



# Road & Bridge Design Publications

Monthly Update – March 2023

This update is dedicated to Carlos Libiran who is retiring after 40 years of MDOT service and 35 years within the Standards Unit. He has been a guiding light, mentor, leader and friend. It is with sadness and envy that we bid him a fond farewell. His contributions will be sorely missed.

The Standards Unit

Revisions for the month of **March** are listed and displayed below and will be included in projects submitted for the **July** letting.

E-mail road related questions to [MDOT-Road-Design-Standards@michigan.gov](mailto:MDOT-Road-Design-Standards@michigan.gov).

E-mail bridge related questions to [MDOT-Bridge-Design-Standards@michigan.gov](mailto:MDOT-Bridge-Design-Standards@michigan.gov).

## Standard Plans

R-56-F: Guardrail Median Object Protection: On sheets one, four, and five, extended the length of the Guardrail Approach Terminal, Type 3B (Option 1) to include the 12'-6" of Type BD guardrail, which was previously shown separately but paid for as part of the terminal.

R-63-C: Guardrail Approach Terminal, Type 3B & 3T: Added a new sheet displaying the full length of the "C-A-T" terminal and the guardrail it ties into. (The length of the Guardrail Approach Terminal, Type 3B (Option 1) was extended to include the 12'-6" of Type BD guardrail which was previously shown separately but paid for as part of the terminal.) On sheets one and ten, added guardrail Types BD & MGS-8 to the types of guardrail the terminal ties into.

R-88-E: Steel End Section: Eliminated the "C" dimension (to match the 2020 Standard Specifications for Construction) as this length of culvert is no longer paid for in the cost of the steel end section.

## Bridge Design Manual

3.01: The construction of culverts with a span between 10' and 20' using staged construction presents unique challenges that can increase the risk of these projects exceeding the programmed budget and delaying the completion of construction. To mitigate these risks a Structure Study is required for projects involving a culvert with a clear span between 10' and 20' that is constructed using staged construction.



# Road & Bridge Design Publications

## Monthly Update – March 2023

7.02.19 B.: Provided clarification that slab overhangs must be designed on all projects regardless of the overhang width. Any slab reinforcement shown in the MDOT Bridge Design Guides is the minimum reinforcement required, and if the design requires larger or additional reinforcement it must be included in the plan details.

7.02.31 D.: Added information on shear stud payment and detailing when deck replacements include widening and adding beam lines.

7.07.03: Clarified that Standard Plan R-45-Series approach pavement should be used at semi-integral abutments with fixed bearings. In general, R-45-Series approach pavements are used at all bridges regardless of roadway approach type or abutment type. Integral and semi-integral abutments, independent backwalls with a sliding slab and sleeper slabs just move the location further from the bridge.

### **Bridge Design Guides**

6.29.06, 6.29.10, 6.29.10C, 6.29.17, 6.29.17E: Provided clarification that slab overhangs must be designed on all projects regardless of the overhang width. Any slab reinforcement shown on the Bridge Design Guides is the minimum reinforcement required, and if the design requires larger or additional reinforcement it must be included in the plan details.

Updates to the MDOT Cell Library, Sample Plans, and other automated tools may be required in tandem with some of this month's updates. Until such updates 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

**3-27-2023**

⑥

SPECIAL DETAIL NUMBER	NUMBER OF SHEETS	TITLE	CURRENT DATE
21	2	GUARDRAIL AT INTERSECTIONS	6-6-22
24	8	GUARDRAIL ANCHORED IN BACKSLOPE TYPES 4B, 4T, & 4MGS-8	12-6-22
99	2	CHAIN LINK FENCE WITH WIRE ROPE	12-6-22
R-32-F	8	APPROACH CURB & GUTTER DOWNSPOUTS	9-20-22
R-32-SD	6	APPROACH CURB & GUTTER DOWNSPOUTS (FOR EXISTING RAILINGS)	12-6-22
R-43-J	2	LOCATION OF TRANSVERSE JOINTS IN PLAIN CONCRETE PAVEMENT	1-4-22
R-44-G	6	CONCRETE PAVEMENT REPAIR	2-27-23
R-45-K	2	PAVEMENT REINFORCEMENT FOR BRIDGE APPROACH	1-4-22
R-53-A	22	TEMPORARY CONCRETE BARRIER LIMITED DEFLECTION	8-14-15
<b>*R-56-F</b>	<b>6</b>	<b>GUARDRAIL MEDIAN OBJECT PROTECTION</b>	<b>3-7-23</b>
R-60-J	17	GUARDRAIL TYPES A, B, BD, T, TD, MGS-8, & MGS-8D	12-3-21
R-62-H	4	GUARDRAIL APPROACH TERMINAL TYPE 2M	6-16-22
<b>*R-63-C</b>	<b>17</b>	<b>GUARDRAIL APPROACH TERMINAL TYPES 3B &amp; 3T</b>	<b>3-7-23</b>
R-66-E	4	GUARDRAIL DEPARTING TERMINAL TYPES B, T, & MGS	9-28-18
R-67-G	16	GUARDRAIL ANCHORAGE, BRIDGE, DETAILS	12-6-22
R-67-SD	7	GUARDRAIL ANCHORAGE, BRIDGE, DETAILS (FOR EXISTING RAILINGS)	12-6-22
R-72-D	6	GUARDRAIL LONG SPAN INSTALLATIONS	8-23-22
R-73-F	3	GUARDRAIL OVER BOX OR SLAB CULVERTS	8-1-19
R-80-F	8	GRANULAR BLANKETS, UNDERDRAINS, OUTLET ENDINGS, & BULKHEADS	6-28-21
<b>*R-88-E</b>	<b>4</b>	<b>STEEL END SECTION</b>	<b>3-7-23</b>
R-100-I	4	SEEDING AND TREE PLANTING	8-3-21
R-110-B	3	PAVEMENT SAFETY EDGE	6-14-21
R-112-J	10	SHOULDER AND CENTER LINE CORRUGATIONS	9-7-22
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 July letting.**

Notes:

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 Bureau of Bridges & Structures, Structure Design Section, Special Structures Unit will provide special details for inclusion in construction plans for MDOT jobs. To assure prompt delivery, requests **must be made in advance**. Contact: [MDOT-TriezenbergSquad@Michigan.gov](mailto:MDOT-TriezenbergSquad@Michigan.gov)

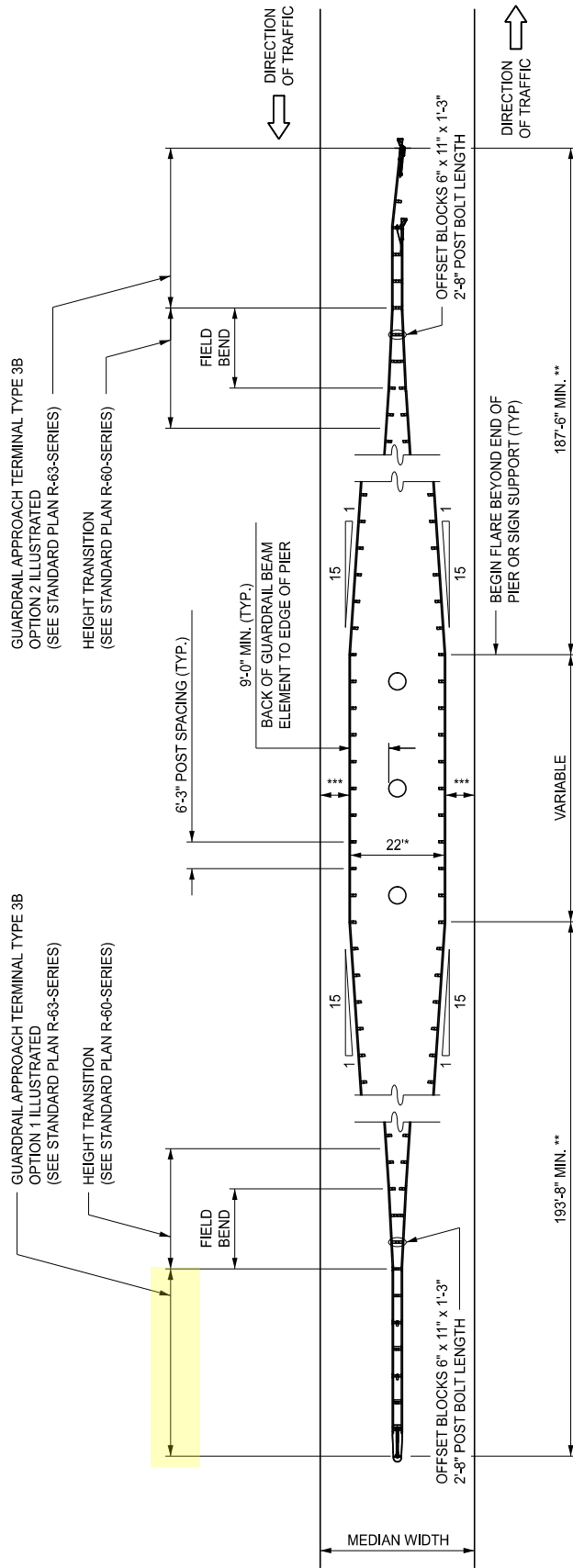
Former Standard Plans IV-93 and IV-94 series have been replaced with precast concrete box & three-sided culverts as per the 2020 Standard Specifications for Construction.

# Index to Bridge Detail Sheets

**3-27-2023**

⑦

DETAIL NUMBER	NUMBER OF SHEETS	TITLE	CURRENT DATE
B-28-A	7	BRIDGE BARRIER RAILING, TYPE 7	9-2-20
B-29-A	8	BRIDGE BARRIER RAILING, TYPE 6	9-2-20
EJ3AF	1 to 4	EXPANSION JOINT DETAILS (See Notes)	1-23-23
EJ4S	1 to 4	EXPANSION JOINT DETAILS (See Notes)	1-23-23
PC-1N	2	PRESTRESSED CONCRETE I-BEAM DETAILS (See Notes)	11-28-22
PC-2I	2	70" PRESTRESSED CONCRETE I-BEAM DETAILS (See Notes)	11-28-22
PC-4G	2	PRESTRESSED CONCRETE 1800 BEAM DETAILS (See Notes)	11-28-22
PC-5A	2	PRESTRESSED CONCRETE BULB-TEE BEAM DETAILS (See Notes)	11-28-22
<p style="text-align: center;"><b>* Denotes New or Revised Special Detail to be included in projects for (beginning with) the July letting.</b></p> <p>Notes:           Details EJ3AF &amp; EJ4S are interactive, i.e., designers and detailers choose details based upon railing type and angle of crossing and fill in the project specific dimensions for the end plate. Place all details appropriate for the project (including the end plate), structure specific information, and the Expansion Joint Device quantity on the sheet. Add the sheet to the plans as a normal plan sheet. Call out and designate the location of the expansion joint device and the end plate on the Superstructure Sheet in the plan set.</p> <p style="margin-left: 40px;">Details PC-1N, PC-2I, PC-4G, and PC-5A 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.</p>			



TYPICAL LAYOUT AT PIERS AND SIGN SUPPORTS USING GUARDRAIL TYPE MGS-8

\* THE 22' DIMENSION IS CENTERED ON THE PIER OR MEDIAN FROM BACK OF GUARDRAIL TO BACK OF GUARDRAIL. FOR PIERS GREATER THAN 4' IN WIDTH/DIAMETER, INCREASE THE 22' DIMENSION TO PIER WIDTH/DIAMETER + 18'.

\*\* INCREASE LENGTH BY 7.5' FOR EACH FOOT OF PIER WIDTH/DIAMETER ABOVE 4'.

\*\*\* ENSURE NO PORTION OF GUARDRAIL ENCROACHES ON SHOULDER.

FOR MEDIANS 36' WIDE  
TO MEDIANS LESS THAN 70' WIDE  
USING GUARDRAIL TYPE MGS-8



ACTING DEPARTMENT DIRECTOR  
Bradley C. Wiefelich

MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF DEVELOPMENT STANDARD PLAN FOR

PREPARED BY  
DESIGN DIVISION

APPROVED BY: \_\_\_\_\_  
DIRECTOR, BUREAU OF FIELD SERVICES

GUARDRAIL  
MEDIAN OBJECT PROTECTION

DRAWN BY: B.L.T.  
CHECKED BY: W.K.P.

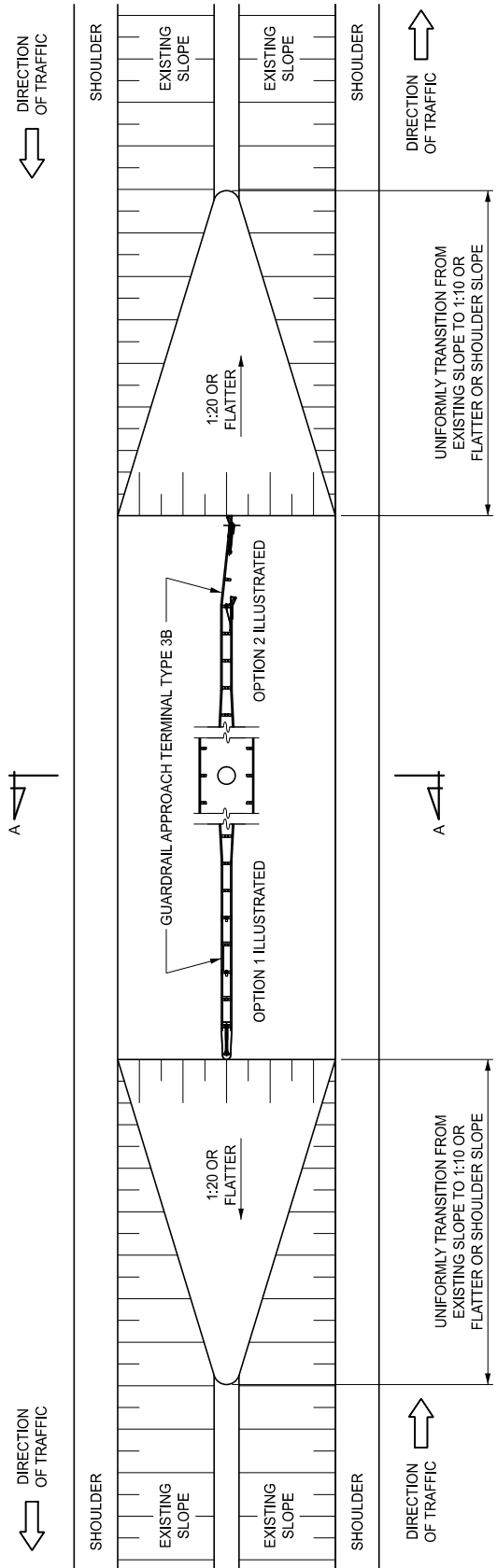
APPROVED BY: \_\_\_\_\_  
DIRECTOR, BUREAU OF DEVELOPMENT

F.H.W.A. APPROVAL

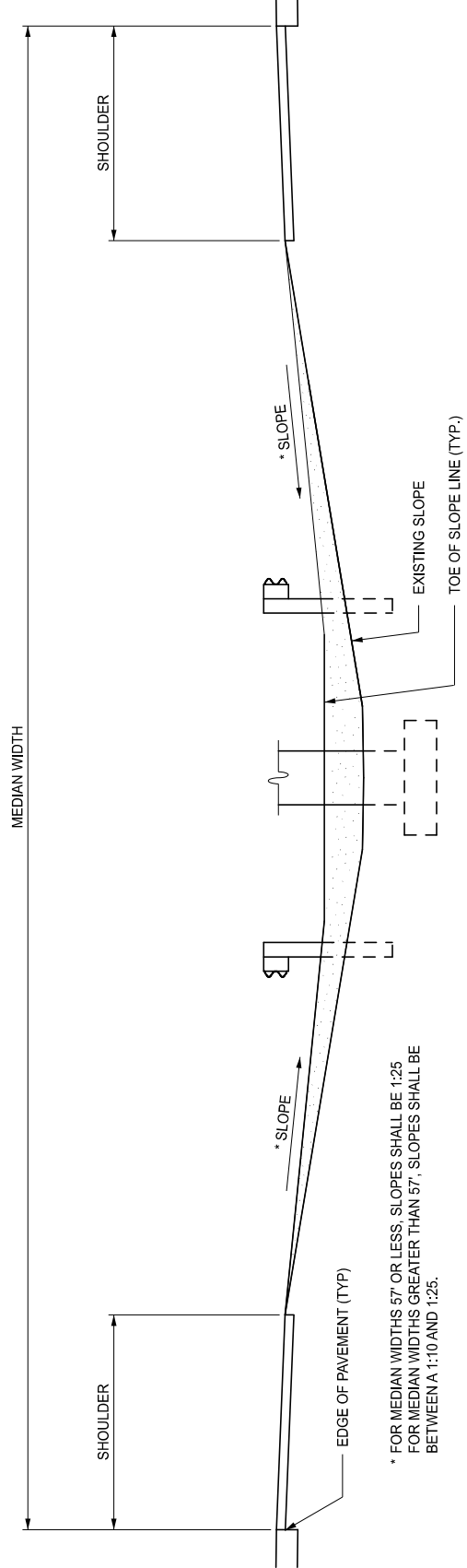
3-7-2023  
PLAN DATE

R-56-F

SHEET  
1 OF 6



GRADING OF SLOPES AT PIERS



SECTION A-A  
 GRADING IN MEDIANS FROM 36' TO LESS THAN 70' IN WIDTH  
 USING GUARDRAIL TYPE MGS-8

MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT STANDARD PLAN FOR			
<h2 style="margin: 0;">GUARDRAIL          MEDIAN OBJECT PROTECTION</h2>			
F.H.W.A. APPROVAL	3-7-2023 PLAN DATE	<h3 style="margin: 0;">R-56-F</h3>	SHEET 2 OF 6

DIRECTION OF TRAFFIC



PIER FOOTING OR SIGN FOUNDATION

MEDIAN C

DIRECTION OF TRAFFIC



GUARDRAIL TYPE MGS-8 VARIABLE LENGTH



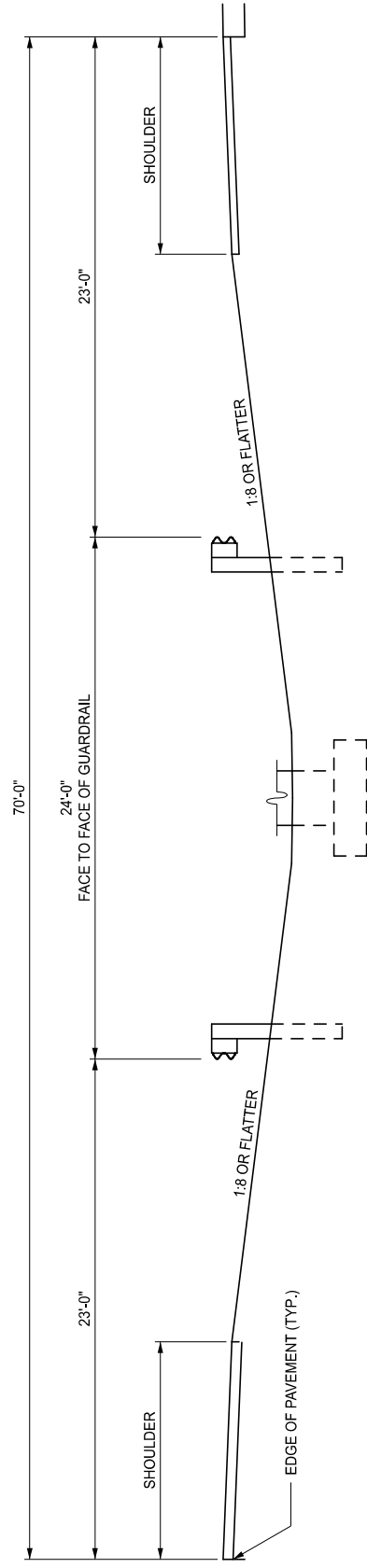
GUARDRAIL DEPARTING TERMINAL TYPE MGS (SEE STANDARD PLAN R-66-SERIES)

75'-0" MIN. GUARDRAIL TYPE MGS-8 IN ADVANCE OF PIER OR SIGN FOUNDATION

GUARDRAIL APPROACH TERMINAL TYPE 2M

70' MEDIAN WIDTH

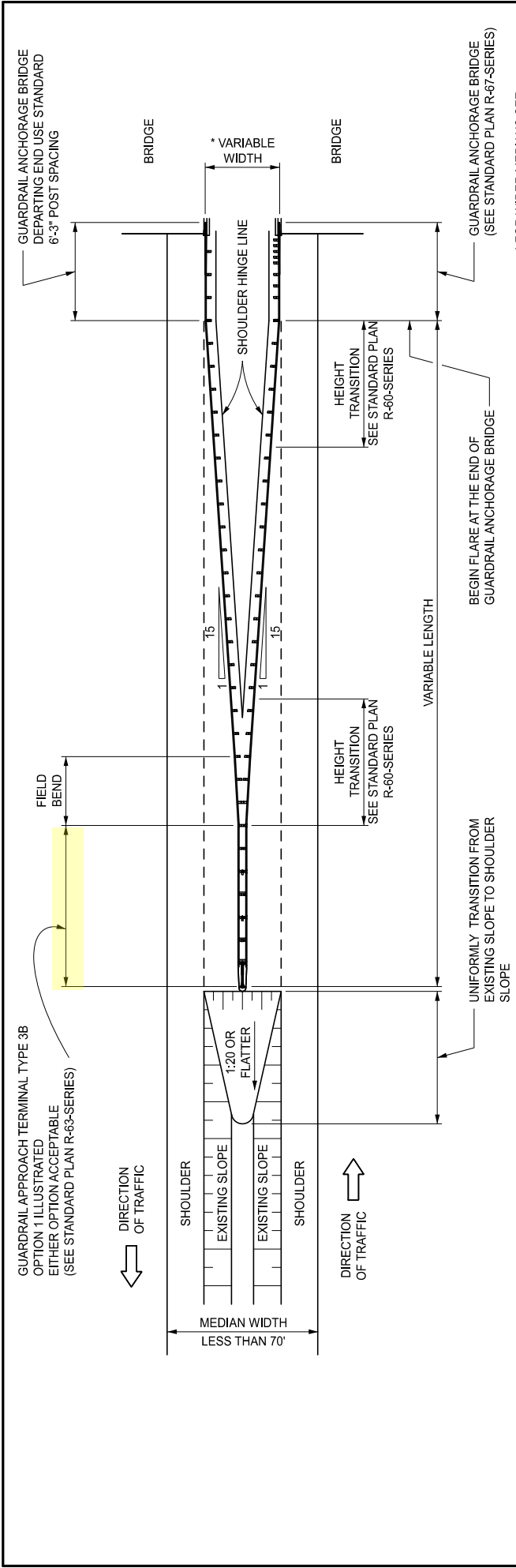
### TWIN PARALLEL GUARDRAIL RUNS USING GUARDRAIL TYPE MGS-8



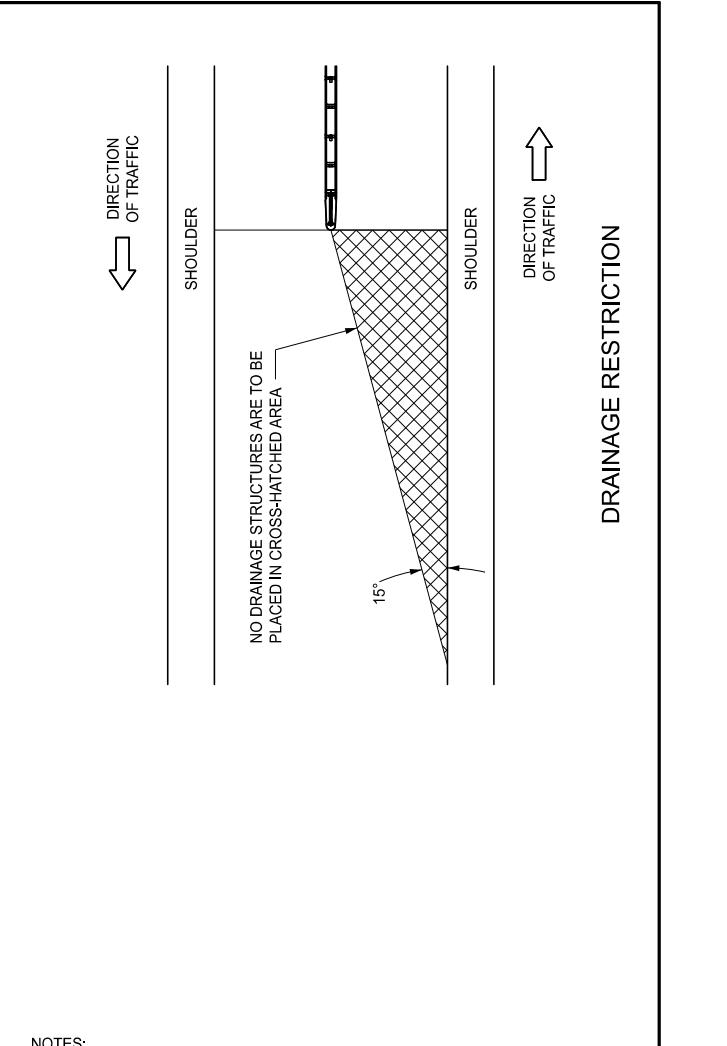
SECTION C-C

### MEDIANS 70' IN WIDTH USING GUARDRAIL TYPE MGS-8

MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT STANDARD PLAN FOR			
<b>GUARDRAIL MEDIAN OBJECT PROTECTION</b>			
F.H.W.A. APPROVAL	3-7-2023 PLAN DATE	<b>R-56-F</b>	SHEET 3 OF 6



### GUARDRAIL AT TWIN BRIDGE APPROACH USING GUARDRAIL TYPE MGS-8



**NOTES:**

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

GUARDRAIL ANCHORAGE, BRIDGE SHALL BE CONSTRUCTED ACCORDING TO STANDARD PLAN R-67-SERIES.

UNLESS INDICATED BY A RADIUS, ALL CURVED GUARDRAIL SHALL BE FIELD BENT.

ANY EXISTING CURB OVER 4" IN HEIGHT SHALL BE REMOVED 150' IN ADVANCE OF THE GUARDRAIL APPROACH TERMINAL OF THE MEDIAN GUARDRAIL INSTALLATION. WHEN IT BECOMES NECESSARY TO USE CURB AND GUTTER IN CONJUNCTION WITH MEDIAN GUARDRAIL INSTALLATIONS, CONTACT THE GEOMETRIC DESIGN UNIT OF THE DESIGN DIVISION.

SLOPES SPECIFIED ON THIS PLAN ARE FOR TYPICAL MEDIAN GUARDRAIL INSTALLATIONS. THE PLACEMENT OF DRAINAGE CULVERTS AND END SECTIONS, WHEN REQUIRED, SHALL BE AS DETAILED ON PLANS OR AS DIRECTED BY THE ENGINEER.

IF THE SPECIFIED MINIMUM OFFSETS FROM THE EDGE OF PIER OR MEDIAN OBJECT TO THE GUARDRAIL CANNOT BE ACHIEVED, EITHER STIFFEN THE GUARDRAIL SYSTEM, AS NEEDED, BY DECREASING THE POST SPACING OR USE CONCRETE BARRIER TO SHIELD THE PIER(S)/MEDIAN OBJECT(S). CONTACT THE GEOMETRIC DESIGN UNIT OF THE DESIGN DIVISION FOR GUIDANCE.

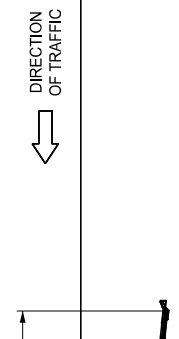
MEDIAN GUARDRAIL INSTALLATIONS ARE NOT REQUIRED IN MEDIANS THAT ARE GREATER THAN 70' IN WIDTH, UNLESS THE OBJECT BEING PROTECTED IS IN THE TARGET PATH OF A CURVE.

WHEN MEDIAN GUARDRAIL INSTALLATIONS ARE TO BE PLACED ON CURVES, CONTACT THE GEOMETRIC DESIGN UNIT OF THE DESIGN DIVISION.

MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT STANDARD PLAN FOR			
<h2 style="margin: 0;">GUARDRAIL MEDIAN OBJECT PROTECTION</h2>			
F.H.W.A. APPROVAL	3-7-2023 PLAN DATE	<h3 style="margin: 0;">R-56-F</h3>	SHEET 4 OF 6



GUARDRAIL APPROACH TERMINAL TYPE 3B  
OPTION 2 ILLUSTRATED  
(SEE STANDARD PLAN R-63-SERIES)



SEE DETAIL BELOW

SEE DETAIL BELOW

DIRECTION OF TRAFFIC

FILLER WALL AND FILLER WALL END BLOCK  
(SEE STANDARD PLAN R-55-SERIES)

TYPICAL LAYOUT

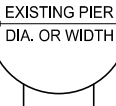
PAID FOR AS GUARDRAIL-ANCHORAGE BRIDGE, DETAIL T-5 (EACH SIDE)

THREE BEAM TERMINAL CONNECTOR & THREE BEAM EXPANSION SECTION  
(SEE STANDARD PLAN R-67-SERIES)

6'-3" POST SPACING

TRANSITION GUARDRAIL TO CONNECT TO GUARDRAIL TYPE B FOR GUARDRAIL APPROACH TERMINAL TYPE 3 (OPTION 1) OR  
TRANSITION GUARDRAIL TO CONNECT TO GUARDRAIL APPROACH TERMINAL TYPE 3 (OPTION 2)

VARIABLE WIDTH TO MATCH PIER



PLAN VIEW

FILLER WALL AND FILLER WALL END BLOCK  
(SEE STANDARD PLAN R-55-SERIES)

PAID FOR AS GUARDRAIL-ANCHORAGE BRIDGE, DETAIL T-5 (EACH SIDE)

43'-9"

FOR POST SPACING SEE STANDARD PLAN R-67-SERIES (APPROACH POST SPACING REQUIREMENTS CHART)

6'-3" SYMMETRICAL THREE BEAM TRANSITION

3-1 1/2" POST SPACING (3 OR 4 SPACES)

1-6 3/4" POST SPACING (4 OR 5 SPACES)

15"

32"

32"

28"

THREE BEAM TERMINAL CONNECTOR & THREE BEAM EXPANSION SECTION  
(SEE STANDARD PLAN R-67-SERIES)

10 GAGE GUARDRAIL REQUIRED IN AREA OF REDUCED POST SPACING

ELEVATION VIEW

GUARDRAIL WITH DIRECT CONNECTION TO PIER

MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF DEVELOPMENT STANDARD PLAN FOR

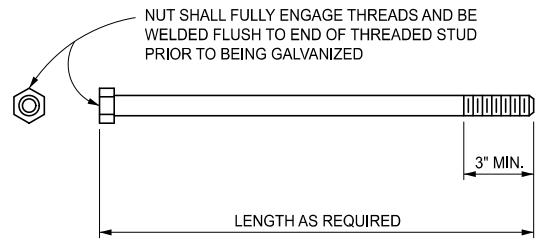
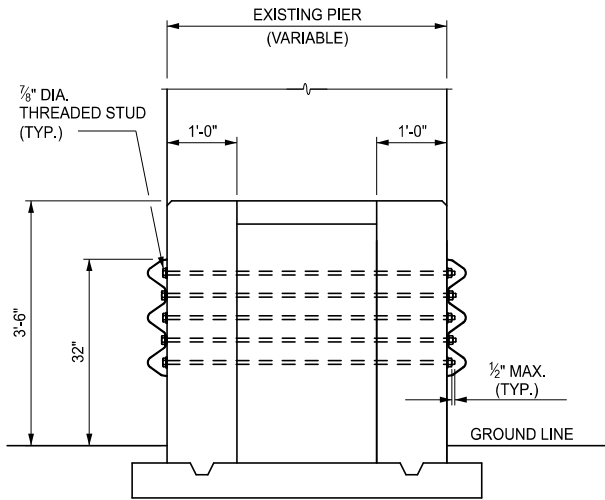
GUARDRAIL  
MEDIAN OBJECT PROTECTION

F.H.W.A. APPROVAL

3-7-2023  
PLAN DATE

R-56-F

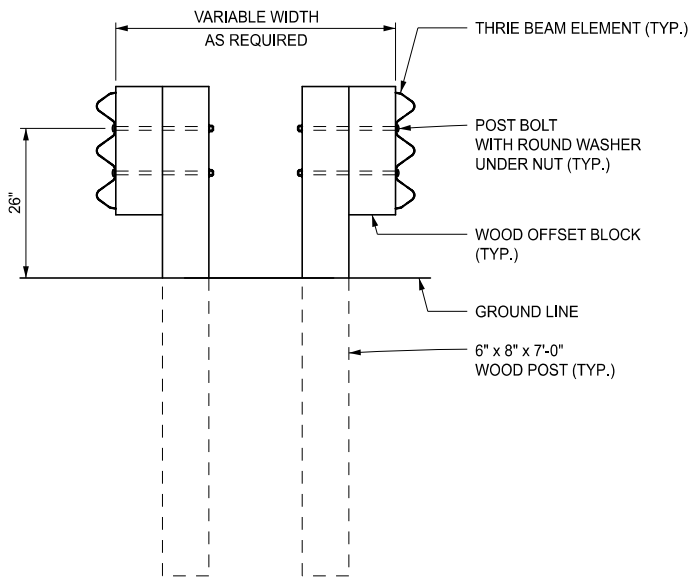
SHEET  
5 OF 6



7/8" DIA. THREADED STUD

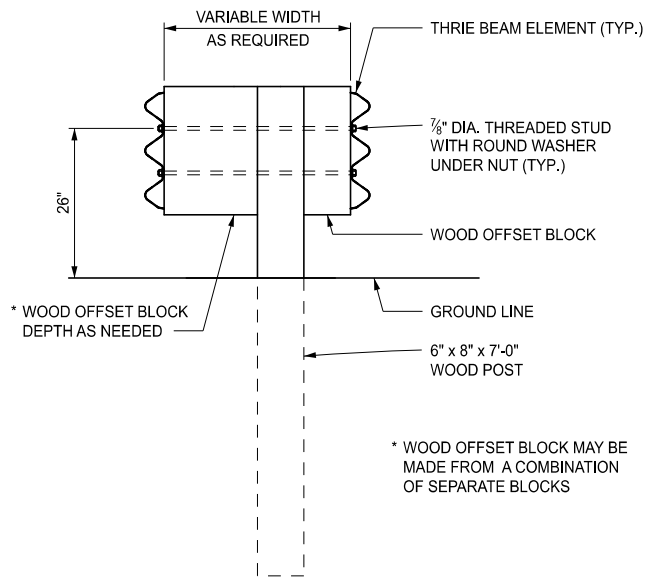
**GUARDRAIL CONNECTION  
AT FILLER WALL**

(FOR FILLER WALL DETAILS SEE STANDARD PLAN R-55-SERIES)



**POST DETAIL**

WHEN WIDTH CAN ACCOMMODATE  
TWO GUARDRAIL POSTS



**POST DETAIL**

WHEN WIDTH CAN ACCOMMODATE  
ONLY ONE GUARDRAIL POST

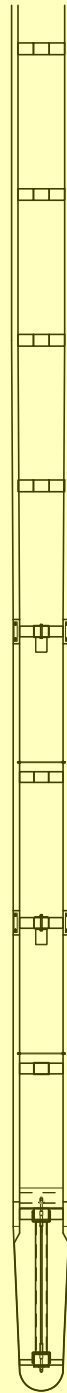
\* WOOD OFFSET BLOCK MAY BE  
MADE FROM A COMBINATION  
OF SEPARATE BLOCKS

MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT STANDARD PLAN FOR			
<h2 style="margin: 0;">GUARDRAIL MEDIAN OBJECT PROTECTION</h2>			
_____ F.H.W.A. APPROVAL	3-7-2023 _____ PLAN DATE	<h3 style="margin: 0;">R-56-F</h3>	SHEET 6 OF 6

DIRECTION OF TRAFFIC

SLOPE NO STEEPER THAN 1:10

EDGE OF SHOULDER



EDGE OF SHOULDER

DIRECTION OF TRAFFIC

PLAN VIEW

GUARDRAIL, TYPE B  
 GUARDRAIL, TYPE BD  
 GUARDRAIL, TYPE MGS-8  
 GUARDRAIL, TYPE MGS-8D \*

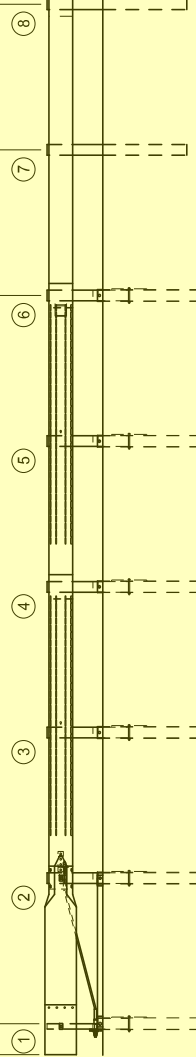
GUARDRAIL APPROACH TERMINAL TYPE 3B (C-A-T)

43'-9"

SEE SHEET 2 FOR POST 1 - 6

12'-6" GUARDRAIL, TYPE BD AND  
 STANDARD POSTS FOR POST 7 AND 8  
 (SEE STANDARD PLAN R-60-SERIES)

28" TYPE B  
 (SEE STANDARD PLAN R-60-SERIES  
 FOR TYPE MGS-8D GUARDRAIL  
 HEIGHT INFORMATION)



\* SEE STANDARD PLAN R-60-SERIES FOR POST SPACING AND  
 GUARDRAIL LAYOUT TO TRANSITION FROM GUARDRAIL, TYPE  
 MGS-8D TO GUARDRAIL APPROACH TERMINAL, TYPE 3B.

AREA OF  
 CONCERN

(X) GUARDRAIL LENGTH OF NEED

ELEVATION  
 GUARDRAIL APPROACH TERMINAL, TYPE 3B  
 "C-A-T"

OPTION 1

(DETAILED ON SHEETS 4 - 9)



ACTING DEPARTMENT DIRECTOR  
 Bradley C. Wiefelich

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT STANDARD PLAN FOR

PREPARED BY  
 DESIGN DIVISION

APPROVED BY: \_\_\_\_\_  
 DIRECTOR, BUREAU OF FIELD SERVICES

GUARDRAIL APPROACH  
 TERMINAL, TYPE 3B & 3T

DRAWN BY: B.L.T.  
 CHECKED BY: W.K.P.

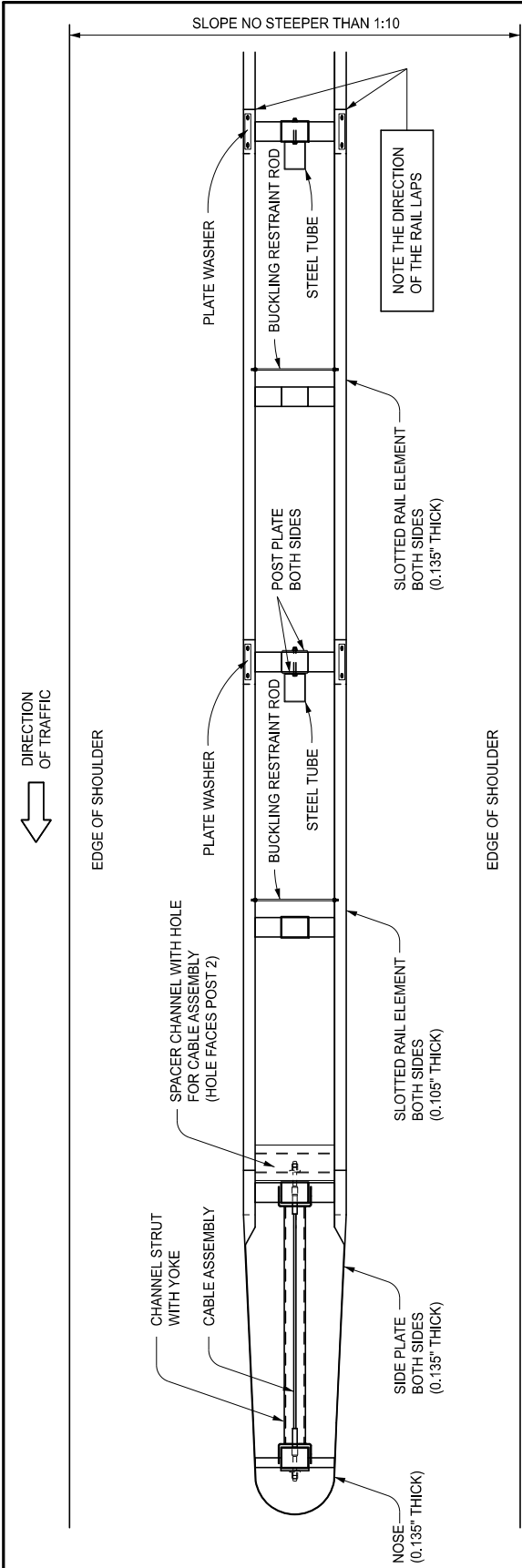
APPROVED BY: \_\_\_\_\_  
 DIRECTOR, BUREAU OF DEVELOPMENT

F.H.W.A. APPROVAL

3-7-2023  
 PLAN DATE

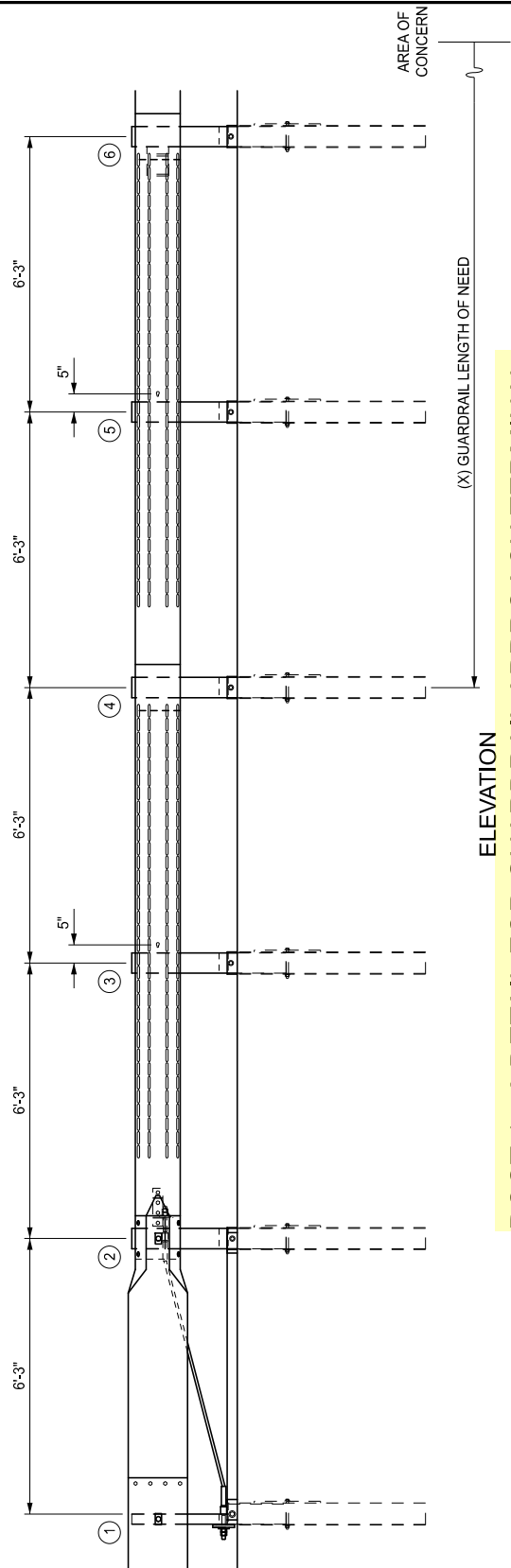
R-63-C

SHEET  
 1 OF 17



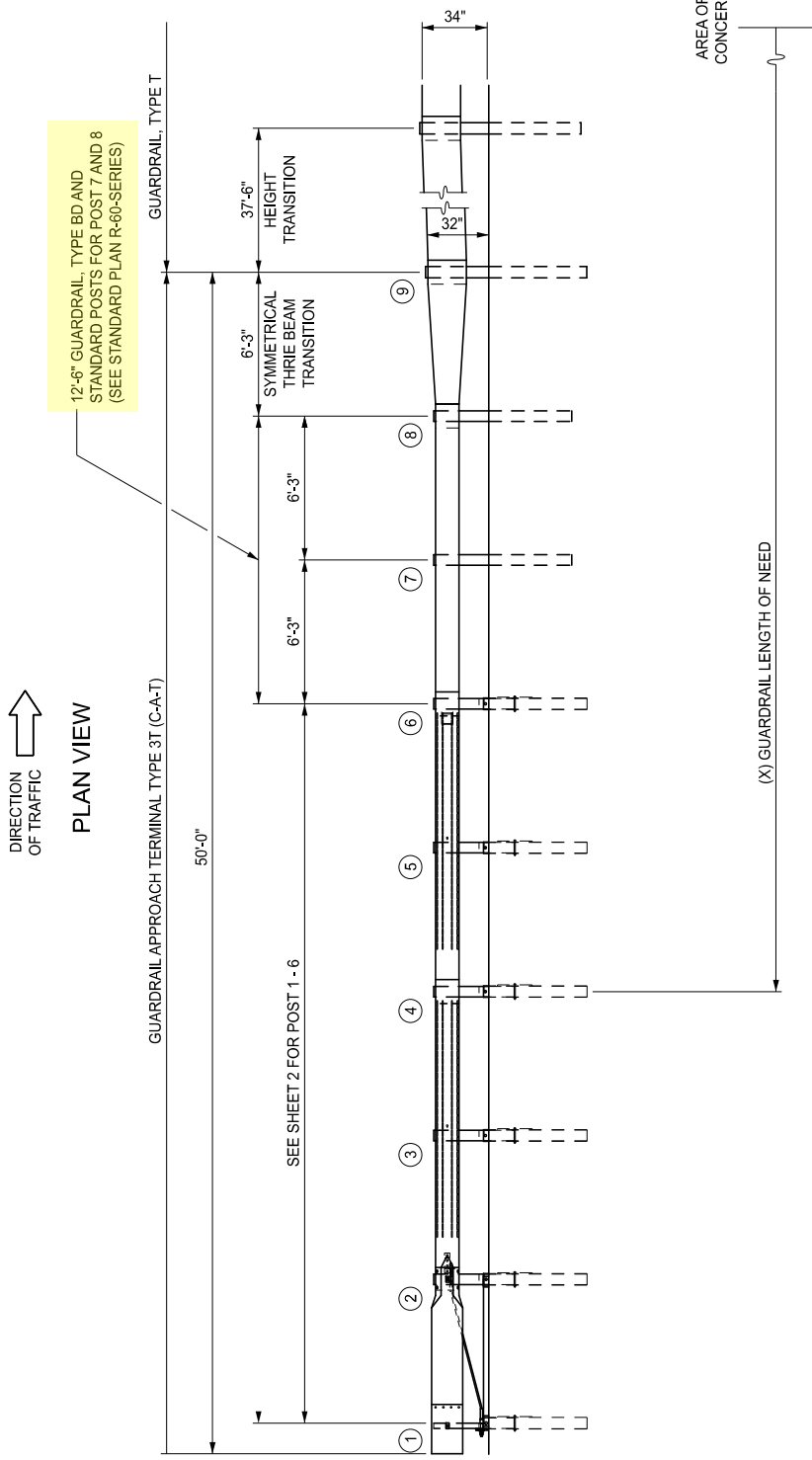
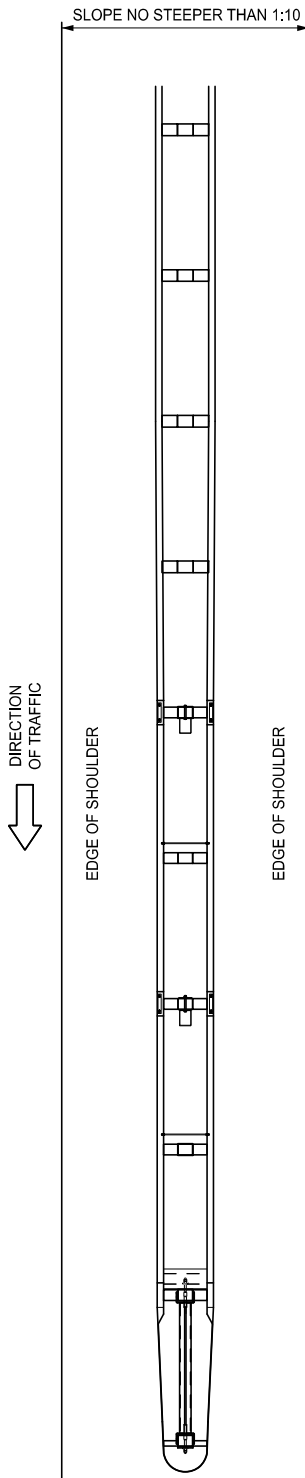
DIRECTION OF TRAFFIC →  
PLAN VIEW

**OPTION 1**  
(DETAILED ON SHEETS 4 - 9)



ELEVATION  
**POST 1 - 6 DETAIL FOR GUARDRAIL APPROACH TERMINAL "C-A-T"**

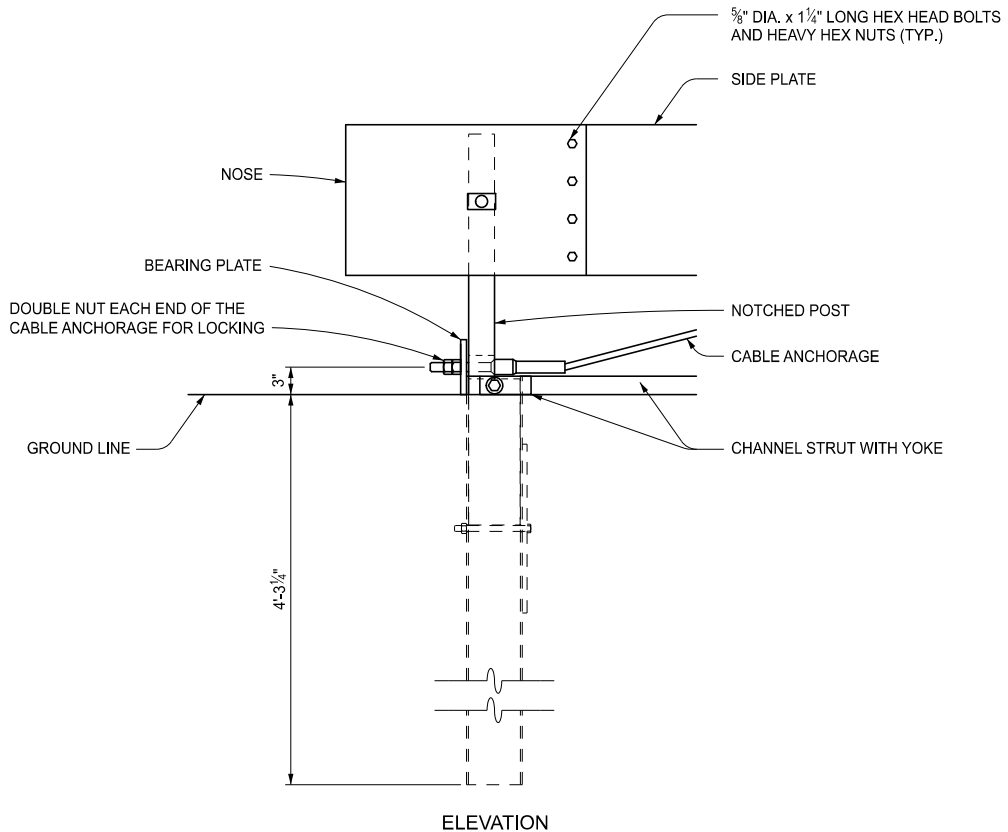
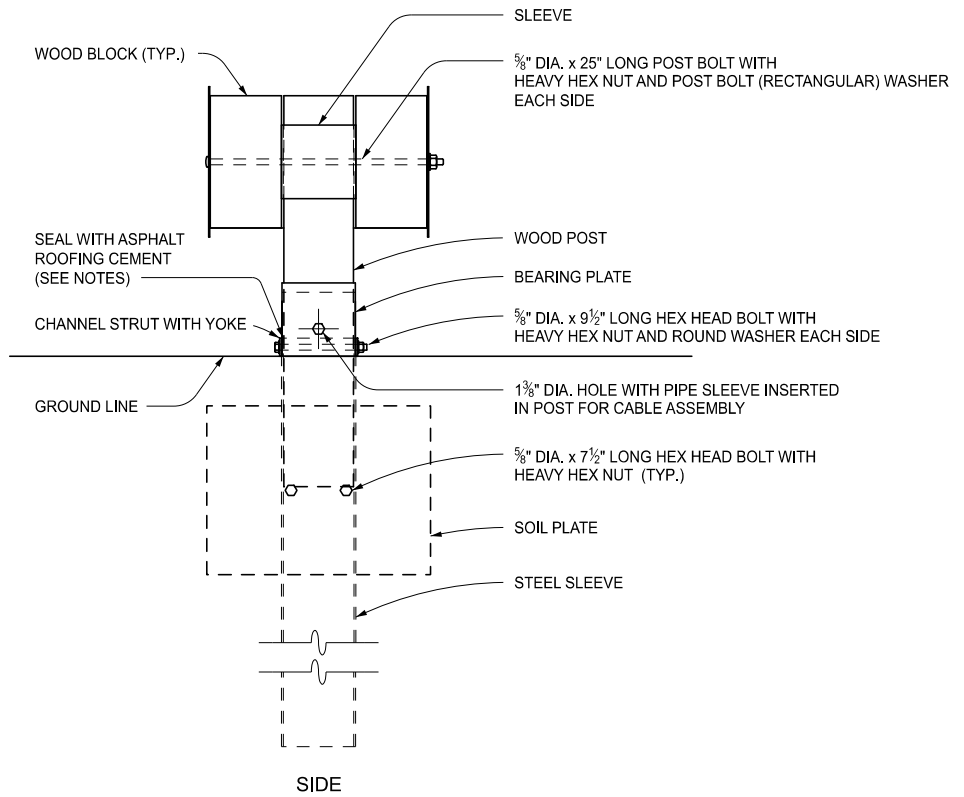
MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT STANDARD PLAN FOR			
<b>GUARDRAIL APPROACH TERMINAL, TYPE 3B &amp; 3T</b>			
F.H.W.A. APPROVAL	3-7-2023 PLAN DATE	R-63-C	SHEET 2 OF 17



ELEVATION  
**GUARDRAIL APPROACH TERMINAL, TYPE 3T**  
**"C-A-T"**

**OPTION 1**  
 (DETAILED ON SHEETS 4 - 9)

MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT STANDARD PLAN FOR			
<b>GUARDRAIL APPROACH          TERMINAL, TYPE 3B &amp; 3T</b>			
F.H.W.A. APPROVAL	3-7-2023 PLAN DATE	<b>R-63-C</b>	SHEET 3 OF 17



POST 1 DETAILS  
(C-A-T)

MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF DEVELOPMENT STANDARD PLAN FOR

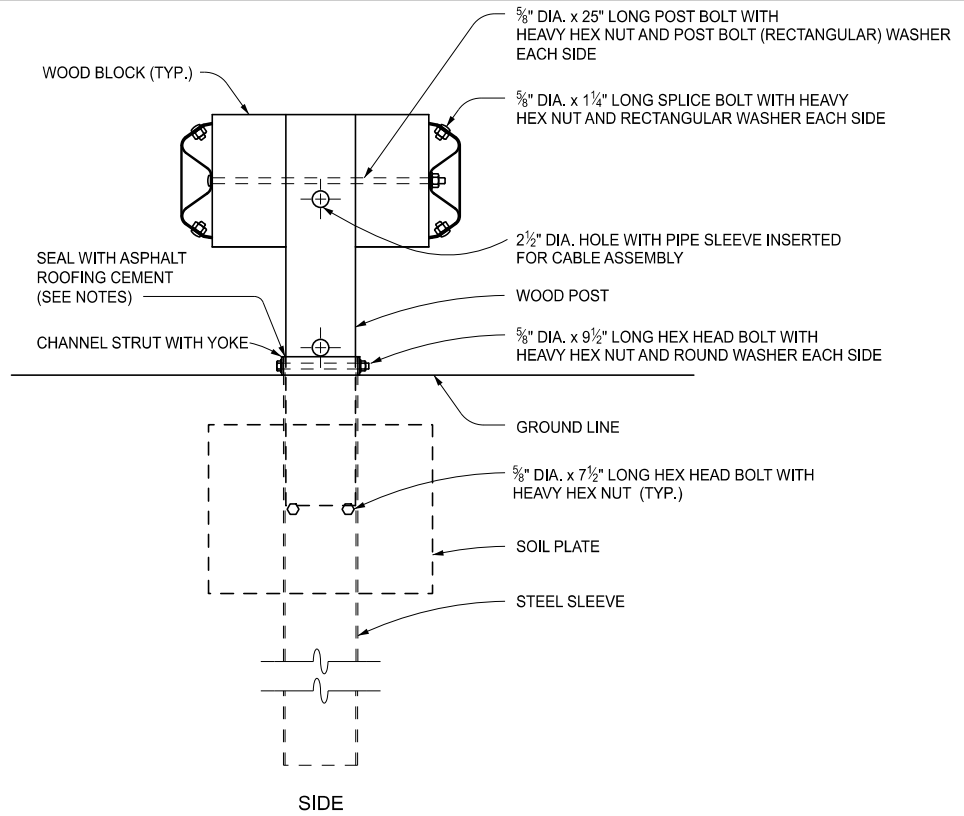
GUARDRAIL APPROACH  
TERMINAL, TYPE 3B & 3T

F.H.W.A. APPROVAL

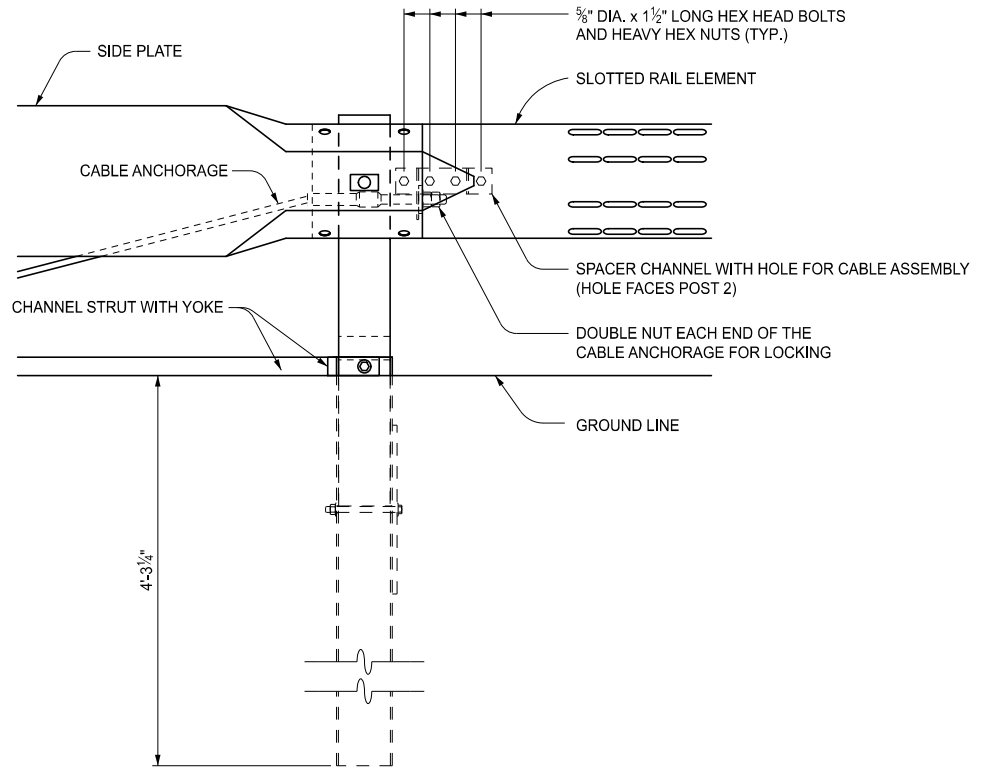
3-7-2023  
PLAN DATE

R-63-C

SHEET  
4 OF 17



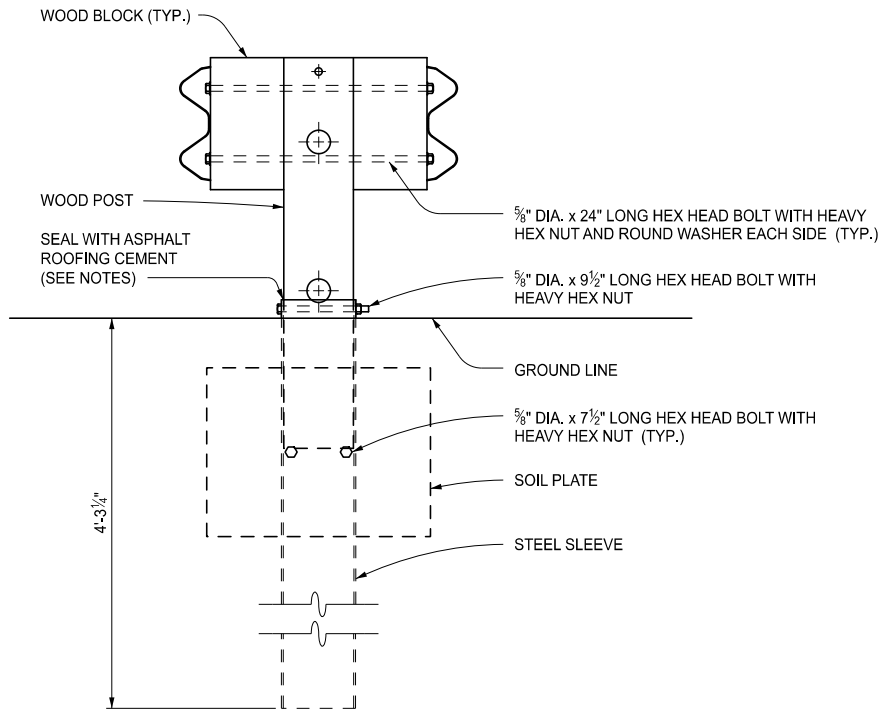
SIDE



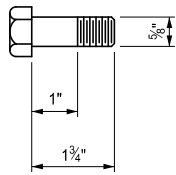
ELEVATION

POST 2 DETAILS  
(C-A-T)

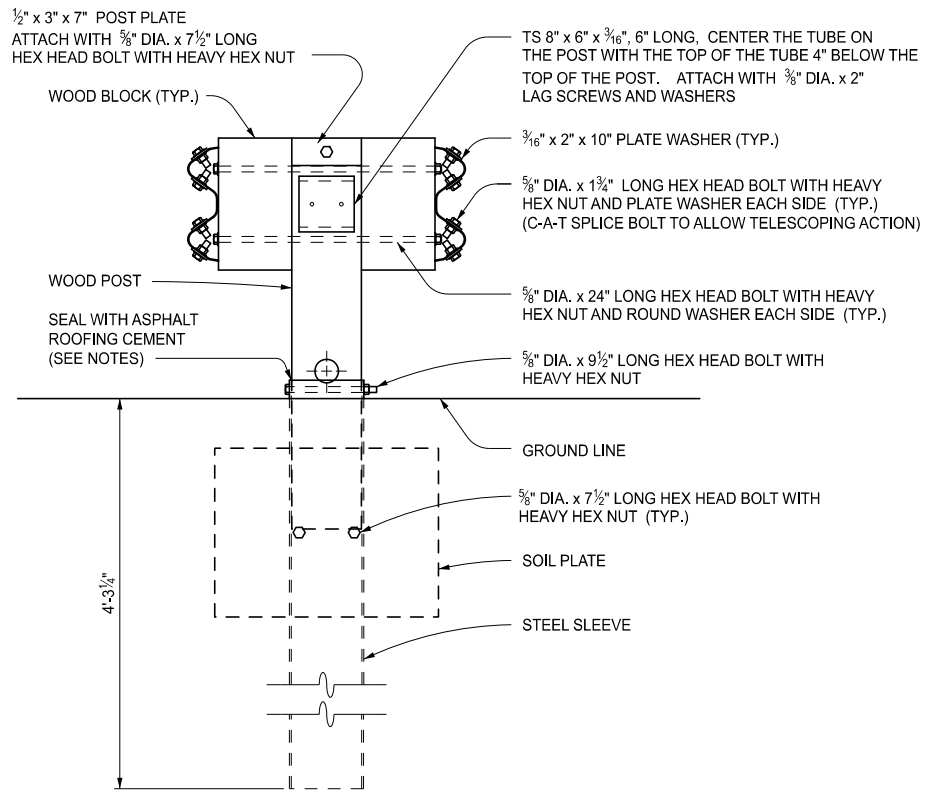
MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT STANDARD PLAN FOR			
<b>GUARDRAIL APPROACH          TERMINAL, TYPE 3B &amp; 3T</b>			
_____ F.H.W.A. APPROVAL	3-7-2023 PLAN DATE	<b>R-63-C</b>	SHEET 5 OF 17



**POST 3 AND 5 DETAIL**  
(C-A-T)



**C-A-T SPLICE BOLT**  
C-A-T SPLICE BOLTS REQUIRED TO ALLOW TELESCOPING ACTION



**POST 4 DETAIL**  
(C-A-T)

MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF DEVELOPMENT STANDARD PLAN FOR

**GUARDRAIL APPROACH  
TERMINAL, TYPE 3B & 3T**

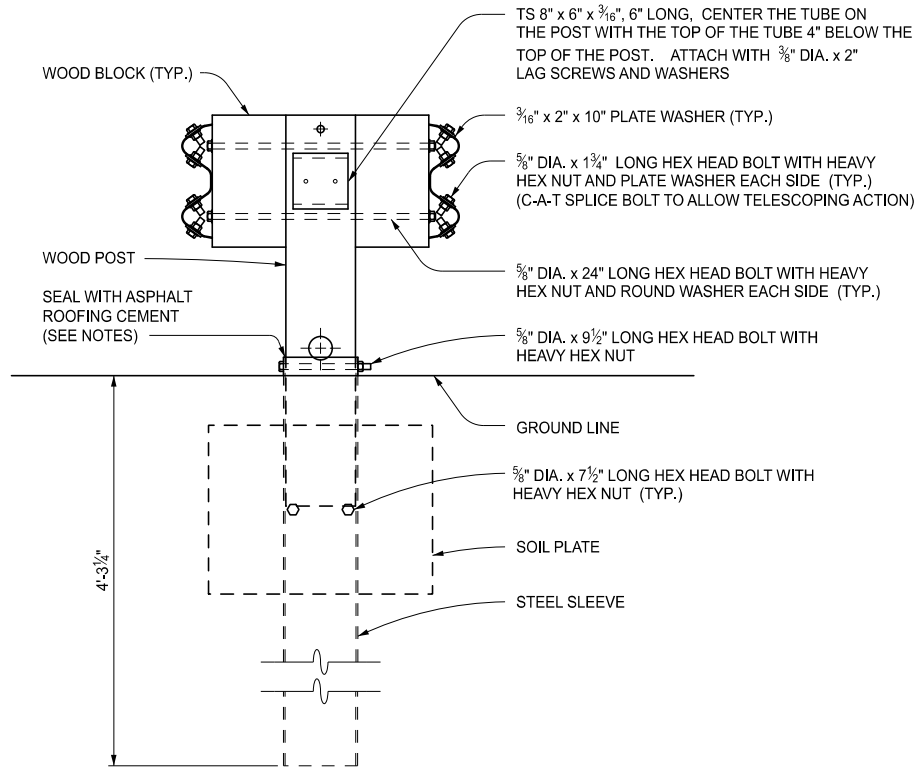
F.H.W.A. APPROVAL

3-7-2023  
PLAN DATE

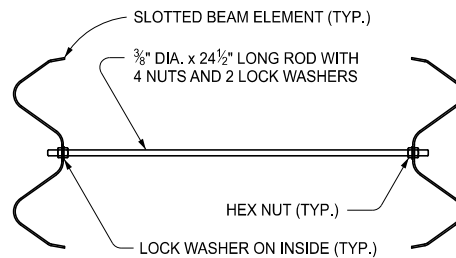
**R-63-C**

SHEET  
6 OF 17



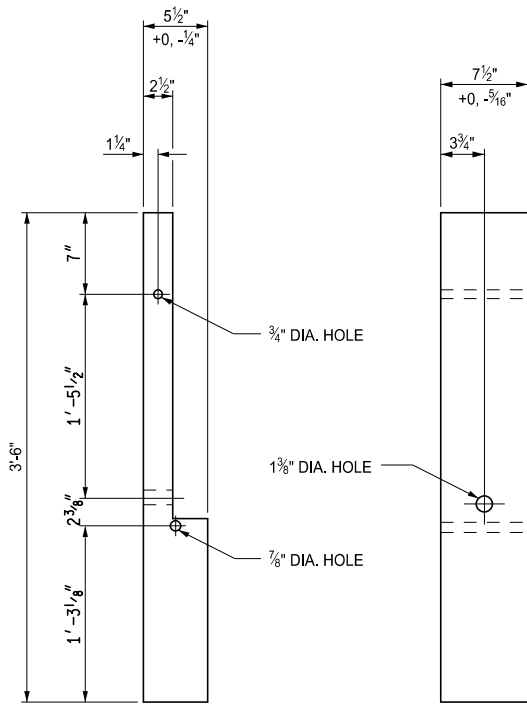


POST 6 DETAIL  
(C-A-T)

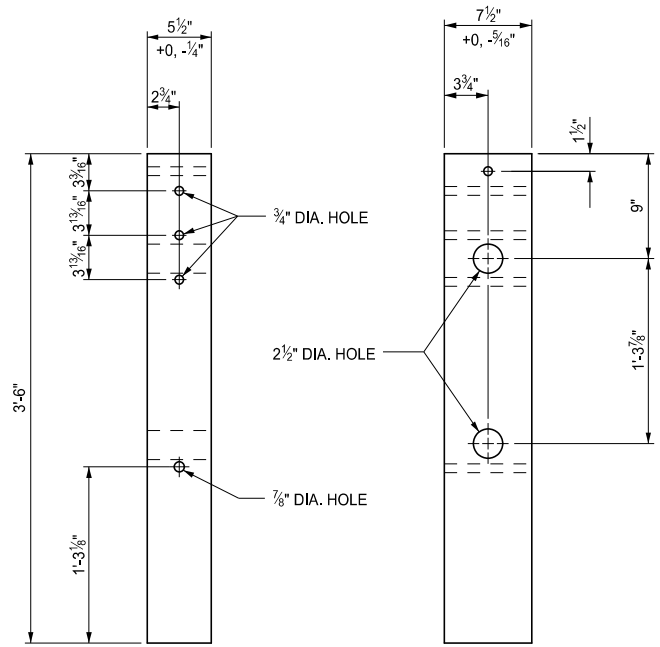


BUCKLING RESTRAINT ROD DETAIL  
(C-A-T)

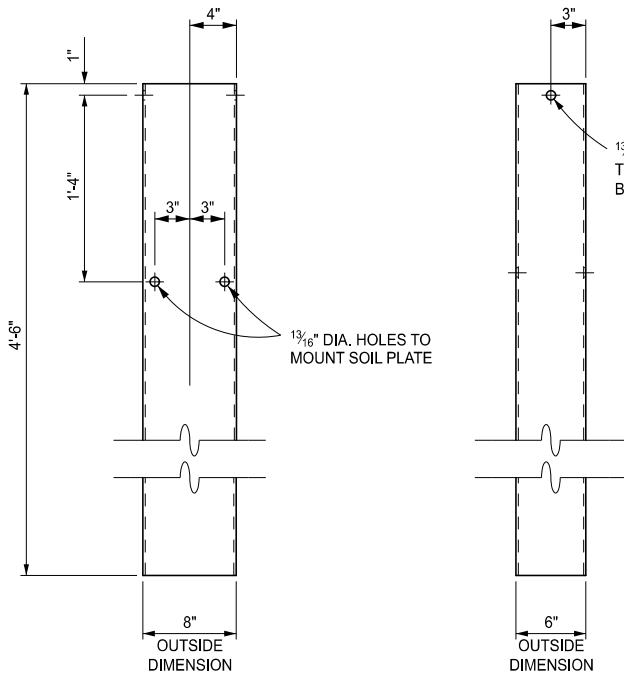
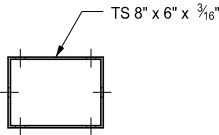
MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT STANDARD PLAN FOR			
<b>GUARDRAIL APPROACH          TERMINAL, TYPE 3B &amp; 3T</b>			
_____ F.H.W.A. APPROVAL	3-7-2023 PLAN DATE	<b>R-63-C</b>	SHEET 7 OF 17



**WOOD BREAKAWAY POST**  
(C-A-T POST 1)

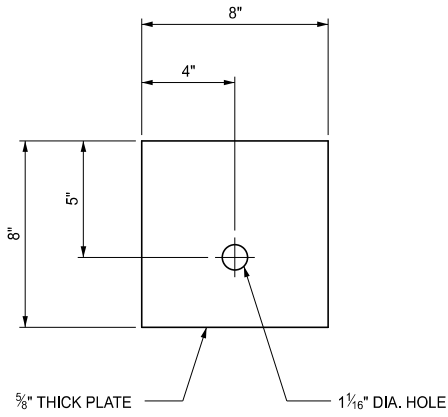


**WOOD BREAKAWAY POST**  
(C-A-T POST 2 - 6)

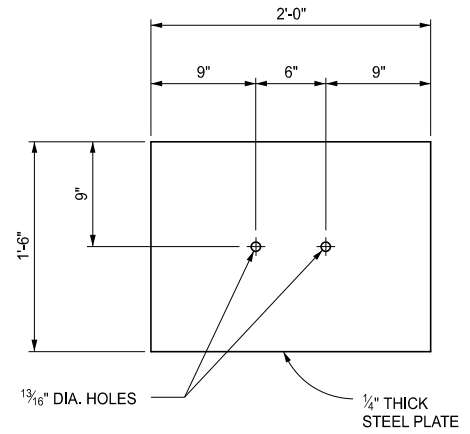


**STEEL SLEEVE**  
(C-A-T)

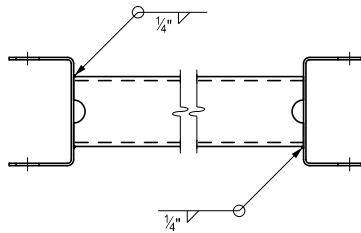
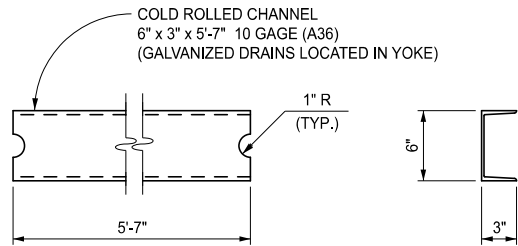
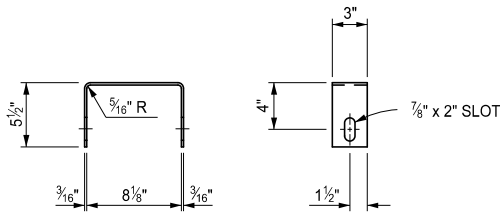
MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT STANDARD PLAN FOR			
<b>GUARDRAIL APPROACH          TERMINAL, TYPE 3B &amp; 3T</b>			
_____ F.H.W.A. APPROVAL	3-7-2023 PLAN DATE	<b>R-63-C</b>	SHEET 8 OF 17



**BEARING PLATE**  
(C-A-T)

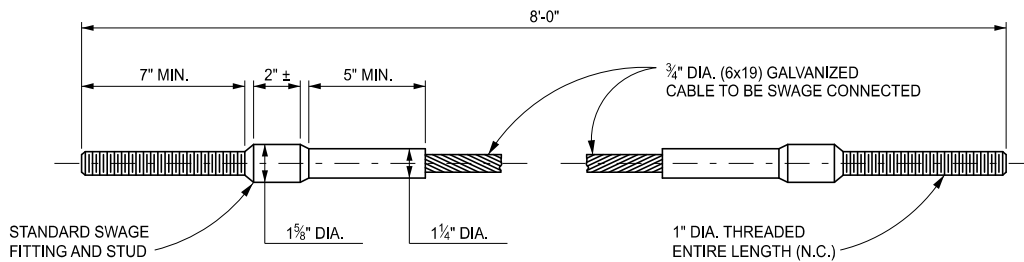


**SOIL PLATE**  
(C-A-T)



ASSEMBLY DETAIL

**STRUT DETAILS**  
(C-A-T)



**CABLE ASSEMBLY**  
(C-A-T)

MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF DEVELOPMENT STANDARD PLAN FOR

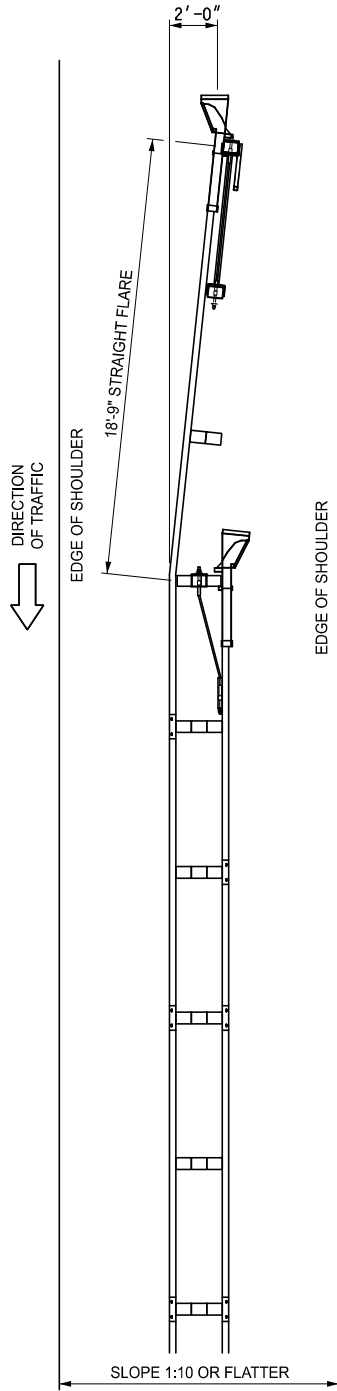
**GUARDRAIL APPROACH  
TERMINAL, TYPE 3B & 3T**

F.H.W.A. APPROVAL

3-7-2023  
PLAN DATE

R-63-C

SHEET  
9 OF 17

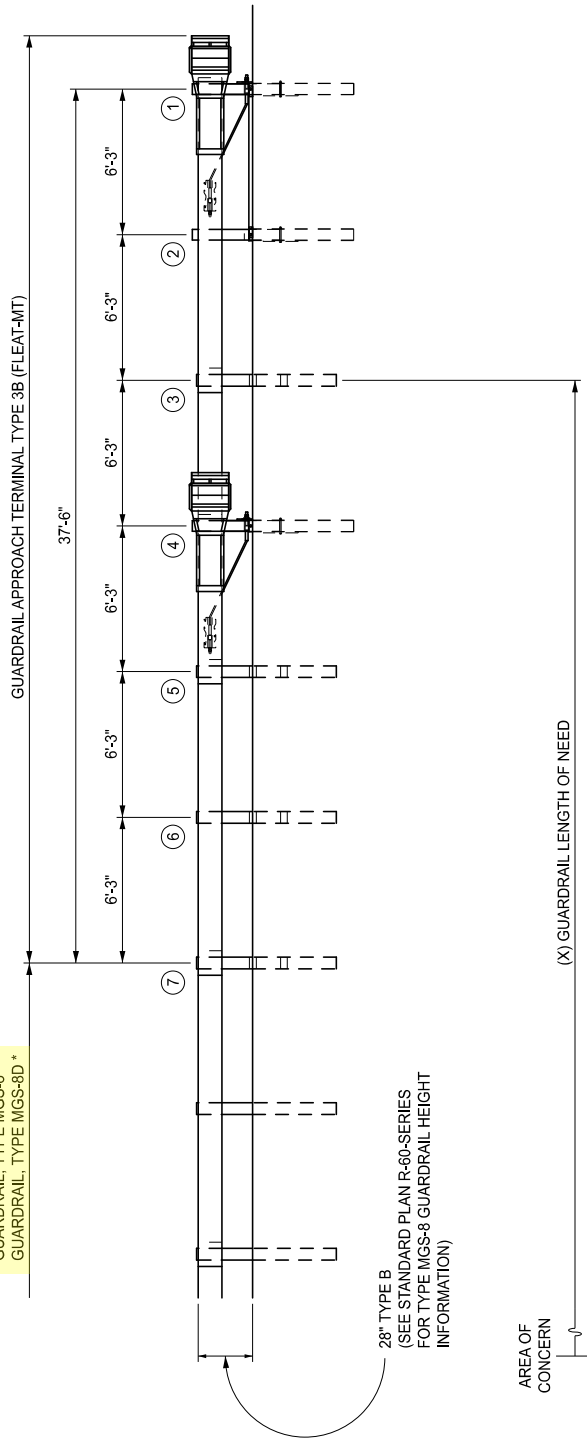


DIRECTION OF TRAFFIC

PLAN VIEW

\* SEE STANDARD PLAN R-60-SERIES FOR POST SPACING AND GUARDRAIL LAYOUT TO TRANSITION FROM GUARDRAIL, TYPE MGS-8D TO GUARDRAIL-APPROACH TERMINAL, TYPE 3B

GUARDRAIL, TYPE B  
 GUARDRAIL, TYPE BD  
 GUARDRAIL, TYPE MGS-8  
 GUARDRAIL, TYPE MGS-8D \*



ELEVATION

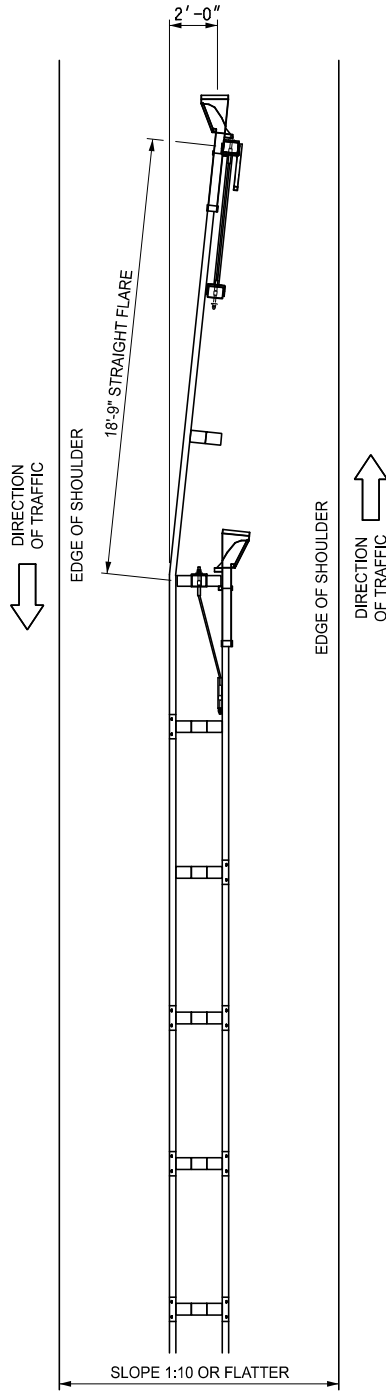
GUARDRAIL-APPROACH TERMINAL, TYPE 3B  
 "FLEAT - MT"

AREA OF CONCERN

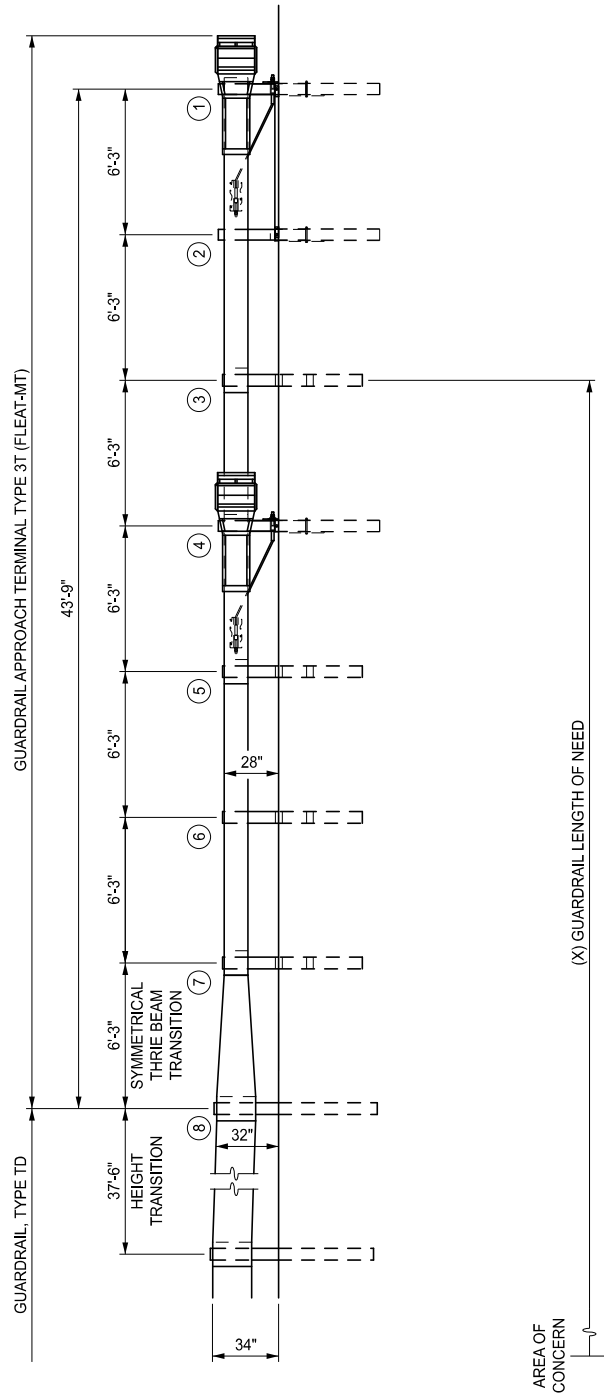
(X) GUARDRAIL LENGTH OF NEED

OPTION 2  
 (DETAILED ON SHEETS 11 - 15)

MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT STANDARD PLAN FOR			
<b>GUARDRAIL APPROACH          TERMINAL, TYPE 3B &amp; 3T</b>			
F.H.W.A. APPROVAL	3-7-2023 PLAN DATE	<b>R-63-C</b>	SHEET 10 OF 17



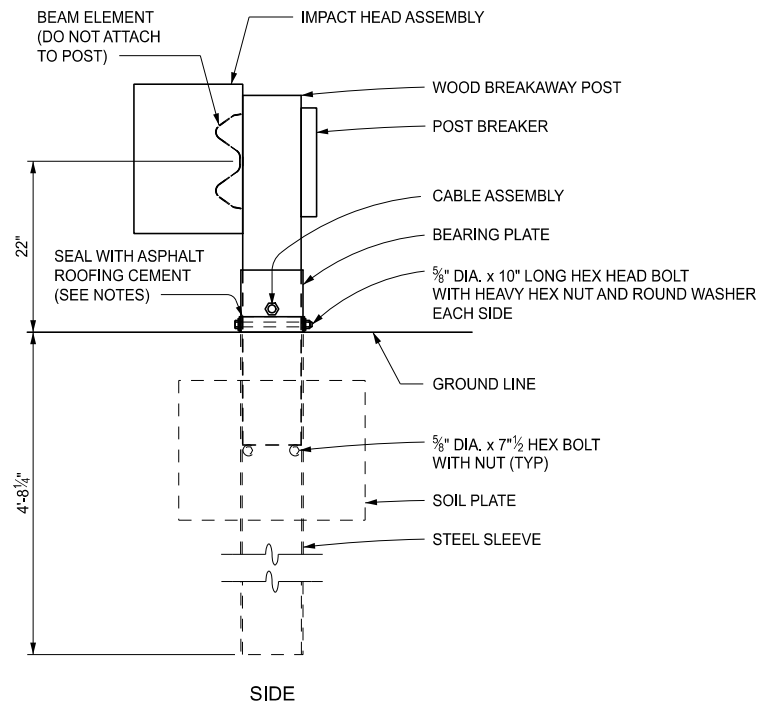
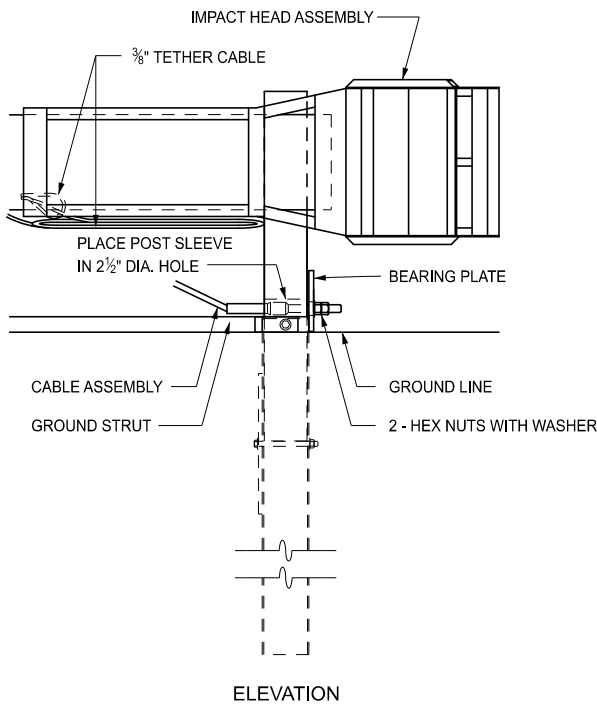
PLAN VIEW



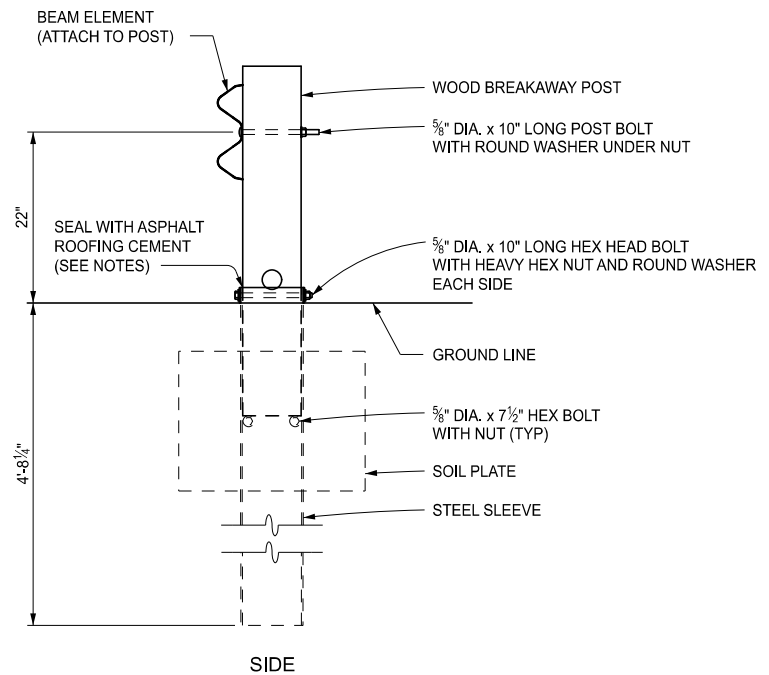
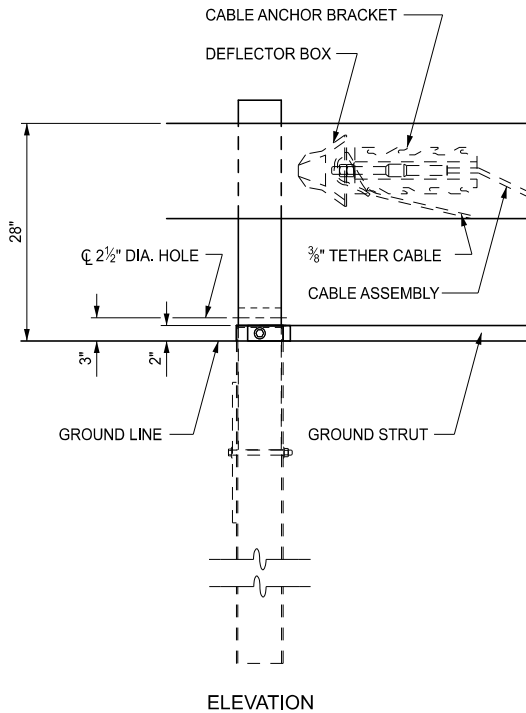
ELEVATION  
GUARDRAIL APPROACH TERMINAL, TYPE 3T  
"FLEAT - MT"

OPTION 2  
(DETAILED ON SHEETS 11 - 15)

MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT STANDARD PLAN FOR			
<b>GUARDRAIL APPROACH          TERMINAL, TYPE 3B &amp; 3T</b>			
F.H.W.A. APPROVAL	3-7-2023 PLAN DATE	<b>R-63-C</b>	SHEET 11 OF 17



POST 1 DETAIL  
(FLEAT-MT)

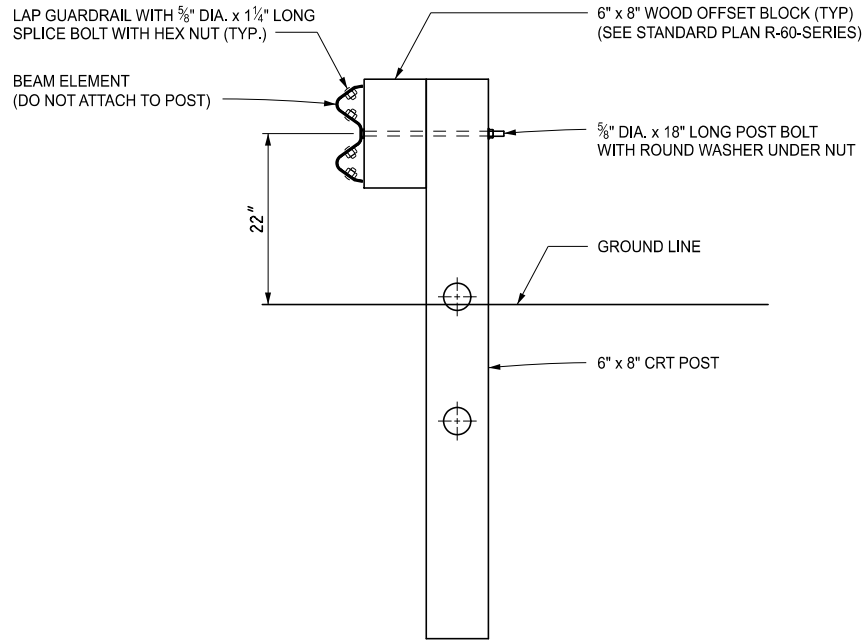


POST 2 DETAIL  
(FLEAT-MT)

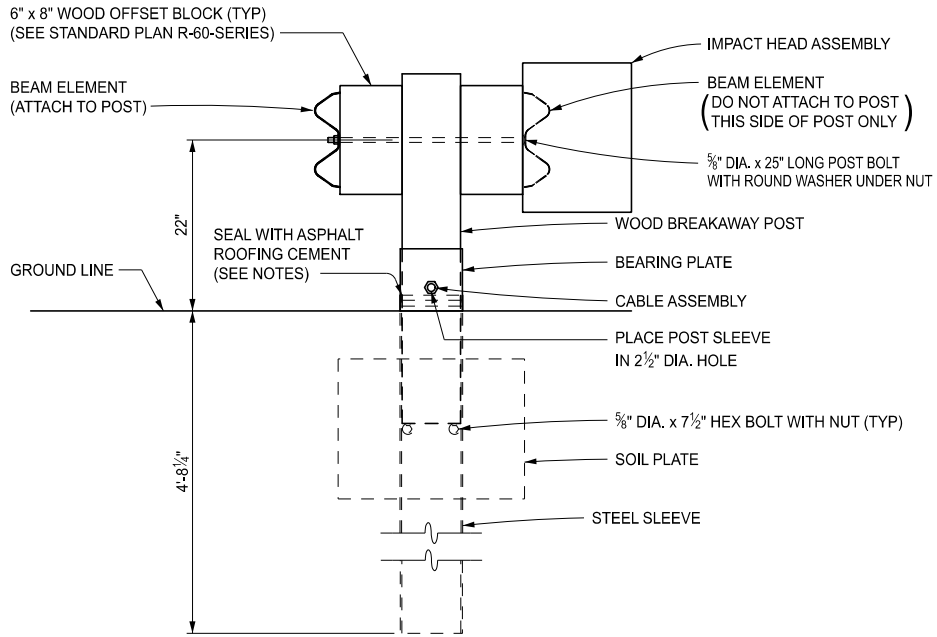
MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF DEVELOPMENT STANDARD PLAN FOR

**GUARDRAIL APPROACH  
TERMINAL, TYPE 3B & 3T**

F.H.W.A. APPROVAL	3-7-2023 PLAN DATE	R-63-C	SHEET 12 OF 17
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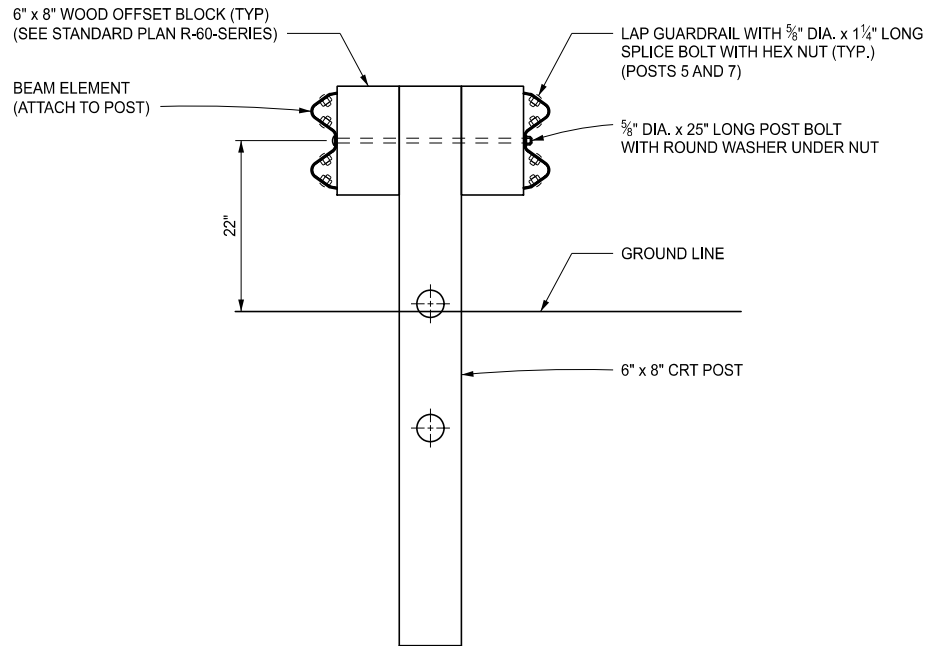


**POST 3 DETAIL**  
(FLEAT-MT)



**POST 4 DETAIL**  
(FLEAT-MT)

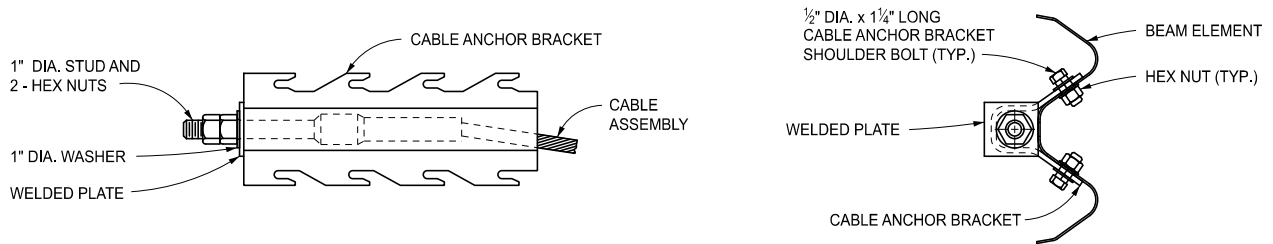
MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT STANDARD PLAN FOR <b>GUARDRAIL APPROACH          TERMINAL, TYPE 3B &amp; 3T</b>			
F.H.W.A. APPROVAL	3-7-2023 PLAN DATE	<b>R-63-C</b>	SHEET 13 OF 17



**POST 5, 6 AND 7 DETAIL**

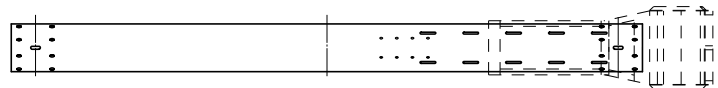
(FLEAT-MT)

NOTE: POST 8 IS A STANDARD LINE POST



**CABLE ANCHOR BRACKET DETAIL**

(FLEAT-MT)



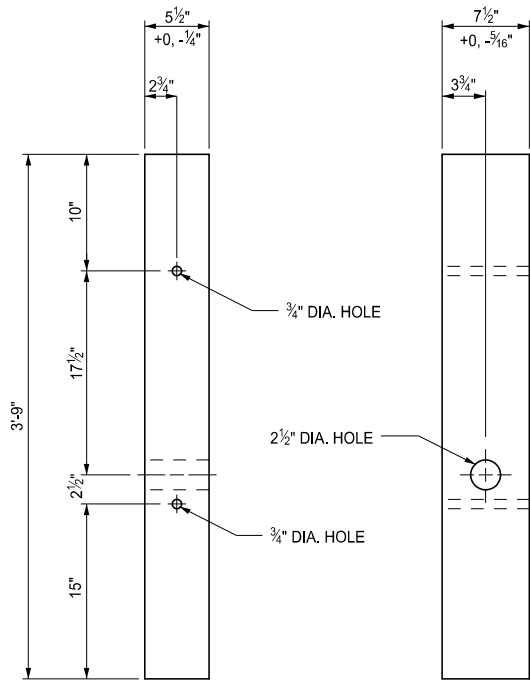
**W-BEAM GUARDRAIL END SECTION**

(USE WITH IMPACT HEAD ASSEMBLY)

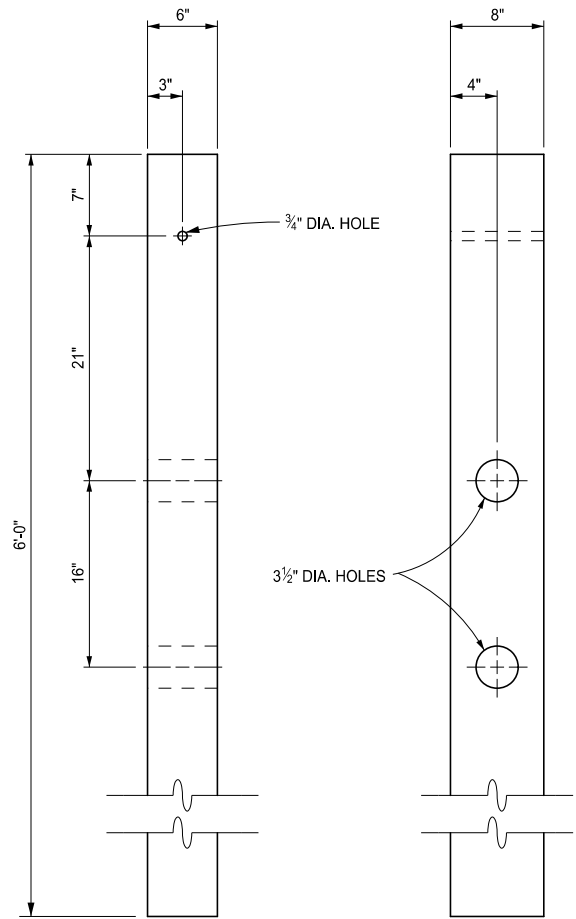
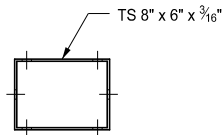
NOTE: ALL (FLEAT-MT) ITEMS ILLUSTRATED WITHOUT DIMENSIONS SHALL BE ACCORDING TO THE MANUFACTURER'S SPECIFICATIONS.

MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT STANDARD PLAN FOR			
<b>GUARDRAIL APPROACH          TERMINAL, TYPE 3B &amp; 3T</b>			
_____ F.H.W.A. APPROVAL	3-7-2023 PLAN DATE	<b>R-63-C</b>	SHEET 14 OF 17

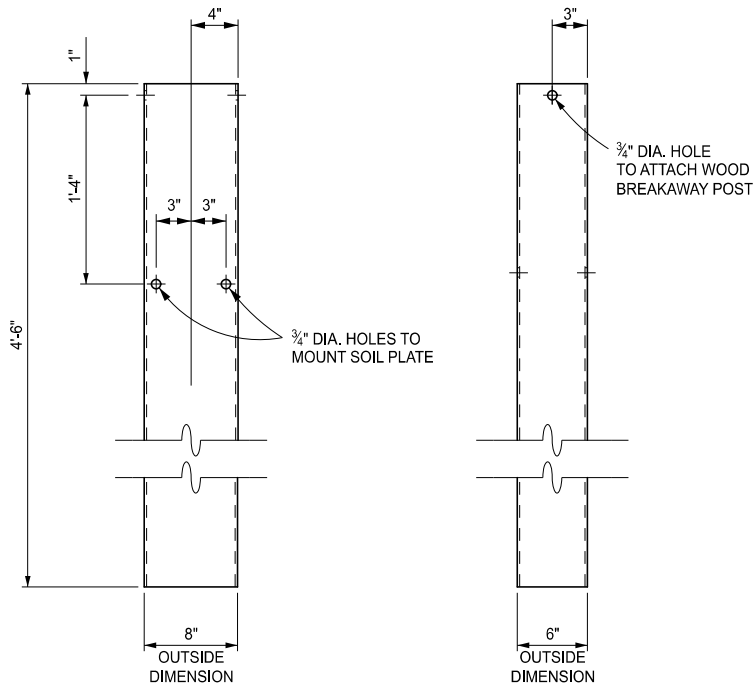




**WOOD BREAKAWAY POST**  
( FLEAT-MT POST 1, 2, & 4 )

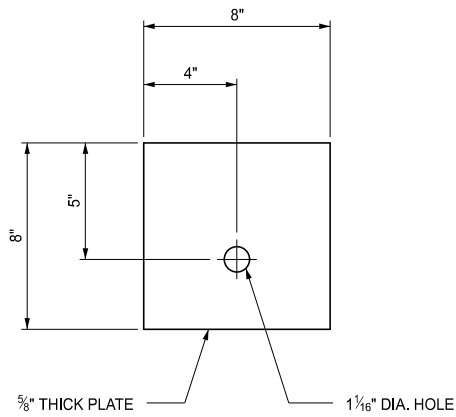


**CRT POST**  
( FLEAT-MT POST 3, 5, 6, & 7 )

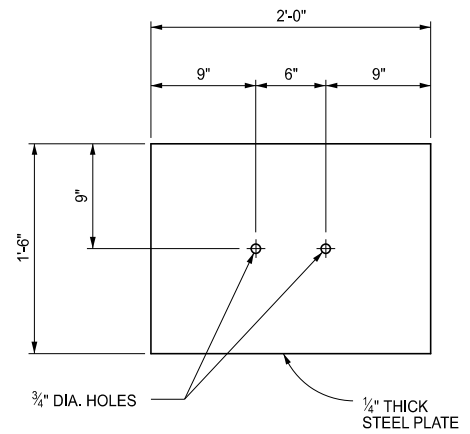


**STEEL SLEEVE**  
( FLEAT-MT )

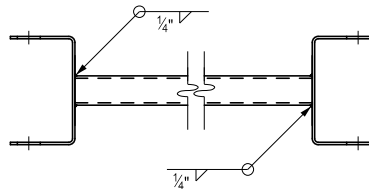
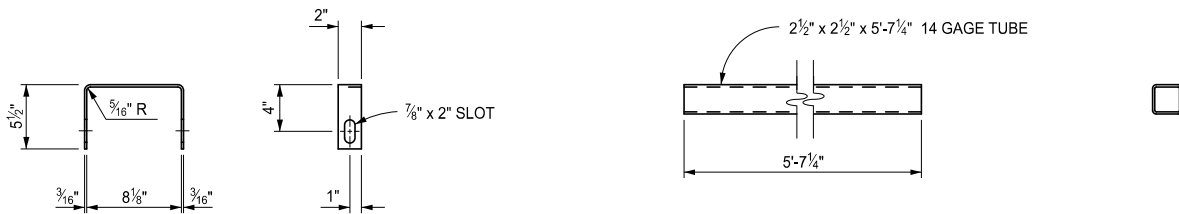
MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT STANDARD PLAN FOR			
<b>GUARDRAIL APPROACH          TERMINAL, TYPE 3B &amp; 3T</b>			
_____ F.H.W.A. APPROVAL	3-7-2023 _____ PLAN DATE	<b>R-63-C</b>	SHEET 15 OF 17



**BEARING PLATE**  
( FLEAT-MT )

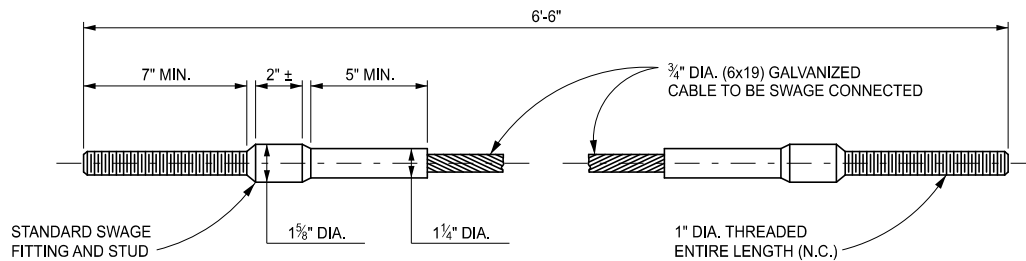


**SOIL PLATE**  
( FLEAT-MT )



ASSEMBLY DETAIL

**STRUT DETAILS**  
( FLEAT-MT )



**CABLE ASSEMBLY**  
( FLEAT-MT )

MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF DEVELOPMENT STANDARD PLAN FOR

**GUARDRAIL APPROACH  
TERMINAL, TYPE 3B & 3T**

F.H.W.A. APPROVAL

3-7-2023  
PLAN DATE

**R-63-C**

SHEET  
16 OF 17

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-56-SERIES, AND R-59-SERIES.

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

HARDWARE BETWEEN POST 1 AND POST 6 (OPTION 1) ARE PROPRIETARY ITEMS OF THE C-A-T AND MUST BE PURCHASED FROM AN AUTHORIZED DISTRIBUTER.

HARDWARE BETWEEN POST 1 AND POST 7 (OPTION 2) ARE PROPRIETARY ITEMS OF THE FLEAT-MT AND MUST BE PURCHASED FROM AN AUTHORIZED DISTRIBUTER.

GUARDRAIL REFLECTORS ARE NOT TO BE USED ON THE "C-A-T" OR "FLEAT-MT". PLACE RELECTORS BEGINNING ON STANDARD RUN OF GUARDRAIL.

USE REFLECTIVE SHEETING ACCORDING TO THE FOLLOWING TRAFFIC CONDITIONS: (NOTE: ALTERNATE 3" BLACK AND 3" YELLOW STRIPES ON A 45° ANGLE)



TRAFFIC PASSING ON THE LEFT SIDE



TRAFFIC PASSING ON BOTH SIDES



TRAFFIC PASSING ON THE RIGHT SIDE

ON THE "C-A-T", THE CURVED PORTION OF THE NOSE FACING TRAFFIC SHALL BE COMPLETELY COVERED WITH HIGH INTENSITY ADHESIVE REFLECTIVE SHEETING.

ON THE "FLEAT-MT", THE PORTION OF THE IMPACT HEAD ASSEMBLIES FACING TRAFFIC SHALL BE COMPLETELY COVERED WITH HIGH INTENSITY ADHESIVE REFLECTIVE SHEETING.

ASPHALT ROOFING CEMENT SHALL BE USED TO SEAL THE PERIMETER AREA BETWEEN THE STEEL SLEEVE (SOIL TUBE) AND THE WOOD BREAKAWAY POST.

MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF DEVELOPMENT STANDARD PLAN FOR

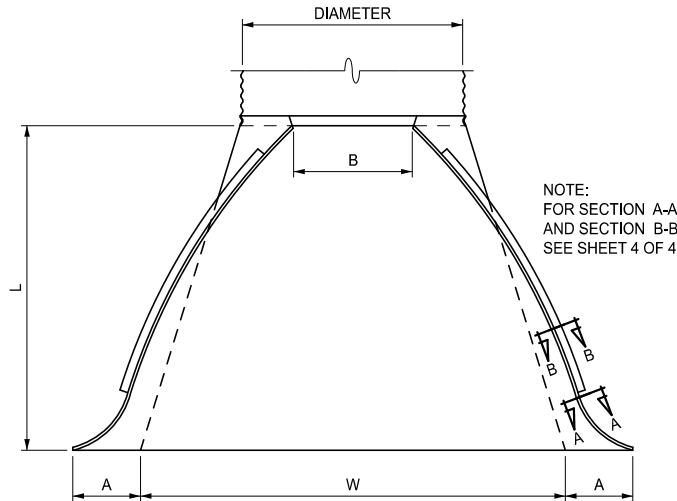
**GUARDRAIL APPROACH  
TERMINAL, TYPE 3B & 3T**

\_\_\_\_\_  
F.H.W.A. APPROVAL

3-7-2023  
\_\_\_\_\_  
PLAN DATE

**R-63-C**

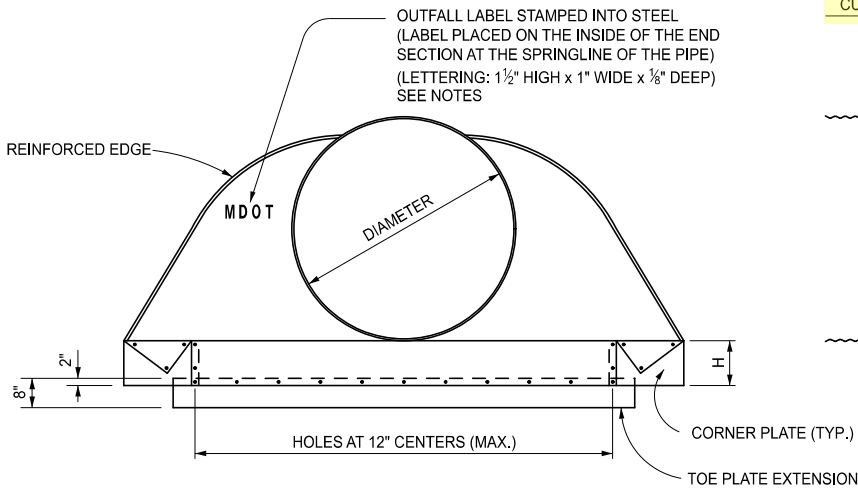
SHEET  
17 OF 17



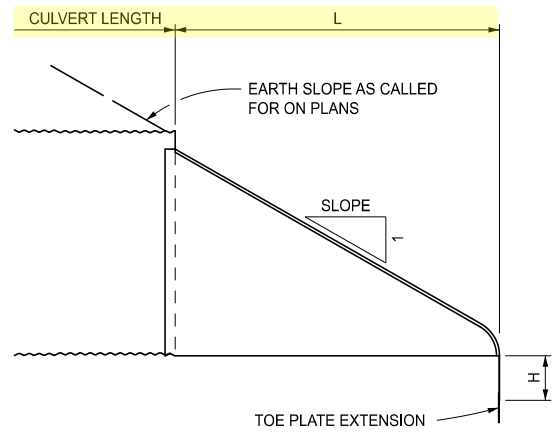
PLAN VIEW

DIMENSIONS								
DIMENSIONS IN INCHES							APPROX SLOPE	BODY
PIPE DIAMETER	MIN. THK.	A ± 1"	B MAX.	H ± 1"	L ± 1½"	W ± 2"		
12	0.064	6	6	6	21	24	2.50	1 Pc
15	0.064	7	8	6	26	30	2.50	1 Pc
18	0.064	8	10	6	31	36	2.50	1 Pc
21	0.064	9	12	6	36	42	2.50	1 Pc
24	0.064	10	13	6	41	48	2.50	1 Pc
30	0.079	12	16	8	51	60	2.50	1 Pc
36	0.079	14	19	9	60	72	2.50	2 Pc
42	0.109	16	22	11	69	84	2.50	2 Pc
48	0.109	18	27	12	78	90	2.25	2 Pc
54	0.109	18	30	12	84	102	2.00	2 Pc
* 60	0.109	18	33	12	87	114	1.75	3 Pc
* 66	0.109	18	36	12	87	120	1.50	3 Pc
* 72	0.109	18	39	12	87	126	1.33	3 Pc
* 78	0.109	18	42	12	87	132	1.25	3 Pc
* 84	0.109	18	45	12	87	138	1.16	3 Pc

\* ALL THREE PIECE BODIES HAVE 0.109" SIDES AND 0.138" CENTER PANELS. WIDTH OF CENTER PANEL TO BE GREATER THAN 20% OF THE PIPE PERIPHERY. MULTIPLE PANEL BODIES TO HAVE LAP SEAMS WHICH ARE TO BE TIGHTLY JOINED BY 3/8" DIAMETER GALVANIZED RIVETS OR BOLTS.



END VIEW



LONGITUDINAL VIEW

NOTE: SEE SHEET 3 FOR CONNECTION DETAILS

STEEL END SECTION FOR CORRUGATED STEEL CIRCULAR PIPE



PREPARED BY DESIGN DIVISION

DRAWN BY: B.L.T.

CHECKED BY: W.K.P.

ACTING DEPARTMENT DIRECTOR  
Bradley C. Wiefelich

APPROVED BY: \_\_\_\_\_  
DIRECTOR, BUREAU OF FIELD SERVICES

APPROVED BY: \_\_\_\_\_  
DIRECTOR, BUREAU OF DEVELOPMENT

MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF DEVELOPMENT STANDARD PLAN FOR

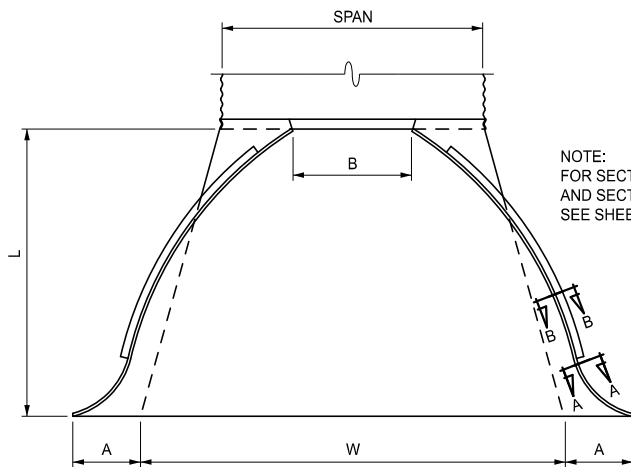
STEEL END SECTION

F.H.W.A. APPROVAL

3-7-2023  
PLAN DATE

R-88-E

SHEET  
1 OF 4

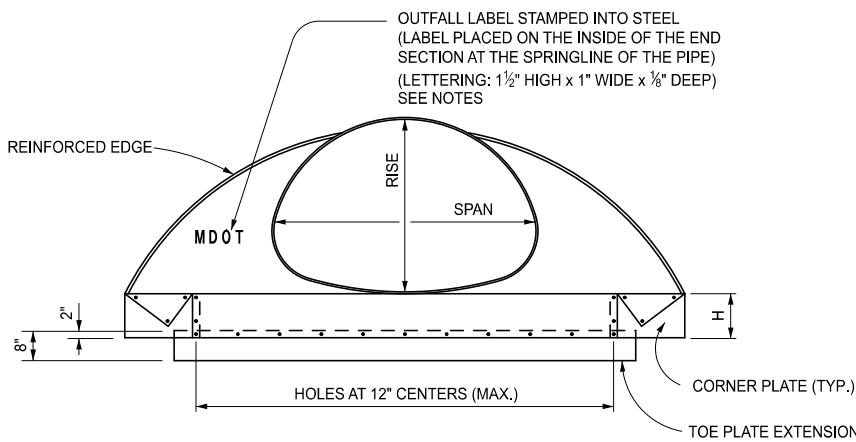


NOTE:  
FOR SECTION A-A  
AND SECTION B-B  
SEE SHEET 4 OF 4

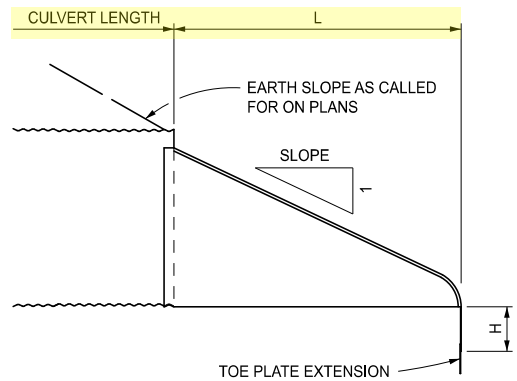
PLAN VIEW

DIMENSIONS								
DIMENSIONS IN INCHES							APPROX SLOPE	BODY
SPAN / RISE	MIN. THK.	A ± 1"	B MAX.	H ± 1"	L ± 1 1/2"	W ± 2"		
17 x 13	0.064	7	9	6	19	30	2.50	1 Pc
21 x 15	0.064	7	10	6	23	36	2.50	1 Pc
24 x 18	0.064	8	12	6	28	42	2.50	1 Pc
28 x 20	0.064	9	14	6	32	48	2.50	1 Pc
35 x 24	0.079	10	16	6	39	60	2.50	1 Pc
42 x 29	0.079	12	18	8	46	75	2.50	1 Pc
49 x 33	0.109	13	21	9	53	85	2.50	2 Pc
57 x 38	0.109	18	26	12	63	90	2.50	2 Pc
64 x 43	0.109	18	30	12	70	102	2.25	2 Pc
* 71 x 47	0.109	18	33	12	77	114	2.25	3 Pc
* 77 x 52	0.109	18	36	12	77	126	2.00	3 Pc
* 83 x 57	0.109	18	39	12	77	138	2.00	3 Pc

\* ALL THREE PIECE BODIES HAVE 0.109" SIDES AND 0.138" CENTER PANELS. WIDTH OF CENTER PANEL TO BE GREATER THAN 20% OF THE PIPE PERIPHERY. MULTIPLE PANEL BODIES TO HAVE LAP SEAMS WHICH ARE TO BE TIGHTLY JOINED BY 3/8" DIAMETER GALVANIZED RIVETS OR BOLTS.



END VIEW



LONGITUDINAL VIEW

NOTE: SEE SHEET 3 FOR CONNECTION DETAILS

STEEL END SECTION FOR CORRUGATED STEEL PIPE ARCHES

MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF DEVELOPMENT STANDARD PLAN FOR

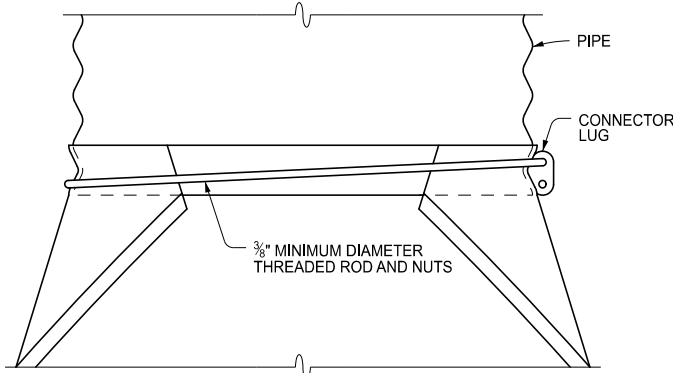
STEEL END SECTION

F.H.W.A. APPROVAL

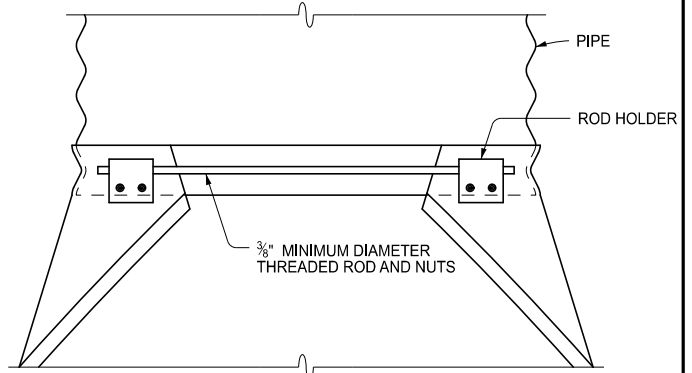
3-7-2023  
PLAN DATE

R-88-E

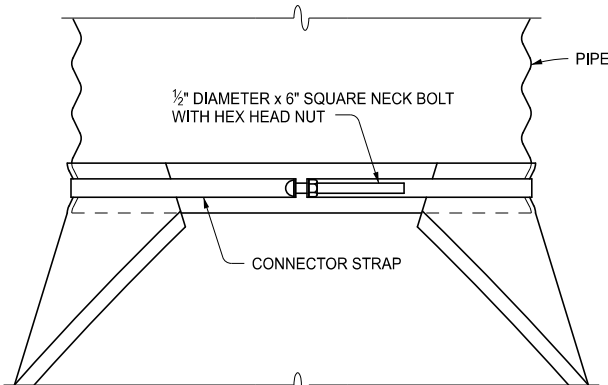
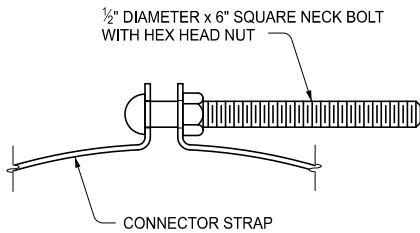
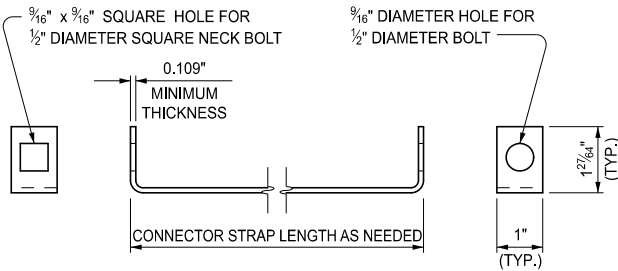
SHEET  
2 OF 4



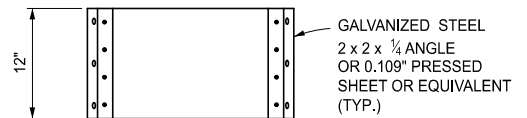
**TYPE 1 CONNECTOR**  
FOR USE ON CIRCULAR PIPE DIAMETERS 12" THROUGH 24"



**TYPE 2 CONNECTOR**  
FOR USE ON CIRCULAR PIPE DIAMETERS 30" AND 36"  
AND FOR ARCH PIPE SIZES 35" x 24" AND 42" x 29"

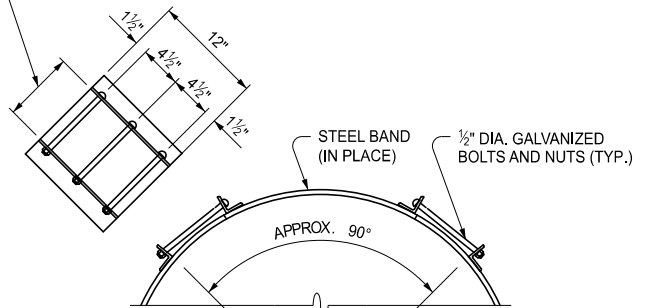


**TYPE 1A CONNECTOR**  
FOR USE ON CIRCULAR PIPE DIAMETERS 12" THROUGH 24"  
AND FOR ARCH PIPE SIZES 17" x 13" THROUGH 28" x 20"



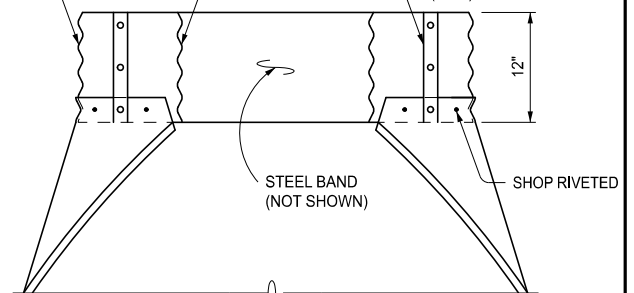
**STEEL BAND**  
(PART OF END SECTION)

AS NEEDED FOR EASE OF INSTALLATION



CONNECTOR SECTION CORRUGATIONS SHALL MATCH THE CORRUGATIONS OF THE PIPE TO WHICH IT WILL BE ATTACHED

GALVANIZED STEEL 2 x 2 x  $\frac{1}{4}$ " ANGLE OR 0.109" PRESSED SHEET OR EQUIVALENT (TYP.)



**TYPE 3 CONNECTOR**  
FOR USE ON CIRCULAR PIPE DIAMETERS 42" THROUGH 84"  
AND FOR ARCH PIPE SIZES 49" x 33" THROUGH 83" x 57"

MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF DEVELOPMENT STANDARD PLAN FOR

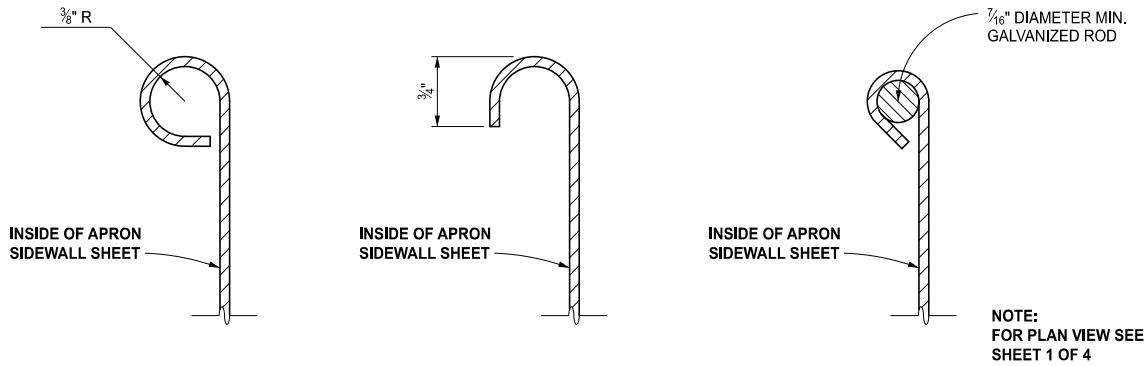
**STEEL END SECTION**

F.H.W.A. APPROVAL

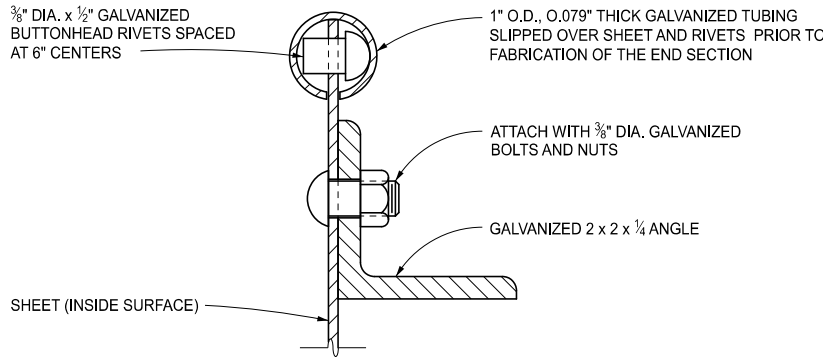
3-7-2023  
PLAN DATE

R-88-E

SHEET  
3 OF 4



**SECTION A - A**  
REINFORCED EDGE ALTERNATIVES



**SECTION B - B**  
TO BE USED ON CIRCULAR PIPE DIAMETERS 60" THROUGH 84"  
AND FOR ARCH PIPE SIZES 77" x 52" AND 83" x 57"

**NOTES:**

GALVANIZED STEEL SHALL MEET THE REQUIREMENTS SPECIFIED IN THE STANDARD SPECIFICATIONS FOR CONSTRUCTION.

GALVANIZED TOE PLATE EXTENSIONS ARE REQUIRED ON STEEL END SECTIONS AS FOLLOWS:

1. WHEN INDICATED ON THE PLANS.
2. WHEN AUTHORIZED BY THE ENGINEER.
3. WHEN THE HEIGHT OF FILL IS 10' OR MORE.
4. WHEN THE CULVERT GRADE IS 10% OR MORE.

GALVANIZED TOE PLATE EXTENSIONS SHALL BE MATCH PUNCHED TO FIT HOLES IN THE TOE PLATE AND SUPPLIED LOOSE, COMPLETE WITH 3/8" DIAMETER GALVANIZED BOLTS. LENGTH OF THE TOE PLATE EXTENSION IS W + A FOR ALL SIZES.

CONNECTOR SECTIONS, TOE PLATE EXTENSIONS AND CORNER PLATES SHALL BE THE SAME THICKNESS AS THE APRON CENTER PANEL, AND SHALL BE GALVANIZED.

CONNECTOR TYPES DESIGNATED FOR LARGER CORRUGATED STEEL PIPES MAY BE USED ON SMALLER CORRUGATED IPES.

CIRCULAR AND ARCH PIPE SIZES SHOWN ON THIS PLAN HAVE 2 2/3" x 1/2" CORRUGATIONS; EQUIVALENT PIPE SIZES WITH 3" x 1" OR 5" x 1" CORRUGATIONS WILL BE ALLOWED.

ALTERNATE DESIGNS THAT HAVE PRIOR APPROVAL BY THE DEPARTMENT WILL BE ACCEPTED.

OUTFALL LABEL TO BE USED ONLY WHERE STORMWATER WILL DISCHARGE DIRECTLY TO THE WATERS OF THE STATE.

MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF DEVELOPMENT STANDARD PLAN FOR

**STEEL END SECTION**

F.H.W.A. APPROVAL

3-7-2023  
PLAN DATE

**R-88-E**

SHEET  
4 OF 4

# MICHIGAN DESIGN MANUAL

## BRIDGE DESIGN

### 3.01

#### STUDY (12-17-2018)

The first plan of a structure is a feasibility study showing the basic design concept and the topography in the immediate structure area. This study is prepared on a reproduction of the General Plan of Site Sheet.

The study is submitted by the Unit Leader to the Chief Structure Design Engineer for approval. FHWA Oversight projects that are federally financed must also be reviewed by the FHWA. For definition/clarification of oversight see Chapter 2. These approvals must be obtained before Preliminary Plans can be started. The study, as approved, then becomes a permanent record and is to be kept by the Unit until the construction of the bridge is completed. (8-6-92)

A study must be completed for all new construction and reconstruction projects. Generally, structure studies are not required for deck replacements on slab and beam bridges unless the deck replacement involves widening requiring more than one beam line, the vertical alignment or horizontal alignment changes significantly, or the project has other unique characteristics that would benefit from the structure study process. Structure studies should be completed for deck replacements on complex bridges. (12-28-2020)

A study must be completed for all projects involving a culvert with a clear span between 10' and 20' that is constructed using staged construction. Construction of these ancillary structures using staged construction present unique challenges that must be considered, and a feasibility study showing the basic design concept for the selected culvert type is the first step in mitigating these challenges. Specific items that should be discussed include, but are not limited to, water diversion, ground water effects, and unique details required to connect the culvert sections at the stage line. (3-27-2023)

For rehabilitation, e.g., railing replacement and/or deck overlay projects see [Chapter 4](#).

### 3.01 (continued)

Where a project involves earth excavation, the Project Manager sends a project description and requests a list of potentially contaminated sites identified by the Environmental Assessment Unit, Project Coordination Unit of the Project Planning Division and the Region Resource Specialist. The Project Manager/Cost and Scheduling Engineer will locate identified potential sites of contamination on the preliminary plans. If earth excavation will impact a potential contaminated site, the Project Manager/Cost and Scheduling Engineer will request further investigation of the site to be done by MDOT Geotechnical Services Section, Bureau of Bridges and Structures. Geotechnical Services Section will provide information on the type and extent of the contamination, appropriate pay items and quantities for the Plans and Specifications. For more detailed information see Section [14.13](#) of the Road Design Manual. (5-1-2000)

Before starting and during the preparation of the study plans, the following information relevant to the design of the bridge should be considered:

- A. Engineering Report. (Including Environmental Impact Statement if applicable.) (8-20-99)
- B. Topography.
- C. Traffic data - If traffic data is unavailable at this time, it should be requested from Region/TSC Traffic and Safety personnel.



# MICHIGAN DESIGN MANUAL

## BRIDGE DESIGN - CHAPTER 7: LRFD

### 7.02.19

#### Slabs

For information on Ride Quality on new slabs see section [7.02.32](#).

#### A. Design (8-20-2009)

MDOT standard LRFD slab is designed using the following criteria:

1. The design loads for decks and deck systems should be specified depending on the method of analysis. When the approximate strip method is used, force effects should be determined on the following basis:
  - a. Where primary strips are transverse and their span does not exceed 15.0 ft., the transverse strip shall be designed for the wheels of the 32.0-kip axle.
  - b. Where primary strips are transverse and their span exceeds 15.0 ft., the transverse strip shall be designed for the wheels of the 32.0-kip axle and the lane load together.
  - c. Where primary strips are longitudinal, the transverse strips shall be designed for all loads specified above, including the lane load.
2. The design truck shall be positioned transversally such that the center of any wheel load is not closer than:
  - a. One foot (1.0 ft.) from the face of the curb or railing for the design of the deck overhang.
  - b. Two Feet (2.0 ft.) from the edge of the design lane for the design of all other components.
3. Where the strip method is used, the extreme positive moment in any deck panel between girders shall be taken to apply to all positive moment regions. The extreme negative moment over any girder shall be taken to apply to all negative moment regions.

### 7.02.19 (continued)

4. For deck/slab design only, the top 1½" of slab is considered a wearing surface and is not included in the design depth, but is included in the dead load. See section [7.02.08 B](#). for composite action of deck slabs. (8-17-2015)

Design of deck slabs using the Empirical Design Method according to AASHTO LRFD 9.7.2 is an approved or allowed alternative. (6-27-2022)

When detailing empirical slabs on plans designate them as an "Empirical Slab". (9-27-2021)

#### B. Overhang

Design slab overhangs for all applied loads and all applicable limit states on every project regardless of the width of the overhang. Horizontal loads on the slab overhang resulting from vehicle collision with the barrier shall be based on a TL-4 railing test level as specified in AASHTO LRFD Chapter 13. (3-27-2023)

Design overhang according to AASHTO LRFD 9.7.1.5. If the deck overhang with cantilever does not exceed 6.0 ft. from the centerline of the exterior girder to the face of a structurally continuous concrete railing, the outside row of wheel loads may be replaced with a uniformly distributed line load of 1.0 klf intensity, located 1.0 ft. from the face of the railing. (6-27-2022)

Limit overhang widths to 2'-6" if possible. Avoid overhangs greater than 6 feet. (3-27-2023)

## MICHIGAN DESIGN MANUAL BRIDGE DESIGN - CHAPTER 7: LRFD

### 7.02.31 Deck Replacements (Cont.)

#### D. Salvaging Shear Developers (10-24-2022)

For full or partial deck replacements on steel superstructures with stud type shear developers, shear developers should be left in place and reused whenever possible to minimize the risk of damage (and associated delays) to the steel beams/girders. For steel superstructures with spiral/coil type shear developers, remove the spirals/coils and install stud type shear developers using the appropriate pay items included in the MDOT Standard Specifications for Construction. If shear developer type cannot be confirmed with existing plans, contact the MDOT Bridge Construction Engineer to request a field investigation to confirm existing shear developer type.

The removal, furnishing, and installation of the additional shear developers is included in the special pay items listed in the Frequently Used Special Provision for Bridge Deck Removal and Salvaging Shear Developers on Steel Beams. Include a quantity equal to approximately 5% of the original shear stud total to account for existing damaged or deteriorated studs that must be removed and replaced. If additional studs are needed to meet strength requirements per AASHTO and Section 7.02.15, add quantity and detail proposed studs in relation to the existing studs on the plans. The location of the additional shear developers must account for the minimum spacing and edge distance requirements specified in AASHTO LRFD. If additional beam lines are being added to the superstructure as part of the deck replacement project the studs required on the new beam are included in the pay items listed in the Frequently Used Special Provision. Detail the transverse spacing and longitudinal pitch as part of the structural steel details.  
(3-27-20223)

Where the existing shear developers are not tall enough to extend sufficiently into the new bridge deck per Bridge Design Guide 8.07.01, add EA04, EW05, and EK05 bars to haunch, similar to Bridge Design Guide 6.42.03A.

# MICHIGAN DESIGN MANUAL

## BRIDGE DESIGN - CHAPTER 7: LRFD

### 7.07

#### APPROACH ITEMS

##### 7.07.01

###### Guardrail

All new guardrail anchorages to bridges will utilize three beam guardrail according to Standard Plan [R-67-Series](#) and will be anchored directly to the bridge railing or pier filler walls. (5-6-99)

Where there are independent backwalls, that is, where there will be thermal deck movement at the abutments, the movement will be accommodated by the slots in the expansion section of the guardrail anchorage.

For additional information see Road Design Manual Section [7.01.16](#).

##### 7.07.02

###### Curb and Gutter for Rural Bridges (6-27-2022)

The types and lengths of bridge approach curb and gutters (including valley gutter, where required) shall be determined by the road/bridge designer and shown on the General Plan of Structure Sheet.

For additional information see Road Design Manual Section [6.06.08](#) and MDOT Drainage Manual.

##### 7.07.03 (5-6-99)

###### Bridge Approach Pavement

To eliminate approach pavement settlement, a concrete approach section will be used for all new bridges and bridge replacements, deck and superstructure replacement projects and concrete overlays. For hot mix asphalt (HMA) deck overlays, a concrete approach section is not necessary. The details of the approach slab shall be as specified on Standard Plan [R-45-Series](#) except on existing structures, where the grade will not be raised; the length of the approach slab shall match the existing slab joint. (9-2-2003)

Use approach pavements for integral and [expansion bearing](#) semi-integral abutment designs according to Bridge Design Guide [6.20.04 Series](#). [At semi-integral abutments with fixed bearings use approach pavement as specified on Standard Plan R-45-Series.](#) (3-27-2023)

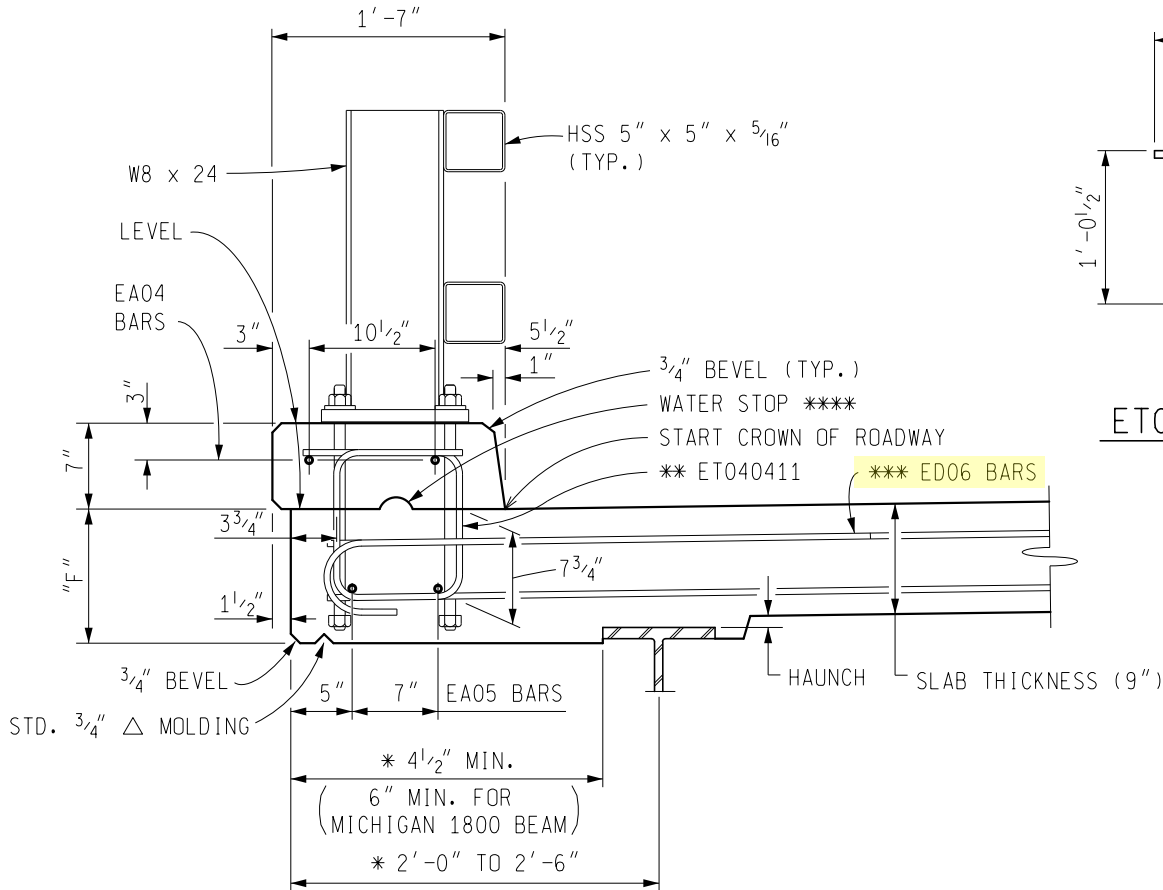
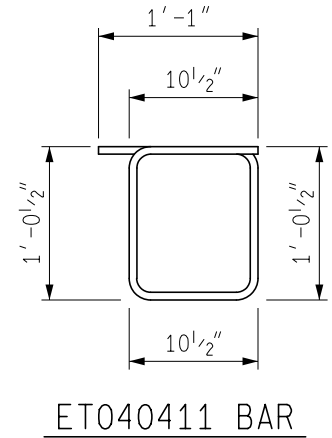
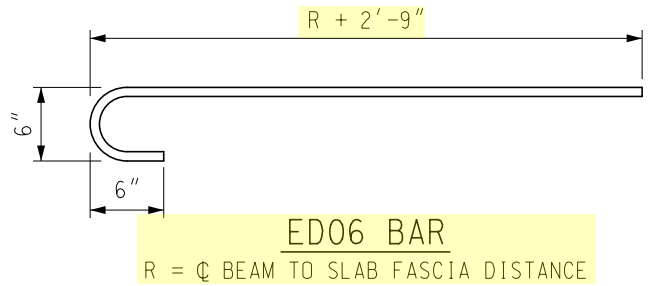
Use approach pavements for sliding slab over backwall designs according to Bridge Design Guides [6.20.03 Series](#). (1-24-2022)

DRAWN BY: BLT  
 CHECKED BY: VZ  
 APPROVED BY: KCK

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT

BRIDGE RAILING, 2 TUBE

ISSUED: 03/27/23  
 SUPERSEDES: 02/14/11



**NOTES:**

"F" CONSTANT EQUALS SLAB THICKNESS PLUS THICKEST FASCIA BEAM FLANGE PLUS 1/2" PLUS AMOUNT OF FASCIA BEAM DROP REQUIRED TO MAINTAIN MINIMUM SLAB THICKNESS AT CURB PLUS HAUNCH (1").

IF "F" BECOMES GREATER THAN 12" USE A HAUNCH DETAIL ON THE FASCIA SIDE OF THE BEAM SIMILAR TO THE HAUNCH DETAIL ON THE INTERIOR SIDE. ADDITIONAL REINFORCEMENT MAY BE REQUIRED IN THE AREA OVER THE BEAM FLANGE IF THE HAUNCH BECOMES EXCESSIVE.

THE DETAILED REINFORCEMENT IN THE SLAB (EA05 & ED06 BARS) IS THE MINIMUM FOR THE RAILING. THE DESIGN OF THE SLAB OVERHANG MAY REQUIRE ADDITIONAL REINFORCEMENT (OR INCREASING THE REINFORCEMENT AREA (DIAMETER) SHOWN). BARS WITH PREFIX "E" ARE TO BE EPOXY COATED.

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

\* IT IS PREFERRED TO POSITION THE FASCIA BEAM TO CARRY THE SCREED RAIL WHICH WILL BE APPROXIMATELY 1'-0" FROM THE ET BAR. HOWEVER, 4 1/2" MINIMUM WILL APPLY TO CURVED GIRDERS ONLY.

\*\* SPACE AT ALTERNATE TRANSVERSE SLAB BARS (1'-6" MAX.). PLACE ADDITIONAL ET040411 BARS 9" EACH SIDE OF  $\phi$  RAILING POST.

\*\*\* AT EACH POST PLACE 7 - ED060409 BARS SPACED AT 9".

\*\*\*\* 2" HIGH x 4" LONG ( $\pm$ ). FORMING NOT REQUIRED.

DRAWN BY: BLT  
 CHECKED BY: VZ  
 APPROVED BY: KCK

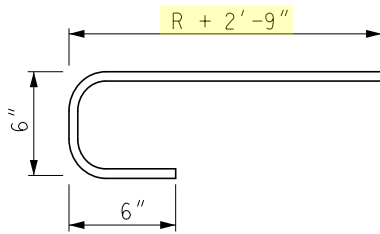
MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT

BRIDGE RAILING,  
 AESTHETIC PARAPET TUBE

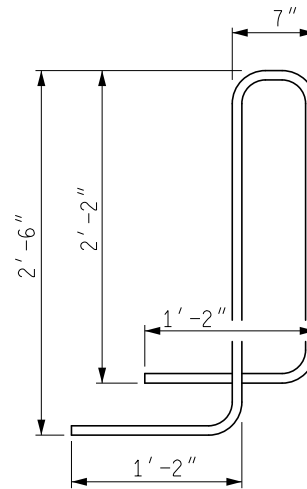
ISSUED: 03/27/23  
 SUPERSEDES: 02/14/11

WEIGHT = 320 LBS/FT

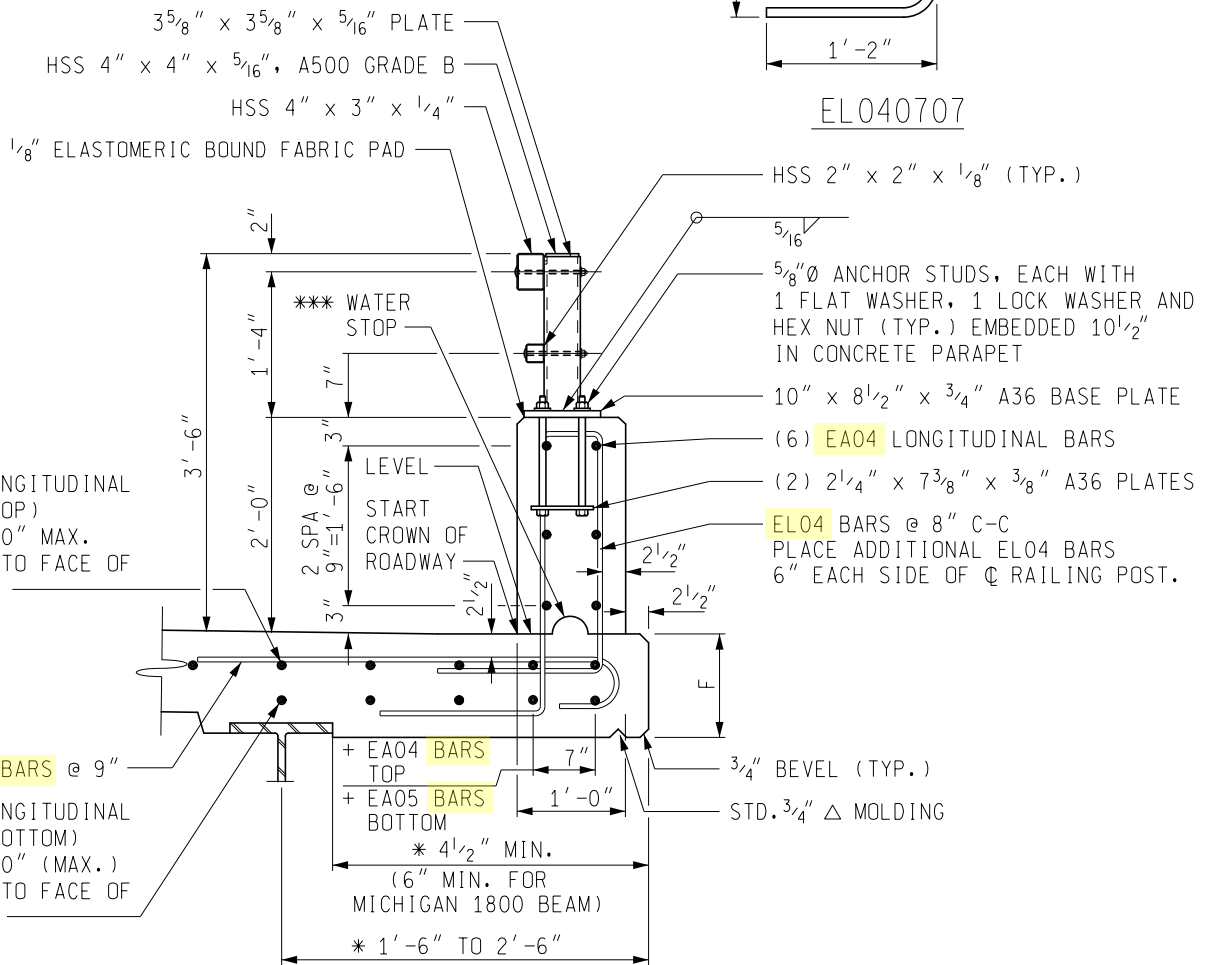
R =  $\phi$  BEAM TO SLAB FASCIA DISTANCE



\*\* ED06 BAR



ELO40707



FLUSH MOUNT BRIDGE RAILING

NOTES:

\* IT IS PREFERRED TO POSITION THE FASCIA BEAM TO CARRY THE SCREED RAIL WHICH WILL BE 6" TO 8" FROM THE EL BAR. HOWEVER 4 1/2" MINIMUM WILL APPLY TO CURVED BRIDGES ONLY.

\*\*\* 2" HIGH x 4" WIDE ( $\pm$ ). FORMING NOT REQUIRED.

+ THE DETAILED REINFORCEMENT IN THE SLAB (EA04, EA05 & ED06 BARS) IS THE MINIMUM FOR THE RAILING IN ADDITION TO STANDARD BRIDGE SLAB REINFORCEMENT. THE DESIGN OF THE SLAB OVERHANG MAY REQUIRE ADDITIONAL REINFORCEMENT (OR INCREASING THE REINFORCEMENT AREA (DIAMETER) SHOWN). ALL TOP TRANSVERSE BRIDGE SLAB REINFORCEMENT IS HOOKED SIMILAR TO THE ED06 BAR DETAILED ON THIS SHEET. BARS WITH PREFIX "E" ARE TO BE EPOXY COATED.

FOR ADDITIONAL DETAILS ON RAILING, SEE STANDARD PLAN B-25-SERIES AND GUIDES 6.29.10A & 6.29.10B.

DO NOT PLACE UTILITY CONDUITS IN THE BARRIER.

IF "F" BECOMES GREATER THAN 12" USE A HAUNCH DETAIL ON THE FASCIA SIDE OF THE BEAM SIMILAR TO THE HAUNCH DETAIL ON THE INTERIOR SIDE. ADDITIONAL REINFORCEMENT MAY BE REQUIRED IN THE AREA OVER THE BEAM FLANGE IF THE HAUNCH BECOMES EXCESSIVE.

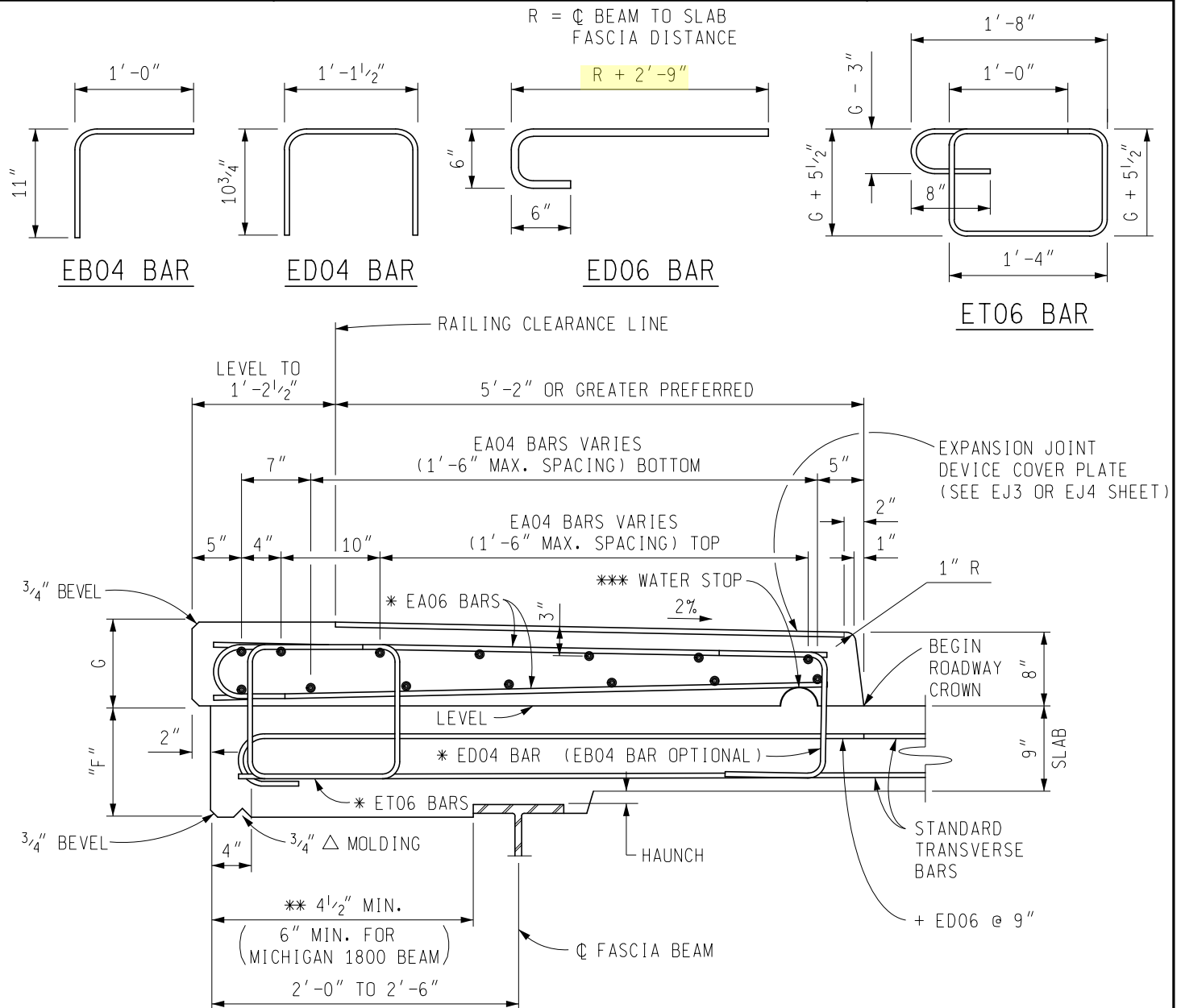
PREPARED BY  
 DESIGN DIVISION

6.29.10

DRAWN BY: BLT  
 CHECKED BY: VZ  
 APPROVED BY: KCK

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT  
 BRIDGE RAILING, AESTHETIC PARAPET TUBE  
 SIDEWALK SECTION

ISSUED: 03/27/23  
 SUPERSEDES: 02/14/11



NOTES:

"F" CONSTANT EQUALS SLAB THICKNESS PLUS HAUNCH PLUS THICKEST FASCIA BEAM FLANGE PLUS 1/2" PLUS AMOUNT OF FASCIA BEAM DROP REQUIRED TO MAINTAIN SLAB THICKNESS AT CURB LINE.

IF "F" BECOMES GREATER THAN 12" USE A HAUNCH DETAIL ON THE FASCIA SIDE OF THE BEAM SIMILAR TO THE HAUNCH DETAIL ON THE INTERIOR SIDE. ADDITIONAL REINFORCEMENT MAY BE REQUIRED IN THE AREA OVER THE BEAM FLANGE IF THE HAUNCH BECOMES EXCESSIVE.

+ THE DETAILED REINFORCEMENT IN THE SLAB (ED06 BARS) IS THE MINIMUM FOR THE RAILING. THE DESIGN OF THE SLAB OVERHANG MAY REQUIRE ADDITIONAL REINFORCEMENT (OR INCREASING THE REINFORCEMENT AREA (DIAMETER) SHOWN). ALL TOP TRANSVERSE BRIDGE SLAB REINFORCEMENT IS HOOKED SIMILAR TO THE ED06 BAR DETAILED ON THIS SHEET. BARS WITH PREFIX "E" ARE TO BE EPOXY COATED.

\* SPACE WITH ALTERNATE TRANSVERSE SLAB BARS (1'-6" MAX.). EB04 BAR MAY BE ADHESIVE ANCHORED INTO 6" DEEP HOLE INSTEAD OF ED04 BAR. PLACE ADDITIONAL ET06 BAR 6" EACH SIDE OF C RAILING POST.

\*\* APPLIES TO CURVED BRIDGES ONLY.

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

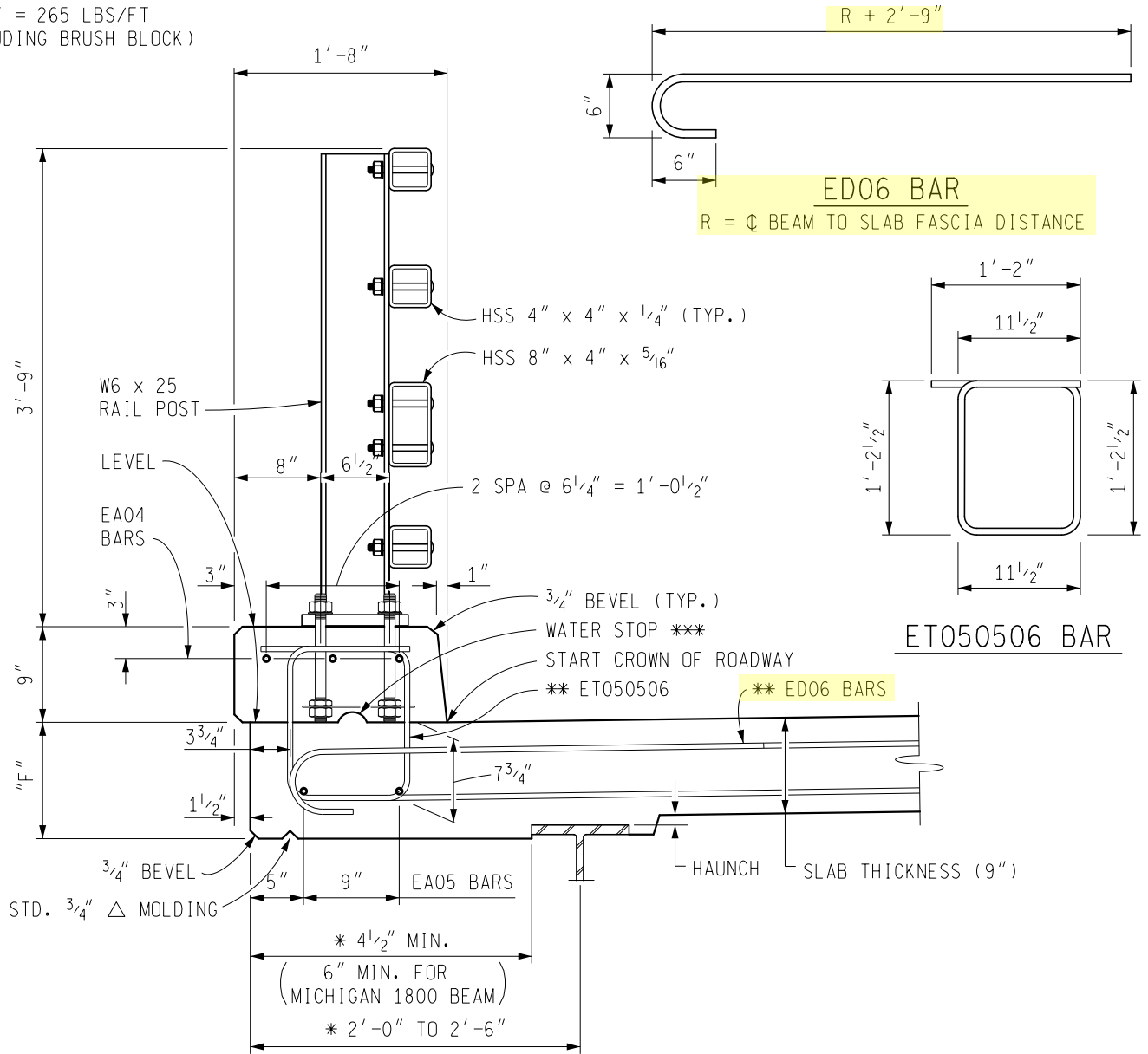
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 CHECKED BY: VZ  
 APPROVED BY: KCK

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT

BRIDGE RAILING, 4 TUBE  
 BICYCLE RAILING OPTION

ISSUED: 03/27/23  
 SUPERSEDES: 02/14/11

WEIGHT = 265 LBS/FT  
 (INCLUDING BRUSH BLOCK)



NOTES:

"F" CONSTANT EQUALS SLAB THICKNESS PLUS THICKEST FASCIA BEAM FLANGE PLUS 1/2" PLUS AMOUNT OF FASCIA BEAM DROP REQUIRED TO MAINTAIN MINIMUM SLAB THICKNESS AT CURB PLUS HAUNCH (1").

IF "F" BECOMES GREATER THAN 12" USE A HAUNCH DETAIL ON THE FASCIA SIDE OF THE BEAM SIMILAR TO THE HAUNCH DETAIL ON THE INTERIOR SIDE. ADDITIONAL REINFORCEMENT MAY BE REQUIRED IN THE AREA OVER THE BEAM FLANGE IF THE HAUNCH BECOMES EXCESSIVE.

THE DETAILED REINFORCEMENT IN THE SLAB (EA05 & ED06 BARS) IS THE MINIMUM FOR THE RAILING. THE DESIGN OF THE SLAB OVERHANG MAY REQUIRE ADDITIONAL REINFORCEMENT (OR INCREASING THE REINFORCEMENT AREA (DIAMETER) SHOWN). BARS WITH PREFIX "E" ARE TO BE EPOXY COATED.

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

\* IT IS PREFERRED TO POSITION THE FASCIA BEAM TO CARRY THE SCREED RAIL WHICH WILL BE APPROXIMATELY 1'-0" FROM THE ET BAR. HOWEVER, 4 1/2" MINIMUM WILL APPLY TO CURVED GIRDERS ONLY.

\*\* AT EACH POST PLACE 7 - ET050506 BARS SPACED AT 6" AND ED06 BARS WITH ALTERNATE ET05 BARS. PLACE ET05 AND ED06 BARS AT 12" MAX. IN REMAINING AREAS.

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

PREPARED BY  
 DESIGN DIVISION

6.29.17

