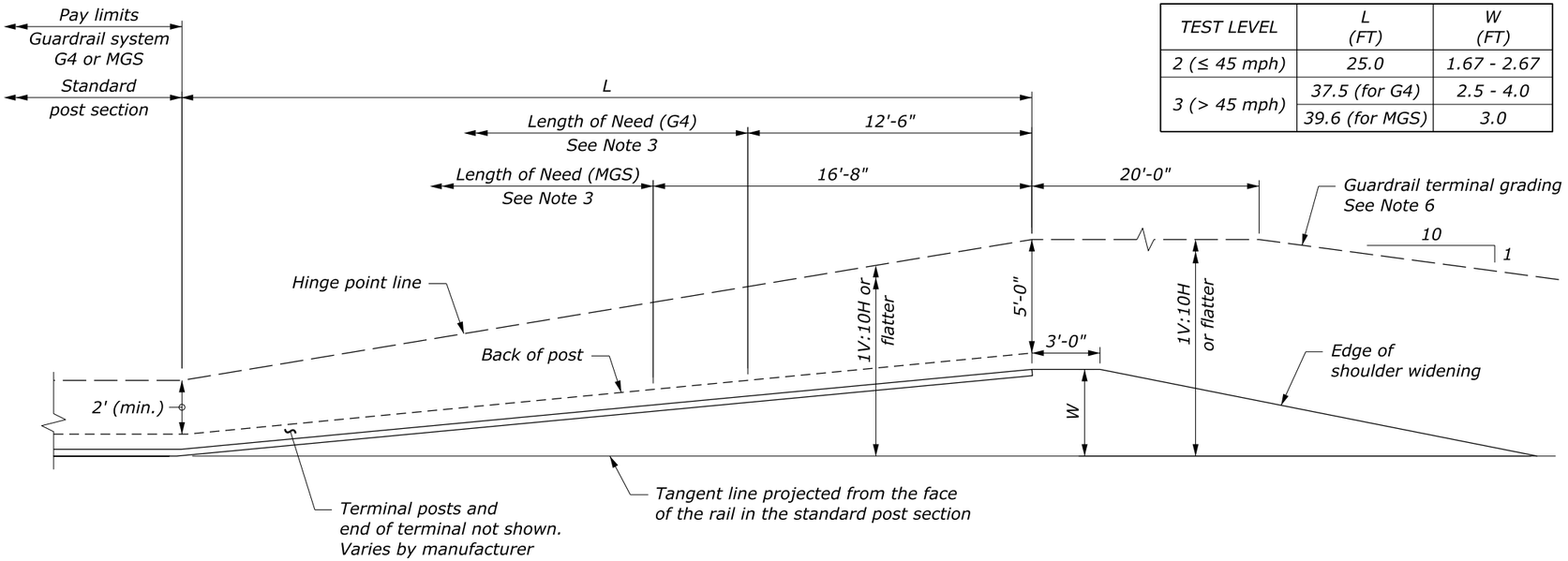
U.S. DEPARTMENT OF TRANSPORTATION, FHWA
OFFICE OF FEDERAL LANDS HIGHWAY

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

Sheet 2 of 2

FLH STANDARD
M617-18
SPECIFICATION
FP-24
APPROVED FOR USE
2/2024

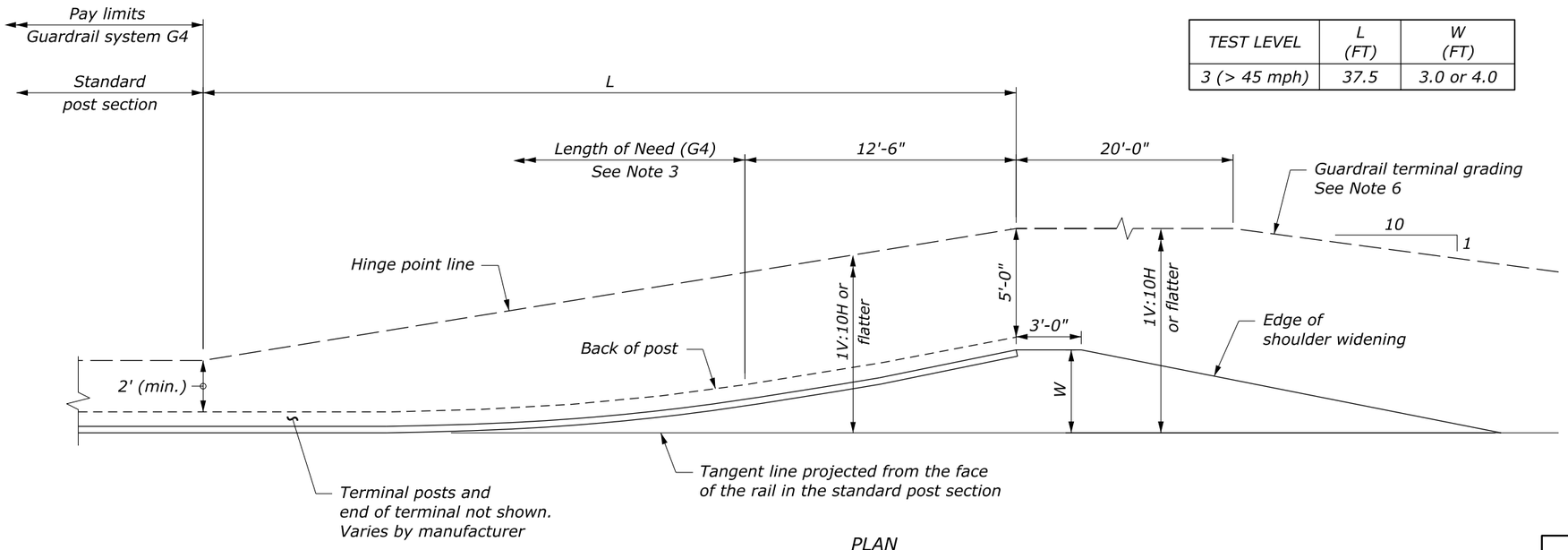
PROJECT	SHEET NUMBER



TEST LEVEL	L (FT)	W (FT)
2 (≤ 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

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

NOTE:

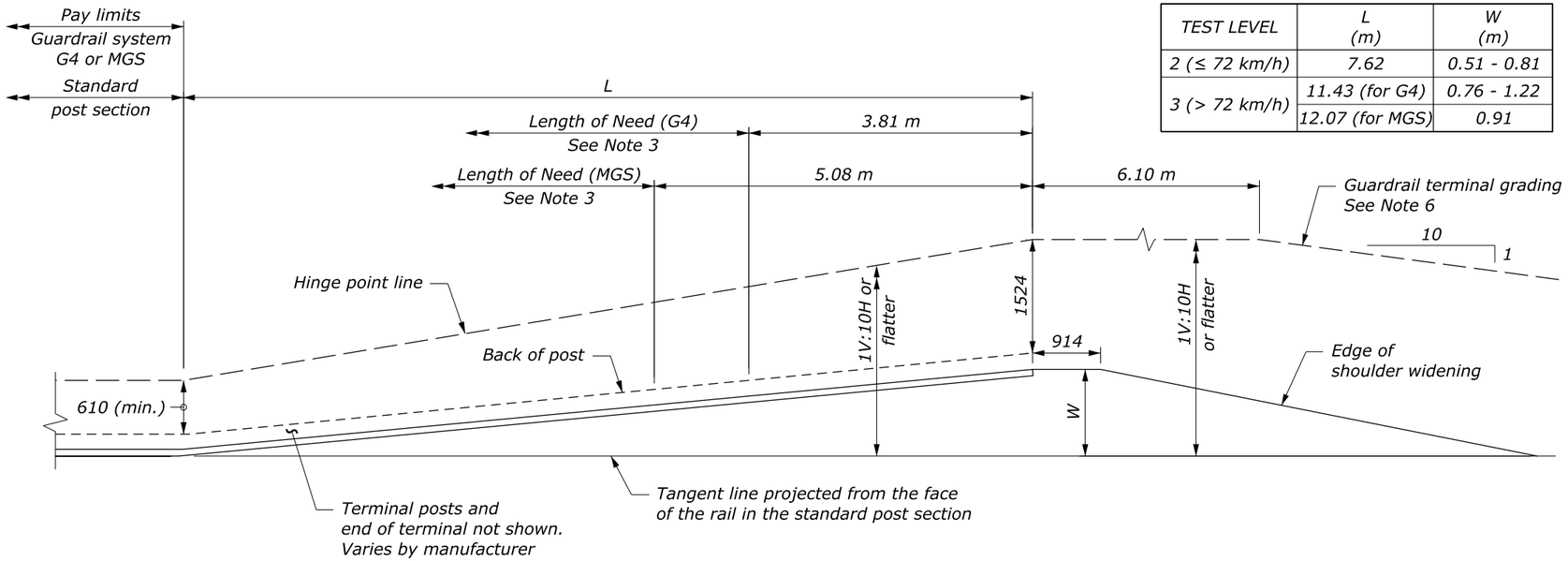
1. Install a flared W-beam guardrail terminal according to the manufacturer's recommendations. See manufacturer's drawings for other details.
2. Construct the terminal grading as shown in the staking notes or model. If no staking notes or model is provided, construct grading as shown on this sheet and 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.

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

MGS AND G4 W-BEAM GUARDRAIL TYPE FLARED TERMINAL AND GRADING

FLH STANDARD
617-19
SPECIFICATION
FP-24, FP-14
APPROVED FOR USE
1/2024

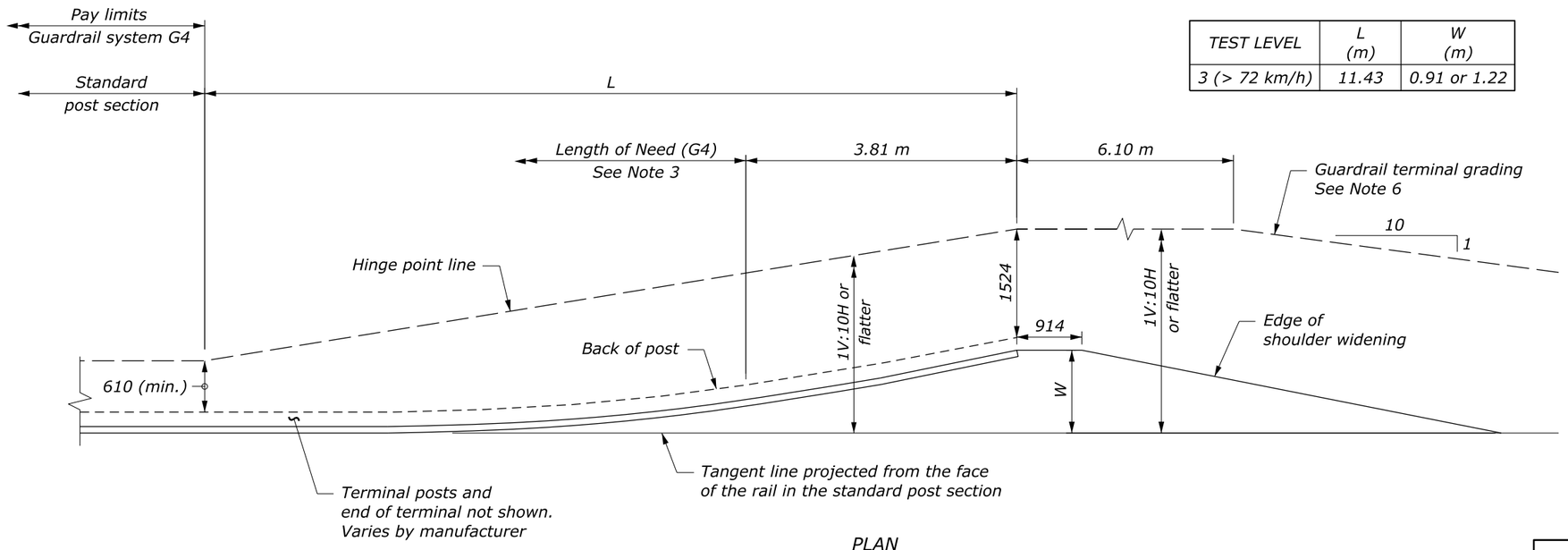
PROJECT	SHEET NUMBER



TEST LEVEL	L (m)	W (m)
2 (≤ 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

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

PLAN

PARABOLIC FLARED OPTION G4 W-BEAM GUARDRAIL

NO SCALE

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.

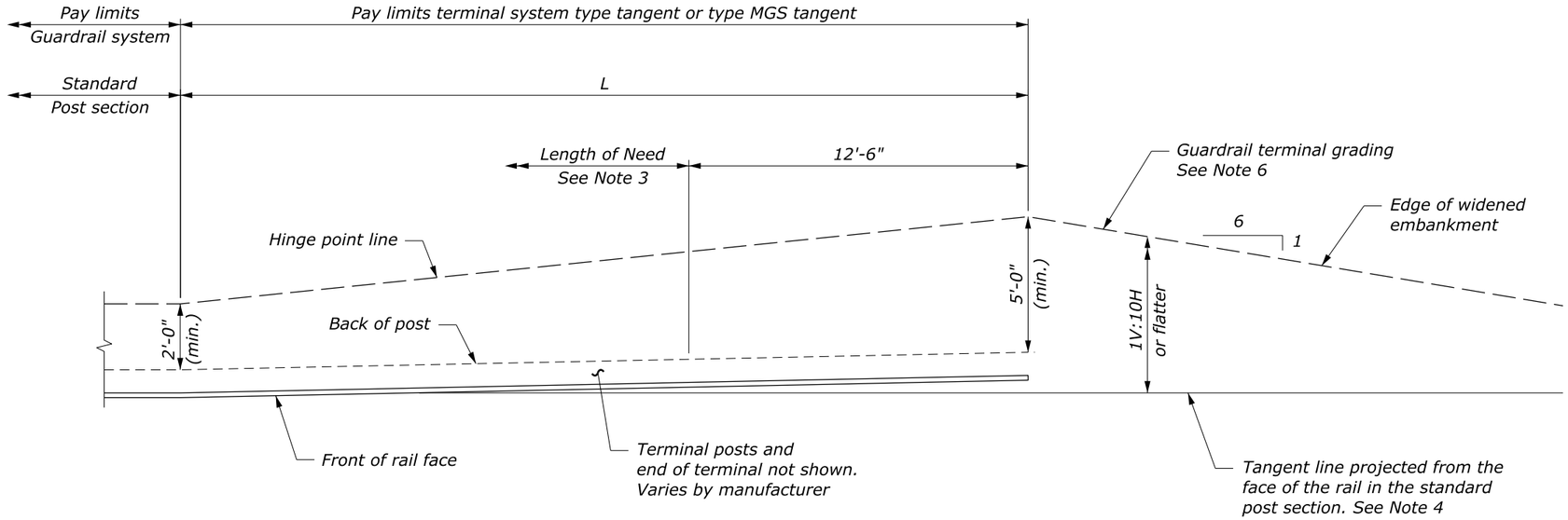
This drawing contains **Metric** units of measure.
Dimensions without units are millimeters.

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

MGS AND G4 W-BEAM GUARDRAIL TYPE FLARED TERMINAL AND GRADING

FLH STANDARD
M617-19
SPECIFICATION
FP-24, FP-14
APPROVED FOR USE
1/2024

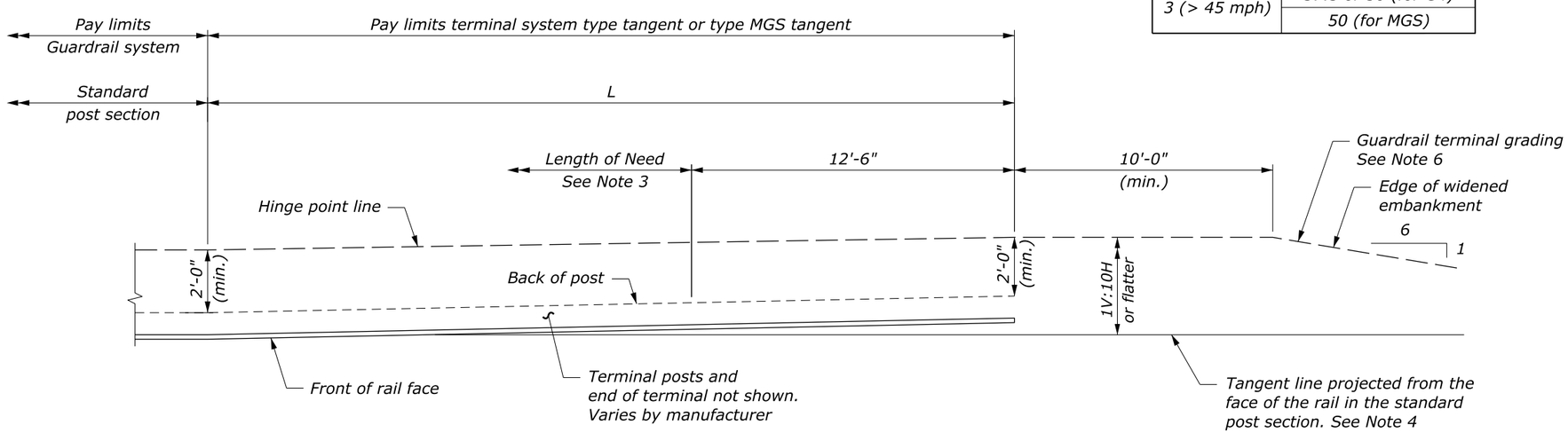
PROJECT	SHEET NUMBER



PLAN

PREFERRED GRADING

TEST LEVEL	L (FT)
2 (≤ 45 mph)	25
3 (> 45 mph)	37.5 or 50 (for G4)
	50 (for MGS)



PLAN

ALTERNATIVE GRADING

NO SCALE

NOTE:

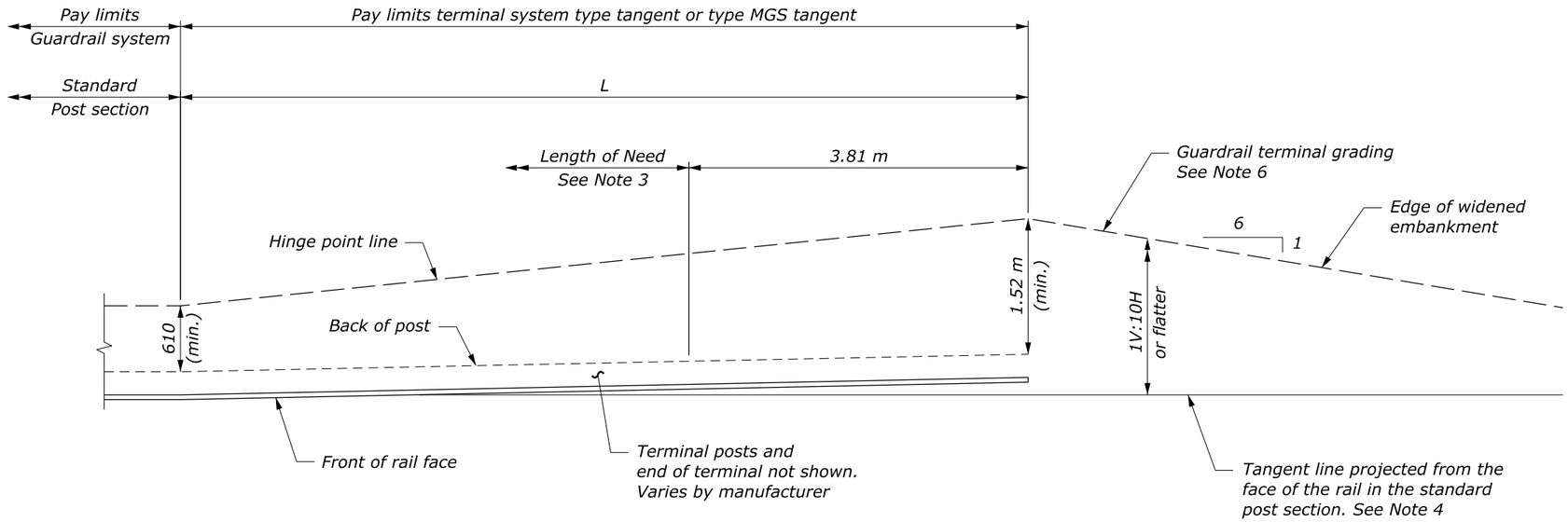
1. Install tangent terminal according to the manufacturer's recommendations. See manufacturer's drawings for other details.
2. Construct the terminal grading layout as shown in the staking notes or model. If no staking notes or model are provided, use the preferred grading layout as much as practical 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.

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

MGS AND G4 W-BEAM GUARDRAIL TYPE TANGENT TERMINAL AND GRADING

FLH STANDARD	617-20
SPECIFICATION	FP-24
APPROVED FOR USE	1/2024

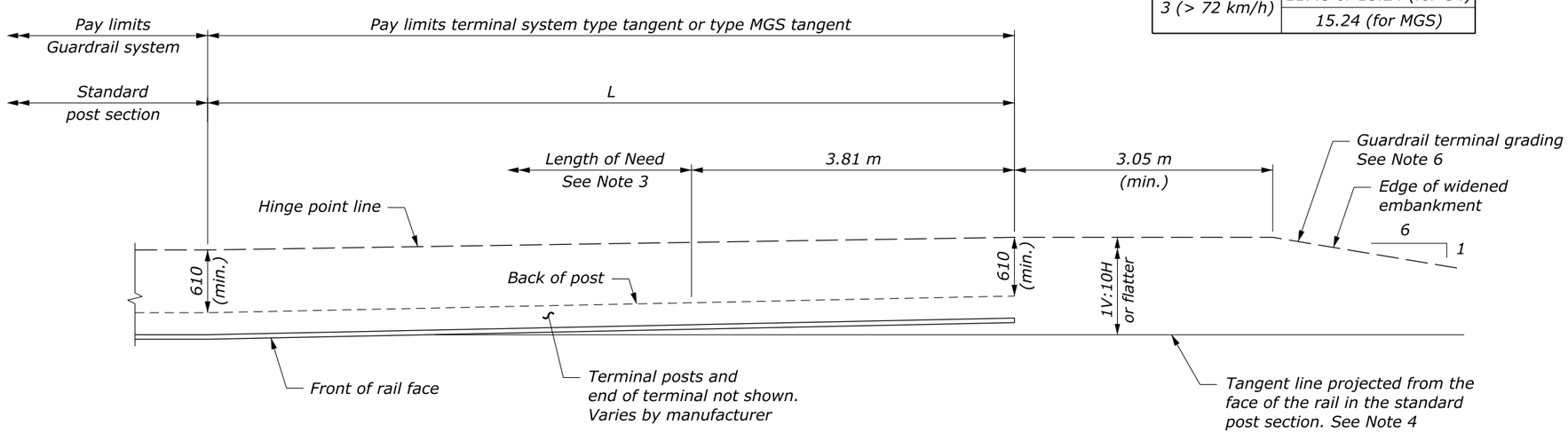
PROJECT	SHEET NUMBER



PLAN

PREFERRED GRADING

TEST LEVEL	L (m)
2 (≤ 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.*

NO SCALE

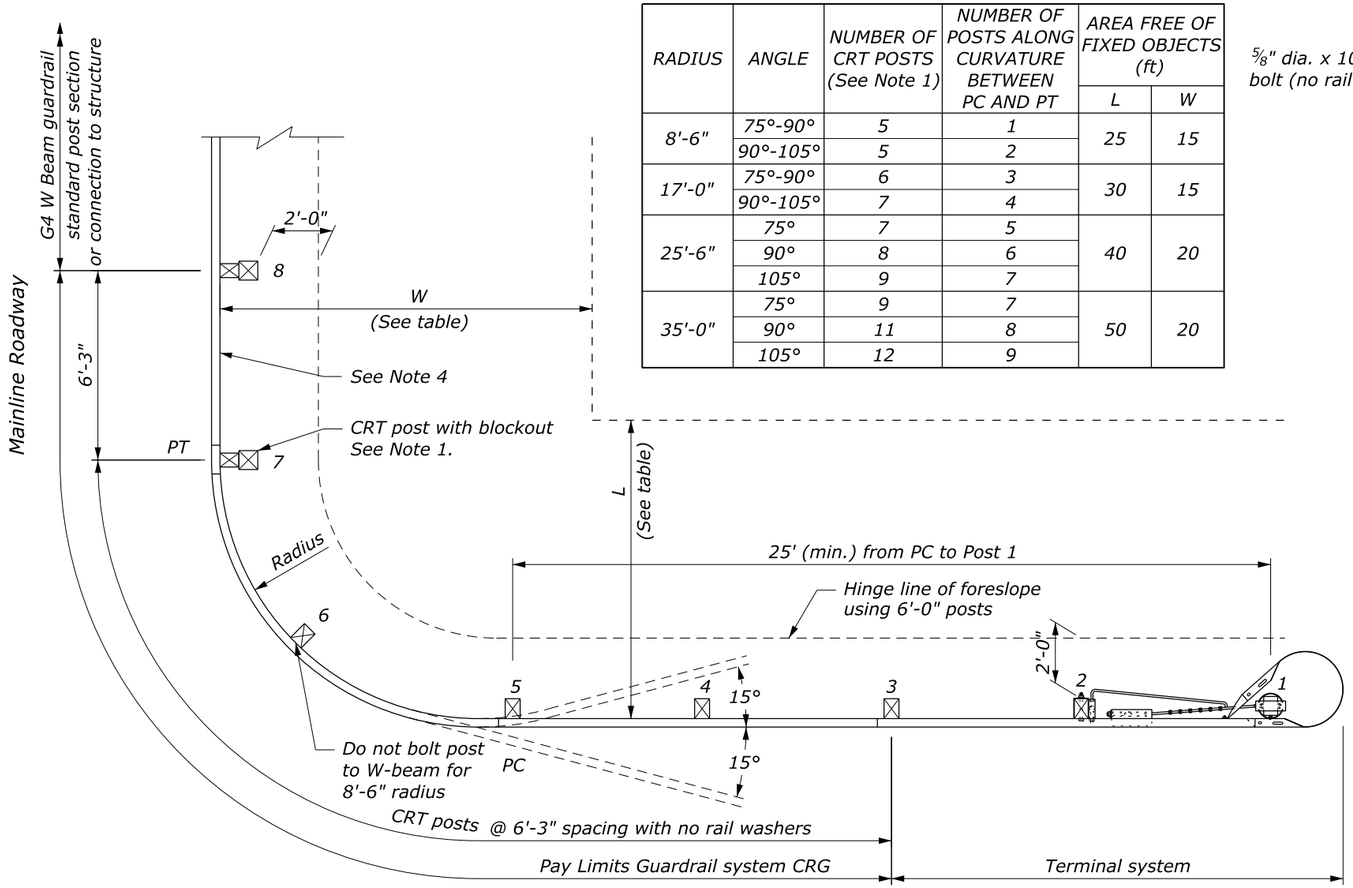
U.S. DEPARTMENT OF TRANSPORTATION, FHWA
OFFICE OF FEDERAL LANDS HIGHWAY

MGS AND G4 W-BEAM GUARDRAIL TYPE TANGENT TERMINAL AND GRADING

FLH STANDARD
M617-20
SPECIFICATION
FP-24
APPROVED FOR USE
1/2024

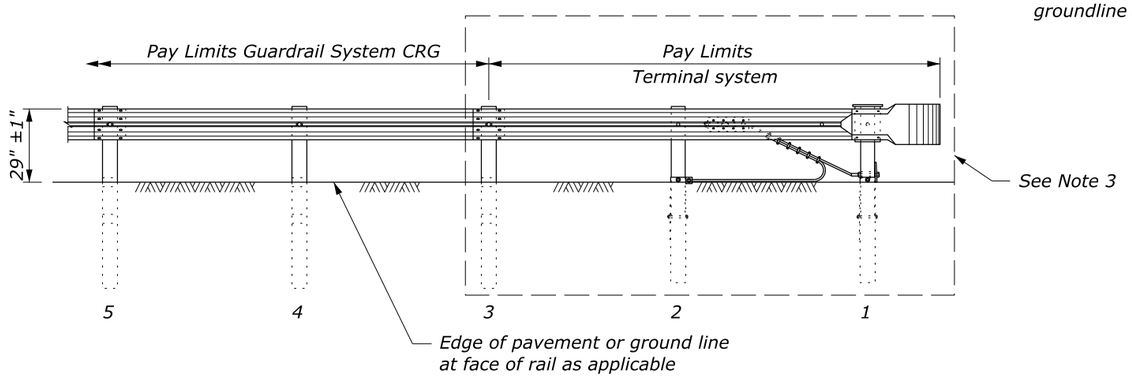
PROJECT	SHEET NUMBER

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		



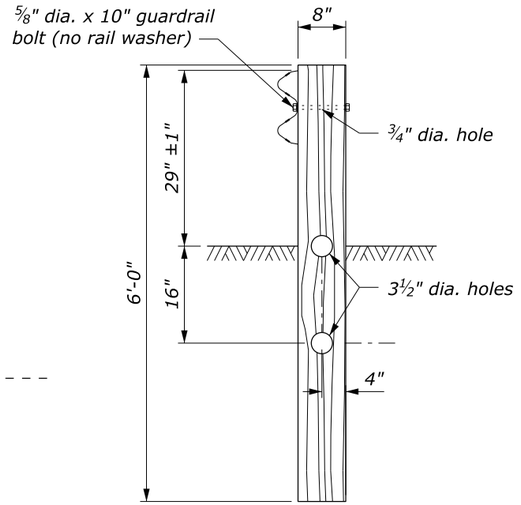
Secondary Roadway or Driveway

PLAN



ELEVATION

GUARDRAIL SYSTEM CRG WITH CRT POSTS



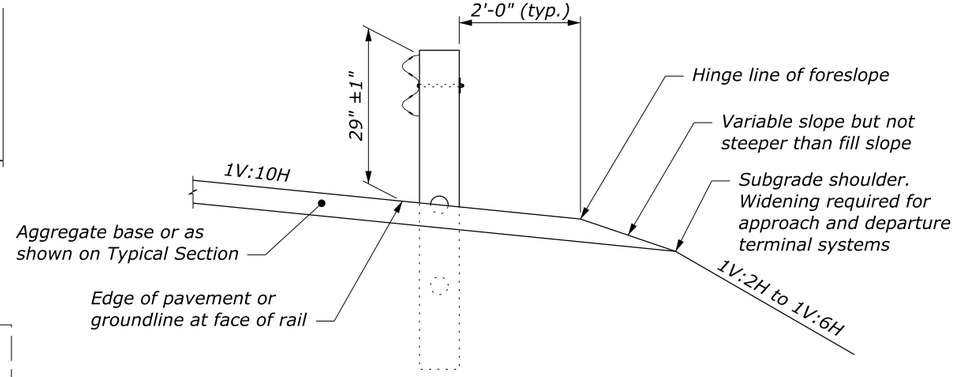
CRT POST DETAIL

POSTS #3 - #7

See Note 1

NOTE:

1. *CRT posts include those posts between the terminal and PT, plus the post with blockout at Post #7.*
2. *Do not use this layout when speeds are in excess of 45 mph.*
3. *See Standard 617-22 for terminal system 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 blockout 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.*



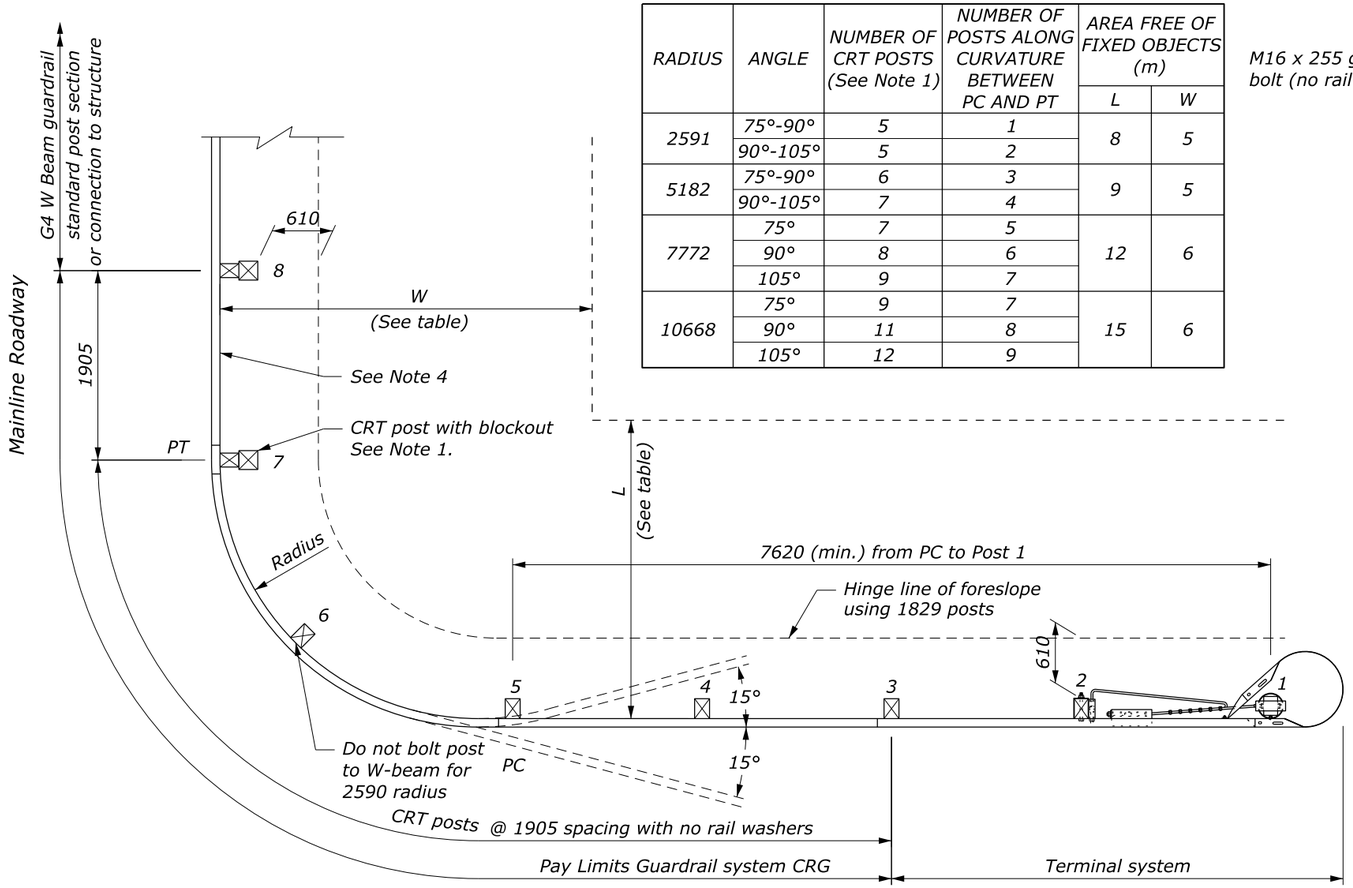
TYPICAL GUARDRAIL CROSS SECTION

NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION, FHWA OFFICE OF FEDERAL LANDS HIGHWAY	FLH STANDARD 617-21
CRG W-BEAM GUARDRAIL WOOD POSTS	SPECIFICATION FP-24
	APPROVED FOR USE 1/2024

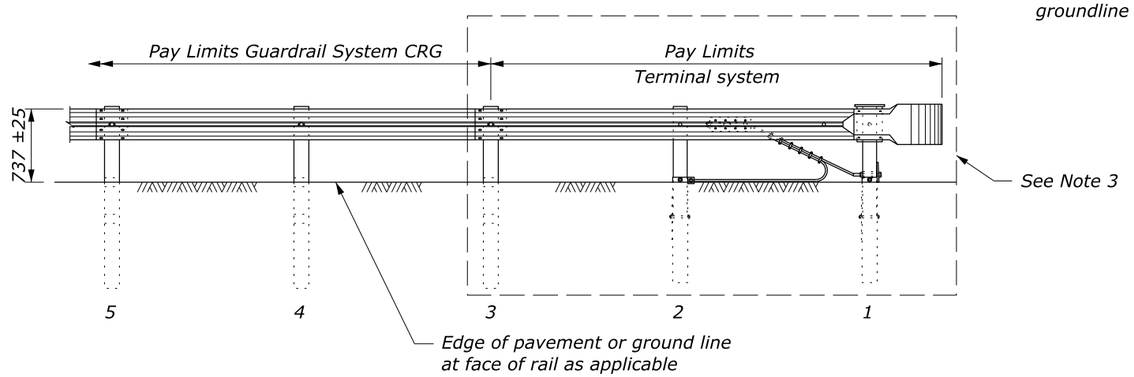
PROJECT	SHEET NUMBER

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		



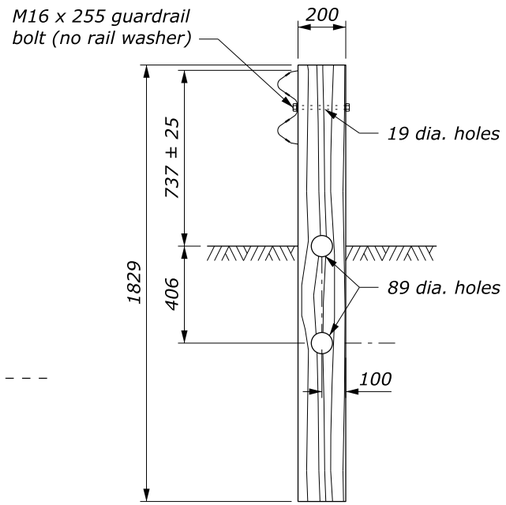
Secondary Roadway or Driveway

PLAN



ELEVATION

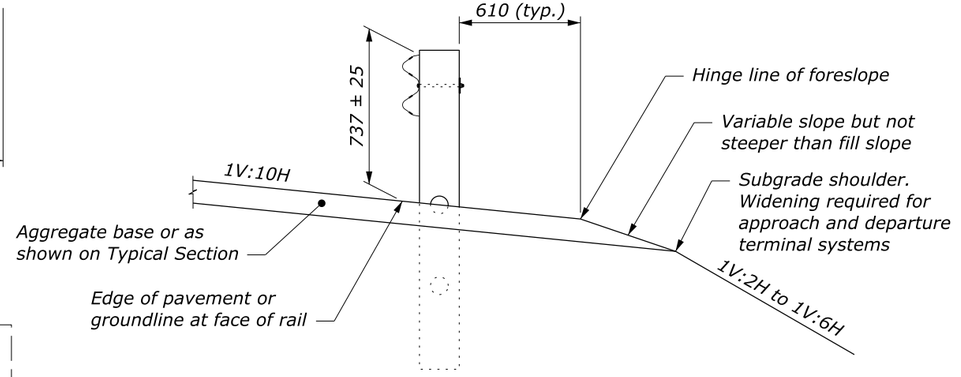
GUARDRAIL SYSTEM CRG WITH CRT POSTS



CRT POST DETAIL

POSTS #3 - #7

See Note 1



TYPICAL GUARDRAIL CROSS SECTION

NOTE:

1. CRT posts include those posts between the terminal and PT, plus the post with blockout at Post #7.
2. Do not use this layout when speeds are in excess of 72 km/h.
3. See Standard M617-22 for terminal system 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 blockout 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.

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

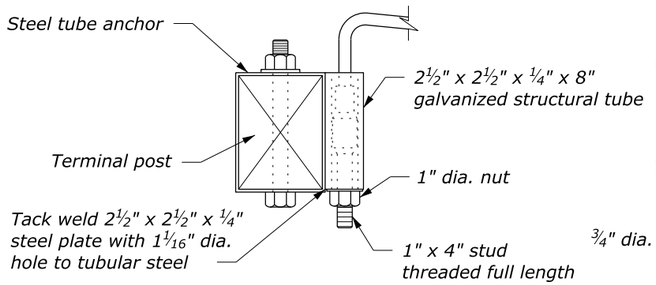
NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION, FHWA OFFICE OF FEDERAL LANDS HIGHWAY	FLH STANDARD M617-21
CRG W-BEAM GUARDRAIL WOOD POSTS	SPECIFICATION FP-24
	APPROVED FOR USE 1/2024

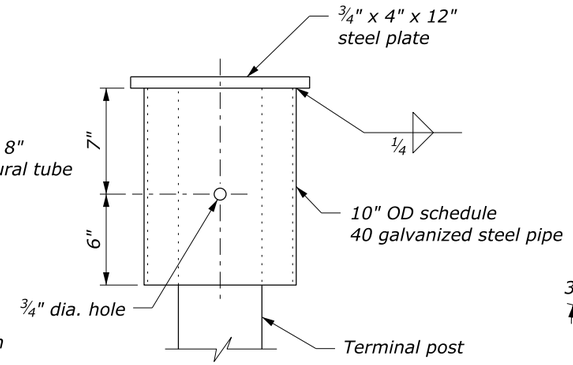
c:\pw-work\d0419223\Std617-21.dgn [Std M617-21]

11 July 2024 10:56 AM

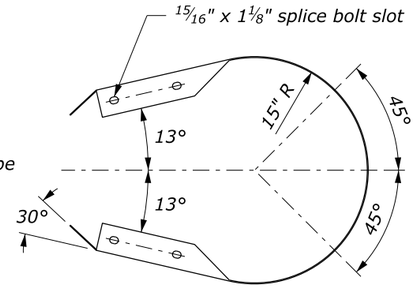
PROJECT	SHEET NUMBER



DETAIL A



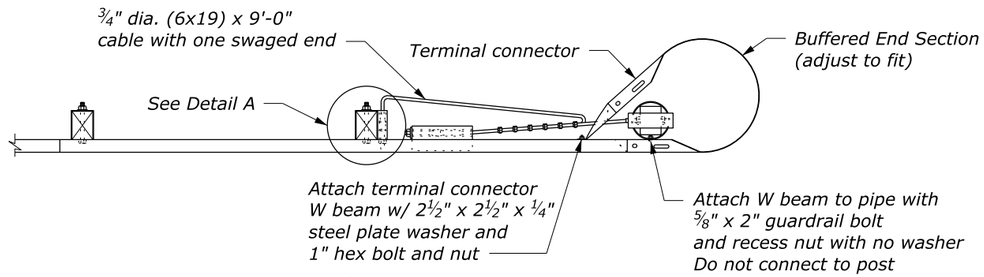
DETAIL B



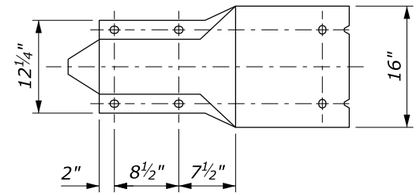
PLAN

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.

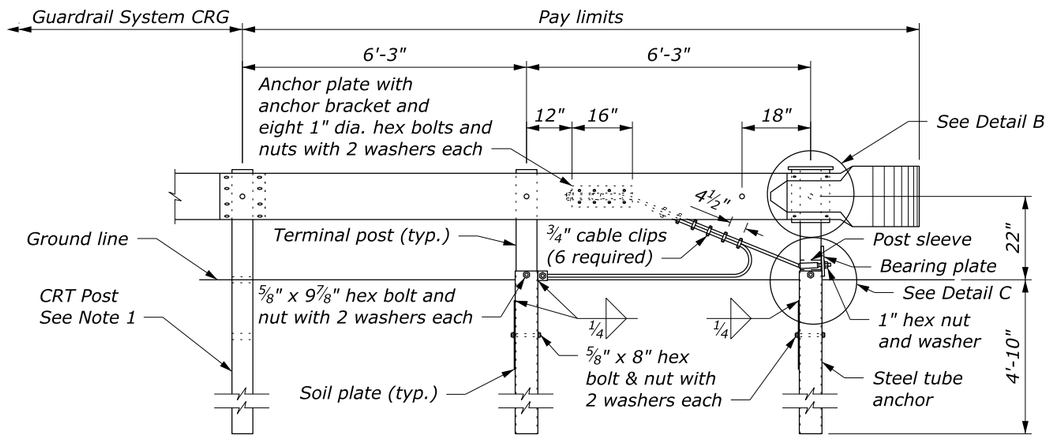


PLAN



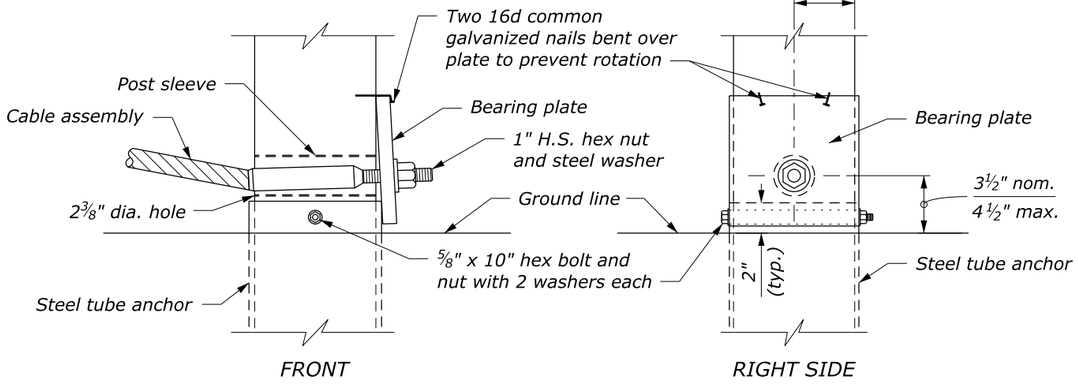
ELEVATION

BUFFERED END SECTION



ELEVATION

ANCHORAGE ASSEMBLY



FRONT RIGHT SIDE

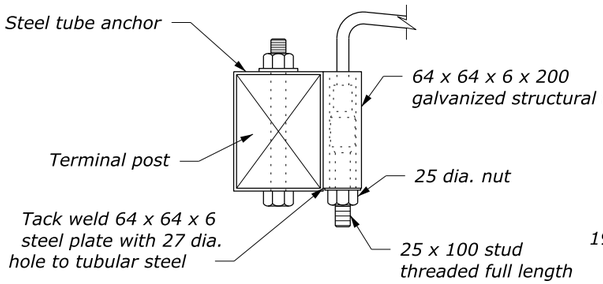
DETAIL C

POST ASSEMBLY

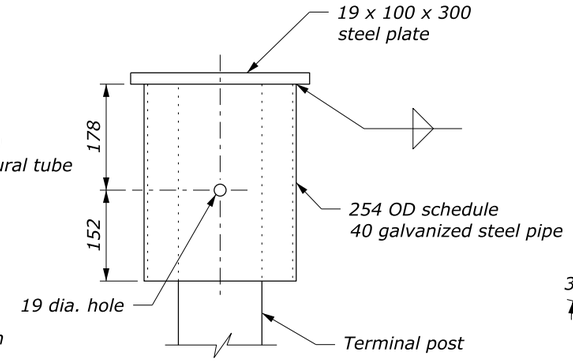
NO SCALE

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

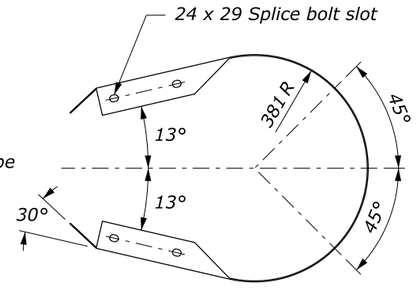
PROJECT	SHEET NUMBER



DETAIL A



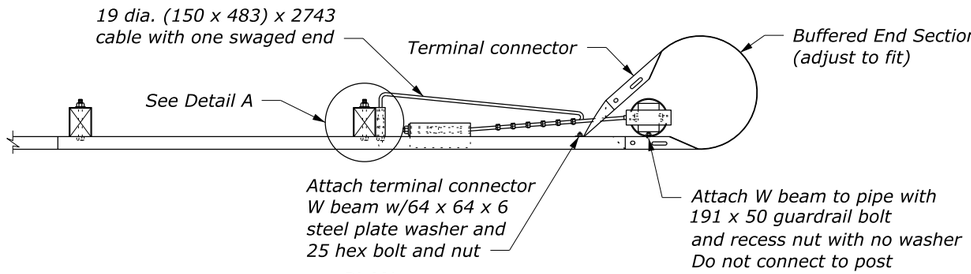
DETAIL B



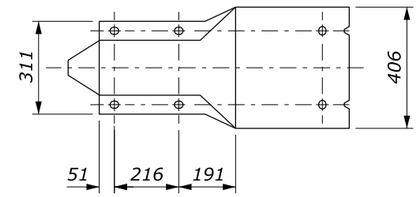
PLAN

NOTE:

1. *See Standard M617-21 and M617-23 for 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.*

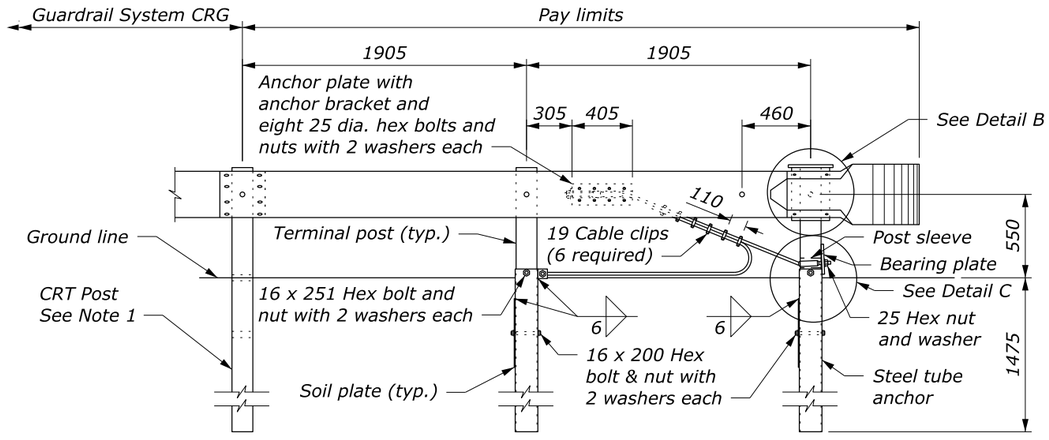


PLAN



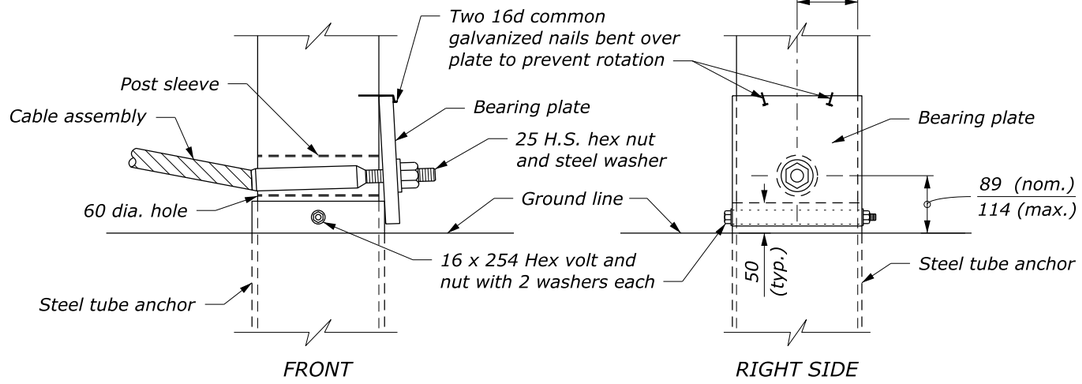
ELEVATION

BUFFERED END SECTION



ELEVATION

ANCHORAGE ASSEMBLY



FRONT RIGHT SIDE

DETAIL C
POST ASSEMBLY

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

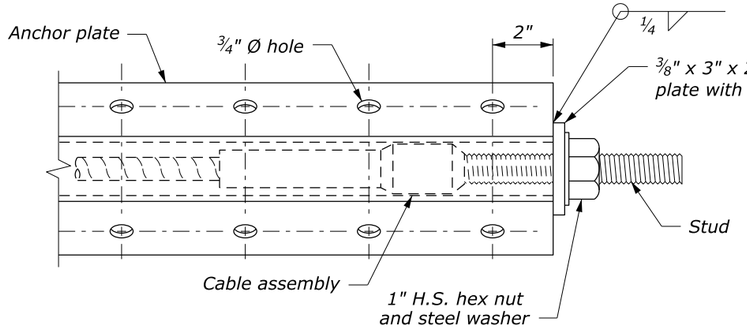
NO SCALE

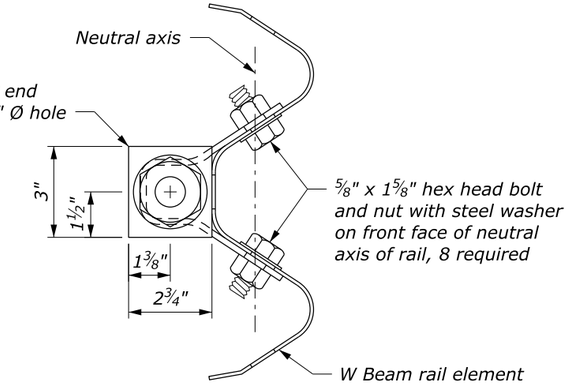
U.S. DEPARTMENT OF TRANSPORTATION, FHWA
OFFICE OF FEDERAL LANDS HIGHWAY

G4 W-BEAM GUARDRAIL CABLE RELEASING TERMINAL TYPE G4-CRT

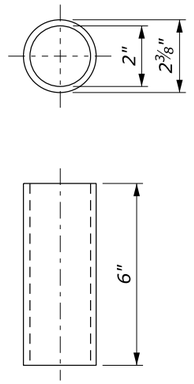
FLH STANDARD
M617-22
SPECIFICATION
FP-24, FP-14
APPROVED FOR USE
1/2024

PROJECT	SHEET NUMBER





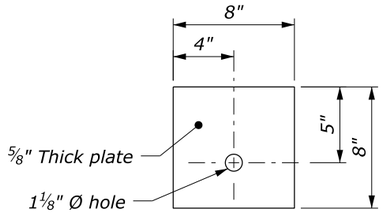
CABLE ANCHOR PLATE DETAILS



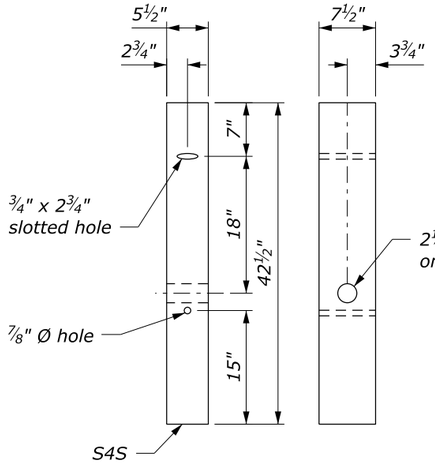
POST SLEEVE

NOTE:

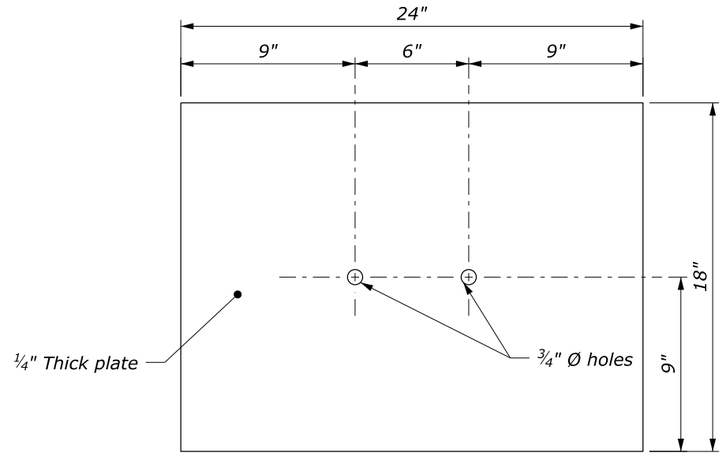
1. *Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.*



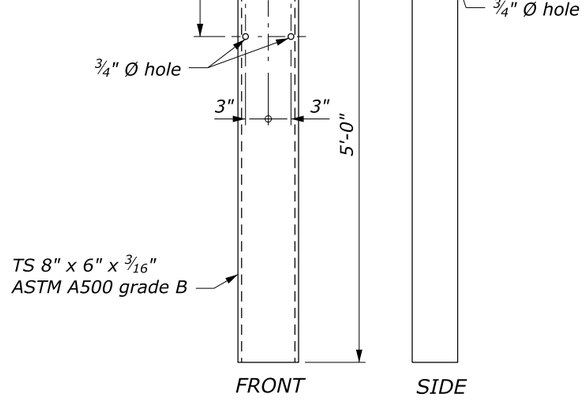
BEARING PLATE



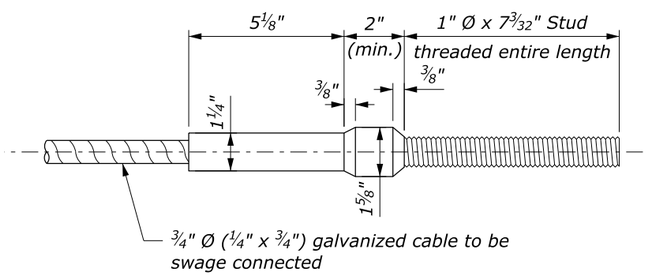
TERMINAL POST



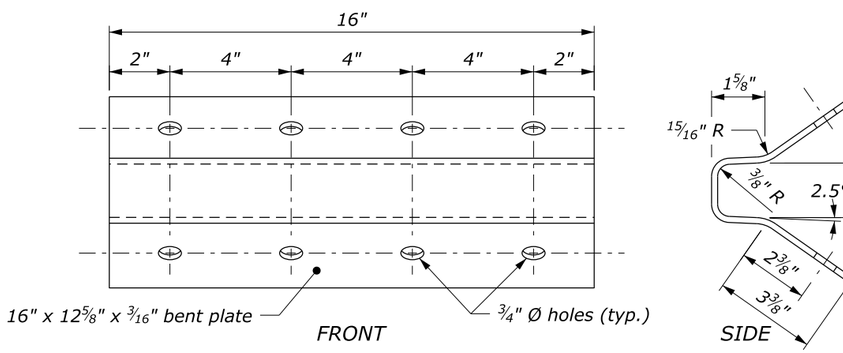
SOIL PLATE
(2 REQUIRED)



STEEL TUBE ANCHOR



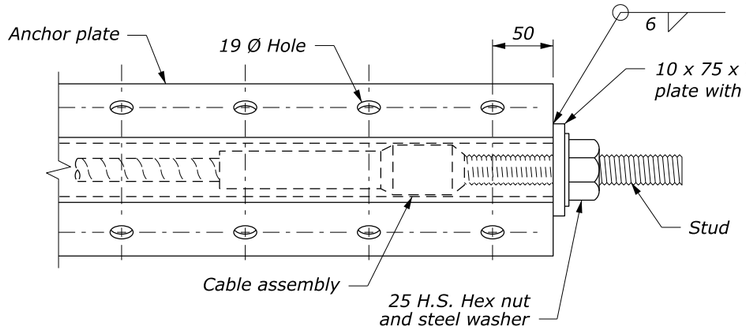
CABLE ANCHOR ASSEMBLY
(Standard swaged fitting and stud)



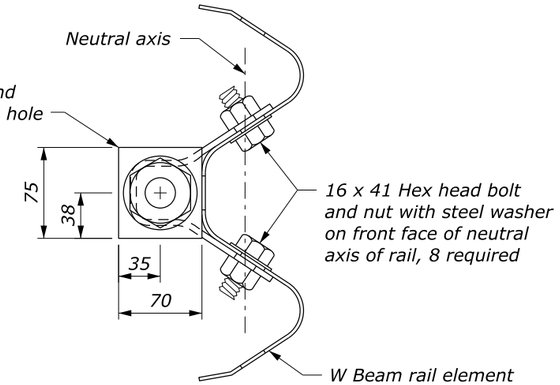
GUARDRAIL ANCHOR BRACKET
NO SCALE

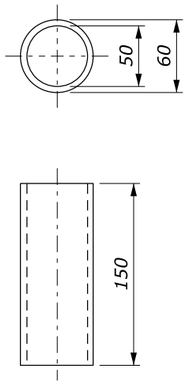
U.S. DEPARTMENT OF TRANSPORTATION, FHWA OFFICE OF FEDERAL LANDS HIGHWAY	FLH STANDARD 617-23
G4 W-BEAM GUARDRAIL CRT ANCHORAGE ASSEMBLY DETAILS	SPECIFICATION FP-24, FP-14
	APPROVED FOR USE 1/2024

PROJECT	SHEET NUMBER



CABLE ANCHOR PLATE DETAILS

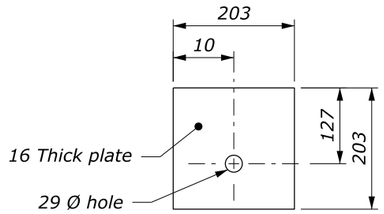




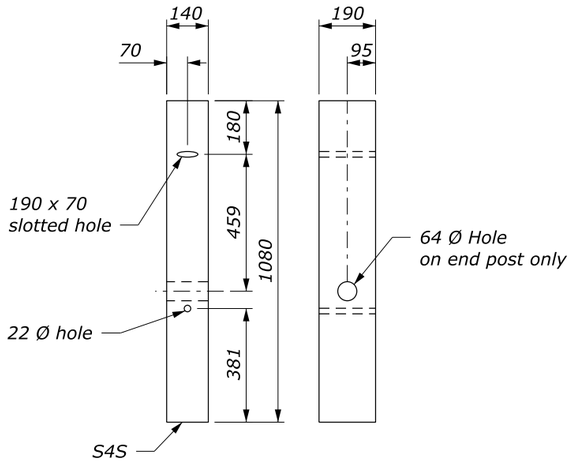
POST SLEEVE

NOTE:

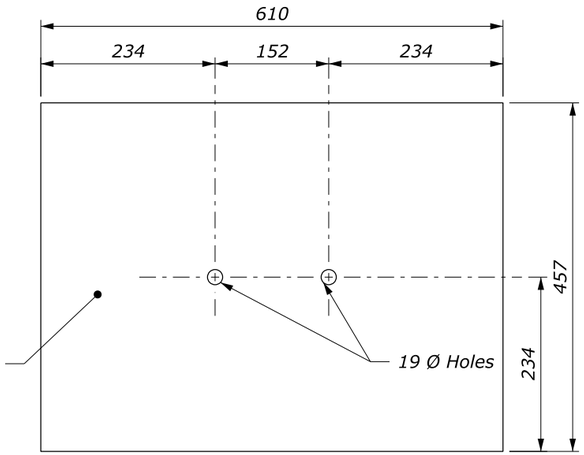
1. *Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.*



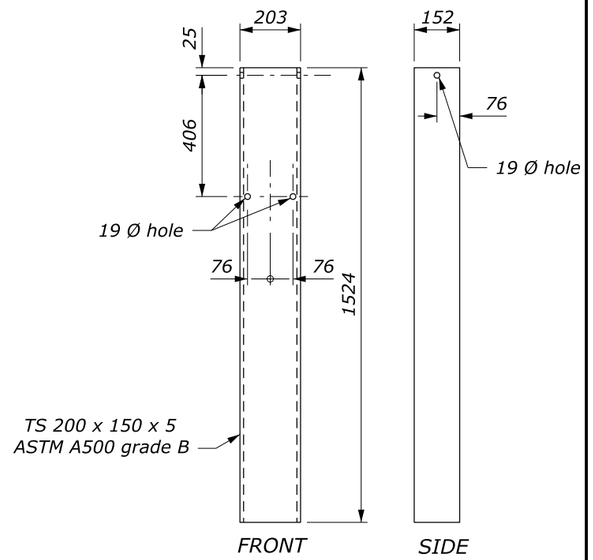
BEARING PLATE



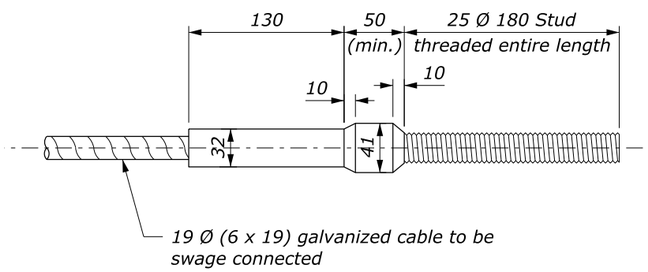
TERMINAL POST



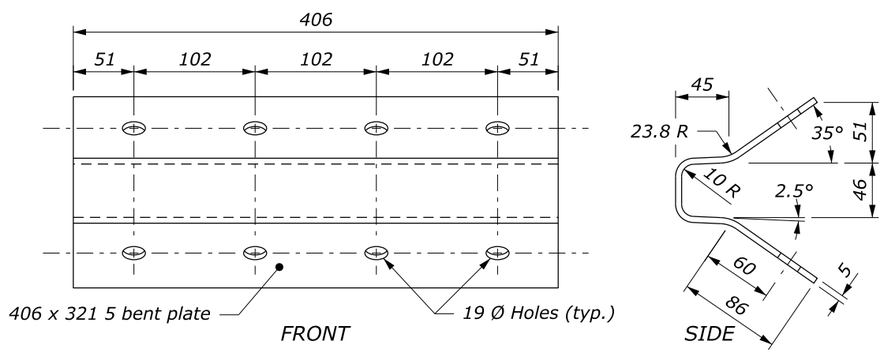
SOIL PLATE
(2 REQUIRED)



STEEL TUBE ANCHOR



CABLE ANCHOR ASSEMBLY
(Standard swaged fitting and stud)



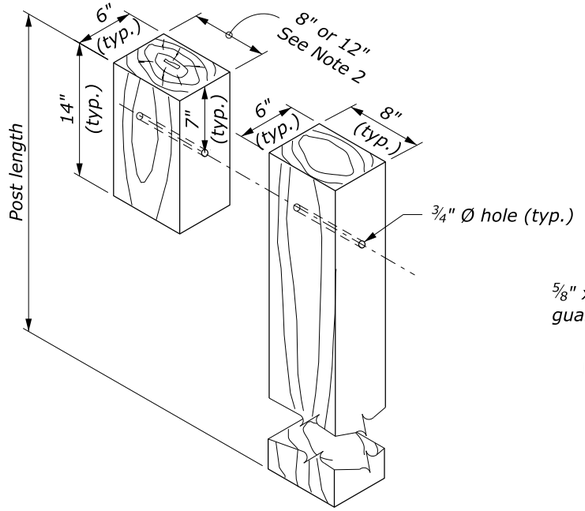
GUARDRAIL ANCHOR BRACKET

NO SCALE

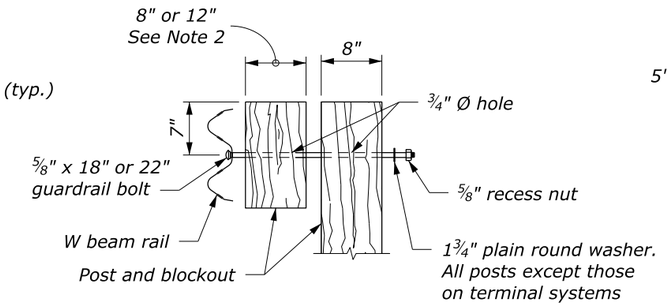
*This drawing contains **Metric** units of measure. Dimensions without units are millimeters.*

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

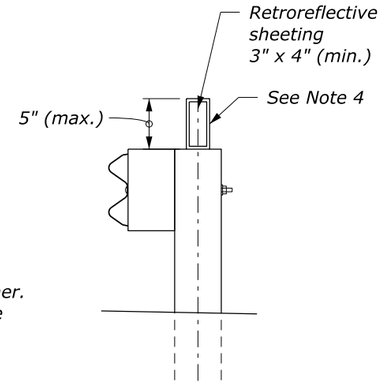
PROJECT	SHEET NUMBER



POST AND BLOCKOUT



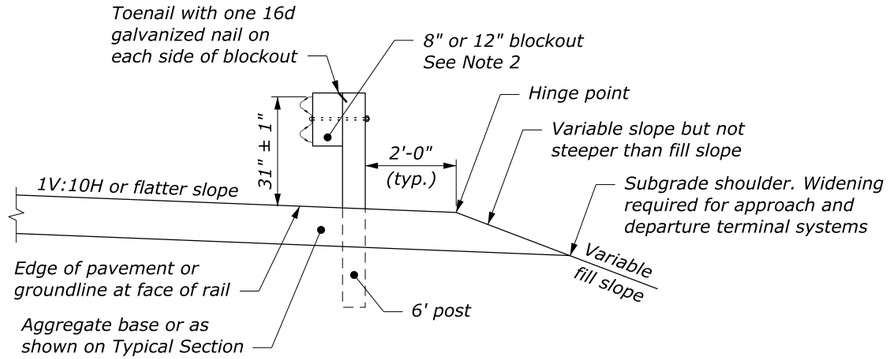
POST BOLT ASSEMBLY



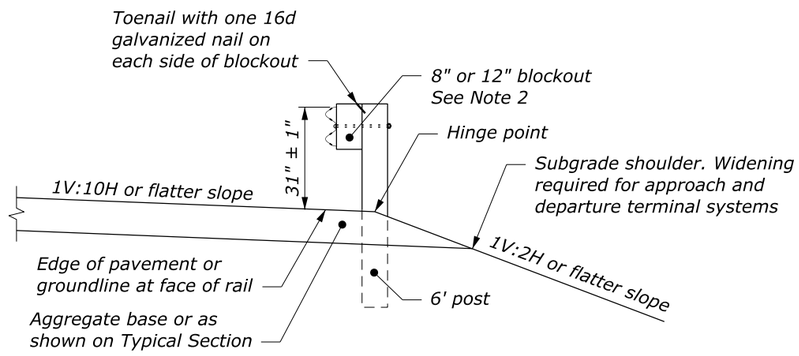
FLEXIBLE DELINEATOR GUARDRAIL MOUNT

NOTE:

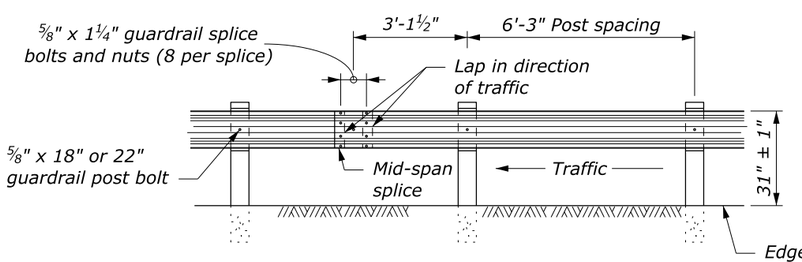
1. When encountering impenetrable material, one post may be omitted in locations where the typical guardrail cross section includes 2 feet (min.) between the back of the guardrail post and the hinge point. For all other locations, see Section 617 and Standard 617-13 or 617-37.
2. Size of blockout shown elsewhere in the plans. Use a single blockout or combination of blockouts (no more than two) to achieve the actual 8 or 12 inch offset. Secure wood blockouts to the posts with anti-rotation nails. If combination blockouts are used, toenail the adjacent blockouts with two 16d galvanized nails to prevent blockout 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.



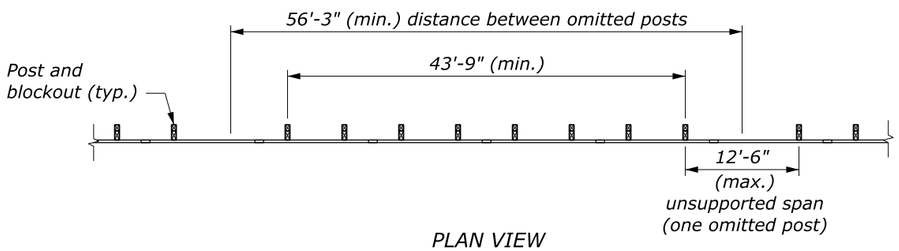
TYPICAL GUARDRAIL CROSS SECTION
6' POST, 8" OR 12" BLOCKOUT



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



TYPICAL GUARDRAIL ELEVATION



PLAN VIEW

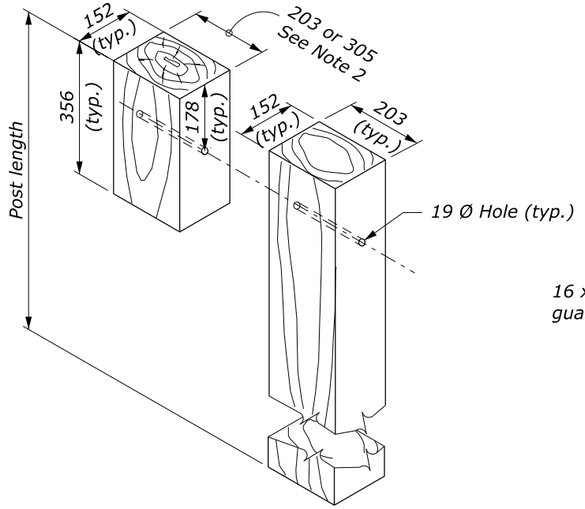
OMITTED POST DETAIL

See Note 1

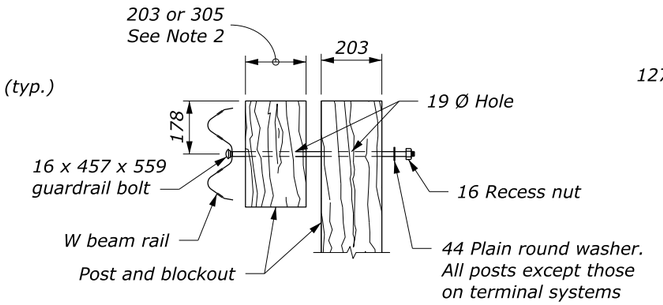
NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION, FHWA OFFICE OF FEDERAL LANDS HIGHWAY	FLH STANDARD 617-31
MGS W-BEAM GUARDRAIL WOOD POSTS	SPECIFICATION FP-24
	APPROVED FOR USE 1/2024

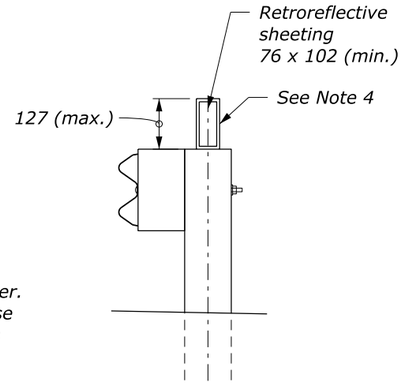
PROJECT	SHEET NUMBER



POST AND BLOCKOUT



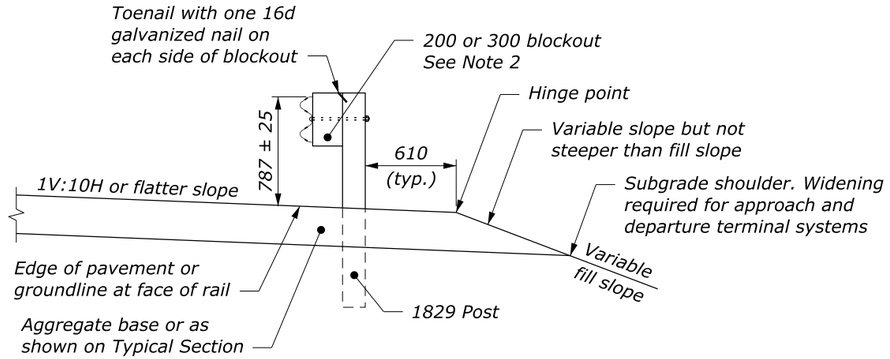
POST BOLT ASSEMBLY



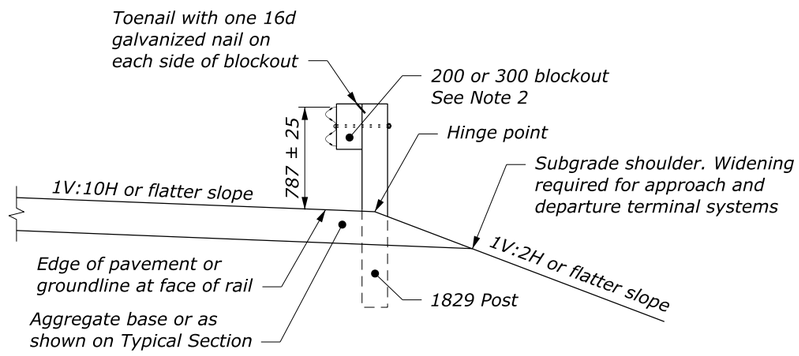
FLEXIBLE DELINEATOR GUARDRAIL MOUNT

NOTE:

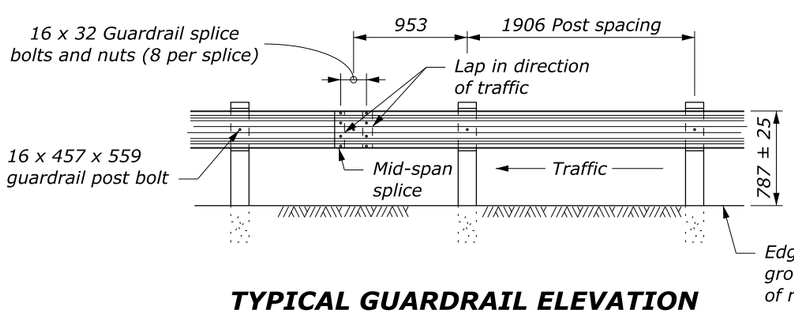
1. *When encountering impenetrable material, one post may be omitted in locations where the typical guardrail cross section includes 610 mm (min.) between the back of the guardrail post and the hinge point. For all other locations, see Section 617 and Standard M617-13 or M617-37.*
2. *Size of blockout shown elsewhere in the plans. Use a single blockout or combination of blockouts (no more than two) to achieve the actual 200 or 300 mm offset secure qood blockouts to the posts with anti-rotation nails. If combination blockouts are used, toenail the adjacent blockouts with two 16d galvanized nails to prevent blockout 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.*



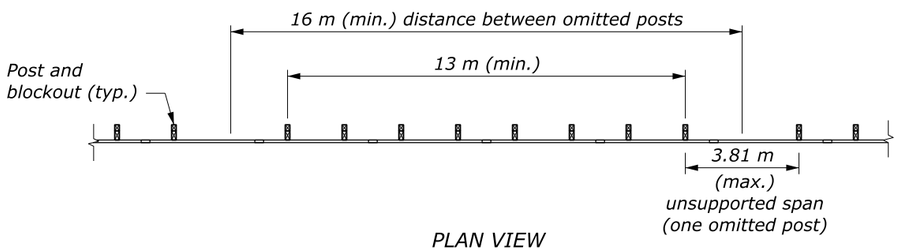
TYPICAL GUARDRAIL CROSS SECTION
1830 POST, 200 OR 300 BLOCKOUT



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



TYPICAL GUARDRAIL ELEVATION



PLAN VIEW

OMITTED POST DETAIL

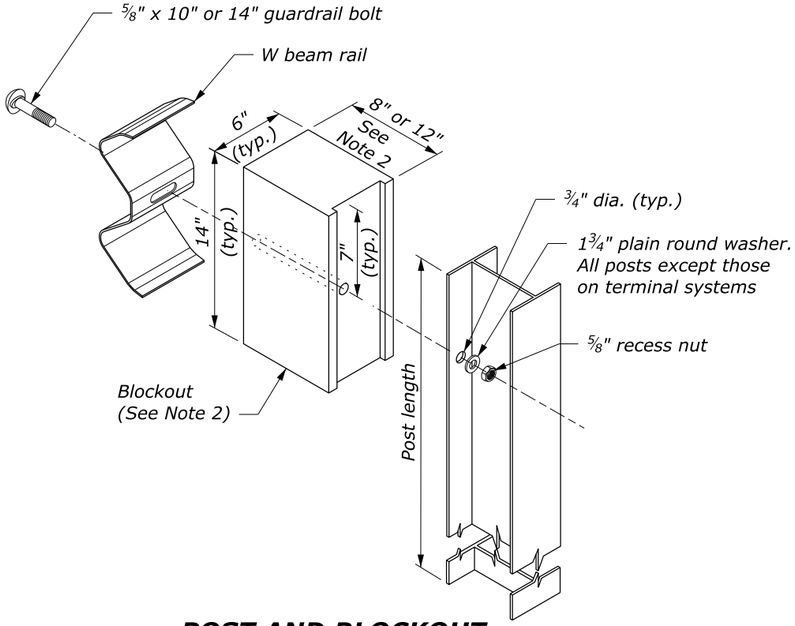
See Note 1

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

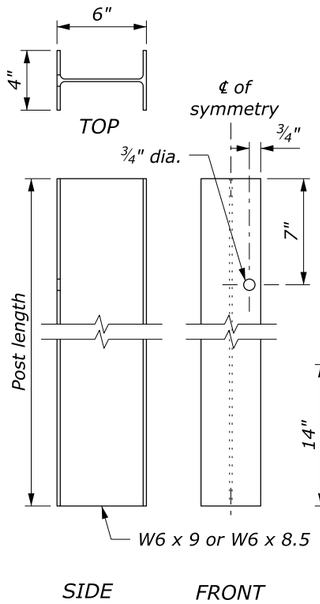
NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION, FHWA OFFICE OF FEDERAL LANDS HIGHWAY	FLH STANDARD M617-31
MGS W-BEAM GUARDRAIL WOOD POSTS	SPECIFICATION FP-24
	APPROVED FOR USE 1/2024

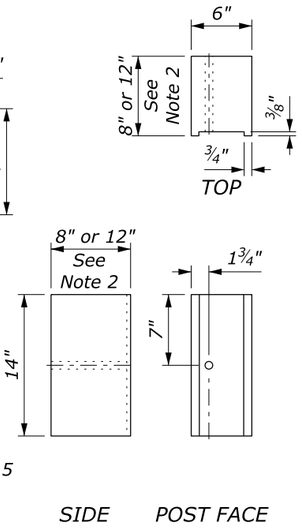
PROJECT	SHEET NUMBER



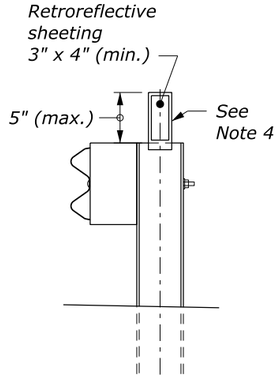
POST AND BLOCKOUT DETAIL



STRUCTURAL SHAPE POST



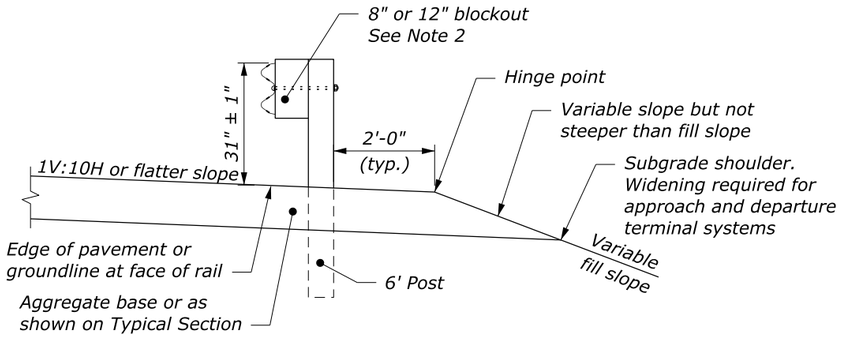
BLOCKOUT



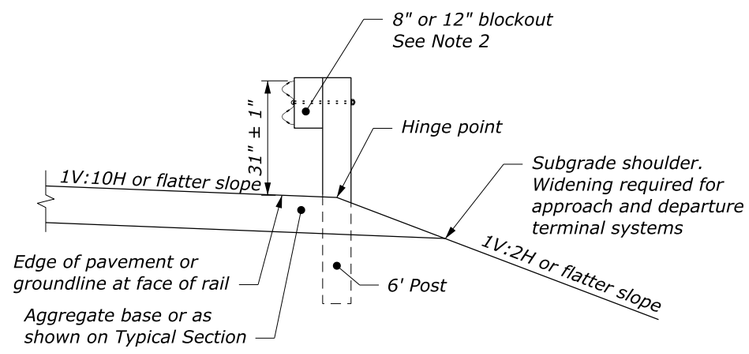
FLEXIBLE DELINEATOR GUARDRAIL MOUNT

NOTE:

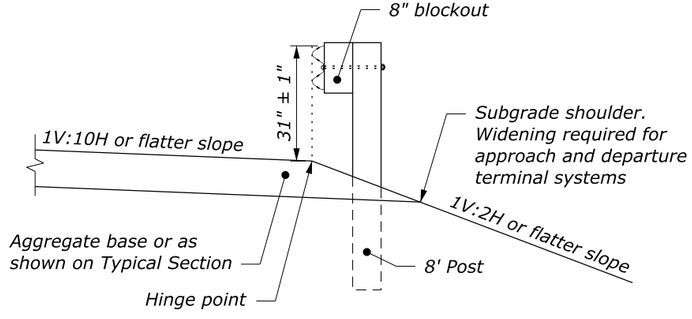
1. *When encountering impenetrable material, one post may be omitted in locations where the typical guardrail cross section includes 2-feet (min.) between the back of the guardrail post and the hinge point. For all other locations, see Section 617 and Standard 617-13 or 617-37.*
2. *Size of blockout 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.*



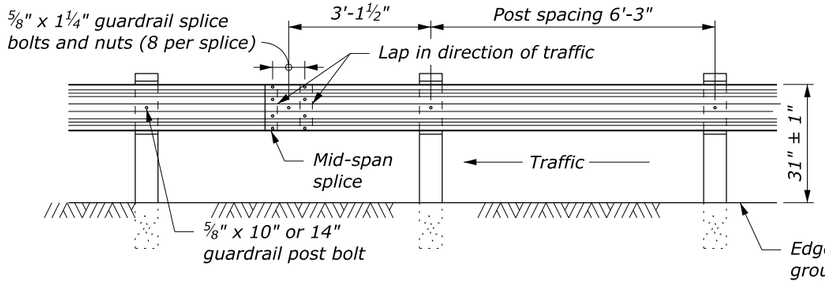
TYPICAL GUARDRAIL CROSS SECTION
6' POST, 8" OR 12" BLOCKOUT



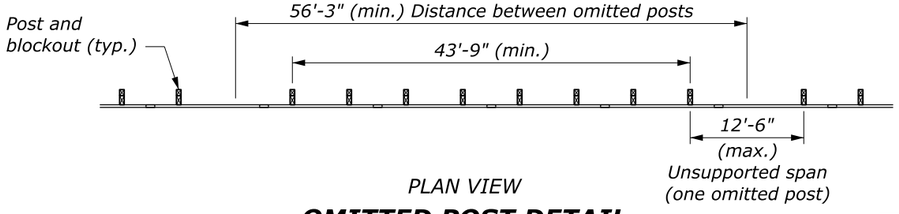
TYPICAL GUARDRAIL CROSS SECTION
6' POST CENTERED ON HINGE, 8" OR 12" BLOCKOUT



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



TYPICAL GUARDRAIL ELEVATION



PLAN VIEW

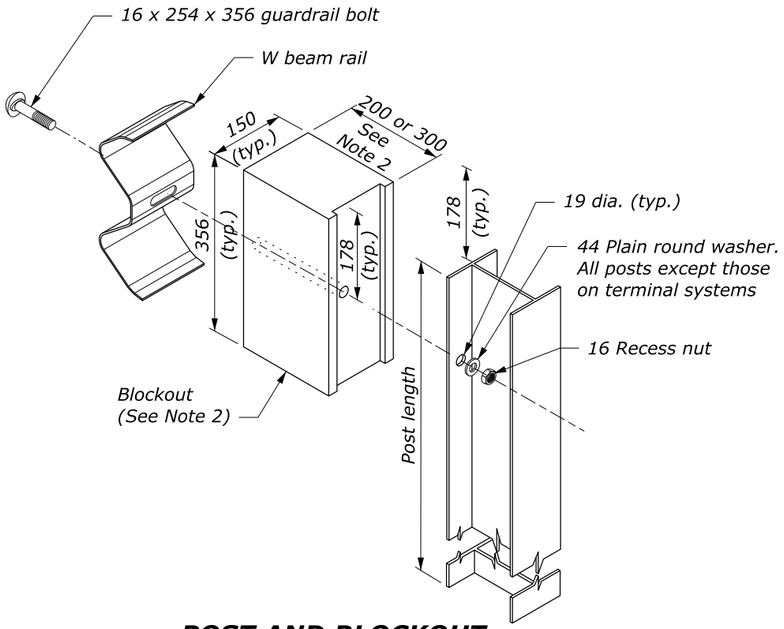
OMITTED POST DETAIL

See Note 1

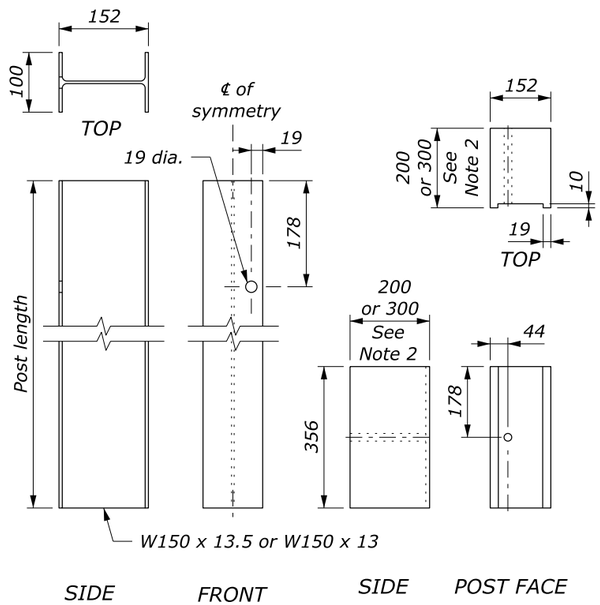
NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION, FHWA OFFICE OF FEDERAL LANDS HIGHWAY	FLH STANDARD 617-32
MGS W-BEAM GUARDRAIL STEEL POSTS	SPECIFICATION FP-24
	APPROVED FOR USE 2/2024

PROJECT	SHEET NUMBER

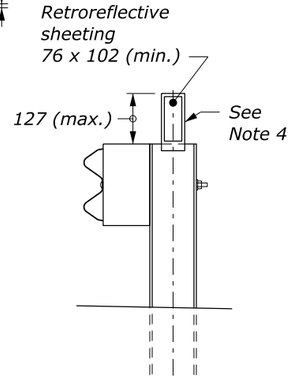


POST AND BLOCKOUT DETAIL



STRUCTURAL SHAPE POST

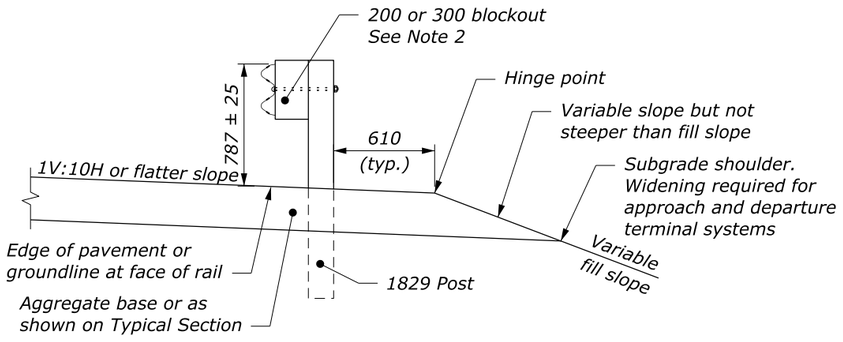
BLOCKOUT



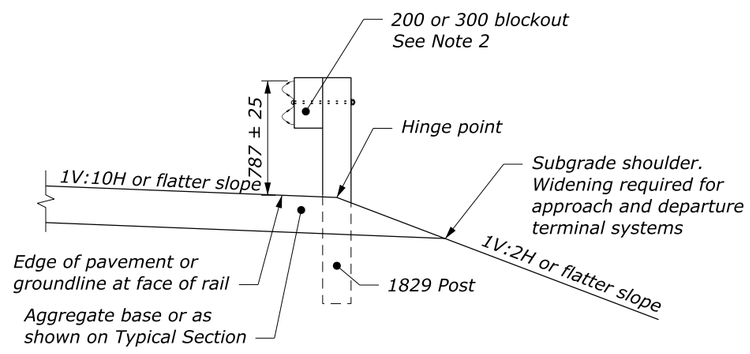
FLEXIBLE DELINEATOR GUARDRAIL MOUNT

NOTE:

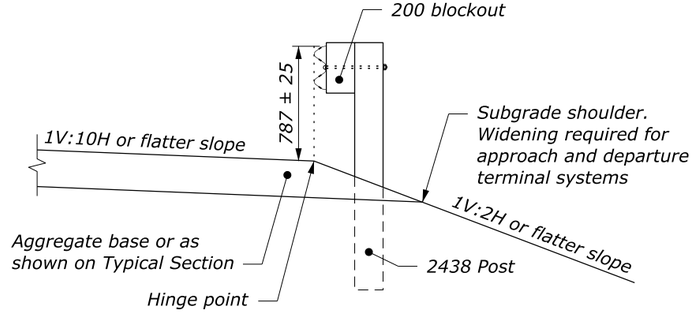
1. *When encountering impenetrable material, one post may be omitted in locations where the typical guardrail cross section includes 609 mm (min.) between the back of the guardrail post and the hinge point. For all other locations, see Section 617 and Standard M617-13 or M617-37.*
2. *Size of blockout 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.*



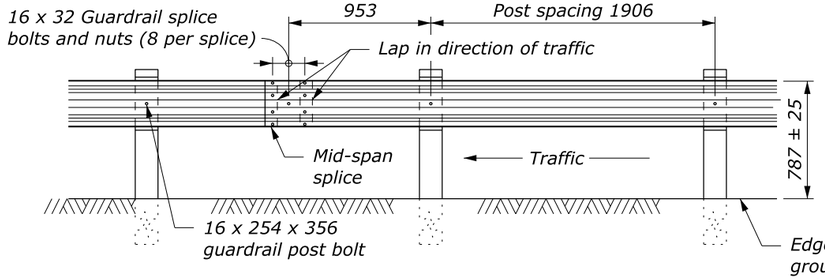
TYPICAL GUARDRAIL CROSS SECTION
1829 POST, 200 OR 300 BLOCKOUT



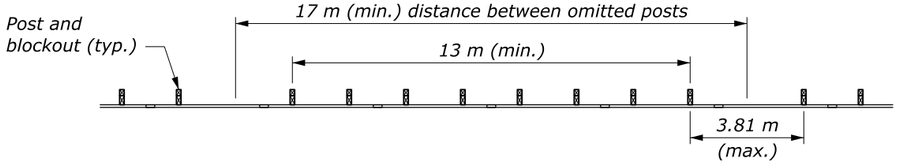
TYPICAL GUARDRAIL CROSS SECTION
1829 POST CENTERED ON HINGE, 200 OR 300 BLOCKOUT



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.*

NO SCALE

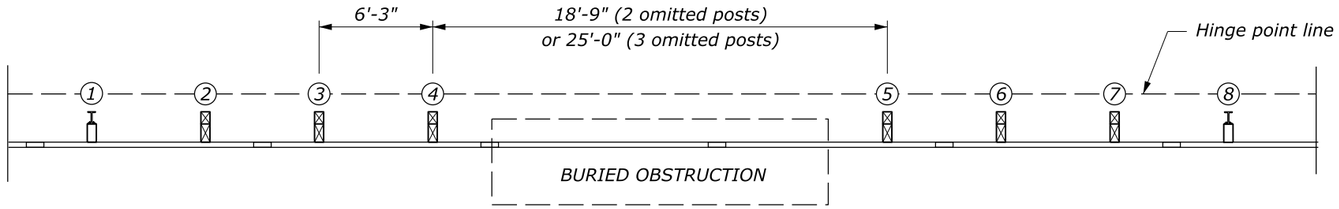
U.S. DEPARTMENT OF TRANSPORTATION, FHWA
OFFICE OF FEDERAL LANDS HIGHWAY

MGS W-BEAM GUARDRAIL STEEL POSTS

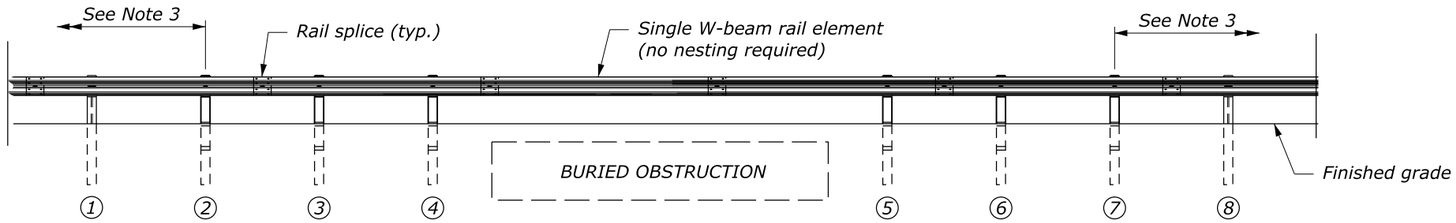
FLH STANDARD
M617-32
SPECIFICATION
FP-24
APPROVED FOR USE
2/2024

c:\pw-work\d0419223\Std617-32.dgn [Std M617-32]
10 July 2024 10:23 AM

PROJECT	SHEET NUMBER



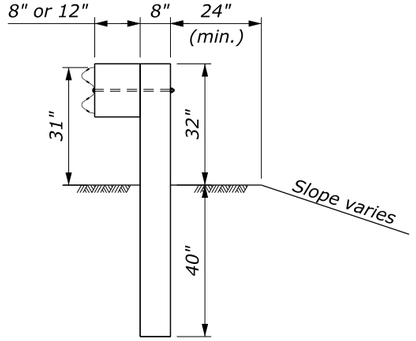
PLAN



ELEVATION

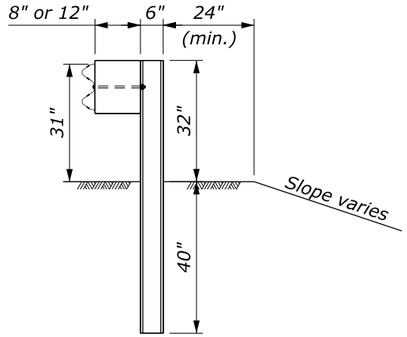
NOTE:

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.



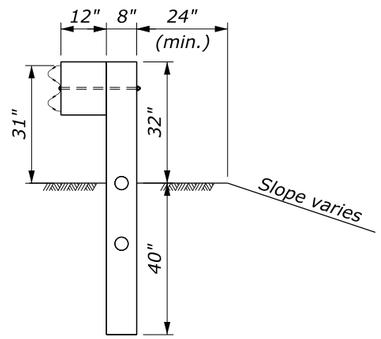
WOOD POST DETAIL

POST ① AND ⑧
See Note 1



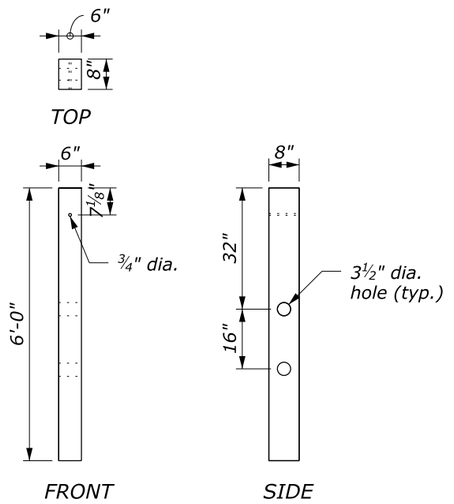
STEEL POST DETAIL

POST ① AND ⑧
See Note 1

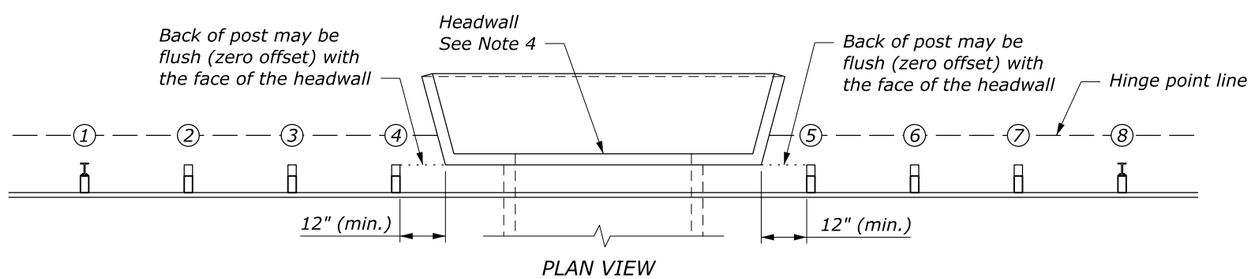


CRT POST DETAIL

POST ② THRU ⑦
See Note 2



CRT WOOD POST



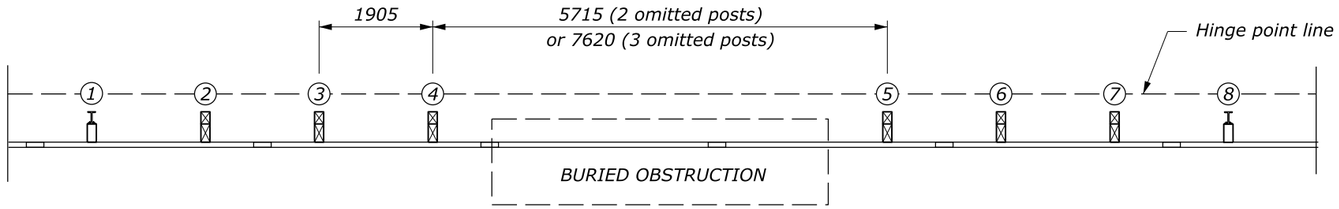
PLAN VIEW

SPAN WITH HEADWALL DETAIL

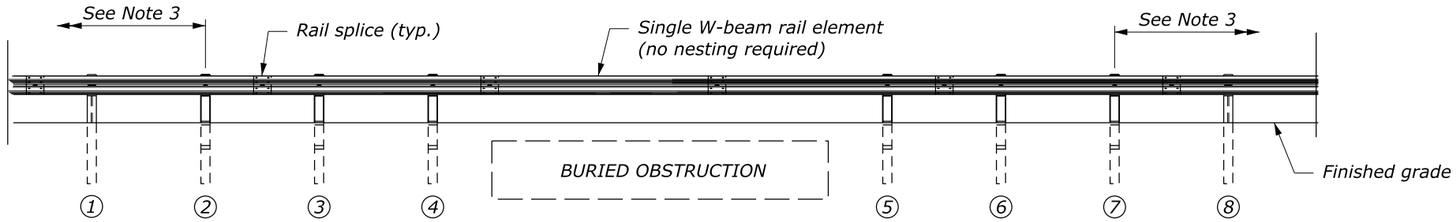
NO SCALE

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

PROJECT	SHEET NUMBER



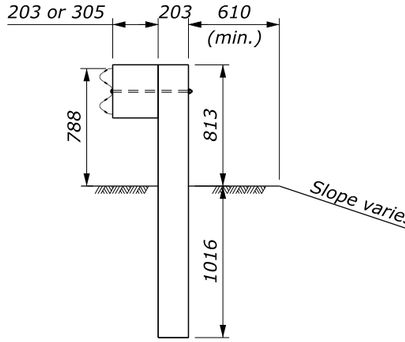
PLAN



ELEVATION

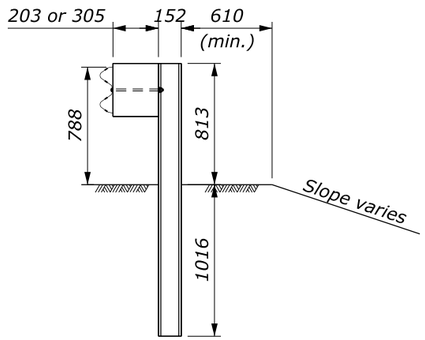
NOTE:

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 19.05 m.
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 50 mm.
5. See Standard M617-31 or M617-32 for other assembly details.



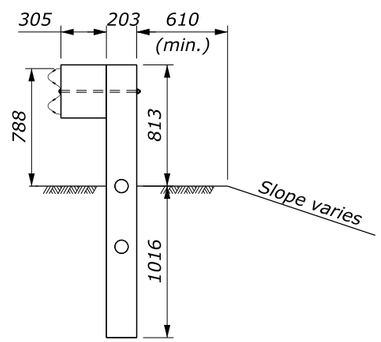
WOOD POST DETAIL

POST ① AND ⑧
See Note 1



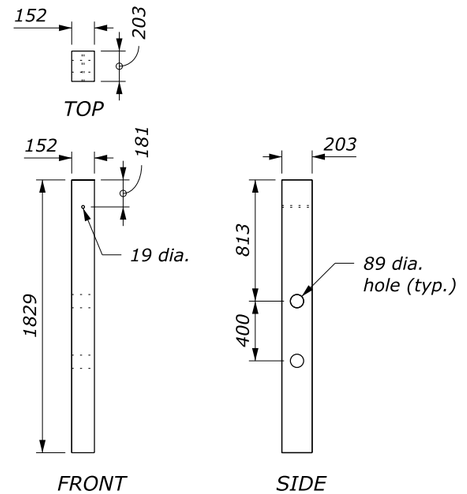
STEEL POST DETAIL

POST ① AND ⑧
See Note 1

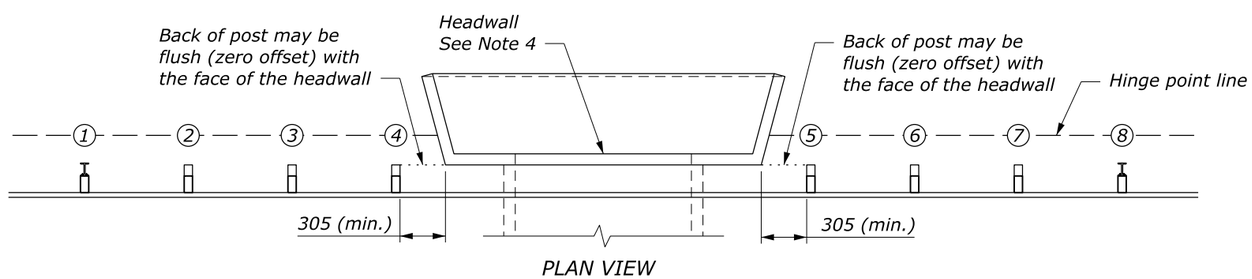


CRT POST DETAIL

POST ② THRU ⑦
See Note 2



CRT WOOD POST



PLAN VIEW

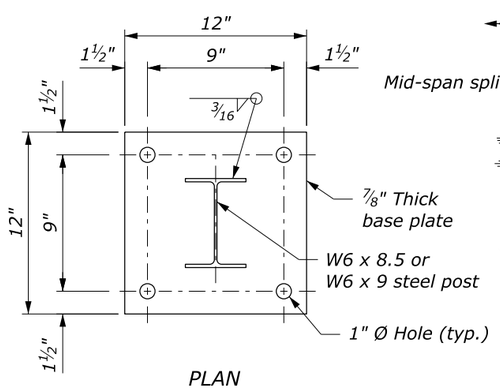
SPAN WITH HEADWALL DETAIL

NO SCALE

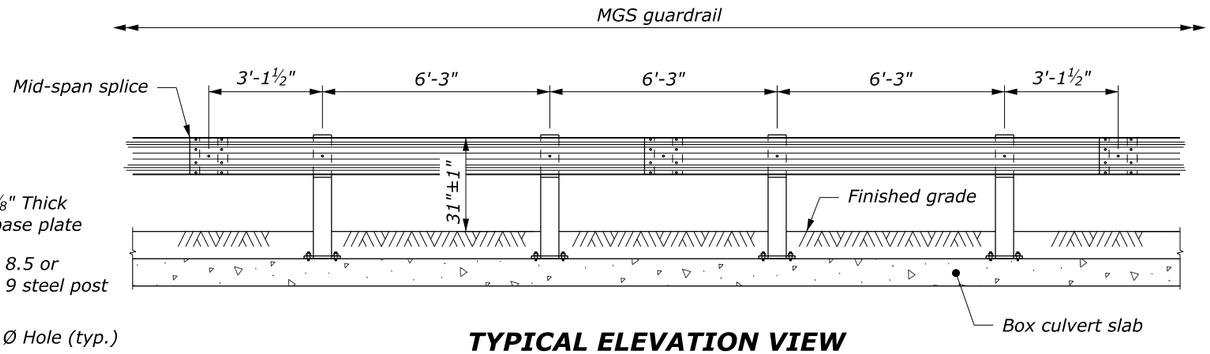
*This drawing contains **Metric** units of measure.*
Dimensions without units are millimeters.

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

PROJECT	SHEET NUMBER



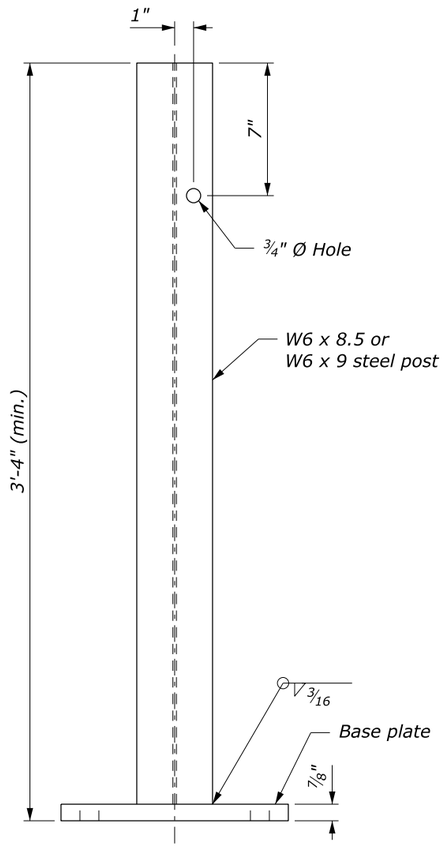
PLAN



TYPICAL ELEVATION VIEW

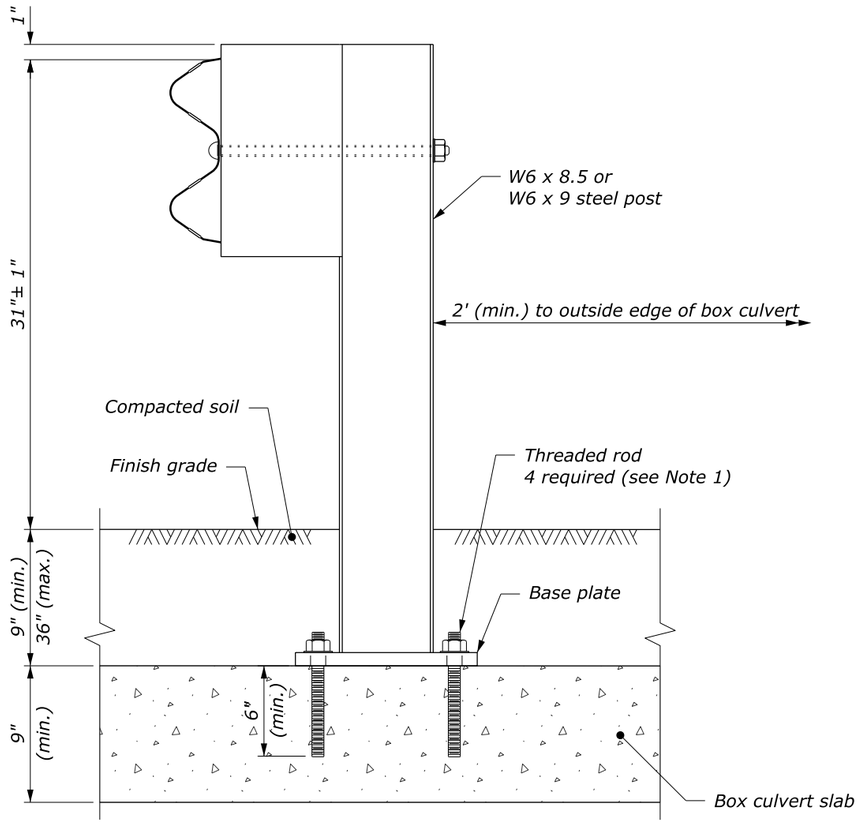
NOTE:

1. *Attach guardrail post to box culvert with 7/8 inch diameter high-strength threaded rods 8½ 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 blockouts are shown. Blockouts of an approved alternative may be used.*
3. *See Standard 617-32 for other details.*

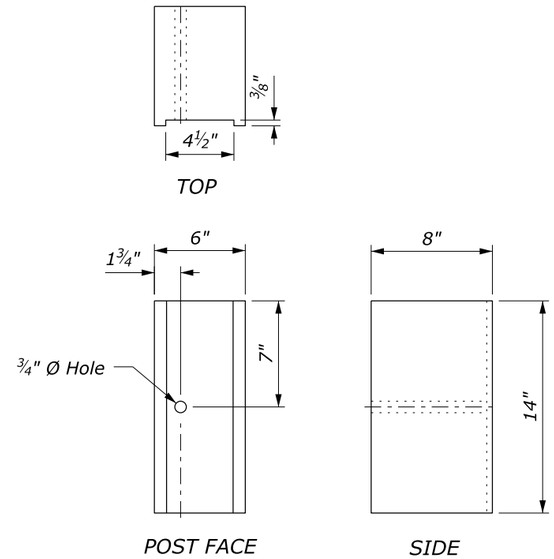


ELEVATION

BOX CULVERT POST



BOX CULVERT MGS GUARDRAIL STEEL POST



BLOCKOUT

See Note 2

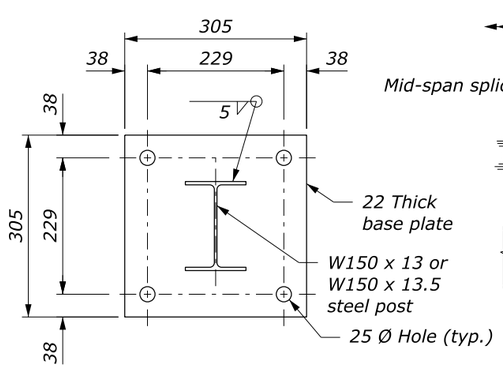
NO SCALE

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

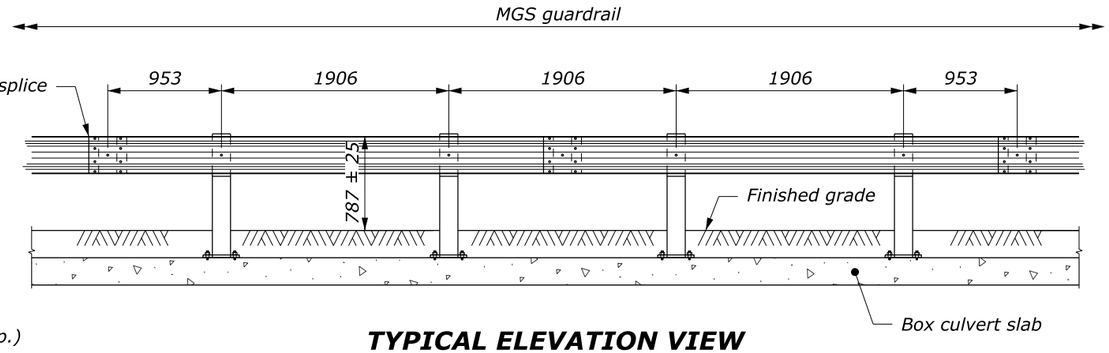
MGS W-BEAM GUARDRAIL STEEL POSTS ATTACHED TO BOX CULVERT

FLH STANDARD
617-38
SPECIFICATION
FP-24
APPROVED FOR USE
1/2024

PROJECT	SHEET NUMBER



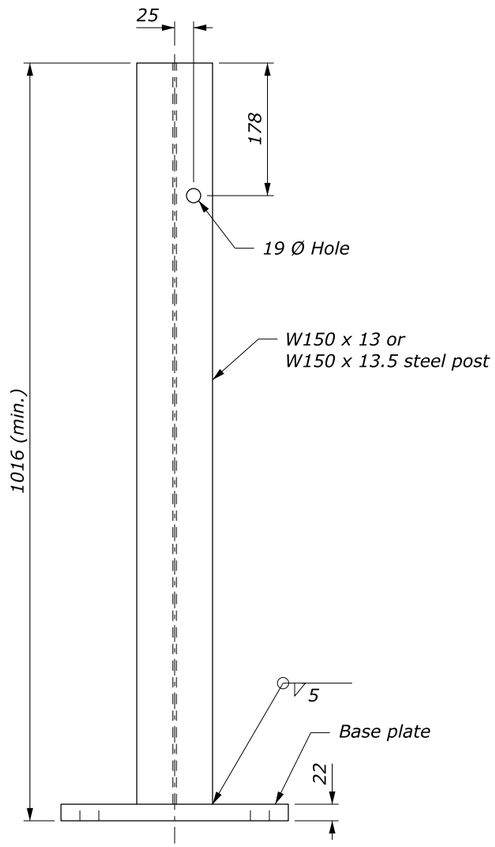
PLAN



TYPICAL ELEVATION VIEW

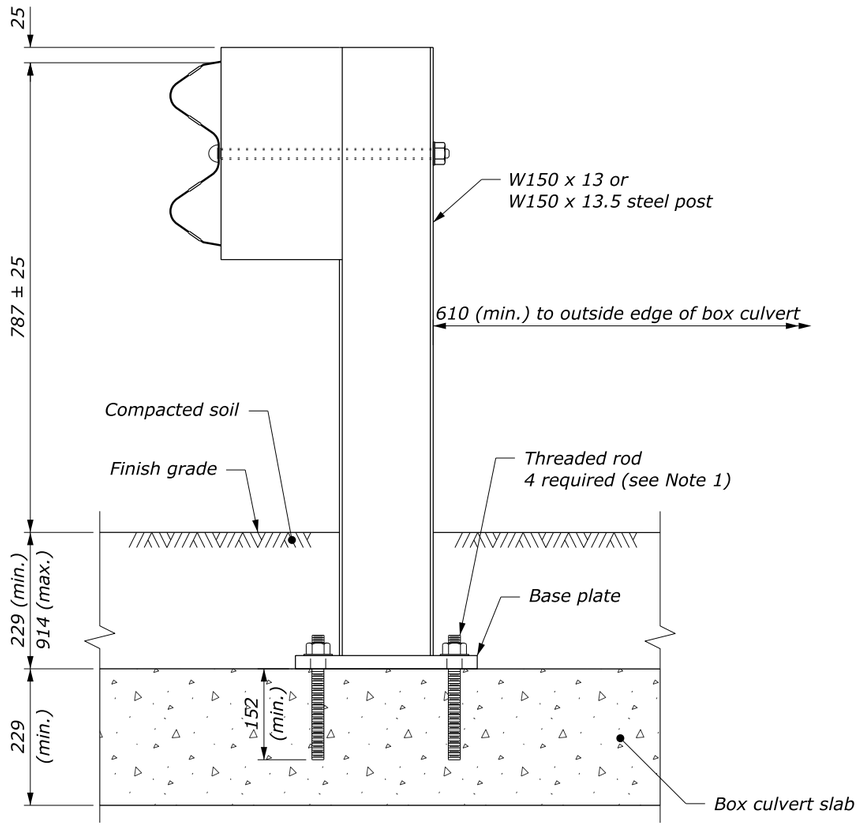
NOTE:

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 blockouts are shown. Blockouts of an approved alternative may be used.
3. See Standard M617-32 for other details.

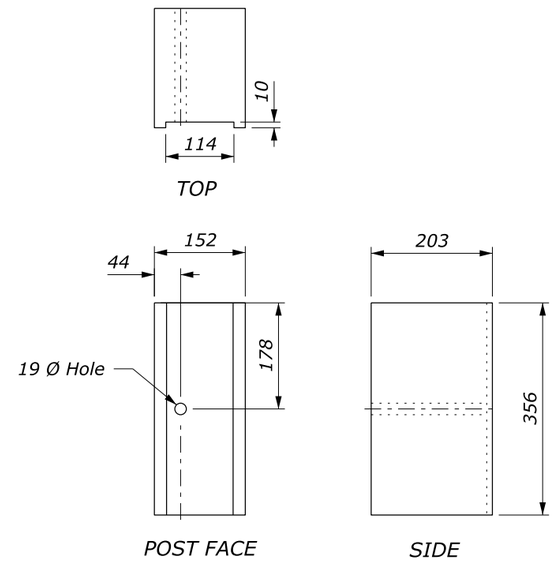


ELEVATION

BOX CULVERT POST



BOX CULVERT MGS GUARDRAIL STEEL POST



BLOCKOUT

See Note 2

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

NO SCALE

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

MGS W-BEAM GUARDRAIL STEEL POSTS ATTACHED TO BOX CULVERT

FLH STANDARD
M617-38
SPECIFICATION
FP-24
APPROVED FOR USE
1/2024

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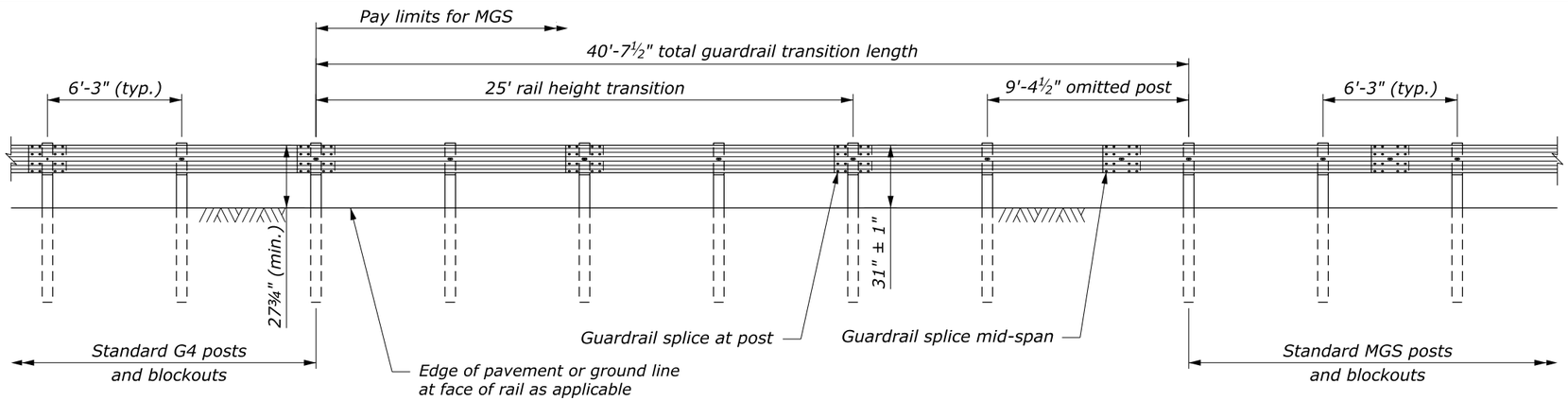
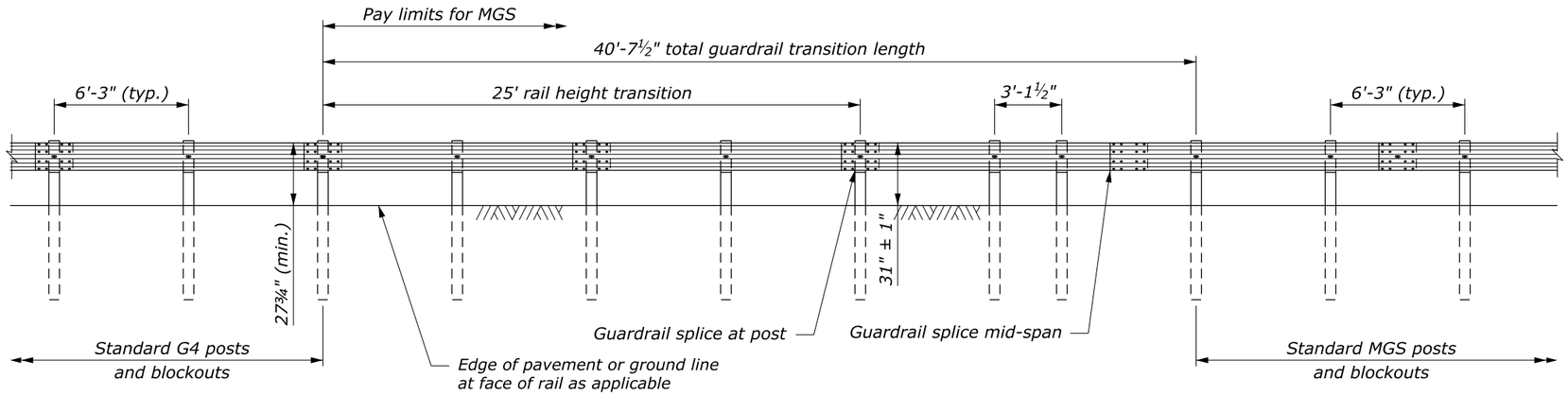
PROJECT	SHEET NUMBER



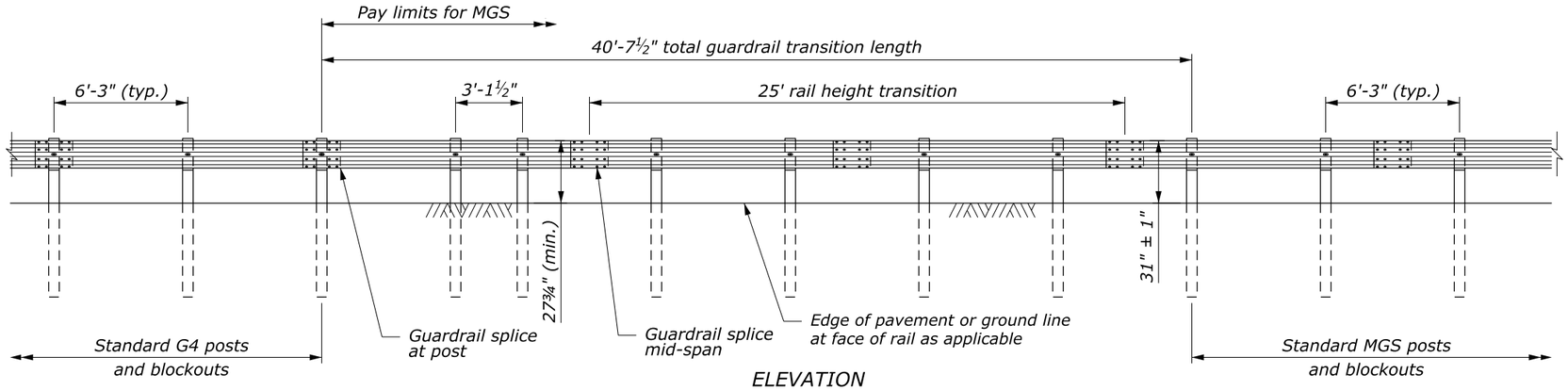
ELEVATION

OMITTED POST OPTION



ELEVATION

HALF-POST SPACING IN MGS OPTION



ELEVATION

HALF-POST SPACING IN G4 OPTION

NO SCALE

NOTE:

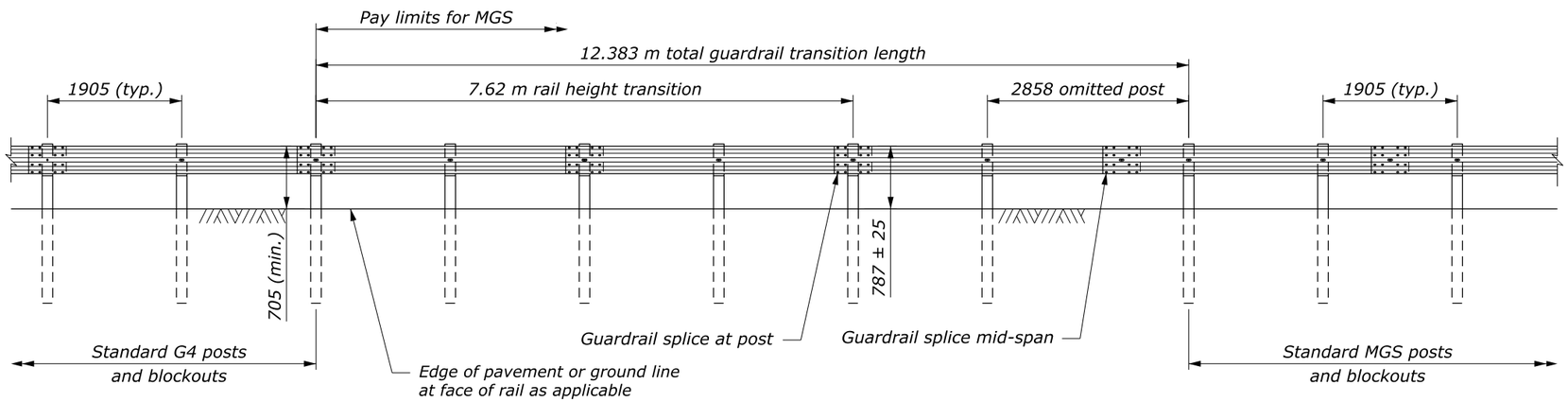
1. *Unless otherwise specified, use any of the options shown as required to meet project-specific conditions.*
2. *Use consistent guardrail post material throughout the length of the guardrail run.*
3. *If applicable, conversion of the 8-inch wide G4 blockout to the 12-inch wide MGS blockout may occur 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.*

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

G4 TO MGS W-BEAM GUARDRAIL TRANSITION

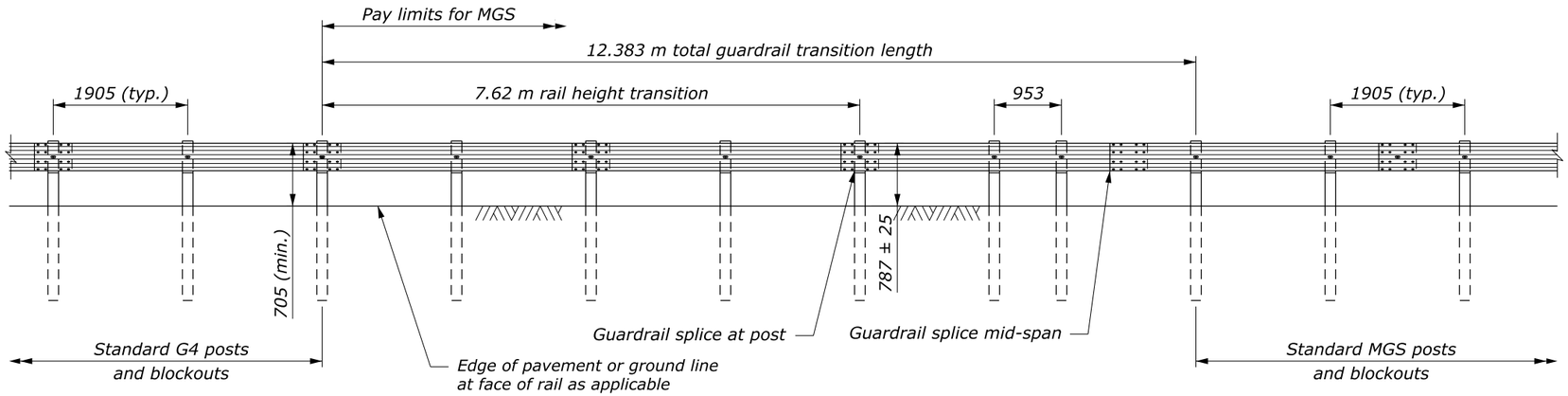
FLH STANDARD	617-39
SPECIFICATION	FP-24
APPROVED FOR USE	1/2024

PROJECT	SHEET NUMBER



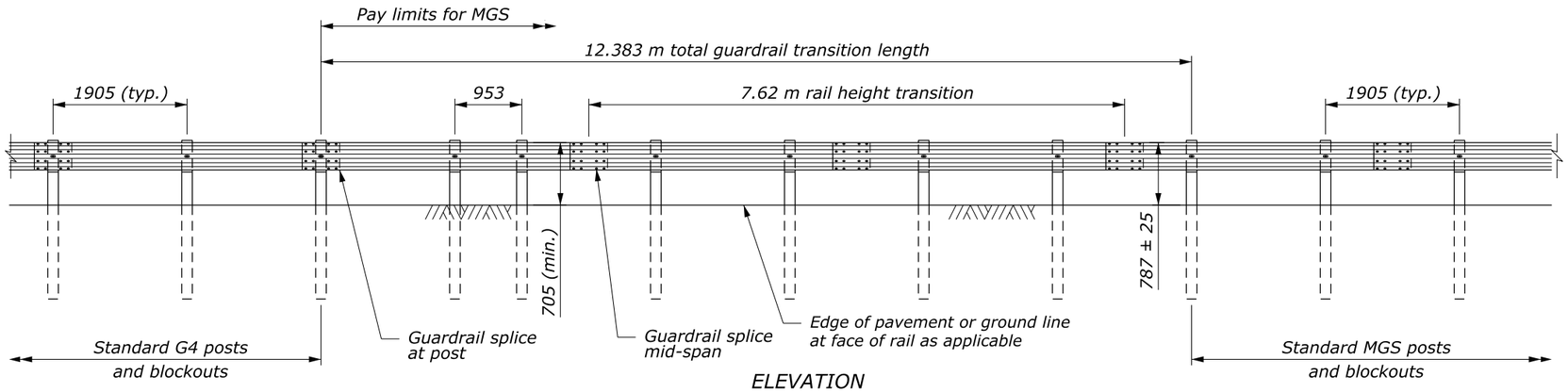
ELEVATION

OMITTED POST OPTION



ELEVATION

HALF-POST SPACING IN MGS OPTION



ELEVATION

HALF-POST SPACING IN G4 OPTION

NO SCALE

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.*

U.S. DEPARTMENT OF TRANSPORTATION, FHWA OFFICE OF FEDERAL LANDS HIGHWAY	FLH STANDARD M617-39
G4 TO MGS W-BEAM GUARDRAIL TRANSITION	SPECIFICATION FP-24
	APPROVED FOR USE 1/2024