



Road & Bridge Design Publications

Monthly Update – May 2016

Revisions for the month of **May** are listed and displayed below. New special details will be included in projects submitted for the **August** letting as is stated on the special detail index sheets. E-mail Road related questions on these changes to MDOT-Road-Design-Standards@michigan.gov. E-mail Bridge related questions to MDOT-Bridge-Design-Standards@michigan.gov.

Special Details

24: Guardrail Anchored in Back Slope Types 4B, 4T, & 4MGS-8: Reduced the length of the Type 4MGS-8 terminal on sheets 2 & 4 from 37'-6" to 34'-4½" using a non-standard beam element (length=9'-4 ½").

R-60-J: Guardrail Types A, B, BD, T, TD, MGS-8, & MGS-8D: Reduced the length of the transition from guardrail Type MGS to guardrail Type B or T by 3'-1½" (sheet 10) using the non-standard beam element (length = 9'-4 ½") on sheet 11.

R-66-E: Guardrail Departing Terminal Types B, D, & MGS: Reduced the length of the departing terminal Type MGS on sheet 2 by 3'-1½" using a non-standard beam element (length=9'-4 ½").

R-72-D: W-Beam Backed Guardrail & Guardrail Long Span Installations: Deleted the 2'-8" offset from the face of the post to the hinge point in the detail at the top of sheet 8, since it is only applicable to the MGS long span details.

Bridge Design Manual

Chapter 2 Table of Contents and 2.05: New section for Bridge Design Quality Assurance & Quality Control.

Chapter 6: Sample Plans have been deleted from the manual and new [Guidelines For Bridge Plan Preparation](#) (MDOT Sample Plans Bridge) are available at the MDOT Development Guide ([Design Submittal Requirements Chapter 7](#)).

Chapter 9: Chapter 9 has been condensed and the information previously contained within Chapter 9 has been incorporated into or is contained in the following documents or sections of the Bridge Design Manual:



Road & Bridge Design Publications

Monthly Update – May 2016

[Guidelines For Bridge Plan Preparation](#) (MDOT Sample Plans Bridge) are available at the MDOT Development Guide ([Design Submittal Requirements Chapter 7](#))

[Standard Naming Conventions](#) (Chapter 3) of Development Guide (Design Submittal Requirements).

[Michigan Structure Inventory and Appraisal Coding Guide](#)

Bridge Design Manual Section 2.05, Bridge Design Quality Assurance & Quality Control

Bridge Design Guides

6.29.06A: Revised EA04 bars to EB04 bars at fascia and under railing.

6.29.09E, 6.29.17A: Revised EA06 bars to EB06 bars at fascia and under railing.

6.29.10B: Added note to use waterstop only when railing is mounted flush to the slab.

6.29.10D: Added dimensions for EB06 bar for 4 foot wide box beams.

6.29.16A: Added waterstop to section A-A.

6.29.17H: Deleted waterstop from sections.

Updates to MDOT Cell Library, Bridge Auto Draw Program, etc., may be required in tandem with some of this month's updates. Until such updates to automated tools can be made, it is the designer's/detailer's responsibility to manually incorporate any necessary revisions to notes and plan details to reflect these revisions.

Index to Special Details

5-23-2016

⑥

SPECIAL DETAIL NUMBER	NUMBER OF SHEETS	TITLE	CURRENT DATE
21	2	GUARDRAIL AT INTERSECTIONS	3-14-16
*24	8	GUARDRAIL ANCHORED IN BACKSLOPE TYPES 4B, 4T, & 4MGS-8	4-25-16
99	2	CHAIN LINK FENCE WITH WIRE ROPE	9-22-14
R-1-G	9	DRAINAGE STRUCTURES	7-28-15
R-28-J	7	SIDEWALK RAMP AND DETECTABLE WARNING DETAILS	3-15-16
R-53-A	22	TEMPORARY CONCRETE BARRIER LIMITED DEFLECTION	8-14-15
*R-60-J	16	GUARDRAIL TYPES A, B, BD, T, TD, MGS-8, & MGS-8D	4-22-16
R-61-H	19	GUARDRAIL APPROACH TERMINAL TYPES 1B & 1T (SKT, FLEAT, & X-Lite)	3-15-16
R-62-H	10	GUARDRAIL APPROACH TERMINAL TYPES 2B & 2T (SKT & X-Lite)	3-15-16
R-63-C	16	GUARDRAIL APPROACH TERMINAL TYPES 3B & 3T	3-15-16
*R-66-E	4	GUARDRAIL DEPARTING TERMINAL TYPES B, T, & MGS	4-27-16
R-67-G	7	GUARDRAIL ANCHORAGE, BRIDGE, DETAILS	3-15-16
*R-72-D	11	W-BEAM BACKED GUARDRAIL & GUARDRAIL LONG SPAN INSTALLATIONS	5-11-16
R-73-F	6	GUARDRAIL OVER BOX OR SLAB CULVERTS	3-15-16
R-83-C	5	UTILITY TRENCHES	2-8-16
R-126-I	5	PLACEMENT OF TEMPORARY CONCRETE & STEEL BARRIER	8-25-15

*** Denotes New or Revised Special Detail to be included in projects for (beginning with) the August letting.**

Note:

Former Standard Plans IV-87, IV-89, IV-90, and IV-91 Series, used for building cast-in-place concrete head walls for elliptical and circular pipe culverts, are now being replaced with plans that detail each specific size. The Municipal Utilities Unit will provide these full sized special details for inclusion in construction plans for MDOT jobs. To assure prompt delivery, requests **must** be made in advance.

Former Standard Plans IV-93 and IV-94 series have been replaced with precast concrete box & three-sided culverts as per the 2012 Standard Specifications for Construction.

Index to Bridge Detail Sheets

5-23-2016

7

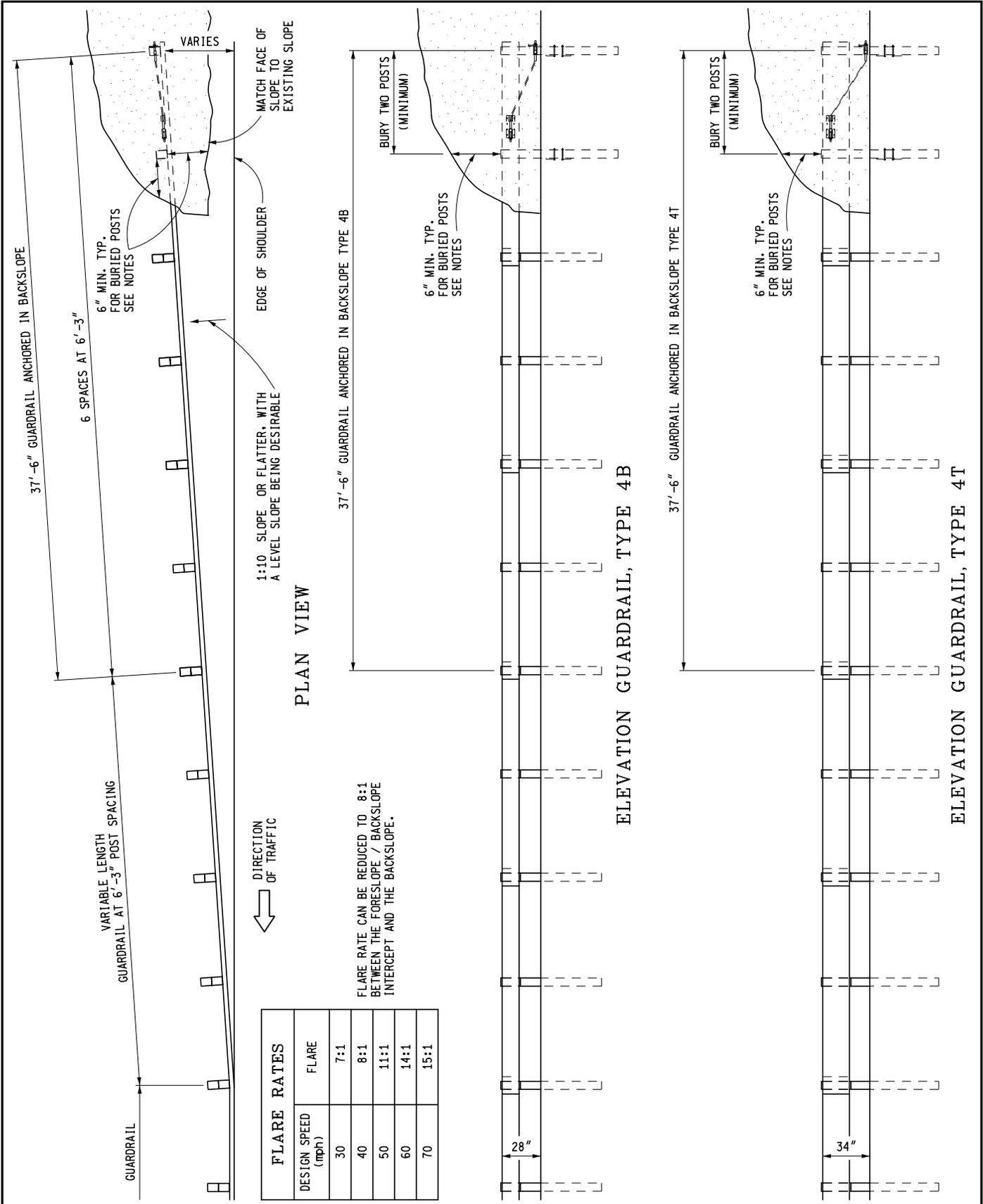
DETAIL NUMBER	NUMBER OF SHEETS	TITLE	CURRENT DATE
B-22-E	4	BRIDGE RAILING, THRIE BEAM RETROFIT (R4 TYPE RAILING)	3-15-16
B-23-F	4	BRIDGE RAILING, THRIE BEAM RETROFIT (OPEN PARAPET RAILING)	3-15-16
B-101-G	2	DRAIN CASTING ASSEMBLY DETAILS	2-8-16
EJ3AB	1 or 2	EXPANSION JOINT DETAILS	2-10-16
EJ4O	1 or 2	EXPANSION JOINT DETAILS	2-10-16
PC-2G	1	70" PRESTRESSED CONCRETE I-BEAM DETAILS	3-31-06
PC-4E	1	PRESTRESSED CONCRETE 1800 BEAM DETAILS	3-31-06
PC-1L	1	PRESTRESSED CONCRETE I-BEAM DETAILS	7-12-06

* Denotes New or Revised Special Detail to be included in projects for (beginning with) the August letting.

Note:

Details EJ3AA & EJ4N are interactive, i.e. designers and detailers choose details based upon railing type and angle of crossing. Place all details appropriate for the project, structure specific information, and the Expansion Joint Device quantity on the sheet. The sheet shall then be added to the plans as a normal plan sheet.

Detail PC-1L, PC-2G and PC-4E shall have structure specific information and quantities added to the sheet. The sheet shall then be added to the plans as a normal plan sheet.



FLARE RATES	
DESIGN SPEED (mph)	FLARE
30	7:1
40	8:1
50	11:1
60	14:1
70	15:1

FLARE RATE CAN BE REDUCED TO 8:1 BETWEEN THE FORESLOPE / BACKSLOPE INTERCEPT AND THE BACKSLOPE.

MDOT
Michigan Department of Transportation

PREPARED BY
DESIGN DIVISION

DRAWN BY: B.L.T.

CHECKED BY: W.K.P.

DEPARTMENT DIRECTOR
Kirk T. Stuedle

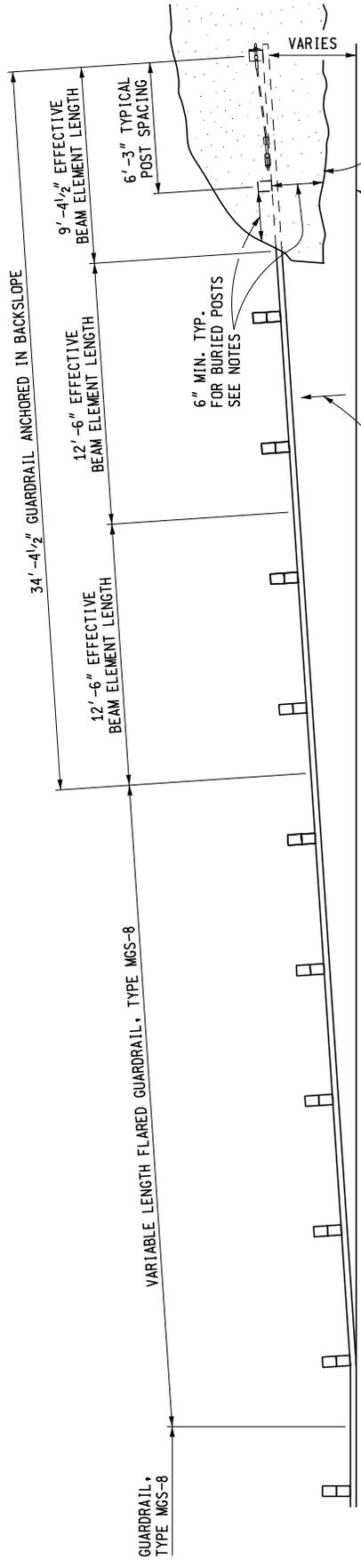
APPROVED BY: _____
DIRECTOR, BUREAU OF FIELD SERVICES

APPROVED BY: _____
DIRECTOR, BUREAU OF DEVELOPMENT

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF DEVELOPMENT SPECIAL DETAIL FOR

GUARDRAIL ANCHORED IN BACKSLOPE TYPES 4B, 4T, & 4MGS-8

F.H.W.A. APPROVAL	4-25-2016 PLAN DATE	SPECIAL DETAIL 24	SHEET 1 OF 8
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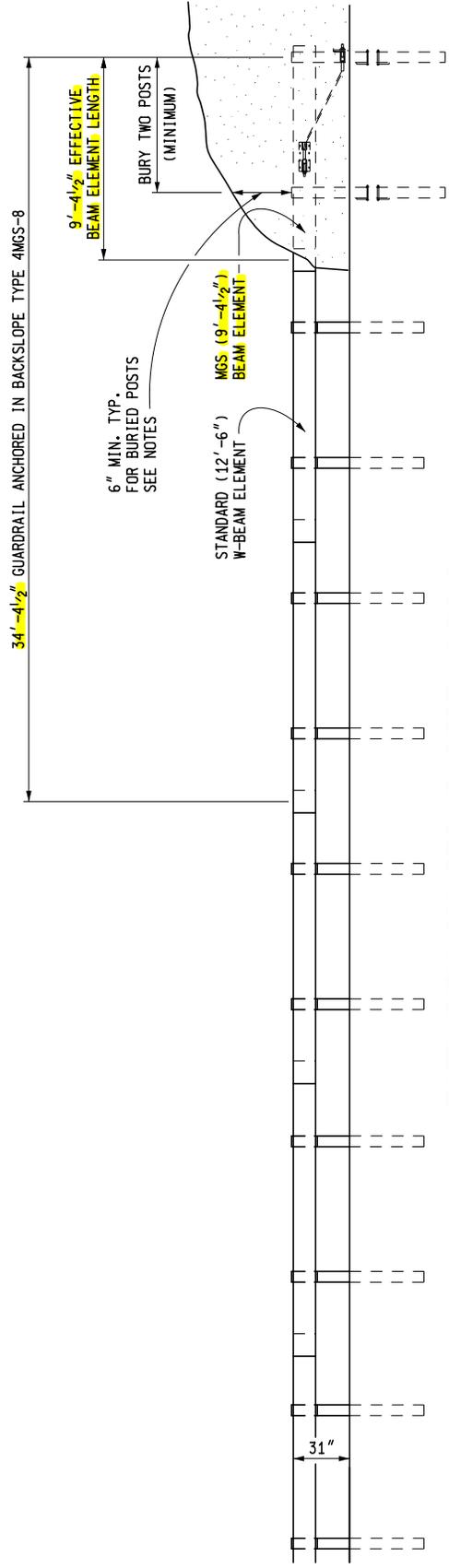


PLAN VIEW

← DIRECTION OF TRAFFIC

FLARE RATES	
DESIGN SPEED (mph)	FLARE
30	7:1
40	8:1
50	11:1
60	14:1
70	15:1

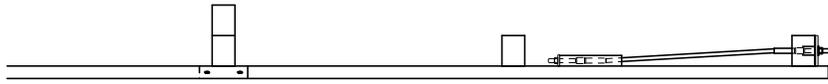
FLARE RATE CAN BE REDUCED TO 8:1 BETWEEN THE FORESLOPE / BACKSLOPE INTERCEPT AND THE BACKSLOPE.



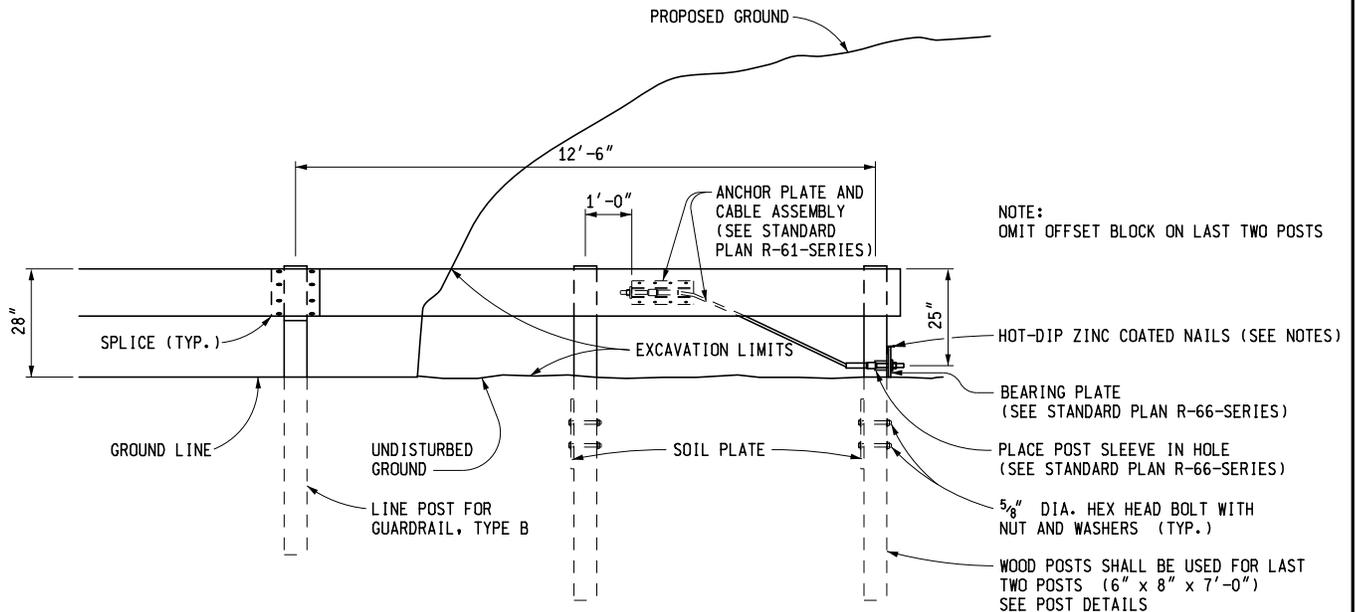
ELEVATION GUARDRAIL, TYPE 4MGS-8

MICHIGAN DEPARTMENT OF TRANSPORTATION
 BUREAU OF DEVELOPMENT SPECIAL DETAIL FOR
GUARDRAIL ANCHORED IN BACKSLOPE TYPES 4B, 4T, & 4MGS-8

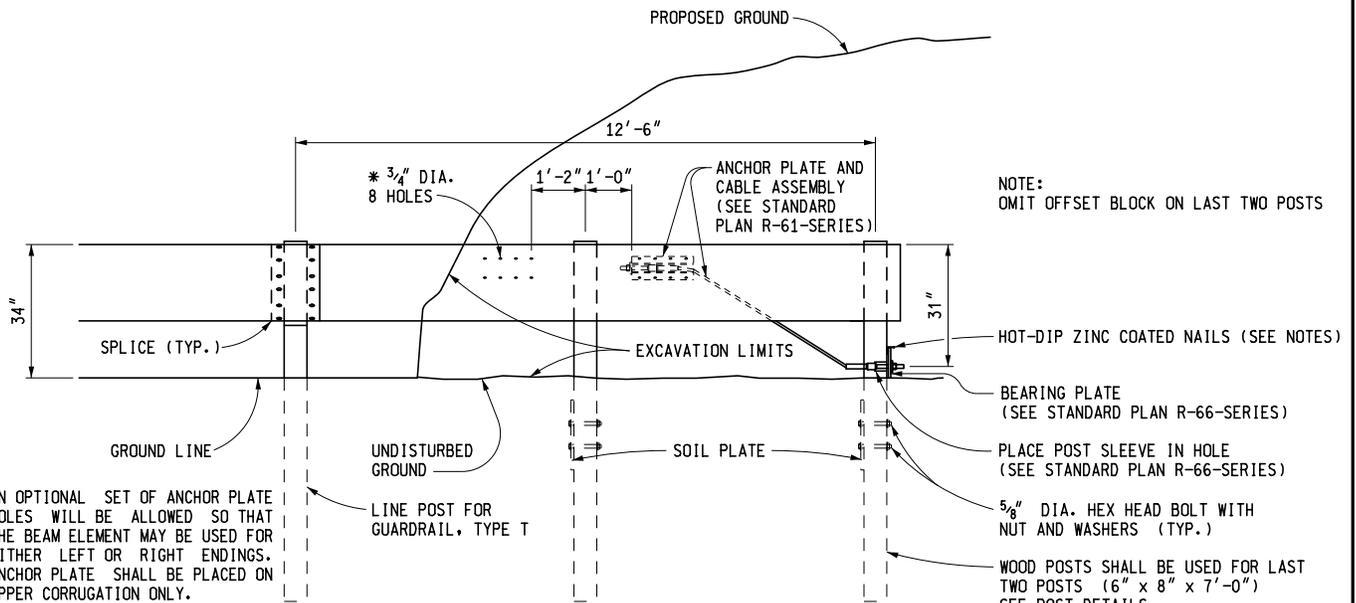
F.H.W.A. APPROVAL	4-25-2016 PLAN DATE	SPECIAL DETAIL 24	SHEET 2 OF 8
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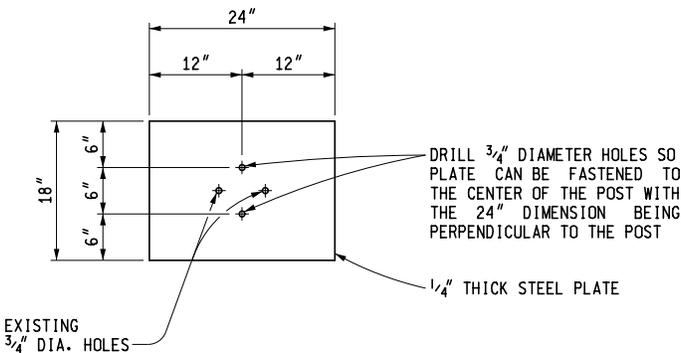
PLAN VIEW



ELEVATION GUARDRAIL, TYPE 4B



ELEVATION GUARDRAIL, TYPE 4T

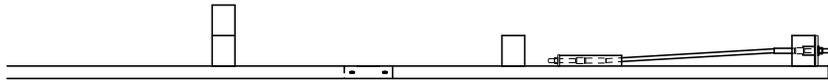


SOIL PLATE

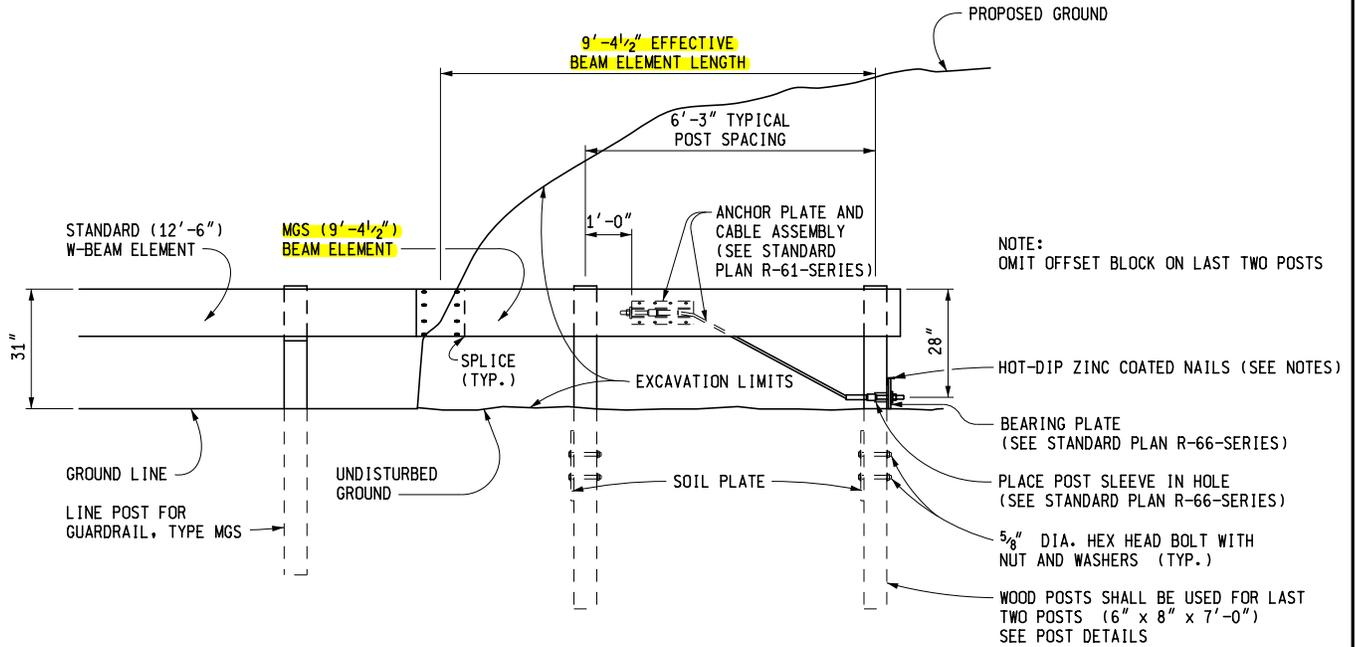
MODIFIED FROM SOIL PLATE SPECIFIED ON STANDARD PLAN R-61-SERIES BY ADDING TWO HOLES

MICHIGAN DEPARTMENT OF TRANSPORTATION
 BUREAU OF DEVELOPMENT SPECIAL DETAIL FOR
GUARDRAIL ANCHORED IN BACKSLOPE TYPES 4B, 4T, & 4MGS-8

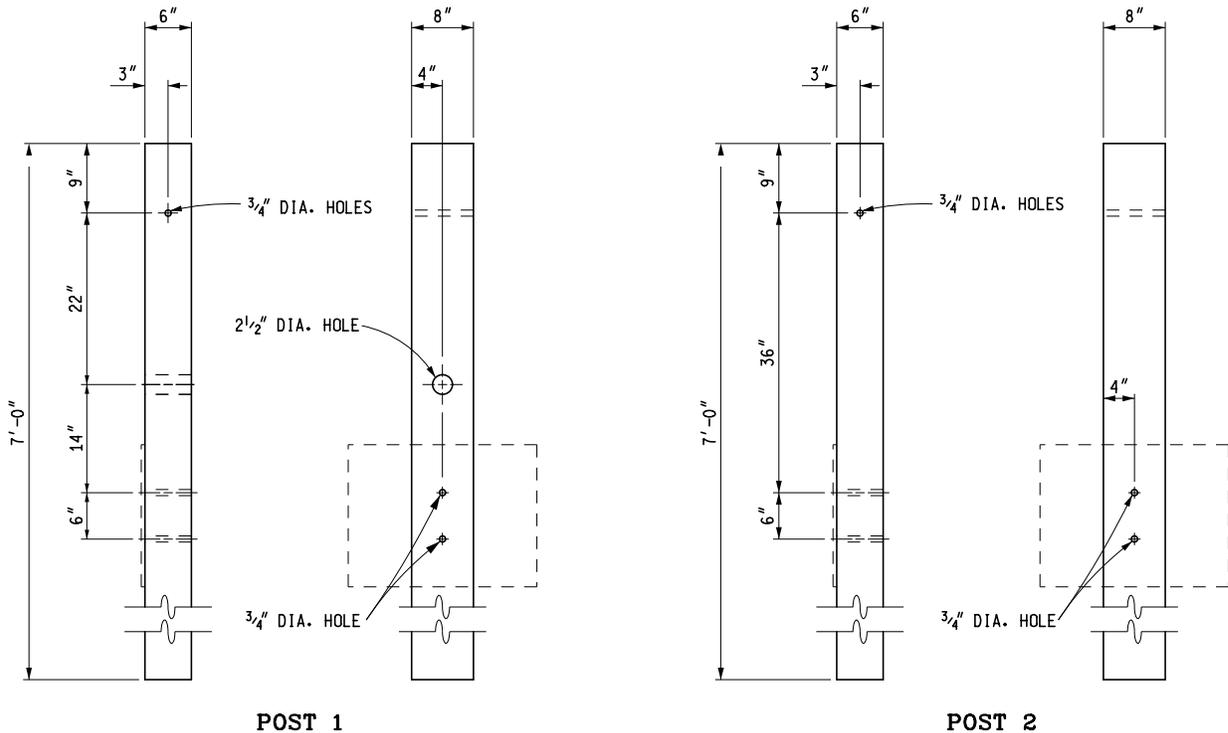
F.H.W.A. APPROVAL	4-25-2016 PLAN DATE	SPECIAL DETAIL 24	SHEET 3 OF 8
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PLAN VIEW



ELEVATION GUARDRAIL, TYPE 4MGS-8



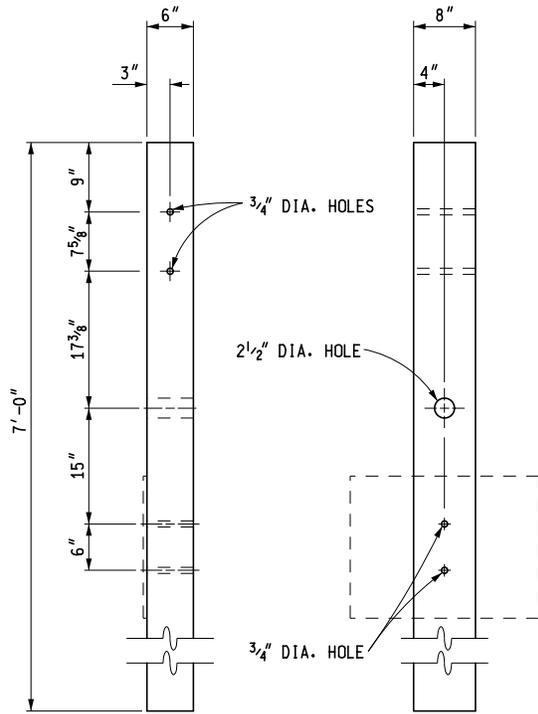
WOOD POST DETAILS

GUARDRAIL ANCHORED IN BACKSLOPE TYPE 4MGS-8

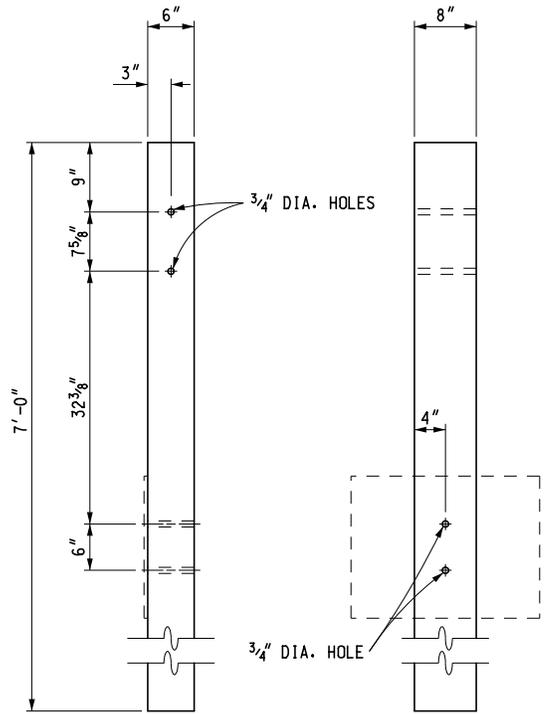
MICHIGAN DEPARTMENT OF TRANSPORTATION
 BUREAU OF DEVELOPMENT SPECIAL DETAIL FOR

**GUARDRAIL ANCHORED IN
 BACKSLOPE TYPES
 4B, 4T, & 4MGS-8**

F.H.W.A. APPROVAL	4-25-2016 PLAN DATE	SPECIAL DETAIL 24	SHEET 4 OF 8
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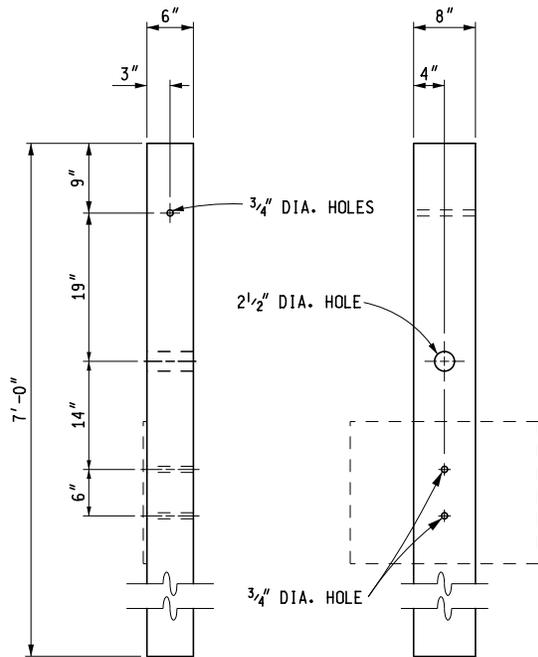
POST 1



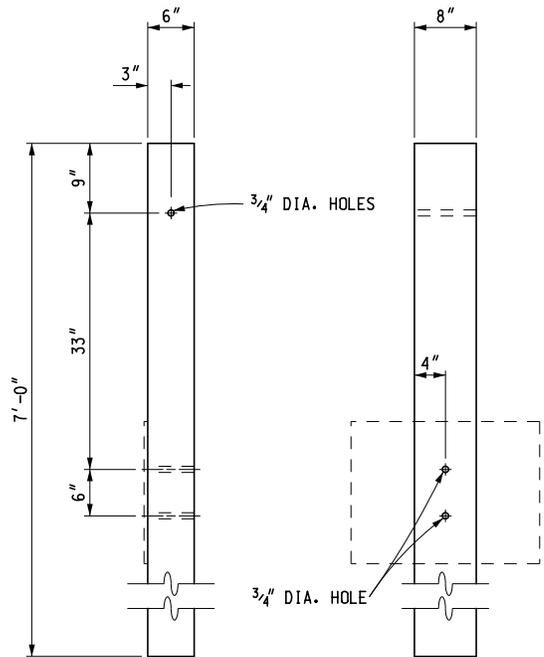
POST 2

WOOD POST DETAILS

GUARDRAIL ANCHORED IN BACKSLOPE TYPE 4T



POST 1

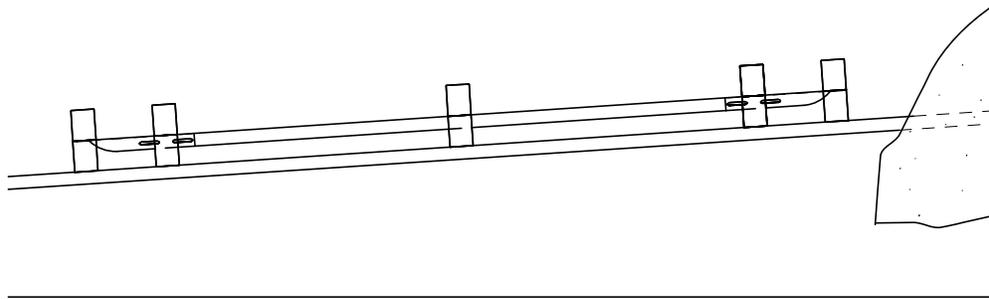


POST 2

WOOD POST DETAILS

GUARDRAIL ANCHORED IN BACKSLOPE TYPE 4B

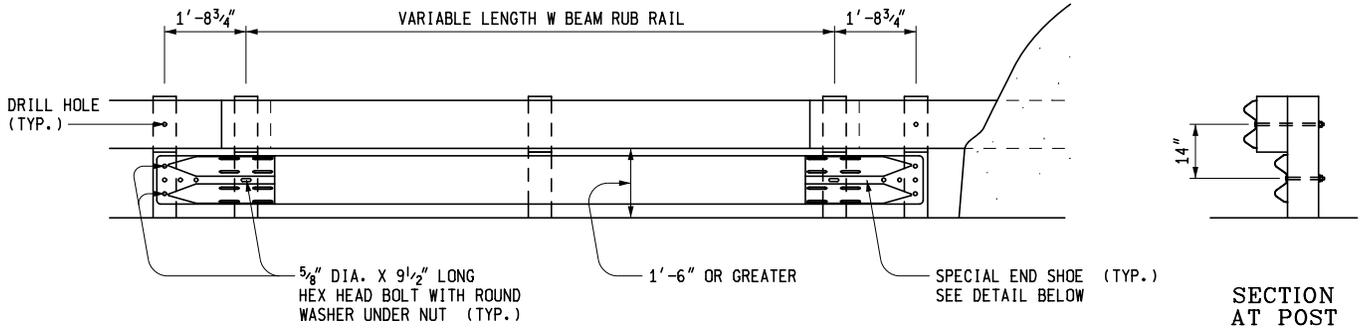
MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT SPECIAL DETAIL FOR GUARDRAIL ANCHORED IN BACKSLOPE TYPES 4B, 4T, & 4MGS-8			
F.H.W.A. APPROVAL	4-25-2016 PLAN DATE	SPECIAL DETAIL 24	SHEET 5 OF 8



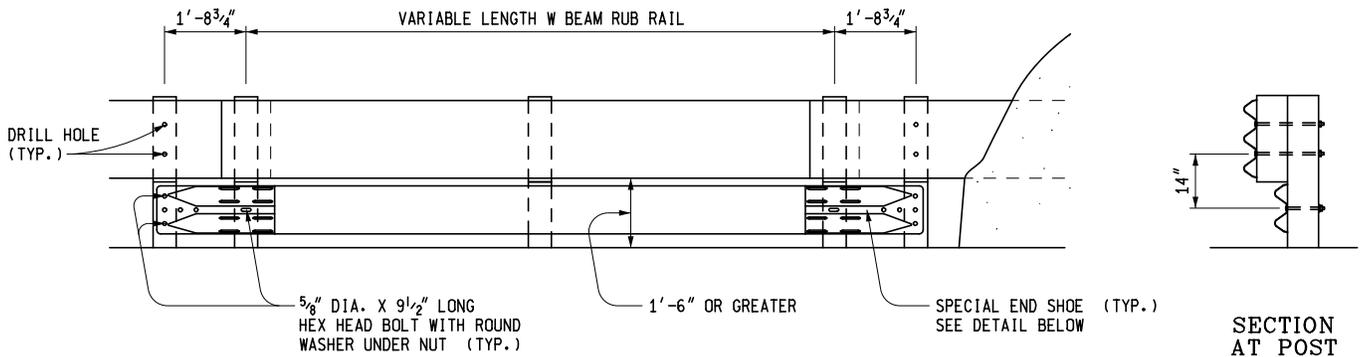
PLAN VIEW
WITH RUB RAIL

NOTE:

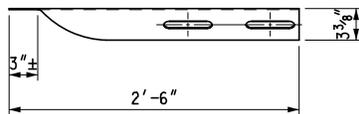
EXTRA POSTS, SPECIAL END SHOES, GUARDRAIL, HARDWARE AND ANY EXTRA WORK ARE INCLUDED IN THE BID ITEM GUARDRAIL ANCHORED IN BACKSLOPE TYPE 4B OR TYPE 4T.



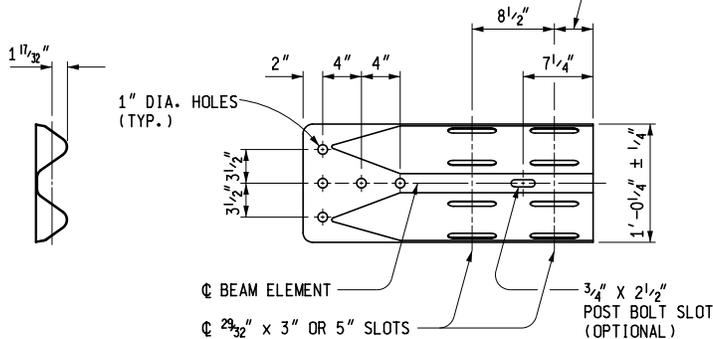
ELEVATION GUARDRAIL, TYPE 4B
WITH RUB RAIL



ELEVATION GUARDRAIL, TYPE 4T
WITH RUB RAIL



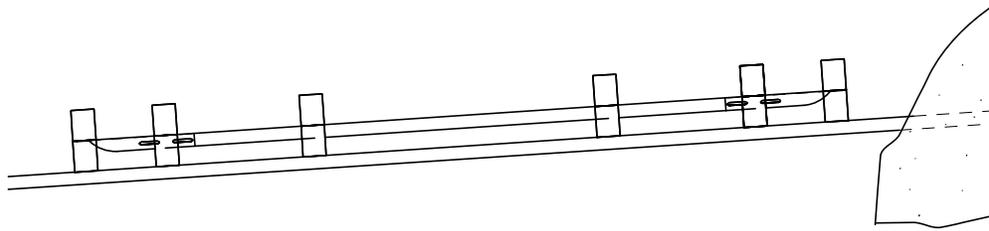
3" WHEN SLOT LENGTH IS 3"
4" WHEN SLOT LENGTH IS 5"



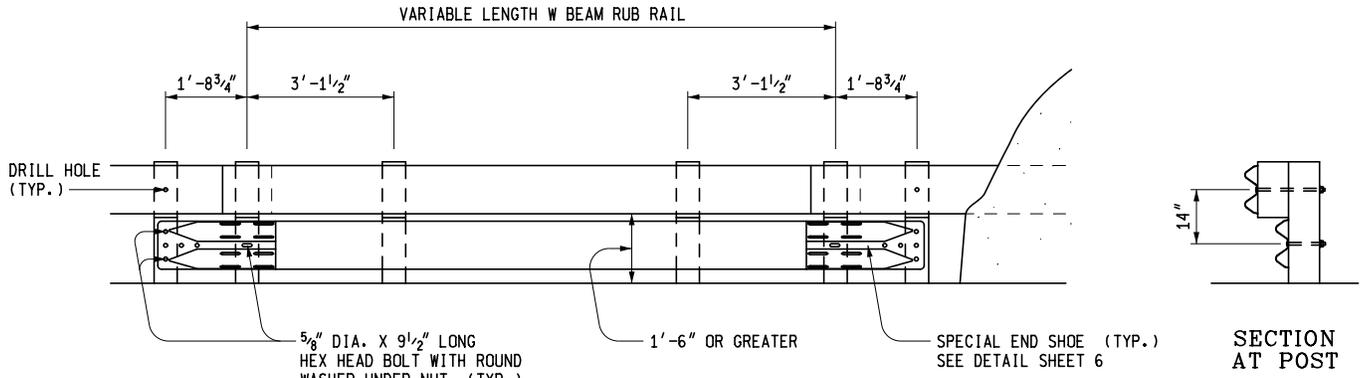
SPECIAL END SHOE
(3" OR 5" SLOT LENGTHS)

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF DEVELOPMENT SPECIAL DETAIL FOR
**GUARDRAIL ANCHORED IN
BACKSLOPE TYPES
4B, 4T, & 4MGS-8**

F.H.W.A. APPROVAL	4-25-2016 PLAN DATE	SPECIAL DETAIL 24	SHEET 6 OF 8
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PLAN VIEW GUARDRAIL, TYPE 4MGS-8
WITH RUB RAIL

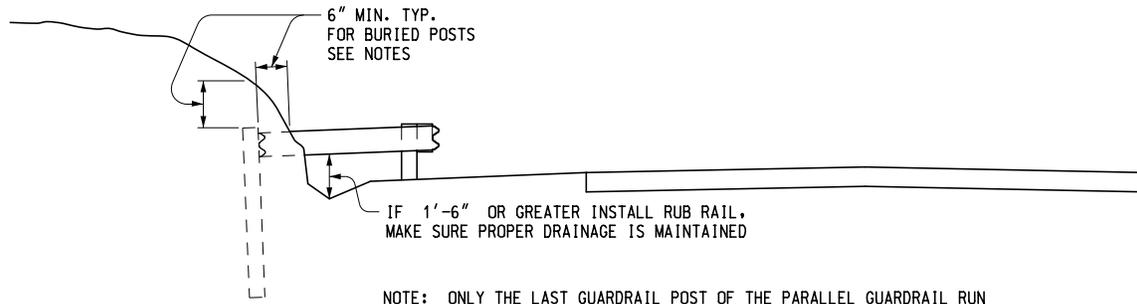


ELEVATION GUARDRAIL, TYPE 4MGS-8
WITH RUB RAIL

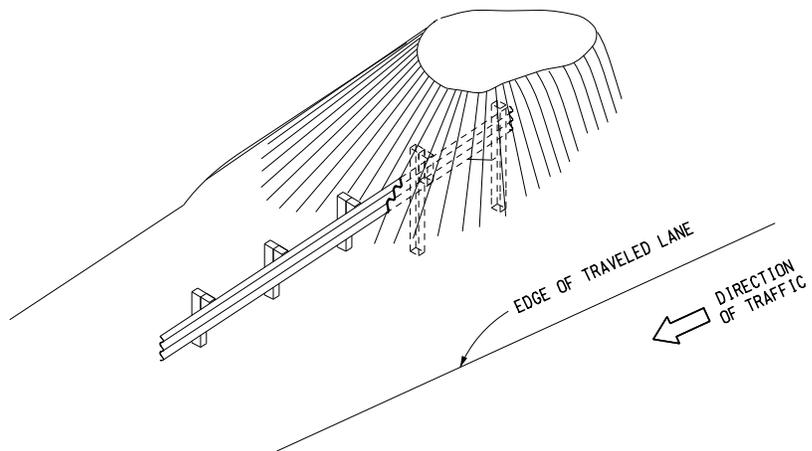
NOTE:

EXTRA POSTS, SPECIAL END SHOES, GUARDRAIL, HARDWARE AND ANY EXTRA WORK ARE INCLUDED IN THE BID ITEM GUARDRAIL ANCHORED IN BACKSLOPE TYPE 4MGS-8

MICHIGAN DEPARTMENT OF TRANSPORTATION			
BUREAU OF DEVELOPMENT SPECIAL DETAIL FOR			
GUARDRAIL ANCHORED IN BACKSLOPE TYPES 4B, 4T, & 4MGS-8			
	4-25-2016 PLAN DATE	SPECIAL DETAIL 24	SHEET 7 OF 8
F.H.W.A. APPROVAL			



NOTE: ONLY THE LAST GUARDRAIL POST OF THE PARALLEL GUARDRAIL RUN AND THE LAST BURIED GUARDRAIL POST ARE SHOWN.
(OTHER POSTS ALONG THE FLARED GUARDRAIL RUN ARE NOT SHOWN)



BURIED ENDING SKETCHES

NOTES:

ALL POSTS, OFFSET BLOCKS, BEAM ELEMENTS, AND HARDWARE (INCLUDING BOLTS, NUTS, AND WASHERS) SHALL CONFORM TO THE CURRENT STANDARD SPECIFICATIONS AND TO THE CURRENT STANDARD PLAN R-60-SERIES, WHERE APPLICABLE, EXCEPT AS SPECIFIED ON THIS PLAN.

ALL 1:10 SLOPES SHALL BE GRADED TO CLASS A SLOPE TOLERANCES.

AFTER THE CABLE ASSEMBLY HAS BEEN TIGHTENED, A SECOND NUT SHALL BE INSTALLED SO THAT THE CABLE WILL NOT LOOSEN.

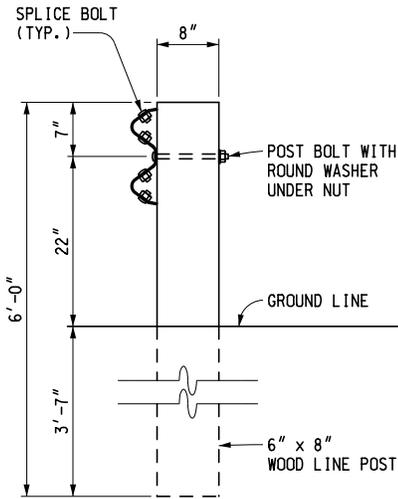
TWO HOT-DIP ZINC COATED NAILS SHALL BE DRIVEN INTO THE WOOD POST AT THE TOP OF THE BEARING PLATE TO KEEP THE BEARING PLATE FROM ROTATING.

WHEN ADDITIONAL POST BOLT SLOTS ARE REQUIRED, THEY SHALL BE DRILLED OR PUNCHED AND REGALVANIZED. BURNING WILL NOT BE ALLOWED.

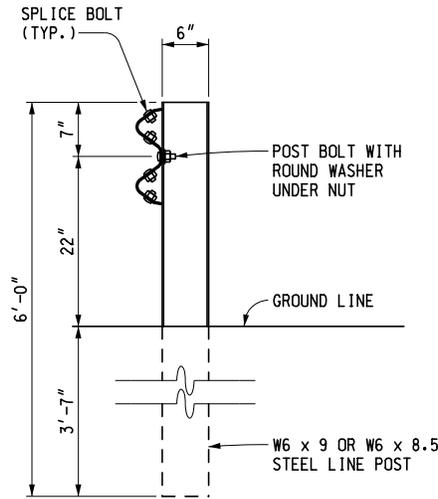
TERMINAL SHALL BE SET A MINIMUM 6" INTO THE BACKSLOPE AND HAVE 6" OF COVER ON ALL SIDES TO LESSEN THE POSSIBILITY IT WILL BE EXPOSED BY EROSION AND SNAG AN IMPACTING VEHICLE.

THE GUARDRAIL SHALL REMAIN AT A CONSTANT HEIGHT RELATIVE TO THE LOCAL GRADE. A W BEAM RUB RAIL WILL BE REQUIRED IF THE OPENING UNDER THE PRIMARY RAIL IS 1'-6" OR MORE. SEE DETAILS.

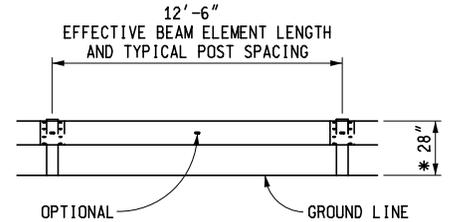
MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT SPECIAL DETAIL FOR GUARDRAIL ANCHORED IN BACKSLOPE TYPES 4B, 4T, & 4MGS-8			
_____ F.H.W.A. APPROVAL	4-25-2016 PLAN DATE	SPECIAL DETAIL 24	SHEET 8 OF 8



WOOD POST

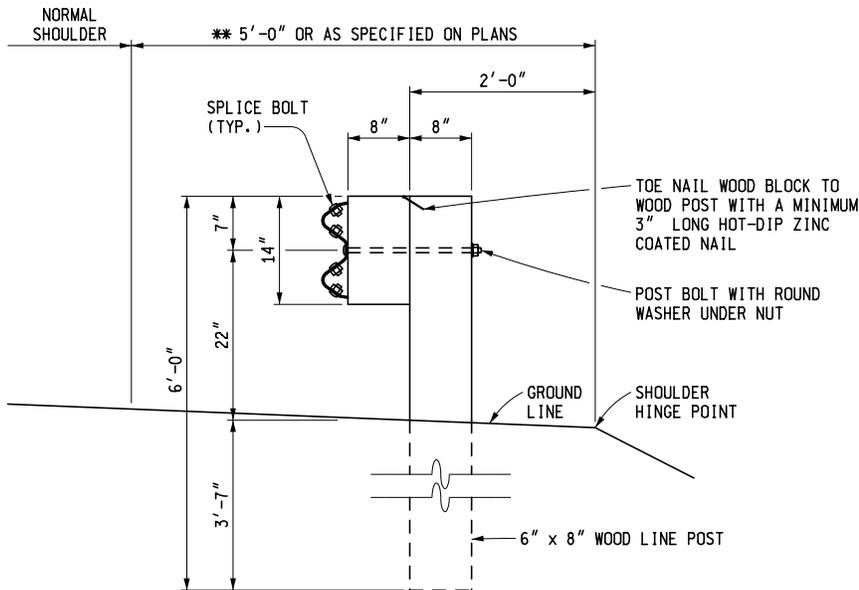


STEEL POST

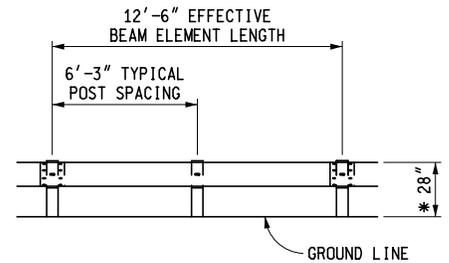


ELEVATION SHOWING POST SPACING
* SEE NOTES FOR GUARDRAIL IN CONJUNCTION WITH CURB

GUARDRAIL, TYPE A



** FOR PAVED SHOULDER WIDTHS OF AT LEAST 12', USE 3'-0".



ELEVATION SHOWING POST SPACING
* SEE NOTES FOR GUARDRAIL IN CONJUNCTION WITH CURB

GUARDRAIL, TYPE B
(WOOD POST)



PREPARED BY
DESIGN DIVISION

DRAWN BY: B.L.T.

CHECKED BY: W.K.P.

DEPARTMENT DIRECTOR
Kirk T. Stuedle

APPROVED BY: _____
DIRECTOR, BUREAU OF FIELD SERVICES

APPROVED BY: _____
DIRECTOR, BUREAU OF DEVELOPMENT

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF DEVELOPMENT STANDARD PLAN FOR

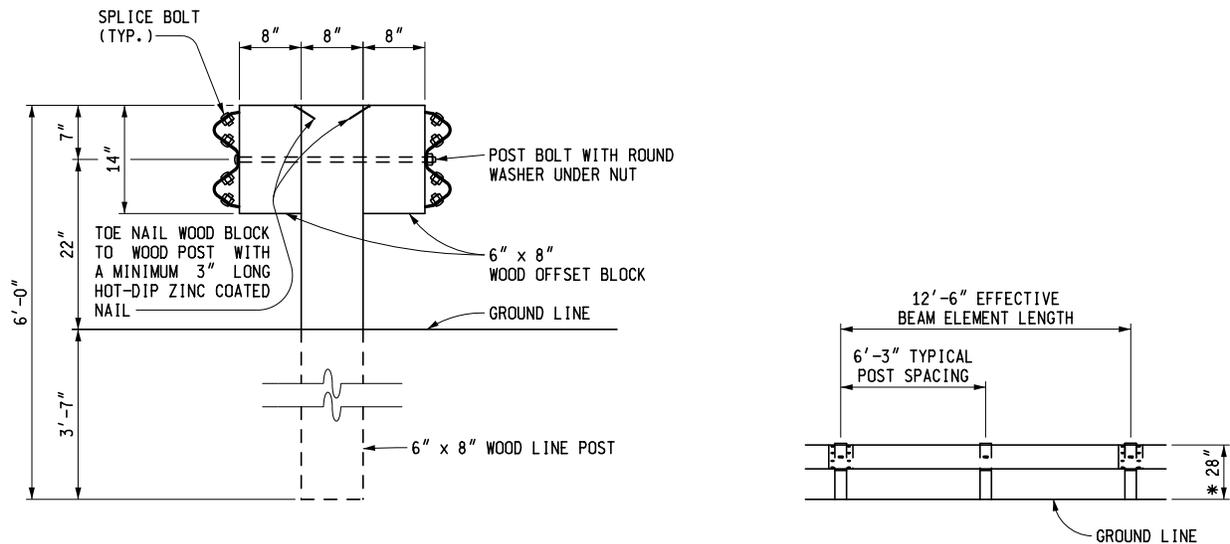
GUARDRAIL,
TYPES A, B, BD, T, TD,
MGS-8, & MGS-8D

F.H.W.A. APPROVAL

4-22-2016
PLAN DATE

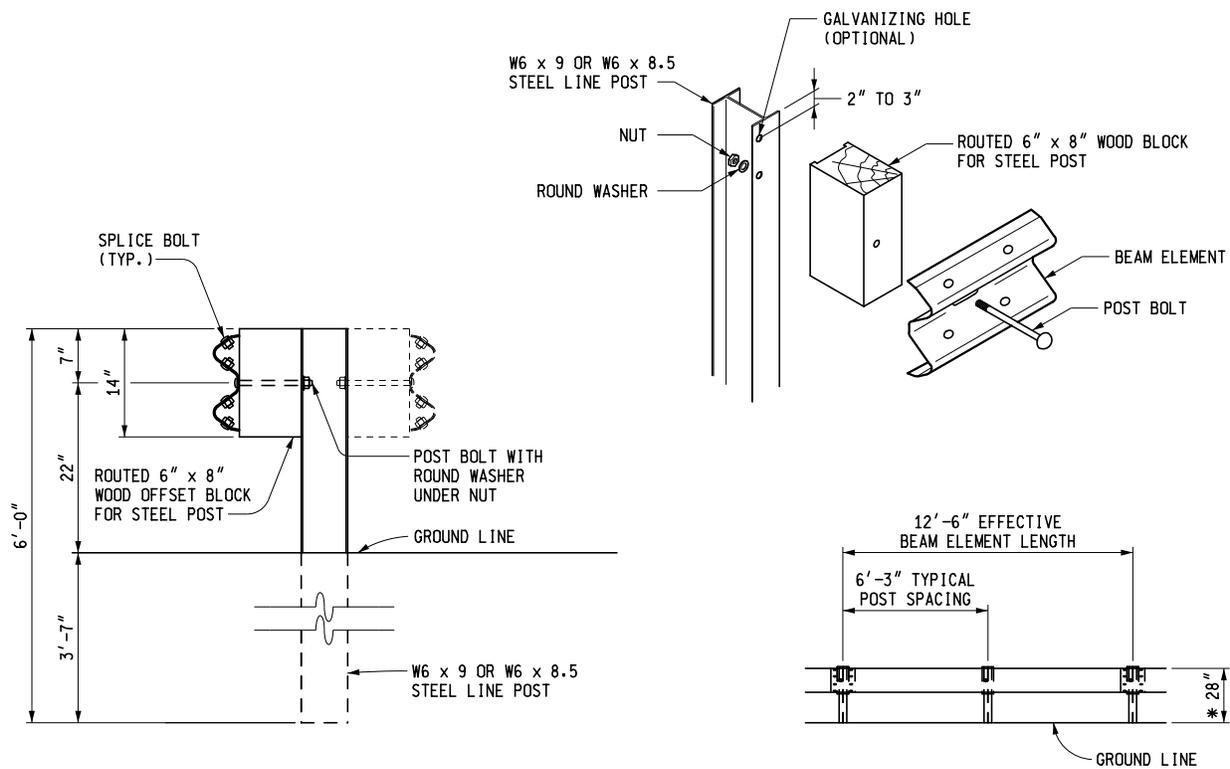
R-60-J

SHEET
1 OF 16



ELEVATION SHOWING POST SPACING
 * SEE NOTES FOR GUARDRAIL IN CONJUNCTION WITH CURB

GUARDRAIL, TYPE BD
 (WOOD POST)



ELEVATION SHOWING POST SPACING
 * SEE NOTES FOR GUARDRAIL IN CONJUNCTION WITH CURB

GUARDRAIL, TYPE B (OR BD)
 (STEEL POST)

MICHIGAN DEPARTMENT OF TRANSPORTATION
 BUREAU OF DEVELOPMENT STANDARD PLAN FOR

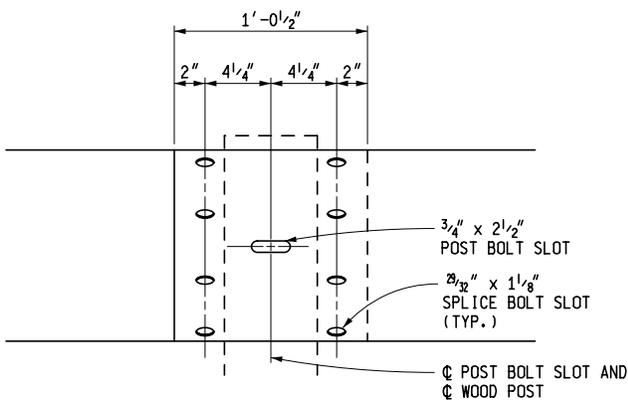
GUARDRAIL,
 TYPES A, B, BD, T, TD,
 MGS-8, & MGS-8D

F.H.W.A. APPROVAL

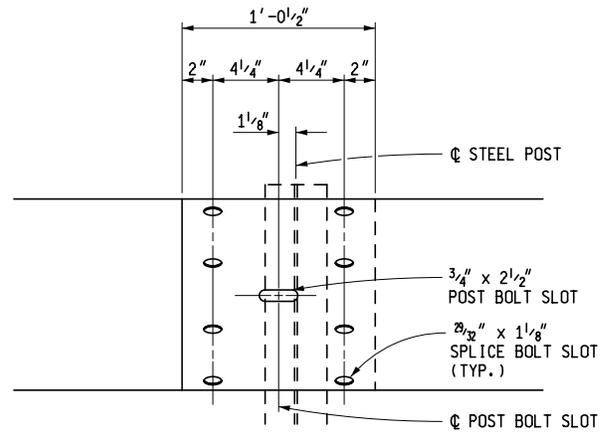
4-22-2016
 PLAN DATE

R-60-J

SHEET
 2 OF 16

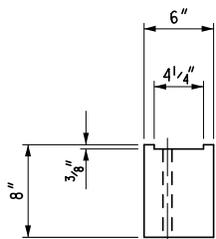


WOOD POST

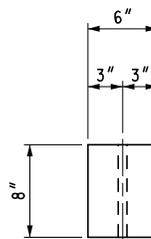


STEEL POST

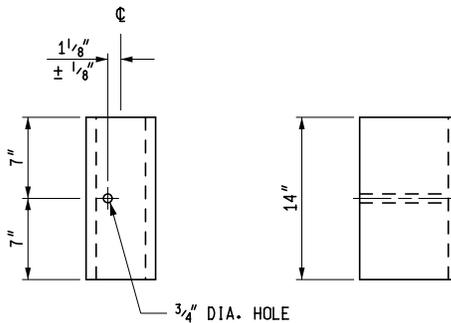
BEAM ELEMENT SPLICE DETAILS



TOP



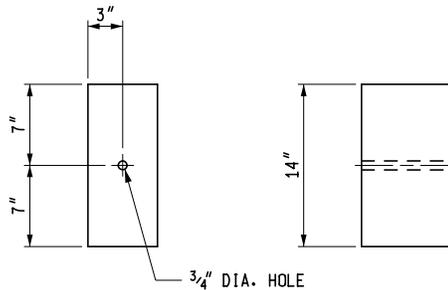
TOP



FRONT

SIDE

FOR USE ON STEEL POSTS



FRONT

SIDE

FOR USE ON WOOD POSTS

(SEE NOTES ON SHEET 16 OF 16)

WOOD OFFSET BLOCKS FOR GUARDRAIL, TYPE B AND TYPE BD

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF DEVELOPMENT STANDARD PLAN FOR

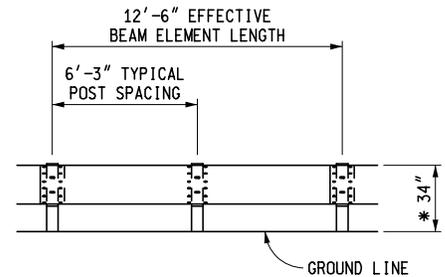
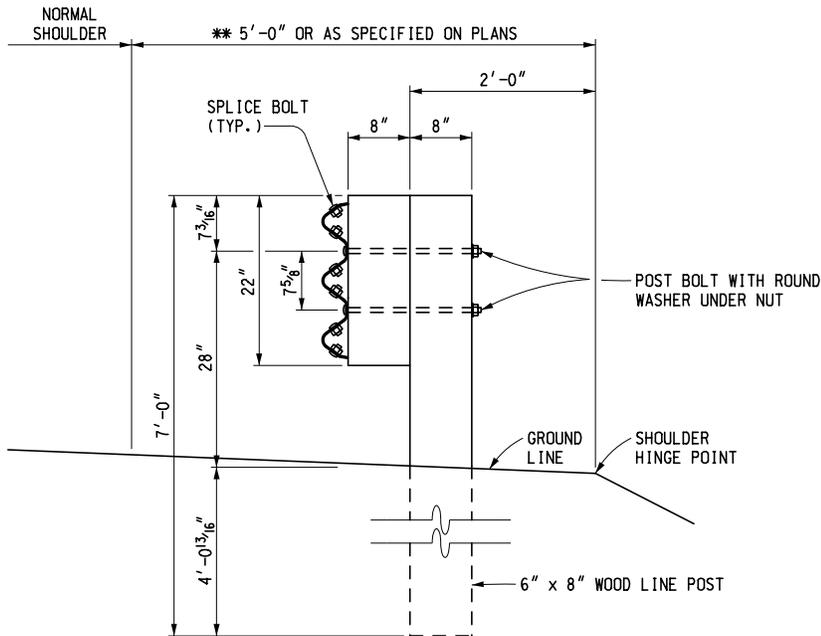
**GUARDRAIL,
TYPES A, B, BD, T, TD,
MGS-8, & MGS-8D**

F.H.W.A. APPROVAL

4-22-2016
PLAN DATE

R-60-J

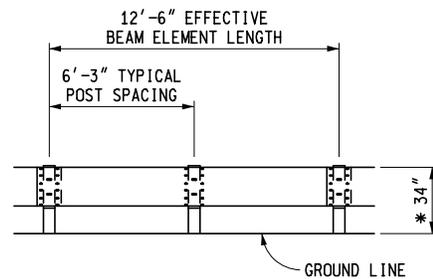
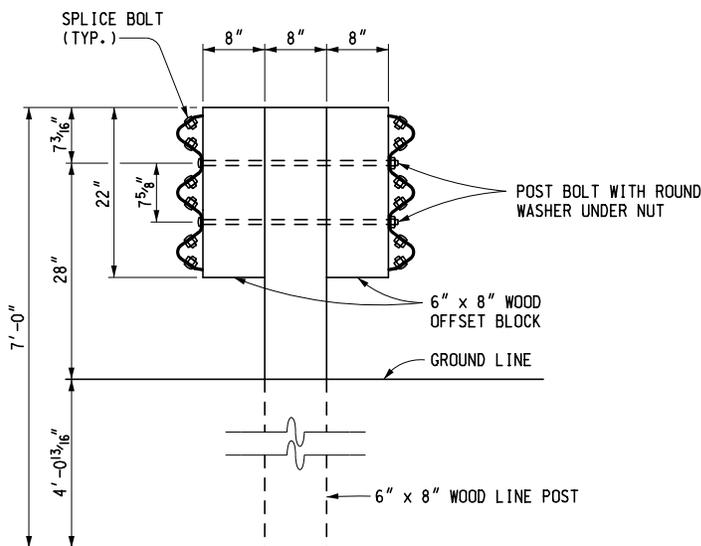
SHEET
3 OF 16



ELEVATION SHOWING POST SPACING
* SEE NOTES FOR GUARDRAIL IN CONJUNCTION WITH CURB

** FOR PAVED SHOULDER WIDTHS OF AT LEAST 12', USE 3'-0".

GUARDRAIL, TYPE T
(WOOD POST)



ELEVATION SHOWING POST SPACING
* SEE NOTES FOR GUARDRAIL IN CONJUNCTION WITH CURB

GUARDRAIL, TYPE TD
(WOOD POST)

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF DEVELOPMENT STANDARD PLAN FOR

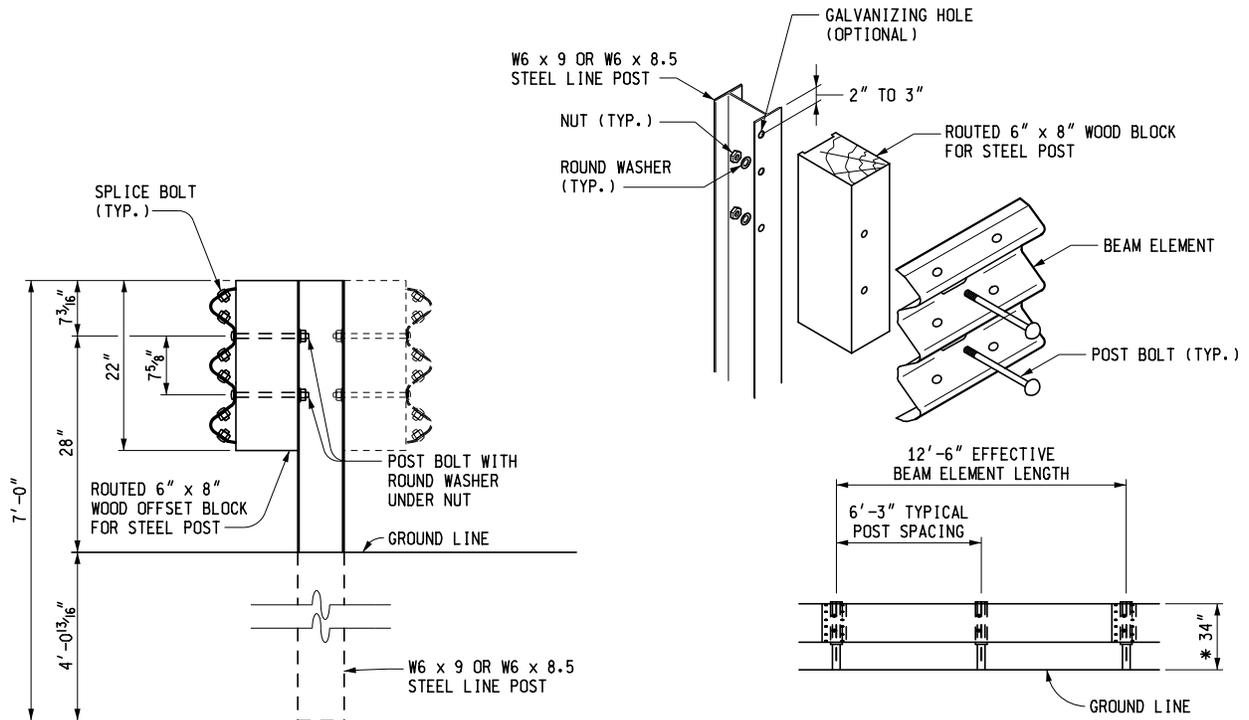
**GUARDRAIL,
TYPES A, B, BD, T, TD,
MGS-8, & MGS-8D**

F.H.W.A. APPROVAL

4-22-2016
PLAN DATE

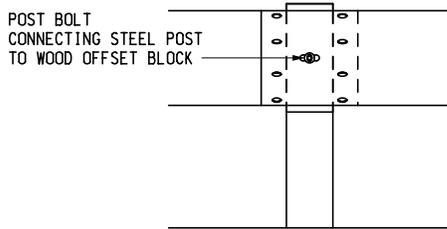
R-60-J

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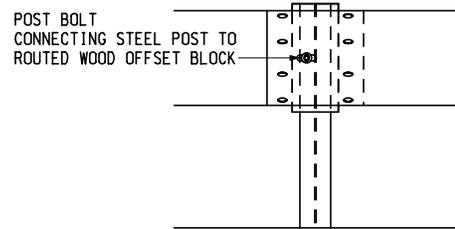


ELEVATION SHOWING POST SPACING
 * SEE NOTES FOR GUARDRAIL IN CONJUNCTION WITH CURB

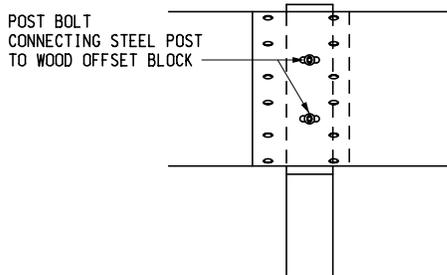
GUARDRAIL, TYPE T OR TD
 (STEEL POST)



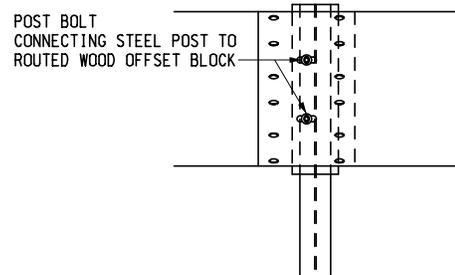
GUARDRAIL, TYPE B
 WOOD POST



GUARDRAIL, TYPE B
 STEEL POST



GUARDRAIL, TYPE T
 WOOD POST



GUARDRAIL, TYPE T
 STEEL POST

BLOCK AND POST CONNECTION DETAILS

MICHIGAN DEPARTMENT OF TRANSPORTATION
 BUREAU OF DEVELOPMENT STANDARD PLAN FOR

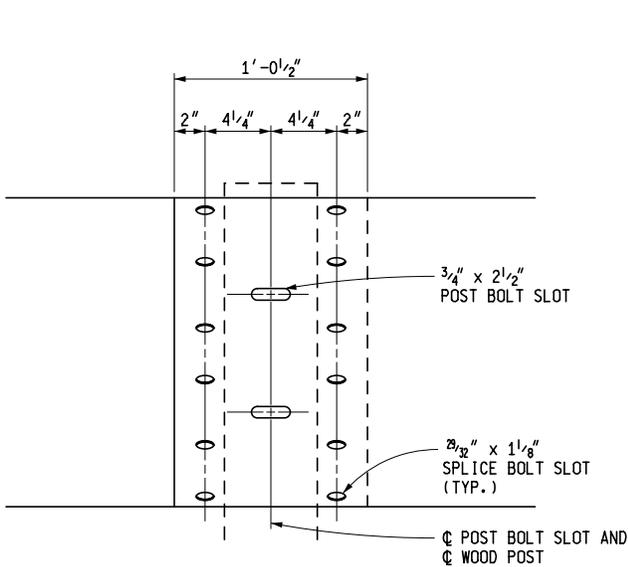
GUARDRAIL,
 TYPES A, B, BD, T, TD,
 MGS-8, & MGS-8D

F.H.W.A. APPROVAL

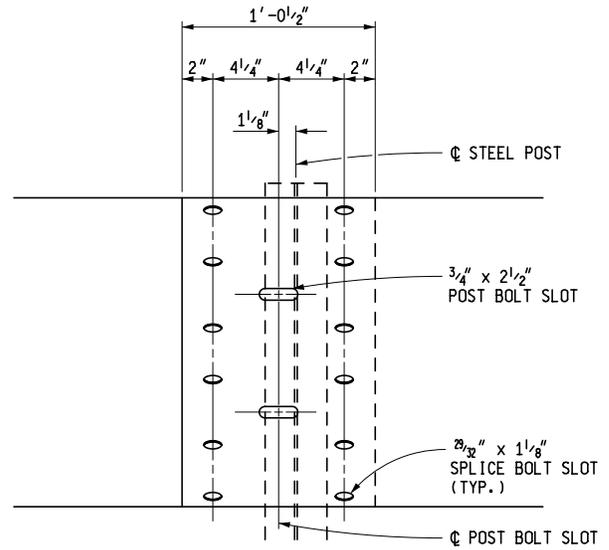
4-22-2016
 PLAN DATE

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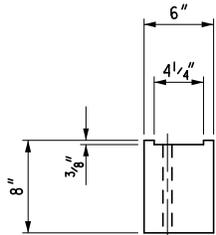


WOOD POST

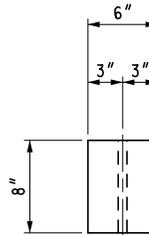


STEEL POST

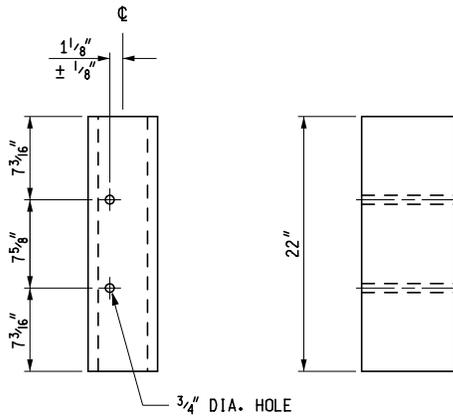
THREE BEAM ELEMENT SPLICE DETAILS



TOP



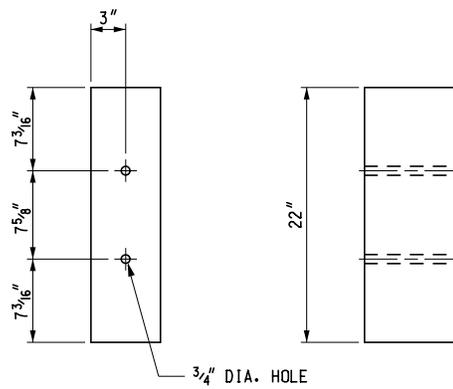
TOP



FRONT

SIDE

FOR USE ON STEEL POSTS



FRONT

SIDE

FOR USE ON WOOD POSTS

(SEE NOTES ON SHEET 16 OF 16)

WOOD OFFSET BLOCKS FOR GUARDRAIL, TYPE T AND TYPE TD

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF DEVELOPMENT STANDARD PLAN FOR

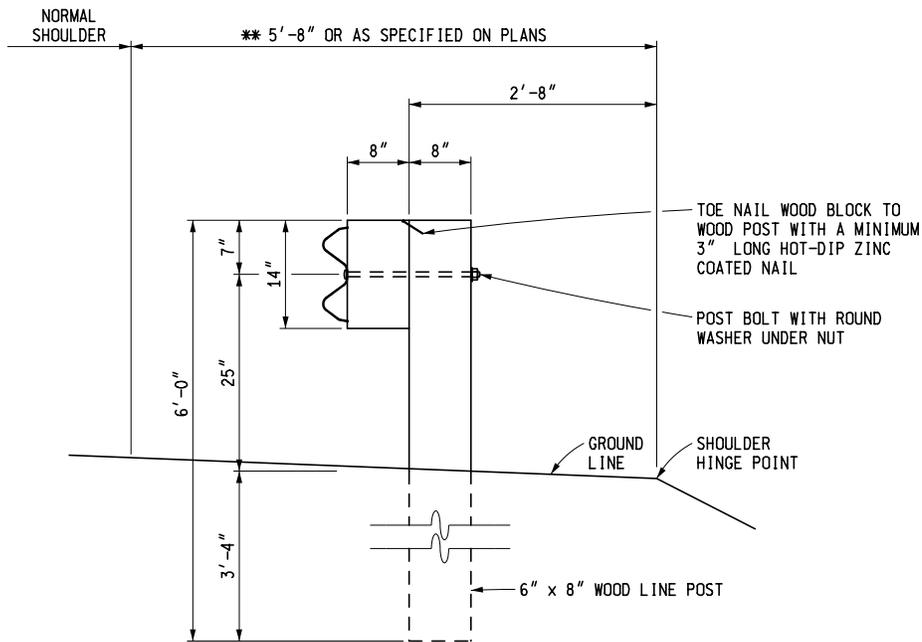
**GUARDRAIL,
TYPES A, B, BD, T, TD,
MGS-8, & MGS-8D**

F.H.W.A. APPROVAL

4-22-2016
PLAN DATE

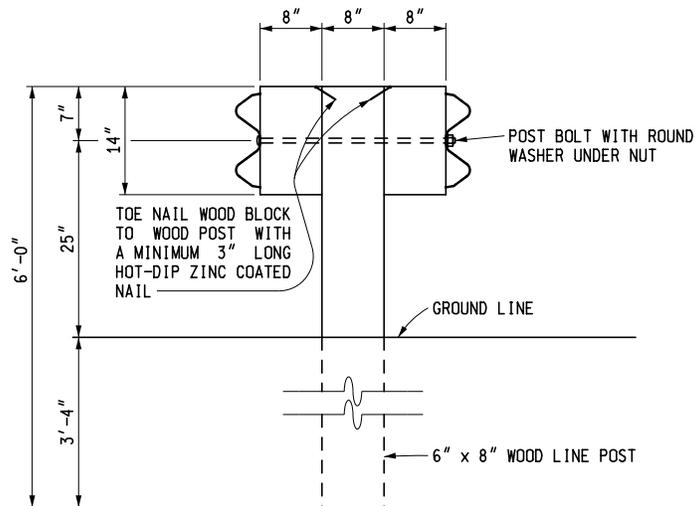
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** FOR PAVED SHOULDER WIDTHS OF AT LEAST 12', USE 3'-8".

GUARDRAIL, TYPE MGS-8
(WOOD POST)



** FOR PAVED SHOULDER WIDTHS OF AT LEAST 12', USE 3'-0".

GUARDRAIL, TYPE MGS-8D
(WOOD POST)

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF DEVELOPMENT STANDARD PLAN FOR

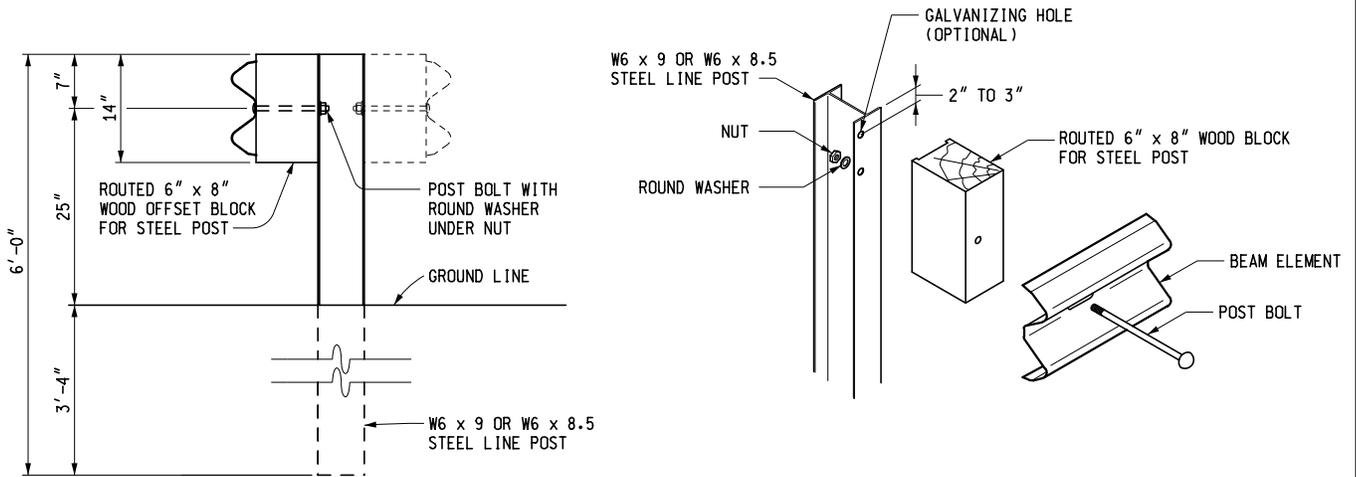
GUARDRAIL,
TYPES A, B, BD, T, TD,
MGS-8, & MGS-8D

F.H.W.A. APPROVAL

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PLAN DATE

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GUARDRAIL, TYPE MGS-8 (OR MGS-8D)
(STEEL POST)

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF DEVELOPMENT STANDARD PLAN FOR

**GUARDRAIL,
TYPES A, B, BD, T, TD,
MGS-8, & MGS-8D**

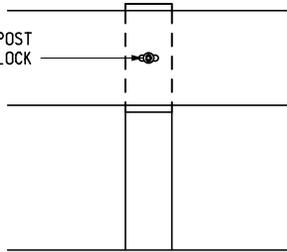
F.H.W.A. APPROVAL

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PLAN DATE

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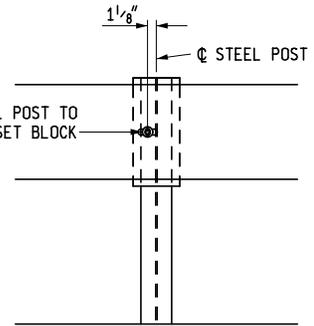
SHEET
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POST BOLT
CONNECTING WOOD POST
TO WOOD OFFSET BLOCK



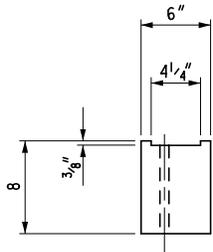
WOOD POST

POST BOLT
CONNECTING STEEL POST TO
ROUTED WOOD OFFSET BLOCK

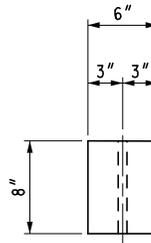


STEEL POST

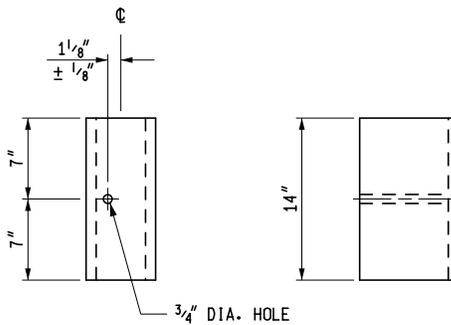
BLOCK AND POST CONNECTION DETAILS



TOP



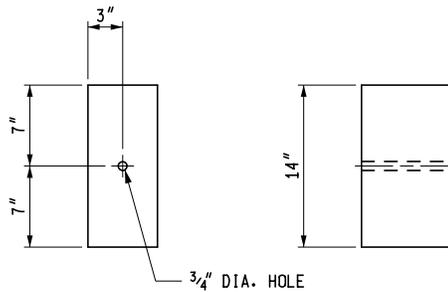
TOP



FRONT

SIDE

FOR USE ON STEEL POSTS



FRONT

SIDE

FOR USE ON WOOD POSTS

(SEE NOTES ON SHEET 16 OF 16)

WOOD OFFSET BLOCKS FOR GUARDRAIL, TYPE MGS-8 AND TYPE MGS-8D

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF DEVELOPMENT STANDARD PLAN FOR

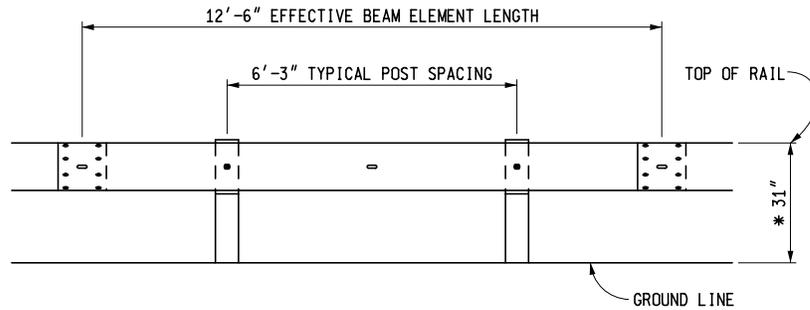
**GUARDRAIL,
TYPES A, B, BD, T, TD,
MGS-8, & MGS-8D**

F.H.W.A. APPROVAL

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PLAN DATE

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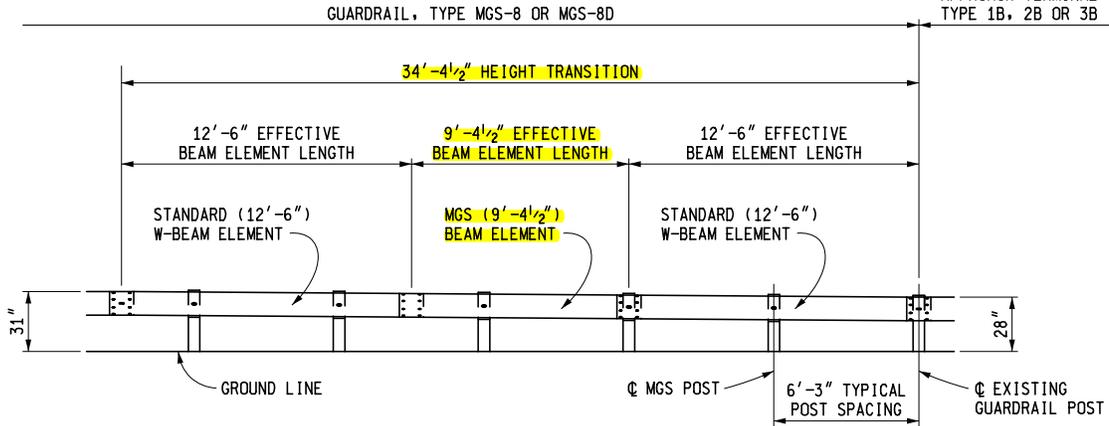
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ELEVATION SHOWING POST SPACING FOR GUARDRAIL, TYPE MGS-8 OR MGS-8D

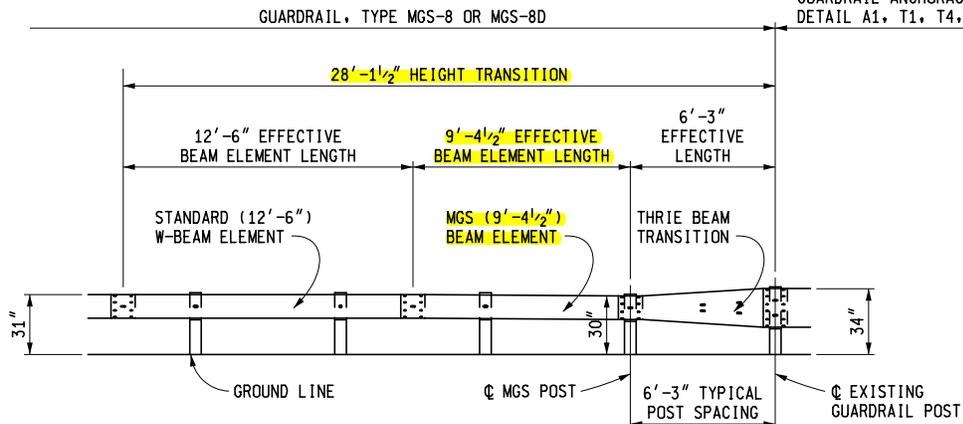
* SEE NOTES FOR GUARDRAIL IN CONJUNCTION WITH CURB

GUARDRAIL, TYPE B
GUARDRAIL, TYPE BD
OR GUARDRAIL
APPROACH TERMINAL
TYPE 1B, 2B OR 3B



ELEVATION SHOWING POST SPACING CONNECTING GUARDRAIL, TYPE MGS-8 OR MGS-8D TO GUARDRAIL, TYPE B, GUARDRAIL, TYPE BD, OR GUARDRAIL APPROACH TERMINAL TYPE 1B, 2B, OR 3B

GUARDRAIL, TYPE T
GUARDRAIL, TYPE TD
GUARDRAIL ANCHORAGE, MEDIAN
GUARDRAIL ANCHORAGE, BRIDGE
DETAIL A1, T1, T4, OR T6



ELEVATION SHOWING POST SPACING CONNECTING GUARDRAIL, TYPE MGS-8 OR MGS-8D TO GUARDRAIL, TYPE T, GUARDRAIL, TYPE TD, GUARDRAIL ANCHORAGE, MEDIAN, GUARDRAIL ANCHORAGE, BRIDGE DETAIL A1, T1, T4 OR T6

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF DEVELOPMENT STANDARD PLAN FOR

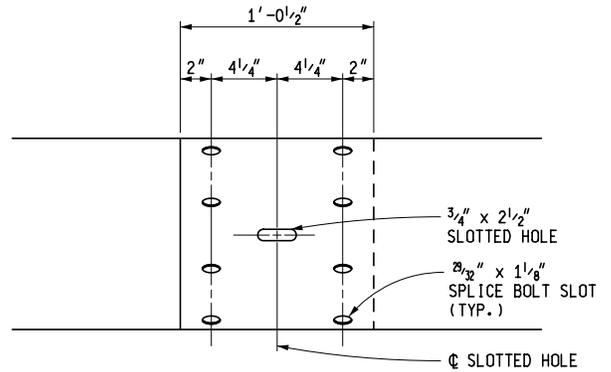
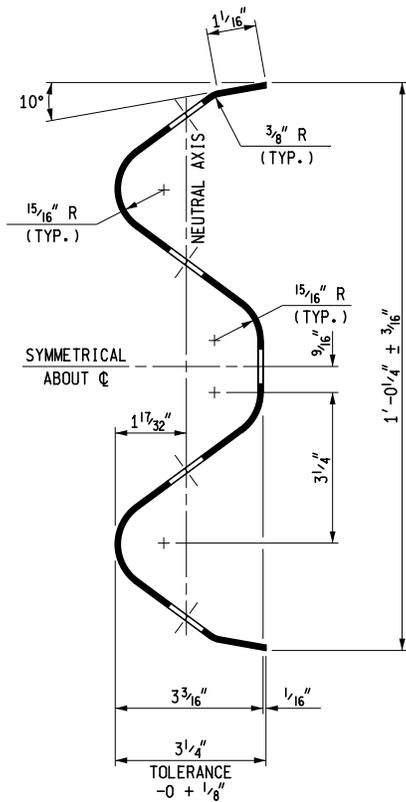
**GUARDRAIL,
TYPES A, B, BD, T, TD,
MGS-8, & MGS-8D**

F.H.W.A. APPROVAL

4-22-2016
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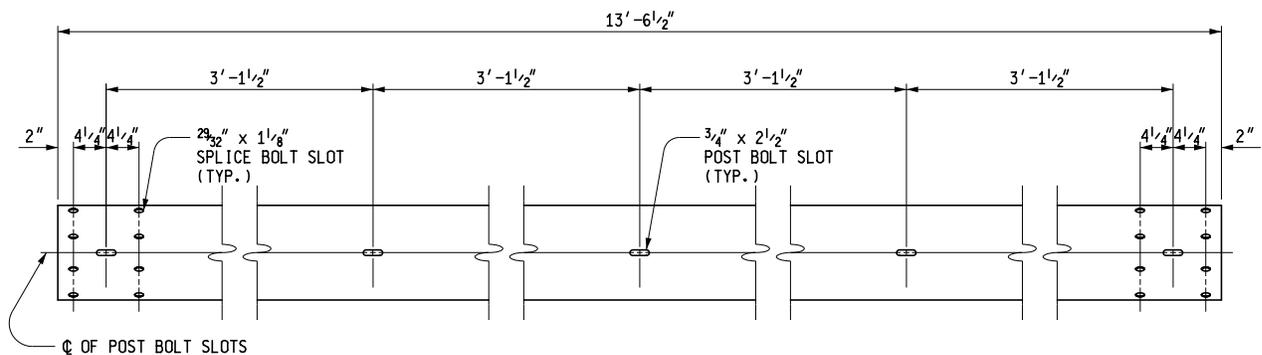
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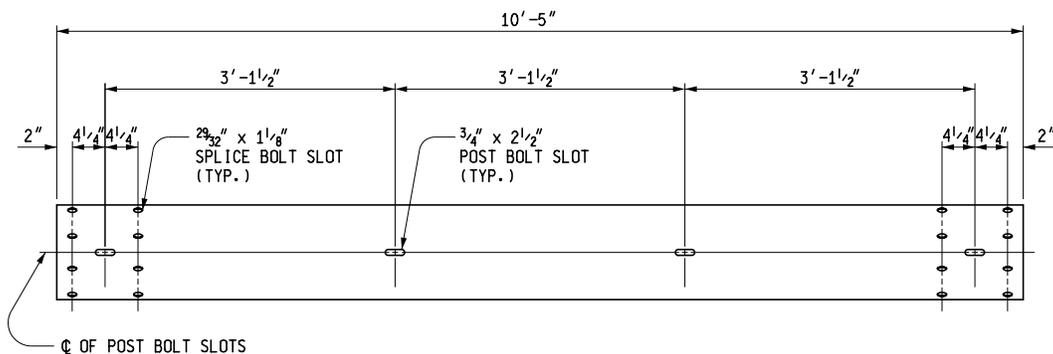


BEAM ELEMENT SPLICE DETAILS

SECTION THROUGH BEAM ELEMENT



FRONT ELEVATION OF BEAM ELEMENT



FRONT ELEVATION OF MGS (9'-4 1/2") BEAM ELEMENT

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF DEVELOPMENT STANDARD PLAN FOR

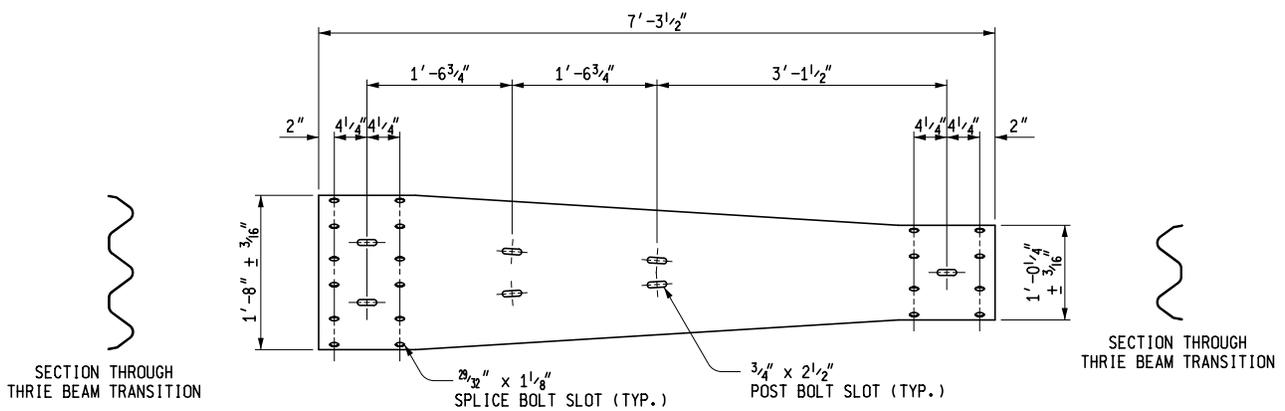
**GUARDRAIL,
TYPES A, B, BD, T, TD,
MGS-8, & MGS-8D**

F.H.W.A. APPROVAL

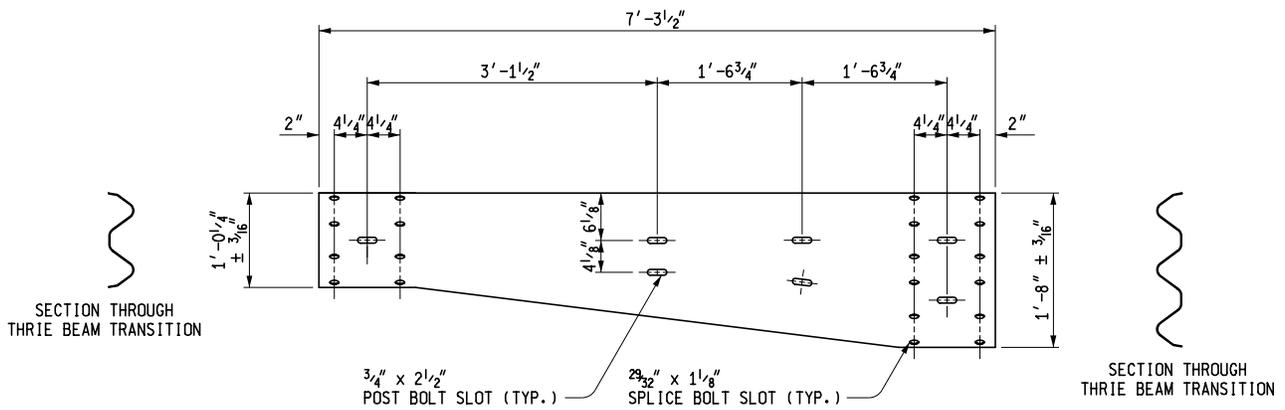
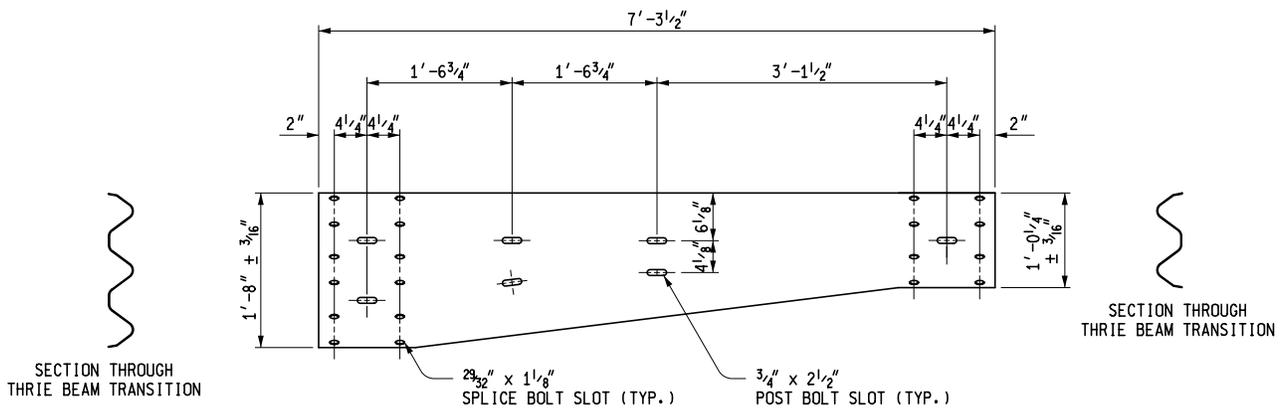
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THRIE BEAM TRANSITION



ASYMMETRICAL THRIE BEAM TRANSITIONS

NOTE: ASYMMETRICAL TRANSITION TYPE WILL VARY BY LOCATION DEPENDING ON GUARDRAIL LAYOUT

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF DEVELOPMENT STANDARD PLAN FOR

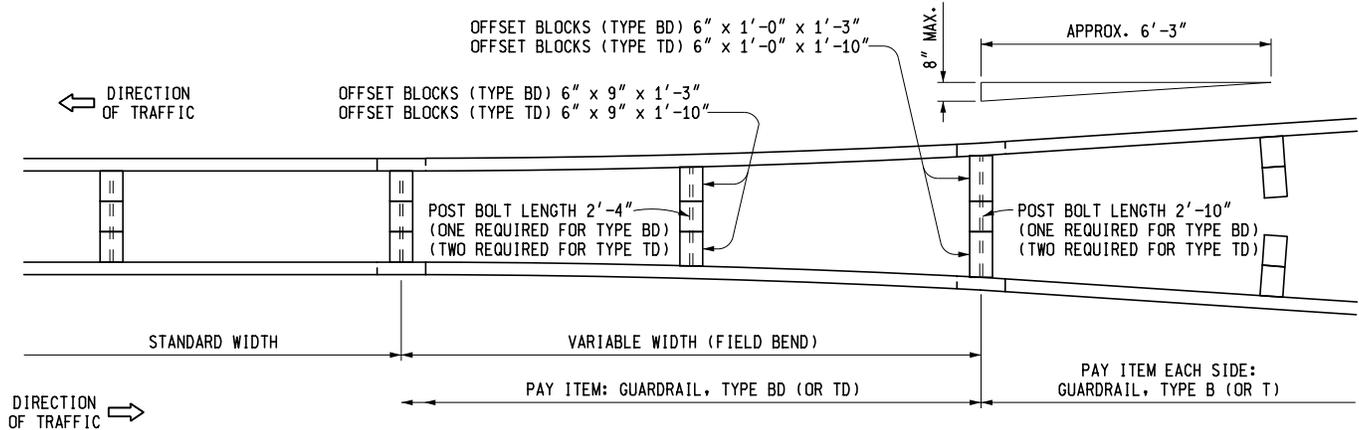
GUARDRAIL,
TYPES A, B, BD, T, TD,
MGS-8, & MGS-8D

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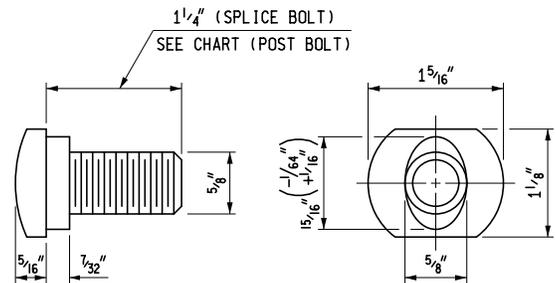
**DETAIL SHOWING TRANSITION FROM GUARDRAIL, TYPE B (OR TYPE T)
TO GUARDRAIL, TYPE BD (OR TYPE TD)**

POST BOLTS, SPLICE BOLTS AND WASHERS AT BEAM ELEMENT SPLICE POSTS AND AT INTERMEDIATE POSTS								
GUARDRAIL TYPE	POST	OFFSET BLOCK	POST BOLTS		SPLICE BOLTS (1 1/4" LONG) (NO. REQ'D)	WASHERS (ROUND) (NO. REQ'D)		
			NO. REQ'D	LENGTH				
A	WOOD	N/A	1	9 1/2"	8	1		
	STEEL	N/A	1	2"		1		
B	WOOD	WOOD	1	18"		8	1	
	STEEL	WOOD	1	9 1/2"			1	
BD	WOOD	WOOD	1	*26 1/2"			16	2
	STEEL	WOOD	2	9 1/2"				2
T	WOOD	WOOD	2	18"	12			2
	STEEL	WOOD	2	9 1/2"				2
TD	WOOD	WOOD	2	*26 1/2"		24		4
	STEEL	WOOD	4	9 1/2"				4

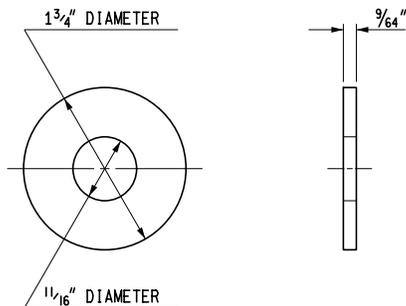
MINIMUM POST BOLT THREAD LENGTH	
BOLT LENGTH	MINIMUM THREAD LENGTH
9 1/2"	1 3/4"
18"	2 1/2"
26 1/2"	3"

THREE BEAM TRANSITIONS REQUIRE 20 SPLICE BOLTS EACH (12 ON TYPE T END AND 8 ON TYPE B END).

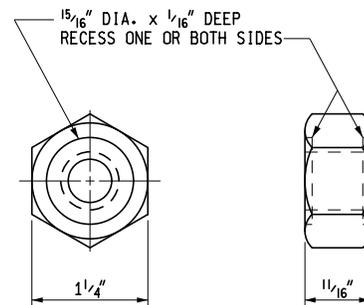
* EXCEPT AS SPECIFIED ON DETAIL SHOWING TRANSITION FROM GUARDRAIL, TYPE B (OR TYPE T) TO GUARDRAIL, TYPE BD (OR TYPE TD). POST BOLTS SHALL NOT EXTEND MORE THAN 1/2" BEYOND NUT.



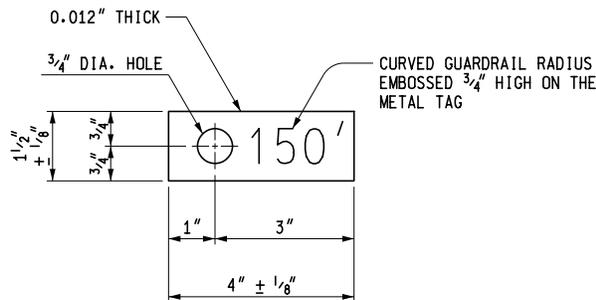
SPLICE BOLT AND POST BOLT



ROUND WASHER



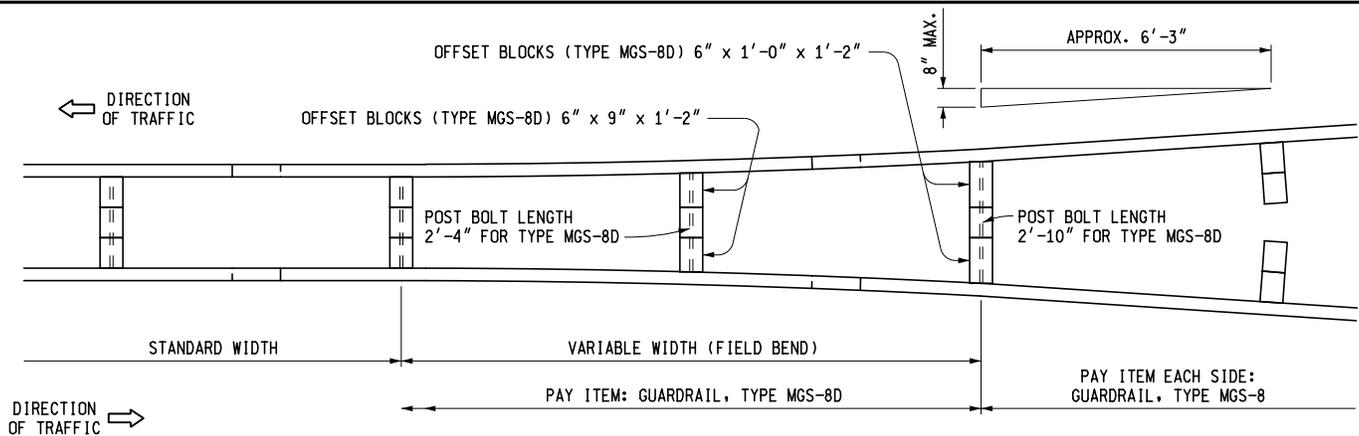
NUT



METAL TAG

FOR CURVED GUARDRAIL WITH RADIUS OF 150' OR LESS

MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT STANDARD PLAN FOR		
GUARDRAIL, TYPES A, B, BD, T, TD, MGS-8, & MGS-8D		
F.H.W.A. APPROVAL	4-22-2016 PLAN DATE	R-60-J
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**DETAIL SHOWING TRANSITION FROM
GUARDRAIL, TYPE MGS-8 TO GUARDRAIL, TYPE MGS-8D**

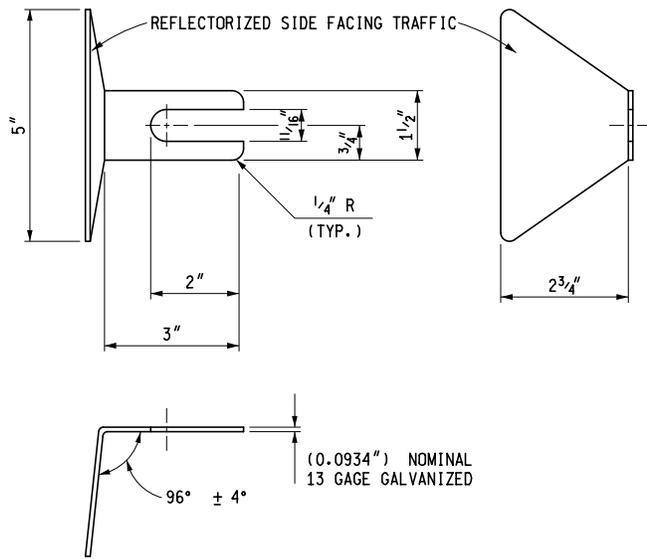
POST BOLTS, SPLICE BOLTS AND WASHERS AT BEAM ELEMENT SPLICE POSTS AND AT INTERMEDIATE POSTS						
GUARDRAIL TYPE	POST	OFFSET BLOCK	POST BOLTS		SPLICE BOLTS (1 1/4" LONG) (NO. REQ'D)	WASHERS (ROUND) (NO. REQ'D)
			NO. REQ'D	LENGTH		
MGS-8	WOOD	WOOD	1	18"	8	1
	STEEL	WOOD	1	9 1/2"		1
MGS-8D	WOOD	WOOD	1	*26 1/2"	16	—
	STEEL	WOOD	2	9 1/2"		2

MINIMUM POST BOLT THREAD LENGTH	
BOLT LENGTH	MINIMUM THREAD LENGTH
9 1/2"	1 3/4"
18"	2 1/2"
26 1/2"	3"

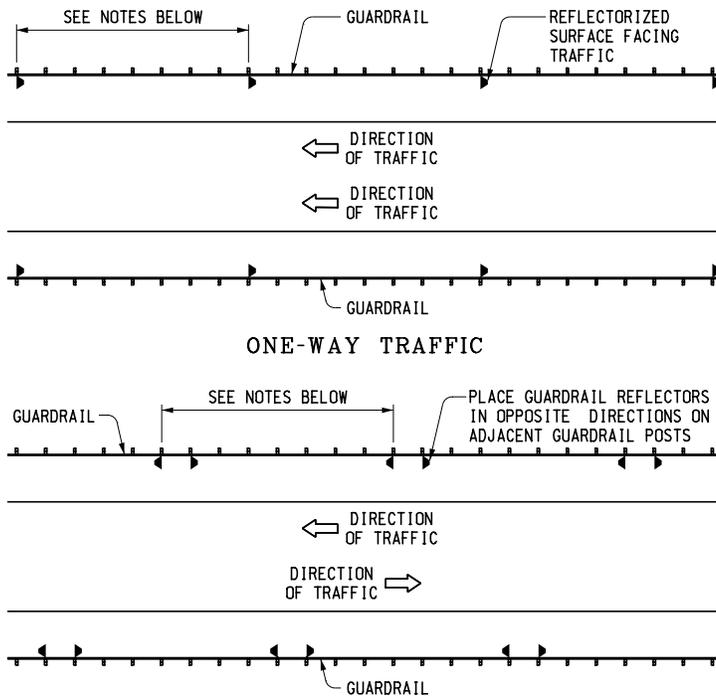
THREE BEAM TRANSITIONS REQUIRE 20 SPLICE BOLTS EACH (12 ON TYPE T END AND 8 ON TYPE MGS END).

* EXCEPT AS SPECIFIED ON DETAIL SHOWING TRANSITION FROM GUARDRAIL, TYPE MGS-8 TO GUARDRAIL, TYPE MGS-8D POST BOLTS SHALL NOT EXTEND MORE THAN 1/2" BEYOND NUT.

MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT STANDARD PLAN FOR GUARDRAIL, TYPES A, B, BD, T, TD, MGS-8, & MGS-8D		
_____ F.H.W.A. APPROVAL	4-22-2016 _____ PLAN DATE	R-60-J
SHEET 15 OF 16		



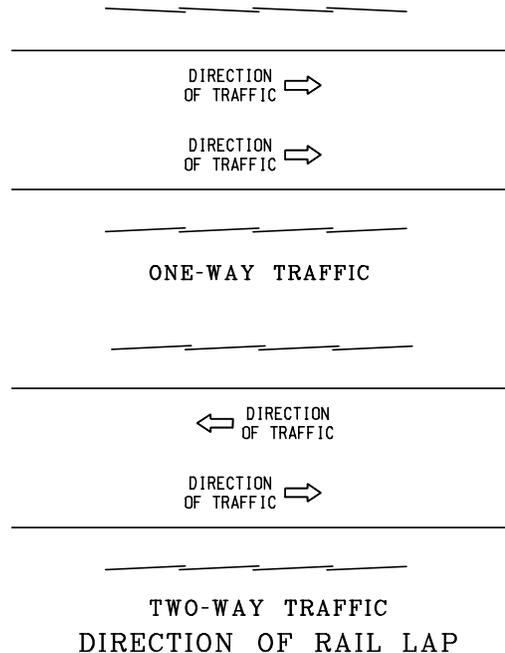
GUARDRAIL REFLECTOR



PLACEMENT OF GUARDRAIL REFLECTORS

NOTES GOVERNING THE USE OF GUARDRAIL REFLECTORS

1. GUARDRAIL REFLECTORS SHALL BE USED ON ALL STANDARD GUARDRAIL RUNS, REGARDLESS OF ROADWAY LIGHTING.
2. GUARDRAIL REFLECTORS ARE TO BE SPACED AT THE FOLLOWING INTERVALS:
 - a) 50'-0" ON TANGENT SECTIONS AND CURVES WITH A RADIUS OF 1150' OR MORE.
 - b) 25'-0" ON CURVES WITH A RADIUS LESS THAN 1150'.
3. FOR GUARDRAIL REFLECTOR PLACEMENT ON APPROACH TERMINALS, SEE THE APPROPRIATE GUARDRAIL APPROACH TERMINAL STANDARD PLAN.
4. A GUARDRAIL REFLECTOR IS TO BE PLACED ON THE SECOND POST FROM THE GUARDRAIL DEPARTING TERMINAL.
5. ON GUARDRAIL, TYPE T AND TYPE TD GUARDRAIL REFLECTORS ARE TO BE PLACED ON THE UPPER POST BOLT.
6. GUARDRAIL REFLECTORS SHALL MATCH COLOR OF EDGE LINE.



NOTES:

DETAILS SPECIFIED ON THIS STANDARD ARE ACCORDING TO THE AASHTO-AGC-ARTBA JOINT COMMITTEE, TASK FORCE 13 PUBLICATION TITLED "A GUIDE TO STANDARDIZED HIGHWAY BARRIER HARDWARE."

BEAM ELEMENTS SHALL BE SHOP BENT TO PLAN RADIUS FOR CURVE RADII 150' OR LESS. A TAG IDENTIFYING THE CURVATURE OF THE SHOP BENT SECTION WILL BE REQUIRED FOR EACH CURVED ELEMENT.

SEE STANDARD PLAN R-61-SERIES, R-62-SERIES OR R-63-SERIES FOR GUARDRAIL APPROACH TERMINALS, STANDARD PLAN R-66-SERIES FOR GUARDRAIL DEPARTING TERMINALS AND STANDARD PLAN R-67-SERIES FOR GUARDRAIL ANCHORAGE, BRIDGE.

WHEN THE PLANS SPECIFY GUARDRAIL (TYPE B OR T) TO BE PLACED ON THE SHOULDER HINGE POINT, RATHER THAN AS SPECIFIED ON THIS PLAN, 8'-0" POSTS SHALL BE PROVIDED, WITH THE ADDITIONAL LENGTH EMBEDDED FOR ADDED STABILITY. (NOT NECESSARY WHEN THE SLOPE IS REASONABLY LEVEL BEYOND THE SHOULDER HINGE POINT, AS DETERMINED BY THE ENGINEER.)

WHEN THE PLANS SPECIFY GUARDRAIL TYPE MGS-8 TO BE PLACED ON THE SHOULDER HINGE POINT, RATHER THAN AS SPECIFIED ON THIS PLAN, 9'-0" POSTS SHALL BE PROVIDED, WITH THE ADDITIONAL LENGTH EMBEDDED FOR ADDED STABILITY. (NOT NECESSARY WHEN THE SLOPE IS REASONABLY LEVEL BEYOND THE SHOULDER HINGE POINT, AS DETERMINED BY THE ENGINEER.)

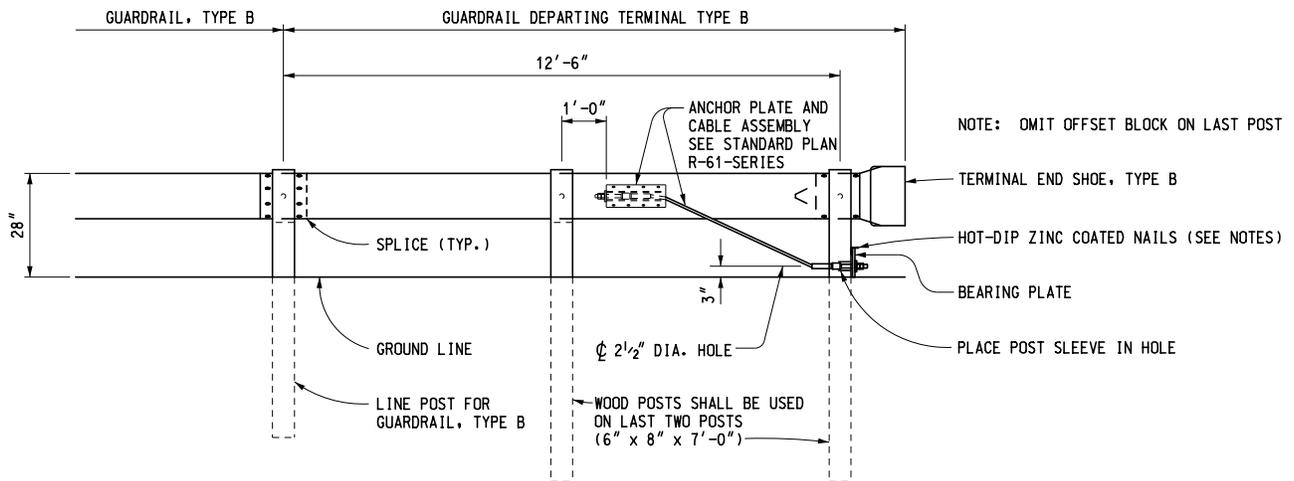
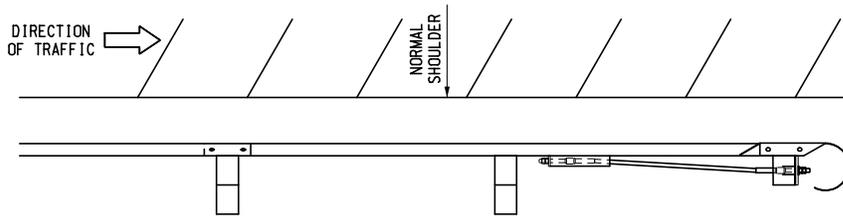
WOOD POSTS WITH 1/2" BEVELS AT THE TOP MAY BE USED IN LIEU OF WOOD POSTS WITHOUT BEVELS SPECIFIED. THE LENGTH, WIDTH AND DEPTH OF THE POST SHALL BE AS SPECIFIED ON THIS STANDARD AND THE POST BOLT HOLES SHALL BE LOCATED TO ENSURE PROPER RAIL HEIGHT.

WOOD OFFSET BLOCKS WITH 1/2" BEVELS AT THE TOP AND BOTTOM OR A 1" BEVELED TOP MAY BE USED IN LIEU OF WOOD BLOCKS WITHOUT BEVELS SPECIFIED. THE LENGTH (FRONT AND BACK FACE), WIDTH AND DEPTH OF THE BLOCK SHALL BE AS SPECIFIED ON THIS STANDARD AND THE POST BOLT HOLES SHALL BE LOCATED TO ENSURE PROPER RAIL HEIGHT AND COMPATIBILITY WITH POST HOLES.

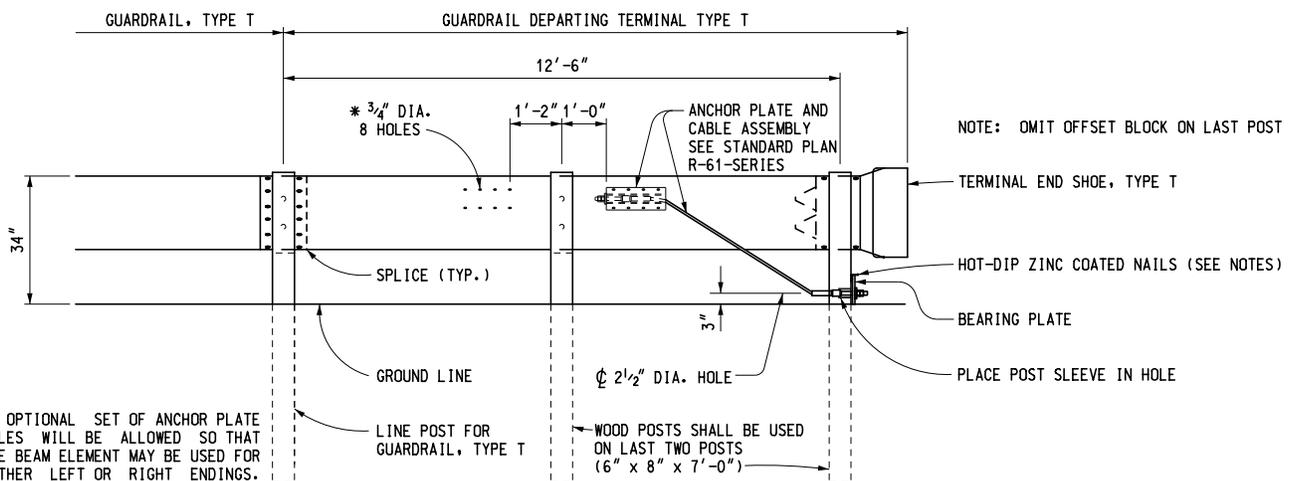
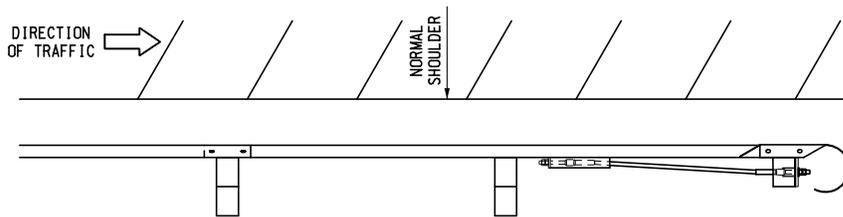
WHEN THE FACE OF GUARDRAIL IS PLACED FLUSH WITH FACE OF CURB, THE RAIL HEIGHT SHOULD BE MEASURED FROM THE FRONT EDGE OF THE GUTTER PAN, WHICH IS THE POINT ON THE GUTTER PAN THAT IS CLOSEST TO THE EDGE OF THE TRAVELED LANE. WHEN THE FACE OF THE GUARDRAIL PANEL IS LOCATED BEHIND THE CURB THE RAIL HEIGHT SHOULD BE MEASURED FROM THE GROUND JUST IN FRONT OF THE GUARDRAIL.

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF DEVELOPMENT STANDARD PLAN FOR

**GUARDRAIL,
TYPES A, B, BD, T, TD,
MGS-8, & MGS-8D**



GUARDRAIL DEPARTING TERMINAL TYPE B



* AN OPTIONAL SET OF ANCHOR PLATE HOLES WILL BE ALLOWED SO THAT THE BEAM ELEMENT MAY BE USED FOR EITHER LEFT OR RIGHT ENDINGS. ANCHOR PLATE SHALL BE PLACED ON UPPER CORRUGATION ONLY.

GUARDRAIL DEPARTING TERMINAL TYPE T



PREPARED BY DESIGN DIVISION

DRAWN BY: B.L.T.

CHECKED BY: W.K.P.

DEPARTMENT DIRECTOR
Kirk T. Stedle

APPROVED BY: _____
DIRECTOR, BUREAU OF FIELD SERVICES

APPROVED BY: _____
DIRECTOR, BUREAU OF DEVELOPMENT

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF DEVELOPMENT STANDARD PLAN FOR

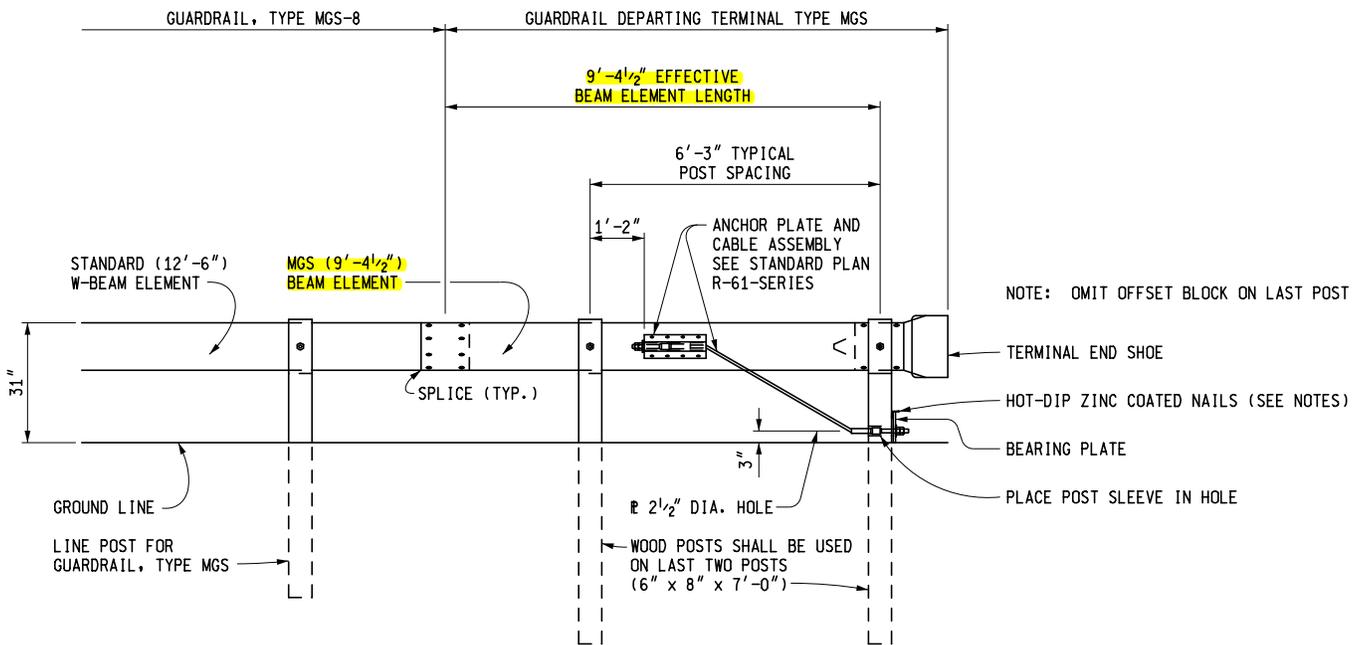
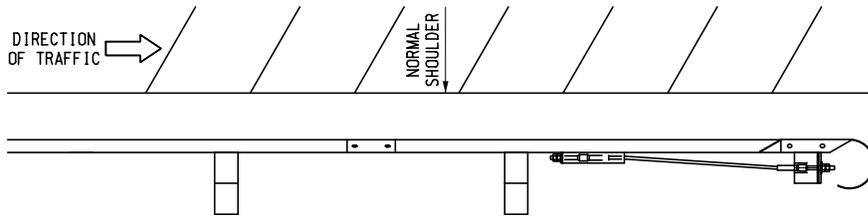
**GUARDRAIL DEPARTING
TERMINAL TYPES B, T, & MGS**

F.H.W.A. APPROVAL

4-27-2016
PLAN DATE

R-66-E

SHEET
1 OF 4



GUARDRAIL DEPARTING TERMINAL TYPE MGS

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF DEVELOPMENT STANDARD PLAN FOR

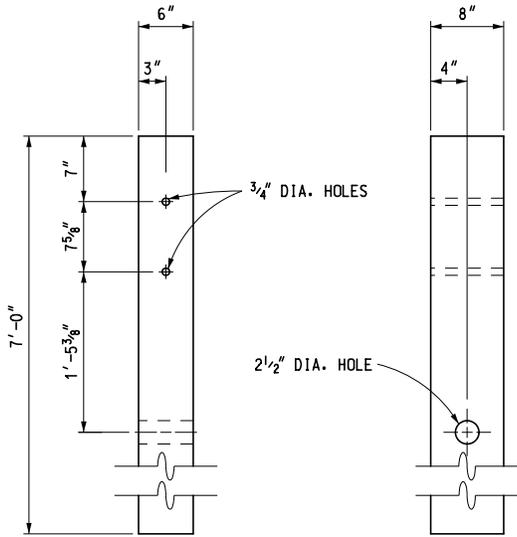
GUARDRAIL DEPARTING
TERMINAL TYPES B, T, & MGS

F.H.W.A. APPROVAL

4-27-2016
PLAN DATE

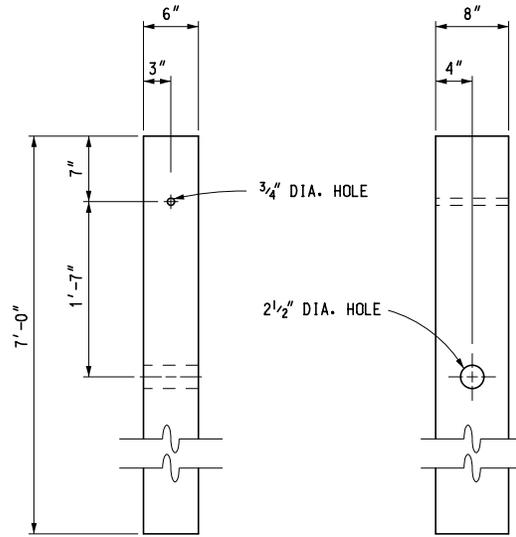
R-66-E

SHEET
2 OF 4



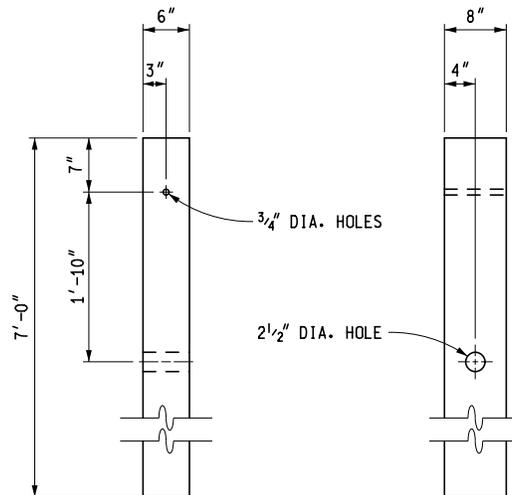
WOOD POST DETAIL

(FOR LAST POST, GUARDRAIL DEPARTING TERMINAL TYPE T)



WOOD POST DETAIL

(FOR LAST POST, GUARDRAIL DEPARTING TERMINAL TYPE B)



WOOD POST DETAIL

(FOR LAST POST, GUARDRAIL DEPARTING TERMINAL TYPE MGS)

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF DEVELOPMENT STANDARD PLAN FOR

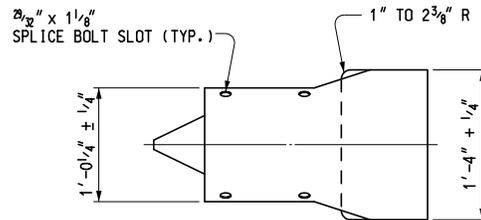
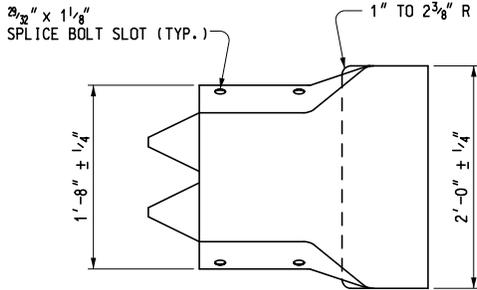
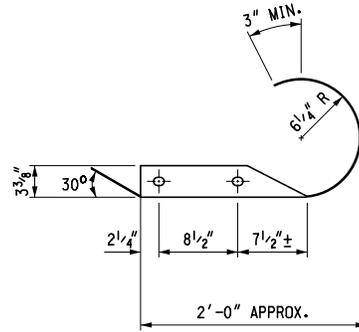
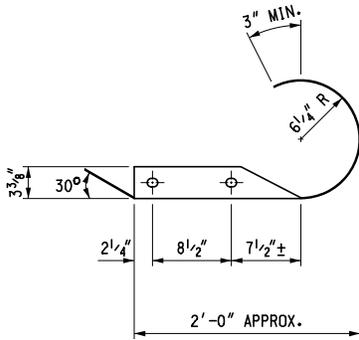
**GUARDRAIL DEPARTING
TERMINAL TYPES B, T, & MGS**

F.H.W.A. APPROVAL

4-27-2016
PLAN DATE

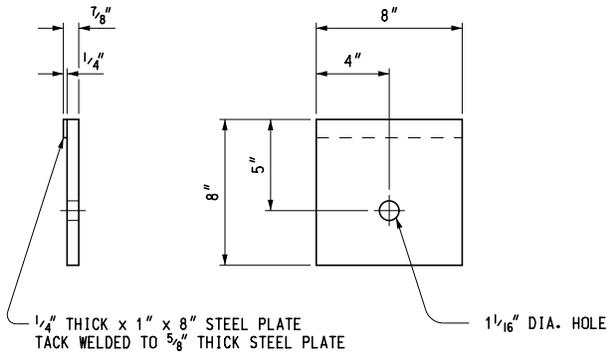
R-66-E

SHEET
3 OF 4



TERMINAL END SHOE,
TYPE B OR TYPE MGS

TERMINAL END SHOE, TYPE T



BEARING PLATE



POST SLEEVE

NOTES:

ALL POSTS, OFFSET BLOCKS, BEAM ELEMENTS, AND HARDWARE (INCLUDING BOLTS, NUTS, AND WASHERS) SHALL CONFORM TO THE CURRENT STANDARD SPECIFICATIONS AND TO THE CURRENT STANDARD PLAN R-60-SERIES, WHERE APPLICABLE, EXCEPT AS SPECIFIED ON THIS STANDARD.

ALL 1:10 SLOPES SHALL BE GRADED TO CLASS A SLOPE TOLERANCES.

FOR DETAILS OF GUARDRAIL PLACEMENT, SEE STANDARD PLAN R-59-SERIES.

AFTER THE CABLE ASSEMBLY HAS BEEN TIGHTENED, A SECOND NUT SHALL BE INSTALLED ON EACH END OF THE CABLE SO THAT THE CABLE WILL NOT LOOSEN.

TWO HOT-DIP ZINC COATED NAILS SHALL BE DRIVEN INTO THE WOOD POST AT THE TOP OF THE BEARING PLATE TO KEEP THE BEARING PLATE FROM ROTATING.

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF DEVELOPMENT STANDARD PLAN FOR

GUARDRAIL DEPARTING
TERMINAL TYPES B, T, & MGS

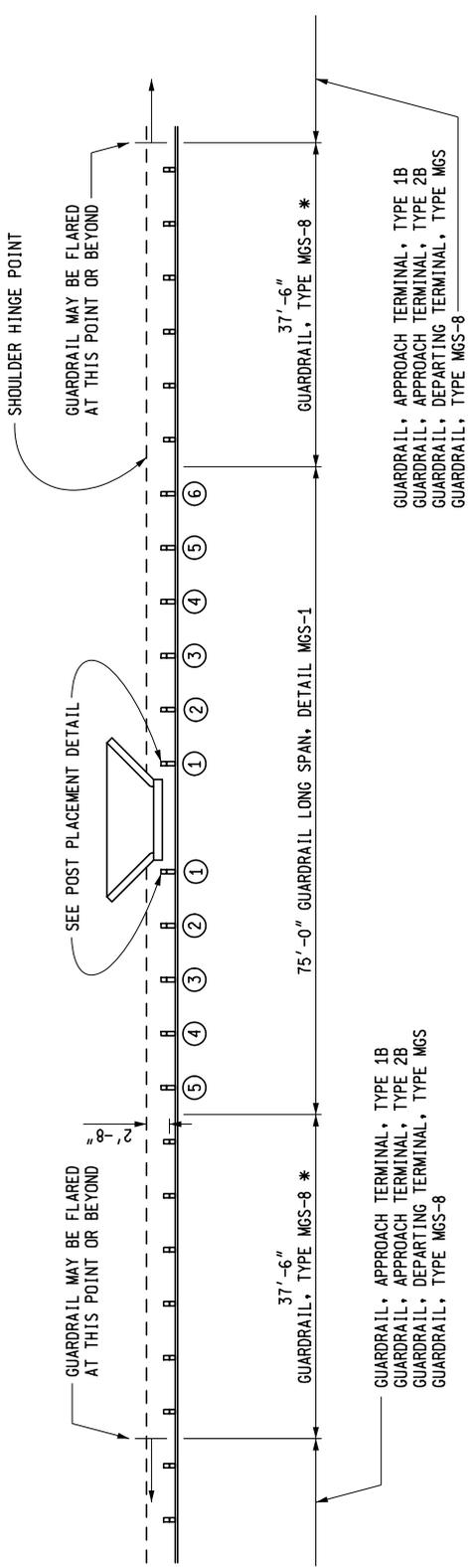
F.H.W.A. APPROVAL

4-27-2016
PLAN DATE

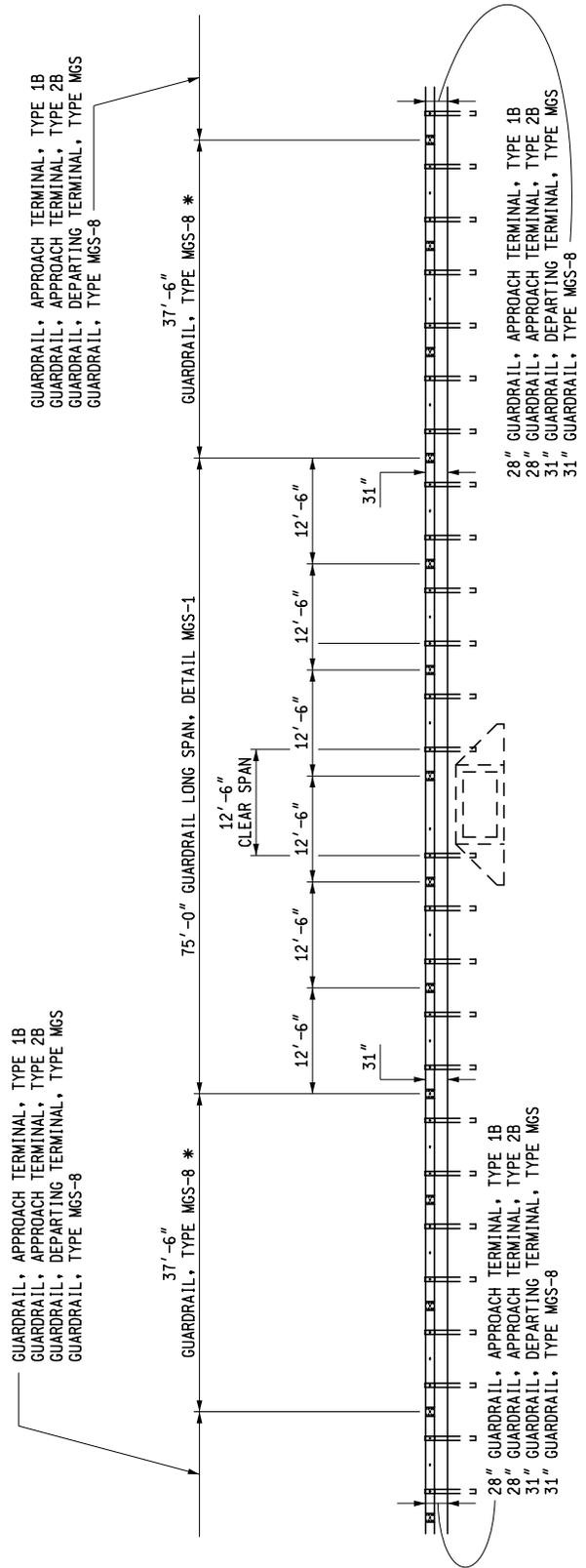
R-66-E

SHEET
4 OF 4

* SEE STANDARD PLAN R-60-SERIES FOR POST SPACING AND GUARDRAIL LAYOUT TO TRANSITION FROM GUARDRAIL, TYPE MGS-8 TO GUARDRAIL APPROACH TERMINAL, TYPE 1B OR GUARDRAIL APPROACH TERMINAL, TYPE 2B.



PLAN

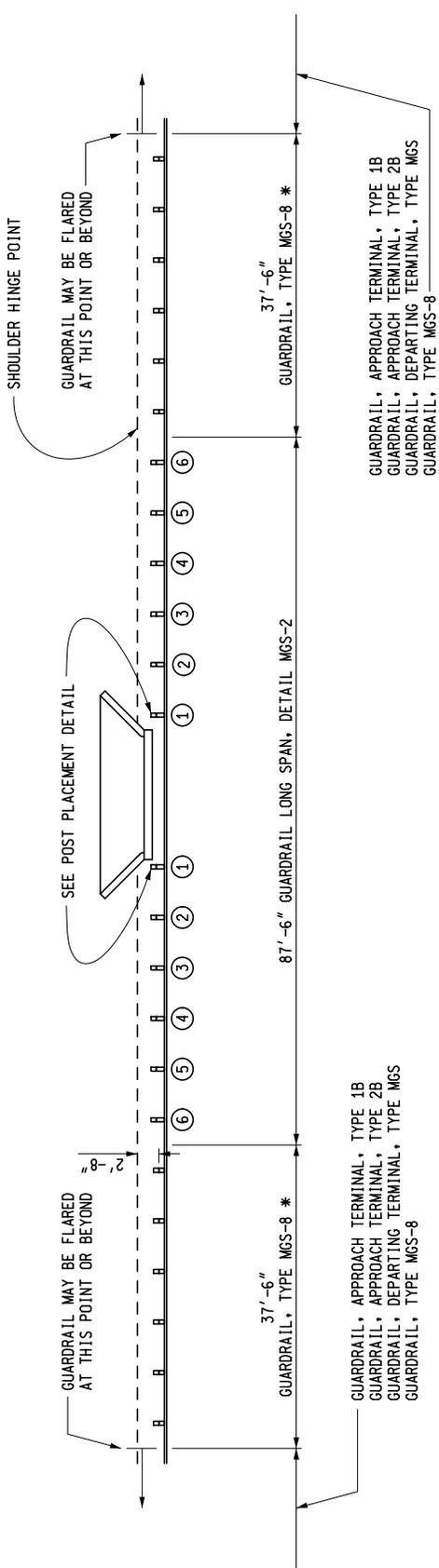


ELEVATION

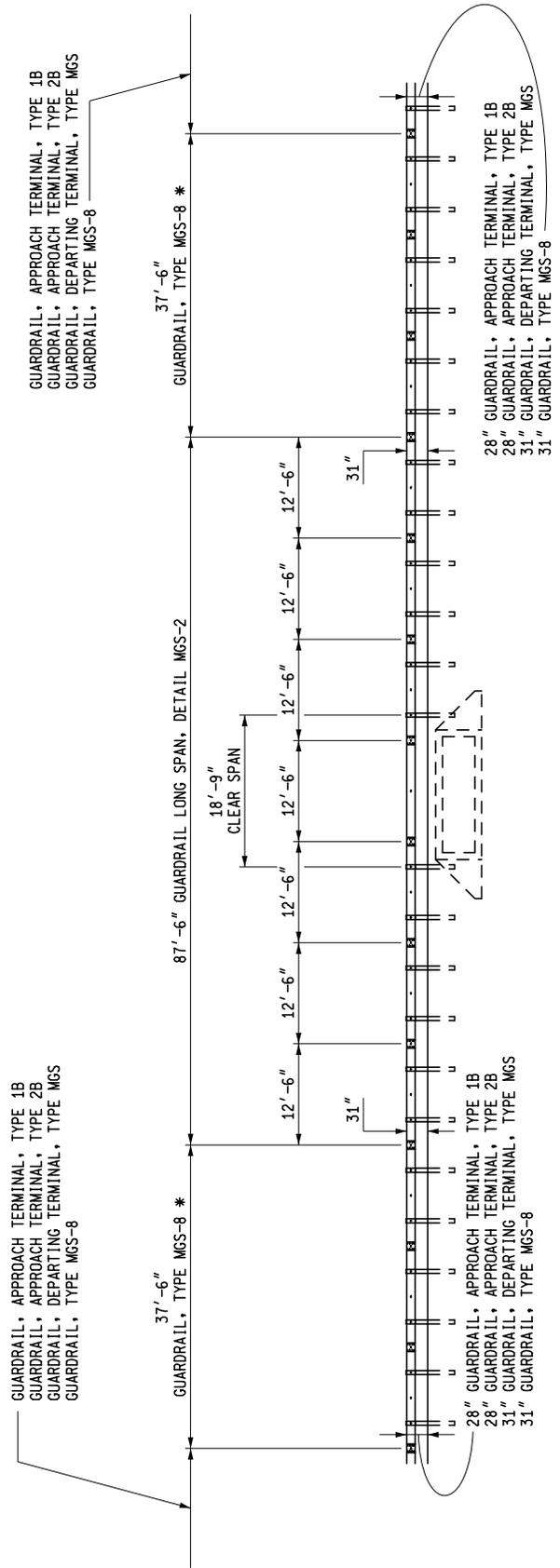
GUARDRAIL LONG SPAN, DETAIL MGS-1

	DEPARTMENT DIRECTOR Kirk T. Stuedle	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT STANDARD PLAN FOR	
	PREPARED BY DESIGN DIVISION	APPROVED BY: _____ DIRECTOR, BUREAU OF FIELD SERVICES	W-BEAM BACKED GUARDRAIL AND GUARDRAIL LONG SPAN INSTALLATIONS
DRAWN BY: <u>B.L.T.</u>	APPROVED BY: _____ DIRECTOR, BUREAU OF DEVELOPMENT	5-11-2016 PLAN DATE	R-72-D
CHECKED BY: <u>W.K.P.</u>		F.H.W.A. APPROVAL	SHEET 1 OF 11

* SEE STANDARD PLAN R-60-SERIES FOR POST SPACING AND GUARDRAIL LAYOUT TO TRANSITION FROM GUARDRAIL, TYPE MGS-8 TO GUARDRAIL APPROACH TERMINAL, TYPE 1B OR GUARDRAIL APPROACH TERMINAL, TYPE 2B.



PLAN



ELEVATION

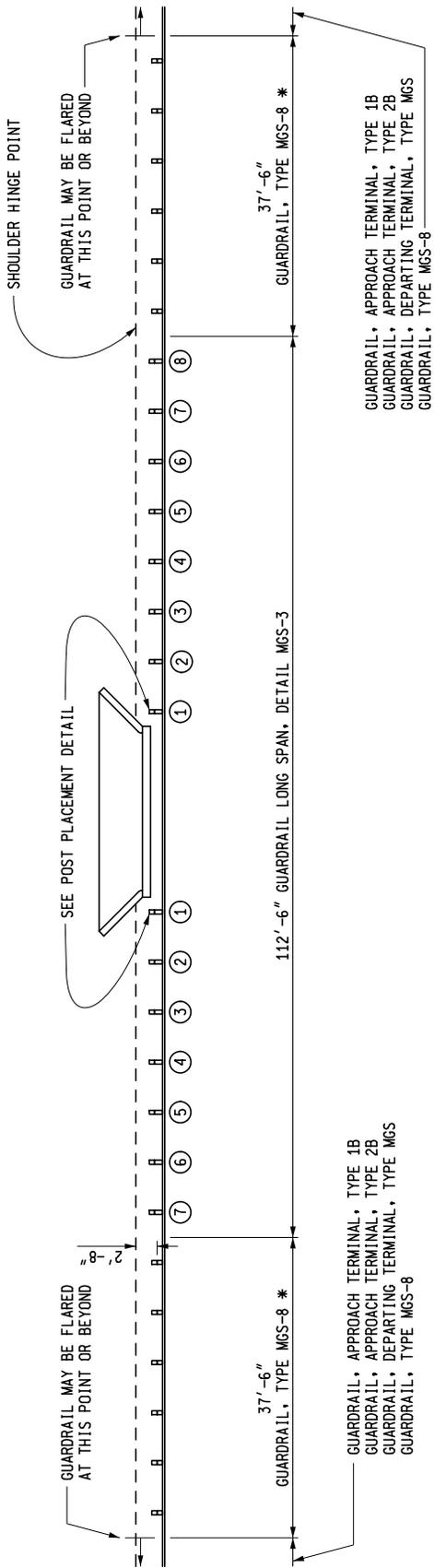
GUARDRAIL LONG SPAN, DETAIL MGS-2

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF DEVELOPMENT STANDARD PLAN FOR

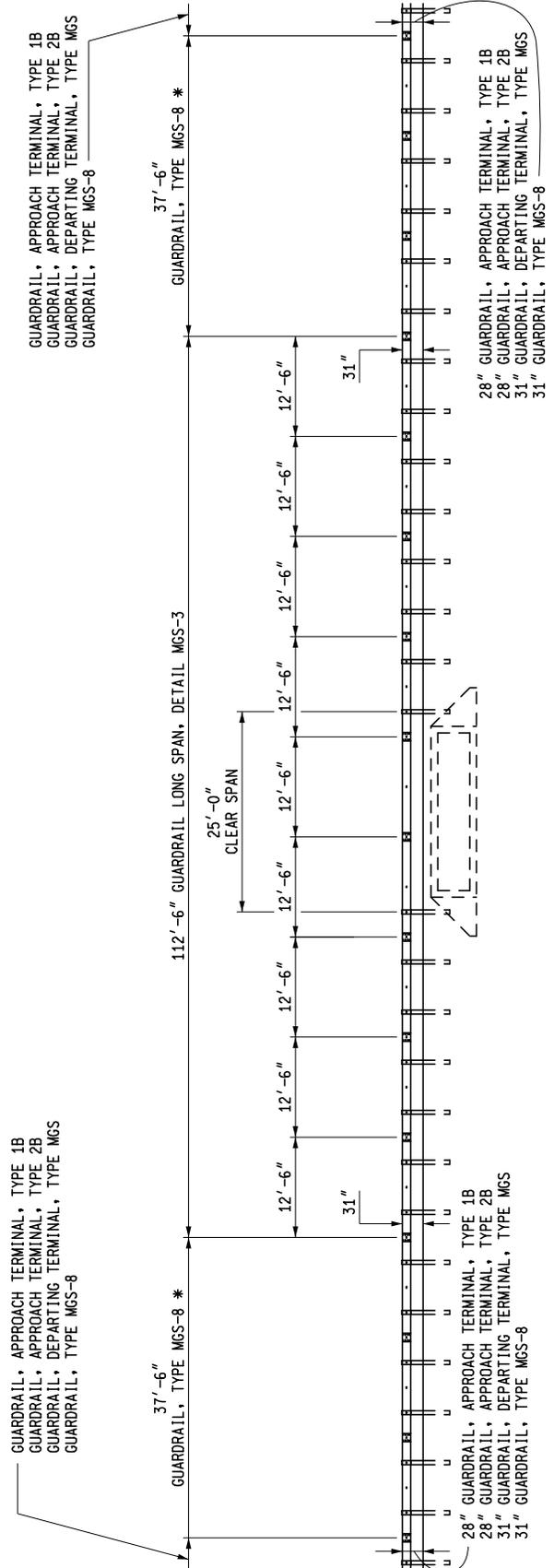
W-BEAM BACKED GUARDRAIL AND GUARDRAIL LONG SPAN INSTALLATIONS

F.H.W.A. APPROVAL	5-11-2016 PLAN DATE	R-72-D
		SHEET 2 OF 11

* SEE STANDARD PLAN R-60-SERIES FOR POST SPACING AND GUARDRAIL LAYOUT TO TRANSITION FROM GUARDRAIL, TYPE MGS-8 TO GUARDRAIL APPROACH TERMINAL, TYPE 1B OR GUARDRAIL APPROACH TERMINAL, TYPE 2B.



PLAN



ELEVATION

GUARDRAIL LONG SPAN, DETAIL MGS-3

MICHIGAN DEPARTMENT OF TRANSPORTATION
 BUREAU OF DEVELOPMENT STANDARD PLAN FOR
**W-BEAM BACKED GUARDRAIL
 AND GUARDRAIL LONG SPAN
 INSTALLATIONS**

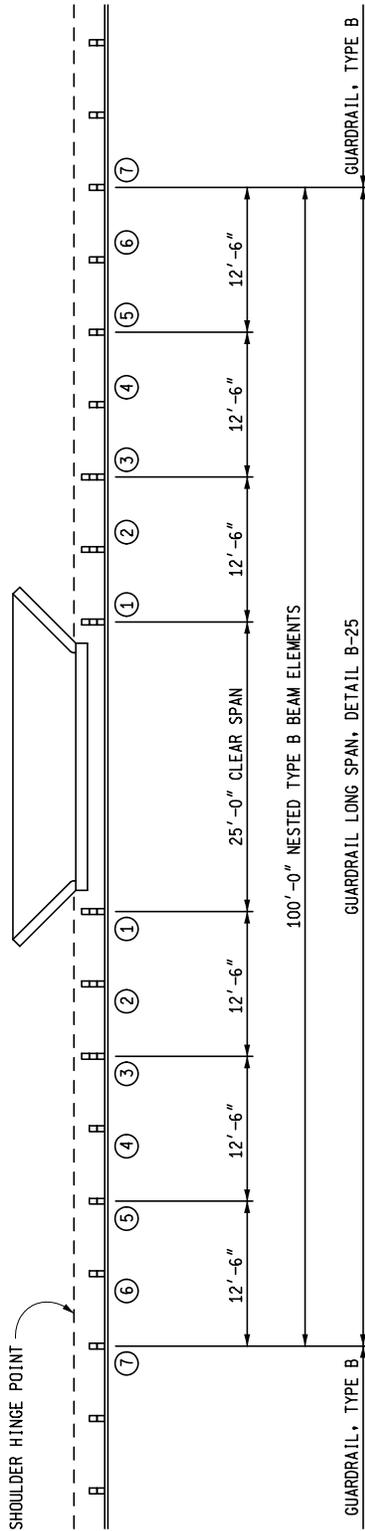
F.H.W.A. APPROVAL	5-11-2016 PLAN DATE	R-72-D	SHEET 3 OF 11
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NOTES:

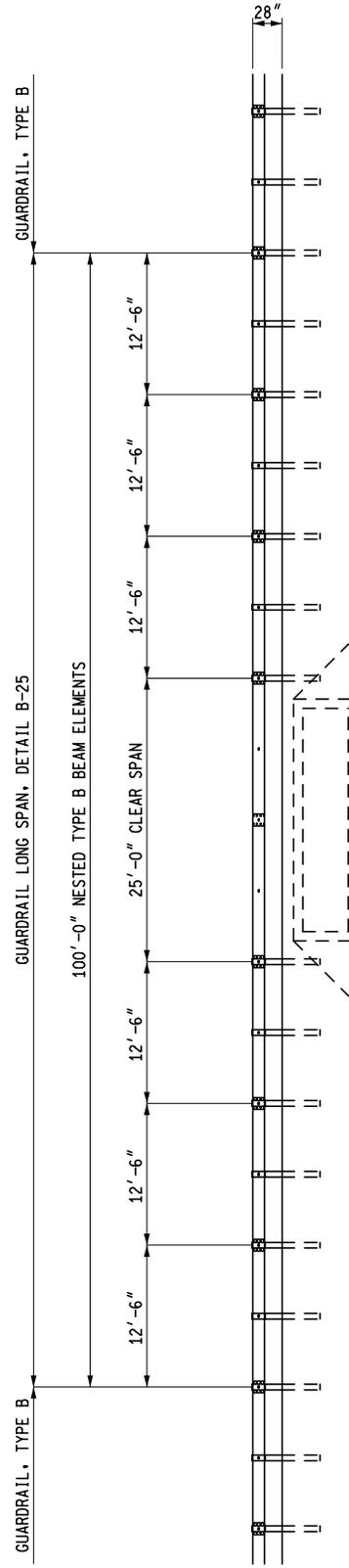
POSTS 1, 2, AND 3 ARE CRT POSTS WITH TWO STANDARD WOOD OFFSET BLOCKS ATTACHED TO THE POST. SEE SHEET 10 FOR CRT POST DETAIL.

POSTS 4, 5, 6, AND 7 ARE STANDARD STEEL OR WOOD TYPE B POSTS WITH OFFSET BLOCK. SEE STANDARD PLAN R-60-SERIES.

INSTALL A MINIMUM OF 12'-6" OF TYPE B GUARDRAIL BETWEEN POST 7 AND GUARDRAIL TERMINAL.

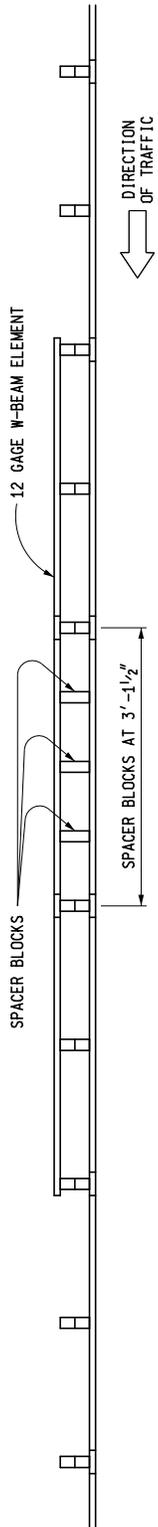


PLAN

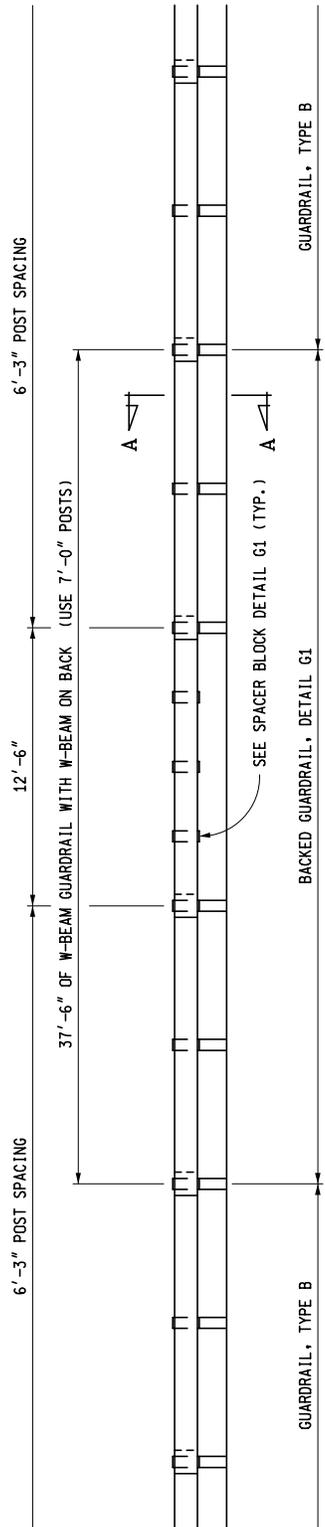


ELEVATION
GUARDRAIL LONG SPAN, DETAIL B-25

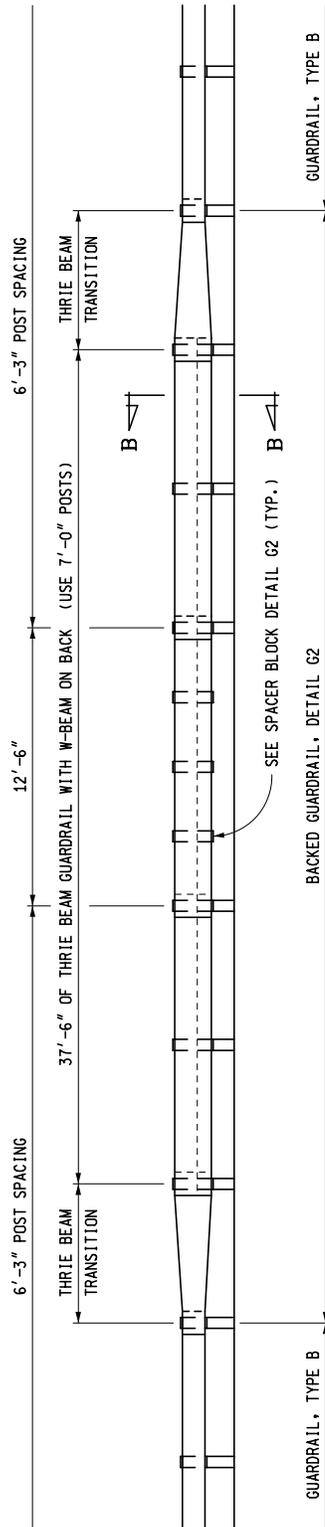
MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT STANDARD PLAN FOR W-BEAM BACKED GUARDRAIL AND GUARDRAIL LONG SPAN INSTALLATIONS		
F.H.W.A. APPROVAL	5-11-2016 PLAN DATE	R-72-D
		SHEET 4 OF 11



PLAN VIEW (12'-6" SPAN)

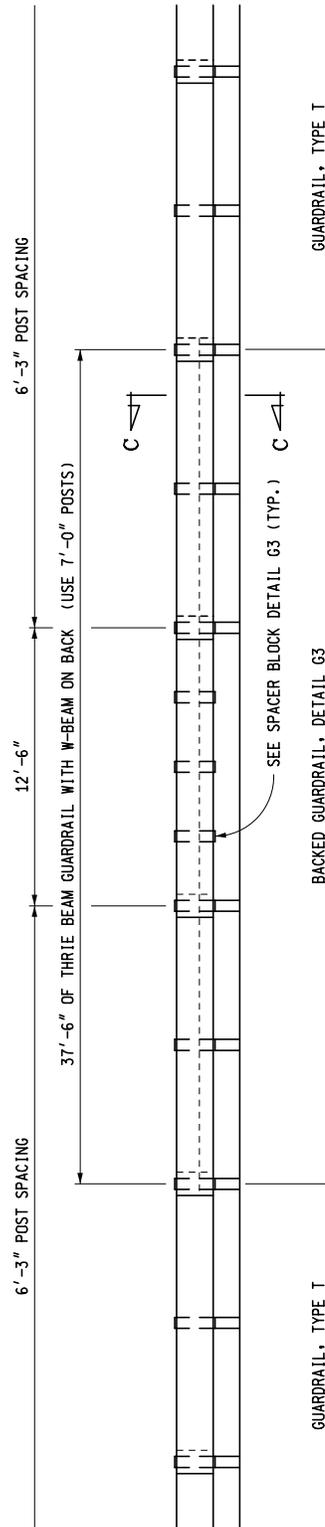


W-BEAM BACKED GUARDRAIL, TYPE B (12'-6" SPAN)



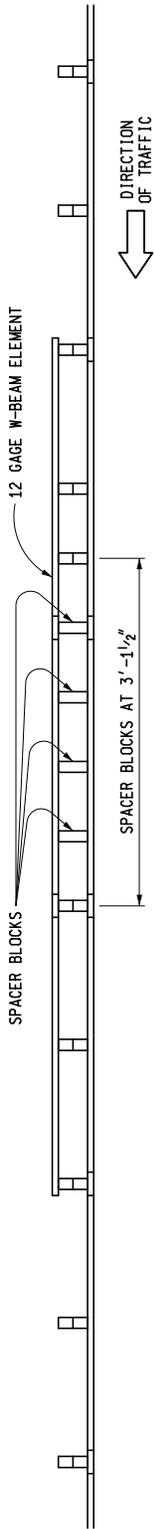
W-BEAM BACKED GUARDRAIL, TYPE T (12'-6" SPAN)

(USE AT DEEP THROATED DOWNSPOUT HEADERS)

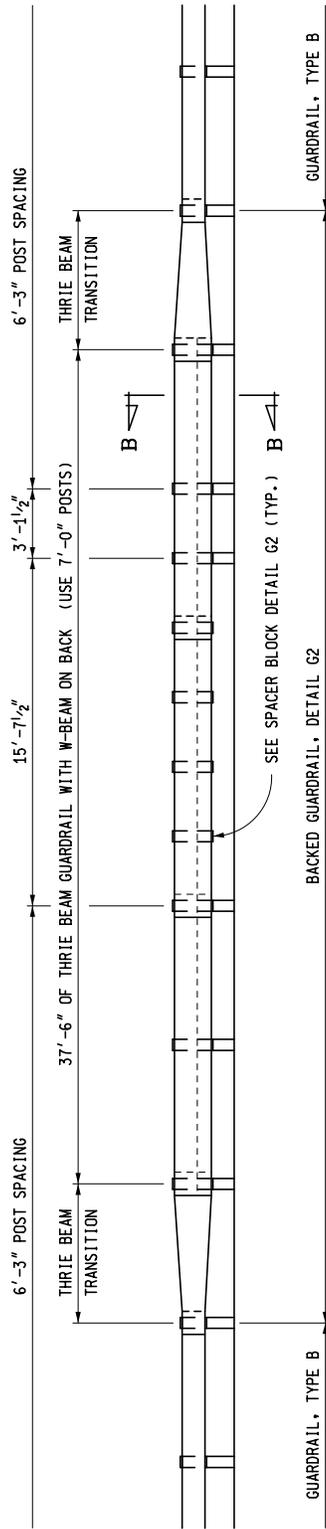


W-BEAM BACKED GUARDRAIL, TYPE T (12'-6" SPAN)

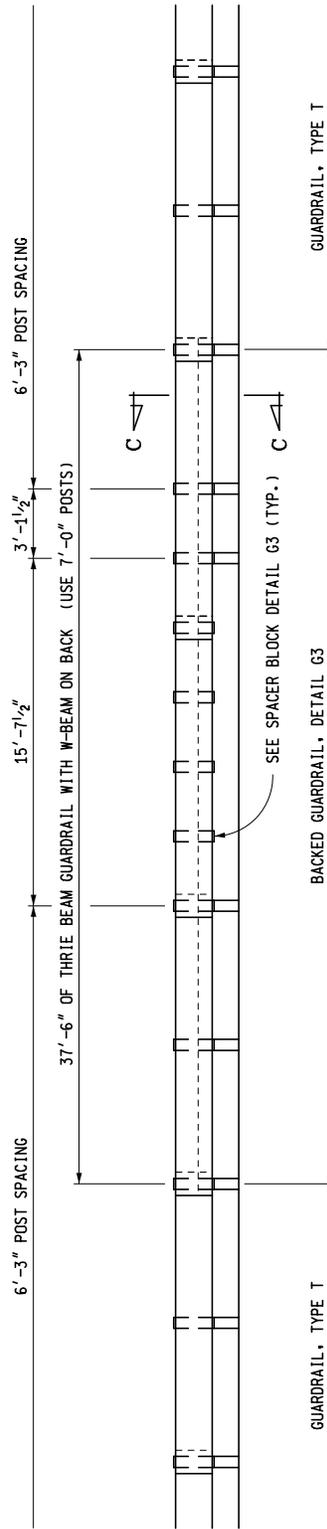
MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT STANDARD PLAN FOR W-BEAM BACKED GUARDRAIL AND GUARDRAIL LONG SPAN INSTALLATIONS		
F.H.W.A. APPROVAL	5-11-2016 PLAN DATE	R-72-D
		SHEET 5 OF 11



PLAN VIEW (15'-7 1/2" SPAN)



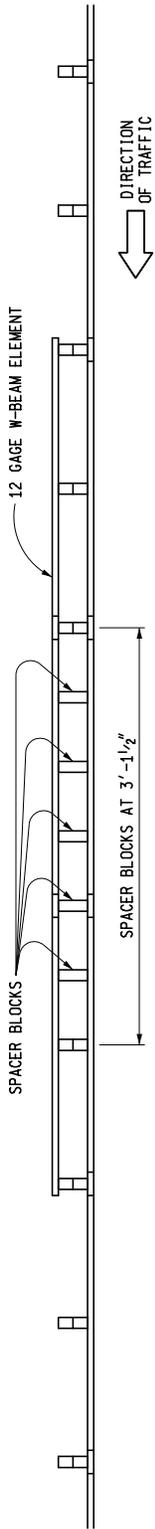
W-BEAM BACKED GUARDRAIL, TYPE T (15'-7 1/2" SPAN)



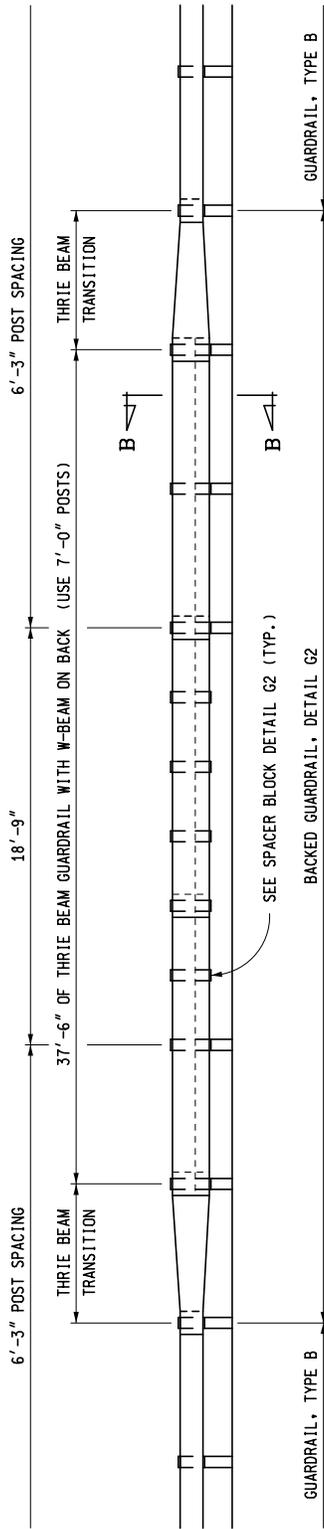
W-BEAM BACKED GUARDRAIL, TYPE T (15'-7 1/2" SPAN)

MICHIGAN DEPARTMENT OF TRANSPORTATION
 BUREAU OF DEVELOPMENT STANDARD PLAN FOR
**W-BEAM BACKED GUARDRAIL
 AND GUARDRAIL LONG SPAN
 INSTALLATIONS**

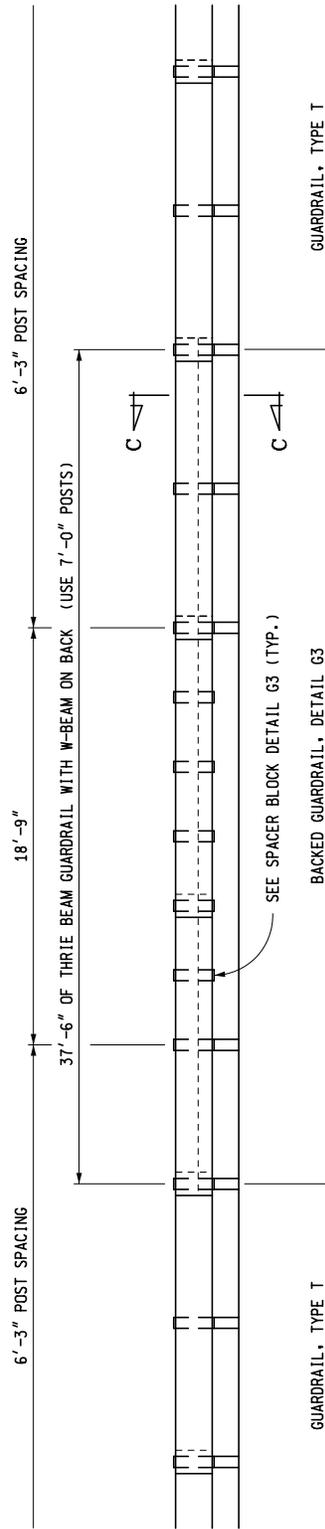
F.H.W.A. APPROVAL	5-11-2016 PLAN DATE	R-72-D	SHEET 6 OF 11
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PLAN VIEW (18'-9" SPAN)

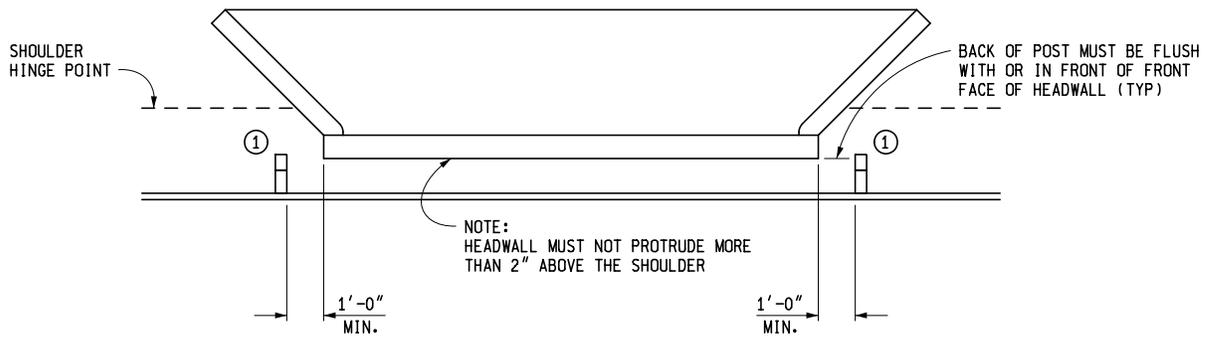


W-BEAM BACKED GUARDRAIL, TYPE T (18'-9" SPAN)

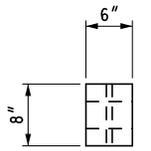


W-BEAM BACKED GUARDRAIL, TYPE T (18'-9" SPAN)

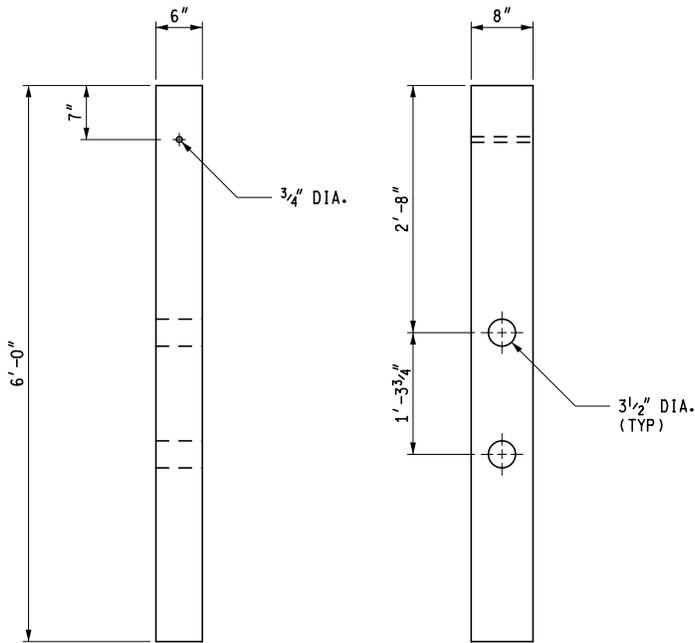
MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT STANDARD PLAN FOR W-BEAM BACKED GUARDRAIL AND GUARDRAIL LONG SPAN INSTALLATIONS		
_____ F.H.W.A. APPROVAL	5-11-2016 PLAN DATE	R-72-D
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POST PLACEMENT DETAIL



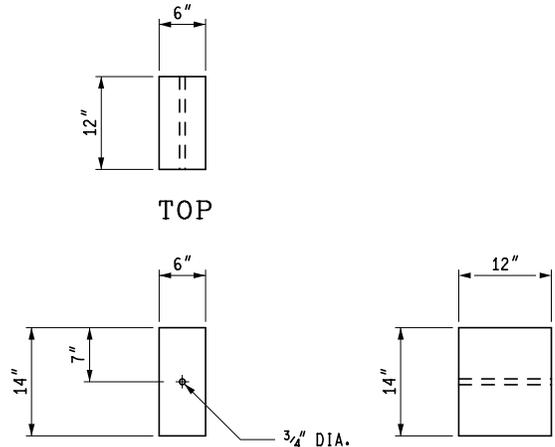
PLAN



FRONT

SIDE

MGS-CRT POST

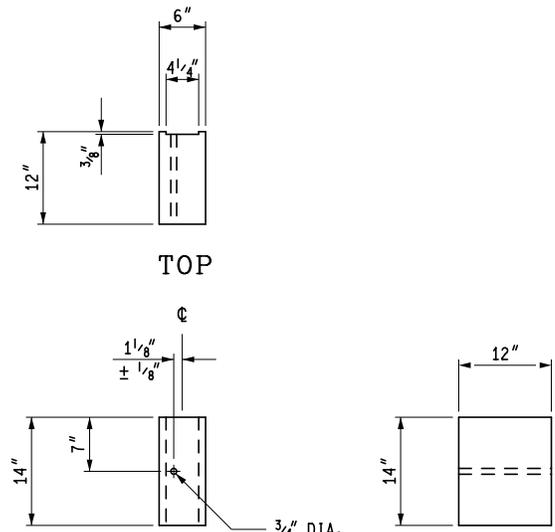


TOP

FRONT

SIDE

MGS 12" OFFSET BLOCK
FOR USE ON WOOD POSTS



TOP

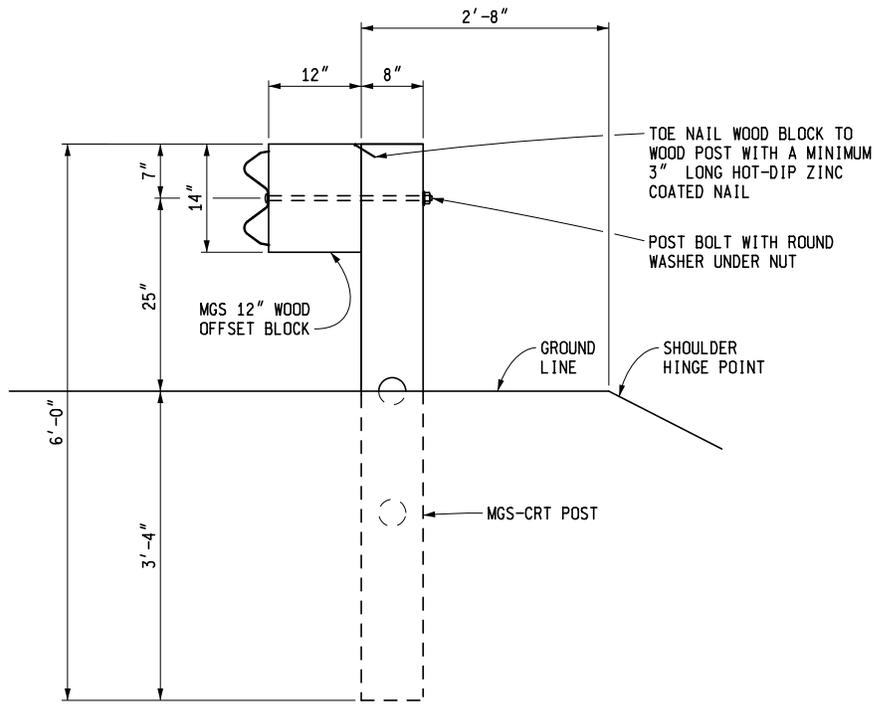
FRONT

SIDE

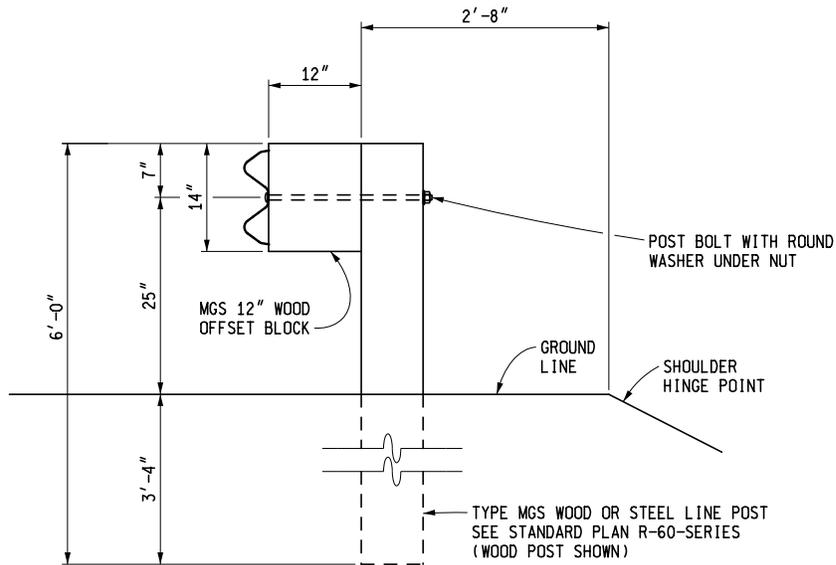
MGS 12" OFFSET BLOCK
FOR USE ON STEEL POSTS

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF DEVELOPMENT STANDARD PLAN FOR
**W-BEAM BACKED GUARDRAIL
AND GUARDRAIL LONG SPAN
INSTALLATIONS**

F.H.W.A. APPROVAL	5-11-2016 PLAN DATE	R-72-D	SHEET 8 OF 11
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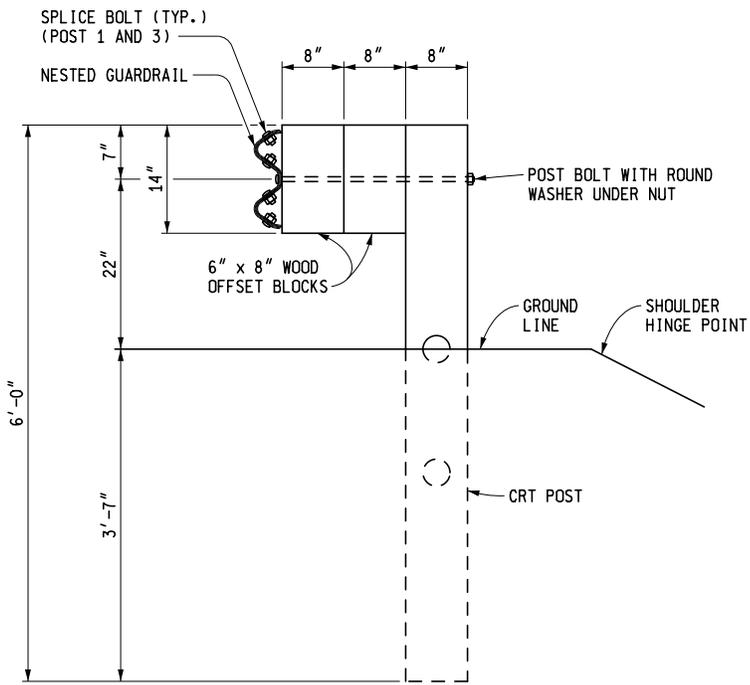
POST 1 THROUGH 3 DETAIL
 GUARDRAIL LONG SPAN DETAILS MGS-1, MGS-2, & MGS-3



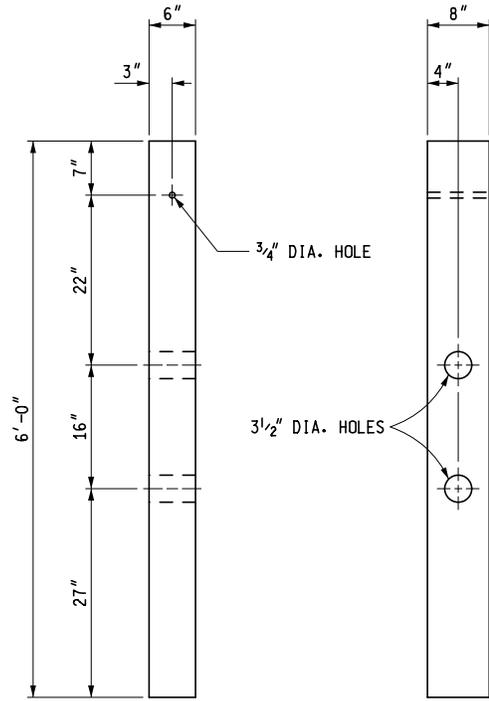
POST 4 THROUGH 6 DETAIL
 GUARDRAIL LONG SPAN DETAILS MGS-1 & MGS-2

POST 4 THROUGH 8 DETAIL
 GUARDRAIL LONG SPAN DETAIL MGS-3

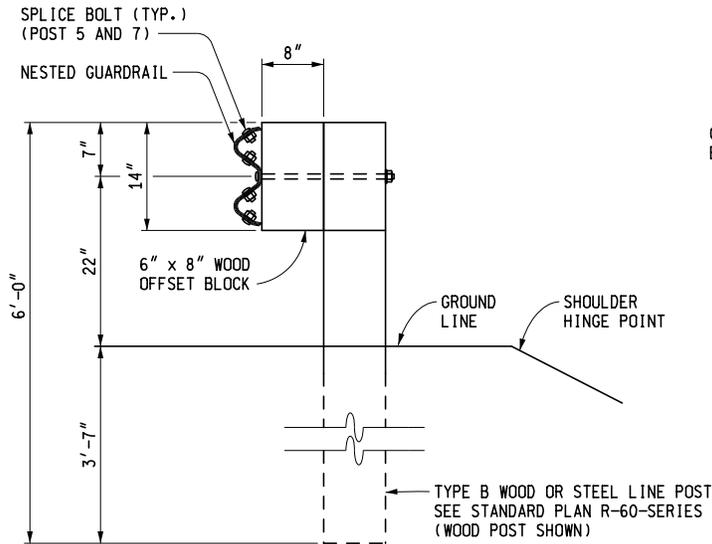
MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT STANDARD PLAN FOR W-BEAM BACKED GUARDRAIL AND GUARDRAIL LONG SPAN INSTALLATIONS		
F.H.W.A. APPROVAL	5-11-2016 PLAN DATE	R-72-D
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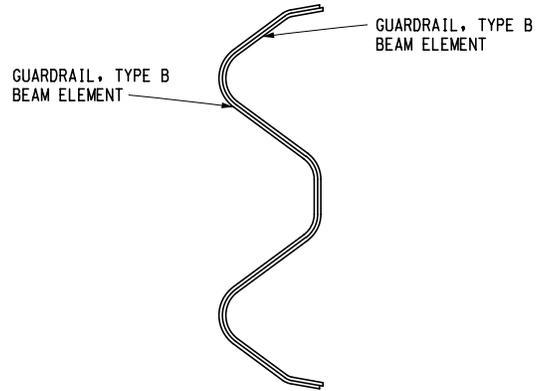
POST 1 THROUGH 3 DETAIL
GUARDRAIL LONG SPAN DETAIL B-25



CONTROLLED RELEASING
TERMINAL POST
(CRT)

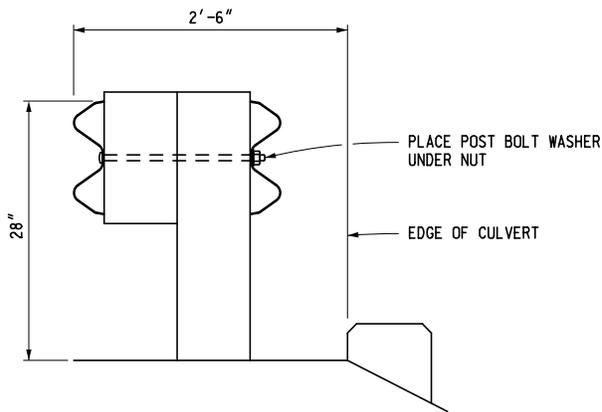


POST 4 THROUGH 7 DETAIL
GUARDRAIL LONG SPAN DETAIL B-25

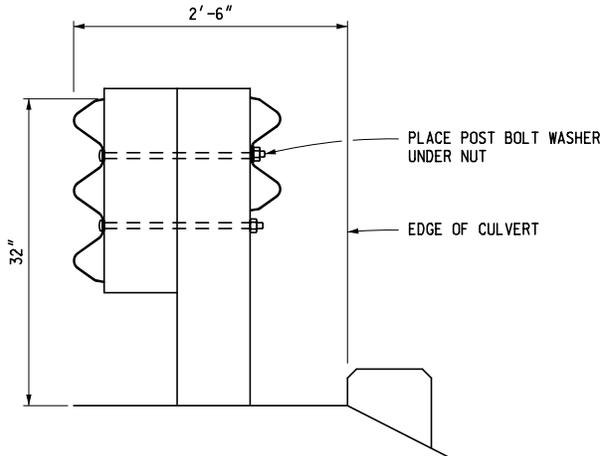


NESTED GUARDRAIL
DETAIL

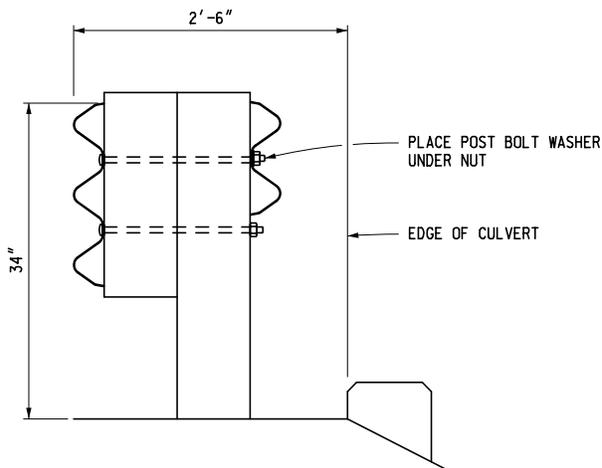
MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT STANDARD PLAN FOR W-BEAM BACKED GUARDRAIL AND GUARDRAIL LONG SPAN INSTALLATIONS		
F.H.W.A. APPROVAL	5-11-2016 PLAN DATE	R-72-D
		SHEET 10 OF 11



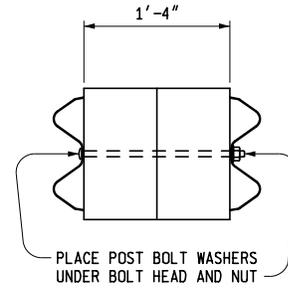
SECTION A - A



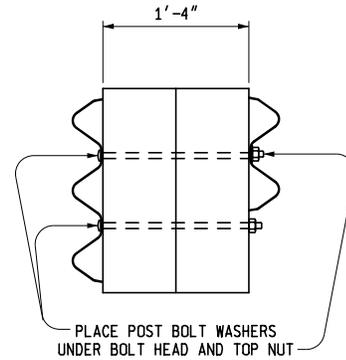
SECTION B - B



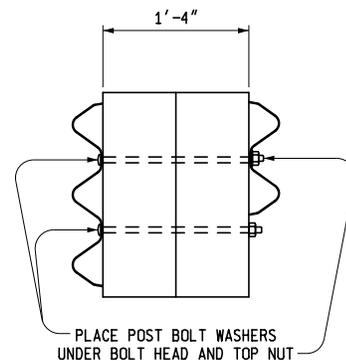
SECTION C - C



SPACER BLOCK DETAIL G1



SPACER BLOCK DETAIL G2



SPACER BLOCK DETAIL G3

NOTES:

ALL POSTS, OFFSET BLOCKS, BEAM ELEMENTS, AND HARDWARE (INCLUDING BOLTS, NUTS, AND WASHERS) SHALL BE ACCORDING TO THE CURRENT STANDARD SPECIFICATIONS AND THE CURRENT STANDARD PLAN R-60-SERIES, WHERE APPLICABLE, EXCEPT WHERE NOTED ON THIS STANDARD.

THE GUARDRAIL MODIFICATIONS DETAILED ON THIS STANDARD SHOULD ONLY BE USED WHERE 6'-3" POST SPACING AND POST EMBEDMENT CANNOT BE MET. WHEN THE SPANNING DISTANCE BETWEEN POSTS IS 15'-7 1/2", THE 3'-1 1/2" POST SPACING SHOULD BE PLACED ON THE APPROACH END.

IF USE OF THIS DESIGN WOULD INTERFERE WITH THE POST SPACING WITHIN A GUARDRAIL BRIDGE ANCHORAGE AS SPECIFIED ON STANDARD PLAN R-67-SERIES, OTHER OPTIONS SHOULD BE INVESTIGATED AND USED.

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF DEVELOPMENT STANDARD PLAN FOR

**W-BEAM BACKED GUARDRAIL
AND GUARDRAIL LONG SPAN
INSTALLATIONS**

F.H.W.A. APPROVAL

5-11-2016
PLAN DATE

R-72-D

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MICHIGAN DESIGN MANUL BRIDGE DESIGN

CHAPTER 2 - STEPS IN PRODUCING PLANS INDEX (continued)

- 2.02.15 Scope Verification Meeting (11-19-99)
- 2.02.16 THE Plan Review (11-19-99) (10-22-2012)
- 2.02.17 Region/TSC Maintaining Traffic Recommendations
- 2.02.18 Final Constructability Review (10-22-2012)
- 2.02.19 Omissions Errors / Check (OEC) Meeting (11-19-99) (10-22-2012)
- 2.02.20 Rehabilitation Project Scoping (11-19-99) (10-22-2012)

2.03 PLAN PREPARATION STEPS

- 2.03.01 FHWA Oversight / MDOT Oversight (12-5-2005)
- 2.03.02 Study
- 2.03.03 Preliminary Plans
- 2.03.04 Final Plans
- 2.03.05 Changes During Plan Preparation
- 2.03.06 Changes After Plan Completion

2.04 PLAN PRODUCTION PROCEDURE

- 2.04.01 Unit Assignment
- 2.04.02 Plan Distribution
- 2.04.03 Estimating Man-Hours
- 2.04.04 Project History
- 2.04.05 Project Contact Person

2.05 BRIDGE DESIGN QUALITY ASSURANCE & QUALITY CONTROL (5-23-2016)

- 2.05.01 Overview
- 2.05.02 Definitions
- 2.05.03 Implementing and Documenting Procedures
- 2.05.04 Role of Federal Highway Administration (FHWA)
- 2.05.05 References and Other Sources of Information

- Appendix 2.02.04 Survey/Mapping Action Request (8-20-2009) (5-28-2013)

MICHIGAN DESIGN MANUAL BRIDGE DESIGN

2.05

BRIDGE DESIGN QUALITY ASSURANCE & QUALITY CONTROL (5-23-2016)

2.05.01

Overview

- A. To ensure bridges are designed correctly, with no errors once the design calculations, drawings, and specifications are finalized, MDOT requires QA/QC procedures in accordance with this section.
- B. The MDOT Bridge Design QA/QC program consists of organizational procedures established to ensure a deliberate and systematic program that reduces the risk of introducing errors and omissions into bridge design final contract documents. The MDOT QA/QC program provides checks and balances within the organization to assure quality in final contract plans and specifications. The MDOT QA/QC program is implemented at different levels or phases of project activity, as defined in the MDOT Bridge Design Manual, the [MDOT Road Design Manual](#), and the [MDOT Quality Assurance and Quality Control Process Guide for Project Managers](#) and as included in this section.
- C. The rigor and level of resources allocated to QA/QC applications on a given bridge are tempered by the size, complexity, and degree of redundancy in the structural system involved, and by the degree of standardization of the design. For major projects involving unusual, complex, and innovative features, a peer review may be desirable to raise the level of confidence in the quality of design and construction.

2.05.02

Definitions

A. Quality Control (QC).

Procedures followed within a unit or working group to check the accuracy of the calculations, drawings, and specifications for the purpose of detecting and correcting design omissions and errors to accomplish the overarching goal of producing complete and error free final plans and specifications. QC occurs continuously throughout the course of a project.

B. Quality Assurance (QA).

Review procedures followed by staff outside the unit or working group to ensure the QC procedures were effective in preventing mistakes and promoting consistency in the development of bridge design calculations, drawings, and specifications.

C. Program Level Quality Assurance (PLQA).

Review procedures followed by management to assure the effectiveness of QC and QA procedures in verifying and measuring the level of quality of the entire bridge design QA/QC program.

D. Peer Review.

A high-level QA review by a separate unit or consultant not intimately involved with the design of the structure. Determination of the need for a peer review is made by the Bridge Design Supervising Engineer, with guidance provided by the State Bridge Alignment Team (SBAT).

E. Designer.

An individual directly responsible for the development of design calculations, drawings, and specifications, and review of shop drawings related to a specific bridge design.

MICHIGAN DESIGN MANUAL BRIDGE DESIGN

2.05.02

Definitions (continued)

F. Checker.

An individual responsible for performing technical review of design calculations, drawings, and specifications.

G. Reviewer.

An individual responsible for performing QA procedures that ensure that QC procedures were performed properly.

H. Engineer of Record (EOR).

An individual responsible for all aspects of the design of the structure, including the design of all of the bridge's systems and components. This individual is appointed by the bridge owner, and must be a licensed Professional Engineer in the State of Michigan. For MDOT in-house projects, the bridge squad leader is the EOR, and signs, but does not seal the final contract plans. For consultant-designed projects, the EOR is the consultant Project Manager, and is required to seal and sign his/her portion of the final contract plans.

MICHIGAN DESIGN MANUAL BRIDGE DESIGN

2.05.03

Implementing and Documenting Procedures

A. Qualification of the Designer, Checker, and Reviewer.

The Designers, Checkers, and Reviewers are key personnel providing well-designed, accurate, and constructible plans for use in the construction of bridges. The Designers, Checkers, and Reviewers must be experienced in structural designs and familiar with the current AASHTO bridge design and construction specifications and the MDOT Bridge Design Manual, [Bridge Design Guides](#), and procedures.

1. Designer and Checker.

The following are the requirements for a bridge Designer and Checker.

- a. Possess a professional engineer (PE) license in Michigan with experience as a Bridge Engineer. A Designer or Checker without a PE license works under the direct supervision of a professional engineer licensed in Michigan who is the Reviewer and Engineer of Record for the project.
- b. Non-engineer staff are often utilized to design and check CADD drawings, develop quantity calculations and perform other non-structural design functions during the course of a project. As noted above, all work is done under the direct supervision of a professional engineer licensed in Michigan who is the Reviewer and Engineer of Record for the project.
- c. The Designers' and Checkers' experience is commensurate with the complexity of the bridge being designed. Whenever possible, the experience of the Checker exceeds the experience of the Designer.

2.05.03 A. (continued)

2. Reviewer.

The Reviewer possesses a professional engineer (PE) license in Michigan, and has significant experience in bridge design and is familiar with MDOT's bridge design and construction practices, procedures, and policies.

MICHIGAN DESIGN MANUL BRIDGE DESIGN

2.05.03

Implementing and Documenting Procedures (continued)

B. Minimum Items/Areas Required to Be Checked.

Design calculations, design drawings, and contract documents are required to be verified by a Checker with a thorough and comprehensive understanding of the project and design methods. In particular, the following minimum items/areas must be checked:

1. Design Computations and Checks.

All structural components, including deck, superstructure, and substructure components. The assumptions of the bridge design including general conditions and loadings are documented. Computations needed to determine type, size, and location of the bridge are checked including grade and quantity calculations.

2.05.03 B. (continued)

2. Bridge Contract Drawings Checks.

All components (as described above) of bridge design drawings are checked in detail. Plan notes are checked, including verification of correct materials specified. Plan notes must not alter the work, materials, or method of payment for standard pay items. All quantities and pay items are verified to be in conformance with plan details, and pay item wording checked against MDOT Standard Specifications for Construction or associated special provisions. In cases where the Designer is not the drawing Checker, the Designer at least reviews the drawings to ensure that they are in conformance with the design. After any required changes are made, names or initials are placed on the drawings indicating the individual who prepared the drawing, the individual who modified the drawing (as needed), and the Designer. The plans include the name of the unit or work area responsible for the plans. Consultant plans include their company logo.

3. Bridge Design Contract Document Checks.

All special provisions are reviewed for appropriateness with respect to the contract plans and pay items and MDOT Standard Specifications for Construction. All permits, certifications, clauses and other supporting information are reviewed to ensure they are complete and correspond with the plans and remainder of contract package and that there are no conflicts between any documents.

MICHIGAN DESIGN MANUL

BRIDGE DESIGN

2.05.03

Implementing and Documenting Procedures (continued)

C. QC Procedures.

1. A supervisor or team leader is responsible for determining the necessary technical knowledge and experience of the Designer and Checker for that specific design. Designers and Checkers are assigned to bridge projects by matching experience and performance to project complexity.
2. The Checker is responsible to the supervisor for quality control of the design, which includes checking the design calculations, plans, and specifications to assure accuracy and constructability. One hundred percent of all design calculations, quantity calculations, plans, and specifications are checked as part of the QC process.
3. All bridge plan sheets include the names or initials of the person who drafted the details along with the Checker of the sheet and the date last revisions were made to that plan sheet. See [Guidelines For Bridge Plan Preparation](#) (MDOT Sample Plans Bridge) of Development Guide ([Design Submittal Requirements Chapter 7](#)) for guidelines related to drafting and plan preparation.

2.05.03 C. (continued)

4. All special provisions include the author's initials and work area identifier, and are subject to a well-defined review process facilitated by MDOT's Quality Assurance Section that includes various subject matter experts.
 - a. Unique special provisions authored specifically for a project are drafted by the Designer or support area and submitted for review and approval during the course of the project.
 - b. Previously approved special provisions can be used, and are reviewed by the Designer to assure that the entire content is appropriate for a project.
 - c. Frequently used special provisions are utilized on projects as noted in specific use statements and are incorporated into the project without any changes.
5. Software programs such as MDOT's Bridge Design System, MDX, or Leap Bridge, various finite element modeling programs, among others, are often too complex for a Designer and Checker to review and confirm directly. The Designer and Checker must fully understand the methodology, assumptions, and limitations of each program prior to utilizing output on a project. This can be accomplished through review of all available program documentation and independent verification with hand calculations, spreadsheets or other known and proven software.

MICHIGAN DESIGN MANUL BRIDGE DESIGN

2.05.03

Implementing and Documenting Procedures (continued)

6. All design calculations include name or initials of the Designer and Checker along with the date designed and checked.
 - a. Hand calculations have a "prepared by", and "checked by" notation for each page of the calculations.
 - b. Spreadsheets, MathCad calculations, and computer programs have a "prepared by" and "checked by" notation on the user input and results pages. These sheets are generated specifically for a project, or are utilized from a previous project, sometimes generated by others. The Checker is responsible for reviewing the data input, and the Designer and Checker must have a full understanding of the methodology, assumptions, and limitations of the program or spreadsheet and be able to verify that they are appropriate for the design.
7. All calculations are checked vs. the Final Package Submittal for the project.
 - a. All dimensions, member sizes, bar sizes from design calculations are verified to match plan dimensions.
 - b. Reinforcing steel takeoffs are performed and verified for consistency between detail drawings and Steel Reinforcement Detail sheets.
 - c. A final cost estimate (project verification estimate) is printed, and the wording for each pay item is verified for consistency between the cost estimate, plan drawings and (if applicable) special provisions.

2.05.03 C. (continued)

8. Calculations.

At the completion of the project, provide a set of design calculations for all elements of the bid package for the design file. All calculations include completed "prepared by" and "checked by" fields. Consultants provide calculations sealed/stamped and signed by the Engineer of Record for the project, who is licensed in Michigan. Design calculations are stored within the project file in ProjectWise and hard copies (if applicable) are stored in the MDOT Design Unit in accordance with the MDOT plan retention policy.

9. The design file includes (but is not limited to) the following.

- a. Design calculations.
- b. Check calculations (e.g. to verify computer output, if applicable).
- c. Supporting reports (e.g. geotechnical recommendations).
- d. Cost estimates including quantity calculations and supporting documentation
- e. Review comments/resolutions.
- f. Documentation substantiating the completion of Quality Control and Quality Assurance procedures in accordance with this document and other accepted standards.

MICHIGAN DESIGN MANUL BRIDGE DESIGN

2.05.03

Implementing and Documenting Procedures (continued)

D. QA procedures.

1. The MDOT Quality Assurance and Quality Control Process Guide for Project Managers provides a deliberate and systematic process for plan development and quality assurance. These processes are further defined in other sections of the MDOT Bridge Design Manual and the MDOT Road Design Manual.
2. The MDOT Design Division Quality Assurance Section performs QA during The Plan Review, Plan Completion (Omissions and Errors Check) and Final Package Submittal stages of each project. The Quality Assurance Section reviews all project contract documents, facilitates department wide review, and documents all review comments in accordance with section 14 of the MDOT Road Design Manual.
3. In accordance with National Bridge Inspection Standard requirements, a load rating is performed for each bridge rehabilitation and bridge replacement/new construction project. For bridge rehabilitation projects, a preliminary load rating is typically performed at The Plan Review stage, and finalized at the Plan Completion stage. For new or reconstructed bridges, load rating is typically performed at Plan Completion stage. Load rating calculations serve as a QA of structural design of the beams for projects, and feedback is provided to the Designer if deficiencies are discovered.
4. MDOT's Bridge Field Services (BFS) section performs QA at the Plan Completion (Omissions and Errors Check) stage of each project. BFS maintains a plan review checklist

2.05.03 D. (continued)

- comprised of focus areas for plan reviews based on past experience with construction issues. BFS focuses specifically on constructability and structural fabrication aspects of bridge projects and provides feedback to the designer for incorporation into the final project package.
5. QA is performed by the project supervisor or team leader at various times during the project and at The Plan Review, Plan Completion, and Final Package submittal stages. While QC is performed on one hundred percent of project documents, the level of QA performed by the supervisor or team leader is subject to the supervisor's discretion based on a combination of factors such as experience of the Designer and Checker, complexity of the project, uniqueness of project parameters and details.
 6. PLQA is performed by the Bridge Design Supervising Engineer to ensure that the bridge design units, consultant coordinators, and consultant design teams are performing adequate QA/QC in accordance to this document. This involves periodic review of a representative sample of bridge design units and consultant coordinator projects at selected project milestones. The Bridge Design Supervising Engineer may assign peer reviews to promote consistency and uniformity between MDOT working units and between MDOT in-house and consultant designers. Performance measures will be developed and used to track progress in key areas.
 7. If the QA review shows evidence that the proper QA/QC process is not being properly followed, a more rigorous review of the QA/QC process documentation is performed, and recommendations are provided.

MICHIGAN DESIGN MANUL

BRIDGE DESIGN

2.05.03

Implementing and Documenting Procedures (continued)

E. In-House Design Quality Control/Quality Assurance.

All bridges designed by MDOT are reviewed in compliance with this document and the referenced manuals and procedures. Each work unit documents a process for implementing the procedures to assure consistency within the Bridge Design Section.

F. Design Consultant Quality Control/Quality Assurance.

1. Every consultant performing bridge design for MDOT is required to have its own QA/QC process in place. As part of the prequalification application, each consultant must submit a Quality Control Plan in accordance with the [MDOT Consultant Prequalification Instructions](#). The QA/QC program document is available to the MDOT consultant coordinator to review as necessary throughout the course of a project.

2. Project proposals define the QA/QC program and responsibilities specific to a project. In general, each prime consultant and sub consultant follows their own documented QA/QC procedures on file with their prequalification. Additionally, the prime consultant for a project is responsible for project level QA of sub consultant's deliverables to assure uniformity within the project and to assure that sub consultant's procedures are being followed. Documentation of QA/QC procedures for a specific project will be furnished to MDOT at any point during a project upon request.

2.05.03 D. (continued)

3. At the completion of a project, the consultant furnishes the completed design package, including all design calculations, quantity calculations, and documentation of completed QA/QC along with a letter certifying completion of QA/QC.

4. Consultant design contracts have clauses protecting MDOT from design errors and omissions by requiring that the consultant's work meet "sound, prudent, appropriate, and required professional standards and practices," and that the consultant will promptly revise work that does not meet MDOT criteria, at no additional cost to MDOT.

5. The consultant coordinator or project manager assures that the documented QA and QC program is followed by the consultant in accordance with this document and the project QA/QC program by performing cursory checks of submittals and contract documents throughout the course of the project and requiring changes as appropriate. Additionally, consultant coordinators will verify reasonableness of the design based on knowledge of design standards and engineering judgement.

6. At the completion of each project, consultants are rated via performance evaluations. Past performance is a part of the scoring criteria for proposals for all Quality Based Selections. Consultants are also scored based on the experience of their QA/QC review team and the quality of their QA/QC plan as detailed in a project proposal.

MICHIGAN DESIGN MANUAL BRIDGE DESIGN

2.05.03

Implementing and Documenting Procedures (continued)

G. Corrective Actions.

QA/QC procedures are implemented on all projects. Through the PLQA, the overall program is continually monitored for effectiveness. When level of QC or QA is found to be insufficient, corrective actions are required.

1. The following actions are taken if QA or PLQA reviews indicate that a specific design unit, consultant, or consultant coordinator is not following the process.

a. The representative sample of projects for that unit or coordinator is increased until the Bridge Design Supervising Engineer is satisfied that the issue is corrected.

b. Concerns with consultant's performance are noted on consultant's review at the completion of the project.

c. Concerns with MDOT staff member's performance are reflected in the staff member's annual performance review or interim performance review, depending on severity.

2. If, during the review of project submittals, it is evident that the consultant team has not followed QA/QC practices, payment for hours associated with QA of a project as negotiated prior to the start of a project can be withheld.

2.05.04

Role of Federal Highway Administration (FHWA)

A. Initial Review and Approval of Program.

The general role of FHWA Division Office is to review each State Highway Agency (SHA) QA/QC Program and to ensure the QA/QC program is thorough, effective, documented, and followed. Further, it is the role of the FHWA Office of Bridge Technology to assure uniformity within division offices regarding implementation of this guidance.

B. Periodic Program Reviews.

FHWA division offices may perform periodic reviews of the MDOT's programs. Upon request, MDOT will provide project documents to the FHWA division office for review, in accordance with the Federal-Aid Stewardship Agreement. The need of periodic reviews depends on the complexity of the bridge projects.

MICHIGAN DESIGN MANUAL BRIDGE DESIGN

2.05.05

References and Other Sources of Information

A. MDOT Bridge Design Manual

The procedures involved in preparing bridge plans, quality control and quality assurance are interlaced within Chapters 2 – 6 as well as Chapter 15.

B. MDOT Road Design Manual

Procedures for plan preparation are addressed in Chapter 14.

C. The Quality Assurance and Quality Control Process Guide for Project Managers

Documents the MDOT QA/QC process for preparing road and bridge projects, and is based on a well-documented plan development procedure.

D. Program/Project Management System (PPMS) Task Manual

Documents the preconstruction process as it pertains to project development. Networks based on the PPMS Tasks are used to plan and to track virtually every aspect of a project design schedule.

E. Guidelines For Bridge Plan Preparation (MDOT Sample Plans Bridge)

Bridge sample plans including plan sheet examples of typical plan set detailing preferred details and drafting procedures.

CHAPTER 6

PLAN SHEET EXAMPLES

6.00

INTRODUCTION (5-23-2016)

Plan sheet examples can be found at [Guidelines for Bridge Plan Preparation \(MDOT Sample Plans Bridge\)](#). The document presents samples of detail sheets that can be used as guides in preparing plans of highway bridges. The samples were selected and tailored to provide as much reference data as possible on a limited number of sheets. Each of the detail sheets of a typical set of plans is represented. At the same time, detailing procedures for a variety of bridge types are illustrated. Commentary is provided for more clarity and background on guidelines and detailing procedures. Also included are abbreviations, symbols and naming conventions for files.

In general, adherence to these guides is recommended. Many of them result from past construction experience, and while other methods of presenting structural details may be equally effective, it is possible that they would create problems. The format shown is preferred if for no other reason than the familiarity that the state contractors have developed following it on previous jobs. On rare occasions, the guides may not be appropriate, but before electing to deviate, drafting personnel should be sure there is ample justification.

(2-23-2001)

MICHIGAN DESIGN MANUAL BRIDGE DESIGN

CHAPTER 9

DETAILING PRACTICES

9.00

DETAILING PRACTICES (5-23-2016)

Drafting details and practices, cell libraries and other [miscellaneous](#) files can be found on the [MDOT Design Services Website](#). (8-20-2009) (5-28-2013)

Various details have been standardized and appear on specific sheets. See [Guidelines For Bridge Plan Preparation](#) (MDOT Sample Plans Bridge) of Development Guide ([Design Submittal Requirements Chapter 7](#)) for various details, practices and sample plan sheets. It also contains drafting degrees of accuracy, abbreviations and symbols used on plans.

For naming convention of files see [Chapter 3](#) of Development Guide ([Design Submittal Requirements](#)).

Structure designations and additional bridge/structure information is available in the [Michigan Structure Inventory and Appraisal Coding Guide](#).

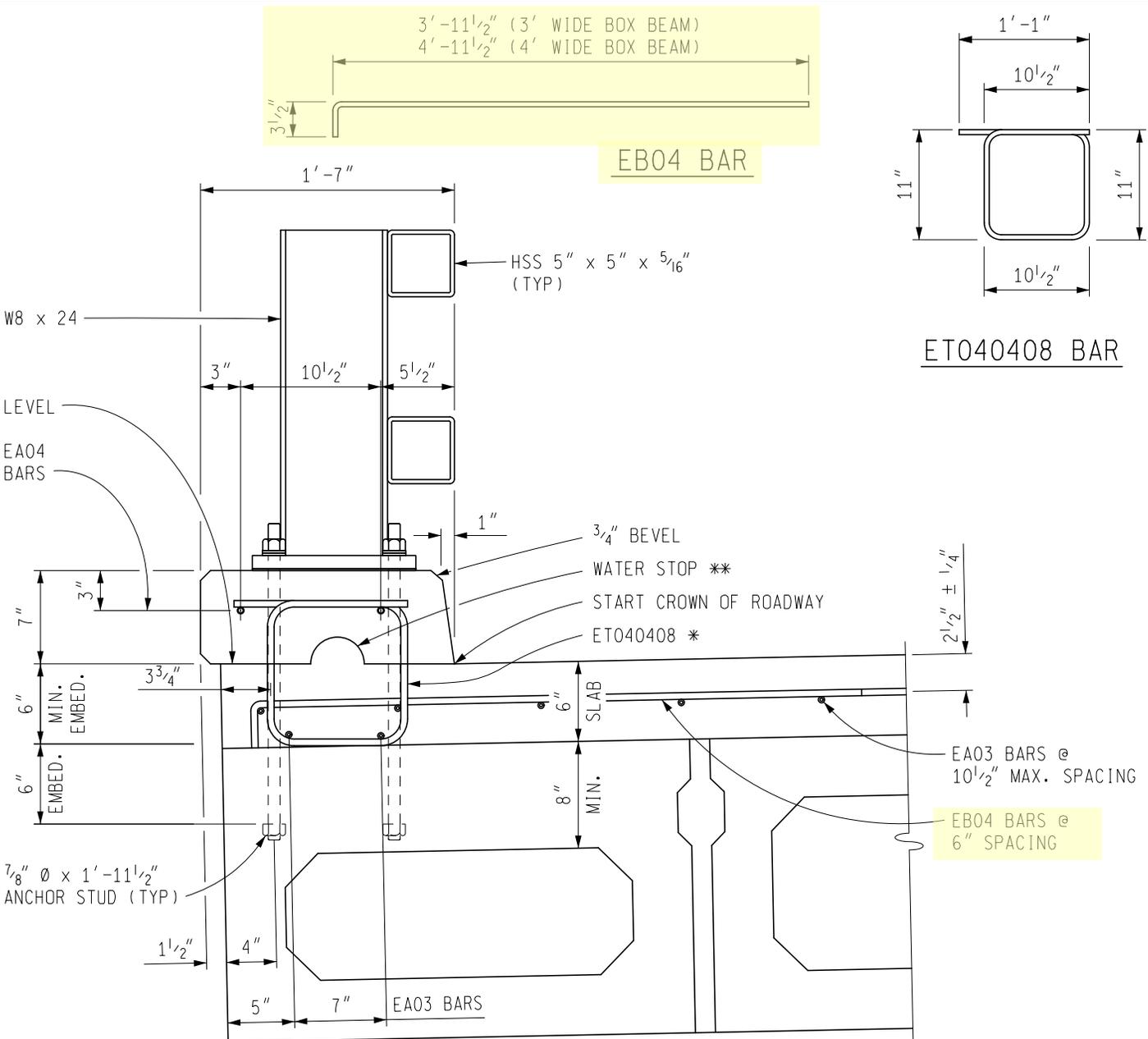
Checking of all detail drawings must be done to assure the accuracy of the plans. The drawings shall comply with the design calculations, existing design guides, and the practices listed in [Guidelines For Bridge Plan Preparation](#) and Section 2.05, Bridge Design Quality Assurance & Quality Control.

DRAWN BY: BLT
 CHECKED BY: VZ
 APPROVED BY: DAJ

MICHIGAN DEPARTMENT OF TRANSPORTATION
 BUREAU OF HIGHWAY DEVELOPMENT

BRIDGE RAILING, 2 TUBE
 PRESTRESSED BOX BEAM DECK

ISSUED: 05/23/16
 SUPERSEDES: 11/27/01



NOTES:

FOR ANGLE OF CROSSING 70° TO 90°, PLACE TRANSVERSE STEEL PARALLEL TO REF. LINE.
 FOR ANGLE OF CROSSING < 70° AND SPAN LENGTH > DECK WIDTH, PLACE TRANSVERSE STEEL I TO BRIDGE C.
 FOR ANGLE OF CROSSING < 70° AND SPAN LENGTH < DECK WIDTH, PLACE TRANSVERSE STEEL II TO REF. LINE.
 PLACE LONGITUDINAL STEEL PARALLEL TO BRIDGE C IN ALL CASES.

* SPACE AT ALTERNATE TRANSVERSE SLAB BARS. PLACE ADDITIONAL ET040408 BARS 9" EACH SIDE OF C RAILING POST.

** 2" HIGH x 4" LONG (±). FORMING NOT REQUIRED.

BARS WITH PREFIX "E" ARE TO BE EPOXY COATED.

FOR ADDITIONAL DETAILS OF RAILING, SEE STANDARD PLAN B-21-SERIES.

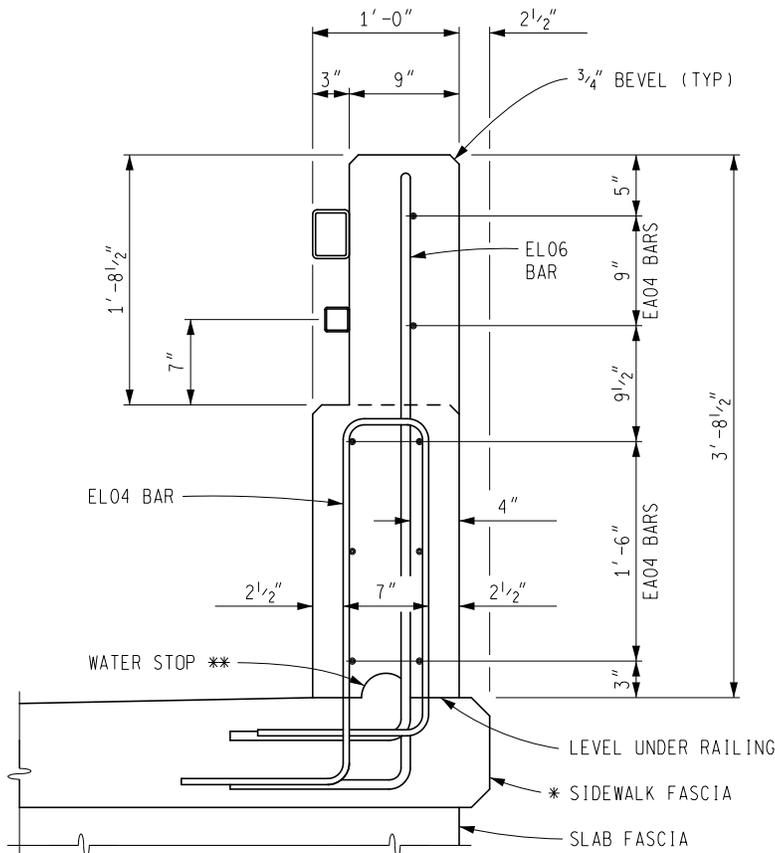
PREPARED BY
 DESIGN DIVISION

6.29.06A

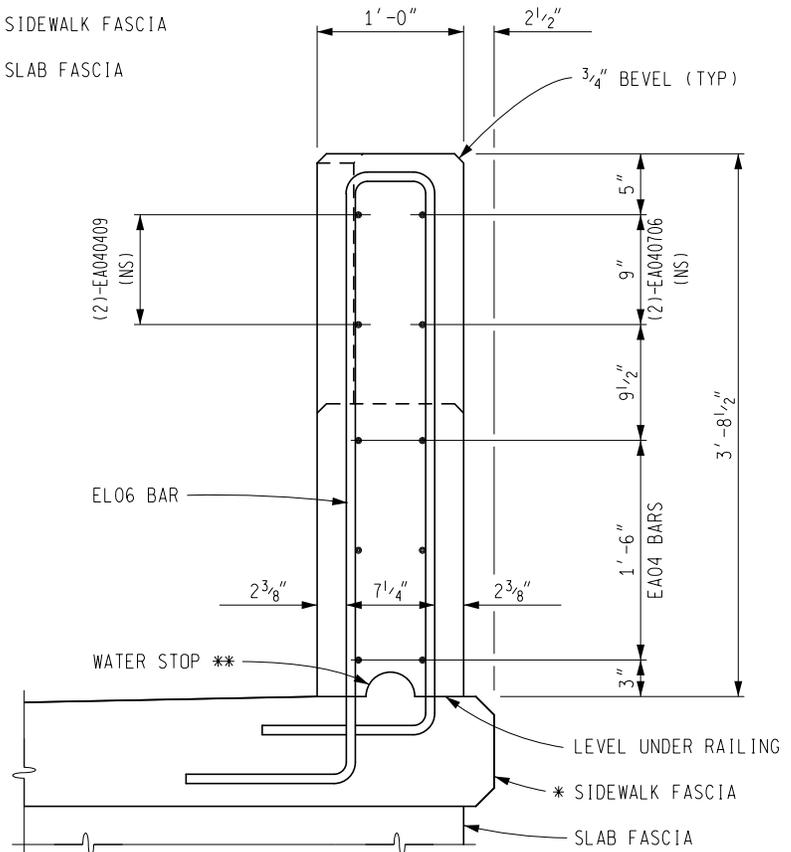
DRAWN BY: BLT
 CHECKED BY: VZ
 APPROVED BY: DAJ

MICHIGAN DEPARTMENT OF TRANSPORTATION
 BUREAU OF HIGHWAY DEVELOPMENT
 BRIDGE RAILING, AESTHETIC PARAPET TUBE
 END WALL SECTIONS

ISSUED: 05/23/16
 SUPERSEDES: 12/22/11



SECTION AT END WALL
 (TUBE CONNECTION AREA)



SECTION AT END WALL
 (FULL CONCRETE AREA)

NOTE:

* IF BRIDGE RAILING IS MOUNTED FLUSH TO THE SLAB, THE "EL" BARS SHALL BE CAST IN THE SLAB.

** 2" HIGH x 4" LONG (±). FORMING NOT REQUIRED. USE WHEN RAILING IS MOUNTED FLUSH TO THE SLAB.

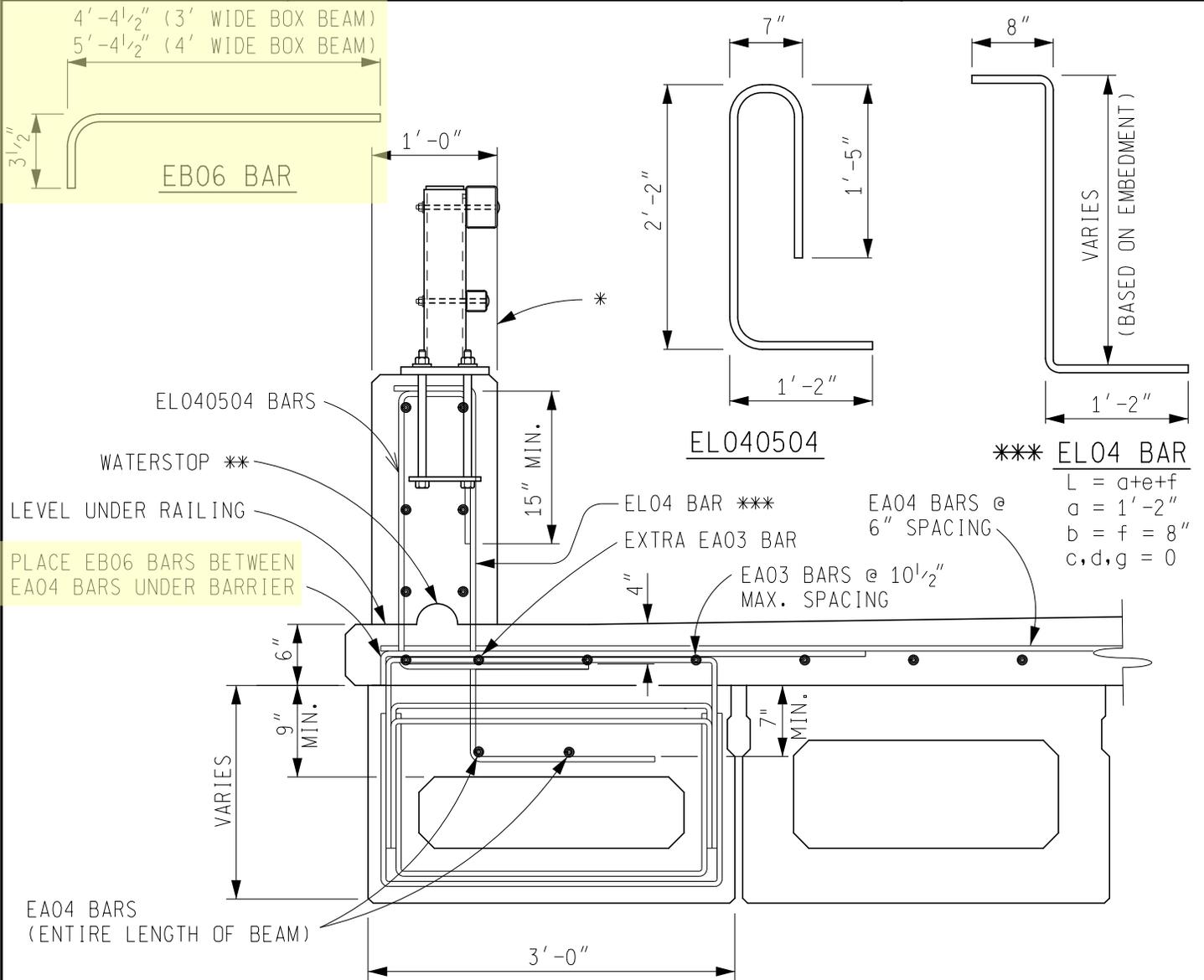
PREPARED BY
 DESIGN DIVISION

6.29.10B

DRAWN BY: BLT
 CHECKED BY: VZ
 APPROVED BY: DAJ

MICHIGAN DEPARTMENT OF TRANSPORTATION
 BUREAU OF HIGHWAY DEVELOPMENT
 AESTHETIC PARAPET TUBE RAILING ON
 PRESTRESSED CONCRETE BOX BEAM

ISSUED: 05/23/16
 SUPERSEDES: 02/27/12



BEAM DESIGN MUST BE CHECKED FOR ADDITIONAL DEAD LOAD AND POSSIBLE PULLOUT OF ELO4 BAR.

FOR ANGLE OF CROSSING 70° TO 90° PLACE TRANSVERSE STEEL PARALLEL TO REF. LINE.

FOR ANGLE OF CROSSING < 70° AND SPAN LENGTH > DECK WIDTH PLACE TRANSVERSE STEEL ⊥ TO BRIDGE ⊕.

FOR ANGLE OF CROSSING < 70° AND SPAN LENGTH < DECK WIDTH PLACE TRANSVERSE STEEL || TO REF. LINE.

PLACE LONGITUDINAL STEEL PARALLEL TO BRIDGE ⊕ IN ALL CASES.

* PERPENDICULAR TO PLANE OF SLAB - NORMAL CROWN SECTION AND HIGH SIDE OF SUPERELEVATED SECTIONS.

VERTICAL - LOW SIDE OF SUPERELEVATED SECTIONS.

** 2" HIGH x 4" LONG (±). FORMING NOT REQUIRED.

FOR ADDITIONAL DETAILS OF BRIDGE RAILING, SEE STANDARD PLAN B-25-SERIES.

BARS WITH PREFIX "E" ARE TO BE EPOXY COATED.

PREPARED BY
 DESIGN DIVISION

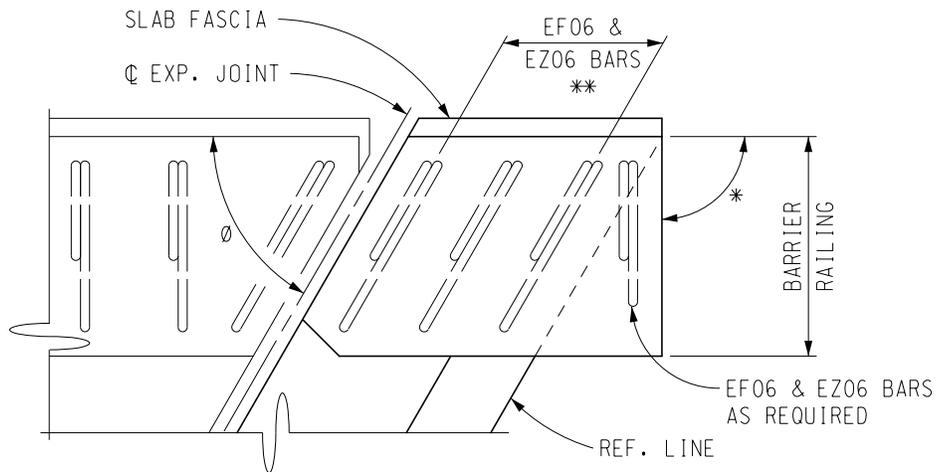
6.29.10D

DRAWN BY: BLT
 CHECKED BY: VZ
 APPROVED BY: DAJ

MICHIGAN DEPARTMENT OF TRANSPORTATION
 BUREAU OF HIGHWAY DEVELOPMENT

ISSUED: 05/23/16
 SUPERSEDES: 05/04/06

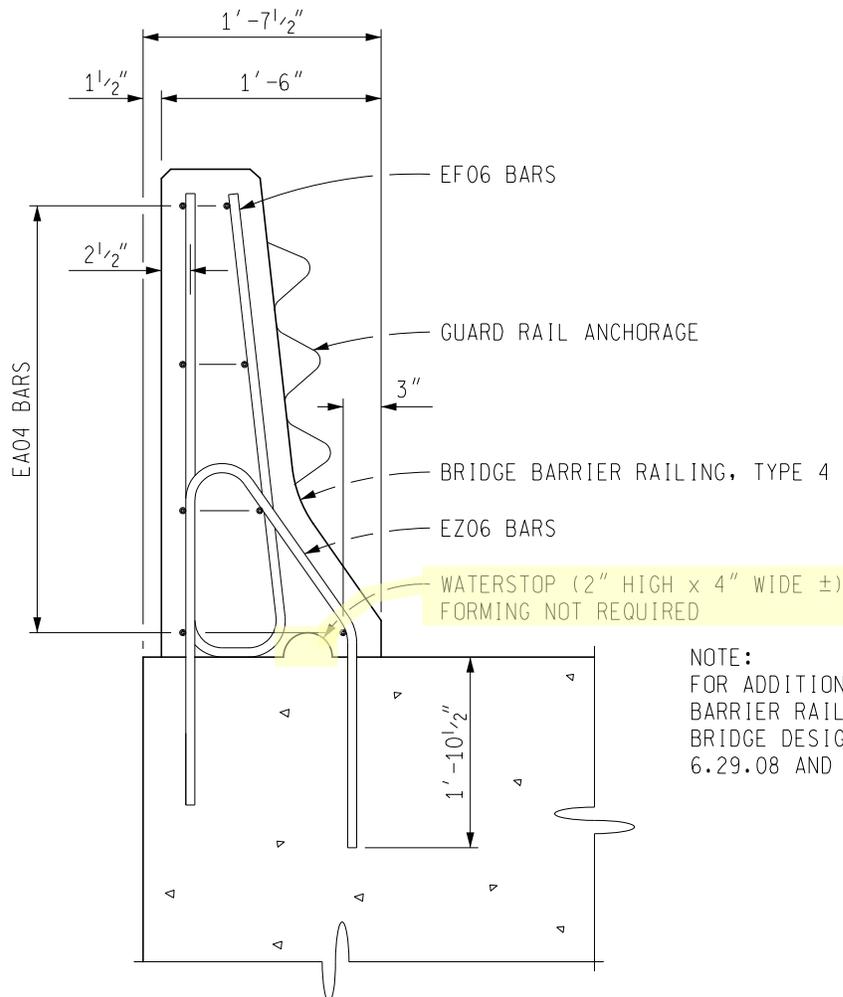
BARRIER RAILING DETAILS
 AT INDEPENDENT BACKWALL



PLAN

* WHEN $\theta \leq 70^\circ$ OR $\theta \geq 110^\circ$, CAST BARRIER END SQUARE; OTHERWISE CAST PARALLEL TO REFERENCE LINE.

** WHEN $\theta \leq 80^\circ$ OR $\theta \geq 100^\circ$, PLACE BARS PARALLEL TO REFERENCE LINE, OTHERWISE PLACE PERPENDICULAR TO BARRIER.



NOTE:
 FOR ADDITIONAL DETAILS OF
 BARRIER RAILINGS, SEE
 BRIDGE DESIGN GUIDES
 6.29.08 AND 6.29.09.

SECTION A-A

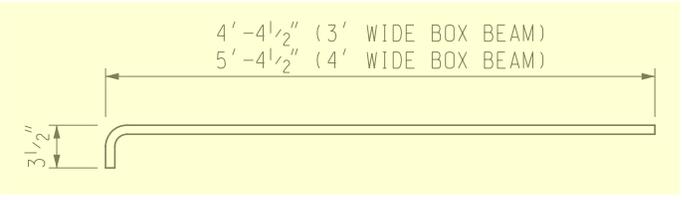
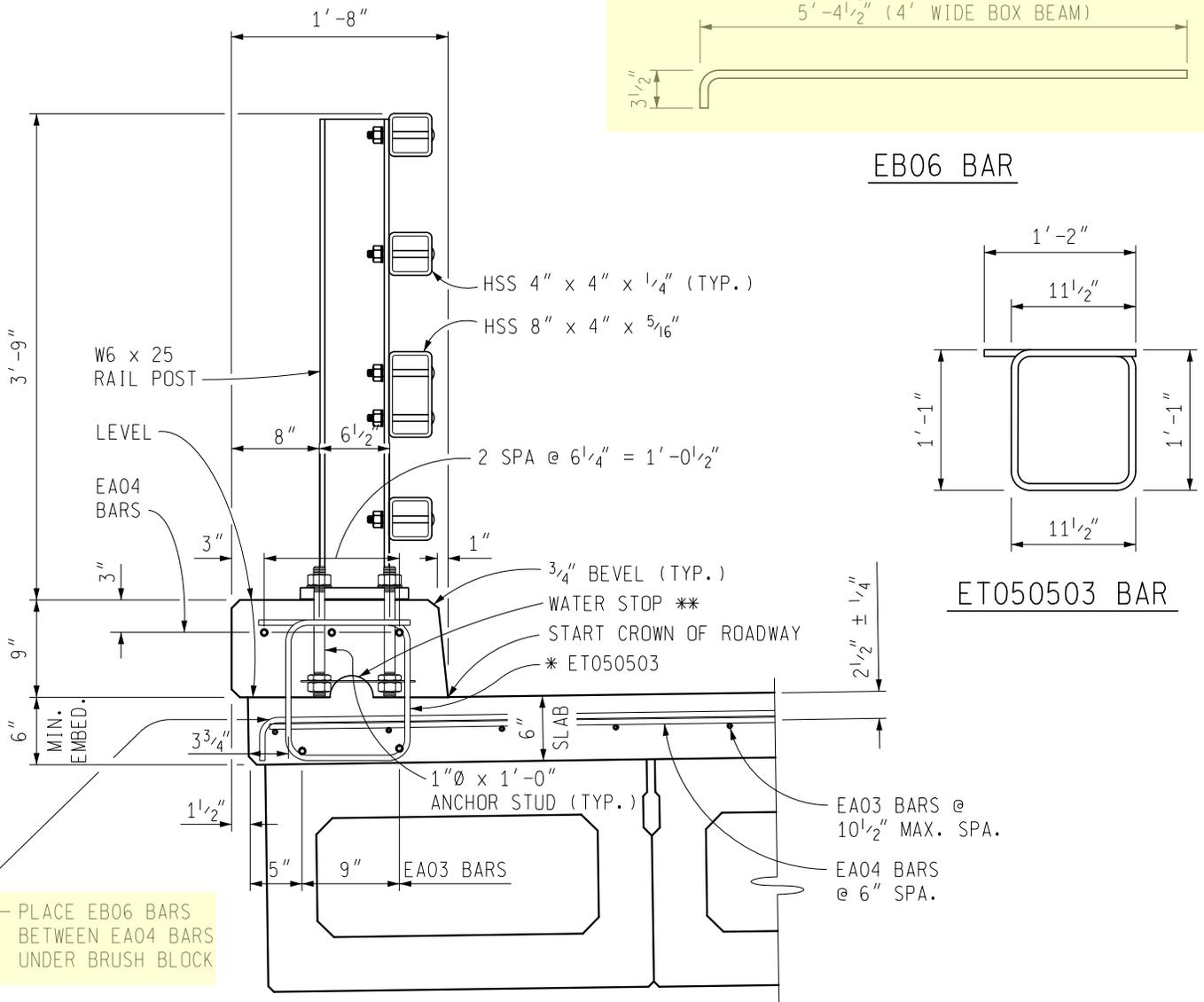
PREPARED BY
 DESIGN DIVISION

6.29.16A

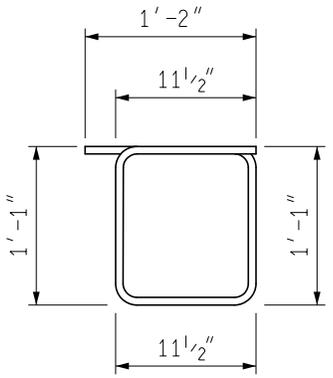
DRAWN BY: BLT
 CHECKED BY: VZ
 APPROVED BY: DAJ

MICHIGAN DEPARTMENT OF TRANSPORTATION
 BUREAU OF HIGHWAY DEVELOPMENT
 BRIDGE RAILING, 4 TUBE - BICYCLE RAILING
 OPTION ON PRESTRESSED BOX BEAM DECK

ISSUED: 05/23/16
 SUPERSEDES: 05/04/06



EB06 BAR



ET050503 BAR

PLACE EB06 BARS
 BETWEEN EA04 BARS
 UNDER BRUSH BLOCK

NOTES:

- FOR ANGLE OF CROSSING 70° TO 90°, PLACE TRANSVERSE STEEL PARALLEL TO REF. LINE.
- FOR ANGLE OF CROSSING < 70° AND SPAN LENGTH < DECK WIDTH, PLACE TRANSVERSE STEEL ⊥ TO BRIDGE C.
- FOR ANGLE OF CROSSING < 70° AND SPAN LENGTH > DECK WIDTH, PLACE TRANSVERSE STEEL || TO REF. LINE.
- PLACE LONGITUDINAL STEEL PARALLEL TO BRIDGE C IN ALL CASES.

* AT EACH POST PLACE 7 - ET050503 BARS SPACED AT 6". PLACE ET050503 BARS AT 12" MAX. IN REMAINING AREAS.

** 2" HIGH x 4" LONG (±). FORMING NOT REQUIRED.

BARS WITH PREFIX "E" ARE TO BE EPOXY COATED.

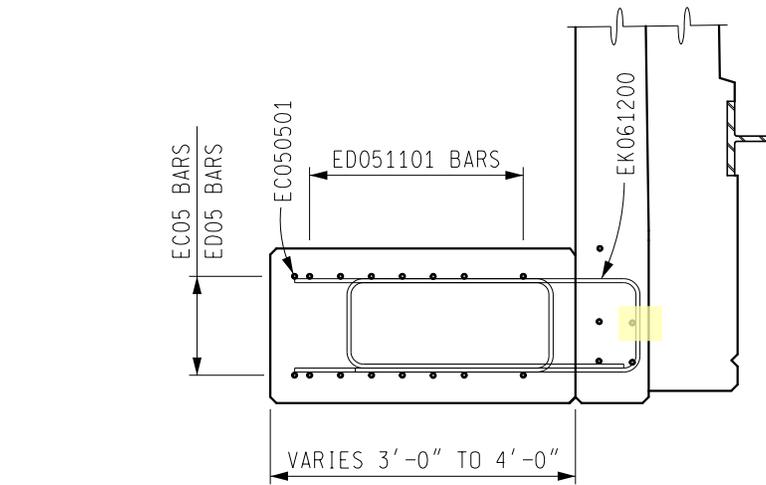
FOR ADDITIONAL DETAILS OF RAILING, SEE STANDARD PLAN B-26-SERIES.

DRAWN BY: BLT
 CHECKED BY: VZ
 APPROVED BY: DAJ

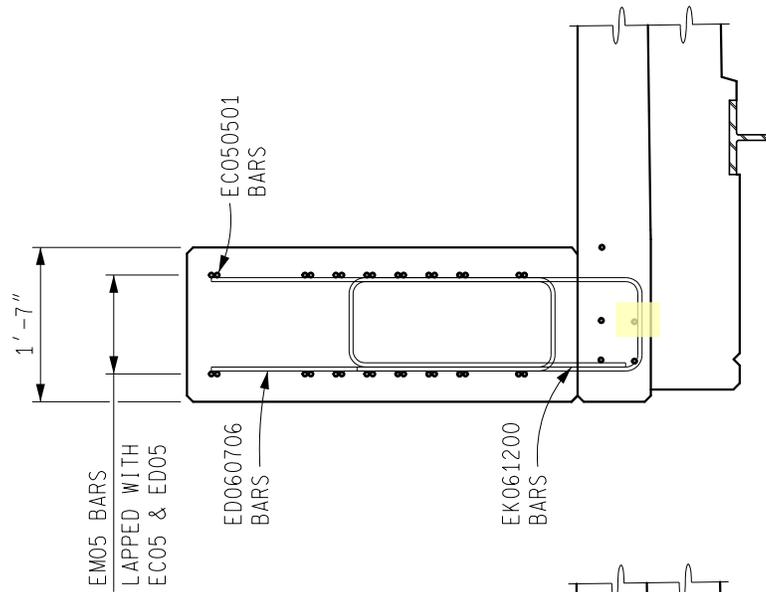
MICHIGAN DEPARTMENT OF TRANSPORTATION
 BUREAU OF HIGHWAY DEVELOPMENT

BRIDGE RAILING, 4 TUBE
 PEDESTRIAN RAILING SECTION

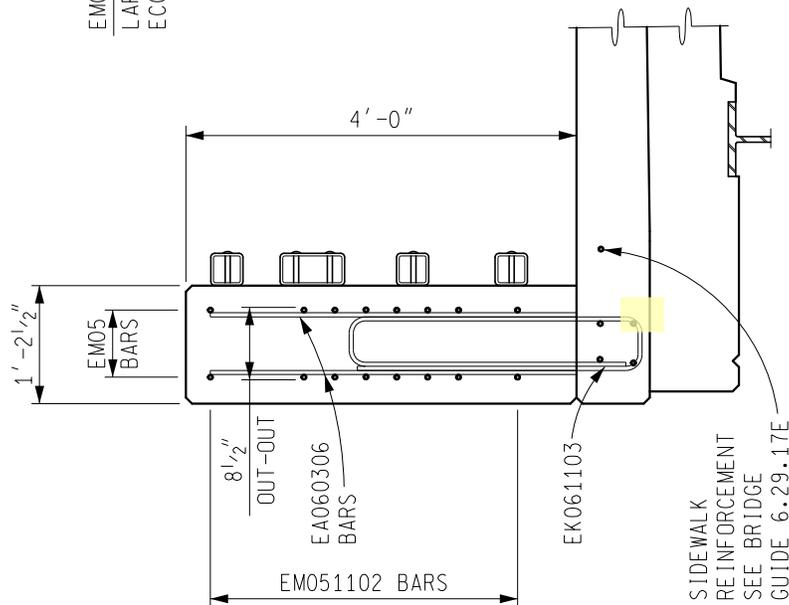
ISSUED: 05/23/16
 SUPERSEDES: 08/15/03



SECTION F-F



SECTION E-E



SECTION D-D