



# Road & Bridge Design Publications

Monthly Update – October 2016

Revisions for the month of **October** are listed and displayed below. New special details will be included in projects submitted for the **January** 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](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).

## Special Details

R-62-H: Guardrail Approach Terminals Type 2B & 2T: Added the ET-Plus terminal back onto the standard, per EOC recommendation. Replaced the angle strut with the strut and yoke assembly from R-61-series. Also, added notes (and referenced R-60-series) regarding connecting the ET terminal to MGS-8 guardrail. In regards to details for the SKT, revised the strut & yoke assembly notes to reference the strut details from the FLEAT-MT from R-63-series.

## Road Design Manual

1.03.01: Order of Plan Sheets: Inserted “ITS Plans” between Lighting Plans and Signal Plans in the “order of plan sheets” list.

Appendix 3A, Geometric Design Elements: Urban Lane Width: Added a speed requirement for 10’ lane widths on urban, non-freeway arterials. This update matches the terminology used in the current (2011) AASHTO Geometric Design of Highways and Streets.

## Bridge Design Manual

7.01.03 (LFD & LRFD) & 8.02 G. (LFD & LRFD): Updated designation for pre-stressing strand tensile strength to  $f_{pu}$  from  $f'_s$ .

## Bridge Design Guides

8.21.03: Added 16” pile and corresponding pile point plate and welds.

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

10-17-2016

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	6-15-16
R-28-J	7	SIDEWALK RAMP AND DETECTABLE WARNING DETAILS	3-15-16
R-39-J	5	TRANSVERSE PAVEMENT JOINTS	7-13-16
R-53-A	22	TEMPORARY CONCRETE BARRIER LIMITED DEFLECTION	8-14-15
R-56-F	8	GUARDRAIL MEDIAN OBJECT PROTECTION	9-8-16
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)	8-1-16
*R-62-H	14	GUARDRAIL APPROACH TERMINAL TYPES 2B & 2T (SKT,ET-Plus, & X-Lite)	10-14-16
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 January 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

10-17-2016

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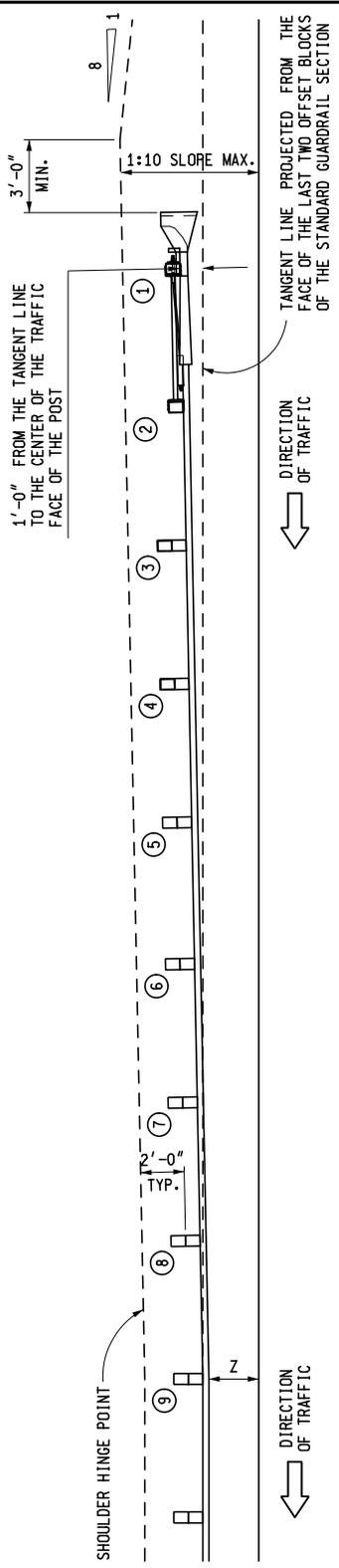
DETAIL NUMBER	NUMBER OF SHEETS	TITLE	CURRENT DATE
B-22-E	4	BRIDGE RAILING, THRIE BEAM RETROFIT (R4 TYPE RAILING)	3-15-16
B-23-F	4	BRIDGE RAILING, THRIE BEAM RETROFIT (OPEN PARAPET RAILING)	3-15-16
B-101-G	2	DRAIN CASTING ASSEMBLY DETAILS	2-8-16
EJ3AB	1 or 2	EXPANSION JOINT DETAILS	2-10-16
EJ4O	1 or 2	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 January letting.**

Note:

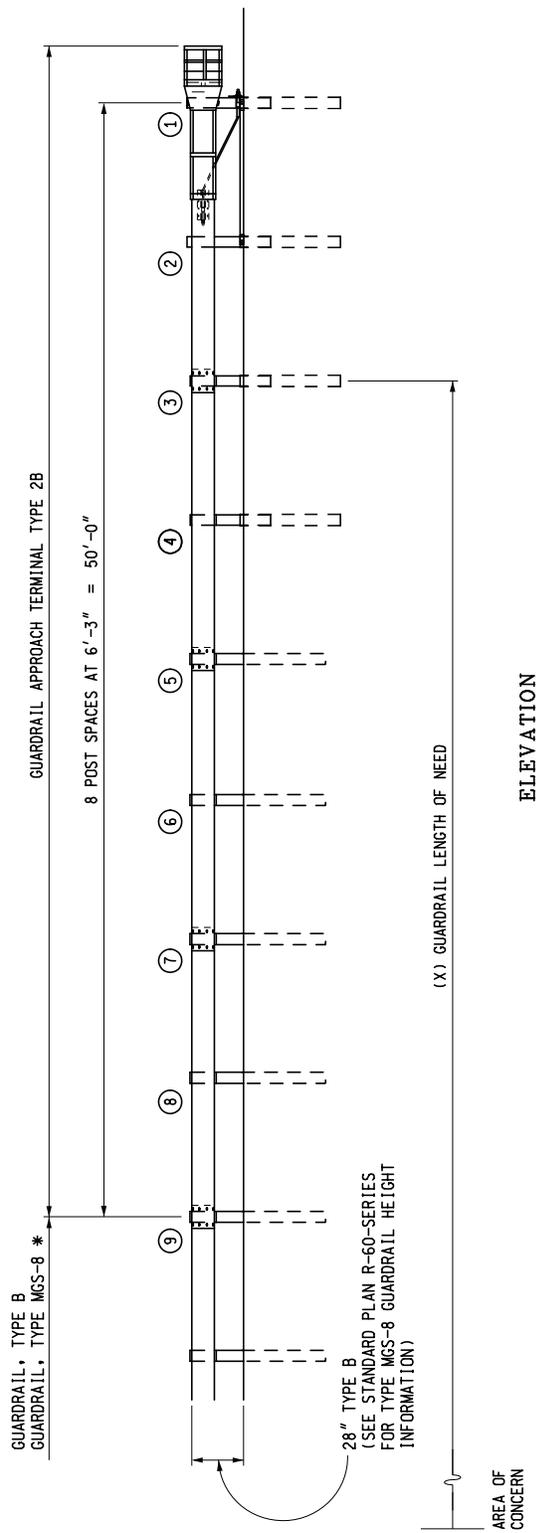
Details EJ3AA & EJ4N are interactive, i.e. designers and detailers choose details based upon railing type and angle of crossing. Place all details appropriate for the project, structure specific information, and the Expansion Joint Device quantity on the sheet. The sheet shall then be added to the plans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



PLAN VIEW

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



ELEVATION

GUARDRAIL APPROACH TERMINAL TYPE 2B "SKT"

**OPTION 1**

(DETAILED ON SHEETS 1 THROUGH 4)



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 HIGHWAY DEVELOPMENT

MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF DEVELOPMENT STANDARD PLAN FOR

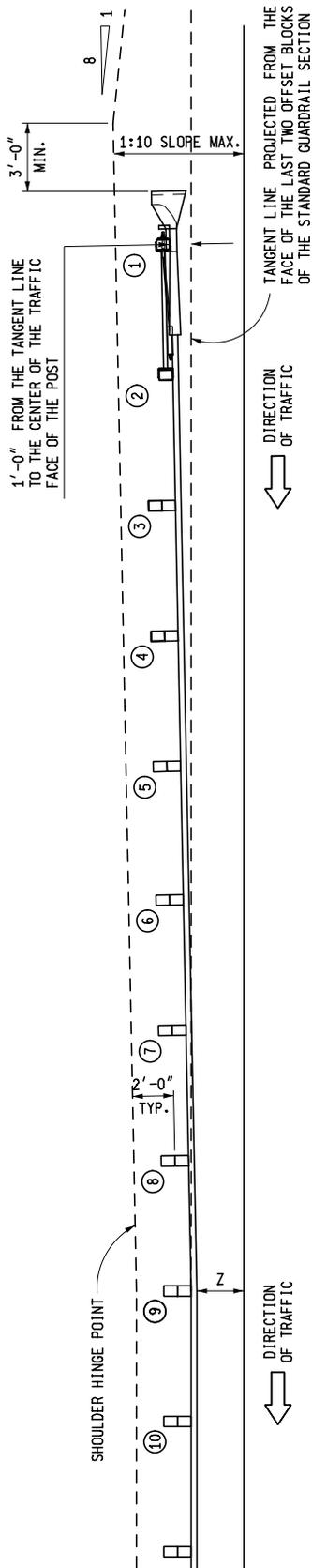
**GUARDRAIL APPROACH  
TERMINAL TYPES 2B & 2T  
(SKT, ET-PLUS & X-LITE-TANGENT-50)**

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

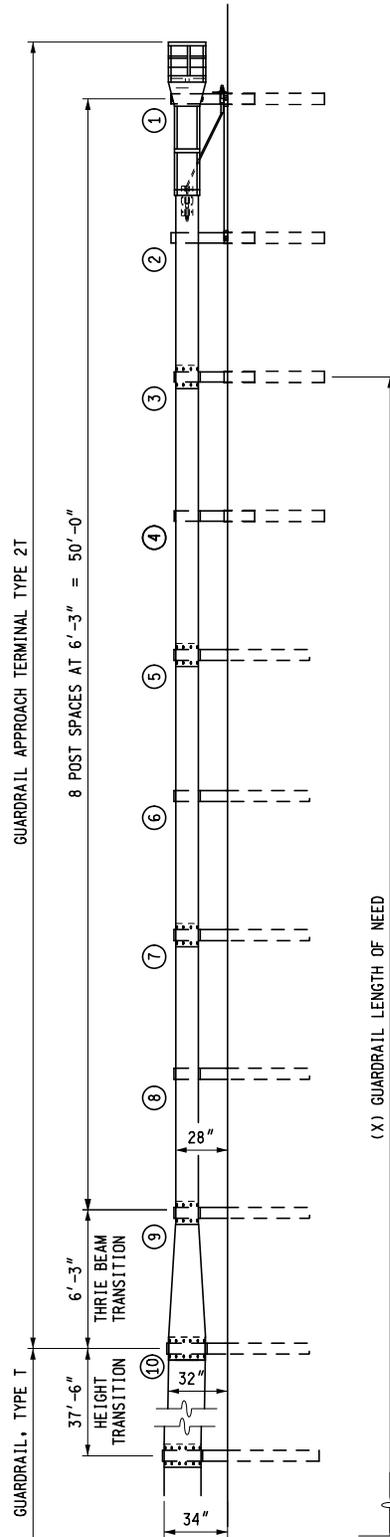
10-14-2016  
PLAN DATE

**R-62-H**

SHEET  
1 OF 14



PLAN VIEW



ELEVATION

GUARDRAIL APPROACH TERMINAL TYPE 2T  
"SKT"

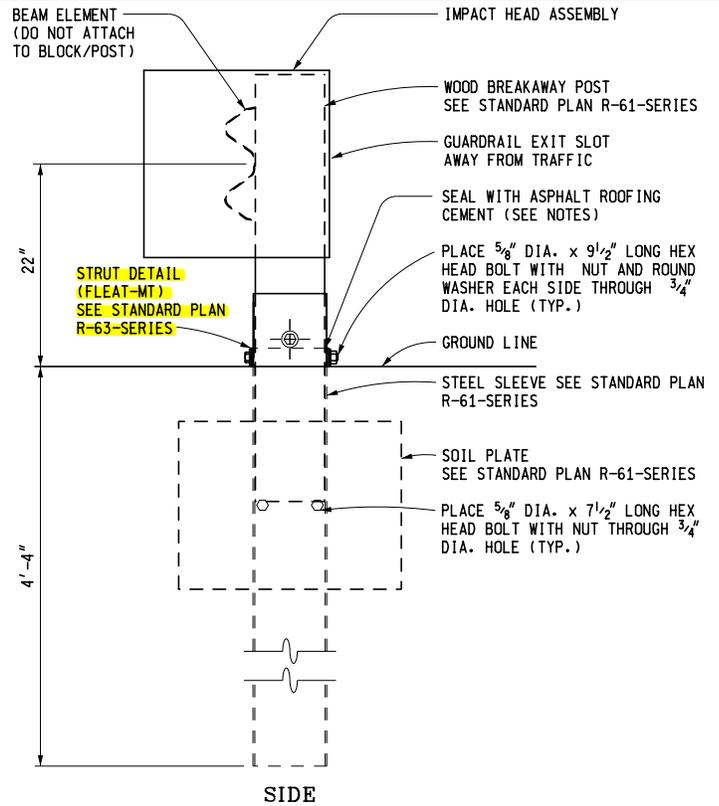
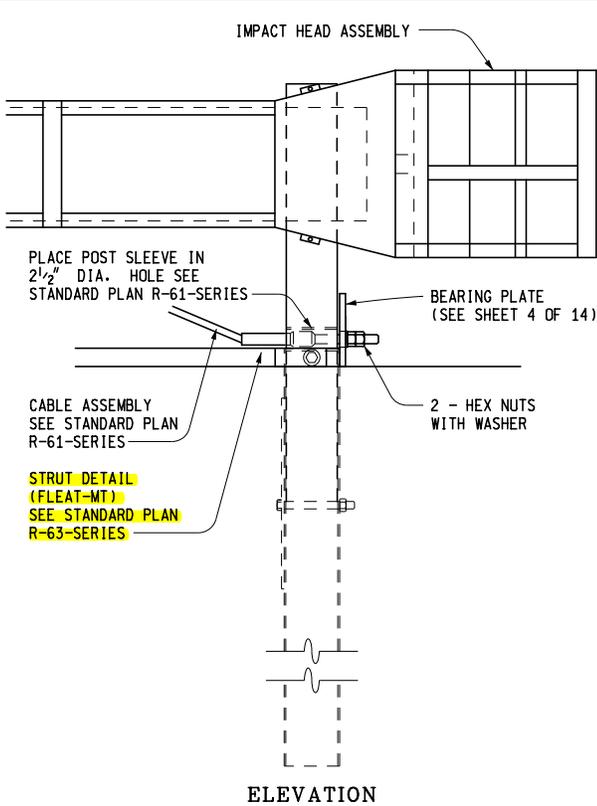
MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF DEVELOPMENT STANDARD PLAN FOR  
**GUARDRAIL APPROACH  
TERMINAL TYPES 2B & 2T**  
(SKT, ET-PLUS & X-LITE-TANGENT-50)

F.H.W.A. APPROVAL

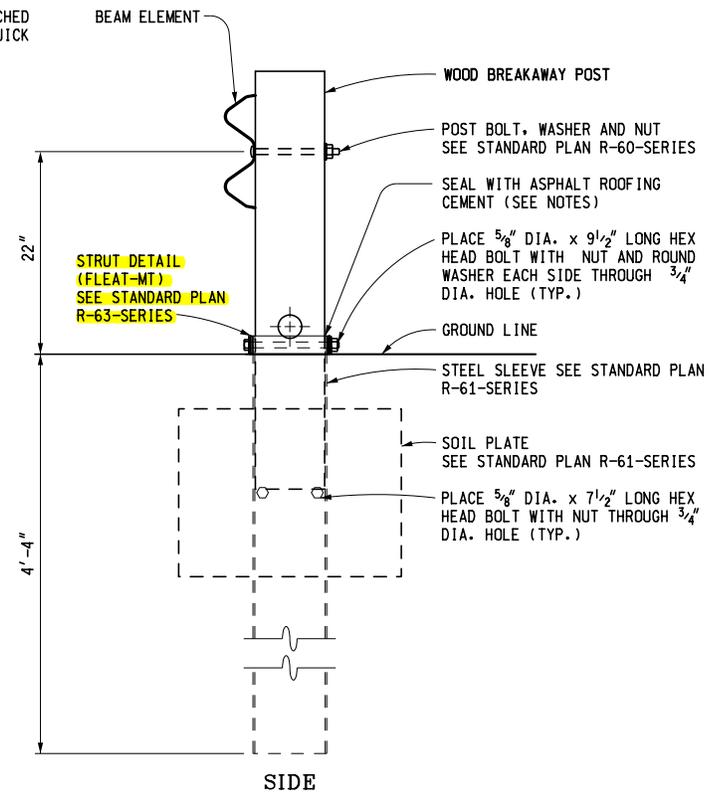
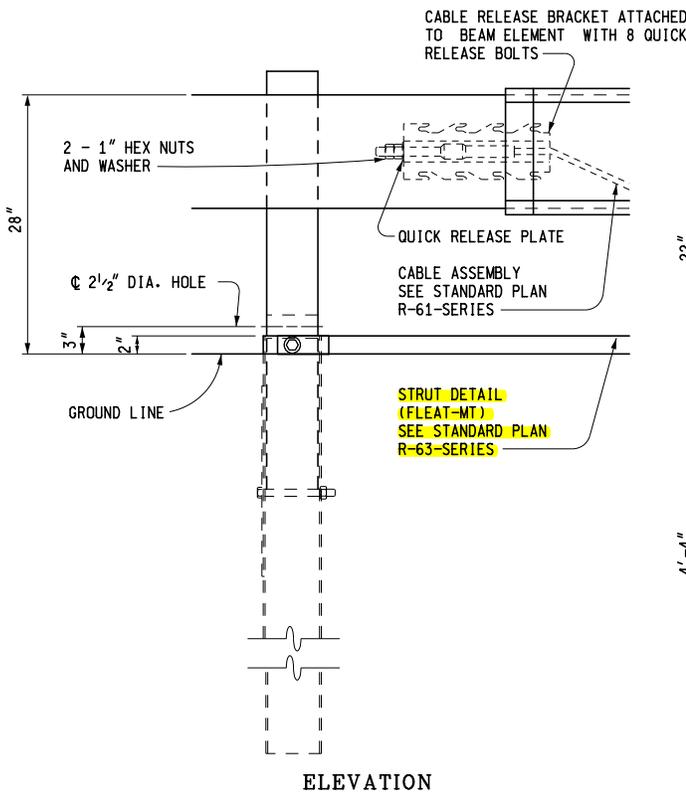
10-14-2016  
PLAN DATE

R-62-H

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2 OF 14



POST 1 DETAIL



POST 2 DETAIL

NOTE:

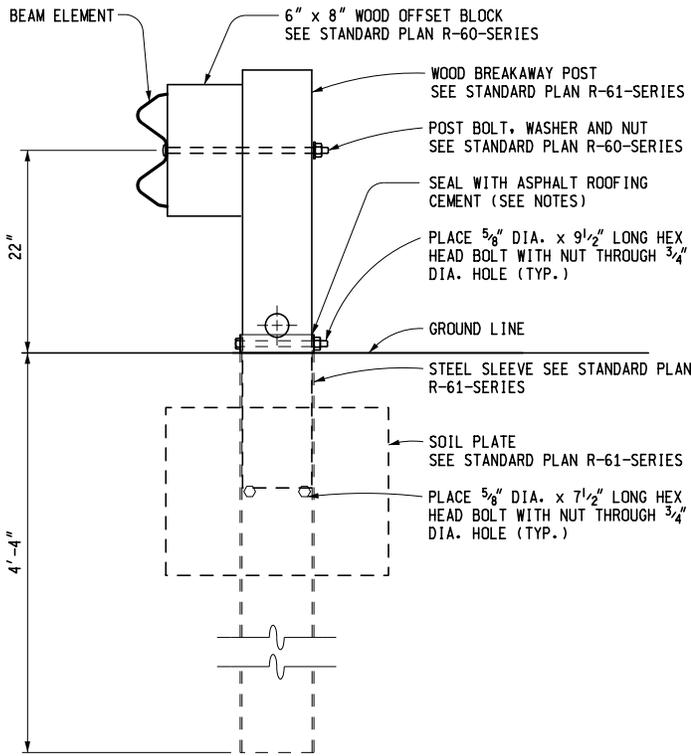
THE BREAKAWAY CABLE ASSEMBLY MUST BE TAUT. A LOCKING DEVICE (VICE GRIPS OR CHANNEL LOCK PLIERS) SHOULD BE USED TO PREVENT THE CABLE FROM TWISTING WHEN TIGHTENING THE NUTS.

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.

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

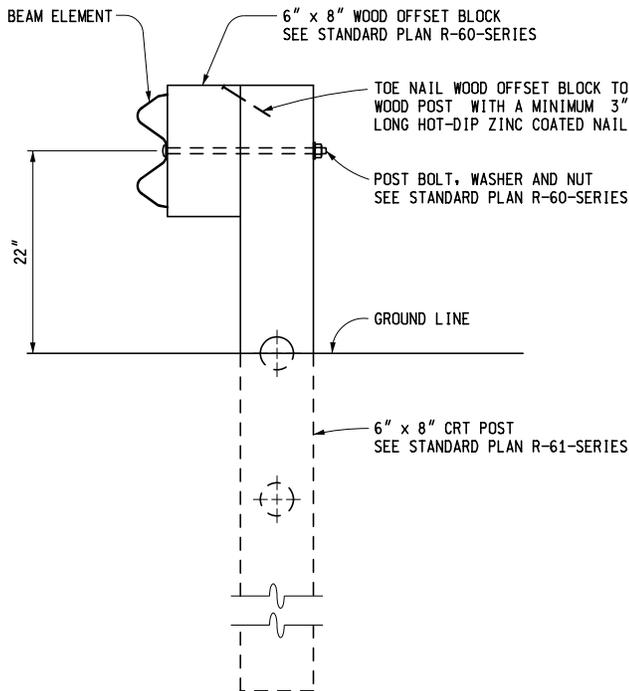
MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF DEVELOPMENT STANDARD PLAN FOR  
**GUARDRAIL APPROACH  
TERMINAL TYPES 2B & 2T  
(SKT, ET-PLUS & X-LITE-TANGENT-50)**

F.H.W.A. APPROVAL	10-14-2016 PLAN DATE	R-62-H	SHEET 3 OF 14
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### POST 3 AND 4 DETAIL

NOTE: BEAM ELEMENTS ARE SPLICED TOGETHER AT POST 3

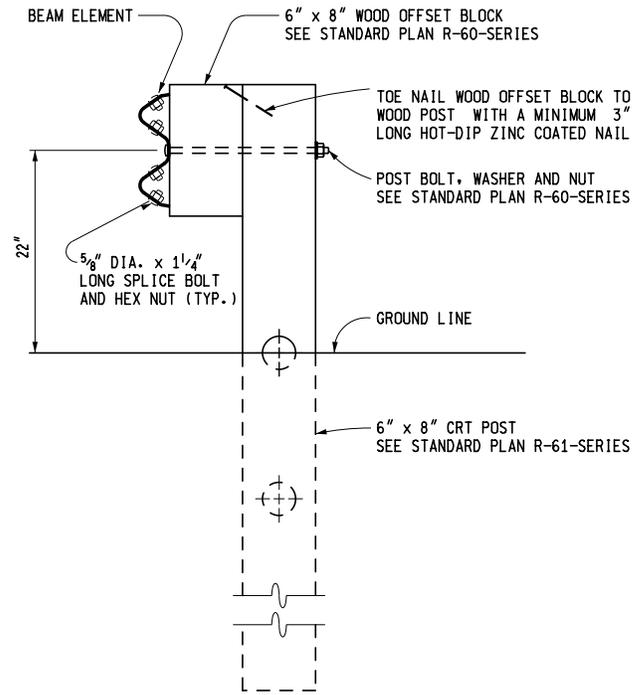


### POST 6 AND 8 DETAIL

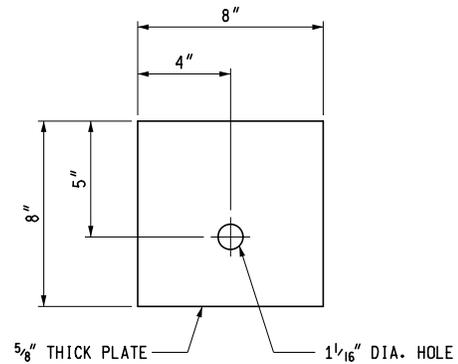
NOTE: POST 9 IS A STANDARD LINE POST.

NOTE:

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



### POST 5 AND 7 DETAIL



### BEARING PLATE

( SKT & ET-PLUS )

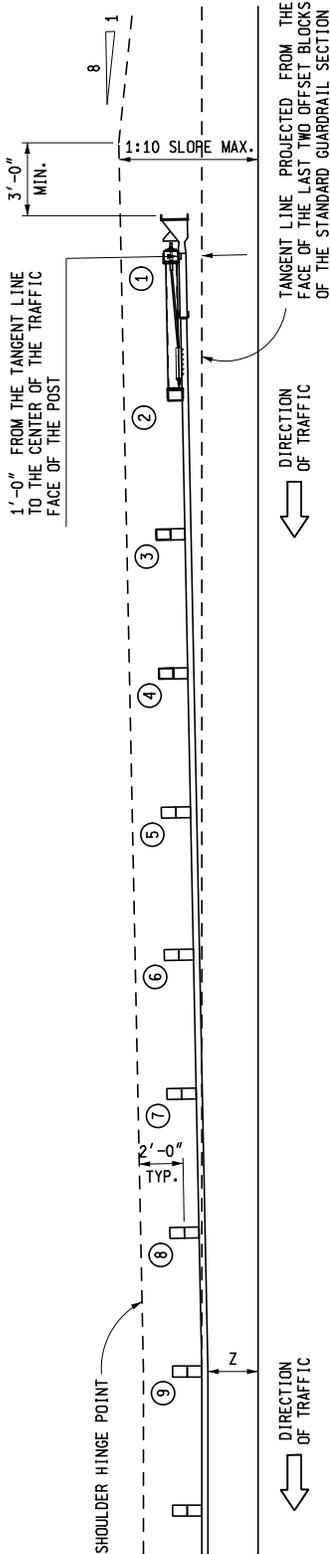
MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF DEVELOPMENT STANDARD PLAN FOR  
**GUARDRAIL APPROACH  
TERMINAL TYPES 2B & 2T  
(SKT, ET-PLUS & X-LITE-TANGENT-50)**

F.H.W.A. APPROVAL

10-14-2016  
PLAN DATE

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4 OF 14

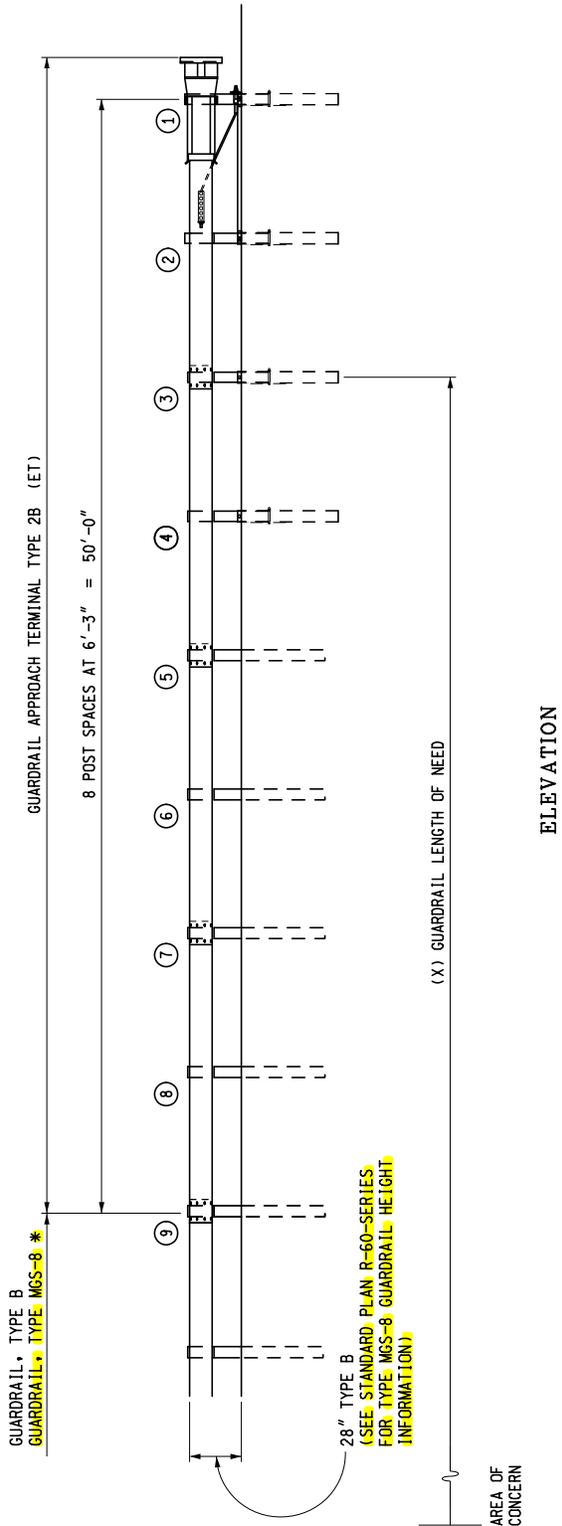


PLAN VIEW

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

**OPTION 2**

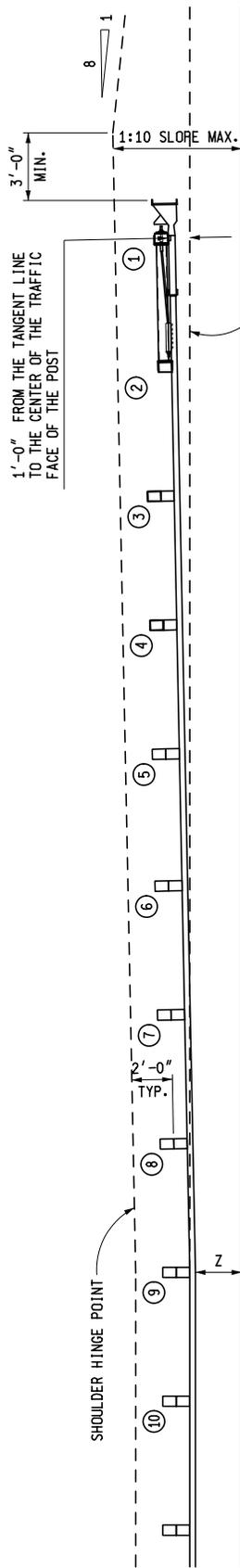
(DETAILED ON SHEETS 5 THROUGH 8 AND 14)



**GUARDRAIL APPROACH TERMINAL TYPE 2B  
"ET-PLUS"**

MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF DEVELOPMENT STANDARD PLAN FOR  
**GUARDRAIL APPROACH  
TERMINAL TYPES 2B & 2T**  
(SKT, ET-PLUS & X-LITE-TANGENT-50)

F.H.W.A. APPROVAL	10-14-2016 PLAN DATE	R-62-H	SHEET 5 OF 14
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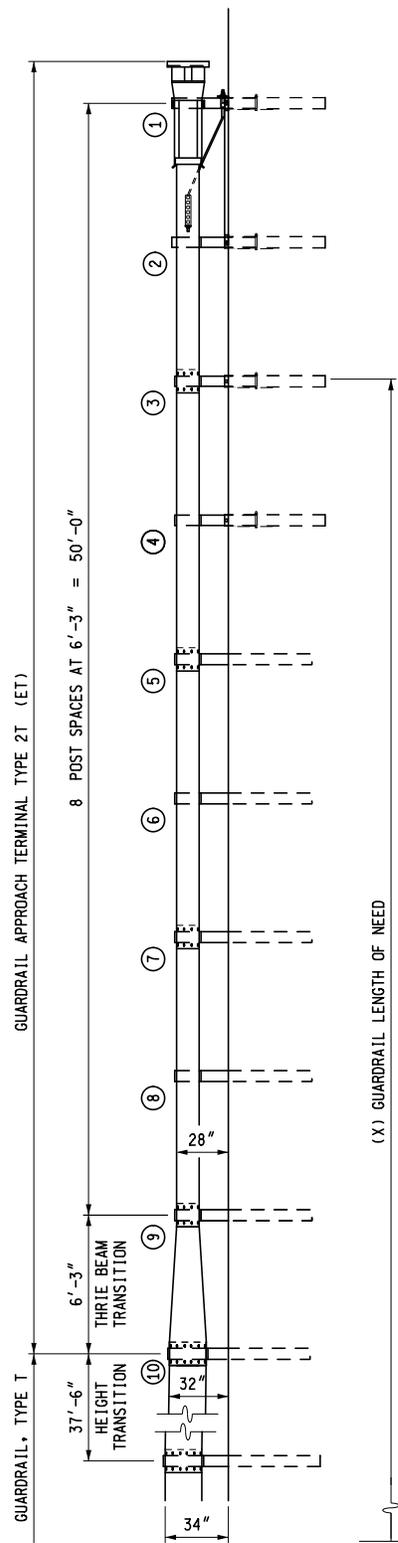


TANGENT LINE PROJECTED FROM THE FACE OF THE LAST TWO OFFSET BLOCKS OF THE STANDARD GUARDRAIL SECTION

DIRECTION OF TRAFFIC

PLAN VIEW

DIRECTION OF TRAFFIC



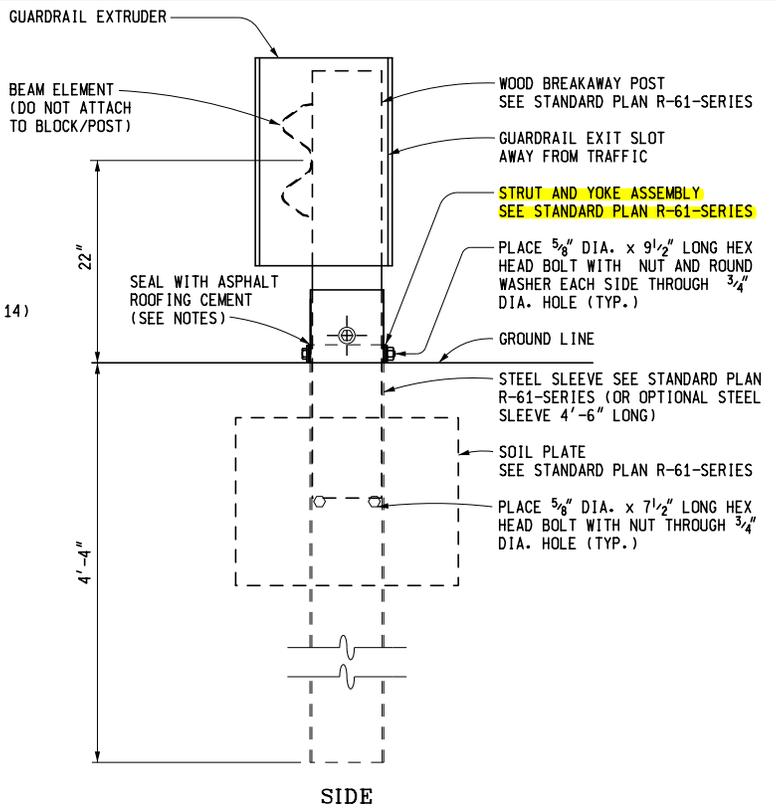
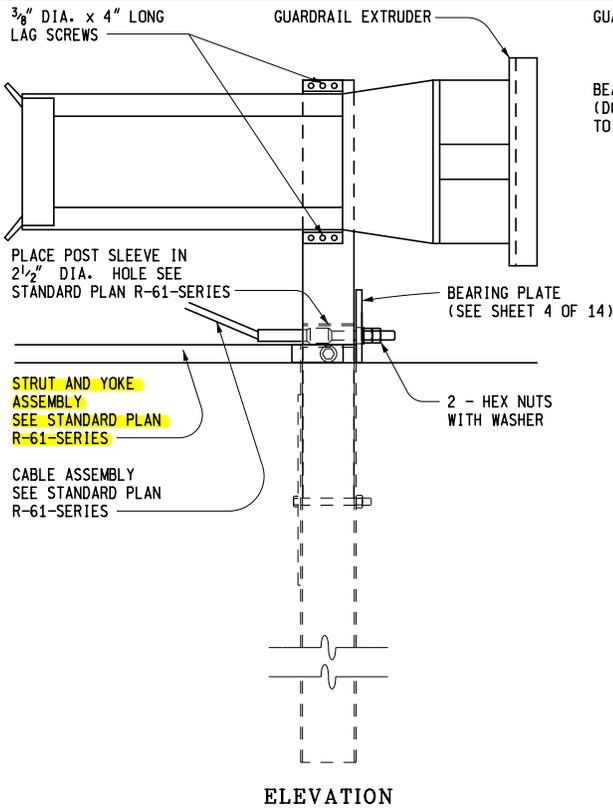
AREA OF CONCERN

ELEVATION

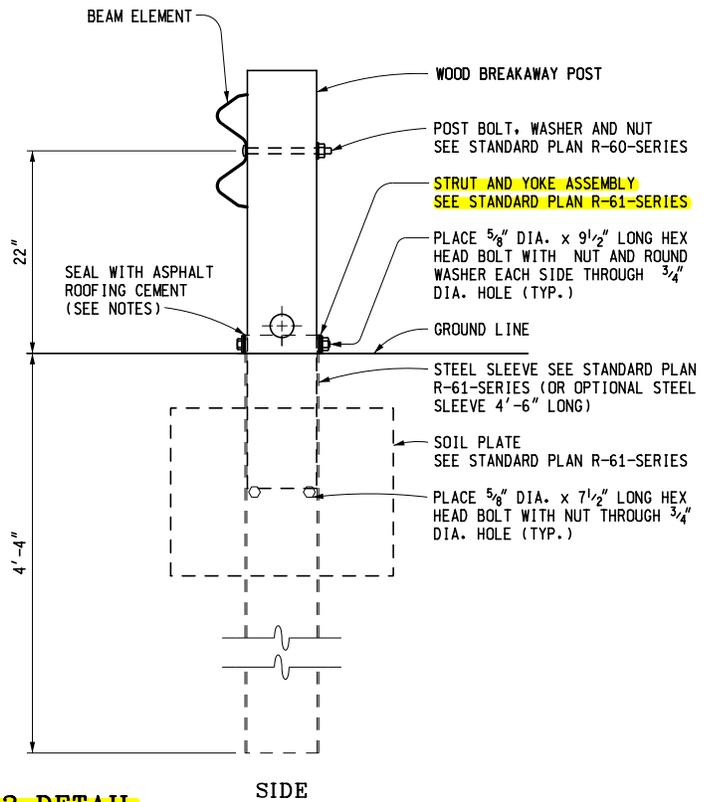
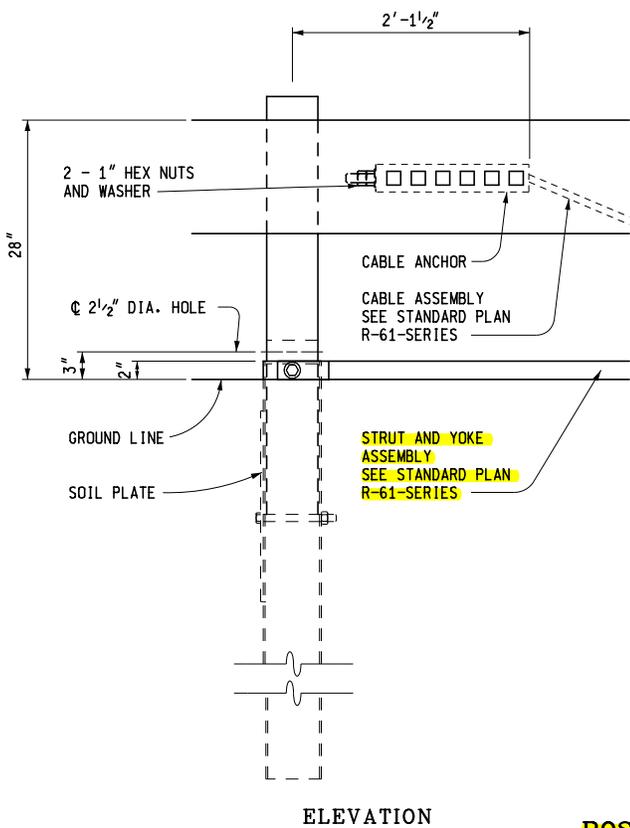
**GUARDRAIL APPROACH TERMINAL TYPE 2T**  
**"ET-PLUS"**

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT STANDARD PLAN FOR  
**GUARDRAIL APPROACH TERMINAL TYPES 2B & 2T**  
 (SKT, ET-PLUS & X-LITE-TANGENT-50)

F.H.W.A. APPROVAL	10-14-2016 PLAN DATE	R-62-H	SHEET 6 OF 14
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**POST 1 DETAIL**  
(ET-PLUS)



**POST 2 DETAIL**  
(ET-PLUS)

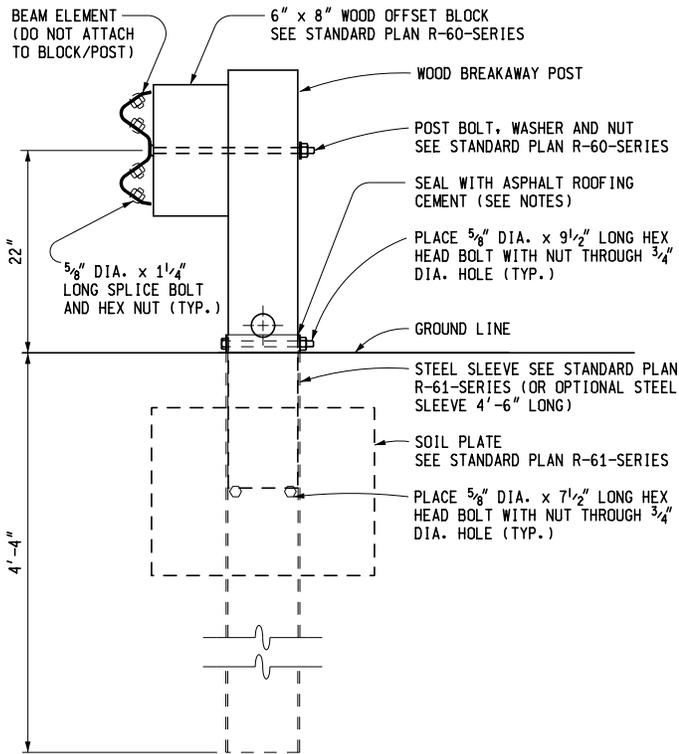
MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF DEVELOPMENT STANDARD PLAN FOR  
**GUARDRAIL APPROACH  
TERMINAL TYPES 2B & 2T  
(SKT, ET-PLUS & X-LITE-TANGENT-50)**

F.H.W.A. APPROVAL

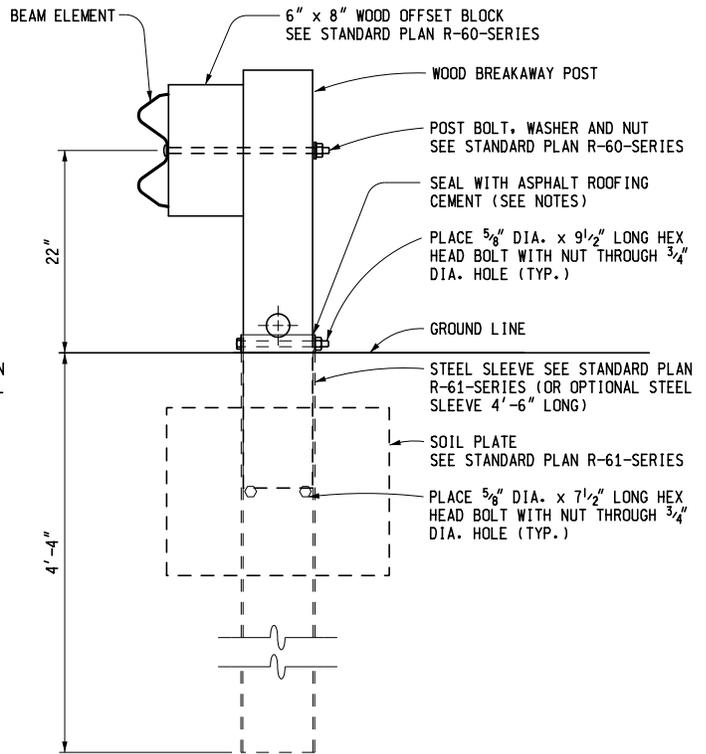
10-14-2016  
PLAN DATE

**R-62-H**

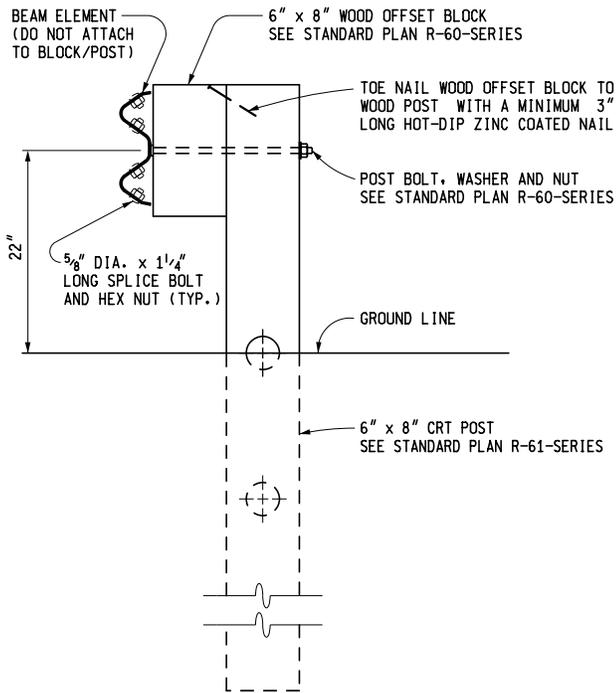
SHEET  
7 OF 14



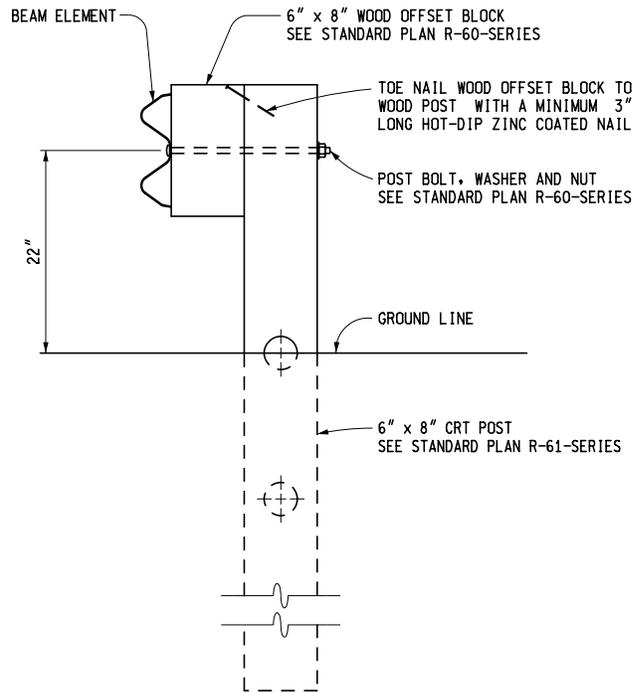
**POST 3 DETAIL**  
(ET-PLUS)



**POST 4 DETAIL**  
(ET-PLUS)



**POST 5 AND 7 DETAIL**  
(ET-PLUS)



**POST 6, AND 8 DETAIL**  
(ET-PLUS)

NOTE: POST 9 IS A STANDARD LINE POST.

MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF DEVELOPMENT STANDARD PLAN FOR  
**GUARDRAIL APPROACH**  
**TERMINAL TYPES 2B & 2T**  
**(SKT, ET-PLUS & X-LITE-TANGENT-50)**

F.H.W.A. APPROVAL

10-14-2016  
PLAN DATE

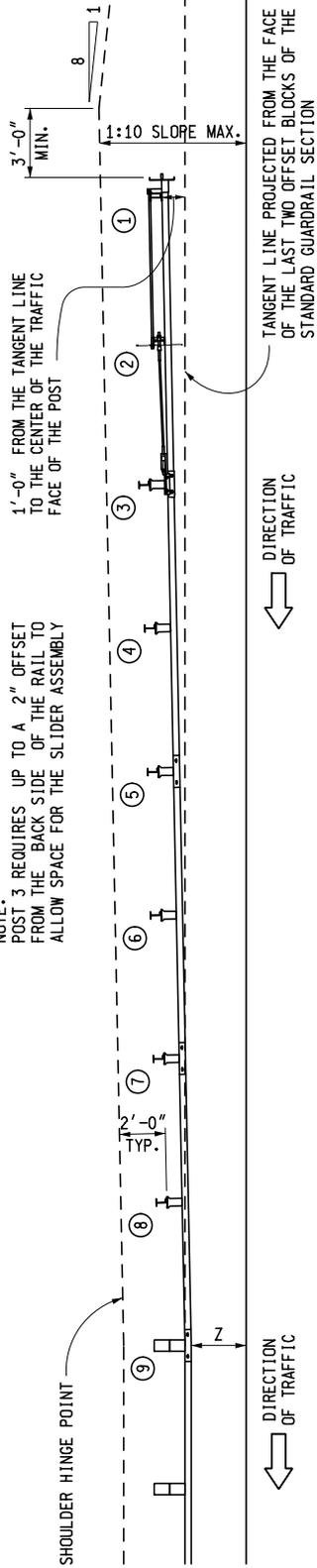
**R-62-H**

SHEET  
8 OF 14

TRAILING END

APPROACH END

NOTE:  
POST 3 REQUIRES UP TO A 2" OFFSET  
FROM THE BACK SIDE OF THE RAIL TO  
ALLOW SPACE FOR THE SLIDER ASSEMBLY

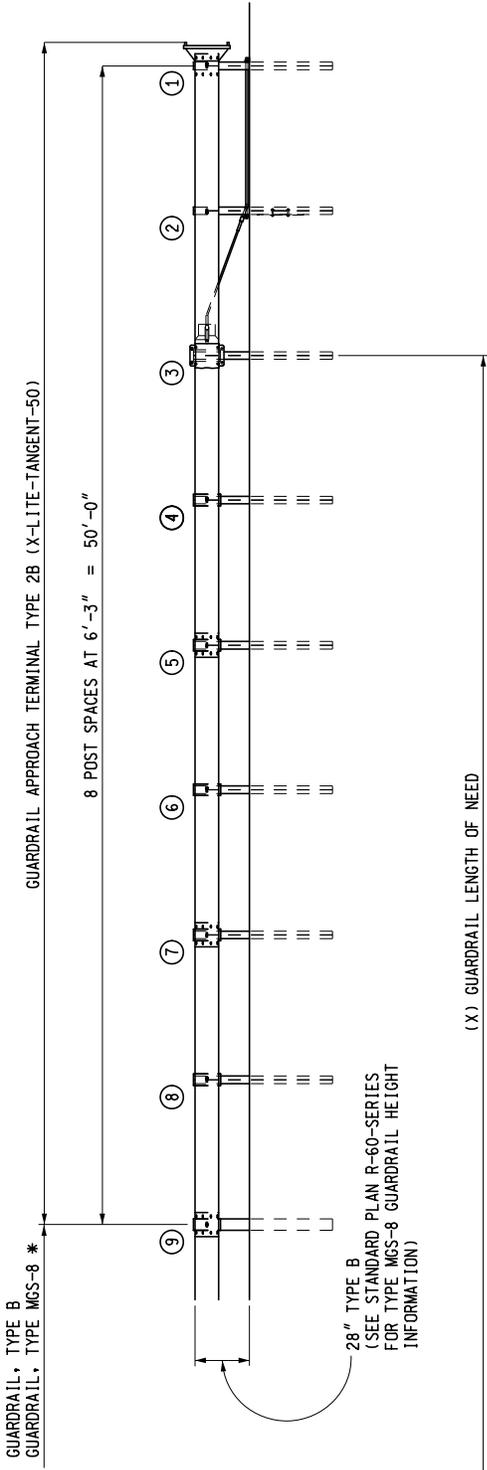


PLAN VIEW

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

### OPTION 3

(DETAILED ON SHEETS 9 THROUGH 13)



ELEVATION

### GUARDRAIL APPROACH TERMINAL TYPE 2B "X-LITE-TANGENT-50"

AREA OF CONCERN

MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF DEVELOPMENT STANDARD PLAN FOR

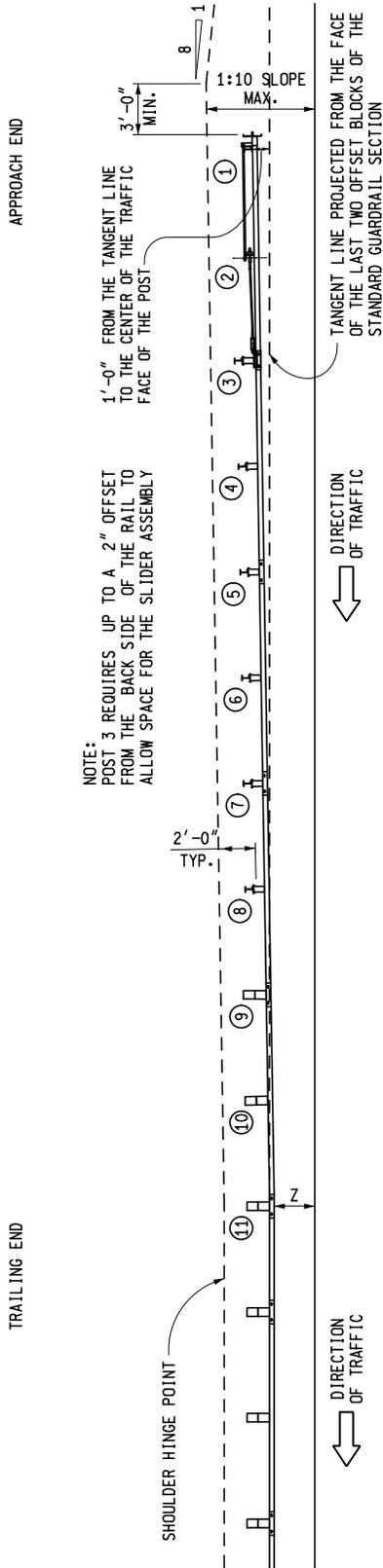
## GUARDRAIL APPROACH TERMINAL TYPES 2B & 2T (SKT, ET-PLUS & X-LITE-TANGENT-50)

F.H.W.A. APPROVAL

10-14-2016  
PLAN DATE

R-62-H

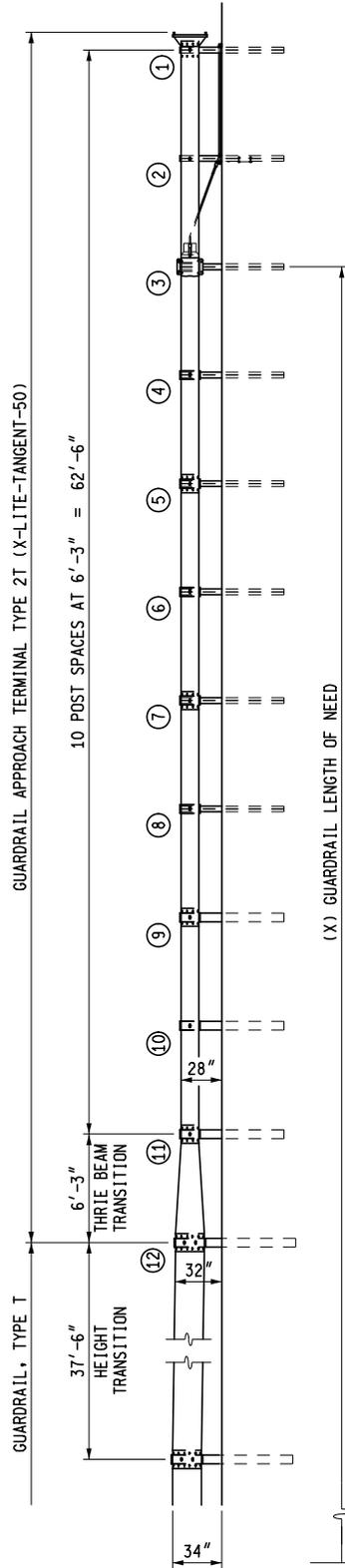
SHEET  
9 OF 14



NOTE:  
POST 3 REQUIRES UP TO A 2" OFFSET FROM THE BACK SIDE OF THE RAIL TO ALLOW SPACE FOR THE SLIDER ASSEMBLY

1'-0" FROM THE TANGENT LINE TO THE CENTER OF THE TRAFFIC FACE OF THE POST

PLAN VIEW



(X) GUARDRAIL LENGTH OF NEED

AREA OF CONCERN

ELEVATION

GUARDRAIL APPROACH TERMINAL TYPE 2T  
"X-LITE-TANGENT-50"

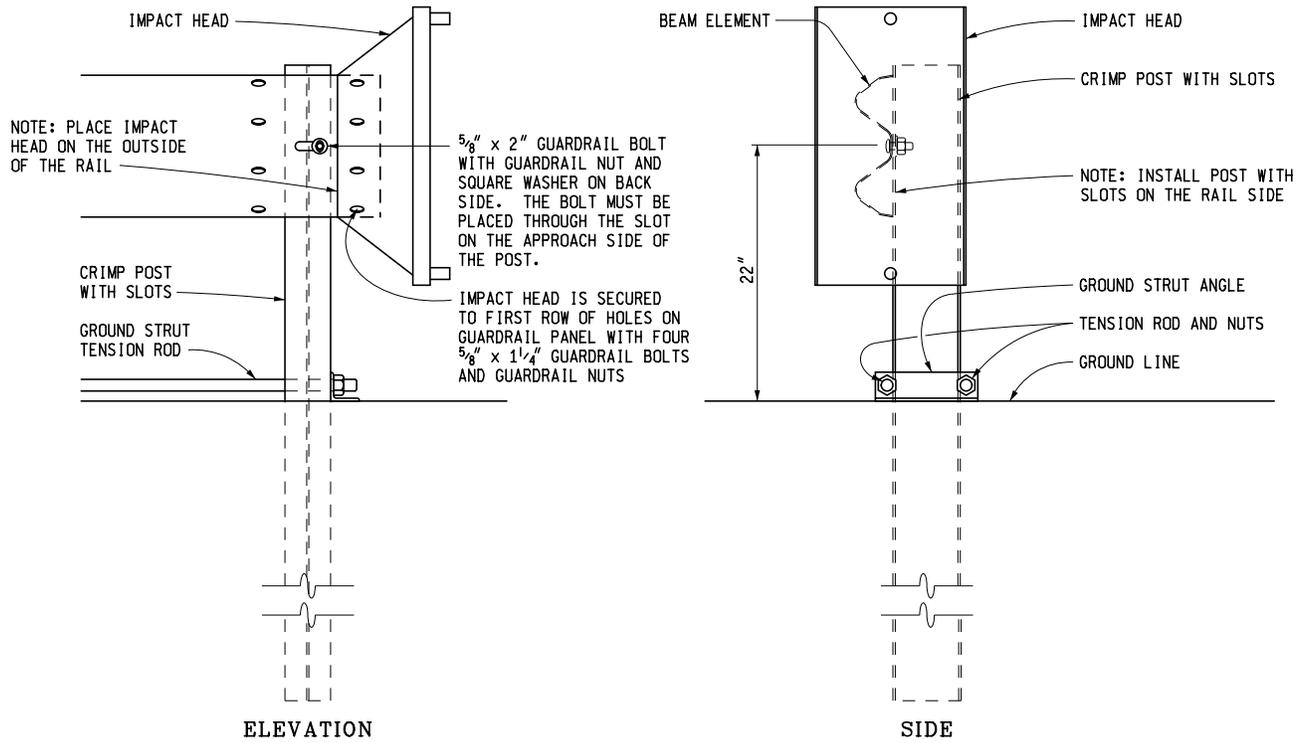
MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF DEVELOPMENT STANDARD PLAN FOR  
**GUARDRAIL APPROACH  
TERMINAL TYPES 2B & 2T**  
(SKT, ET-PLUS & X-LITE-TANGENT-50)

F.H.W.A. APPROVAL

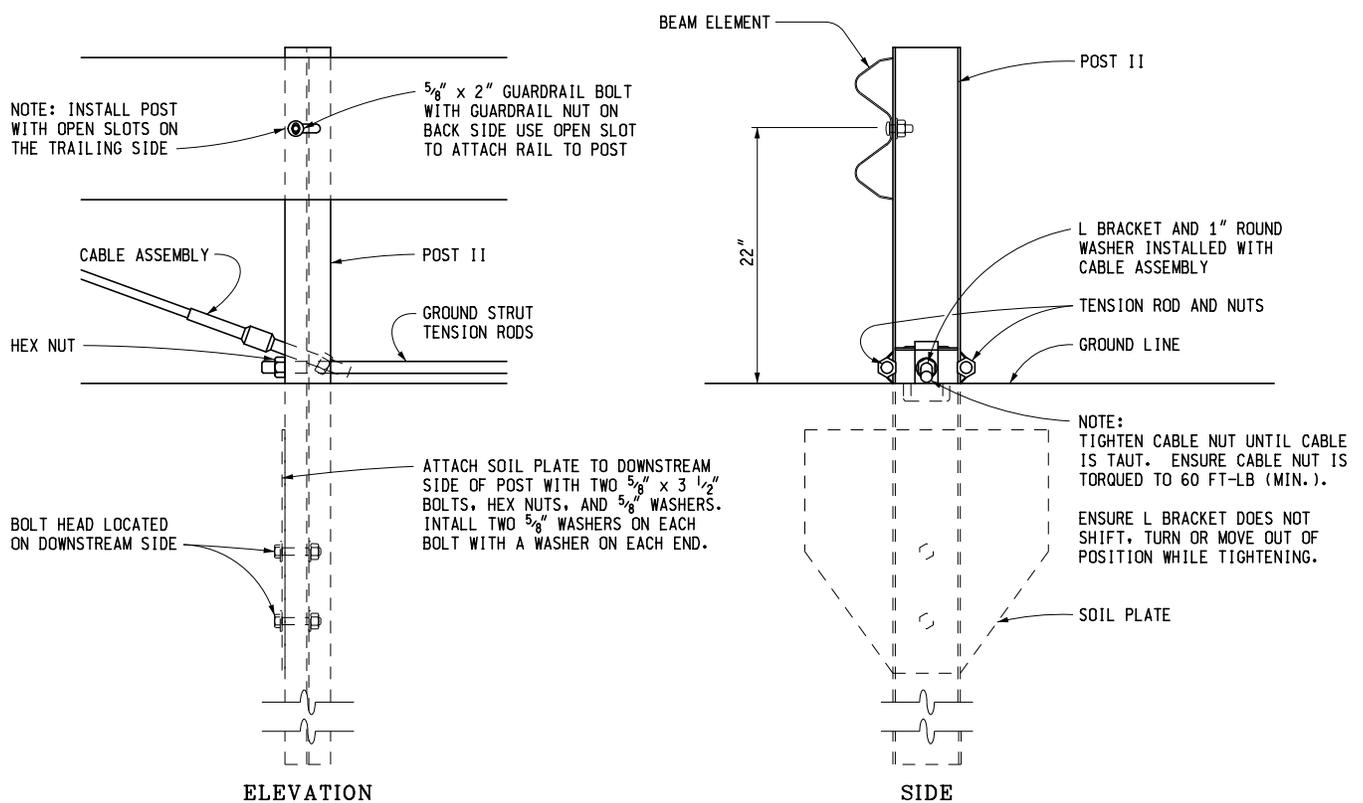
10-14-2016  
PLAN DATE

R-62-H

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10 OF 14



POST 1 DETAIL



POST 2 DETAIL

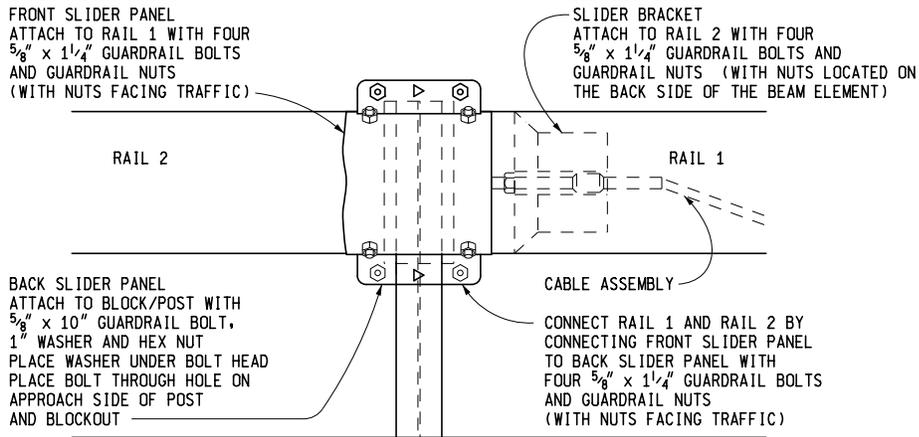
MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT STANDARD PLAN FOR  
**GUARDRAIL APPROACH  
 TERMINAL TYPES 2B & 2T**  
 (SKT, ET-PLUS & X-LITE-TANGENT-50)

F.H.W.A. APPROVAL

10-14-2016  
 PLAN DATE

R-62-H

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**NOTES:**

POST 3 REQUIRES UP TO AN ADDITIONAL 2" OFFSET BETWEEN THE RAIL AND THE OFFSET BLOCK TO ALLOW SPACE FOR THE SLIDER ASSEMBLY.

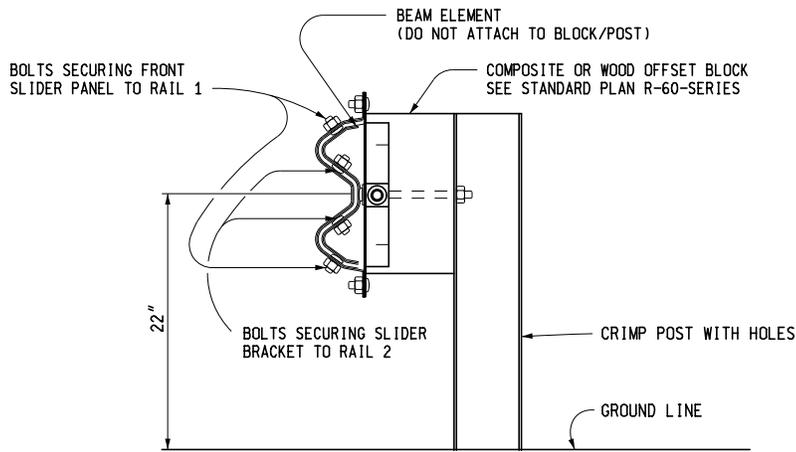
POST 3 REQUIRES GUARDRAIL BOLT TO BE ATTACHED TO HOLE ON APPROACH SIDE OF THE POST.

ENSURE OPEN END OF THE SLOT ON THE BACK SLIDER PANEL IS POINTING TOWARD THE APPROACH END.

ENSURE ANGLED PORTION OF THE FRONT SLIDER PANEL EXTENDS BEYOND THE END OF THE RAIL 1, AND IS FACING THE TRAILING END OF THE TERMINAL.

ARROWS ON FRONT AND BACK SLIDER PANELS NEED TO POINT TOWARD THE APPROACH END OF THE TERMINAL.

**ELEVATION**



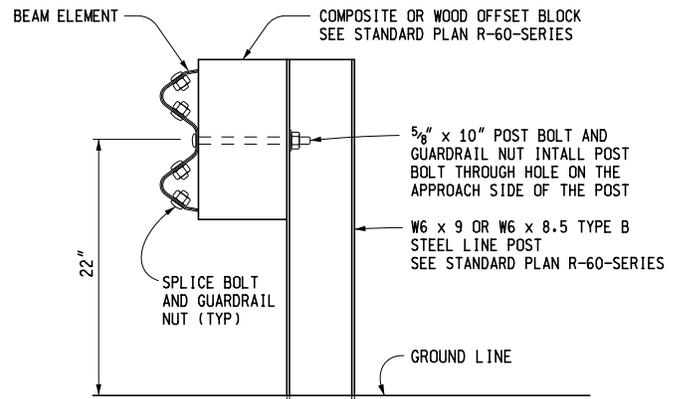
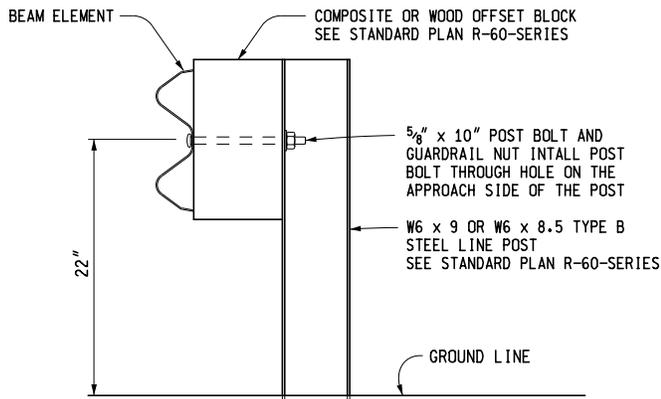
**SIDE**

**POST 3 DETAIL**

MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF DEVELOPMENT STANDARD PLAN FOR

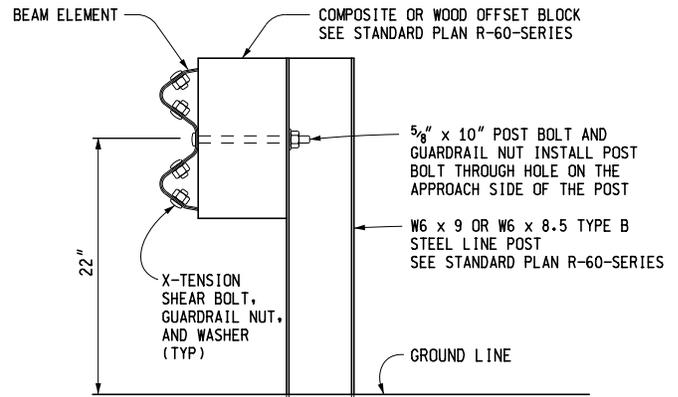
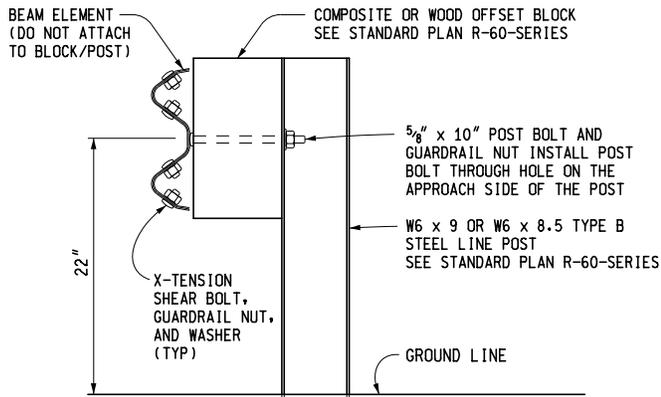
**GUARDRAIL APPROACH  
TERMINAL TYPES 2B & 2T  
(SKT, ET-PLUS & X-LITE-TANGENT-50)**

F.H.W.A. APPROVAL	10-14-2016 PLAN DATE	R-62-H	SHEET 12 OF 14
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**POST 4, 6, AND 8 DETAIL  
POST 10 DETAIL (TYPE 2T TERMINAL ONLY)**

**POST 9 DETAIL**



**POST 5 DETAIL**

**POST 7 DETAIL**

NOTE:  
OVERLAP BEAM ELEMENTS WITH ELEMENTS  
ON THE APPROACH END OVER ELEMENTS  
ON THE TRAILING END

AVOID OVERTIGHTENING X-TENSION SHEAR  
BOLTS. DO NOT USE AN IMPACT WRENCH  
TO TIGHTEN X-TENSION SHEAR BOLTS.

POST 11 (TYPE 2T TERMINAL ONLY) IS A  
STANDARD LINE POST.

MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF DEVELOPMENT STANDARD PLAN FOR  
**GUARDRAIL APPROACH  
TERMINAL TYPES 2B & 2T  
(SKT, ET-PLUS & X-LITE-TANGENT-50)**

F.H.W.A. APPROVAL

10-14-2016  
PLAN DATE

**R-62-H**

SHEET  
13 OF 14

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.

WHEN SITE CONDITIONS WARRANT AND WITH THE APPROVAL OF THE ENGINEER, GUARDRAIL APPROACH TERMINAL TYPES 2B & 2T CAN BE INSTALLED STRAIGHT (WITHOUT THE 1'-0" OFFSET FROM THE TANGENT LINE TO THE TRAFFIC FACE OF POST 1).

GUARDRAIL REFLECTORS ARE NOT TO BE USED ON THE GUARDRAIL APPROACH TERMINAL. PLACE REFLECTORS 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

THE PORTION OF THE IMPACT HEAD ASSEMBLY FACING TRAFFIC SHALL BE COMPLETELY COVERED WITH HIGH INTENSITY ADHESIVE REFLECTIVE SHEETING.

MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF DEVELOPMENT STANDARD PLAN FOR  
**GUARDRAIL APPROACH  
TERMINAL TYPES 2B & 2T  
(SKT, ET-PLUS & X-LITE-TANGENT-50)**

F.H.W.A. APPROVAL

10-14-2016  
PLAN DATE

R-62-H

SHEET  
14 OF 14

# MICHIGAN DESIGN MANUAL

## ROAD DESIGN

### 1.03

#### MISCELLANEOUS

##### 1.03.01 (revised 10-17-2016)

#### Order of Plan Sheets

Plans should be assembled in the following order:

- Title
- Project Information
- Legend
- ROW Vicinity/Drainage Map
- Note
- Miscellaneous Quantities
- Typical Cross Sections
- Miscellaneous Details
- Survey Information
- Alignment
- Removal, Construction, Drainage & Profile
- Water Main & Sanitary Sewer
- Maintaining Traffic/Construction Staging Plans
- Detail Grades
- Culvert Plans
- Detention Basin Details
- Wetland Mitigation Plans
- Rest Area/Landscape Plans
- Permanent Signing Plans
- Pavement Marking Plans
- Lighting Plans
- ITS Plans**
- Signal Plans
- Log of Borings
- Special Details
- Bridge Plans

Removal, construction, drainage if needed, and profile sheets should be arranged in this order according to station limits.

Only the sheets included in a set of plans should appear in the index of the title sheet.

### 1.03.02 (revised 3-16-2015)

#### Plan Preparation Conventions

##### A. Drafting

See the [Sample Plans](#) for examples of drafting conventions, symbols, line weights, etc. to use in preparing plans.

##### B. File Naming Conventions

#### 1. Plan and Proposal Milestones

See [Chapter 3](#) of [Design Submittal Requirements](#).

#### 2. Reference Information Documents (RID)

See [Section 14.65](#) and [Design Submittal Requirements](#).

**Appendix 3A  
GEOMETRIC DESIGN ELEMENTS  
New Construction / Reconstruction**

Element		Urban	Rural						
<b>Design Speed</b>	<b>Freeway</b>	60 mph (For posted urban freeway speeds greater than 55 mph, use a design speed 5 mph greater than posted speed.)	75 mph but not less than 70 mph.						
	<b>Non Freeway (Arterial)</b>	Posted speed plus 5 mph, but not less than 30 mph.	Posted speed plus 5 mph, but not less than 40 mph.						
	<b>Collector Roads</b>	5 mph over posted speed.	5 mph over posted speed.						
<b>Lane Width</b>	<b>Freeway</b>	12 ft.		12 ft.					
	<b>Non Freeway (Arterial)</b>	12 ft, lanes are most desirable and should be used where practical. 11 ft. lanes are often used for low speed (45 mph design)  <b>Lane widths of 10 ft. may be used in more constrained areas where truck and bus volumes are relatively low and speeds are less than 35 mph.</b>  12 ft. lanes are required on the National Network (NN).		Design Speed, (mph)	Minimum Lane Width, ft.				
					ADT, vehicles/day				
					Under 400	400 to 1500	1500 to 2000	Over 2000	
					40	11*	11*	11*	12
					45	11*	11*	11*	12
					50	11*	11*	12	12
					55	11*	11*	12	12
					60	12	12	12	12
					65	12	12	12	12
70	12	12	12	12					
75	12	12	12	12					
*12 ft. desirable									
<b>Collector Roads</b>	Added turn lanes at intersections      10-12 ft. Where right-of-way is restricted.      11 ft. Industrial Areas      12 ft.		Design Speed, (mph)	Minimum Lane Width, ft.					
				ADT, vehicles/day					
				Under 400	400 to 1500	1500 to 2000	Over 2000		
	20	10*	10*	11*	12				
	25	10*	10*	11*	12				
	30	10*	10*	11*	12				
	35	10*	11*	11*	12				
	40	10*	11*	11*	12				
	45	10*	11*	11*	12				
	50	10*	11*	11*	12				
55	11*	11*	12	12					
60	11*	11*	12	12					
*12 ft. desirable									
		Where shoulders are used, see guidelines for Rural Collectors							

# MICHIGAN DESIGN MANUAL BRIDGE DESIGN

## CHAPTER 7

### DESIGN CRITERIA - NEW AND RECONSTRUCTION PROJECTS

#### 7.01

#### GENERAL

##### 7.01.01

##### Design Specifications

In general, bridges in Michigan carrying vehicular traffic are designed according to the current edition of the Standard Specifications for the Design of Highway Bridges published by the American Association of State Highway and Transportation Officials (AASHTO). The exceptions to changes in AASHTO requirements are presented in this volume of the Design Manual.

The AASHTO specifications are also applied in the design of pedestrian bridges and major structures such as retaining walls and pumphouses.

Bridges carrying railroads are designed according to the current specifications of the American Railway Engineering and Maintenance-of-Way Association Specifications (AREMA).

##### 7.01.02

##### Design Method

In general, elastomeric pad designs, as well as footing pressure and pile load determinations, are done by the Allowable Stress Method. All other elements of the structure are designed by the Load Factor Method. (12-5-2005)

#### 7.01.03

##### Design Stresses (12-5-2005)

Concrete: Grade S2	$f'_c = 3000$ psi
Concrete: Grade D	$f'_c = 4000$ psi
Steel Reinforcement	$f_y = 60,000$ psi
Steel Reinforcement:	
Stirrups for	
Prestressed Beams	$f_y = 60,000$ psi
Stirrups for	
17" & 21" Box Beams	$f_y = 40,000$ psi
Structural Steel:	
AASHTO M270	
Grade 36	$F_y = 36,000$ psi
Grade 50	$F_y = 50,000$ psi
Grade 50W	$F_y = 50,000$ psi
Structural Steel Pins:	
ASTM A276	
UNS Designation	
S20161 or S21800	$F_y = 50,000$ psi
Temp Support Hanger Rods:	
ASTM A 193 Grade B7(AISI 4140)	
2 ½" and under	$F_u = 125,000$ psi
	$F_y = 105,000$ psi
Over 2 ½" to 4"	$F_u = 115,000$ psi
	$F_y = 95,000$ psi
Over 4" to 7"	$F_u = 100,000$ psi
	$F_y = 75,000$ psi
Prestressed Concrete *	$f'_c = 5000 - 8000$ psi
Prestressed Concrete Compressive	
Strength at Release	$f'_{ci} = 7000$ psi (max)
Prestressing Strands	$f_{pu} = 270,000$ psi
High Strength Bolts:**	
Organic zinc rich primer (Class B)	
(Type 4 coating system)	$F_s = 32,000$ psi

\* See Subsection 7.02.03.

\*\* Value of  $F_s$  is Design Slip Resistance for Slip-Critical Connections with faying surfaces coated. (12-5-2005)  
(11-28-2011) (11-24-2014) (10-17-2016)

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

**CHAPTER 7- LRFD**

**DESIGN CRITERIA - NEW AND RECONSTRUCTION PROJECTS**

**7.01**

**GENERAL**

**7.01.01**

**Design Specifications (8-20-2009)**

In general, bridges in Michigan carrying vehicular traffic are designed according to the current edition of the LRFD Bridge Design Specification published by the American Association of State Highway and Transportation Officials (AASHTO). The exceptions to changes in AASHTO requirements are presented in this volume of the Design Manual.

The AASHTO specifications are also applied in the design of pedestrian bridges and major structures such as retaining walls and pumphouses.

Bridges carrying railroads are designed according to the current specifications of the American Railway Engineering and Maintenance-of-Way Association Specifications (AREMA).

**7.01.02**

**Design Method (8-20-2009)**

The design of all structural elements shall satisfy Service Limit State and/or Strength Limit State requirements of the AASHTO LRFD Bridge Design Specifications.

**7.01.03**

**Design Stresses (12-5-2005)**

Concrete: Grade S2	$f'_c = 3000$ psi
Concrete: Grade D	$f'_c = 4000$ psi
Steel Reinforcement	$f_y = 60,000$ psi
Steel Reinforcement:	
Stirrups for	
Prestressed Beams	$f_y = 60,000$ psi
Stirrups for	
17" & 21" Box Beams	$f_y = 40,000$ psi
Structural Steel:	
AASHTO M270	
Grade 36	$F_y = 36,000$ psi
Grade 50	$F_y = 50,000$ psi
Grade 50W	$F_y = 50,000$ psi
Structural Steel Pins:	
ASTM A276	
UNS Designation	
S20161 or S21800	$F_y = 50,000$ psi
Temp Support Hanger Rods:	
ASTM A 193 Grade B7 (AISI 4140)	
2 1/2" and under	$F_u = 125,000$ psi
	$F_y = 105,000$ psi
Over 2 1/2" to 4"	$F_u = 115,000$ psi
	$F_y = 95,000$ psi
Over 4" to 7"	$F_u = 100,000$ psi
	$F_y = 75,000$ psi
Prestressed Concrete *	$f'_c = 5000 - 8000$ psi
Prestressed Concrete Compressive	
Strength at Release	$f'_{ci} = 7000$ psi (max)
Prestressing Strands	$f_{pu} = 270,000$ psi
High Strength Bolts:**	
Organic zinc rich primer (Class B)	
(Type 4 coating system)	$F_s = 32,000$ psi

\* See Subsection 7.02.03.

\*\* Value of  $F_s$  is Design Slip Resistance for Slip-Critical Connections with faying surfaces coated. (12-5-2005) (11-28-2011) (11-24-2014) (10-17-2016)

## MICHIGAN DESIGN MANUAL BRIDGE DESIGN

### 8.02 (continued)

#### TITLE SHEET

- G. The design of the structural members is based on material of the following grades and stresses:

Concrete: Grade S2  $f'_c = 3,000$  psi  
 Concrete: Grade D  $f'_c = 4,000$  psi  
 Steel Reinforcement  $f_y = 60,000$  psi  
 Steel Reinforcement:

(Stirrups for Prestressed Beams  
 $f_y = 60,000$  psi)

(Stirrups for (17") (21") Box Beams  
 $f_y = 40,000$  psi)

Structural Steel:  
 AASHTO M270  
 Grade 36  $F_y = 36,000$  psi

Structural Steel:  
 AASHTO M270  
 Grade 50  $F_y = 50,000$  psi

Structural Steel:  
 AASHTO M270  
 Grade 50W  $F_y = 50,000$  psi

Structural Steel Pins:  
 ASTM A276  
 UNS Designation  
 S20161 or S21800  $F_y = 50,000$  psi

Temp Support Hanger Rods:  
 ASTM A 193 Grade B7 (AISI 4140)  
 2½" and under  $F_u = 125,000$  psi  
 $F_y = 105,000$  psi  
 Over 2½" to 4"  $F_u = 115,000$  psi  
 $F_y = 95,000$  psi  
 Over 4" to 7"  $F_u = 100,000$  psi  
 $F_y = 75,000$  psi

Prestressed Concrete  $f'_c = \underline{\hspace{2cm}}$  psi  
 Prestressed Concrete Compressive  
 Strength at Release  $f'_{ci} = \underline{\hspace{2cm}}$  psi  
 [7000 psi max]

Prestressing Strands  $f_{pu} = 270,000$  psi  
 (12-5-05)(11-28-11)(11-24-2014)(10-17-2016)

- H. (year) Estimated Traffic Distribution  
 0000 Average Daily Traffic  
 (000) Design Hourly Volume  
 % Commercial  
 0000 Commercial Directional Design  
 Hourly Volume  
 0000 Directional Traffic  
 0000 Total Traffic  
 [Use on Rehabilitation jobs where there is  
 no plan of site or structure.] (9-18-98)

### 8.02 (continued)

- I. All exposed concrete corners shown square on the plans shall be beveled with ½" triangular moldings except as otherwise noted. (8-20-99)
- J. Bidders will be furnished with scanned images of plan sheets of the existing structure if requested. [Use on all projects where existing structure plans are known to exist.] (11-28-2011)
- K. Old plans do not exist for this structure. [Use on all projects where the designer is unable to verify that existing structure plans exist.] (11-28-2011)
- L. The bridge paint may contain lead. [Use on all projects with existing painted structural steel regardless of work type. If no bridge Title Sheet is present with project place note on road Note Sheet. Also place on existing structural steel sheets (see note 8.09.07 D.)] (11-28-2011)
- M. Note skipped
- N. Unless otherwise shown on the plans provide minimum concrete clear cover for reinforcement according to the following:
- |                                  |       |
|----------------------------------|-------|
| Concrete cast against earth:     | 3 in. |
| Prestressed Beams:               | 1 in. |
| All other unless shown on plans: | 2 in. |
- (11-28-2011)
- O. The bridge deck surface has an HMA overlay, HMA cap or HMA patches. Removal of HMA as a result of removal of other superstructure items shall be included in the removal of those items. (11-28-2011)

**MICHIGAN DESIGN MANUAL  
BRIDGE DESIGN - CHAPTER 8: LRFD**

**8.02 (continued)**

**TITLE SHEET**

- D. The stationing as shown on these plans for the intersection of the centerline of bridge and roadway (and the railroad) centerline is believed to be correct. It shall, however, be checked at the time of starting construction, and if the stationing shown on the plans is incorrect, it shall be reported to the Design office in Lansing, and the structure shall be staked out using the actual intersection of the centerline of bridge and roadway (and the railroad) centerline as the control point.
- E. This contract is for "Structural Steel, \_\_\_\_\_, Furn and Fab" only. Other items of work indicated on these plans are not a part of this contract. [Use when structural steel furnishing and fabricating must be done early in project to ensure timely delivery for construction.] (12-5-2005)
- F. The Regulated Waste Activity Identification Numbers for this project are as follows:

Control Section	Number
_____	_____

[Use when cleaning or working on painted steel structure constructed prior to 1978 or when hydrodemolition is part of the project work. Place note directly above title block and use lettering twice the size of the other notes.]  
(9-18-98) (4-18-2016)

**8.02 (continued)**

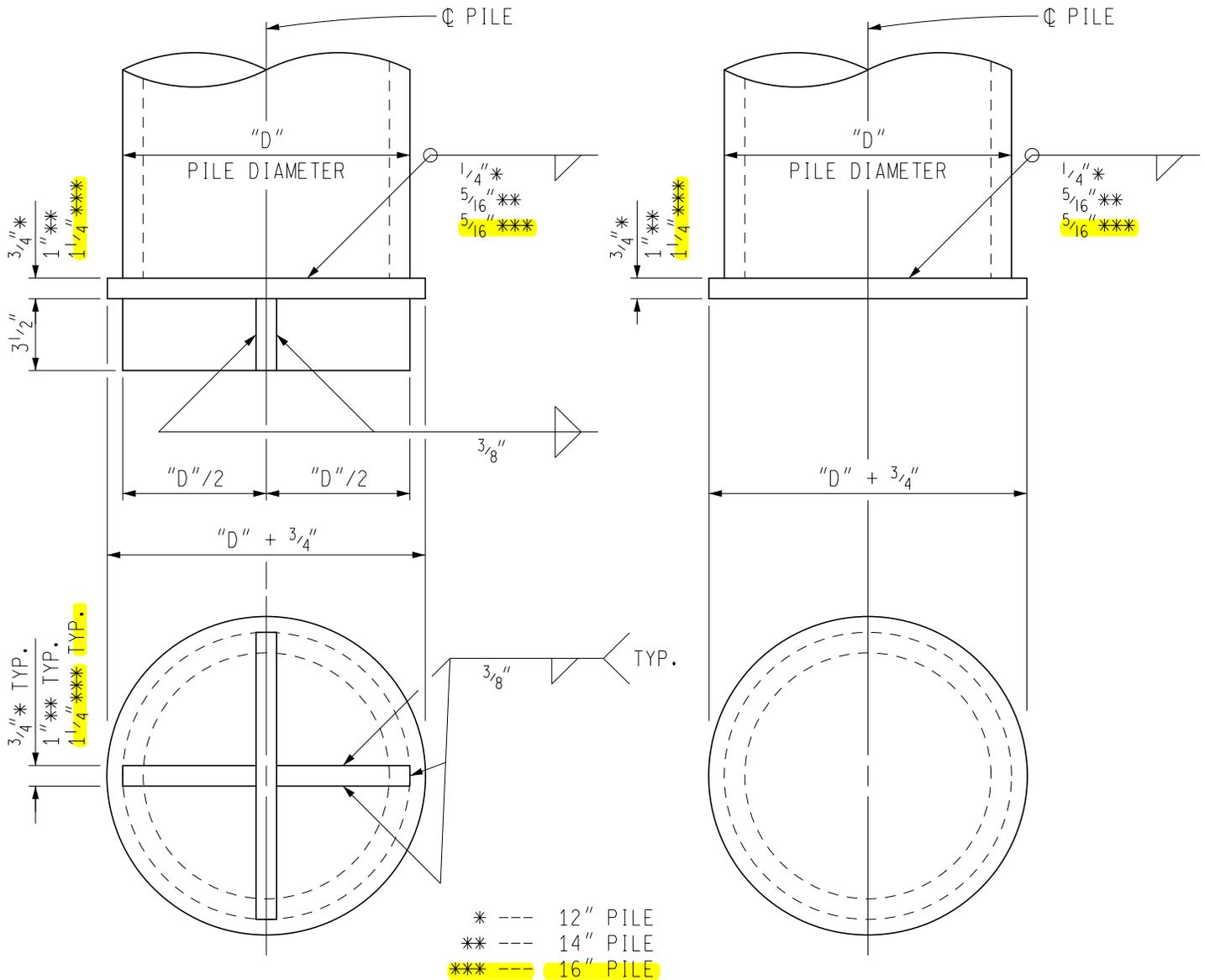
- G. The design of the structural members is based on material of the following grades and stresses:
- |                                      |  |
|--------------------------------------|--|
| Concrete: Grade S2                   | $f'_c = 3,000$ psi                       |
| Concrete: Grade D                    | $f'_c = 4,000$ psi                       |
| Steel Reinforcement                  | $f_y = 60,000$ psi                       |
| Steel Reinforcement:                 |  |
| (Stirrups for Prestressed Beams)     | $f_y = 60,000$ psi)                      |
| (Stirrups for (17") (21") Box Beams) | $f_y = 40,000$ psi)                      |
| Structural Steel:                    |  |
| AASHTO M270                          |  |
| Grade 36                             | $F_y = 36,000$ psi                       |
| Structural Steel:                    |  |
| AASHTO M270                          |  |
| Grade 50                             | $F_y = 50,000$ psi                       |
| Structural Steel:                    |  |
| AASHTO M270                          |  |
| Grade 50W                            | $F_y = 50,000$ psi                       |
| Structural Steel Pins:               |  |
| ASTM A276                            |  |
| UNS Designation                      |  |
| S20161 or S21800                     | $F_y = 50,000$ psi                       |
| Temp Support Hanger Rods:            |  |
| ASTM A 193 Grade B7 (AISI 4140)      |  |
| 2½" and under                        | $F_u = 125,000$ psi                      |
|                                      | $F_y = 105,000$ psi                      |
| Over 2½" to 4"                       | $F_u = 115,000$ psi                      |
|                                      | $F_y = 95,000$ psi                       |
| Over 4" to 7"                        | $F_u = 100,000$ psi                      |
|                                      | $F_y = 75,000$ psi                       |
| Prestressed Concrete                 | $f'_c = \underline{\hspace{1cm}}$ psi    |
| Prestressed Concrete Compressive     |  |
| Strength at Release                  | $f'_{ci} = \underline{\hspace{1cm}}$ psi |
|                                      | [7000 psi max]                           |
| Prestressing Strands                 | $f_{pu} = 270,000$ psi                   |
|                                      | (12-5-2005) (11-28-2011)                 |
|                                      | (11-24-2014) (10-17-2016)                |

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

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT

ISSUED: 10/17/16  
 SUPERSEDES: 06/25/12

CIP PILE POINT DETAILS



ALTERNATE CIP PILE POINT DETAILS

FOR POINT BEARING PILES ONLY. USE  
 WHEN RECOMMENDED BY SOILS SECTION.

CIP PILE POINT DETAILS

NOTE TO DESIGNER:

THE PILE POINTS DETAILED ON THIS SHEET SHOULD NOT BE PAID FOR SEPARATELY.

PLAN NOTE:

POINTS FOR FLUTED SHELLS SHALL BE FORGINGS IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.

PREPARED BY  
 DESIGN DIVISION

8.21.03