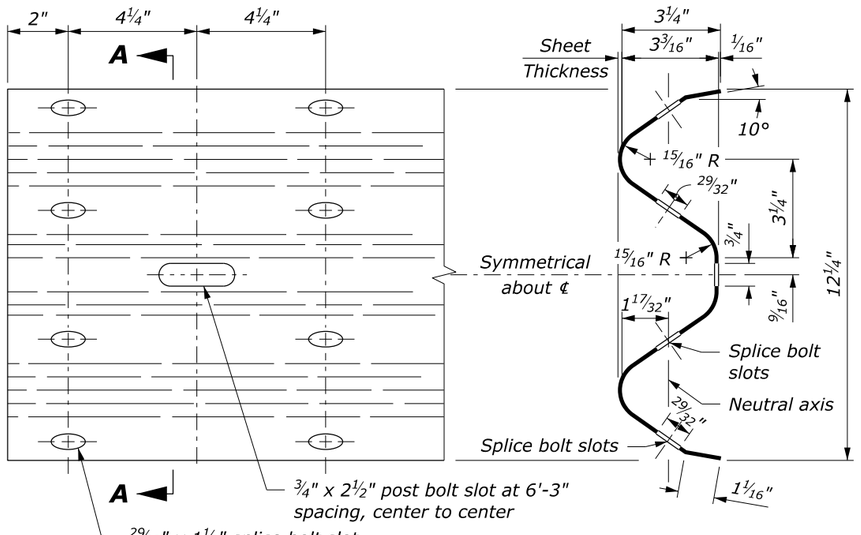
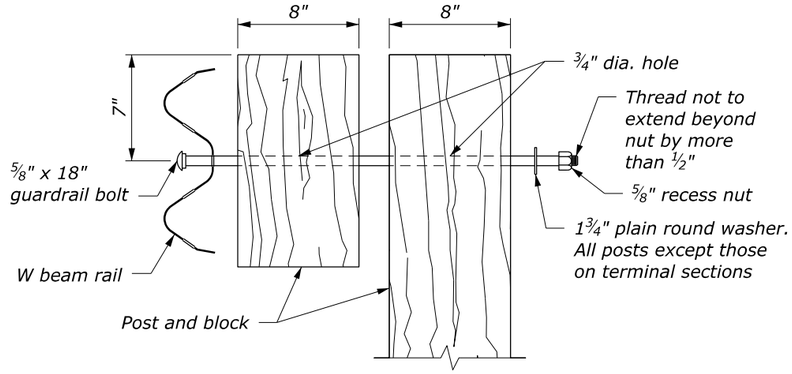
PROJECT	SHEET NUMBER



RAIL ELEVATION

SECTION A-A

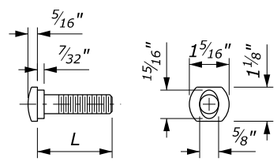
W BEAM RAIL



POST BOLT ASSEMBLY

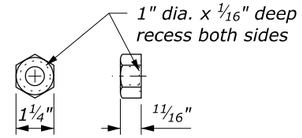
NOTE:

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 alternative 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.
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.



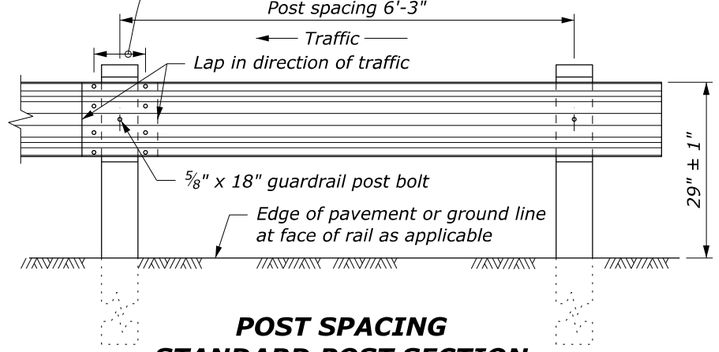
⅝" GUARDRAIL BOLT

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

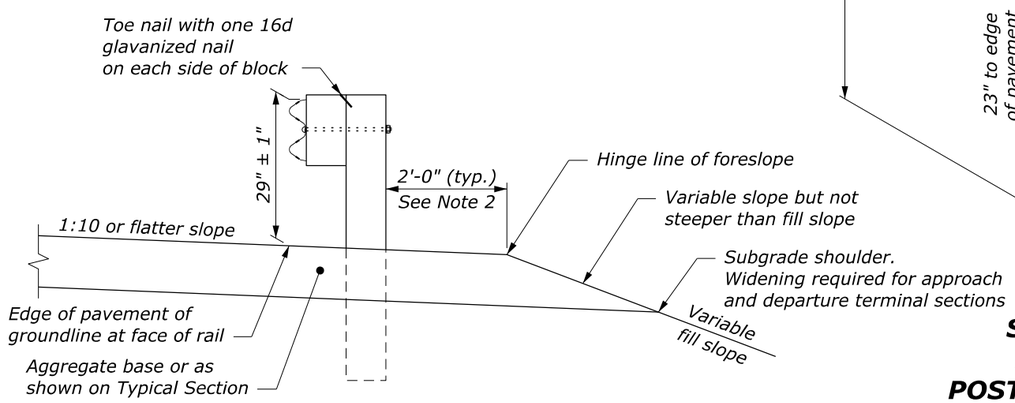


⅝" RECESS NUT

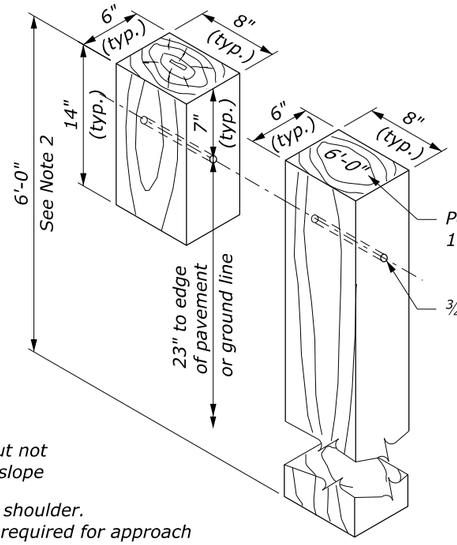
GUARDRAIL BOLT AND RECESS NUT



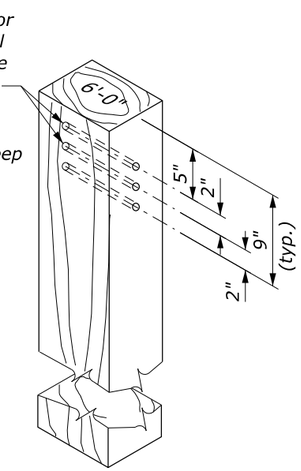
POST SPACING
STANDARD POST SECTION



TYPICAL GUARDRAIL CROSS SECTION

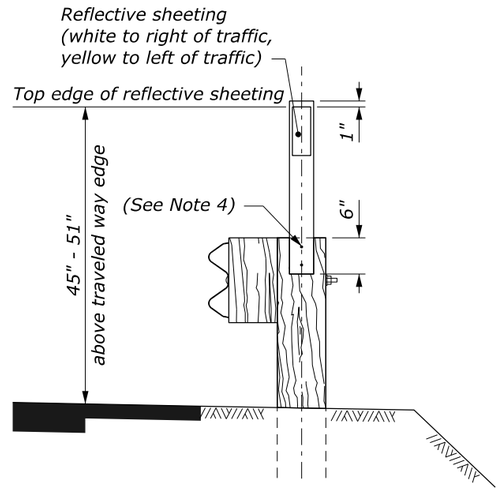


STANDARD HOLE ARRANGEMENT POST AND BLOCK DETAIL



ALTERNATE HOLE ARRANGEMENT POST AND BLOCK DETAIL

NO SCALE



FLEXIBLE GUIDE POST GUARDRAIL MOUNT

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
OFFICE OF FEDERAL LANDS HIGHWAY

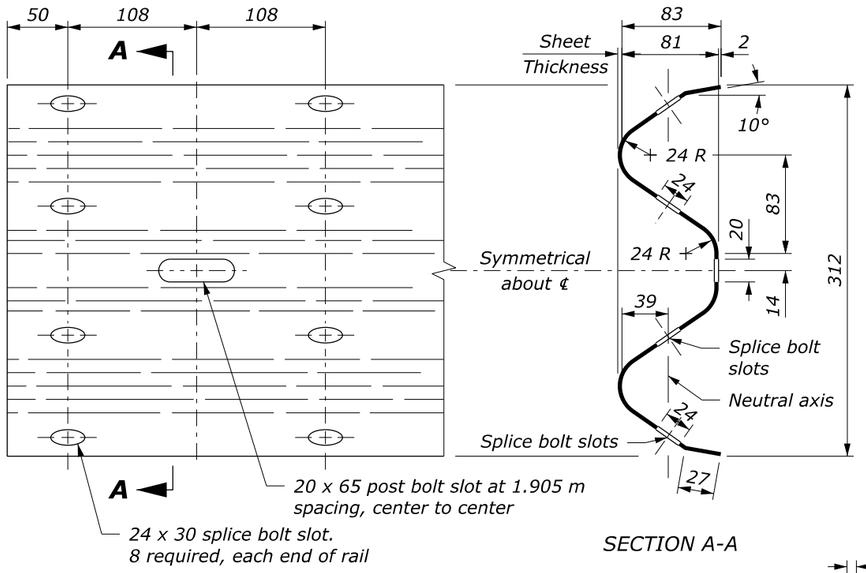
FLH STANDARD

G4 W-BEAM GUARDRAIL WOOD POSTS

STANDARD APPROVED FOR USE 1/1994	STANDARD
REVISED: 4/1994 6/2005 7/2022	617-10

c:\pw-work\d0419223\Std617-10.dgn [Std 617-10]
10 August 2022 12:56 PM

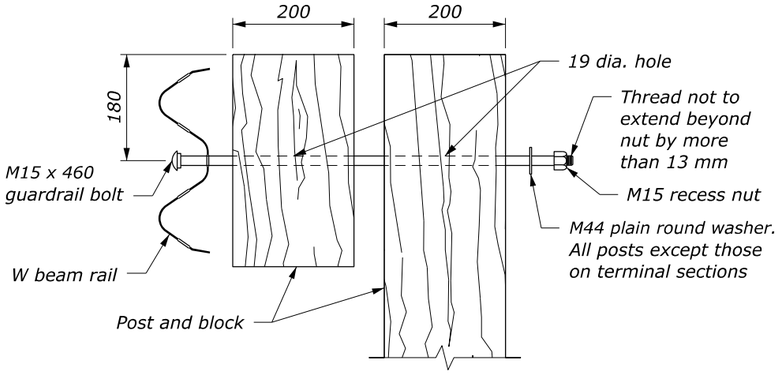
PROJECT	SHEET NUMBER



RAIL ELEVATION

SECTION A-A

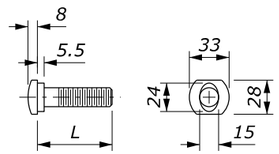
W BEAM RAIL



POST BOLT ASSEMBLY

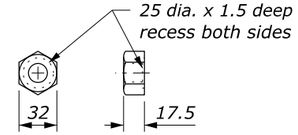
NOTE:

1. When encountering impenetrable material, see Section M617-13.
2. See Special Contract Requirements when 2 m or longer posts are specified.
3. See Special Contract Requirements when the alternative 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.
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.
7. Dimensions without units are millimeters.



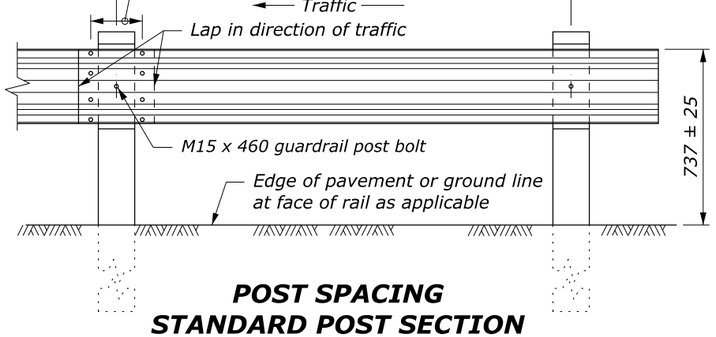
M15 GUARDRAIL BOLT

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

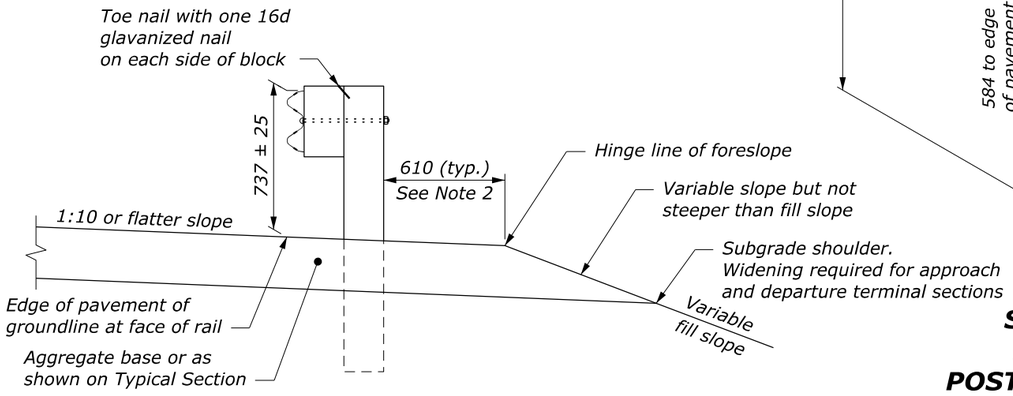


M15 RECESS NUT

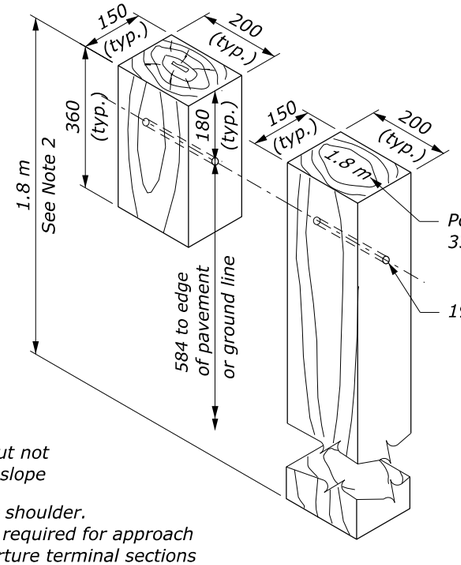
GUARDRAIL BOLT AND RECESS NUT



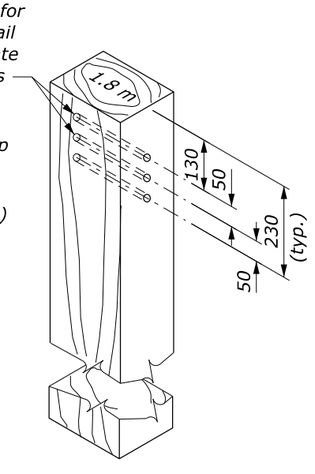
POST SPACING
STANDARD POST SECTION



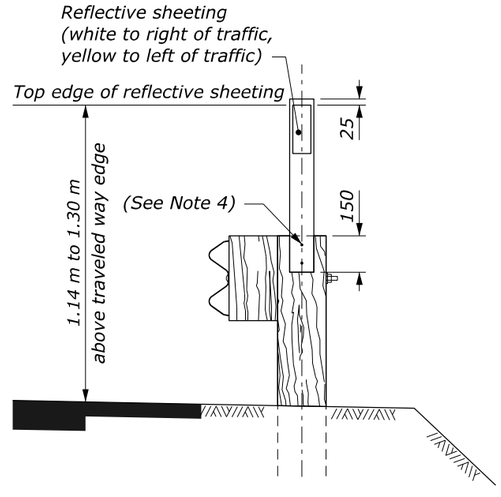
TYPICAL GUARDRAIL CROSS SECTION



STANDARD HOLE ARRANGEMENT POST AND BLOCK DETAIL



ALTERNATE HOLE ARRANGEMENT POST AND BLOCK DETAIL



FLEXIBLE GUIDE POST GUARDRAIL MOUNT

NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
OFFICE OF FEDERAL LANDS HIGHWAY

METRIC FLH STANDARD

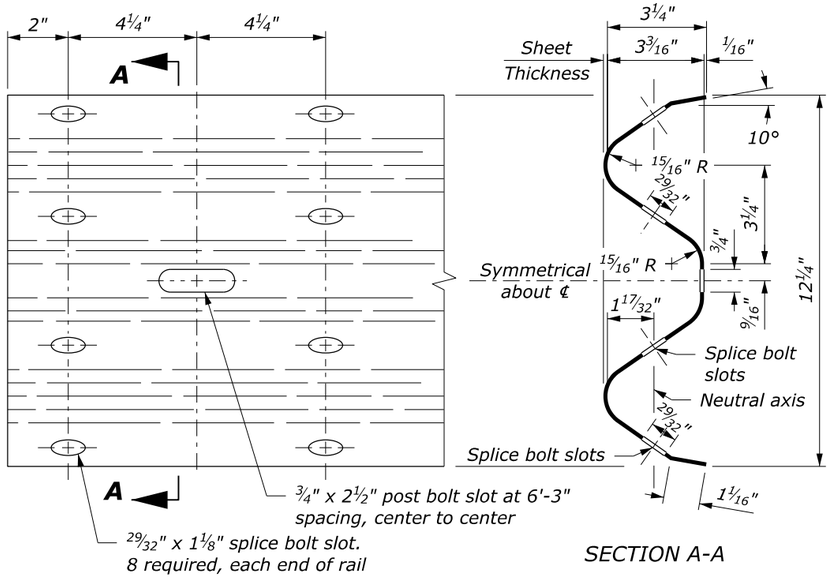
G4 W-BEAM GUARDRAIL WOOD POSTS

STANDARD APPROVED FOR USE 3/1996
REVISED: 8/1997 6/2005 7/2022

STANDARD M617-10

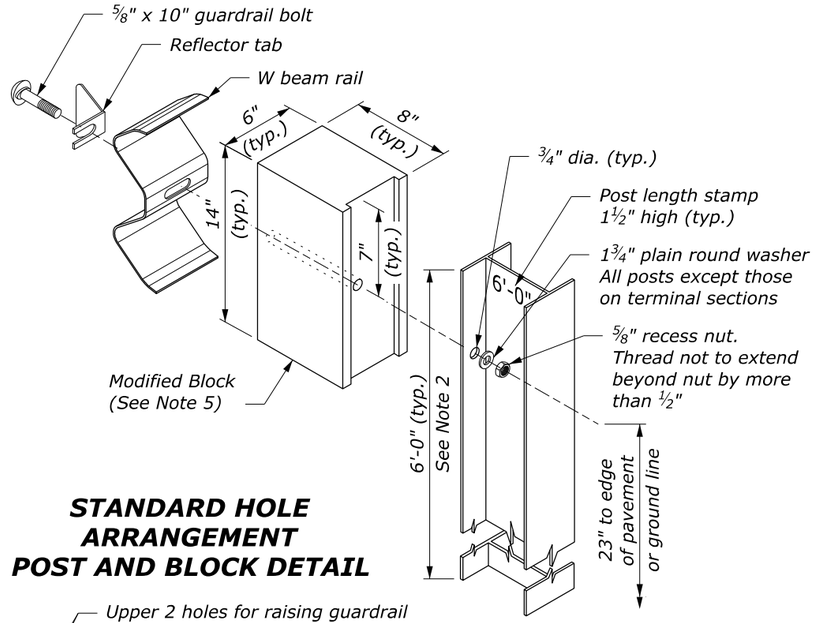
c:\pw-work\d0419223\Std617-10.dgn [Std M617-10]
10 August 2022 12:55 PM

PROJECT	SHEET NUMBER



RAIL ELEVATION

SECTION A-A

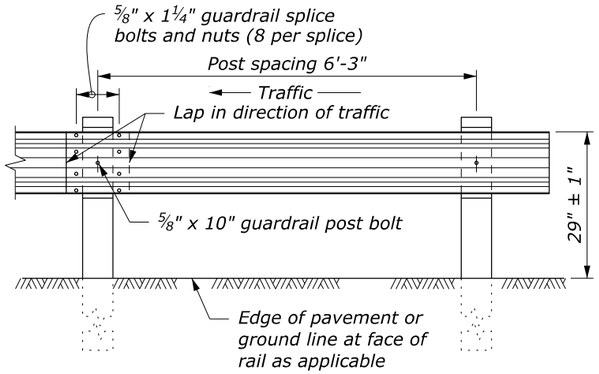


STANDARD HOLE ARRANGEMENT POST AND BLOCK DETAIL

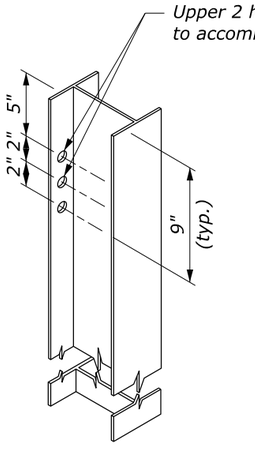
NOTE:

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 alternative 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.
5. Modified block 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.

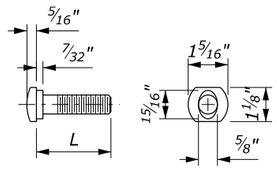
W BEAM RAIL



POST SPACING STANDARD POST SECTION

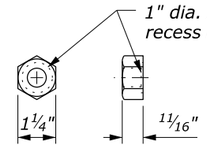


ALTERNATE HOLE ARRANGEMENT POST AND BLOCK DETAIL



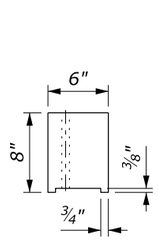
L	Thread Length
1¼"	1⅛" minimum
2"	1¾" minimum
10"	4" minimum
18"	4" minimum
25"	4" minimum

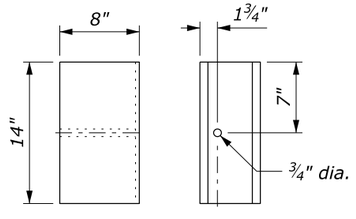
⅝" GUARDRAIL BOLT



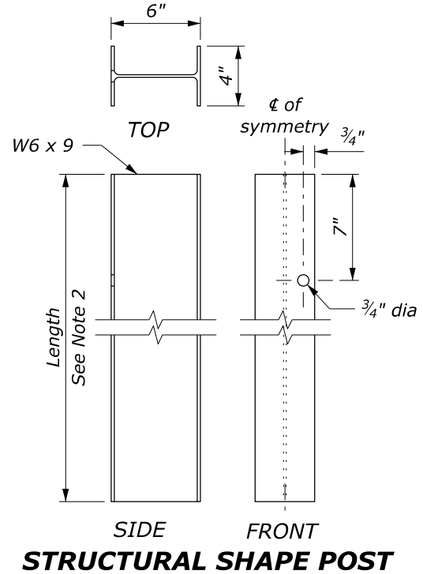
⅝" RECESS NUT

GUARDRAIL BOLT AND RECESS NUT



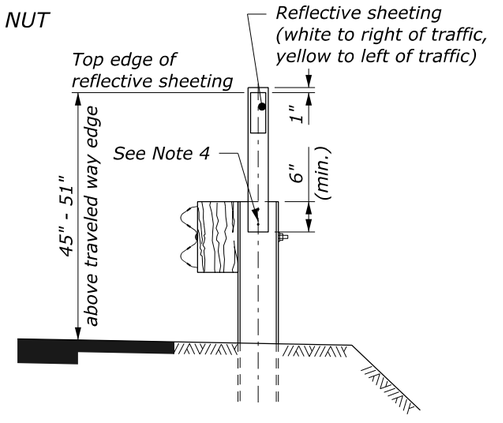


BLOCK

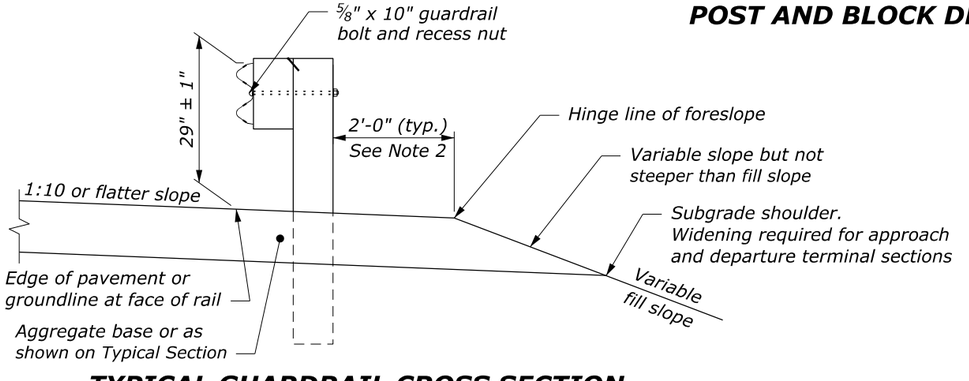


STRUCTURAL SHAPE POST (STANDARD HOLE ARRANGEMENT)

NO SCALE



FLEXIBLE GUIDE POST GUARDRAIL MOUNT



TYPICAL GUARDRAIL CROSS SECTION

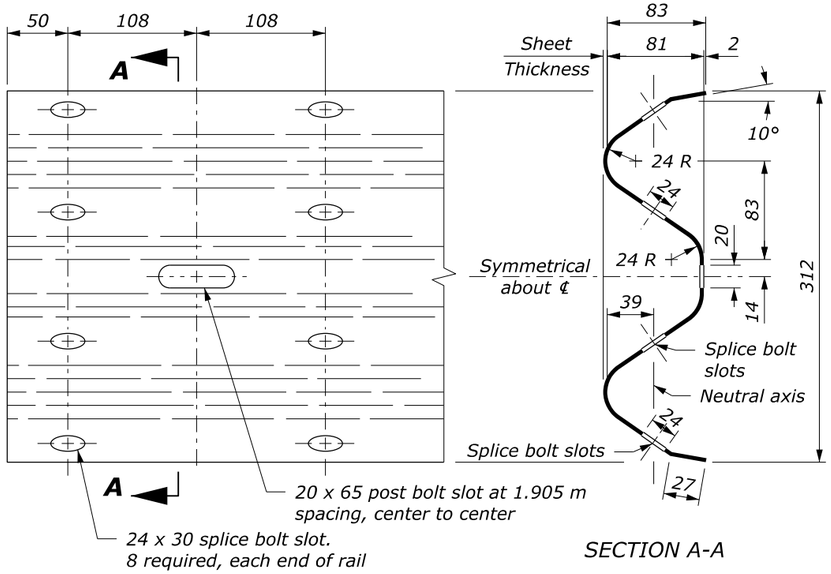
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
OFFICE OF FEDERAL LANDS HIGHWAY

FLH STANDARD

G4 W-BEAM GUARDRAIL STEEL POSTS

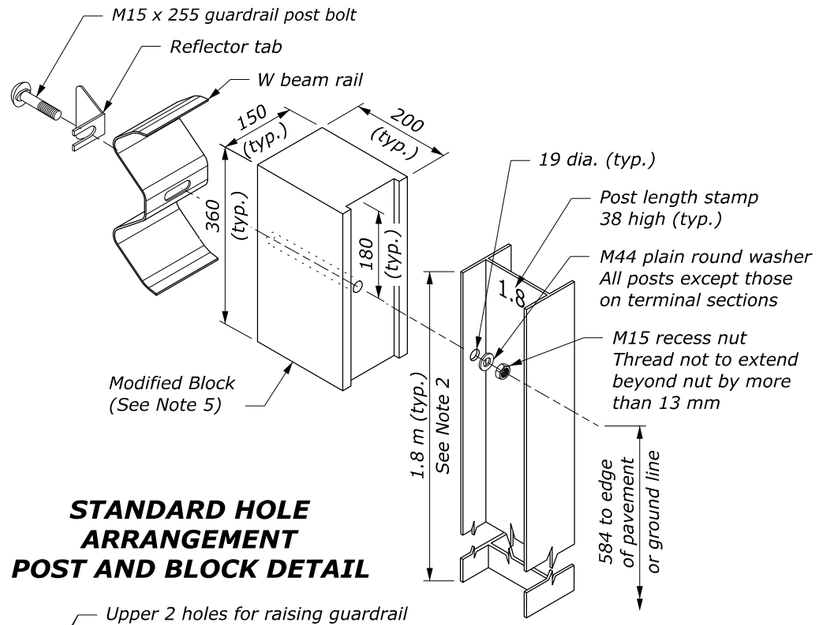
STANDARD APPROVED FOR USE 1/1994	STANDARD
REVISED: 4/1994 6/2005 7/2022	617-11

PROJECT	SHEET NUMBER



RAIL ELEVATION

SECTION A-A

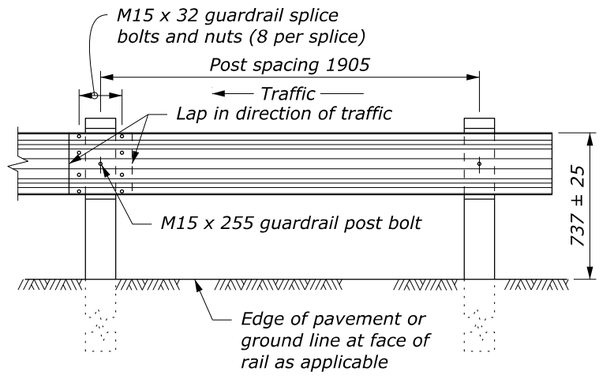


STANDARD HOLE ARRANGEMENT POST AND BLOCK DETAIL

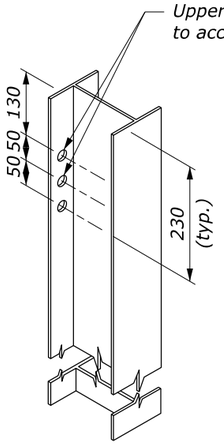
NOTE:

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 alternative 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.
5. Modified block 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.
8. Dimensions without units are millimeters.

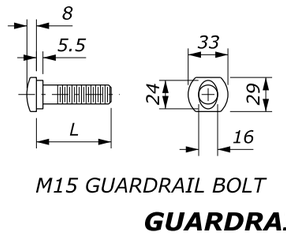
W BEAM RAIL



POST SPACING STANDARD POST SECTION

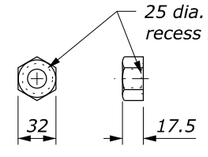


ALTERNATE HOLE ARRANGEMENT POST AND BLOCK DETAIL



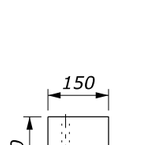
M15 GUARDRAIL BOLT

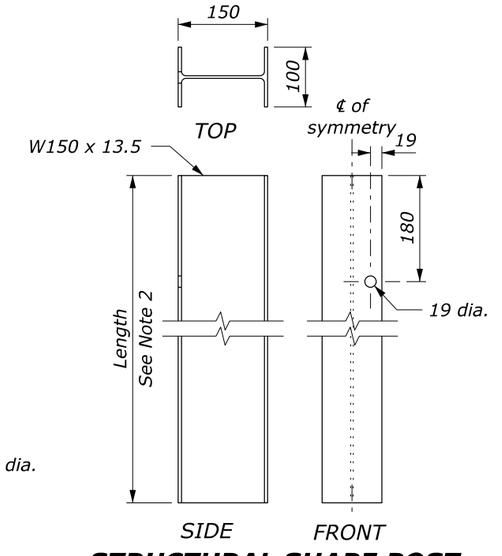
L	Thread Length
32	30 minimum
50	45 minimum
255	100 minimum
460	100 minimum
640	100 minimum

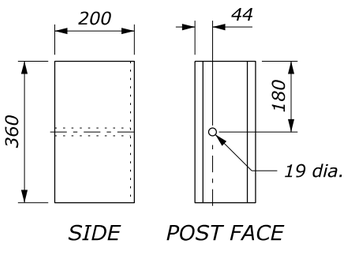


M15 RECESS NUT

GUARDRAIL BOLT AND RECESS NUT



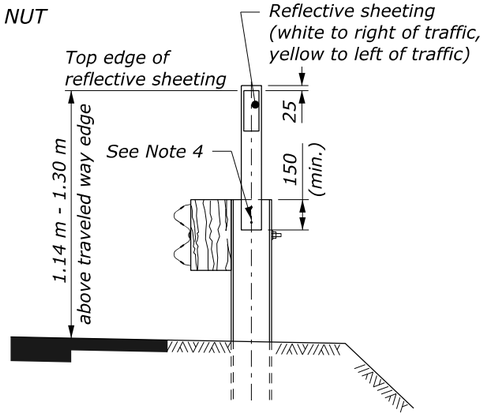




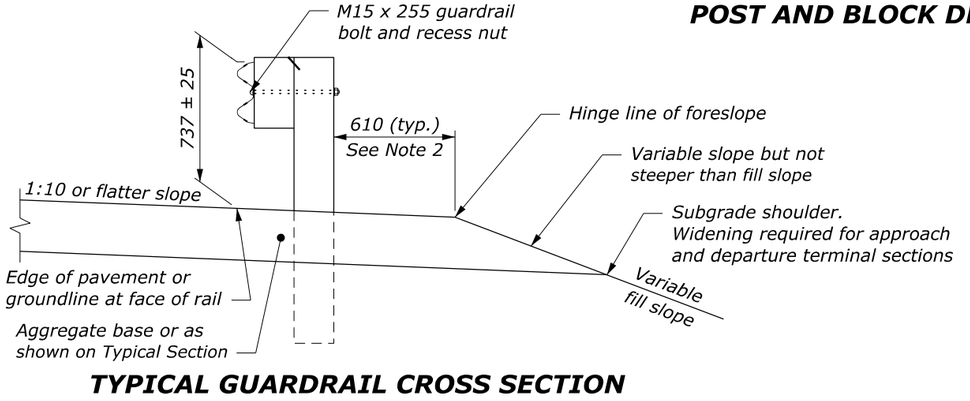
BLOCK

STRUCTURAL SHAPE POST (STANDARD HOLE ARRANGEMENT)

NO SCALE



FLEXIBLE GUIDE POST GUARDRAIL MOUNT



TYPICAL GUARDRAIL CROSS SECTION

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
OFFICE OF FEDERAL LANDS HIGHWAY

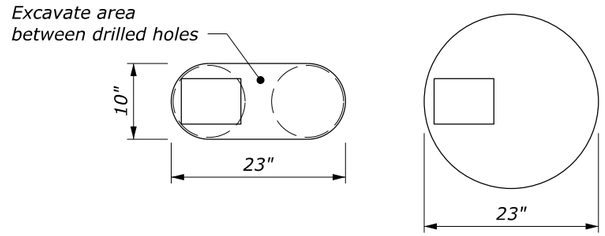
METRIC FLH STANDARD

G4 W-BEAM GUARDRAIL STEEL POSTS

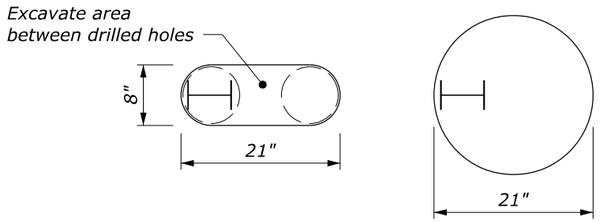
STANDARD APPROVED FOR USE 3/1996
REVISED: 6/1997 12/1998 6/2005 7/2022

STANDARD M617-11

PROJECT	SHEET NUMBER

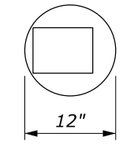


Wood Post

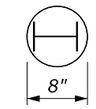


Steel Post

PLAN VIEW



Wood Post

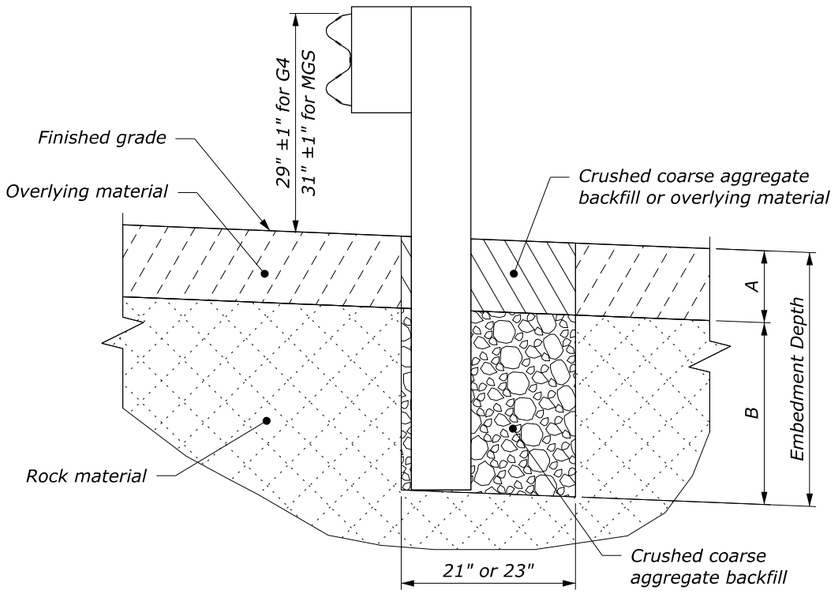


Steel Post

PLAN VIEW

NOTE:

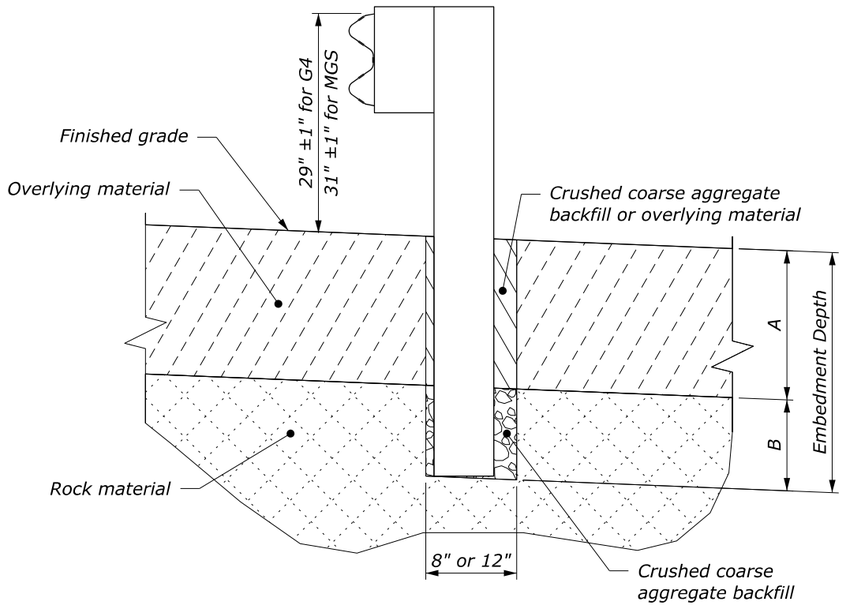
1. *Use this standard when posts cannot be embedded to the minimum depth shown on Standard 617-10, 617-11, 617-31 or 617-32.*
2. *Unless otherwise specified, use either the circular or the oblong hole configuration for Case 1 conditions.*
3. *Use crushed coarse aggregate backfill that conforms to "coarse aggregate for concrete" or "granular backfill for underdrain pipe with geotextile" in Section 703.*
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

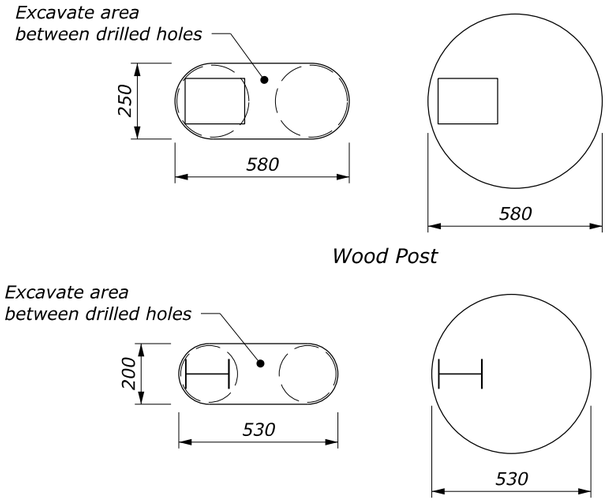
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
OFFICE OF FEDERAL LANDS HIGHWAY

FLH STANDARD

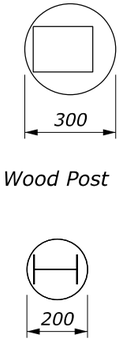
MGS AND G4 W-BEAM GUARDRAIL INSTALLATION IN ROCK

STANDARD APPROVED FOR USE 6/2022	STANDARD
REVISED:	617-13

PROJECT	SHEET NUMBER



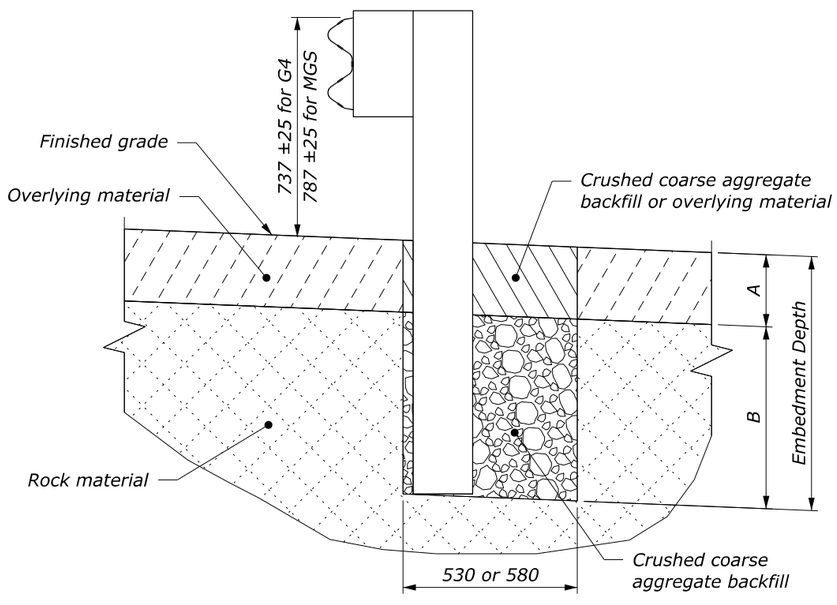
PLAN VIEW



PLAN VIEW

NOTE:

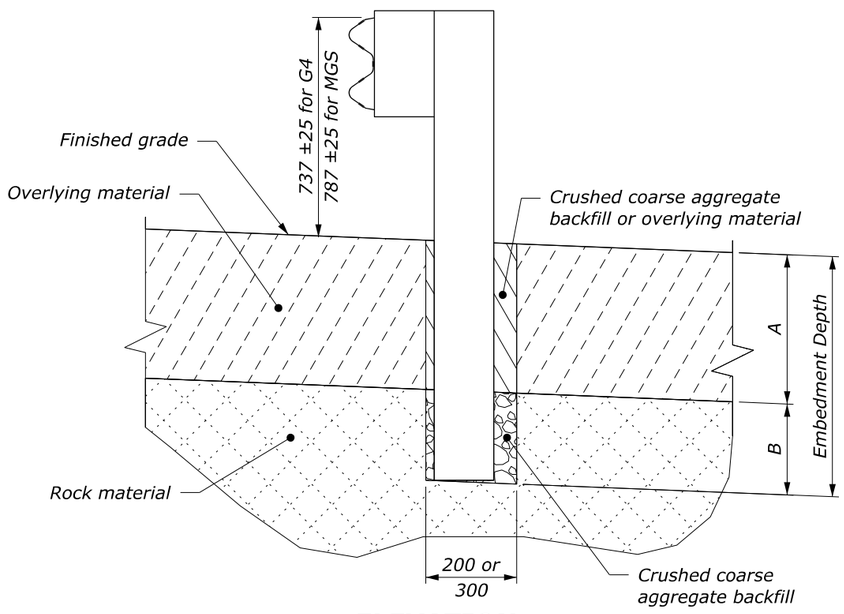
1. *Use this standard when posts cannot be embedded to the minimum depth shown on Standard M617-10, M617-11, M617-31 or M617-32.*
2. *Unless otherwise specified, use either the circular or the oblong hole configuration for Case 1 conditions.*
3. *Use crushed coarse aggregate backfill that conforms to "coarse aggregate for concrete" or "granular backfill for underdrain pipe with geotextile" in Section 703.*
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.*
6. *Dimensions without units are millimeters.*



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

NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
OFFICE OF FEDERAL LANDS HIGHWAY

METRIC FLH STANDARD

MGS AND G4 W-BEAM GUARDRAIL INSTALLATION IN ROCK

STANDARD APPROVED FOR USE 6/2022
REVISED:

STANDARD M617-13

Designer Notes: FLH Standard Drawing 617-13
Last Updated: August 2021

MGS and G4 W-Beam Guardrail Installation in Rock

General Information

Appropriate Applications.

- MGS and G4 W-beam guardrail is designed so that the posts can rotate back in the soil. The rotation in the soil absorbs a significant amount of the impact energy. If the posts are installed in a rigid foundation, such as bedrock, the posts fail to rotate, and less energy is absorbed.

Crash Test Criteria	NCHRP Report 350
Test Level	TL-3
FHWA Eligibility Letter	B-64B
TF 13 Designator	SGR27a-b
Crash Test Report	MwRSF report No. TRP-03-119-03

Limitations. Include this drawing with the plans for all projects with G4 or MGS guardrail in case bedrock or boulders are encountered during post installation.

Layout Guidance.

- See AASHTO *Roadside Design Guide* Section 5.6.7.1

Typical Pay Item Used

Typically, there is no direct payment for this work.

Updates

February 2019

- New Detail drawing

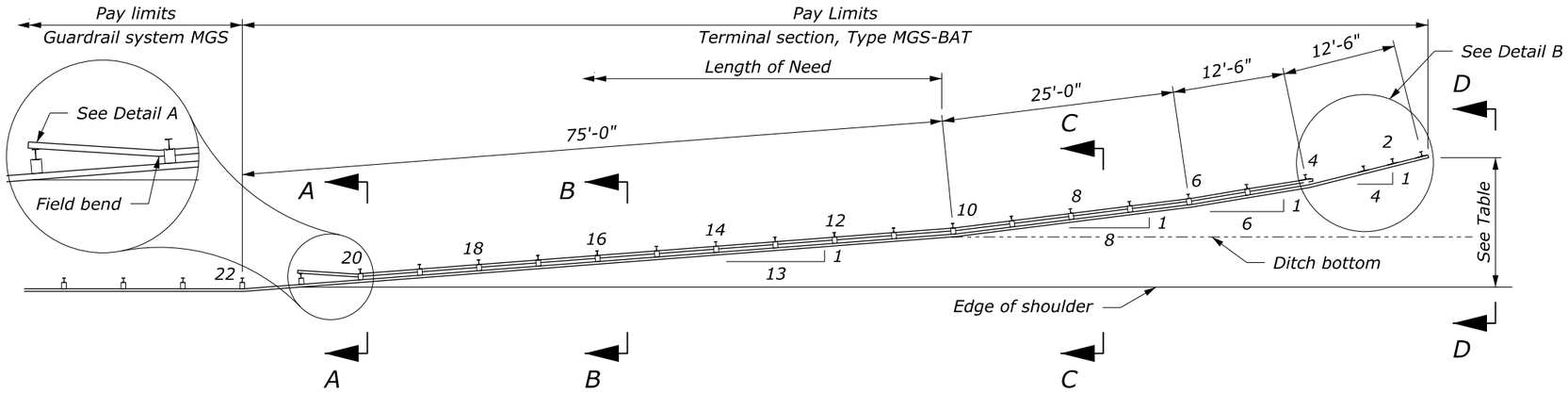
April 2020

- Updated Designer Notes

August 2021

- Converted from CFL Detail to FLH Standard

PROJECT	SHEET NUMBER

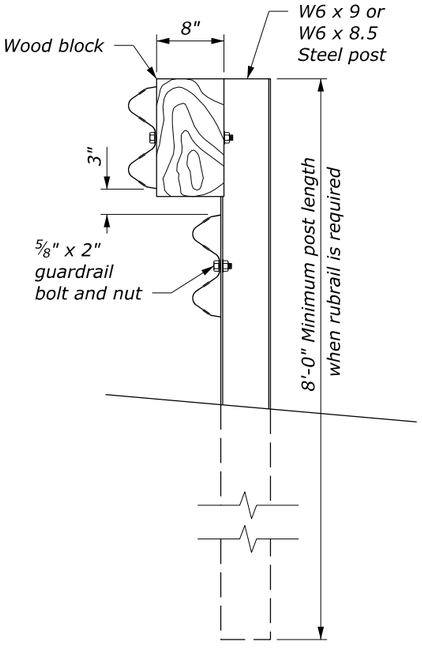


PLAN

NOTE:

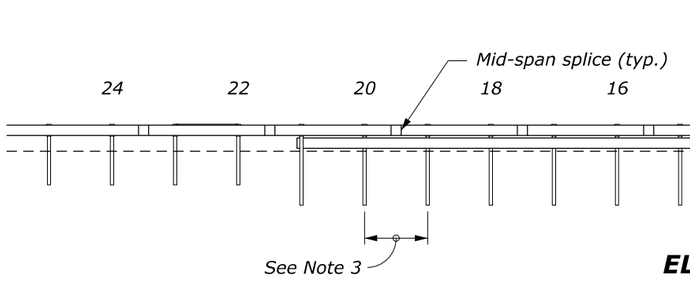
1. Steel posts shown. Wood posts may be used as an alternate, except that steel posts are required for Posts 1 – 3.
2. See Standard 617-31 (wood posts) and 617-32 (steel posts) for other details.
3. Typical post spacing is 6'-3" unless otherwise noted.

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

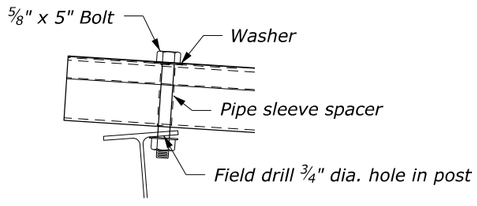


ELEVATION

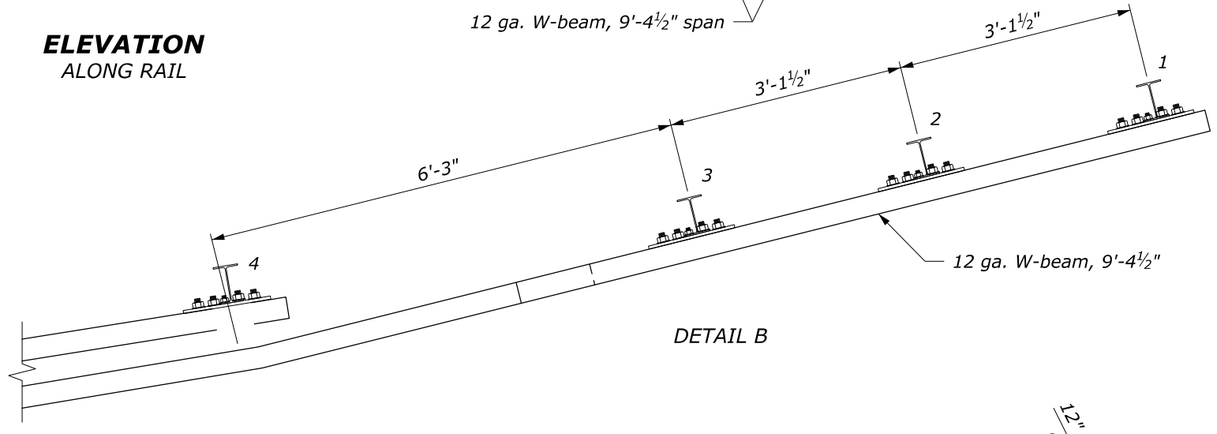
STEEL POST AND BLOCK DETAIL



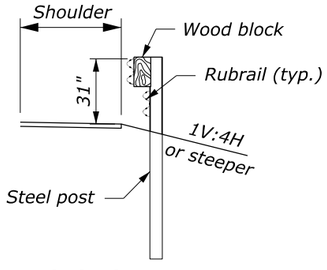
ELEVATION
ALONG RAIL



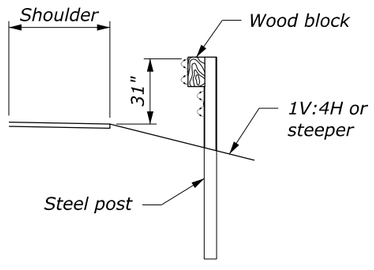
DETAIL A



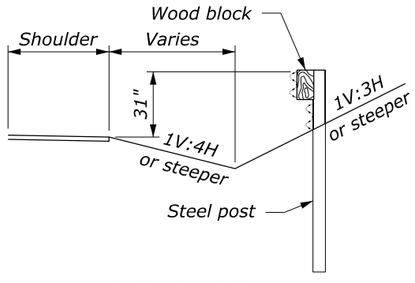
DETAIL B



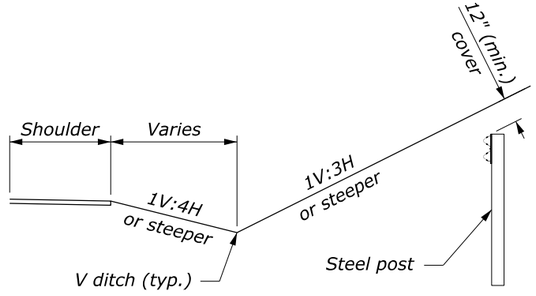
SECTION A-A



SECTION B-B



SECTION C-C



SECTION D-D

NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
OFFICE OF FEDERAL LANDS HIGHWAY

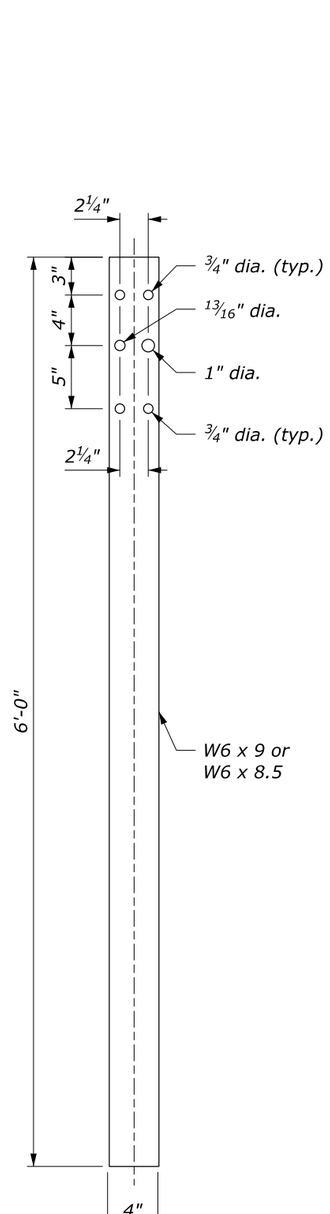
FLH STANDARD

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

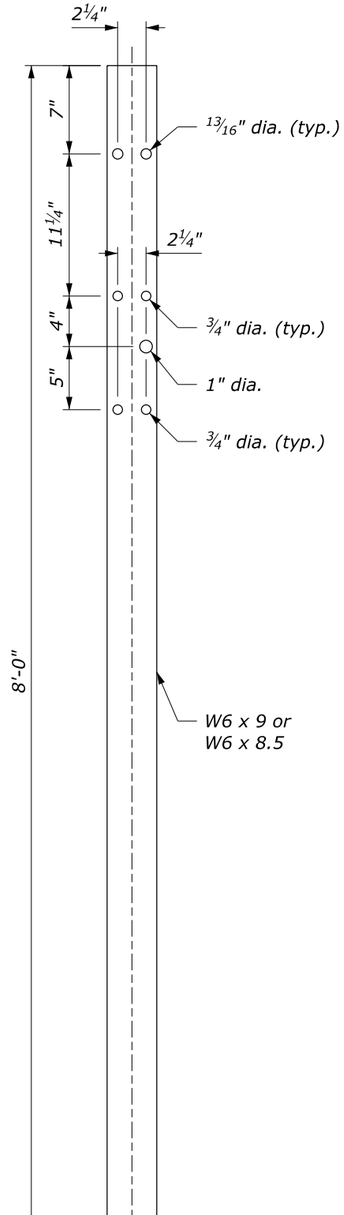
Sheet 1 of 2

STANDARD APPROVED FOR USE 6/2022	STANDARD
REVISED:	617-18

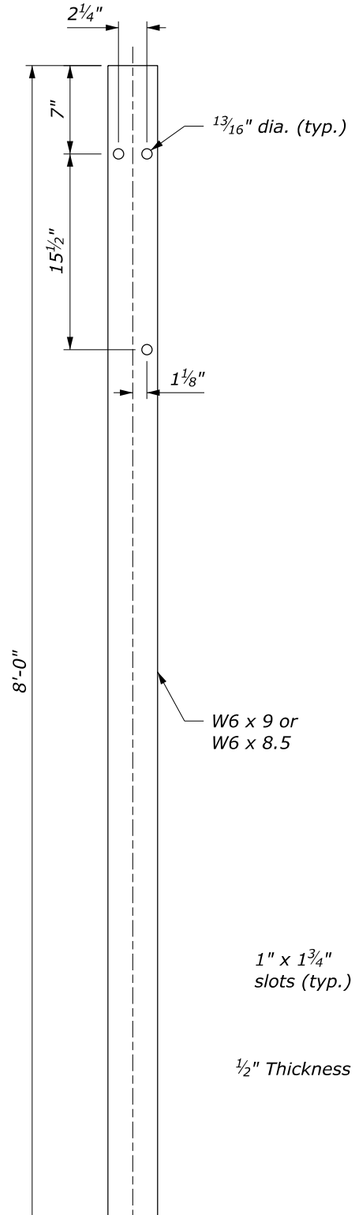
PROJECT	SHEET NUMBER



POSTS 1-3



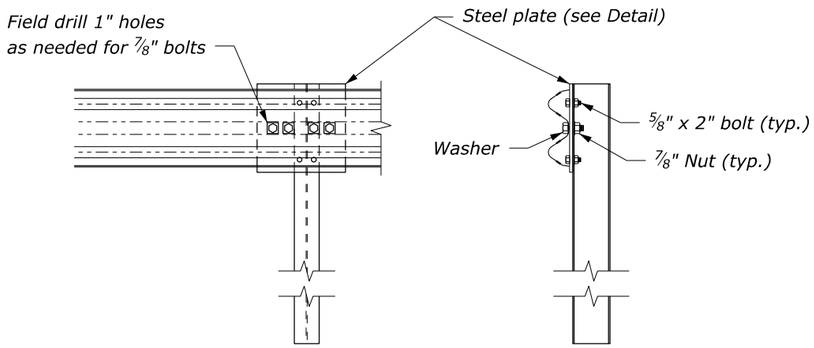
POST 4



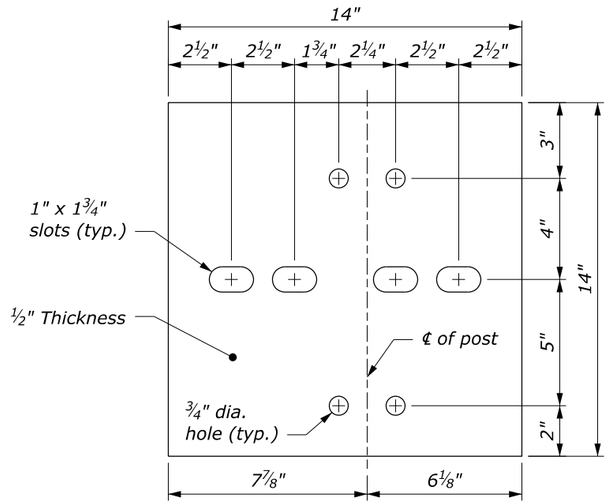
POSTS 5-21

NOTE:

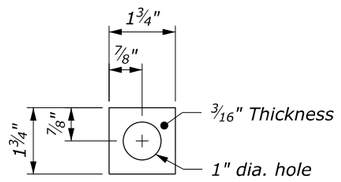
1. See Sheet 1 of 2 for terminal layout.
2. Use zinc rich paint to coat field drilled holes.
3. Anchor plate and hardware are typical on top rail of Posts 1 -3 and rub rail at Post 4.



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
FEDERAL HIGHWAY ADMINISTRATION
OFFICE OF FEDERAL LANDS HIGHWAY

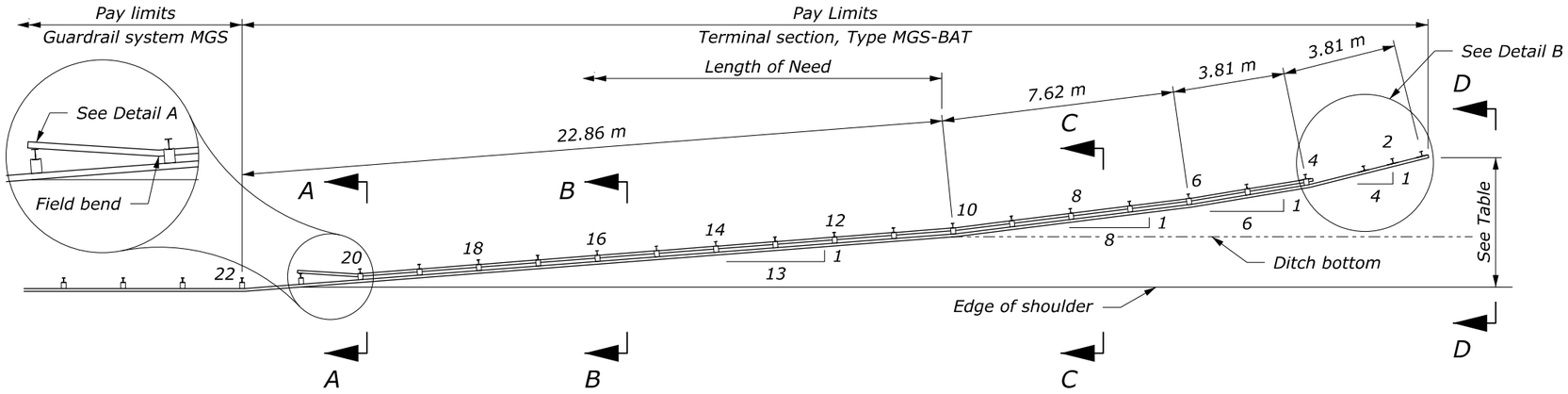
FLH STANDARD

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

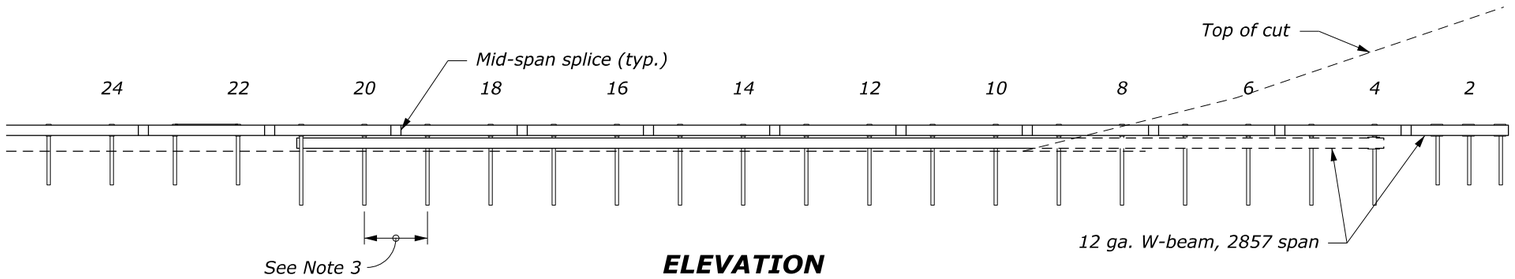
Sheet 2 of 2

STANDARD APPROVED FOR USE 6/2022	STANDARD
REVISED:	617-18

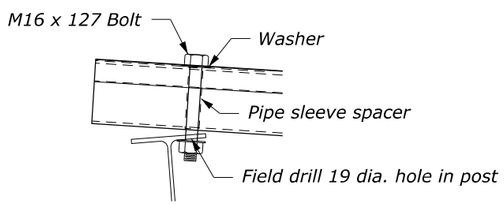
PROJECT	SHEET NUMBER



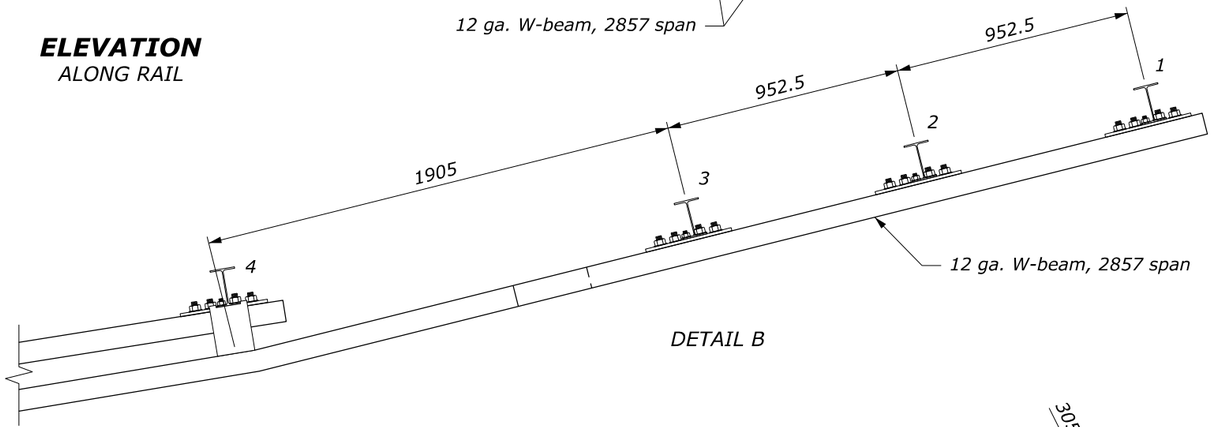
PLAN



ELEVATION
ALONG RAIL



DETAIL A

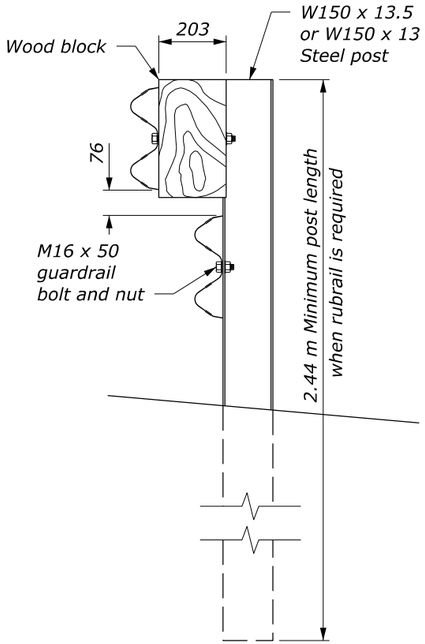


DETAIL B

NOTE:

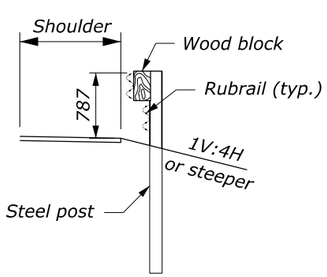
1. *Steel posts shown. Wood posts may be used as an alternate, except that steel posts are required for Posts 1 – 3.*
2. *See Standard M617-31 (wood posts) and M617-32 (steel posts) for other details.*
3. *Typical post spacing is 1.905 m unless otherwise noted.*
4. *Dimensions without units are millimeters.*

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

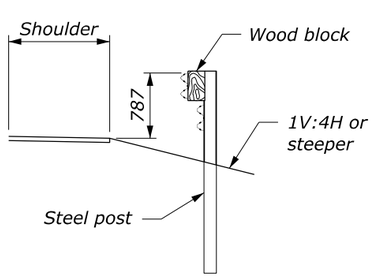


ELEVATION

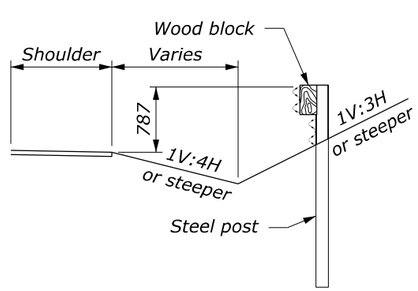
STEEL POST AND BLOCK DETAIL



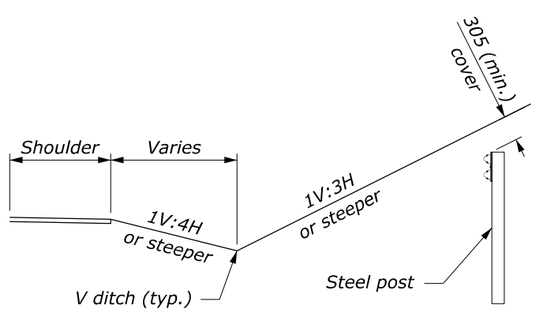
SECTION A-A



SECTION B-B



SECTION C-C



SECTION D-D

NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
OFFICE OF FEDERAL LANDS HIGHWAY

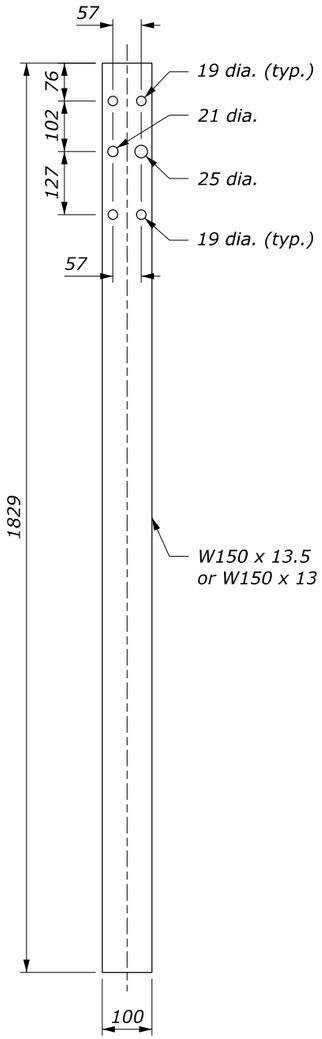
METRIC FLH STANDARD

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

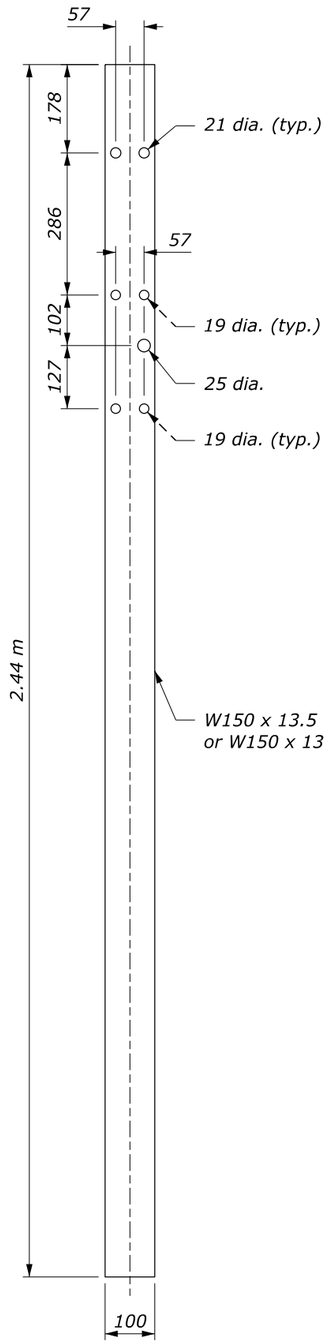
Sheet 1 of 2

STANDARD APPROVED FOR USE 6/2022	STANDARD
REVISED:	M617-18

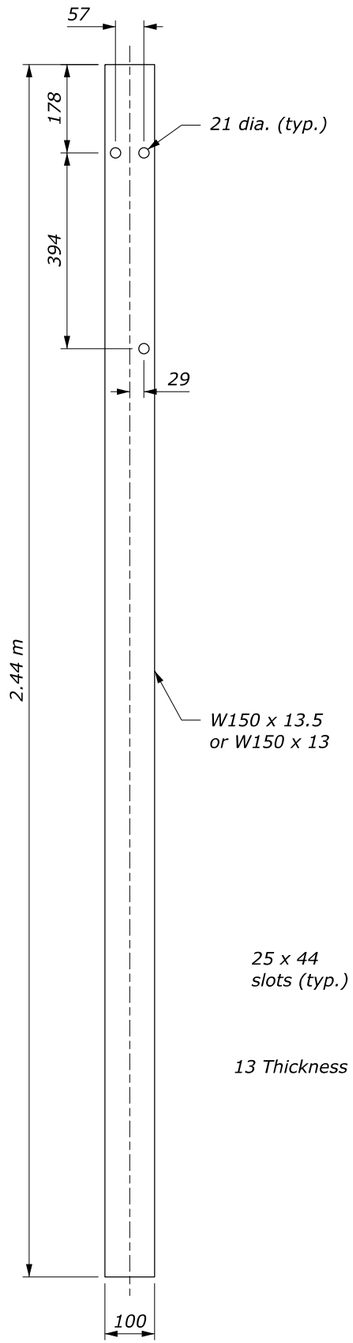
PROJECT	SHEET NUMBER



POSTS 1-3



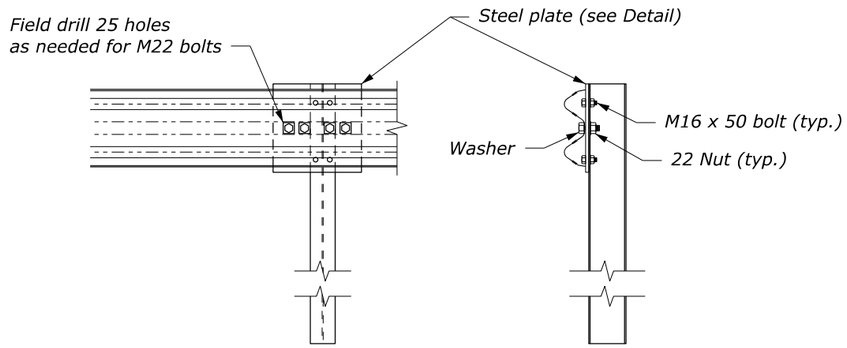
POST 4



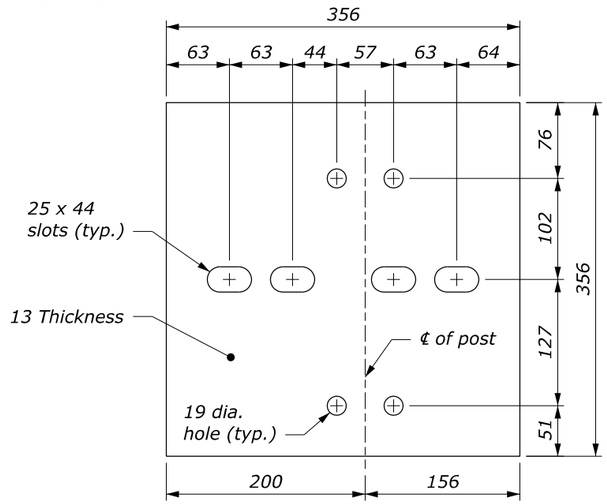
POSTS 5-21

NOTE:

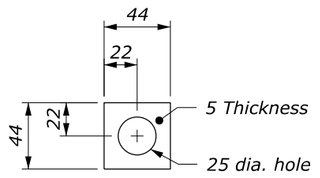
1. *See Sheet 1 of 2 for terminal layout.*
2. *Use zinc rich paint to coat field drilled holes.*
3. *Anchor plate and hardware are typical on top rail of Posts 1 -3 and rub rail at Post 4.*



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
FEDERAL HIGHWAY ADMINISTRATION
OFFICE OF FEDERAL LANDS HIGHWAY

METRIC FLH STANDARD

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

Sheet 2 of 2

STANDARD APPROVED FOR USE 6/2022	STANDARD
REVISED:	M617-18

Designer Notes: FLH Standard Drawing 617-18
Last Updated: August 2021

MGS W-Beam Guardrail, Back Slope Anchor Terminal Type MGS-BAT

General Information

Appropriate Applications.

- In areas of cut sections, or where the road is transitioning from cut to fill, the back slope anchor terminates a W-beam guardrail installation by burying the end into a slope.

Crash Test Criteria	MASH
Test Level	TL-3
FHWA Eligibility Letter	None available
TF 13 Designator	Not posted
Crash Test Report	TTI report 608431-01-1&2

Limitations. Need a steep, natural backslope to bury the terminal into (1V:3H or steeper). Need a 1V:4H or flatter foreslope.

Layout Guidance.

- See AASHTO *Roadside Design Guide*, Section 8.3.6.1
- Carefully review the site, especially the foreslope, backslope, and ditch configuration. Verify onsite drainage needs can be met.

Typical Pay Item Used

- 61702-1700 Terminal section, type MGS-BAT [EA]

Updates

February 2019

- New Detail drawing

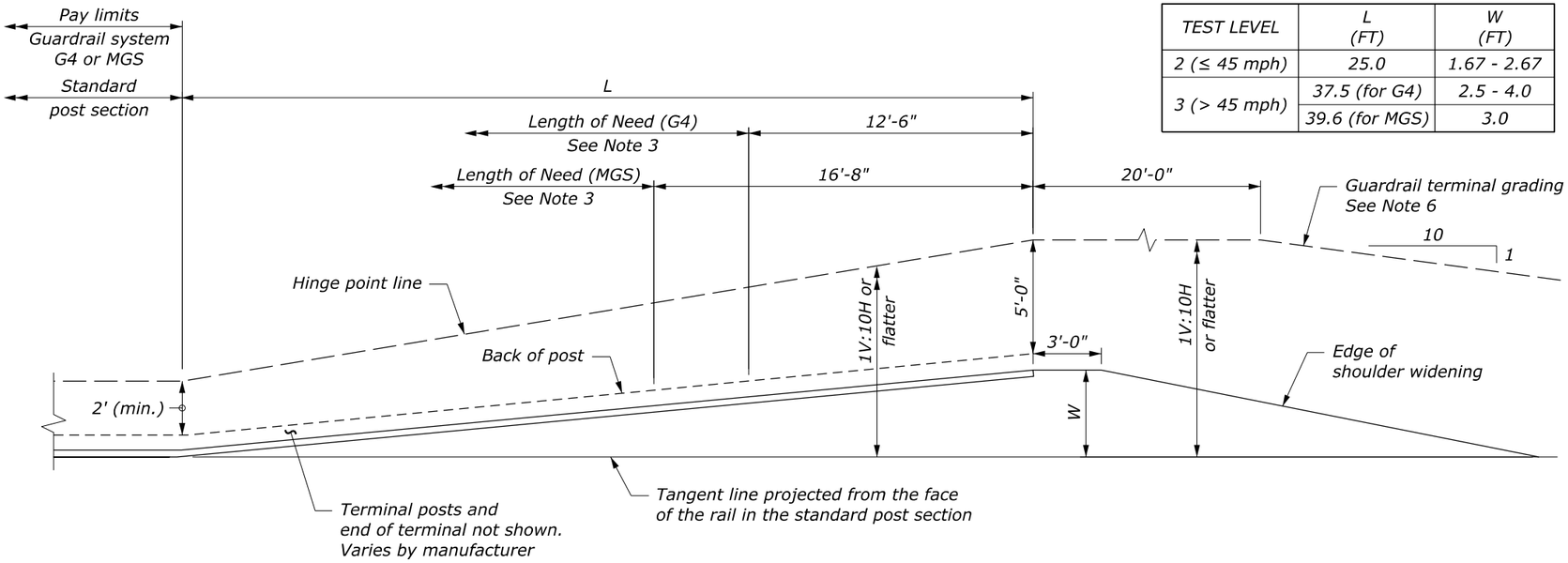
April 2020

- Revised LON point, note 2, added rail height callouts, revised steel post callouts

August 2021

- Converted from CFL Detail to FLH Standard, updated notes, and plate detail

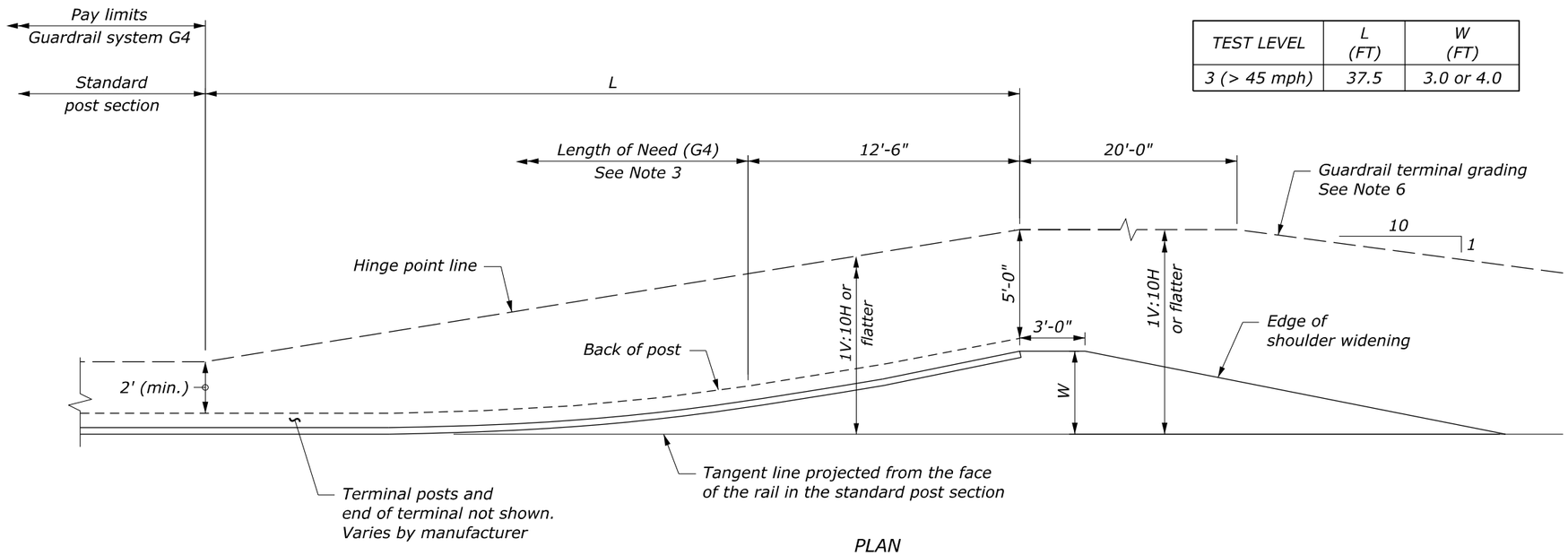
PROJECT	SHEET NUMBER



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.

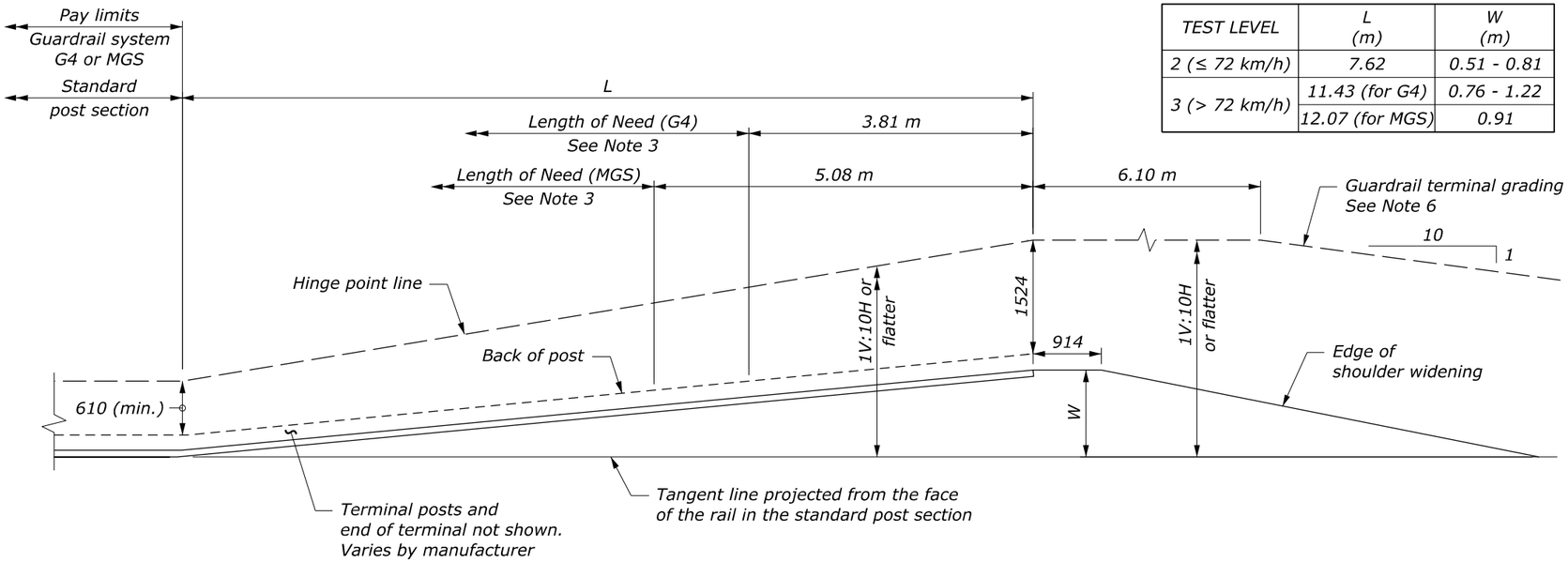
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
OFFICE OF FEDERAL LANDS HIGHWAY

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

STANDARD APPROVED FOR USE 6/2005
REVISED: 6/2022

STANDARD 617-19

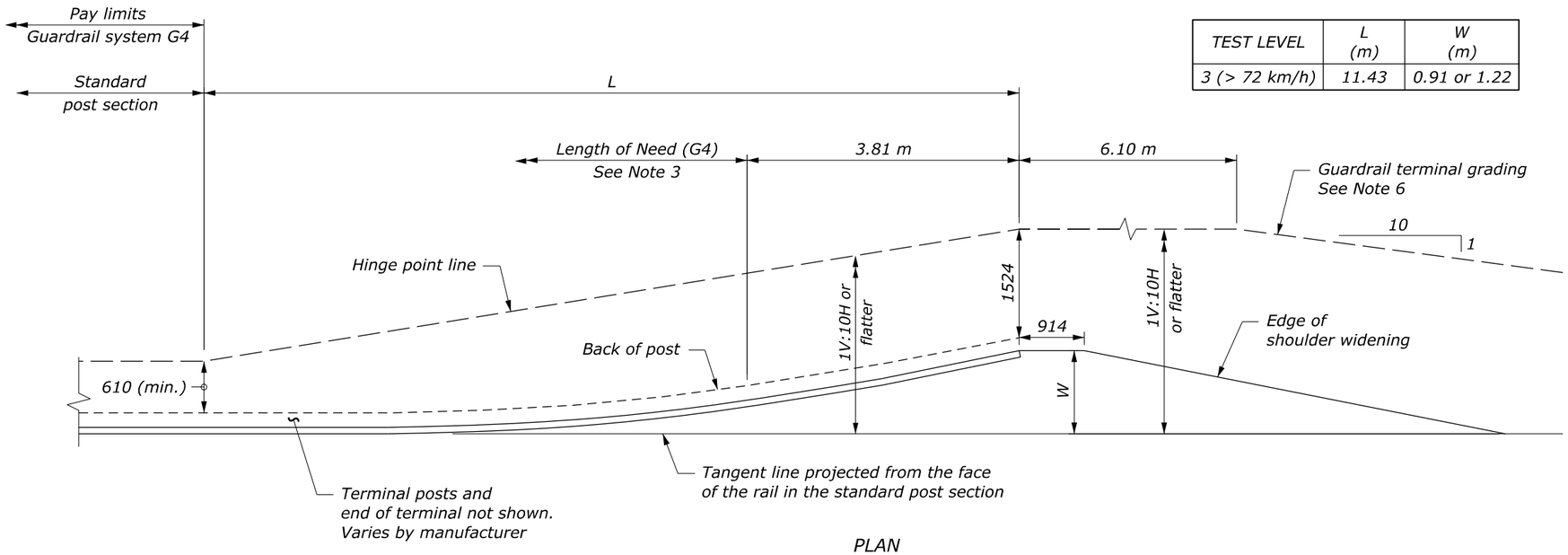
PROJECT	SHEET NUMBER



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.
7. Dimensions without units are millimeters.

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
OFFICE OF FEDERAL LANDS HIGHWAY

METRIC FLH STANDARD

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

STANDARD APPROVED FOR USE 6/2005
REVISED: 6/2022

STANDARD M617-19

Designer Notes: FLH Standard Drawing 617-19
Last Updated: August 2021

MGS and G4 W-Beam Guardrail, Type Flared Terminal and Grading

General Information

Appropriate Applications.

- Many flared terminals are proprietary systems. Manufacturers of common flared terminal systems include Energy Absorption Systems, Trinity Highway LLC, Road Systems, Inc., and Barrier Systems, Inc. Refer to the manufacturer's recommendations for information on specific flared terminals.

Limitations.

- Site grading in the area of the terminal is an important consideration. Verify that the required grading is included in the project design.

Layout Guidance.

- See AASHTO *Roadside Design Guide* Section 8.3.3.
- See the FLH *Midwest Guardrail System FAQ* document for more information.

Typical Pay Item Used

- 61702-0600 Terminal section, type flared [EA] for G4
- 61702-1600 Terminal section, type MGS flared [EA] for MGS

Updates

February 2019

- New Detail drawing

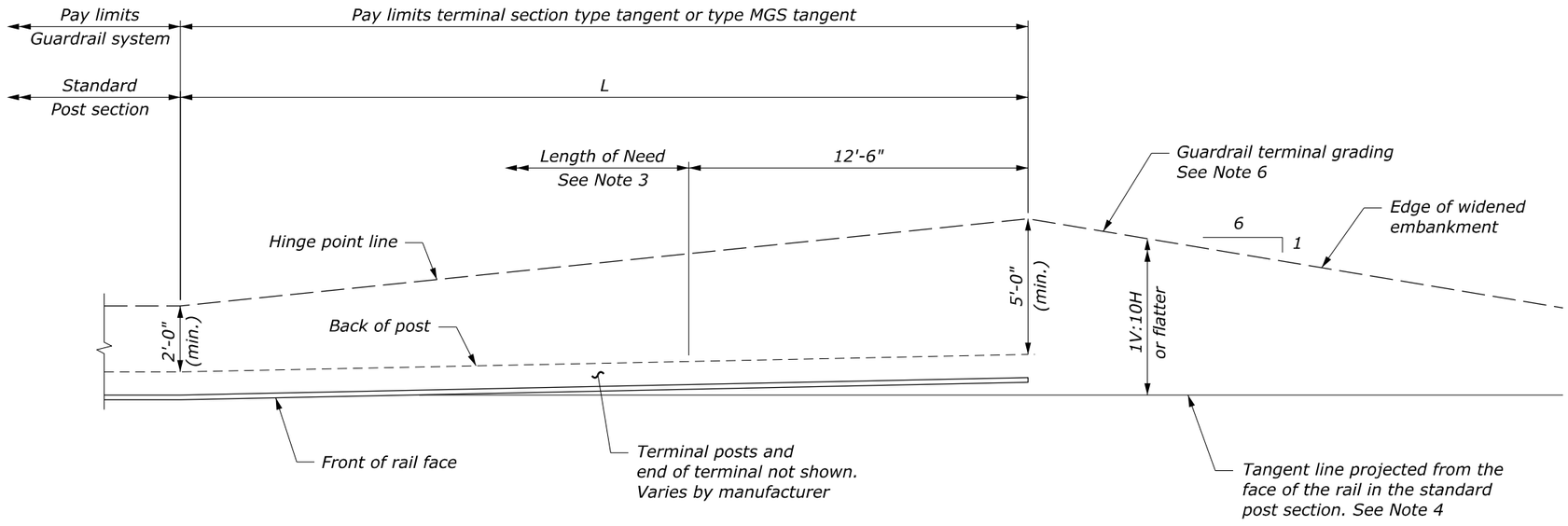
April 2020

- Updated notes and straight flare option detail. Updated MGS drawing.

August 2021

- Converted from CFL Detail to FLH Standard

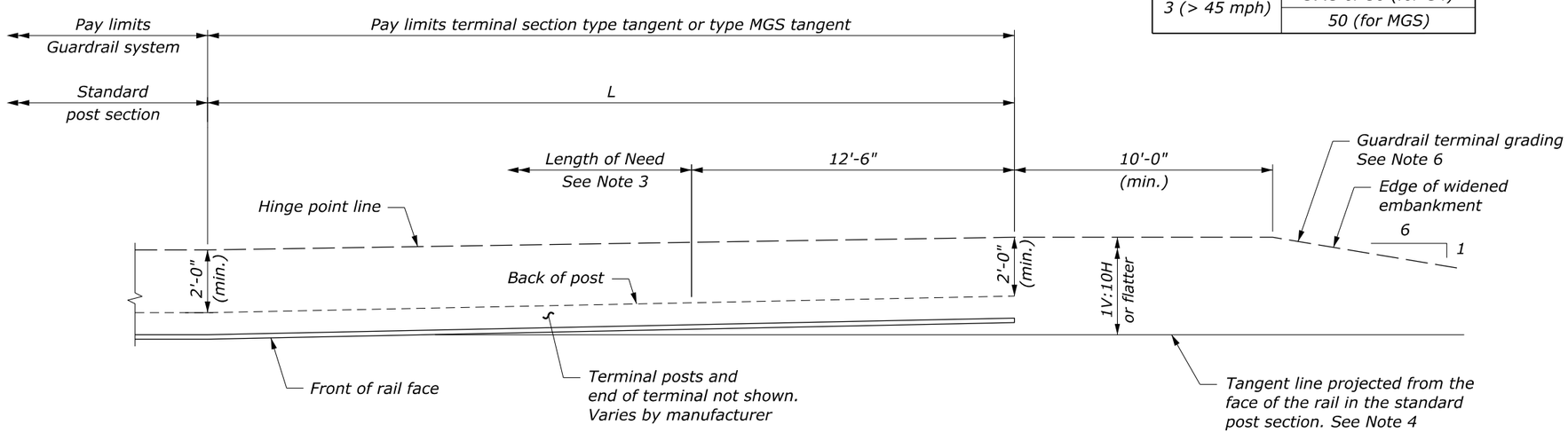
PROJECT	SHEET NUMBER



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.

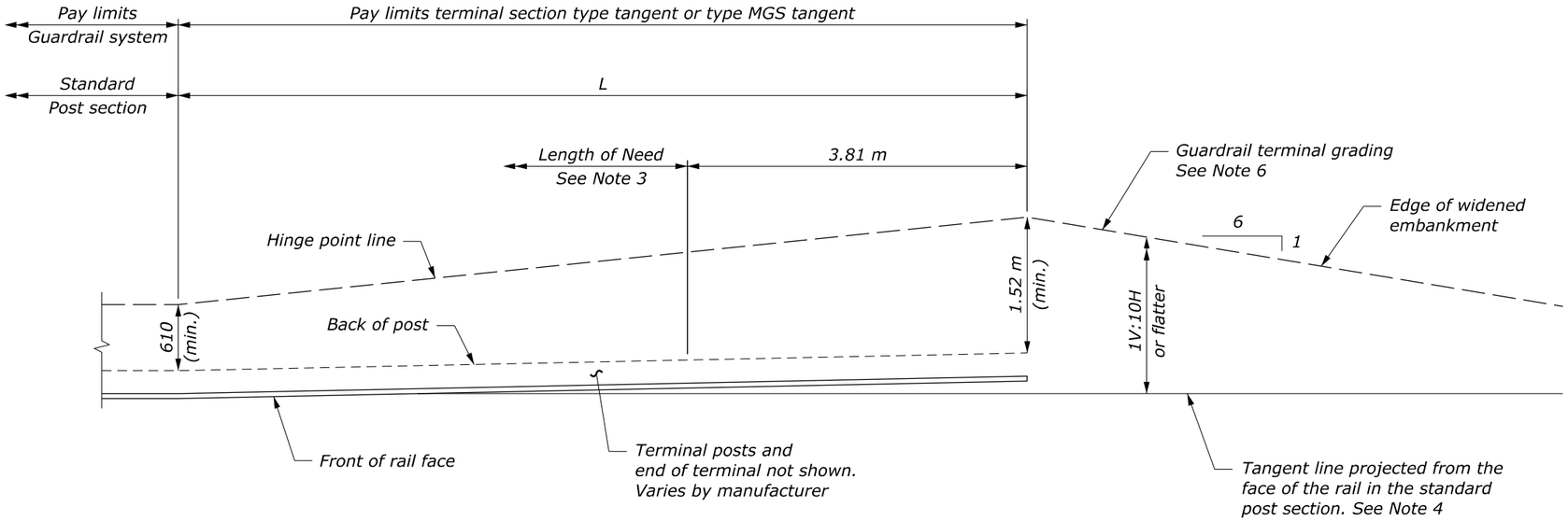
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
OFFICE OF FEDERAL LANDS HIGHWAY

FLH STANDARD

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

STANDARD APPROVED FOR USE 6/2005	STANDARD
REVISED: 6/2022	617-20

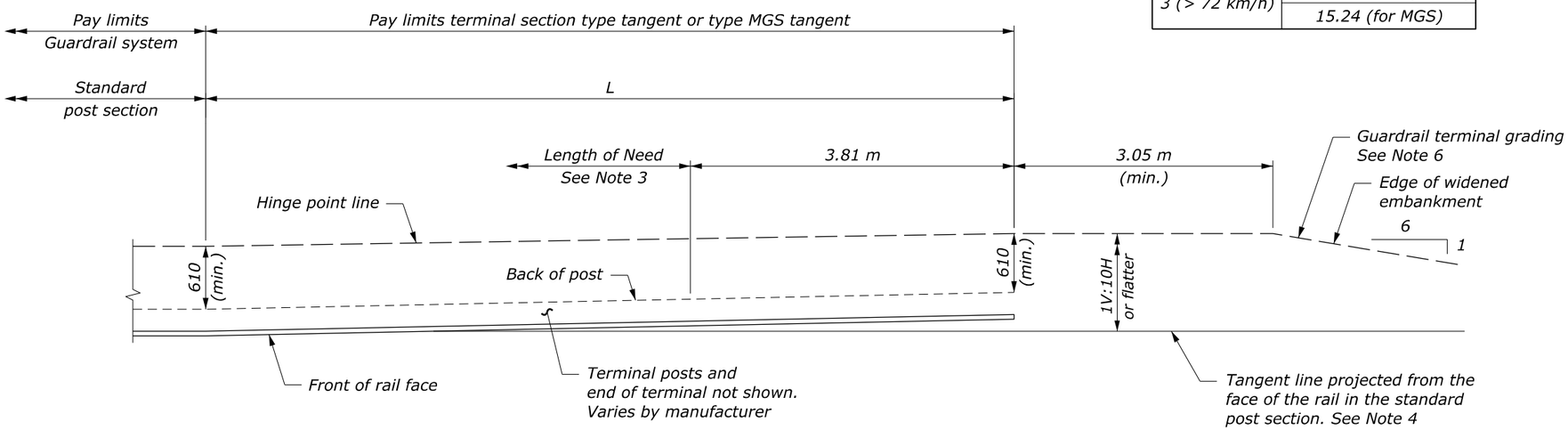
PROJECT	SHEET NUMBER



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.*
7. *Dimensions without units are millimeters.*

NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
OFFICE OF FEDERAL LANDS HIGHWAY

METRIC FLH STANDARD

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

STANDARD APPROVED FOR USE 6/2005
REVISED: 6/2022

STANDARD
M617-20

Designer Notes: FLH Standard Drawing 617-20
Last Updated: August 2021

MGS and G4 W-Beam Guardrail, Type Tangent Terminal and Grading

General Information

Appropriate Applications.

- Tangent terminals are proprietary systems. Manufacturers of common tangent terminal systems include Trinity Highway LLC, Road Systems, Inc., and Barrier Systems, Inc. Refer to the manufacturer's recommendations for information on specific flared terminals.

Limitations.

- Site grading in the area of the terminal is an important consideration. Verify that the required grading is included in the project design.

Layout Guidance.

- See AASHTO *Roadside Design Guide*, Section 8.3.3.
- The drawing shows 2 options for grading that are based on Figure 8-3 in the AASHTO *Roadside Design Guide.* Use the preferred grading as much as practical; use the alternative grading in constrained locations.
- See the FLH *Midwest Guardrail System FAQ* document for more information.

Typical Pay Item Used

- 61702-0800 Terminal section, type tangent [EA] *for G4*
- 61702-1500 Terminal section, type MGS tangent [EA] *for MGS*

Updates

February 2019

- New Detail drawing

April 2020

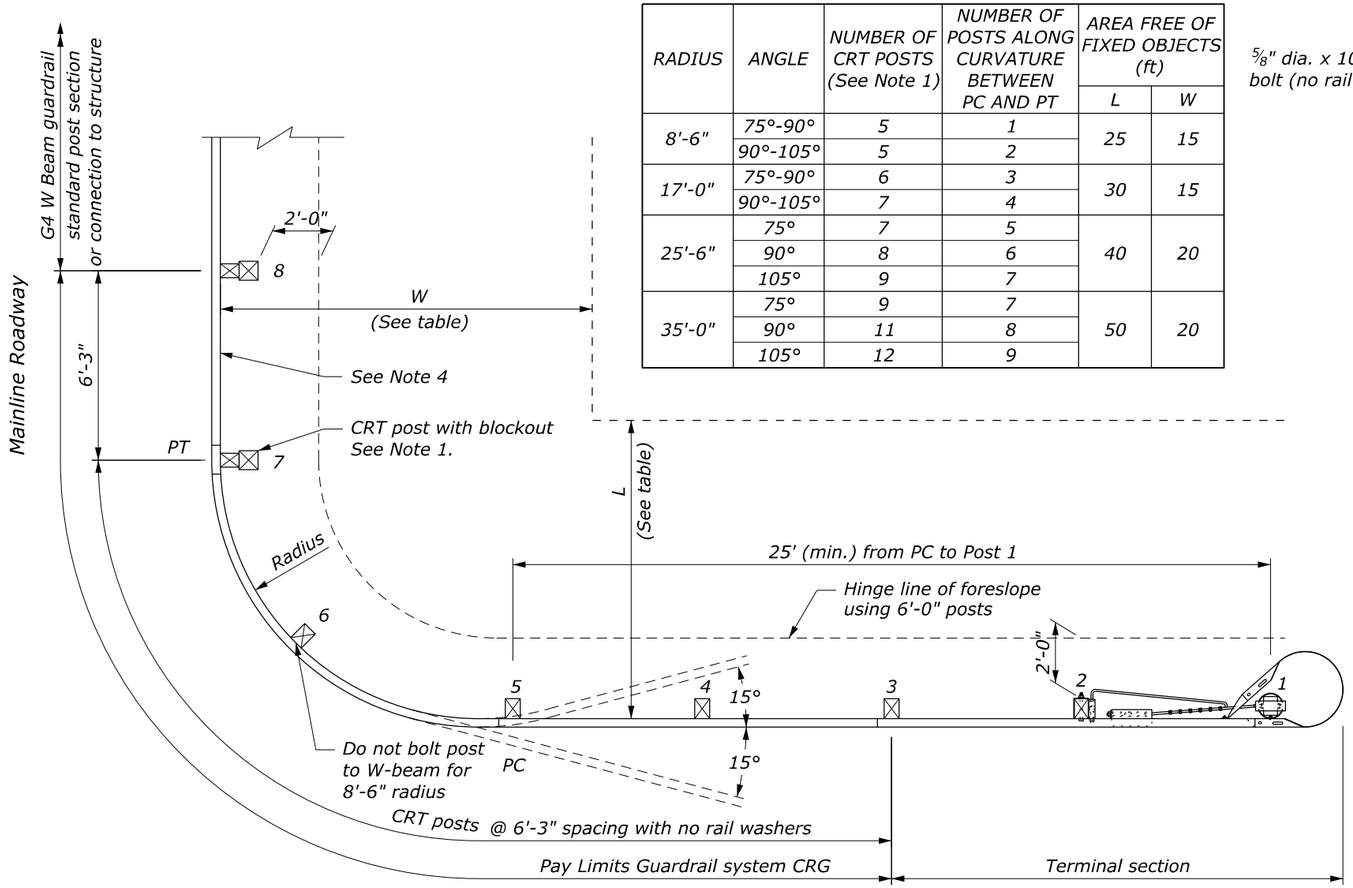
- Updated Note 5

August 2021

- Converted from CFL Detail to FLH Standard

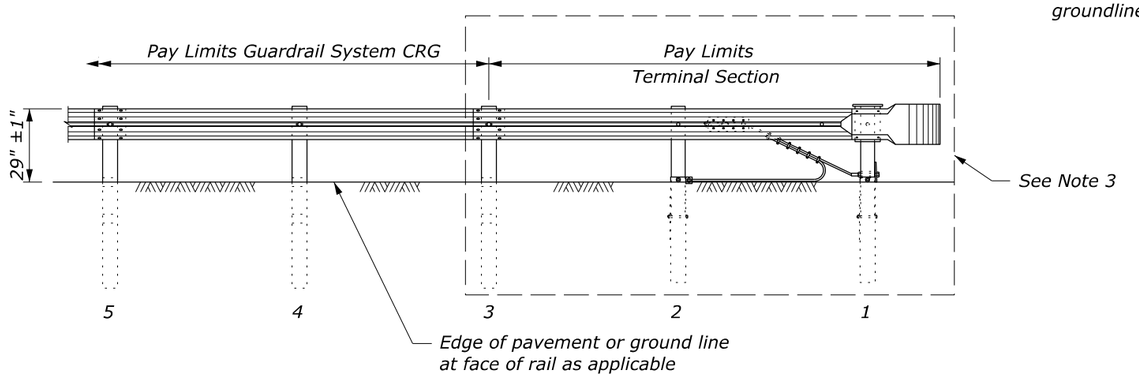
PROJECT	SHEET NUMBER

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		



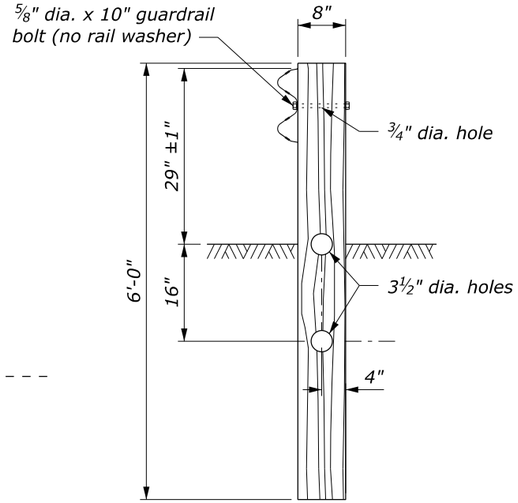
Secondary Roadway or Driveway

PLAN



ELEVATION

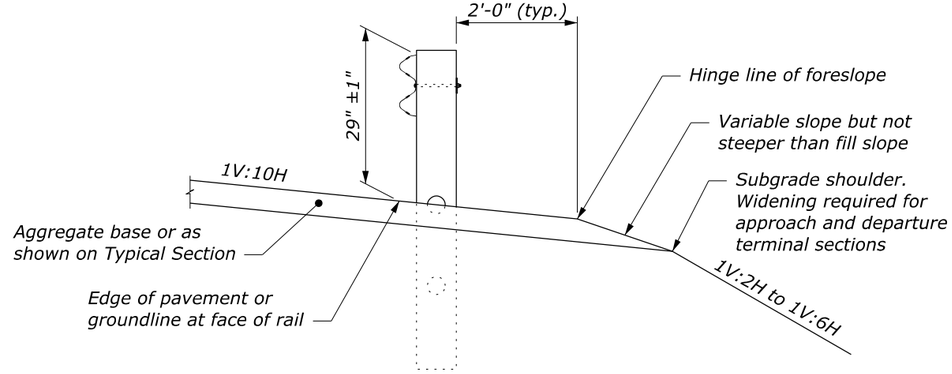
GUARDRAIL SYSTEM CRG WITH CRT POSTS



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 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.



TYPICAL GUARDRAIL CROSS SECTION

NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
OFFICE OF FEDERAL LANDS HIGHWAY

FLH STANDARD

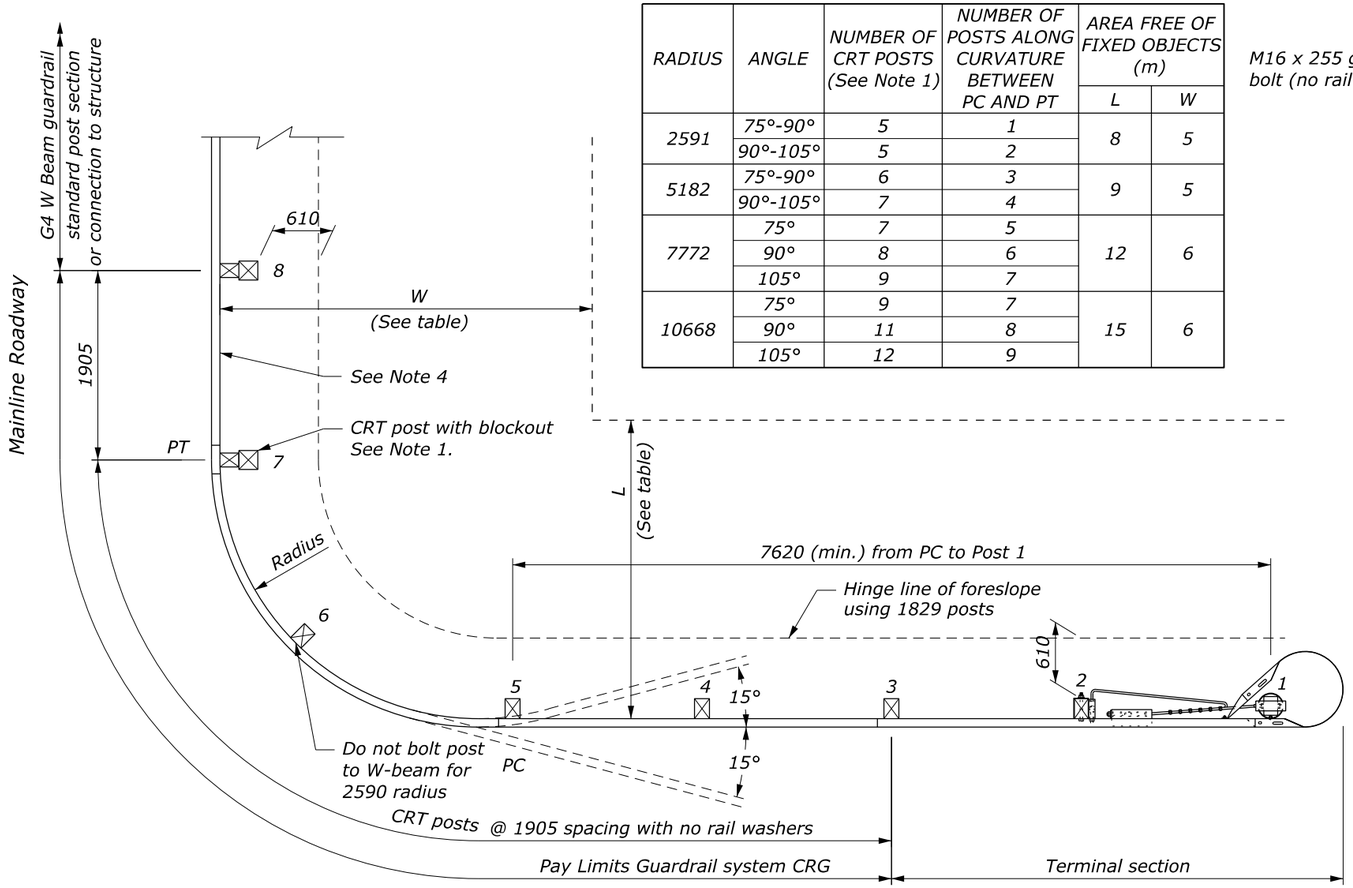
CRG W-BEAM GUARDRAIL WOOD POSTS

STANDARD APPROVED FOR USE 1/1994
REVISED: 4/1994 6/2005 6/2022

STANDARD 617-21

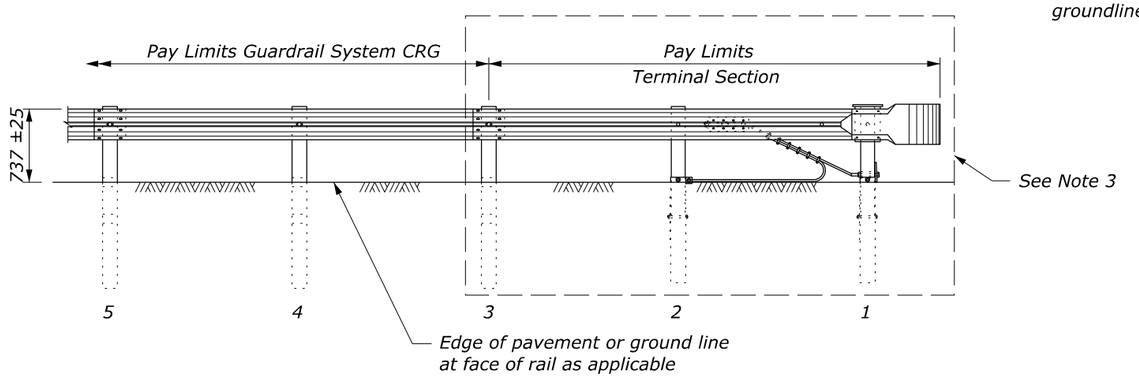
PROJECT	SHEET NUMBER

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		



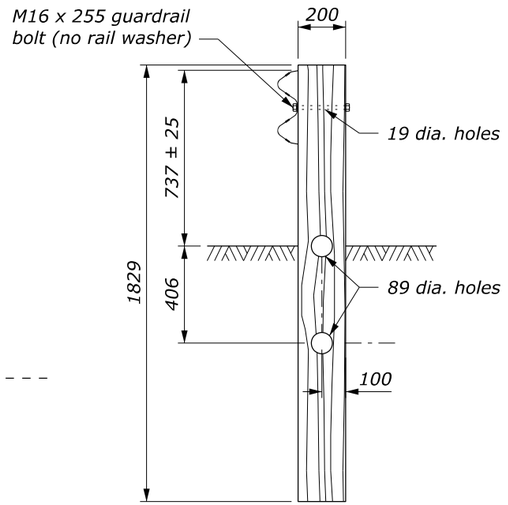
Secondary Roadway or Driveway

PLAN



ELEVATION

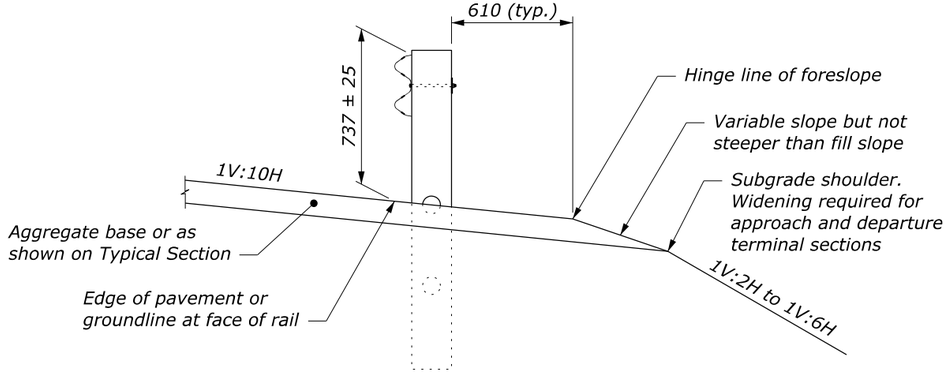
GUARDRAIL SYSTEM CRG WITH CRT POSTS



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

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 72 km/h.*
3. *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.*
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.*
6. *Dimensions without units are millimeters.*



TYPICAL GUARDRAIL CROSS SECTION

NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
OFFICE OF FEDERAL LANDS HIGHWAY

METRIC FLH STANDARD

CRG W-BEAM GUARDRAIL WOOD POSTS

STANDARD APPROVED FOR USE 3/1996
REVISED: 12/1998 6/2005 6/2022

STANDARD M617-21

Designer Notes: FLH Standard Drawing 617-21
Last Updated: August 2021

CRG W-Beam Guardrail, Wood Posts

General Information

Appropriate Applications.

- CRG W-beam guardrail is typically used when a minor road or driveway intersects a main road close to a bridge.
- According to the *Roadside Design Guide* Section 5.6.6, this system may be used on all high-speed routes, until an acceptable system is developed. Research and development of a more acceptable system is underway.

Crash Test Criteria	NCHRP Report 230
Test Level	TL-2
FHWA Eligibility Letter	FHWA Technical Advisory T5040.32
TF 13 Designator	SGR40
Crash Test Report	TTI report 405160-10

Limitations.

- The FLH drawing is based on the guidance provided in FHWA Technical Advisory T5040.32.
- Guidance for installing the short-radius guardrail is given for systems with radius sizes ranging between 8.5 ft and 35 ft. The FHWA guidance does not address larger radii above 35 ft.

Layout Guidance.

- See AASHTO *Roadside Design Guide* Section 5.6.6

Typical Pay Item Used

- 61701-4100 Guardrail system CRG, type 2, class A [LNFT] for galvanized steel
- 61701-4350 Guardrail system CRG, type 4, class B [LNFT] for weathering steel

Updates

February 2019

- New Detail drawing

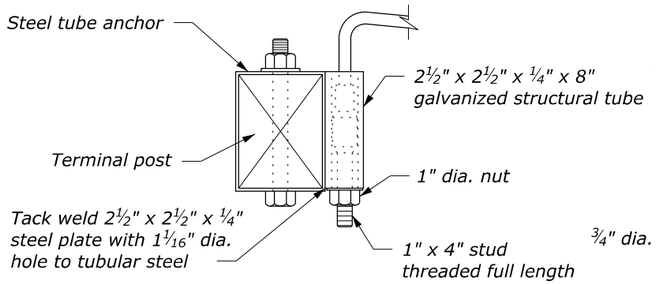
October 2019

- Revised dimensioning on plan view and revised notes

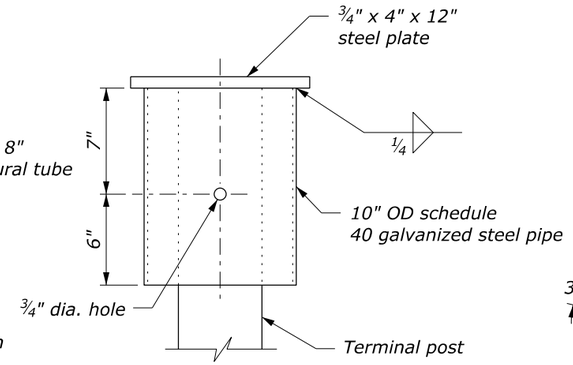
August 2021

- Converted from CFL Detail to FLH Standard

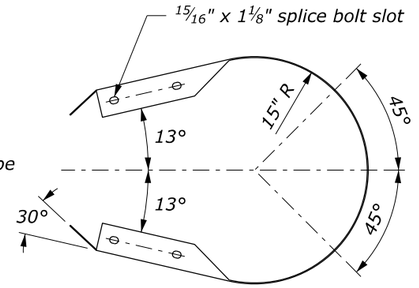
PROJECT	SHEET NUMBER



DETAIL A



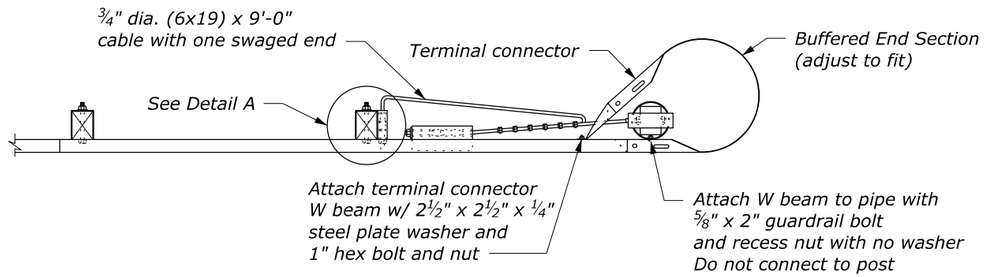
DETAIL B



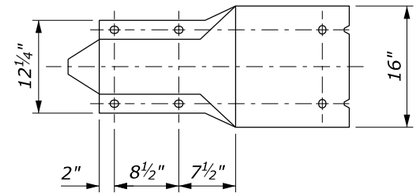
PLAN

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.

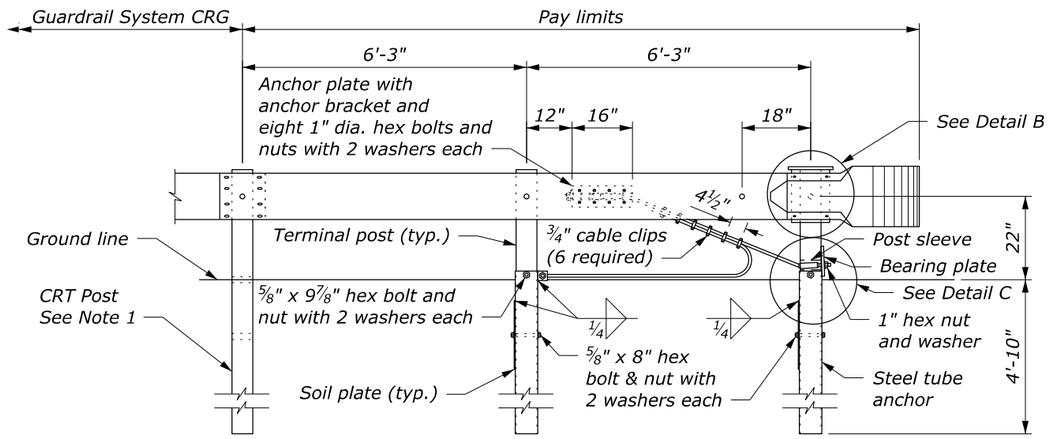


PLAN



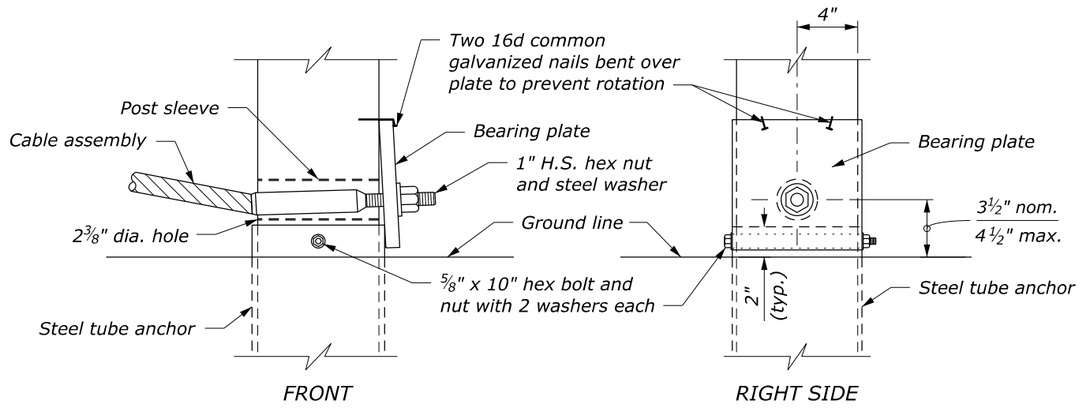
ELEVATION

BUFFERED END SECTION



ELEVATION

ANCHORAGE ASSEMBLY



FRONT RIGHT SIDE

DETAIL C

POST ASSEMBLY

NO SCALE

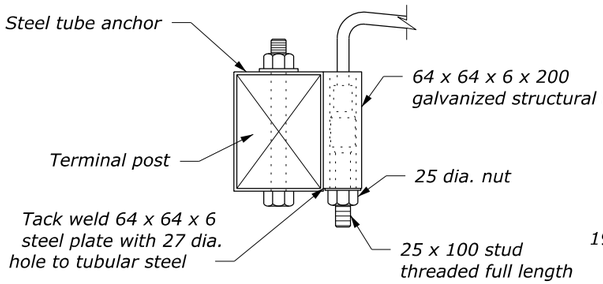
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
OFFICE OF FEDERAL LANDS HIGHWAY

FLH STANDARD

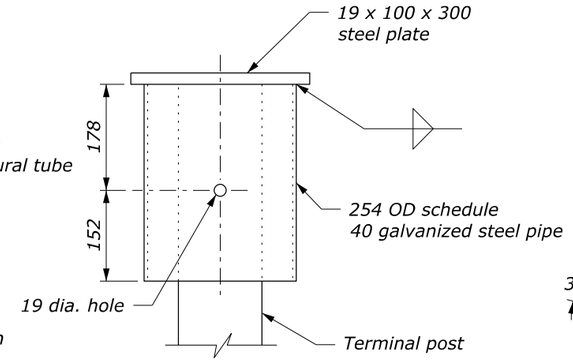
G4 W-BEAM GUARDRAIL CABLE RELEASING TERMINAL TYPE G4-CRT

STANDARD APPROVED FOR USE 1/1994	STANDARD
REVISED: 4/1994 6/2005 6/2022	617-22

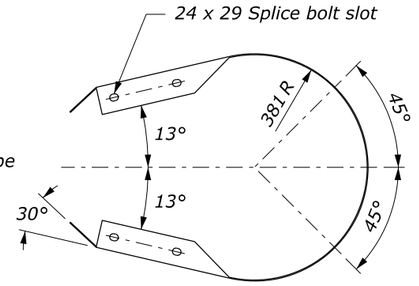
PROJECT	SHEET NUMBER



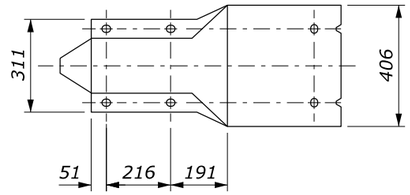
DETAIL A



DETAIL B



PLAN

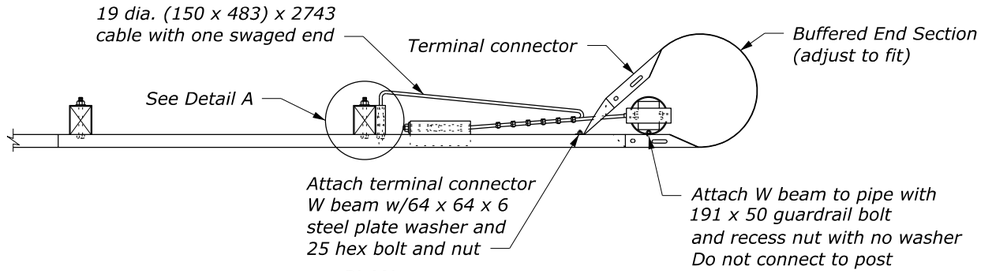


ELEVATION

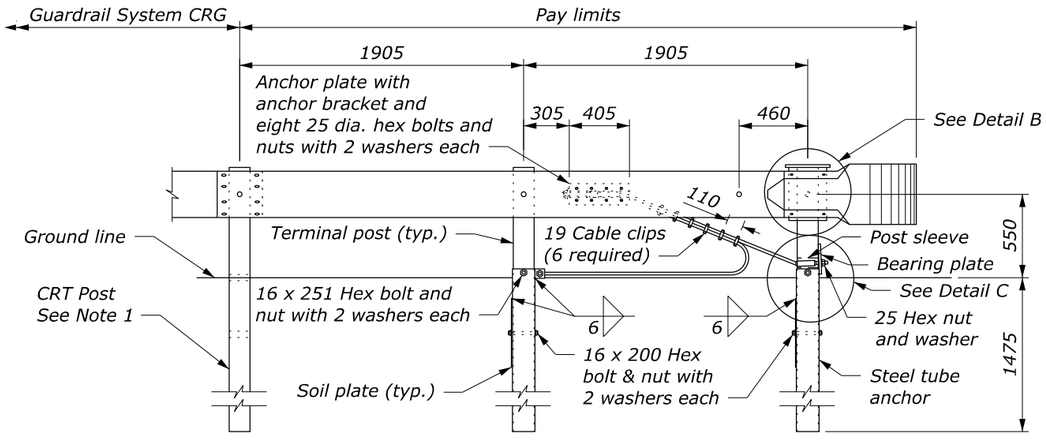
BUFFERED END SECTION

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.
3. Dimensions without units are millimeters.

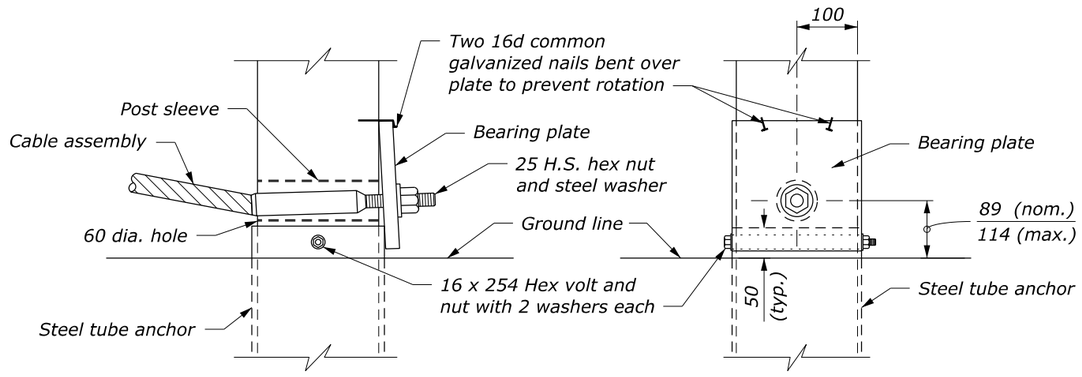


PLAN



ELEVATION

ANCHORAGE ASSEMBLY



FRONT RIGHT SIDE

DETAIL C
POST ASSEMBLY

NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
OFFICE OF FEDERAL LANDS HIGHWAY

METRIC FLH STANDARD

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

STANDARD APPROVED FOR USE 3/1996
REVISED: 6/2005 6/2022

STANDARD M617-22

c:\pw-work\d0419223\Std617-22.dgn [Std M617-22]
10 August 2022 2:14 PM

Designer Notes: FLH Standard Drawing 617-22
Last Updated: August 2021

G4 W-Beam Guardrail, Cable Releasing Terminal Type G4-CRT

General Information

Appropriate Applications.

- The CRT is described in FHWA Technical Advisory T5040.32.
- The CRT has not been crash tested as a guardrail terminal, and its use is limited to low-speed, low-volume roadways with a stop condition, such as driveways, service roads, or other minor roads. For most intersecting public highways, the curved guardrail installation should be terminated with a crashworthy terminal.

Crash Test Criteria	None
Test Level	None
FHWA Eligibility Letter	FHWA Technical Advisory T5040.32
TF 13 Designator	Not posted
Crash Test Report	None

Limitations.

- Low-speed, low-volume roadways (such as driveways or service roads) only.

Layout Guidance.

- See AASHTO Roadside Design Guide, Section 5.6.6

Typical Pay Item Used

- 61702-0400 Terminal section, type G4-CRT [EA]

Updates

February 2019

- New Detail drawing

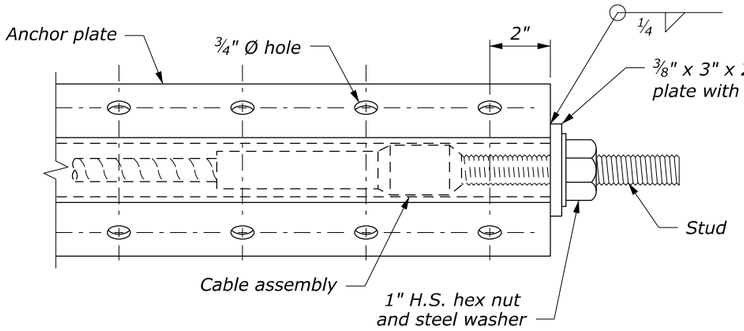
April 2020

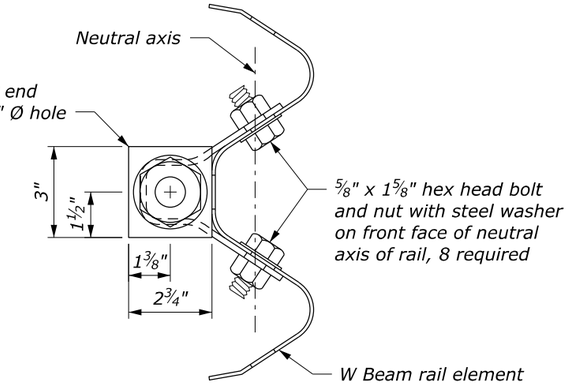
- Revised drawing title to match pay item description

August 2021

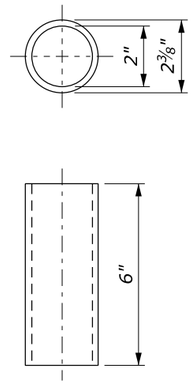
- Converted from CFL Detail to FLH Standard

PROJECT	SHEET NUMBER





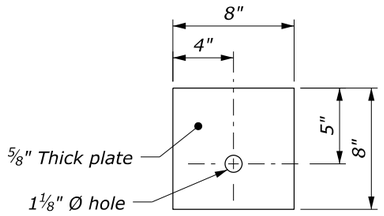
CABLE ANCHOR PLATE DETAILS



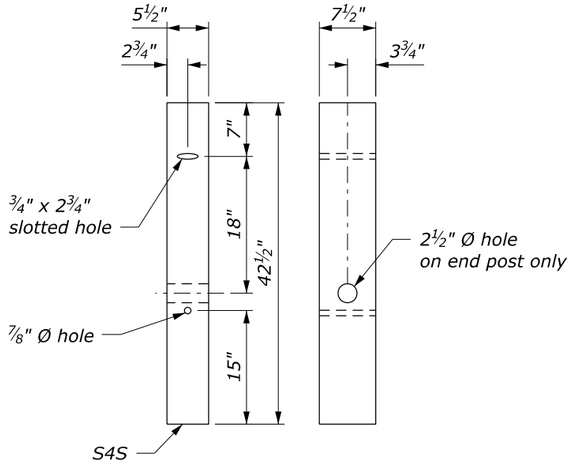
POST SLEEVE

NOTE:

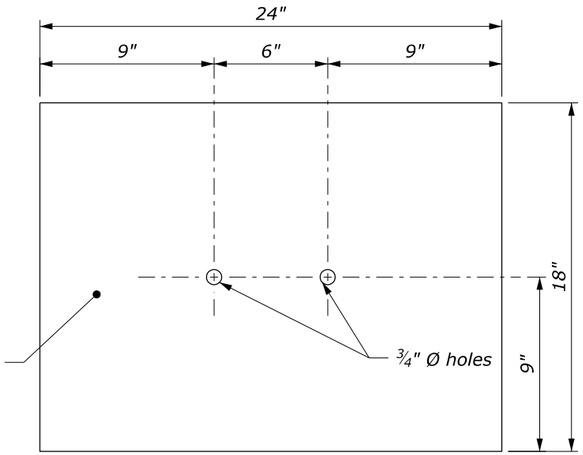
1. *Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.*



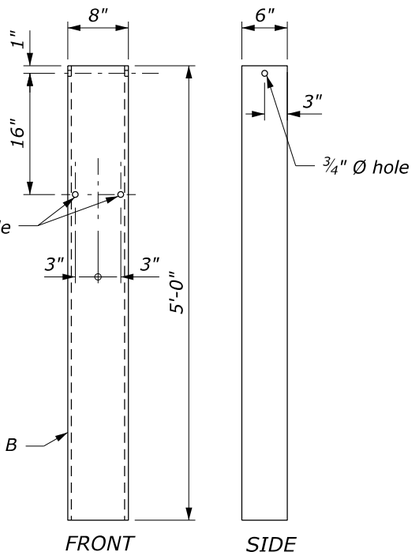
BEARING PLATE



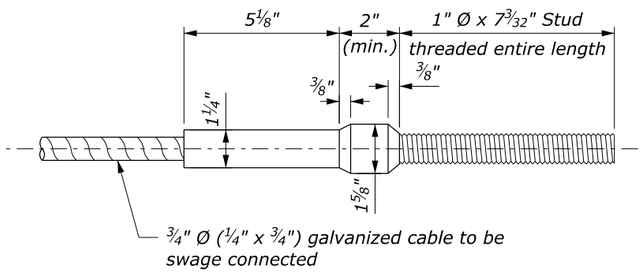
TERMINAL POST



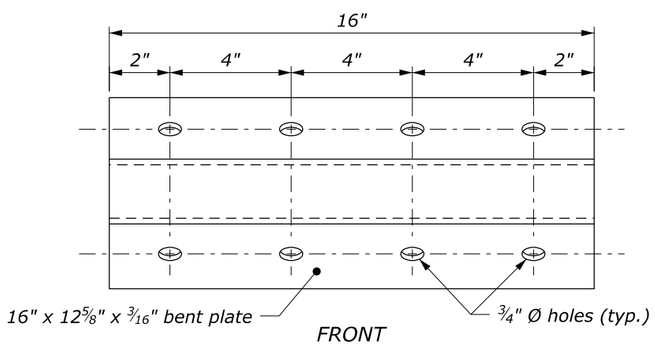
SOIL PLATE
(2 REQUIRED)

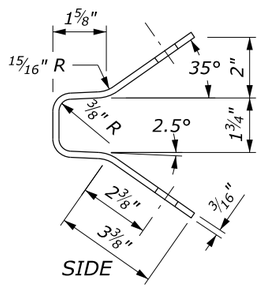


STEEL TUBE ANCHOR



CABLE ANCHOR ASSEMBLY
(Standard swaged fitting and stud)





GUARDRAIL ANCHOR BRACKET

NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
OFFICE OF FEDERAL LANDS HIGHWAY

FLH STANDARD

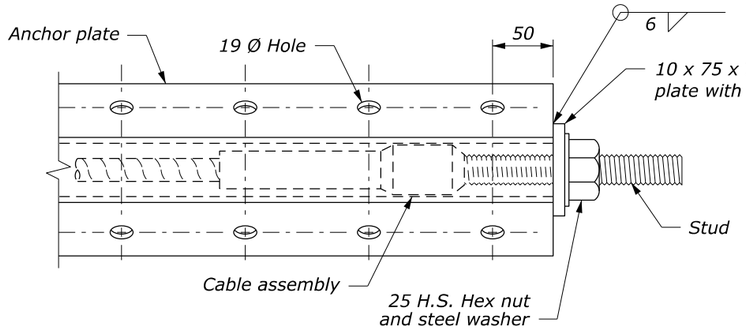
G4 W-BEAM GUARDRAIL CRT ANCHORAGE ASSEMBLY DETAILS

STANDARD APPROVED FOR USE 7/2022	STANDARD
REVISED:	617-23

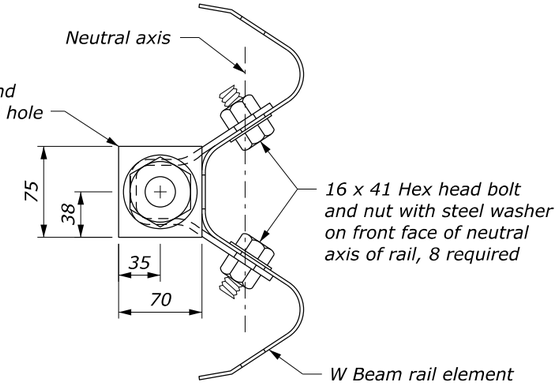
c:\pw-work\d0419223\Std617-23.dgn [Std 617-23]

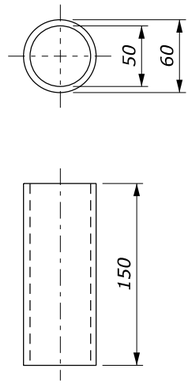
10 August 2022 2:19 PM

PROJECT	SHEET NUMBER



CABLE ANCHOR PLATE DETAILS

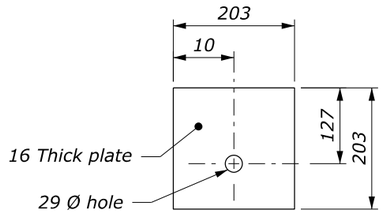




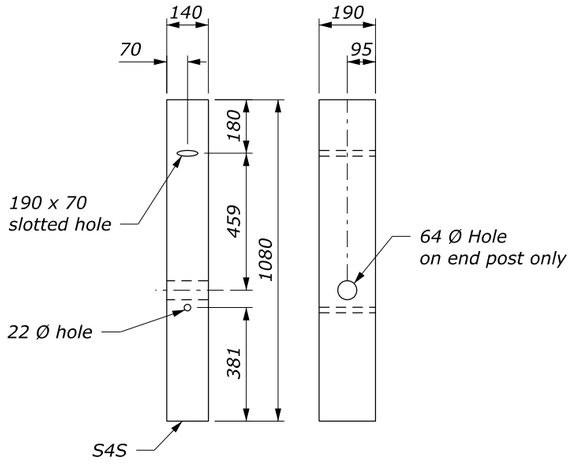
POST SLEEVE

NOTE:

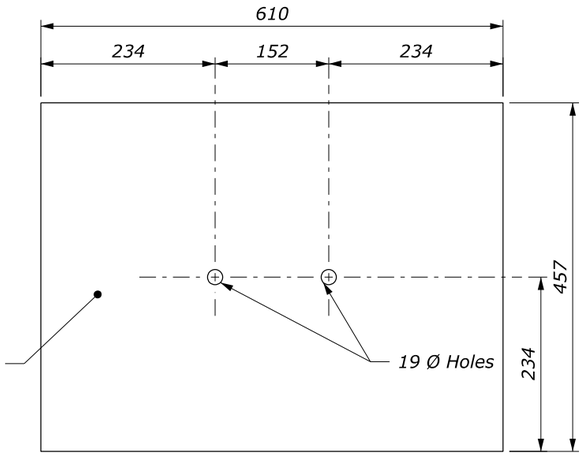
1. Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.
2. Dimensions without units are millimeters.



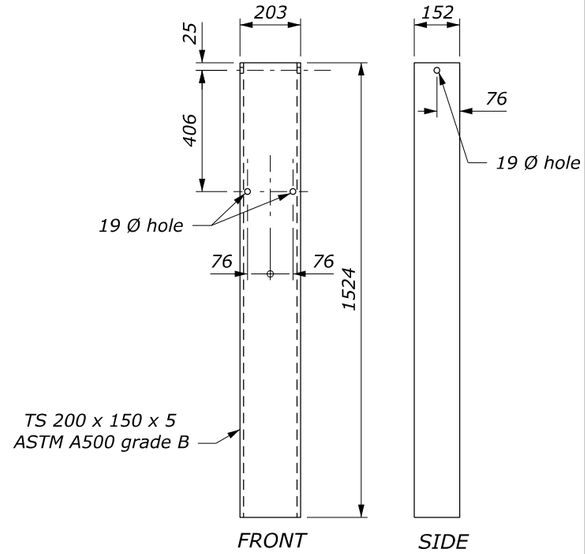
BEARING PLATE



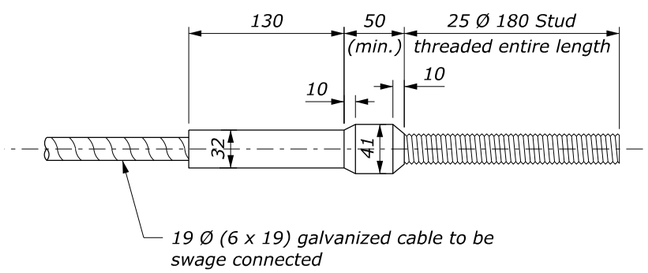
TERMINAL POST



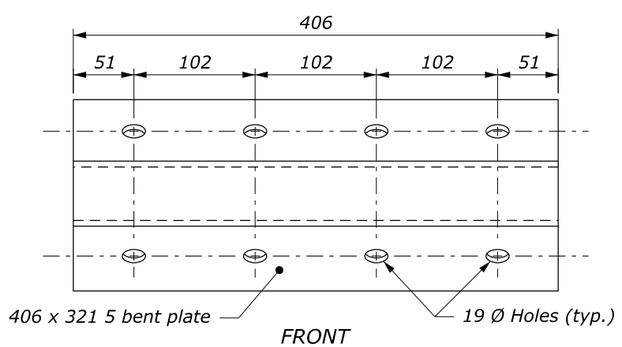
SOIL PLATE
(2 REQUIRED)

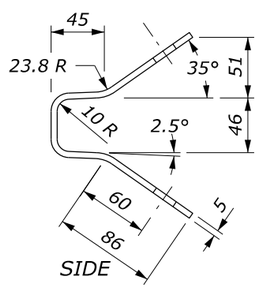


STEEL TUBE ANCHOR



CABLE ANCHOR ASSEMBLY
(Standard swaged fitting and stud)





GUARDRAIL ANCHOR BRACKET

NO SCALE

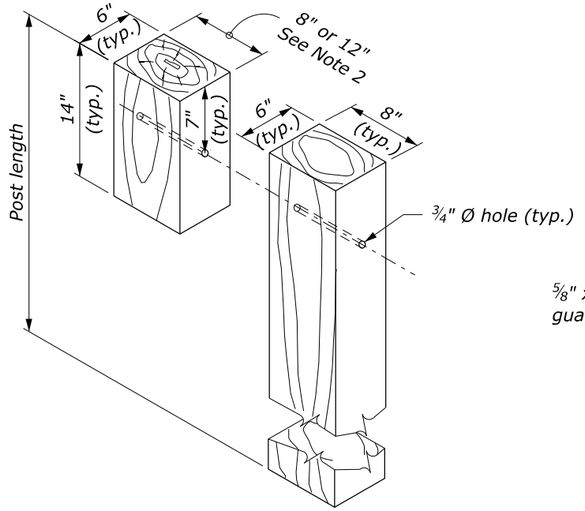
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
OFFICE OF FEDERAL LANDS HIGHWAY

METRIC FLH STANDARD

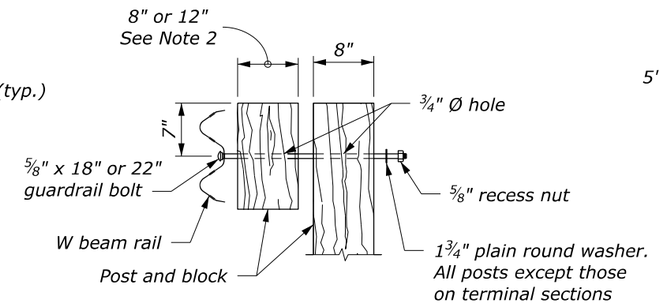
G4 W-BEAM GUARDRAIL CRT ANCHORAGE ASSEMBLY DETAILS

STANDARD APPROVED FOR USE 7/2022	STANDARD
REVISED:	M617-23

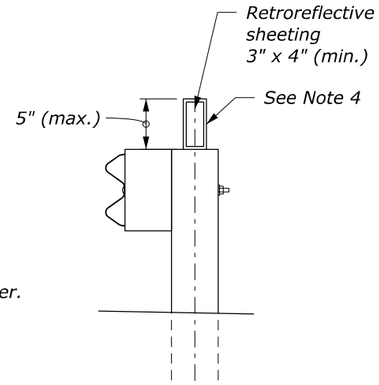
PROJECT	SHEET NUMBER



POST AND BLOCK



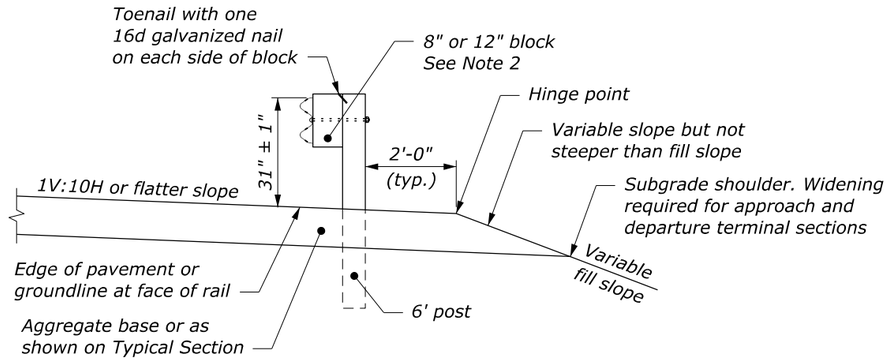
POST BOLT ASSEMBLY



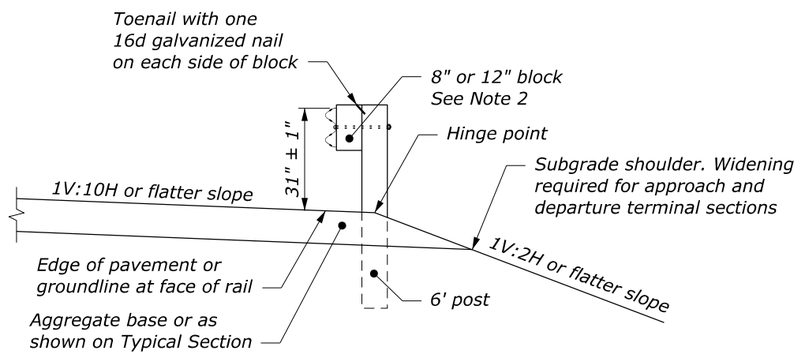
FLEXIBLE DELINEATOR GUARDRAIL MOUNT

NOTE:

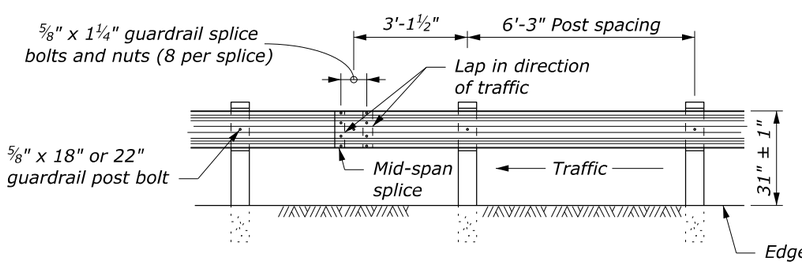
1. When encountering impenetrable material, one post may be omitted in locations where the typical guardrail cross section includes 2-feet (min.) between the back of the guardrail post and the hinge point. For all other locations, see Section 617 and Standard 617-13 or 617-37.
2. Size of block shown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



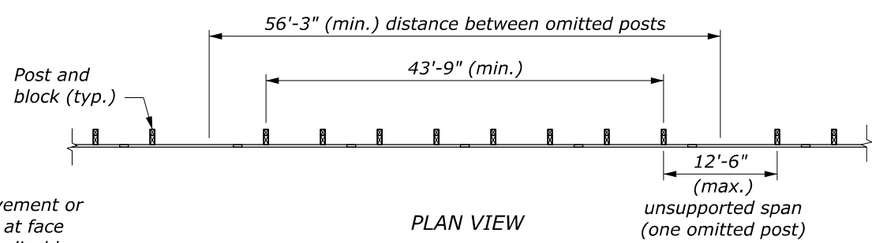
TYPICAL GUARDRAIL CROSS SECTION
6' POST, 8" OR 12" BLOCK



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

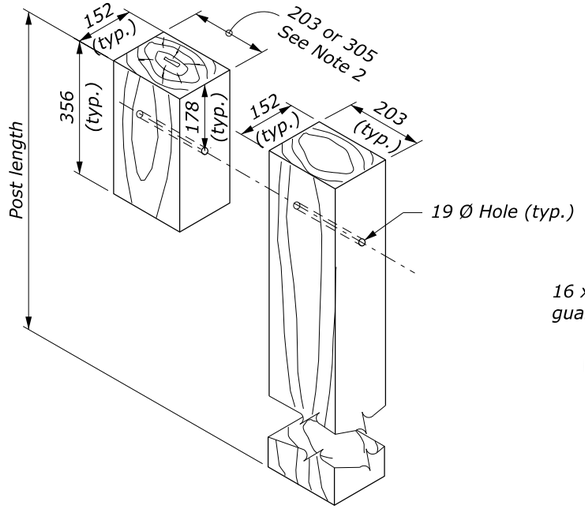
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
OFFICE OF FEDERAL LANDS HIGHWAY

FLH STANDARD

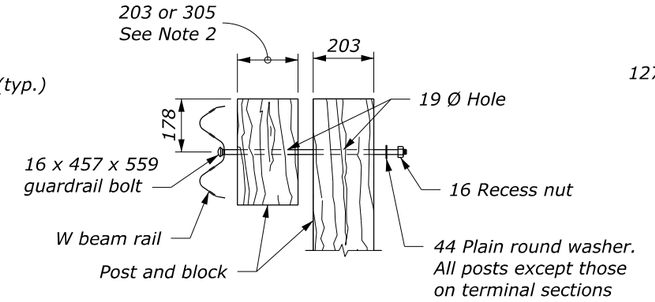
MGS W-BEAM GUARDRAIL WOOD POSTS

STANDARD APPROVED FOR USE 7/2022	STANDARD
REVISED:	617-31

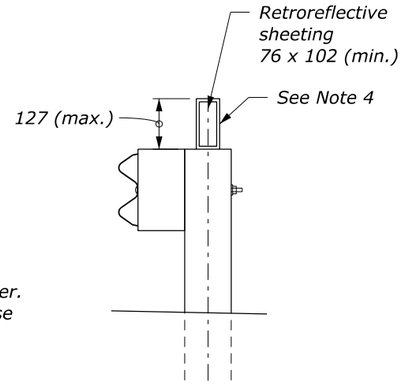
PROJECT	SHEET NUMBER



POST AND BLOCK



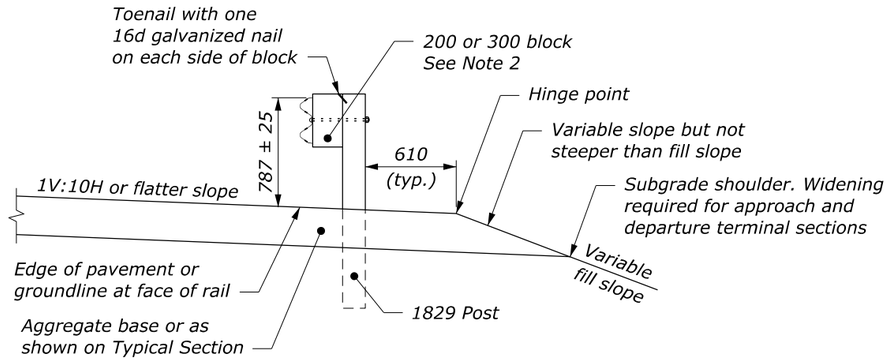
POST BOLT ASSEMBLY



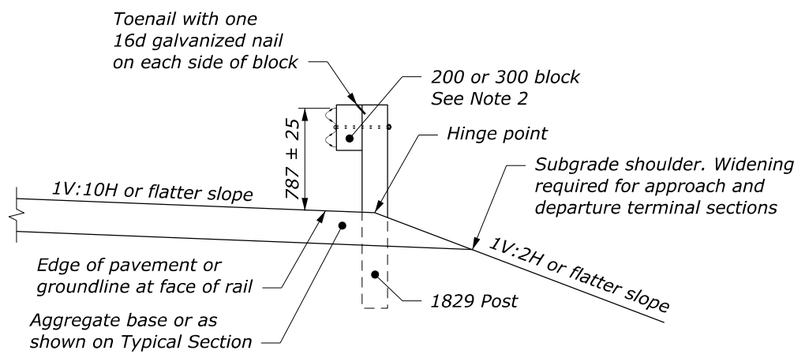
FLEXIBLE DELINEATOR GUARDRAIL MOUNT

NOTE:

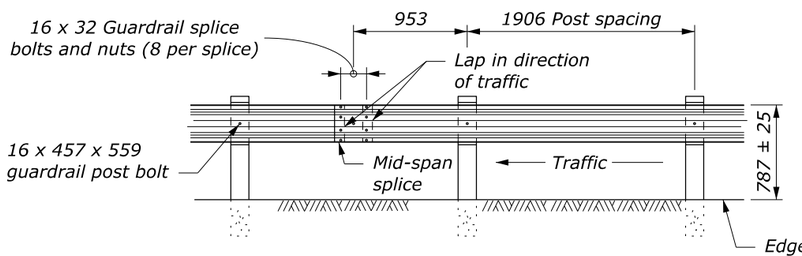
1. When encountering impenetrable material, one post may be omitted in locations where the typical guardrail cross section includes 610 mm (min.) between the back of the guardrail post and the hinge point. For all other locations, see Section 617 and Standard M617-13 or M617-37.
2. Size of block shown elsewhere on the plans. Use a single block or combination of blocks (no more than two) to achieve the actual 200 or 300 mm offset secure qood 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.
5. Dimensions without units are millimeters.



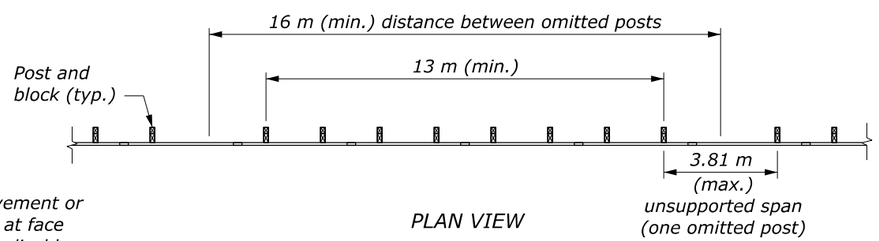
TYPICAL GUARDRAIL CROSS SECTION
1830 POST, 200 OR 300 BLOCK



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



TYPICAL GUARDRAIL ELEVATION



PLAN VIEW

OMITTED POST DETAIL

See Note 1

NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
OFFICE OF FEDERAL LANDS HIGHWAY

METRIC FLH STANDARD

MGS W-BEAM GUARDRAIL WOOD POSTS

STANDARD APPROVED FOR USE 7/2022	STANDARD
REVISED:	M617-31

c:\pw-work\d0419223\Std617-31.dgn [Std M617-31]
10 August 2022 2:22 PM

Designer Notes: FLH Standard Drawing 617-31
Last Updated: June 2022

MGS W-Beam Guardrail, Wood Posts

General Information

Appropriate Applications.

- The Midwest Guardrail System (MGS) is a non-proprietary w-beam guardrail system that meets the current crash testing requirements. MGS is used when w-beam guardrail is selected for barrier installation.

Crash Test Criteria	MASH
Test Level	TL-3
FHWA Eligibility Letter	B-133, B-211A
TF 13 Designator	SGR20a-b, SGR38a-e
Crash Test Report	Multiple MwRSF reports available at https://mwrsf.unl.edu/mgs.php

Limitations. The drawing shows the various options for guardrail near slopes. The preferred option is to use 6' post with 2' between the back of post and the slope hinge point.

Layout Guidance.

- See AASHTO *Roadside Design Guide*
- Use the FLH Barrier Length of Need Calculator available at https://highways.dot.gov/federal-lands/safety/barrier-length-need
- See the FLH *Midwest Guardrail System FAQ* document for more information.

Typical Pay Item Used

- 61701-4550 Guardrail system MGS, type 2, class A wood posts [LNFT] for galvanized steel
- 61701-5150 Guardrail system MGS, type 4, class B wood posts [LNFT] for weathering steel

Updates

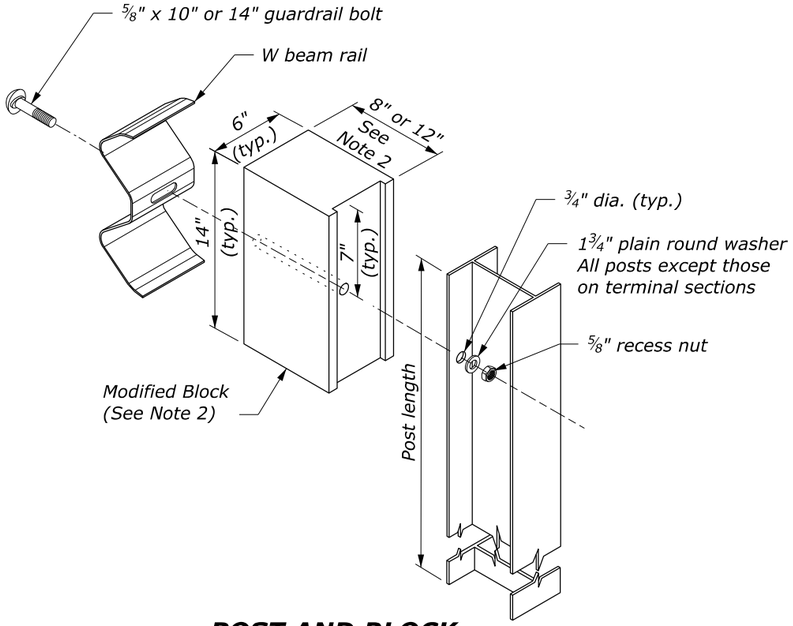
February 2019

- New Detail drawing

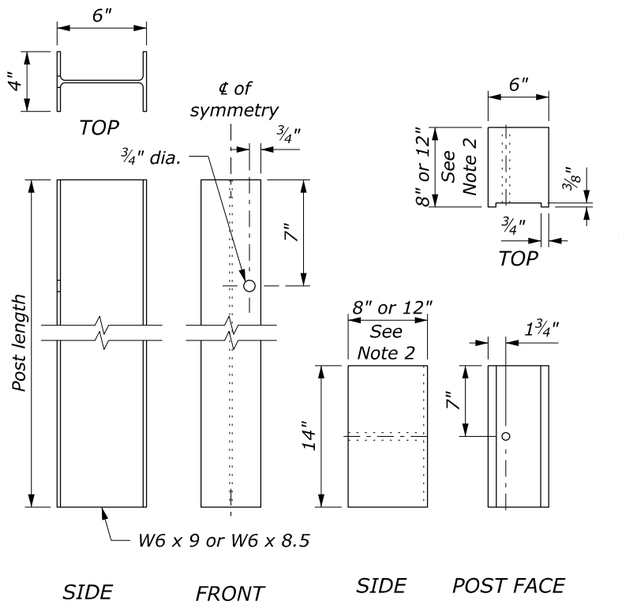
June 2022

- Converted from CFL Detail to FLH Standard

PROJECT	SHEET NUMBER

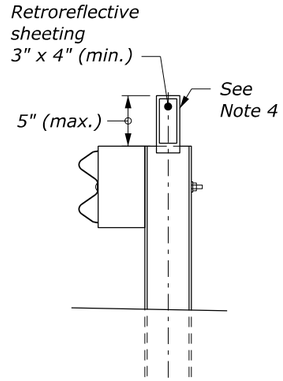


POST AND BLOCK DETAIL



STRUCTURAL SHAPE POST

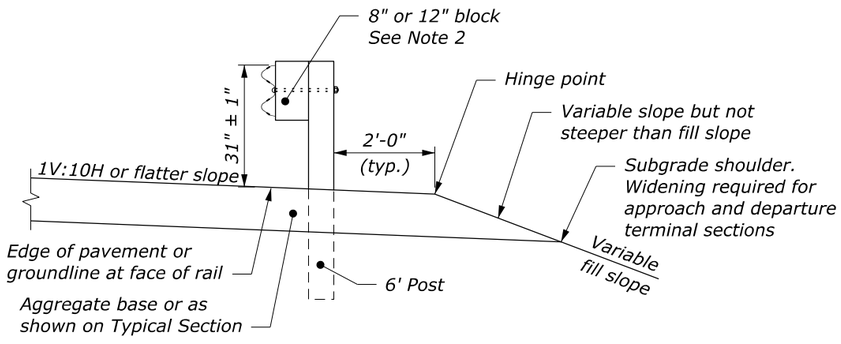
BLOCK



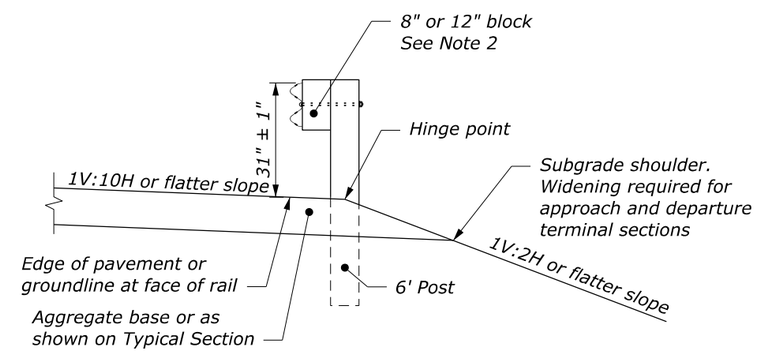
FLEXIBLE DELINEATOR GUARDRAIL MOUNT

NOTE:

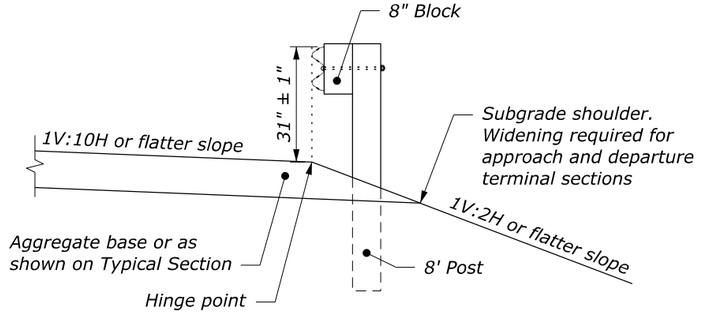
1. When encountering impenetrable material, one post may be omitted in locations where the typical guardrail cross section includes 2-feet (min.) between the back of the guardrail post and the hinge point. For all other locations, see Section 617 and Standard 617-13 or 617-37.
2. Size of block shown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



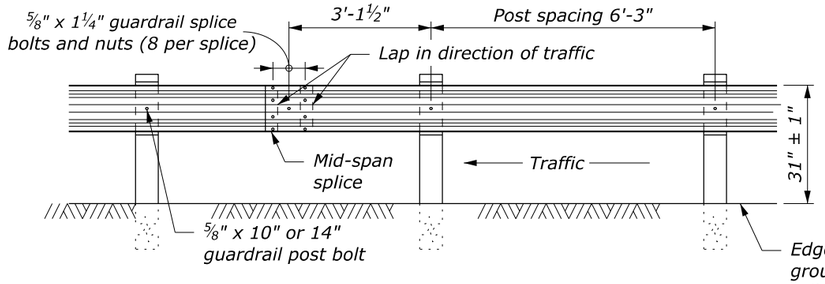
TYPICAL GUARDRAIL CROSS SECTION 6' POST, 8" OR 12" BLOCK



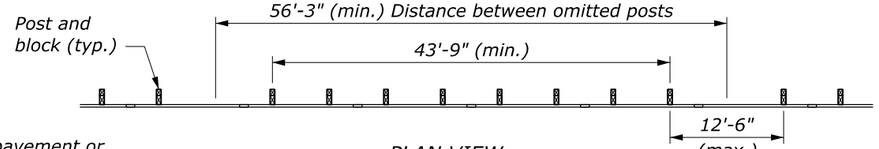
TYPICAL GUARDRAIL CROSS SECTION 6' POST CENTERED ON HINGE, 8" OR 12" BLOCK



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



TYPICAL GUARDRAIL ELEVATION



PLAN VIEW

OMITTED POST DETAIL

See Note 1

NO SCALE

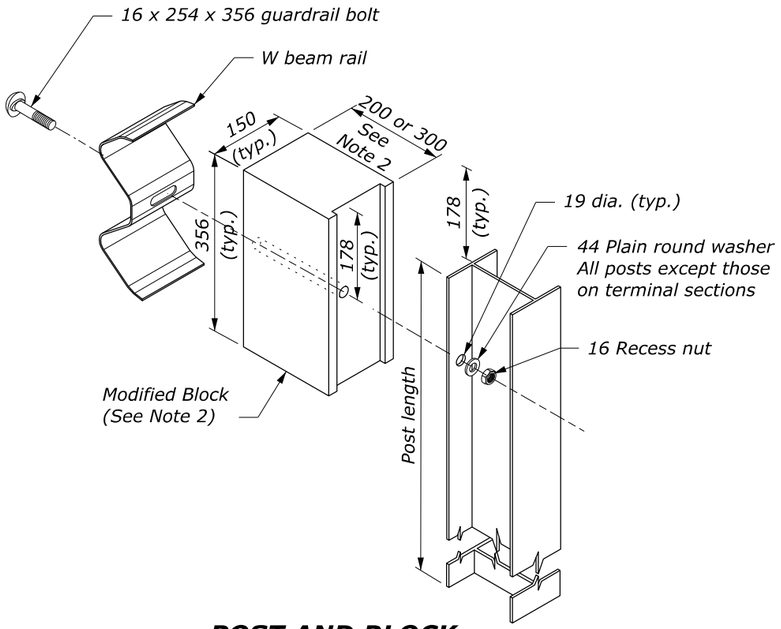
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
OFFICE OF FEDERAL LANDS HIGHWAY

FLH STANDARD

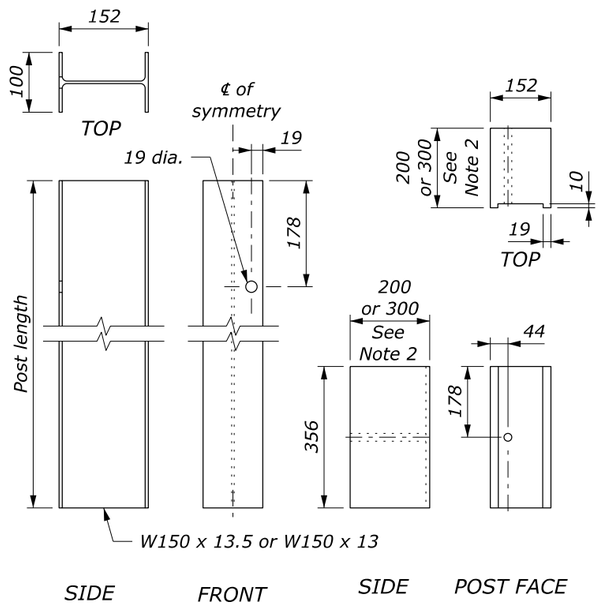
MGS W-BEAM GUARDRAIL STEEL POSTS

STANDARD APPROVED FOR USE 7/2022	STANDARD
REVISED:	617-32

PROJECT	SHEET NUMBER

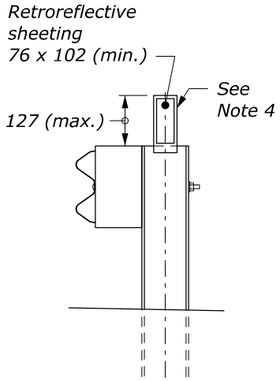


POST AND BLOCK DETAIL



STRUCTURAL SHAPE POST

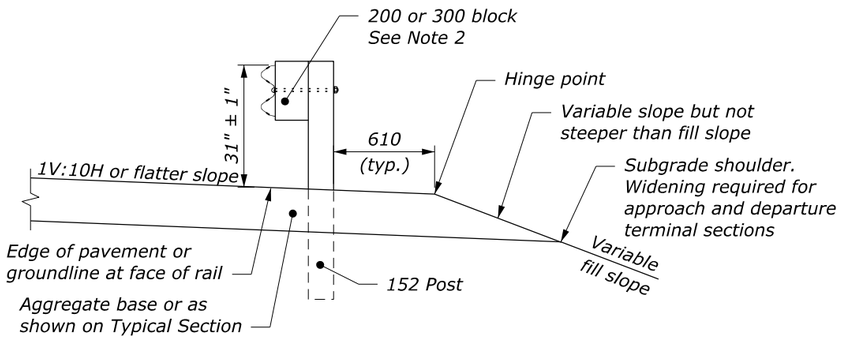
BLOCK



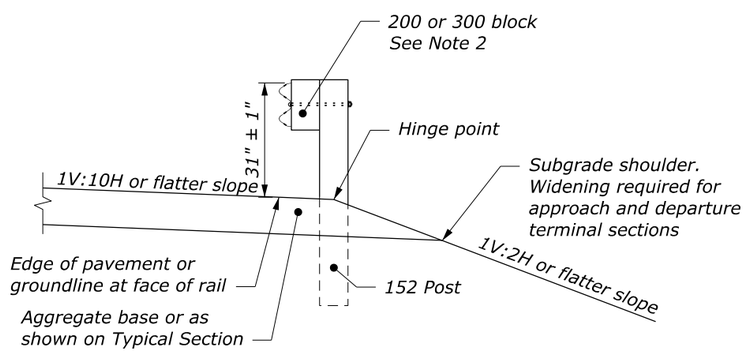
FLEXIBLE DELINEATOR GUARDRAIL MOUNT

NOTE:

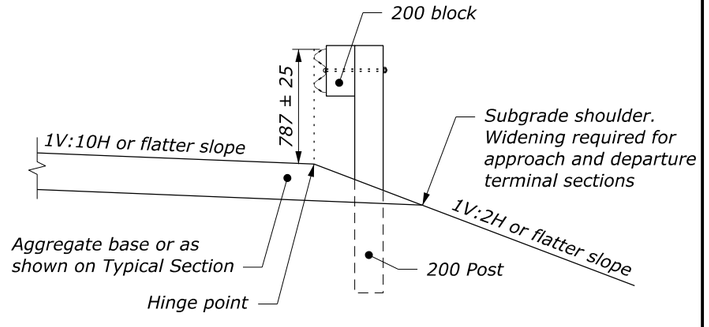
1. *When encountering impenetrable material, one post may be omitted in locations where the typical guardrail cross section includes 609 mm (min.) between the back of the guardrail post and the hinge point. For all other locations, see Section 617 and Standard M617-13 or M617-37.*
2. *Size of block shown elsewhere on the plans. Modified block 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.*
5. *Dimensions without units are millimeters.*



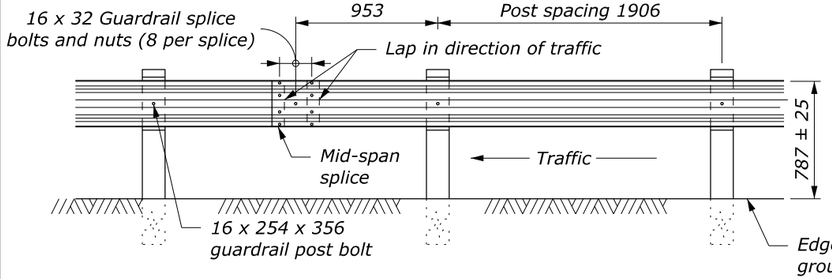
TYPICAL GUARDRAIL CROSS SECTION 1829 POST, 200 OR 300 BLOCK



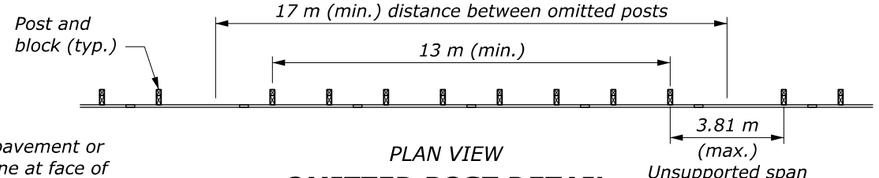
TYPICAL GUARDRAIL CROSS SECTION 1829 POST CENTERED ON HINGE, 200 OR 300 BLOCK



TYPICAL GUARDRAIL CROSS SECTION 2438 POST ON SLOPE, 200 BLOCK



TYPICAL GUARDRAIL ELEVATION



PLAN VIEW

OMITTED POST DETAIL

See Note 1

NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
OFFICE OF FEDERAL LANDS HIGHWAY

METRIC FLH STANDARD

MGS W-BEAM GUARDRAIL STEEL POSTS

STANDARD APPROVED FOR USE 7/2022	STANDARD
REVISED:	M617-32

Designer Notes: FLH Standard Drawing 617-32
Last Updated: June 2022

MGS W-Beam Guardrail, Steel Posts

General Information

Appropriate Applications.

- The Midwest Guardrail System (MGS) is a non-proprietary w-beam guardrail system that meets the current crash testing requirements. MGS is used when w-beam guardrail is selected for barrier installation.

Crash Test Criteria	MASH
Test Level	TL-3
FHWA Eligibility Letter	B-212, B-240, B-261
TF 13 Designator	SGR20a-b
Crash Test Report	Multiple MwRSF reports available at https://mwrsf.unl.edu/mgs.php Multiple TTI reports available at https://www.roadsidepooledfund.org/mash-implementation/search/

Limitations. The drawing shows the various options for guardrail near slopes. The preferred option is to use 6’ post with 2’ between the back of post and the slope hinge point.

Layout Guidance.

- See AASHTO *Roadside Design Guide*
- Use the FLH Barrier Length of Need Calculator available at https://highways.dot.gov/federal-lands/safety/barrier-length-need
- See the FLH *Midwest Guardrail System FAQ* document for more information.

Typical Pay Item Used

- 61701-4500 Guardrail system MGS, type 2, class A steel posts [LNFT] for galvanized steel
- 61701-5100 Guardrail system MGS, type 4, class B steel posts [LNFT] for weathering steel

Updates

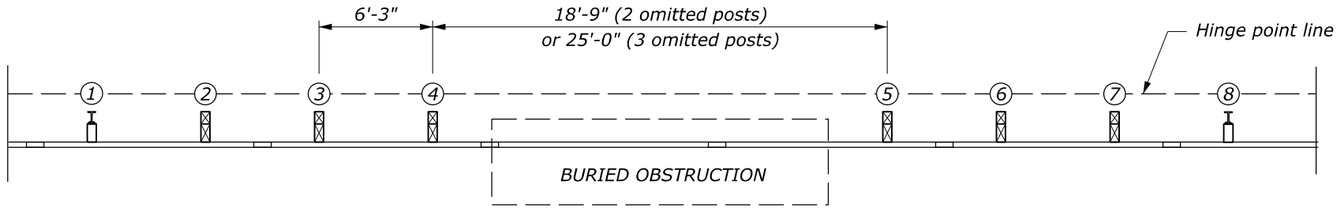
February 2019

- New Detail drawing

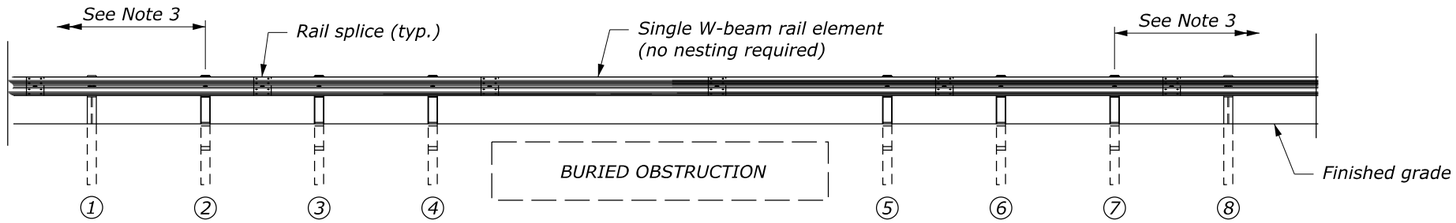
June 2022

- Converted from CFL Detail to FLH Standard

PROJECT	SHEET NUMBER



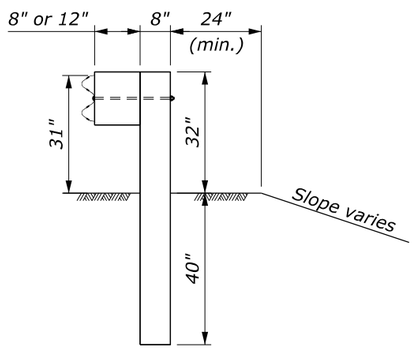
PLAN



ELEVATION

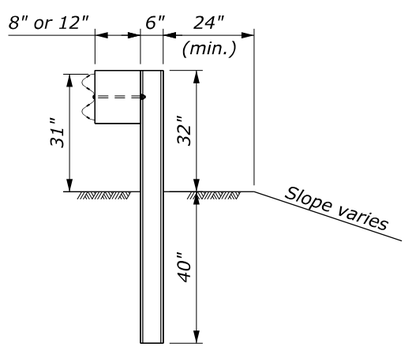
NOTE:

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.



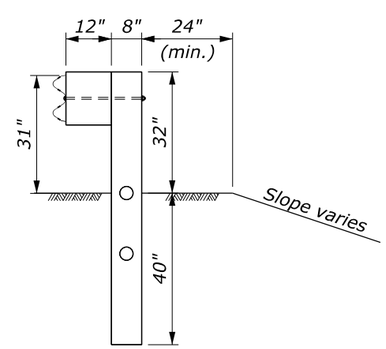
WOOD POST DETAIL

POST ① AND ⑧
See Note 1



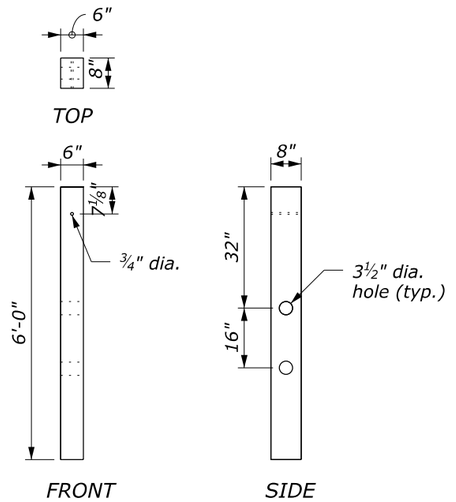
STEEL POST DETAIL

POST ① AND ⑧
See Note 1

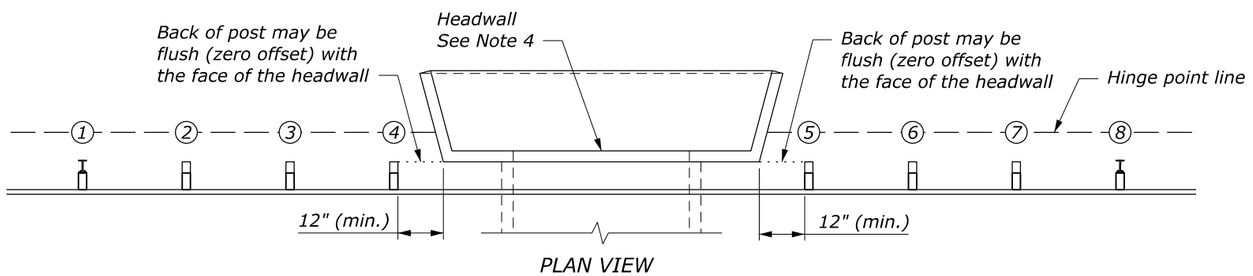


CRT POST DETAIL

POST ② AND ⑦
See Note 2



CRT WOOD POST



PLAN VIEW

SPAN WITH HEADWALL DETAIL

NO SCALE

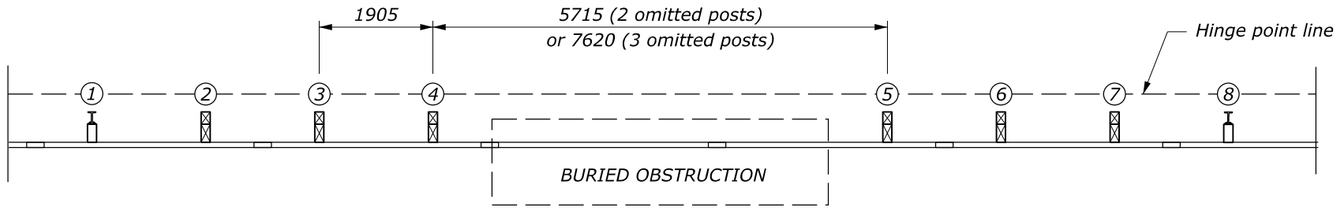
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
OFFICE OF FEDERAL LANDS HIGHWAY

FLH STANDARD

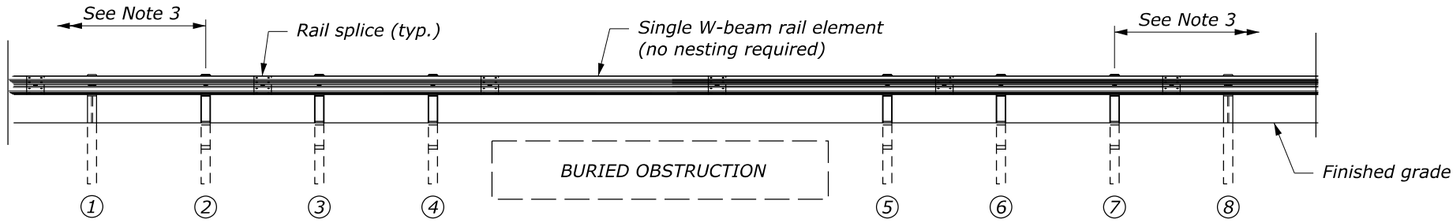
MGS W-BEAM GUARDRAIL LONG-SPAN SYSTEM

STANDARD APPROVED FOR USE 7/2022	STANDARD
REVISED:	617-37

PROJECT	SHEET NUMBER



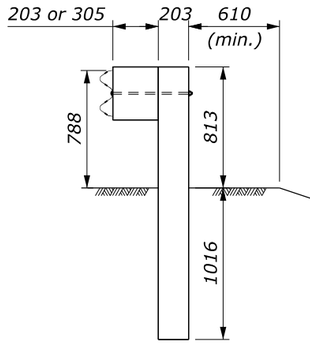
PLAN



ELEVATION

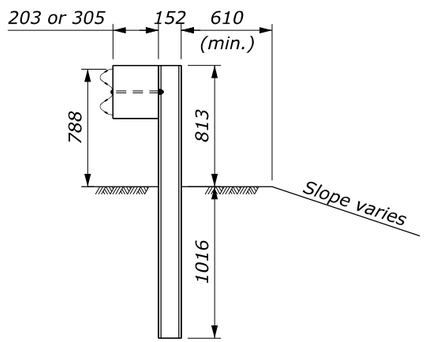
NOTE:

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.
6. Dimensions without units are millimeters.



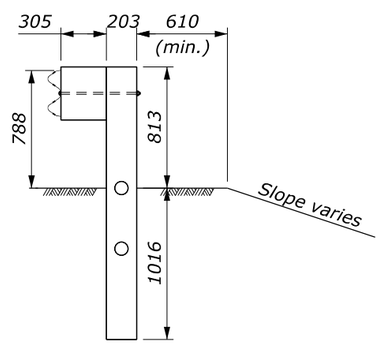
WOOD POST DETAIL

POST ① AND ⑧
See Note 1



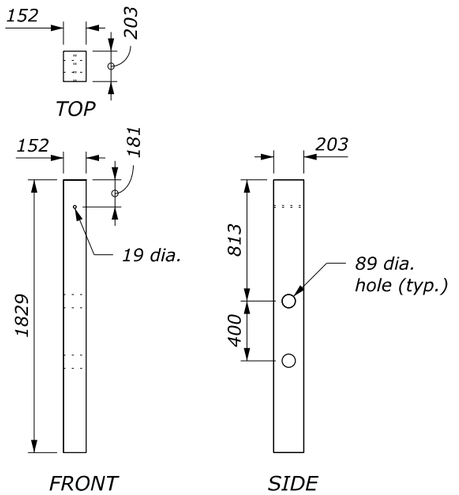
STEEL POST DETAIL

POST ① AND ⑧
See Note 1

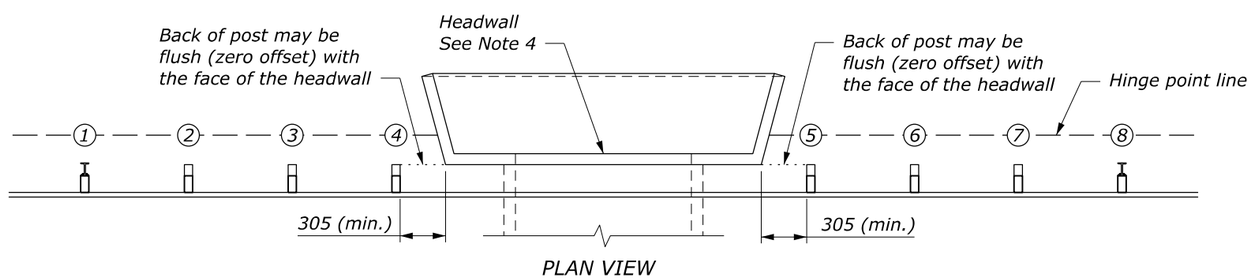


CRT POST DETAIL

POST ② AND ⑦
See Note 2



CRT WOOD POST



PLAN VIEW

SPAN WITH HEADWALL DETAIL

NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
OFFICE OF FEDERAL LANDS HIGHWAY

METRIC FLH STANDARD

MGS W-BEAM GUARDRAIL LONG-SPAN SYSTEM

STANDARD APPROVED FOR USE 7/2022	STANDARD
REVISED:	M617-37

Designer Notes: FLH Standard Drawing 617-37
Last Updated: June 2022

MGS W-Beam Guardrail Long-Span System

General Information

Appropriate Applications.

- Long-span guardrail systems are used to span low-fill culverts. This drawing may also be used if an impenetrable object is encountered at post locations during construction.

Crash Test Criteria	MASH
Test Level	TL-3
FHWA Eligibility Letter	B-133, B-211A
TF 13 Designator	SGR20a-b, SGR38a-e
Crash Test Report	MwRSF Report No TRP-03-187-07

Limitations. The maximum span is 25 feet.

Layout Guidance.

- See AASHTO *Roadside Design Guide* Section 5.4.2
- See the FLH *Midwest Guardrail System FAQ* document for more information.

Typical Pay Item Used

- 61701-4550 Guardrail system MGS, type 2, class A wood posts [LNFT] for galvanized steel
- 61701-5150 Guardrail system MGS, type 4, class B wood posts [LNFT] for weathering steel

Note: long-span systems are paid for using the same pay item as roadside rail.

Updates

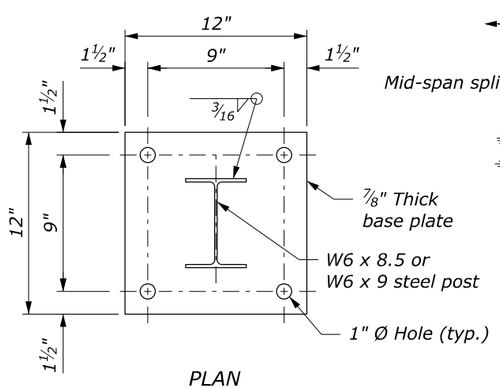
February 2019

- New Detail drawing

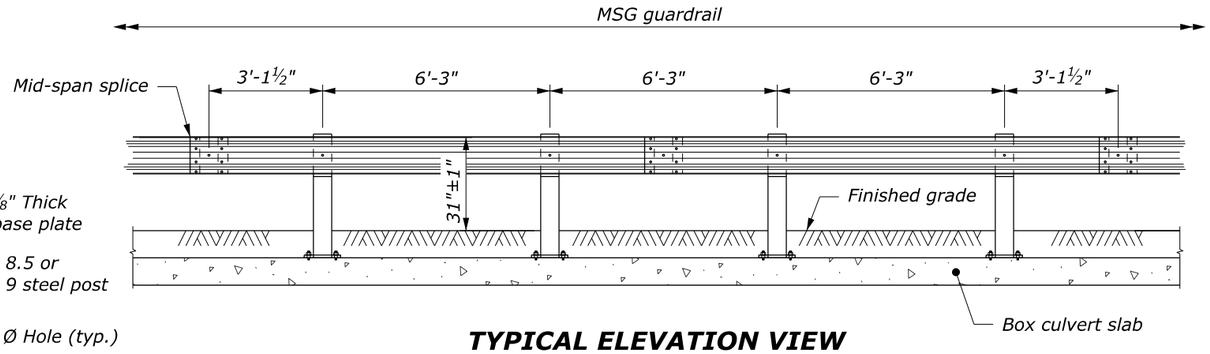
June 2022

- Converted from CFL Detail to FLH Standard

PROJECT	SHEET NUMBER



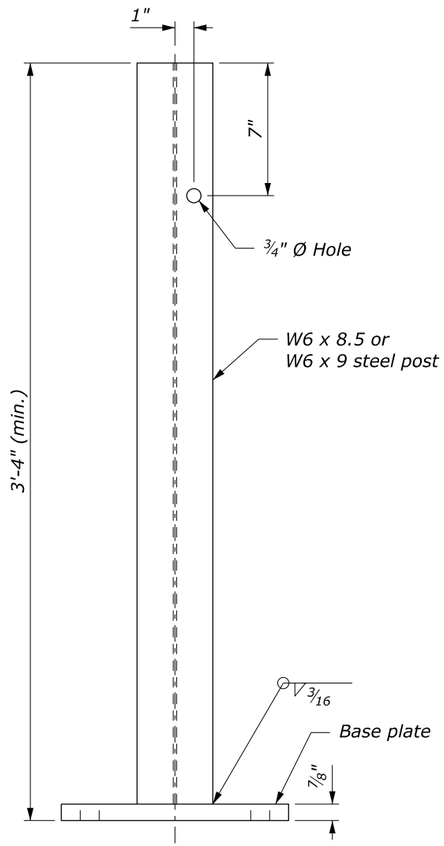
PLAN



TYPICAL ELEVATION VIEW

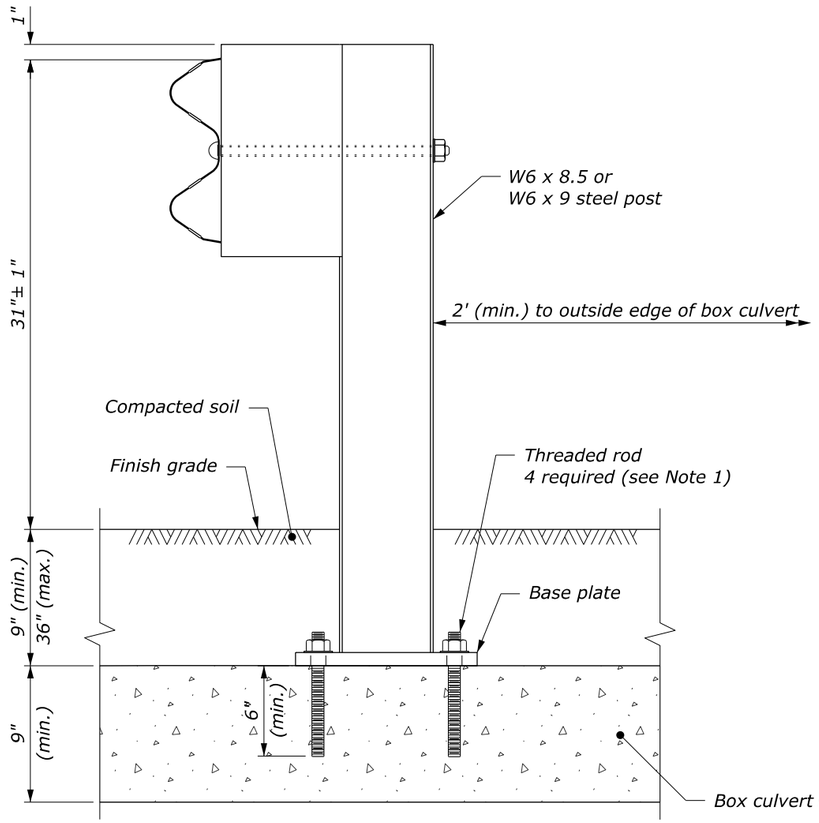
NOTE:

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 blocks are shown. Blocks of an approved alternative may be used.*
3. *See Standard 617-32 for other details.*

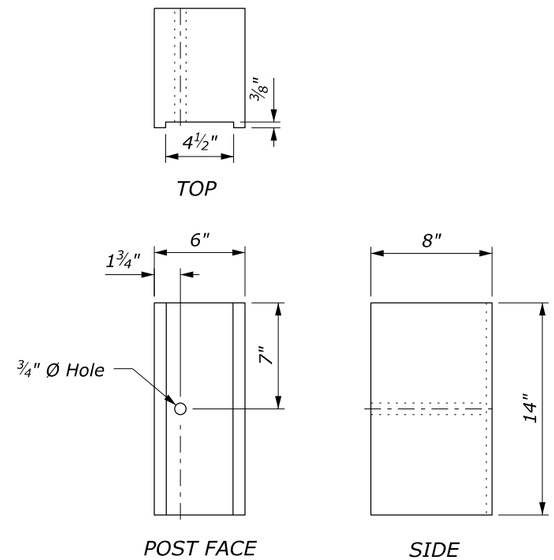


ELEVATION

BOX CULVERT POST



BOX CULVERT MGS GUARDRAIL STEEL POST



BLOCK

See Note 2

NO SCALE

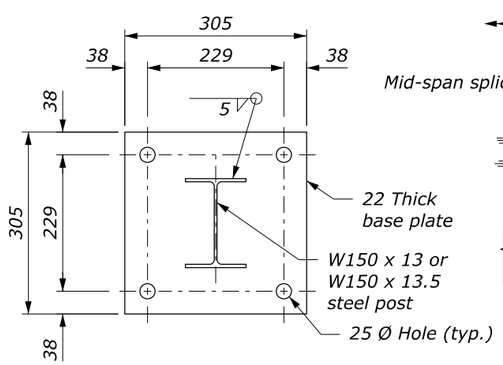
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
OFFICE OF FEDERAL LANDS HIGHWAY

FLH STANDARD

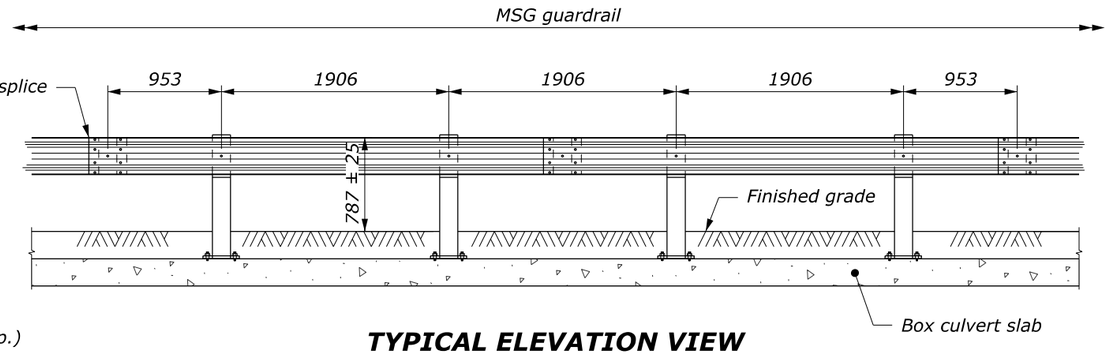
MGS W-BEAM GUARDRAIL STEEL POSTS ATTACHED TO BOX CULVERT

STANDARD APPROVED FOR USE 7/2022	STANDARD
REVISED:	617-38

PROJECT	SHEET NUMBER



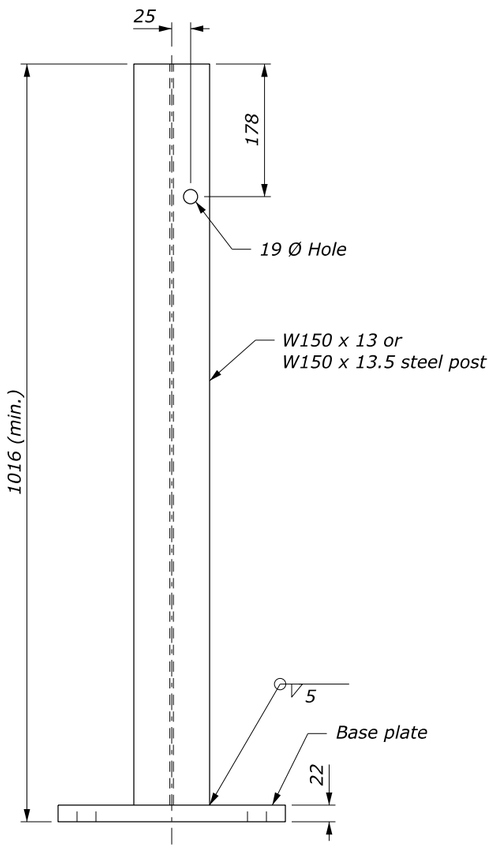
PLAN



TYPICAL ELEVATION VIEW

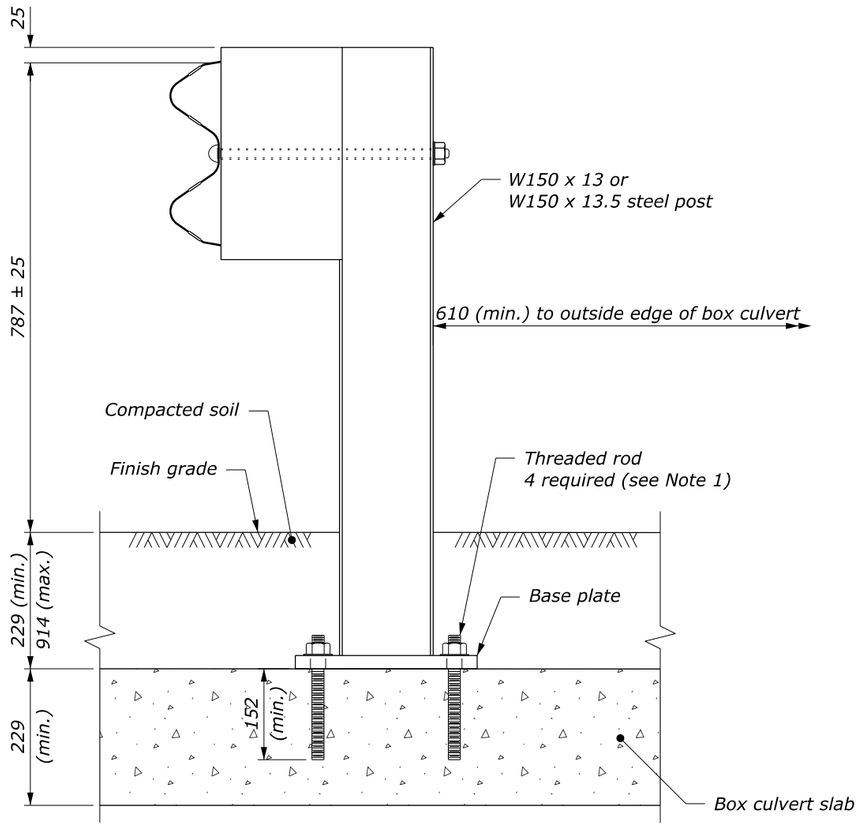
NOTE:

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 blocks are shown. Blocks of an approved alternative may be used.
3. See Standard M617-32 for other details.
4. Dimensions without units are millimeters.

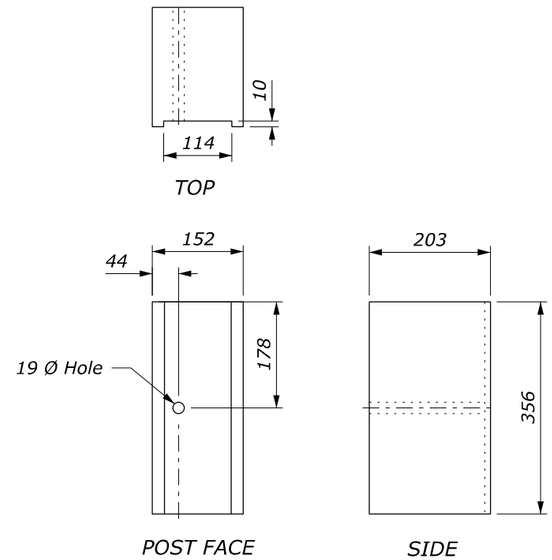


ELEVATION

BOX CULVERT POST



BOX CULVERT MGS GUARDRAIL STEEL POST



BLOCK

See Note 2

NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
OFFICE OF FEDERAL LANDS HIGHWAY

METRIC FLH STANDARD

MGS W-BEAM GUARDRAIL STEEL POSTS ATTACHED TO BOX CULVERT

STANDARD APPROVED FOR USE 7/2022	STANDARD
REVISED:	M617-38

Designer Notes: FLH Standard Drawing 617-38
Last Updated: June 2022

MGS W-Beam Guardrail Steel Posts Attached to Box Culvert

General Information

Appropriate Applications.

- This drawing is used with box culverts with shallow fill.

Crash Test Criteria	MASH
Test Level	TL-3
FHWA Eligibility Letter	B-241
TF 13 Designator	SBW09c
Crash Test Report	TTI Report No. 405160-23-2

Limitations. Embankment over culvert ranges from 9" (min.) to 3' (max.).

Layout Guidance.

- See the FLH *Midwest Guardrail System FAQ* document for more information.

Typical Pay Item Used

- 61701-4500 Guardrail system MGS, type 2, class A steel posts [LNFT] for galvanized steel
- 61701-5100 Guardrail system MGS, type 4, class B steel posts [LNFT] for weathering steel

Note: Use the same pay item as roadside rail.

Updates

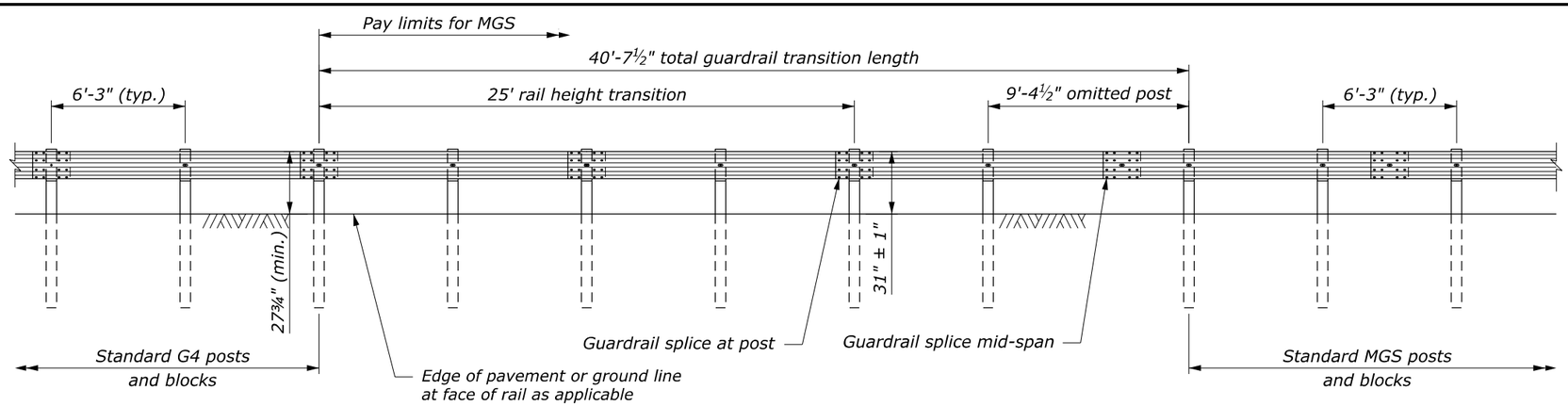
February 2019

- New Detail drawing

June 2022

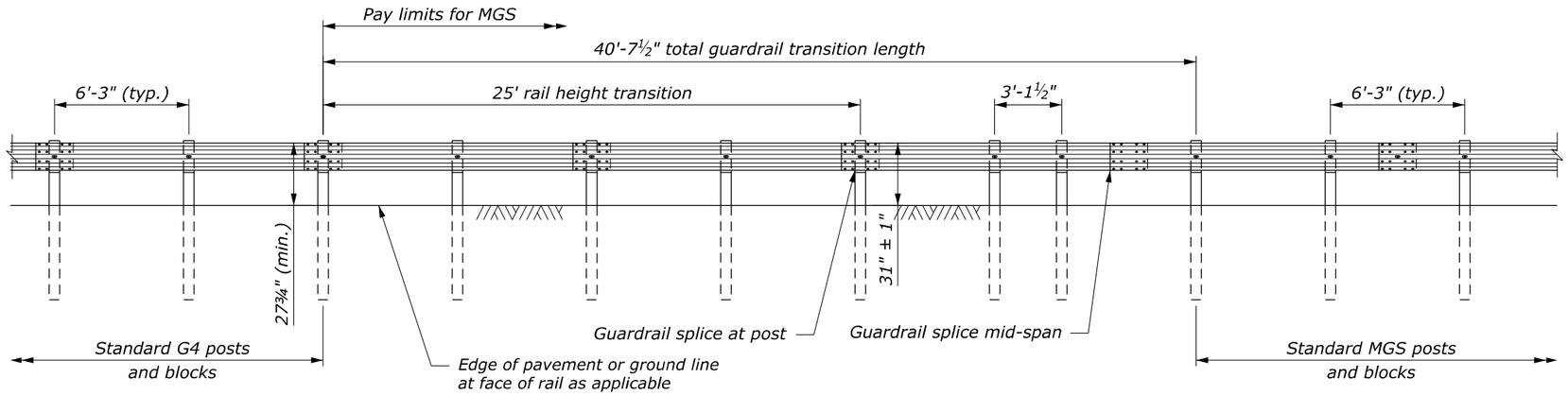
- Converted from CFL Detail to FLH Standard

PROJECT	SHEET NUMBER



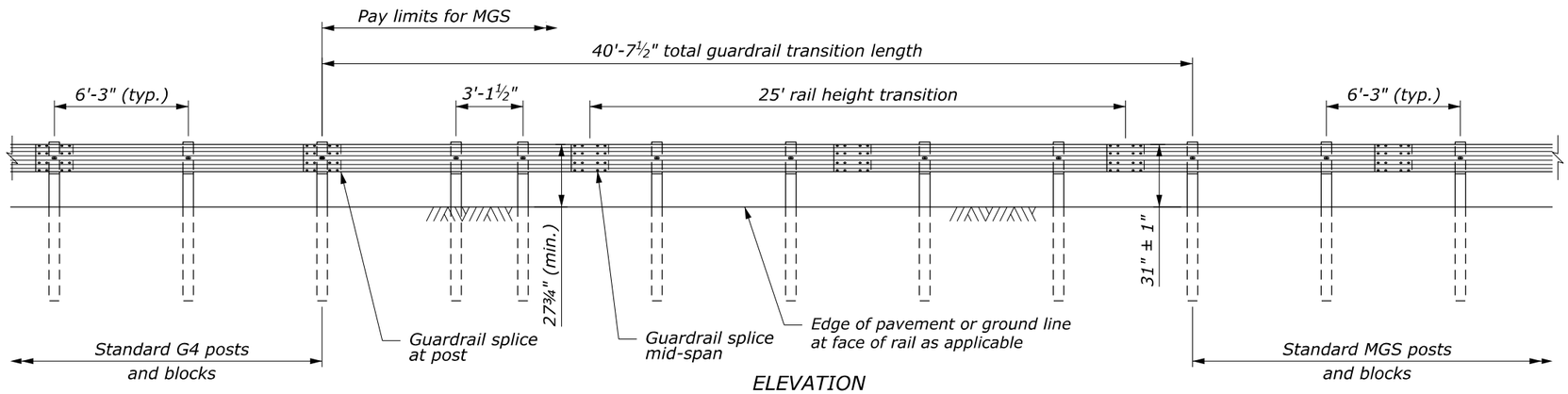
ELEVATION

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 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.*

NO SCALE

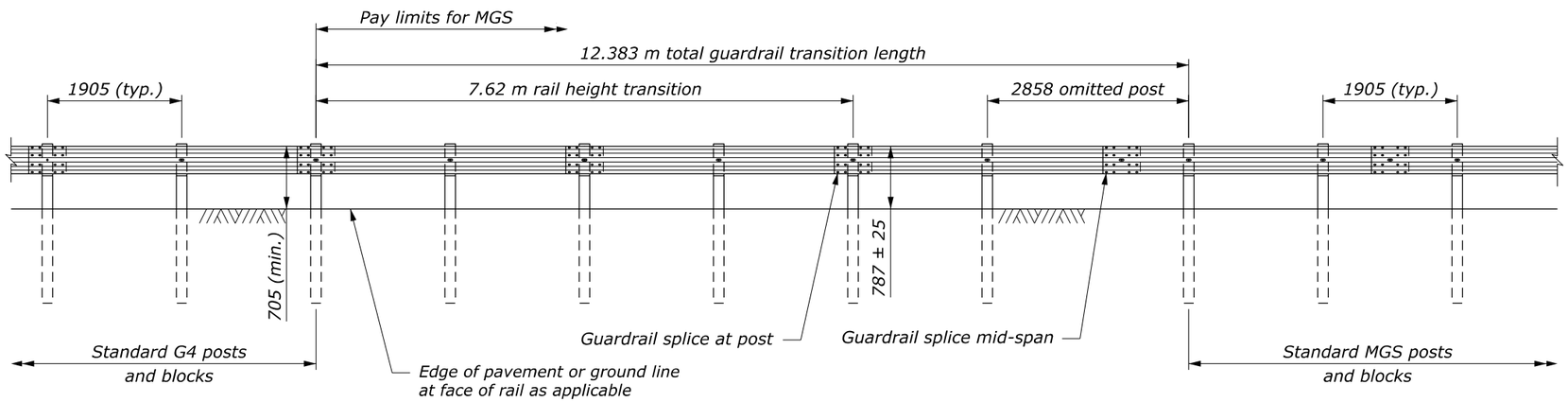
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
OFFICE OF FEDERAL LANDS HIGHWAY

FLH STANDARD

G4 TO MGS W-BEAM GUARDRAIL TRANSITION

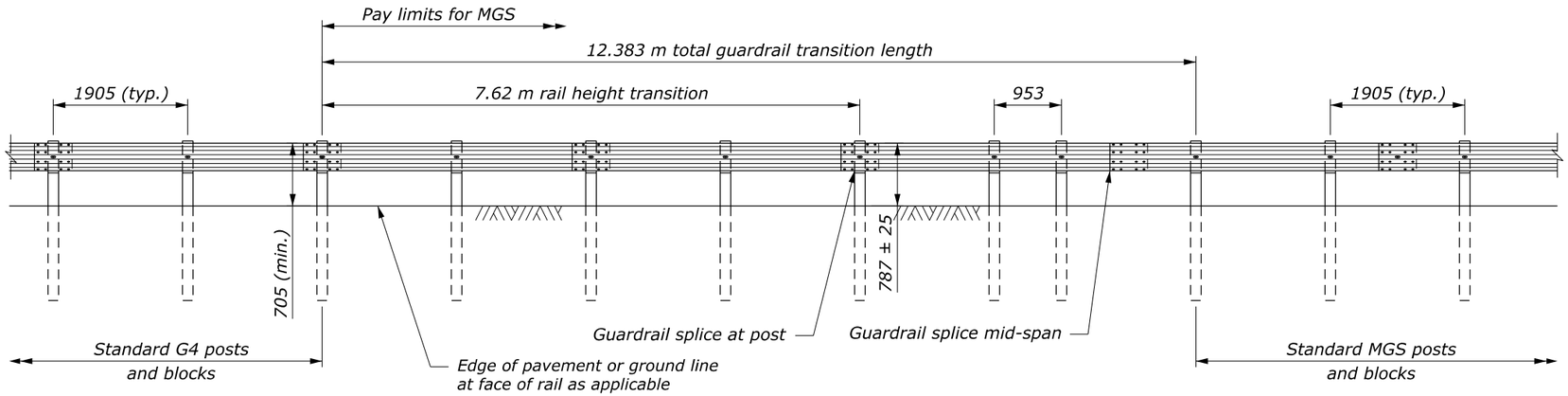
STANDARD APPROVED FOR USE 7/2022	STANDARD
REVISED:	617-39

PROJECT	SHEET NUMBER



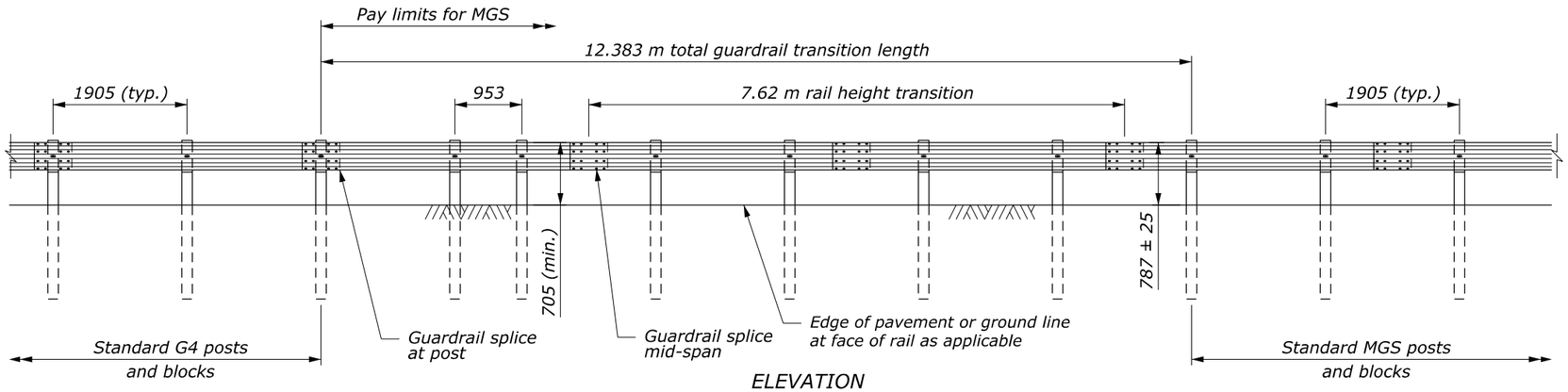
ELEVATION

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.*
5. *Dimensions without units are millimeters.*

NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
OFFICE OF FEDERAL LANDS HIGHWAY

METRIC FLH STANDARD

G4 TO MGS W-BEAM GUARDRAIL TRANSITION

STANDARD APPROVED FOR USE 7/2022
REVISED:

STANDARD
M617-39

Designer Notes: FLH Standard Drawing 617-39
Last Updated: June 2022

G4 to MGS W-Beam Guardrail Transition

General Information

Appropriate Applications.

- This drawing is used to transition the rail height from G4 (27¾" to 29" mounting height) to MGS (31" mounting height) and to transition the location of the splice (G4 has the splice at the post, and MGS has the splice mid-span)

Crash Test Criteria	None
Test Level	None
FHWA Eligibility Letter	None
TF 13 Designator	Not posted
Crash Test Report	MwRSF Report No. TRP-03-335-17

Limitations. No crash testing has been performed for this installation. The drawing is based on recommendations from MwRSF.

Layout Guidance.

- See the FLH *Midwest Guardrail System FAQ* document for more information.

Typical Pay Item Used

- 61701-4500 Guardrail system MGS, type 2, class A steel posts [LNFT] for galvanized steel, steel post
- 61701-4550 Guardrail system MGS, type 2, class A wood posts [LNFT] for galvanized steel, wood post
- 61701-5100 Guardrail system MGS, type 4, class B steel posts [LNFT] for weathering steel, steel post
- 61701-5150 Guardrail system MGS, type 4, class B wood posts [LNFT] for weathering steel, wood post

Note: Use the same pay item as roadside rail.

Updates

February 2019

- New Detail drawing

June 2022

- Converted from CFL Detail to FLH Standard