



**STATE OF TENNESSEE  
DEPARTMENT OF TRANSPORTATION**

**ROADWAY DESIGN DIVISION**  
SUITE 1200 JAMES K. POLK BUILDING  
505 DEADERICK STREET  
NASHVILLE, TENNESSEE 37243-3848  
(615) 741-2221

**CLAY BRIGHT**  
COMMISSIONER

**BILL LEE**  
GOVERNOR

**INSTRUCTIONAL BULLETIN NO. 19-12**

**Regarding New and Revised Standard Drawings for Guardrails.**

**Effective December 13, 2019 letting (October 2, 2019 Turn-in)**, the following standard drawings have been revised and developed according to meet the requirements within AASHTO's, "Manual for Assessing Safety Hardware, 2<sup>nd</sup> edition".

**New Standard Drawings:**

<b>DRAWING NUMBER</b>	<b>REVISION DATE</b>	<b>DESCRIPTION</b>
S-GR31-1B <sup>1</sup>		GUARDRAIL FASTENING HARDWARE
S-GR31-1C <sup>1</sup>		GUARDRAIL GENERAL NOTES AND POST DETAILS
S-GRC-4 <sup>1</sup>		GUARDRAIL CONNECTION TO BRIDGE RAILING CONCRETE PARAPET
S-GRC-5 <sup>1</sup>		GUARDRAIL CONNECTION TO BRIDGE ENDS (TRAILING ENDS)
S-GRC-6 <sup>1</sup>		GUARDRAIL CONNECTION TO BRIDGE ENDS FOR LOW SPEED ROADWAYS

<b>DRAWING NUMBER</b>	<b>REVISION DATE</b>	<b>DESCRIPTION</b>
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**Revised Standard Drawings:**

S-GR31-1 <sup>1</sup>	06-28-19	GUARDRAIL DETAILS
S-GR31-1A <sup>1</sup>	06-28-19	GUARDRAIL AND BLOCK-OUT DETAILS

These standard drawings are revised in the Roadway Design Guidelines, Chapter 5, Index of Standard Drawings and are available online.

**Voided Standard Drawings:**

The following standard drawings will be voided on January 1, 2020.

S-GRC-1	GUARDRAIL CONNECTION TO BRIDGE ENDS OR BARRIER WALL
S-GRC-2	GUARDRAIL CONNECTION TO BRIDGE ENDS FOR LOCAL ROADS (ADT < 2000)

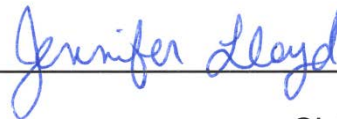
Note 1: F.H.W.A. approval was given on 06/18/19.

Standard Drawings:

<https://www.tn.gov/content/tn/tdot/roadway-design/standard-drawings-library/standard-roadway-drawings.html>

Roadway Design Guidelines:

<https://www.tn.gov/content/tn/tdot/roadway-design/design-standards/design-guidelines.html>

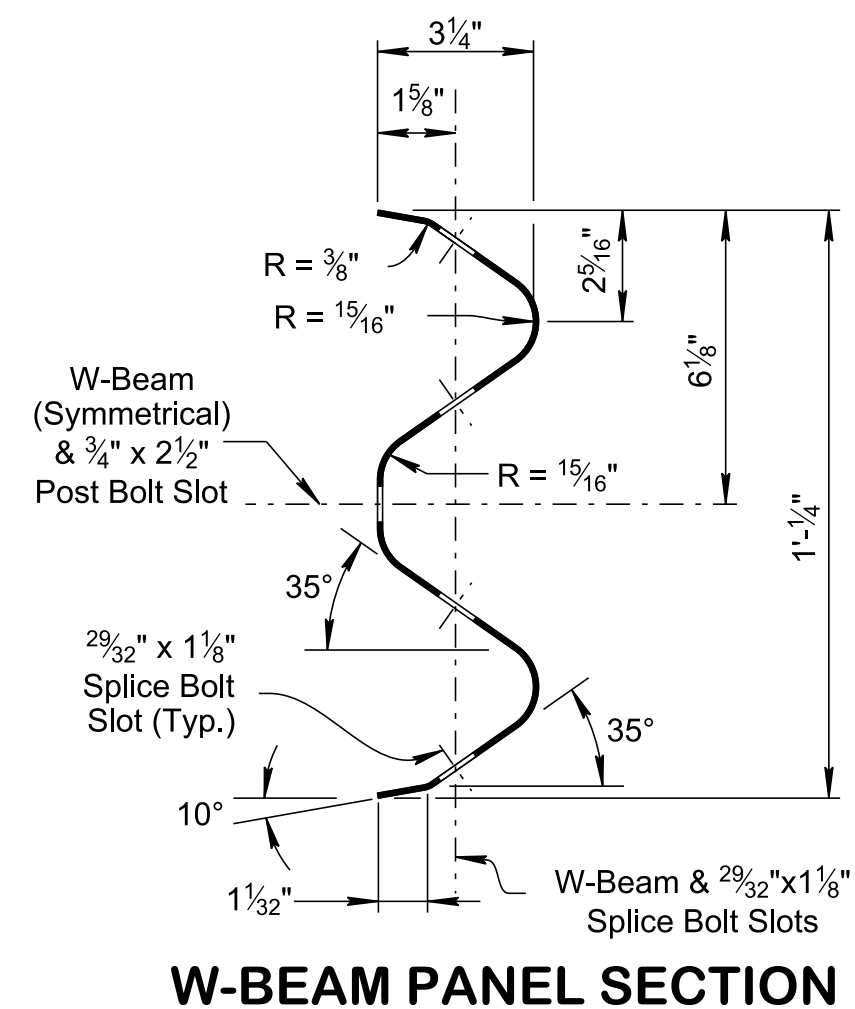


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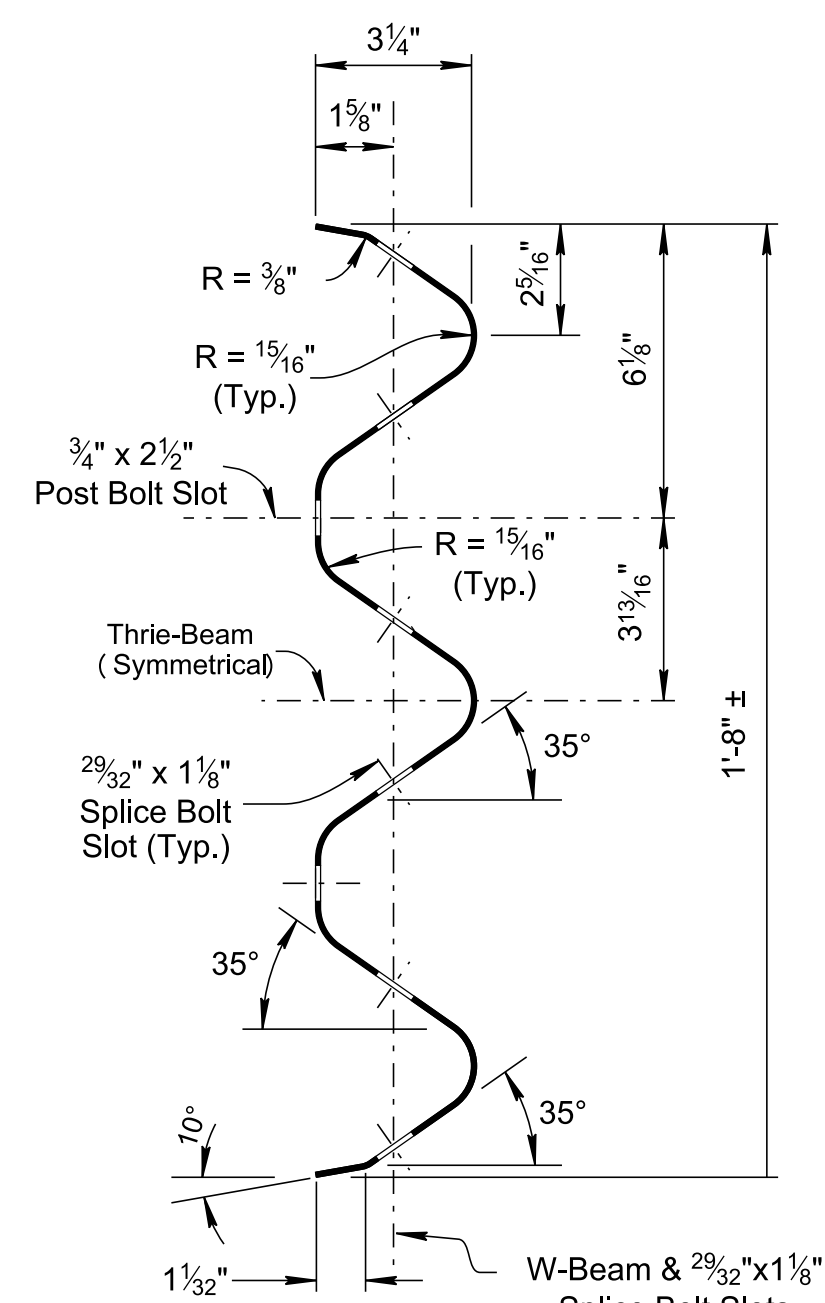
Jennifer Lloyd, PE  
Civil Engineering Director

KJL:ARH:RBB:LLP  
August 1, 2019

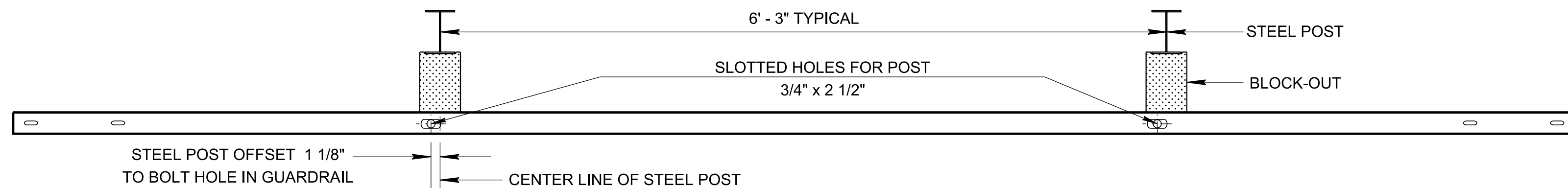
8/7/2019 9:42:33 AM P:\StandDraw\DESIGN STANDARDS\Standards Drawings\Standard Roadway Drawings - CURRENT\In Progress\150.00 Safety Design and Fences IP\150.04 Guardrail Details IP\SGR311-20190628.dgn



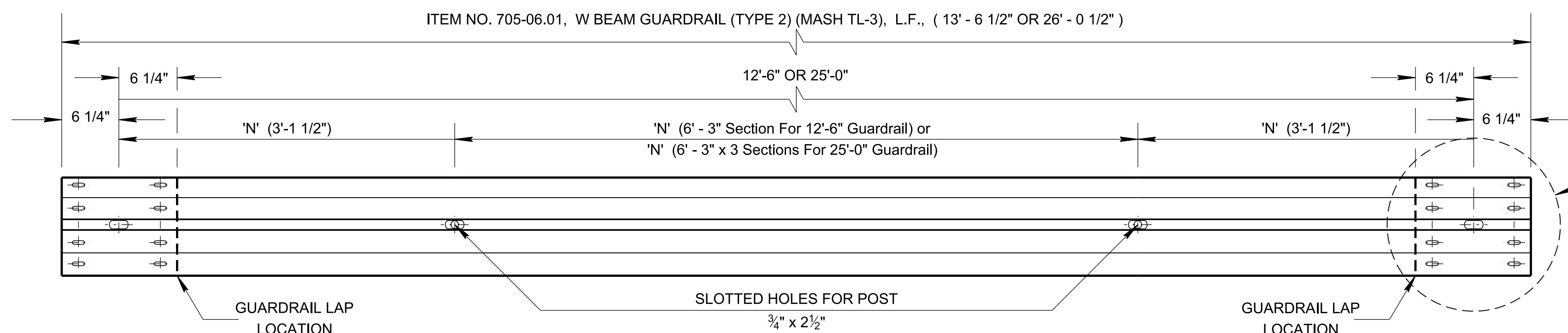
**W-BEAM PANEL SECTION**



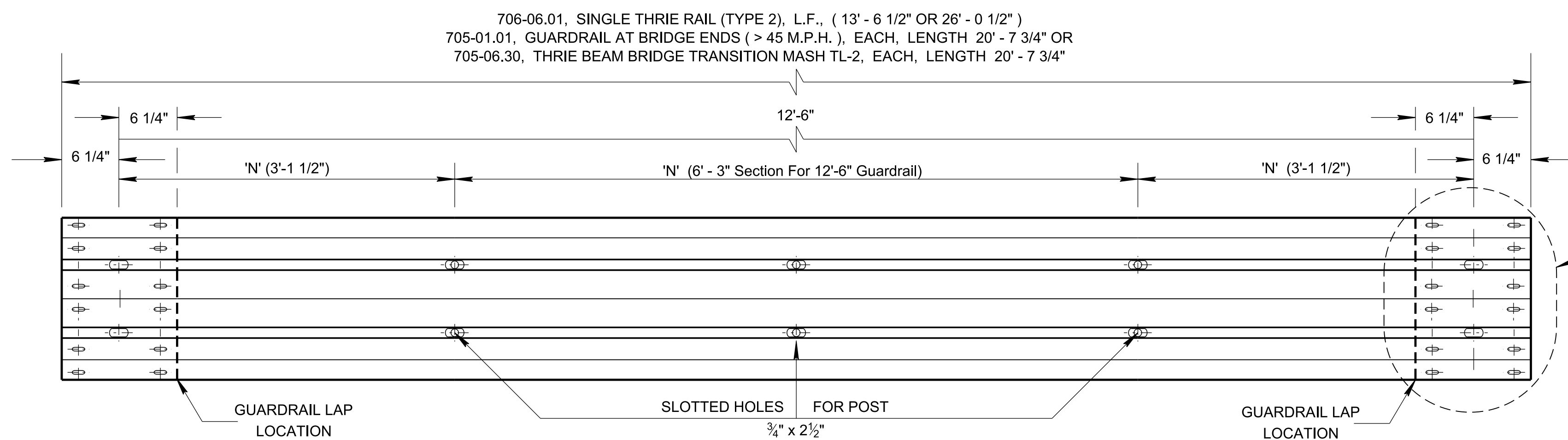
**THRIE-BEAM PANEL SECTION**



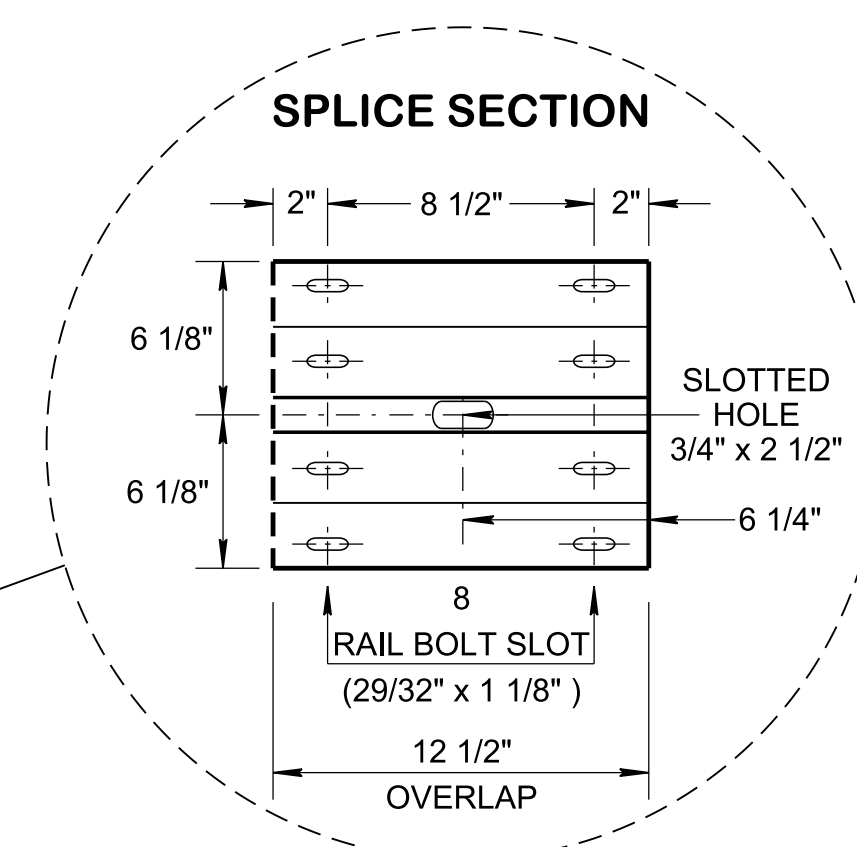
**PLAN VIEW**



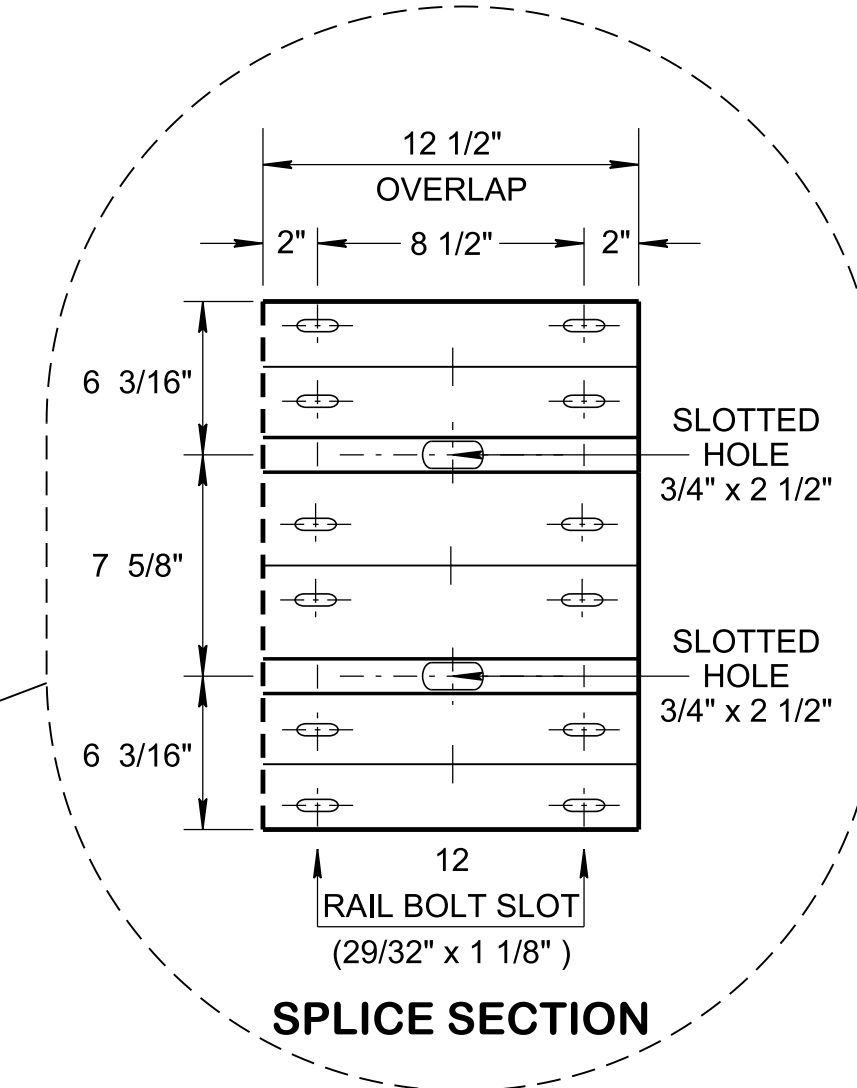
**W-BEAM FRONT ELEVATION**



**THRIE-BEAM RAIL FRONT ELEVATION**



**SPLICE SECTION**



**SPLICE SECTION**

PANEL SUMMARY TABLE		
PANEL TYPE	NUMBER OF SPACES 'N'	GAUGE
9' - 4 1/2" W-Beam	3	12
12' - 6" W-Beam	4	12
25' - 0" W-Beam	8	12
12' - 6" Thrie-Beam	4	12
25' - 0" Thrie-Beam	8	12
Thrie-Beam Trans.	2	10

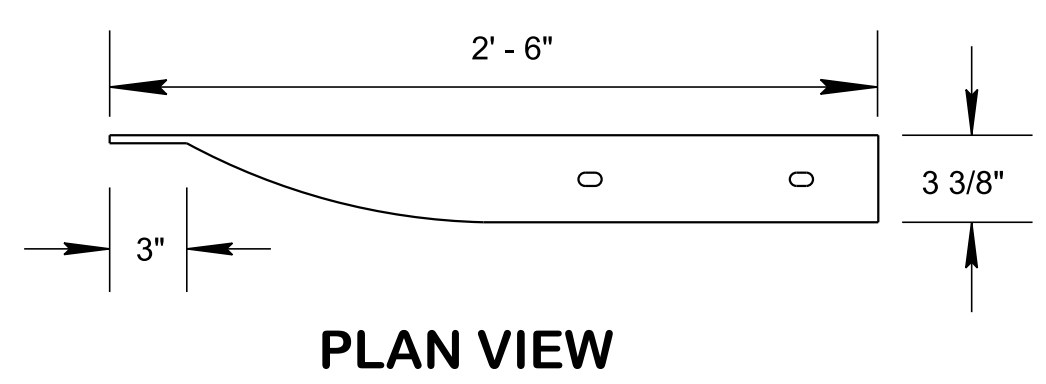
- GENERAL NOTES**
- (A) METAL BEAMS SHALL CONFORM TO AASHTO M 180: TYPE 2, CLASS "A" UNLESS OTHERWISE NOTED ON THE PLANS. SEE PANEL SUMMARY TABLE FOR SPACING AND GUARDRAIL GAUGE REQUIREMENTS.
  - (B) WHERE GUARDRAIL IS PLACED ON A CURVE WITH A RADIUS LESS THAN 150 FEET, THE RAIL IS TO BE SHOP-FORMED TO THE REQUIRED RADIUS.
  - (C) AT THE OPTION OF THE CONTRACTOR THE RAIL ELEMENTS FOR THE GUARDRAIL MAY BE FURNISHED IN EITHER 12'-6" OR 25' NOMINAL LENGTHS WITH POST BOLT SLOTS FOR CONNECTION TO POSTS.

- REV. 12-01-14: REVISED NOTE (L)
- REV. 04-04-16: REVISED NOTES.
- REV. 10-20-16: ADDED NOTE TO ADDRESS ADDITIONAL HOLES.
- REV. 03-28-17: REMOVED NOTE (T) CHANGED PAY ITEM NUMBER. IMPROVED POST SIDE VIEWS AND FRONT ELEVATION VIEWS.
- REV. 06-28-19: MOVED GENERAL NOTES FOR POST, BLOCK-OUTS, FUTURE ADJUSTMENTS, END TREATMENTS, DESIGN AND PAYMENT ALONG WITH GUARDRAIL POST TO STD. DWG. NO. S-GR31-1C. ADDED NEW GUARDRAIL DETAILS. RENAMED AND REDREW SHEET.

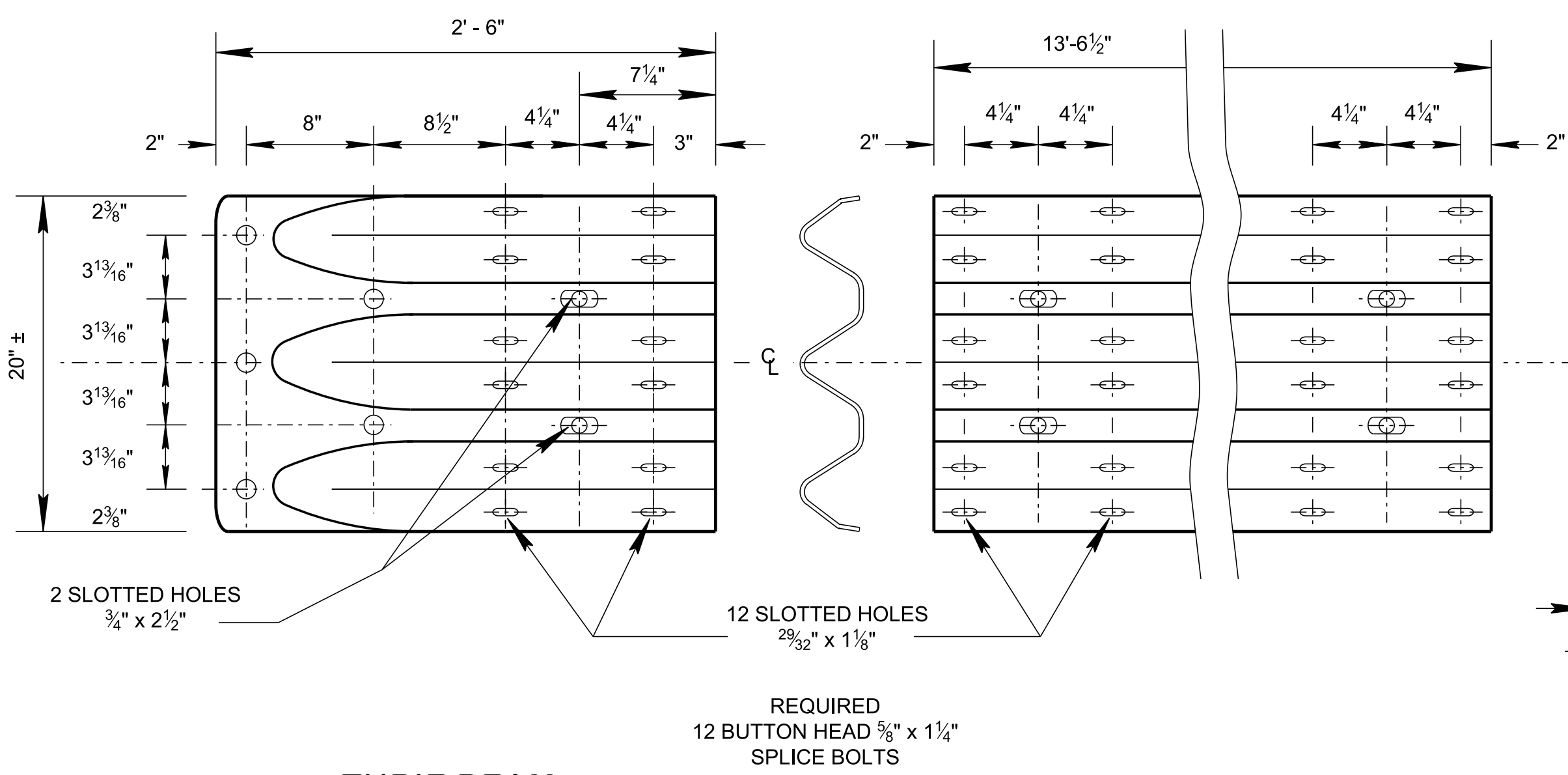
MINOR REVISION -- FHWA APPROVAL NOT REQUIRED

STATE OF TENNESSEE  
STANDARD DRAWING  
DEPARTMENT OF TRANSPORTATION

GUARDRAIL DETAILS



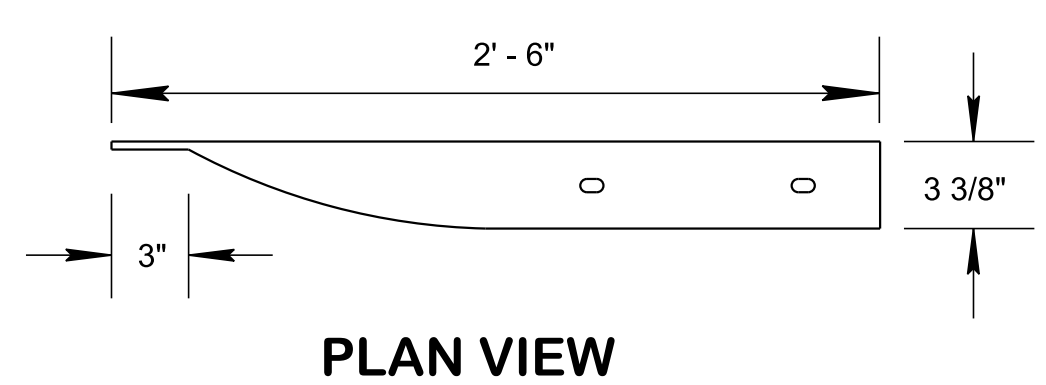
**PLAN VIEW**



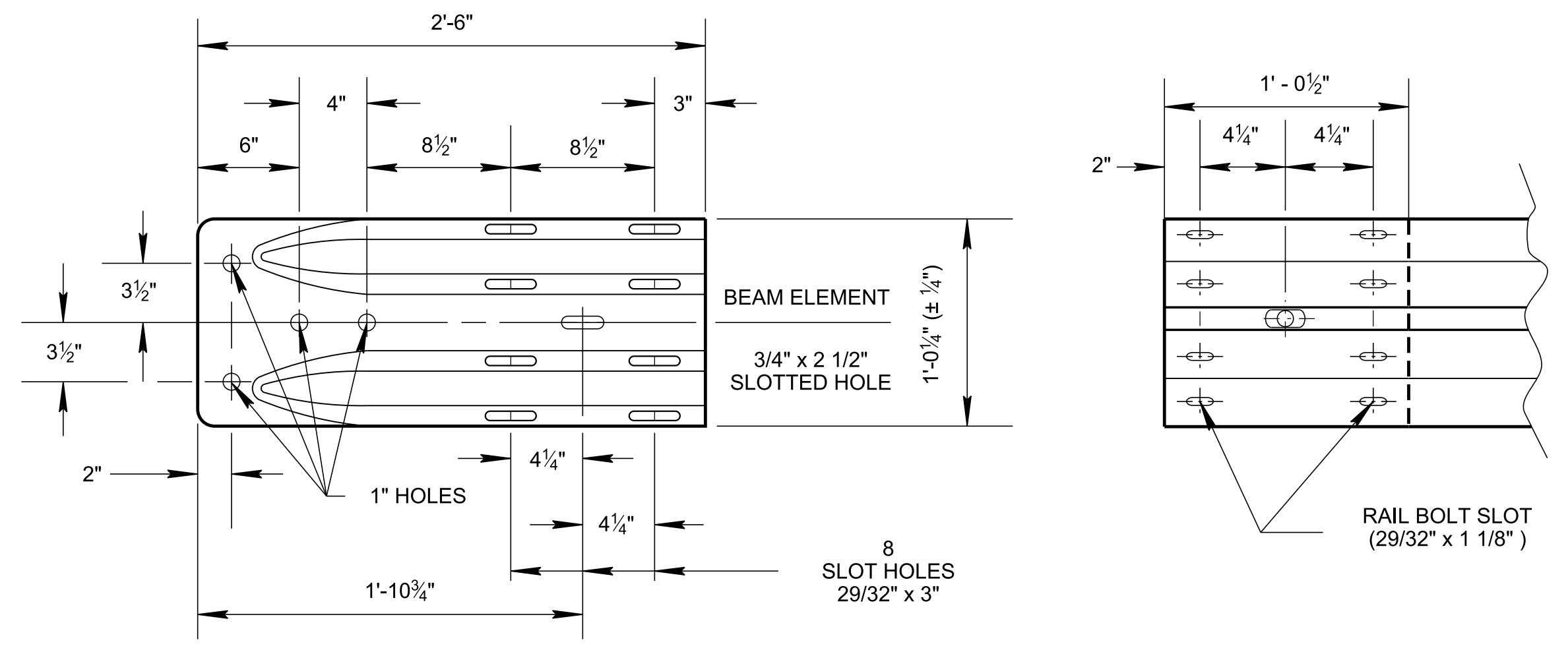
**THRIE BEAM TERMINAL CONNECTION**  
(MODIFIED MICHIGAN END SHOE)  
CONNECTION TO W-BEAM SAME AS SPLICE SECTION ON STD. DWG. S-GR31-1B REQUIRING 12 BUTTON HEAD 5/8" x 1 1/4" SPLICE BOLTS

**THRIE-BEAM RAIL**

**THRIE-BEAM TRANSITION PANEL**  
(Reverse Direction Similar by Opposite Hand)

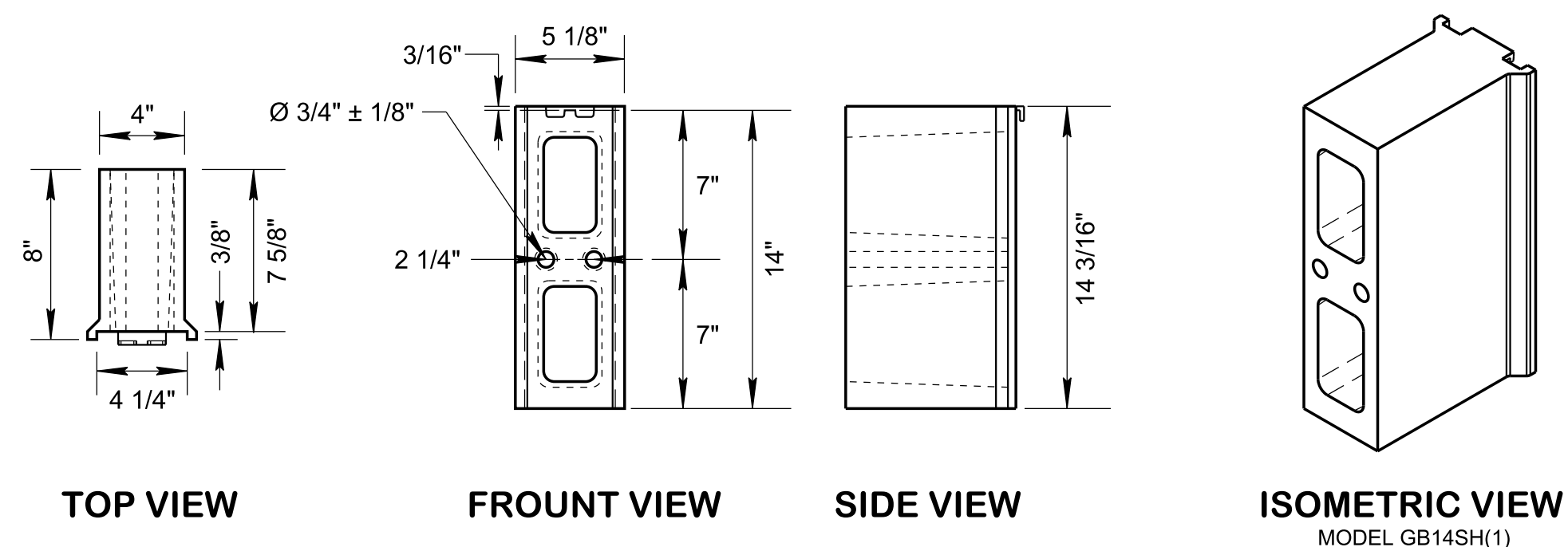


**PLAN VIEW**

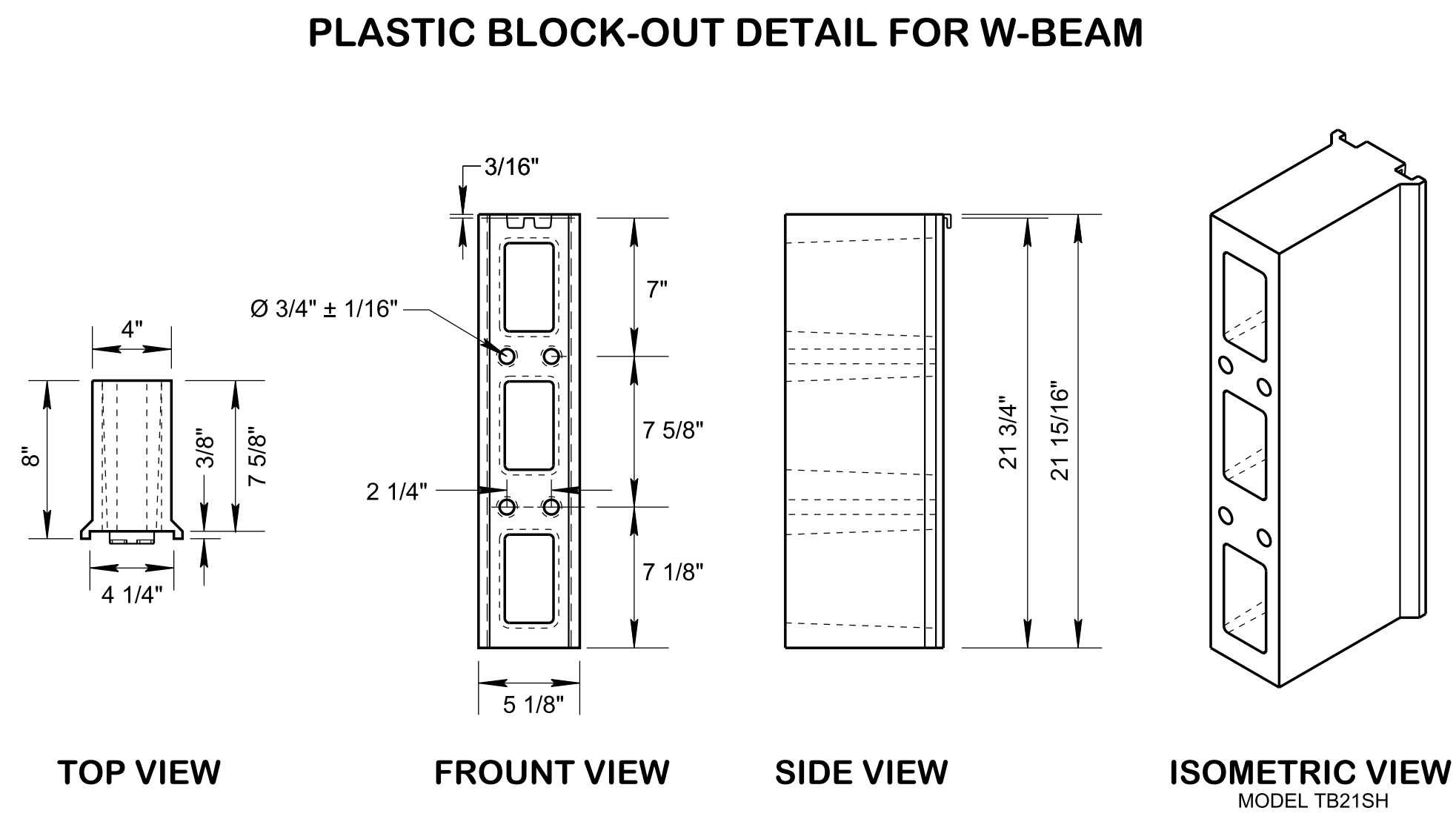


**W-BEAM TERMINAL CONNECTION**  
(MICHIGAN END SHOE)  
CONNECTION TO W-BEAM SAME AS SPLICE SECTION ON STD. DWG. S-GR31-1B REQUIRING 8 BUTTON HEAD 5/8" x 1 1/4" SPLICE BOLTS

**W-BEAM RAIL**



**TOP VIEW FRONT VIEW SIDE VIEW ISOMETRIC VIEW**  
MODEL GB14SH(1)

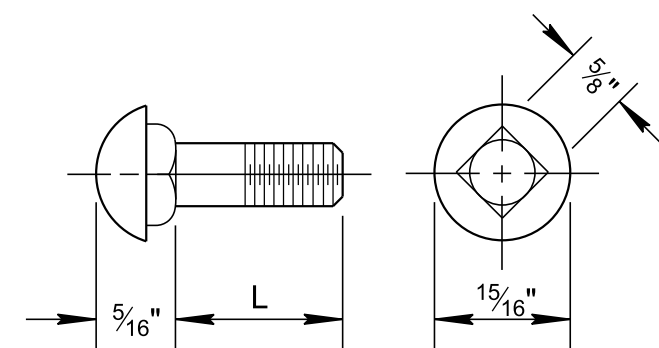


**TOP VIEW FRONT VIEW SIDE VIEW ISOMETRIC VIEW**  
MODEL TB21SH

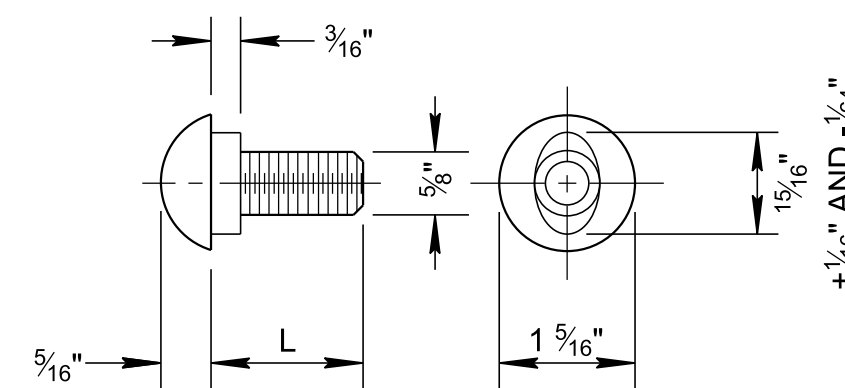
SHOWING MONDO POLYMER TECHNOLOGIES BLOCK-OUTS FOR REFERENCE ONLY. SEE QPL FOR MANUFACTURES LIST.

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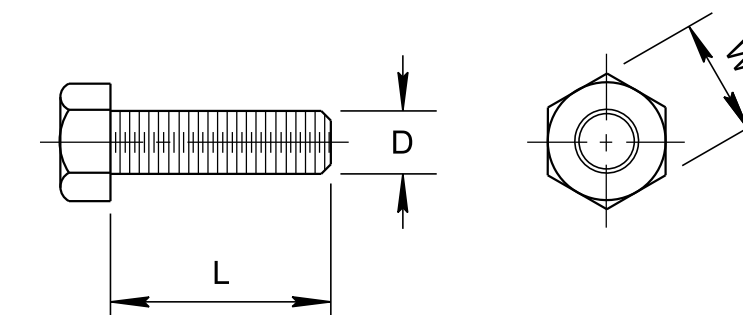
NOT TO SCALE



**5/8" DIAMETER CARRIAGE BOLT**



**5/8" DIAMETER  
BUTTON HEAD BOLT**

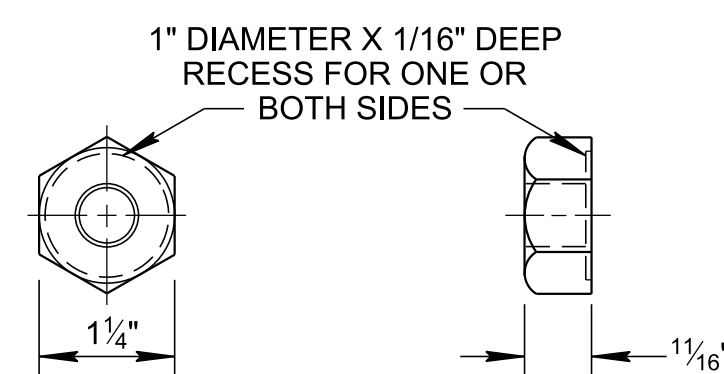


**HEX HEAD BOLT**

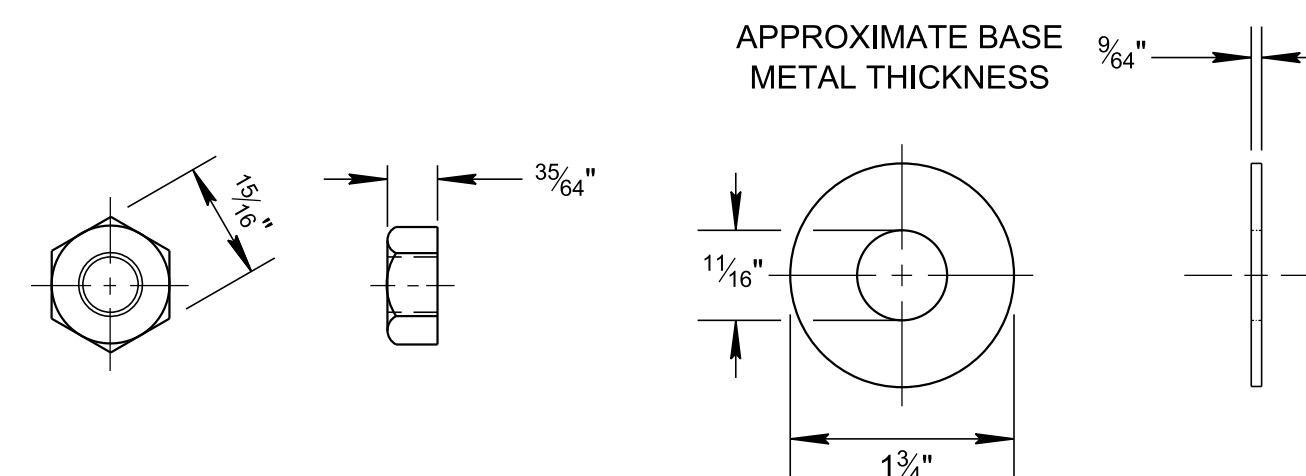
CARRIAGE BOLTS		
L (LENGTH)	MINIMUM THREAD LENGTH	INTENDED USE
1 1/2"	FULL LENGTH	THIS BOLT IS A SPLICE BOLT FOR THE CHANNEL RUB RAIL ELEMENTS.
3"	2"	THIS BOLT IS FOR FASTENING CHANNEL RUB RAIL ELEMENTS TO STEEL POST.

BUTTON HEAD BOLTS		
L (LENGTH)	MINIMUM THREAD LENGTH	INTENDED USE
1 1/4"	FULL LENGTH	THIS BOLT IS FOR GUARDRAIL AT SPLICE JOINTS.
9 1/2"	4"	THIS BOLT IS FOR FASTENING GUARDRAIL ELEMENTS TO STEEL POST WITH BLOCK-OUTS.
18"	4"	THIS BOLT IS FOR FASTENING GUARDRAIL ELEMENTS TO WOOD POST WITH WOOD BLOCK-OUTS.

HEX HEAD BOLTS				
D (DIAMETER)	L (LENGTH)	W (WIDTH)	MINIMUM THREAD LENGTH	INTENDED USE
5/8"	1 1/2"	1 1/16"	FULL LENGTH	IS FOR TYPE 13 ANCHOR. S-GR28-4
5/8"	2"	1 1/16"	FULL LENGTH	IS FOR TYPE 12 ANCHOR STEEL PLATE. S-GRA-1A
5/8"	8"	1 1/16"	4"	IS FOR TYPE 13 ANCHOR. S-GR28-4
5/8"	10"	1 1/16"	4"	IS FOR TYPE 13 ANCHOR. S-GR28-4
3/4"	2" + SLAB THICKNESS	1 1/4"	4"	IS FOR ATTACHING GUARDRAIL TO CONCRETE DECK. S-GR28-6
3/4"	4"	1 1/4"	FULL LENGTH	IS FOR ATTACHING GUARDRAIL TO CONCRETE DECK USING INSERT ASSEMBLY. S-GR28-6
7/8"	2"	1 7/16"	FULL LENGTH	IS FOR INSERT ASSEMBLY S-GRA-1, S-GRC-4 & S-GRC-5



**5/8" DIAMETER RECESS NUT**



**5/8" DIAMETER HEX NUT AND STEEL WASHER**

(ALTERNATE TO RECESS NUT)

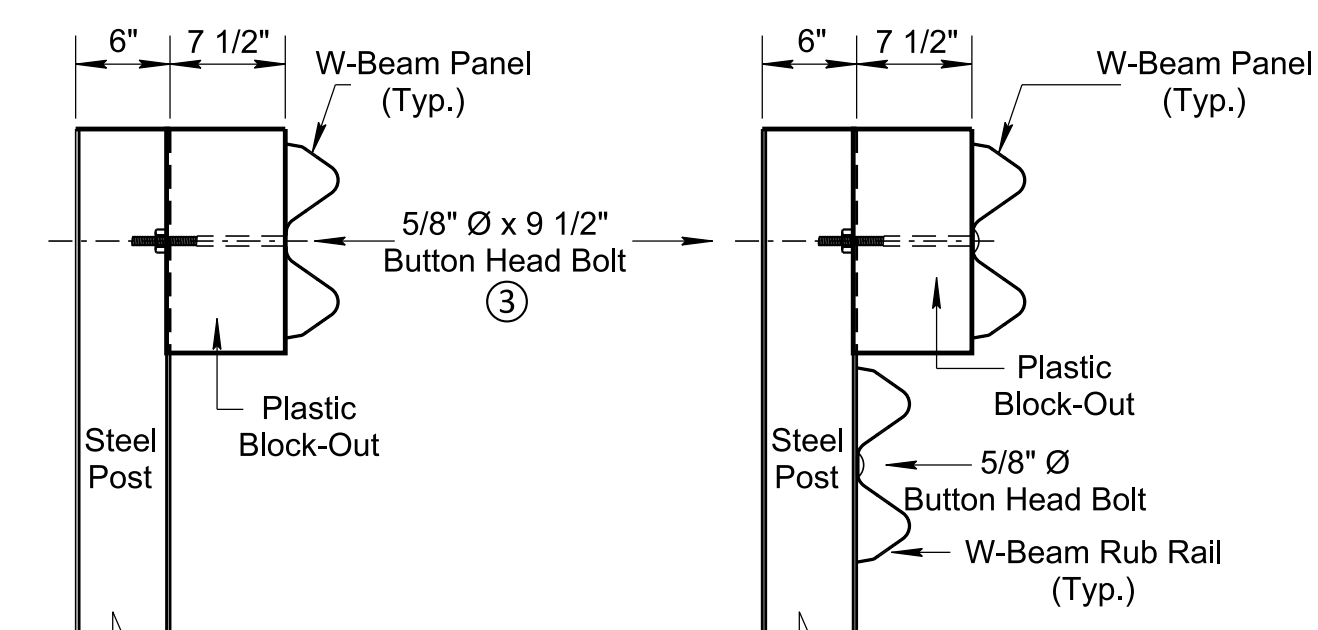
THIS WASHER IS TO BE USED UNDER ALL BOLT HEADS AND NUTS SUBJECT TO TURNING WHEN TORQUED. ROUND WASHERS SHALL BE STEEL, GALVANIZED IN ACCORDANCE WITH AASHTO M232 SPECIFICATION.

**GENERAL NOTES**

- (A) BOLTS FOR CONNECTING RAIL TO POST THROUGH BLOCKOUT SHALL BE 5/8" DIAMETER X 9 1/2" (STEEL POST) OR 5/8" DIAMETER BY 18" (WOOD POST) BUTTON HEAD WITH ROUND STEEL WASHER. A 5/8" DIAMETER RECESSED BOLT (WITHOUT WASHER) MAY BE SUBSTITUTED FOR THE 5/8" DIAMETER BOLT (FOR BOTH WOOD AND STEEL POSTS) PER AASHTO SPECIFICATION M-180.
- (B) BOLTS SHALL BE OF SUFFICIENT LENGTH TO EXTEND THROUGH THE FULL THICKNESS OF THE NUT AND NO MORE THAN 3/4" BEYOND IT.
- (C) BOLTS SHALL CONFORM TO THE REQUIREMENTS OF ASTM A307 AND NUTS TO THE REQUIREMENTS OF ASTM A563M, GRADE "A" OR BETTER, AND BE GALVANIZED IN ACCORDANCE WITH ASTM A153.
- (D) DIMENSIONAL TOLERANCES NOT SHOWN OR IMPLIED ARE INTENDED TO BE THOSE CONSISTENT WITH THE PROPER FUNCTIONING OF THE PART, INCLUDING ITS APPEARANCE, AND ACCEPTED MANUFACTURING PRACTICES.

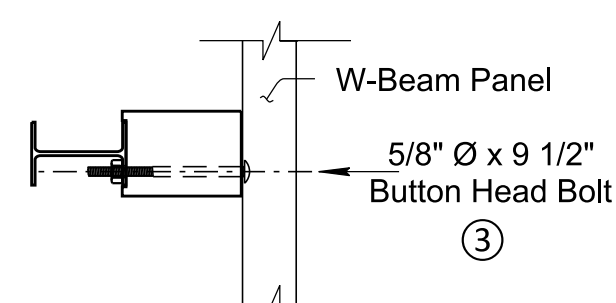
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## STEEL POST GUARDRAIL DETAILS

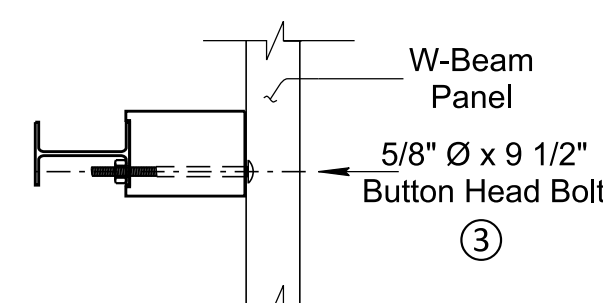


Side View

Side View



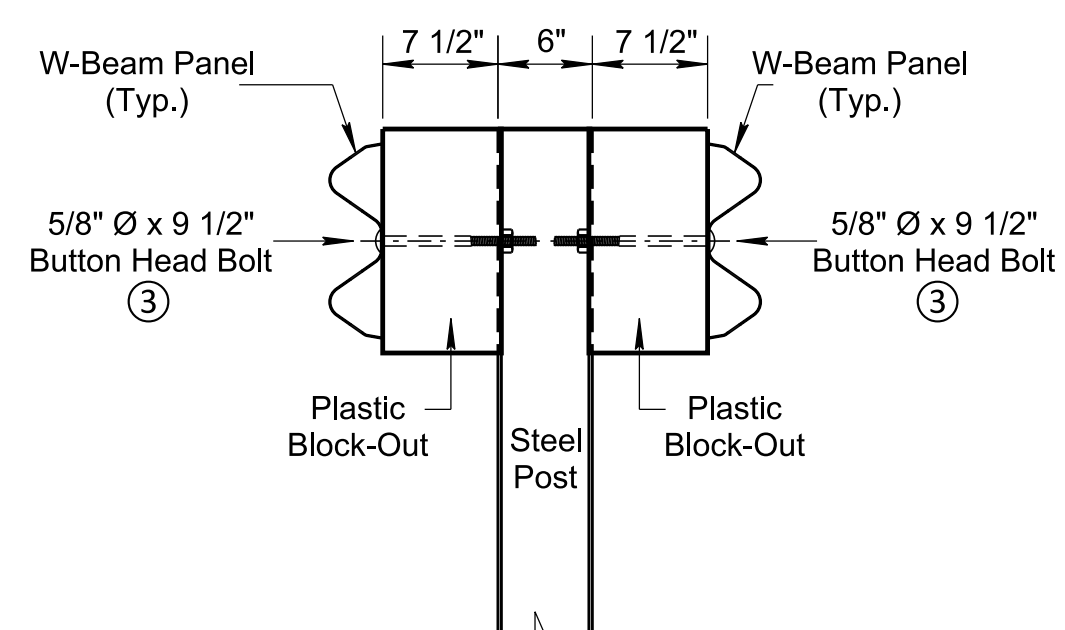
PLAN VIEW



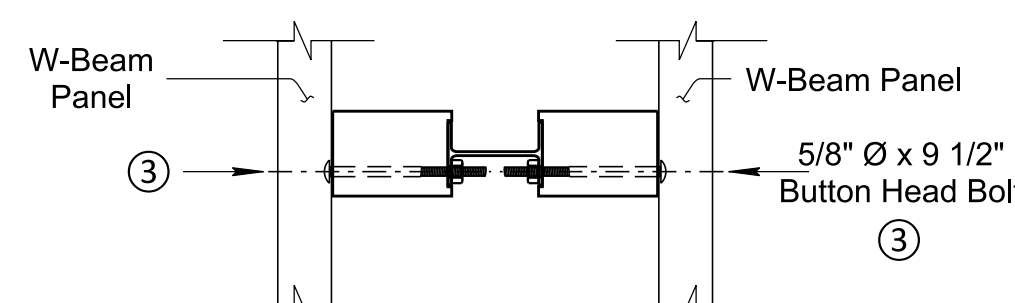
PLAN VIEW

**SINGLE FACE W-BEAM WITH STEEL POST (Timber Post Similar)**

**SINGLE FACE W-BEAM WITH RUB RAIL AND STEEL POST (Timber Post Similar)**

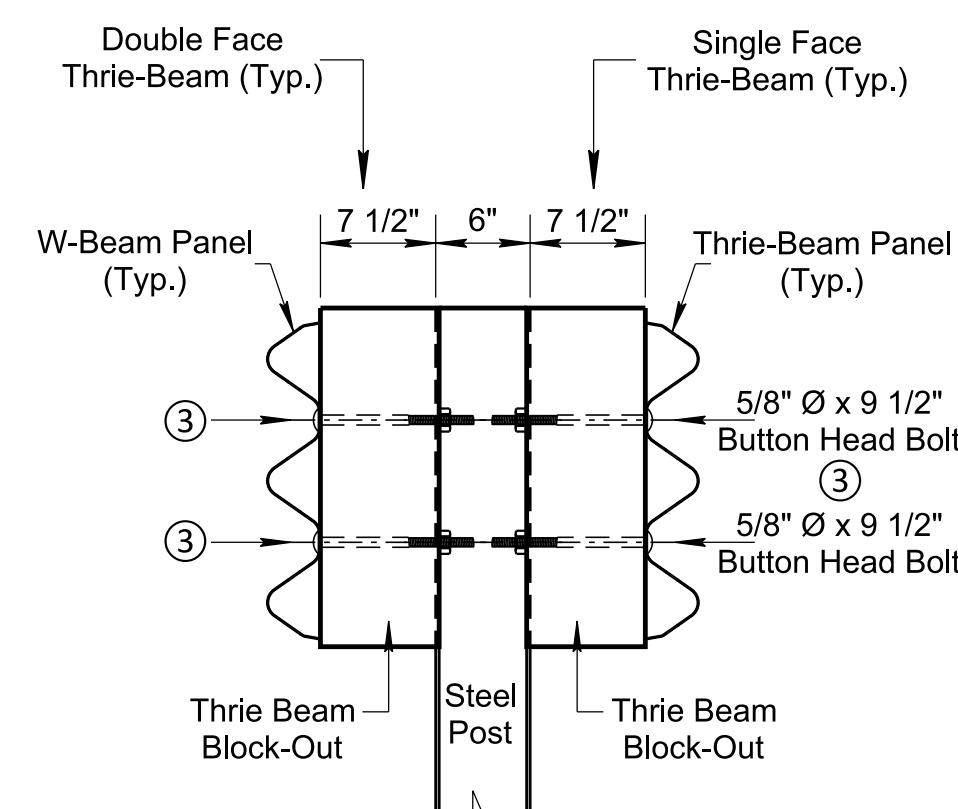


Side View

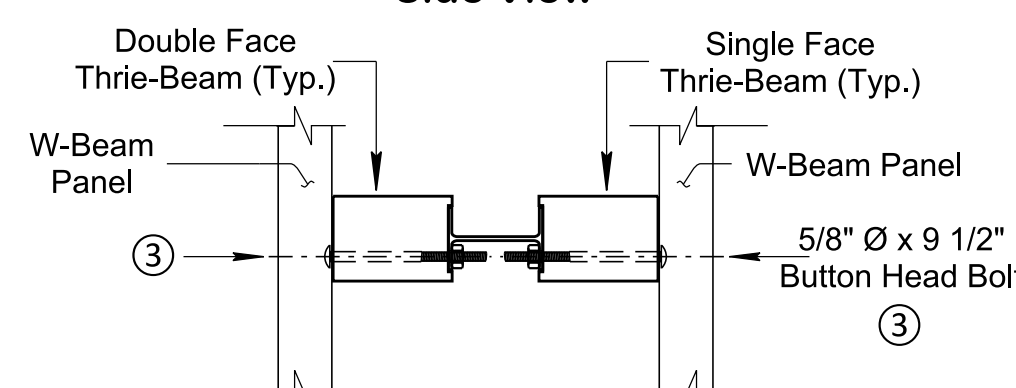


PLAN VIEW

**DOUBLE FACE W-BEAM WITH STEEL POST (Timber Post Similar)**

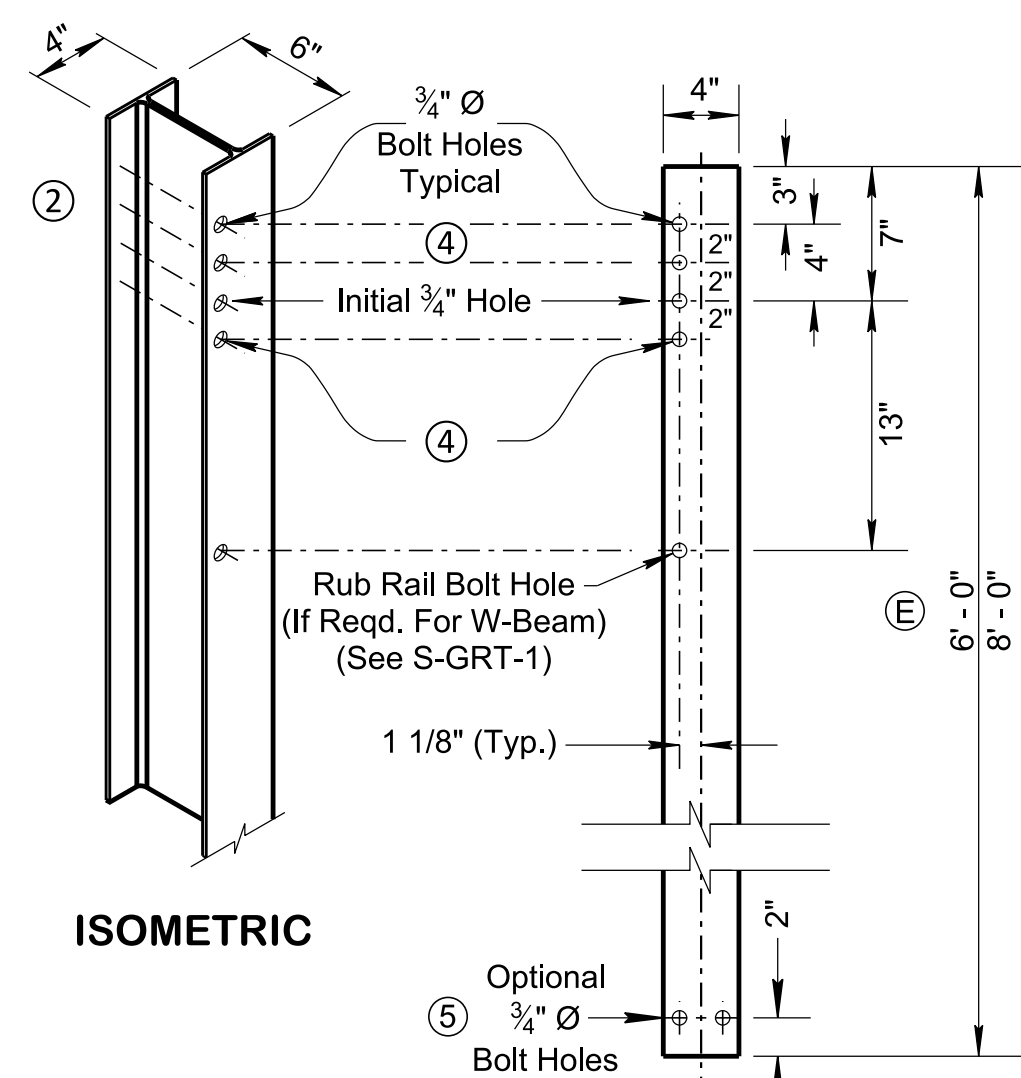


Side View



PLAN VIEW

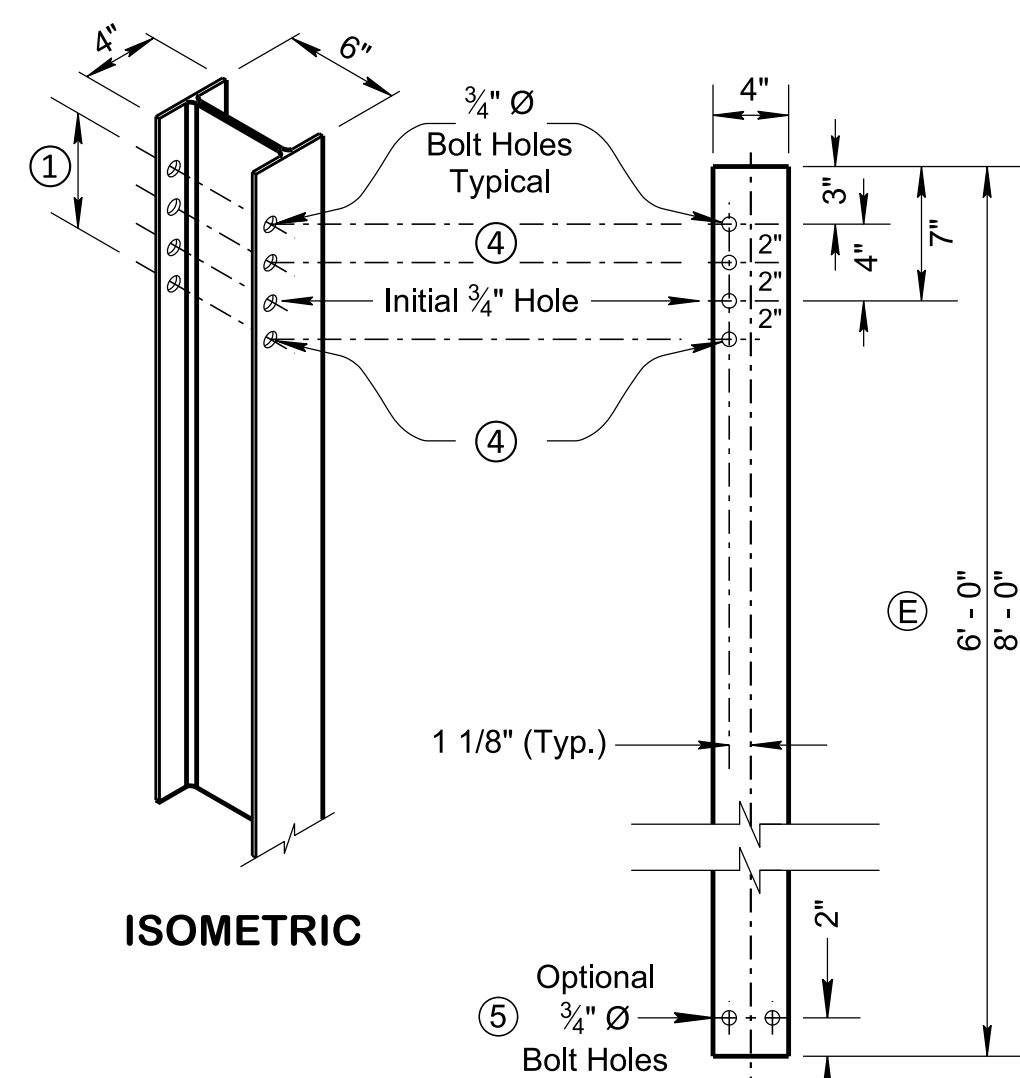
**SINGLE/DOUBLE FACE THRIE-BEAM WITH STEEL POST (Timber Post Similar)**



ISOMETRIC

FRONT VIEW

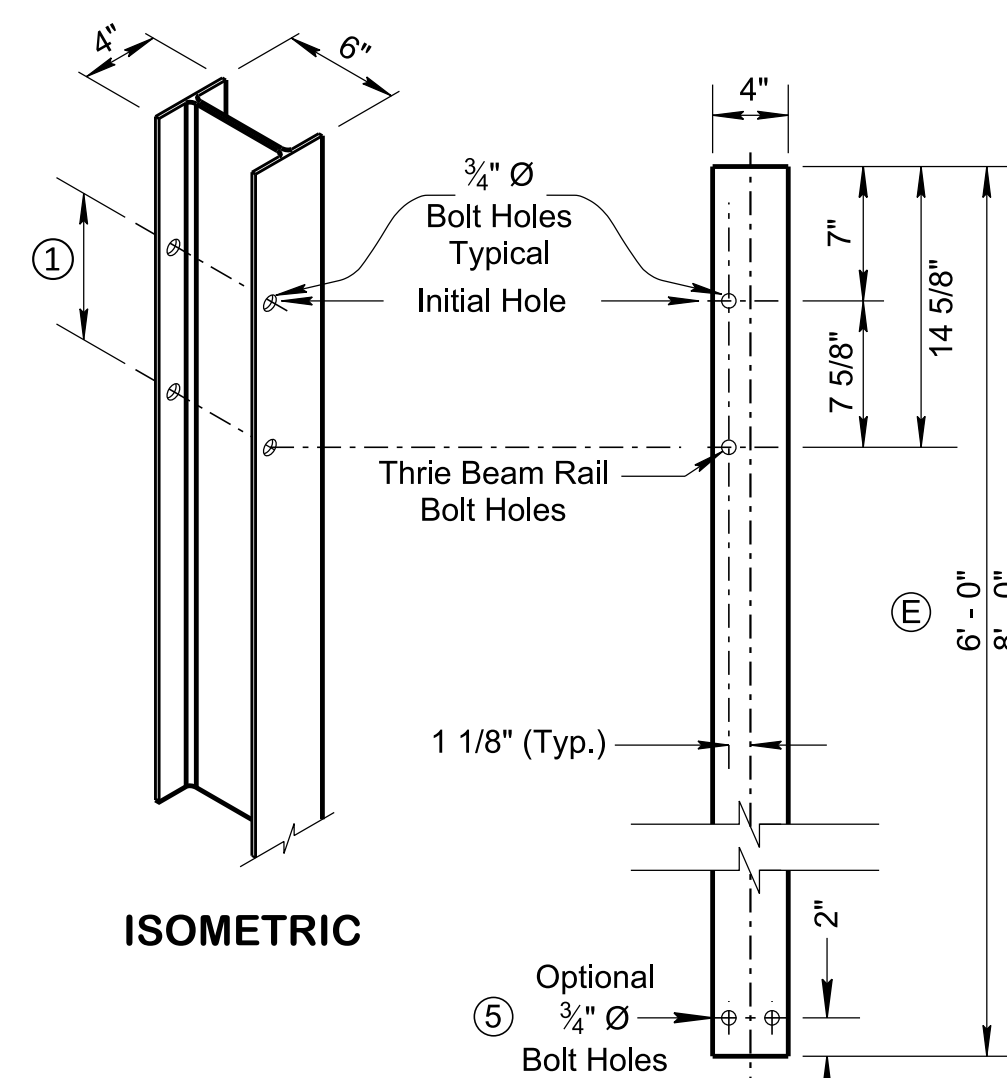
**STEEL POST FOR SINGLE FACE W-BEAM RAIL WITH OPTIONAL RUB RAIL (If Required)**



ISOMETRIC

FRONT VIEW

**STEEL POST FOR DOUBLE FACE W-BEAM RAIL**



ISOMETRIC

FRONT VIEW

**STEEL POST FOR SINGLE AND DOUBLE FACE THRIE-BEAM**

## GENERAL NOTES

**POST**

- (A) THE CONTRACTOR MAY HAVE THE CHOICE OF EITHER HOT ROLLED OR WELDED STEEL W6 X 8.5 OR W6 X 9 OR 8" X 6" WOOD POST. EXCEPT AS NOTED:
  1. THE MIXING OF ANY POST TYPES ON A GIVEN PROJECT WILL BE AVOIDED IF AT ALL POSSIBLE.
  2. SHOULD IT BECOME NECESSARY TO MIX POST TYPES ON A GIVEN PROJECT POSTS SHALL NOT BE MIXED ON A SINGLE RUN OF GUARDRAIL EXCEPT AS NECESSARY AT END TERMINALS.
  3. W6 X 15 IS USED WITH GUARDRAIL CONNECTION TO STRUCTURES.

- (B) STEEL POSTS SHALL CONFORM TO ASTM A36 AND BE GALVANIZED IN ACCORDANCE WITH ASTM A123. BOLT HOLES SHALL BE APPROXIMATELY CENTERED BETWEEN WEB AND EDGE OF FLANGE OF SPACERS AND POSTS.

- (C) WOOD POSTS SHALL CONFORM WITH TDOT CONSTRUCTION STANDARD SPECIFICATIONS.

- (D) WELDED STEEL POSTS SHALL CONFORM TO ASTM A769 AND BE GALVANIZED IN ACCORDANCE WITH ASTM A123, UNLESS OTHERWISE SPECIFIED ON THE PLANS.

- (E) SEE STANDARD DRAWING S-PL-6 FOR POST LENGTH REQUIREMENTS AND PAY ITEMS.

**BLOCK-OUTS**

- (F) BLOCK OUTS SHALL BE WOOD CONFORMING TO THE REQUIREMENTS OF TDOT CONSTRUCTION STANDARD SPECIFICATIONS OR PLASTIC GUARDRAIL BLOCK-OUTS LISTED ON THE TDOT QUALIFIED PRODUCT LIST.

- (G) ONLY WOODEN BLOCK-OUTS MAY BE USED WITH WOODEN POSTS, PLASTIC OR WOODEN BLOCK-OUTS MAY BE USED WITH STEEL POSTS.

- (H) ALL BLOCK-OUTS SHALL MEET MASH GUIDELINES AND NCHRP-350 GUIDELINES.

- (I) FOR BLOCK-OUT DETAILS SEE STANDARD DRAWING S-GR31-1A.

- (J) RECYCLED PLASTIC GUARDRAIL BLOCK-OUTS LISTED ON THE TENNESSEE DEPARTMENT OF TRANSPORTATION'S QUALIFIED PRODUCTS LIST MAY BE SUBSTITUTED FOR WOOD BLOCK-OUTS. THE USE OF RECYCLED PLASTIC GUARDRAIL BLOCK-OUTS ARE SUBJECT TO THE FOLLOWING STIPULATIONS:

1. THE MIXING OF BLOCK-OUTS ON A GIVEN PROJECT WILL BE AVOIDED IF POSSIBLE.
2. SHOULD IT BECOME NECESSARY TO CHANGE THE BLOCK-OUT TYPE ON A GIVEN PROJECT, THE BLOCK-OUTS SHOULD NOT BE MIXED ON A GIVEN RUN OF GUARDRAIL.

**FUTURE ADJUSTMENTS**

- (K) WOOD BLOCK OUTS SHALL HAVE ONE ADDITIONAL 3/4" HOLE, FOUR INCHES BELOW THE INITIAL HOLE FOR FUTURE ADJUSTMENT.

- (L) INITIAL INSTALLATION REQUIRES ONE BOLT CONNECTION, EACH ADJUSTMENT THEREAFTER REQUIRES TWO BOLT CONNECTIONS.

**END TREATMENTS**

- (M) ALL RUNS OF GUARDRAIL WILL BEGIN AND END WITH AN ANCHOR SYSTEM (SEE S-GRA-SERIES).

- (N) GUARDRAIL ENDS THAT ARE INSIDE THE CLEAR ZONE AND EXPOSED TO ONCOMING TRAFFIC SHALL HAVE A CRASH WORTHY END TERMINAL AS NOTED:

1. ANY ROAD WITH SUITABLE BACK SLOPES SHALL USE END TERMINALS BURIED IN BACK SLOPE (SEE S-GRT-1).
2. ALL HIGHWAY SYSTEM ROADS WITHOUT SUITABLE BACK SLOPES SHALL USE MASH TL-3 TANGENTIAL END TERMINALS (SEE S-GRT-2).
3. ALL OTHER ROADS WITH POSTED SPEED < 45 MPH SHALL USE MASH TL-2 END TERMINALS UNLESS OTHERWISE NOTED (SEE S-GRT-3).

**DESIGN**

- (O) 4 FEET BEHIND GUARDRAIL SHALL BE CLEAR OF OBSTRUCTIONS FOR DEFLECTION.

- (P) REFER TO SAFETY PLAN STANDARDS FOR HOW TO DETERMINE THE LENGTH OF NEED.

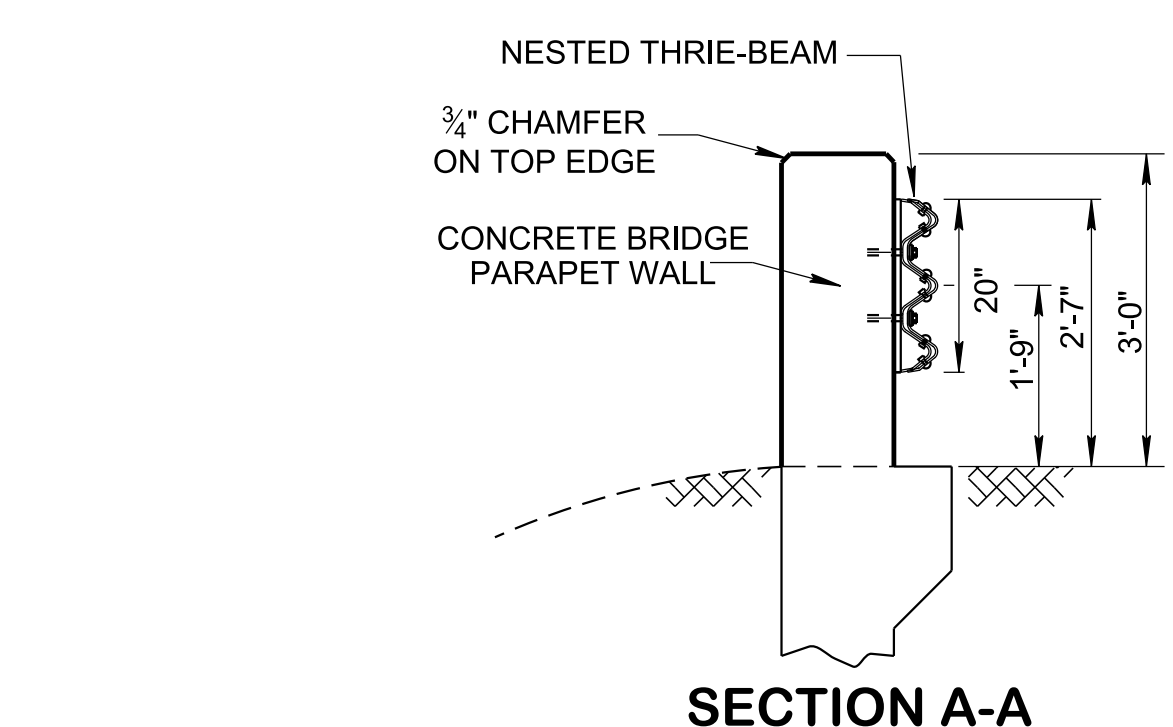
- (Q) SEE STANDARD DRAWING S-GR31-1B FOR FASTENING HARDWARE DETAILS.

## FOOTNOTES

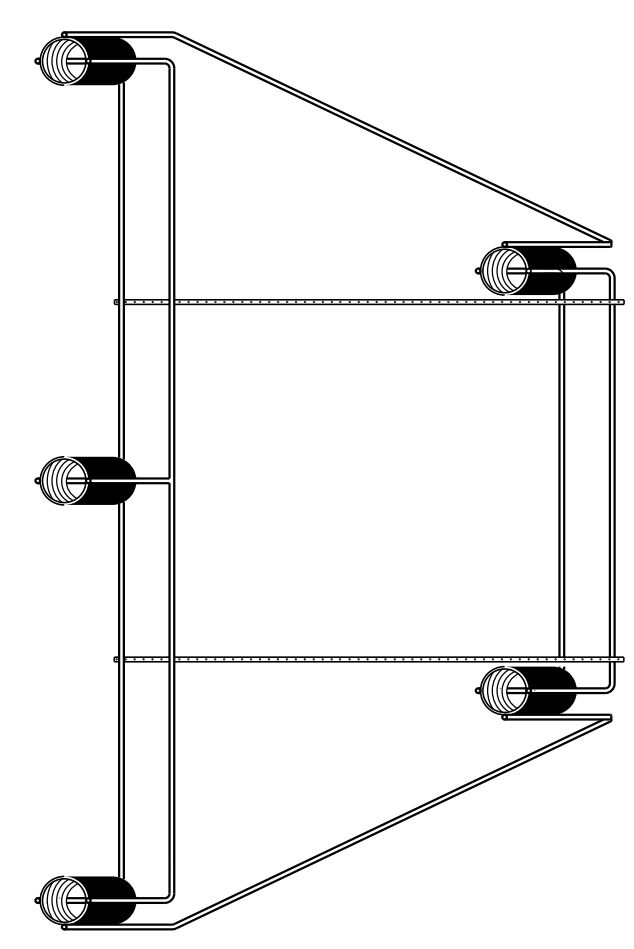
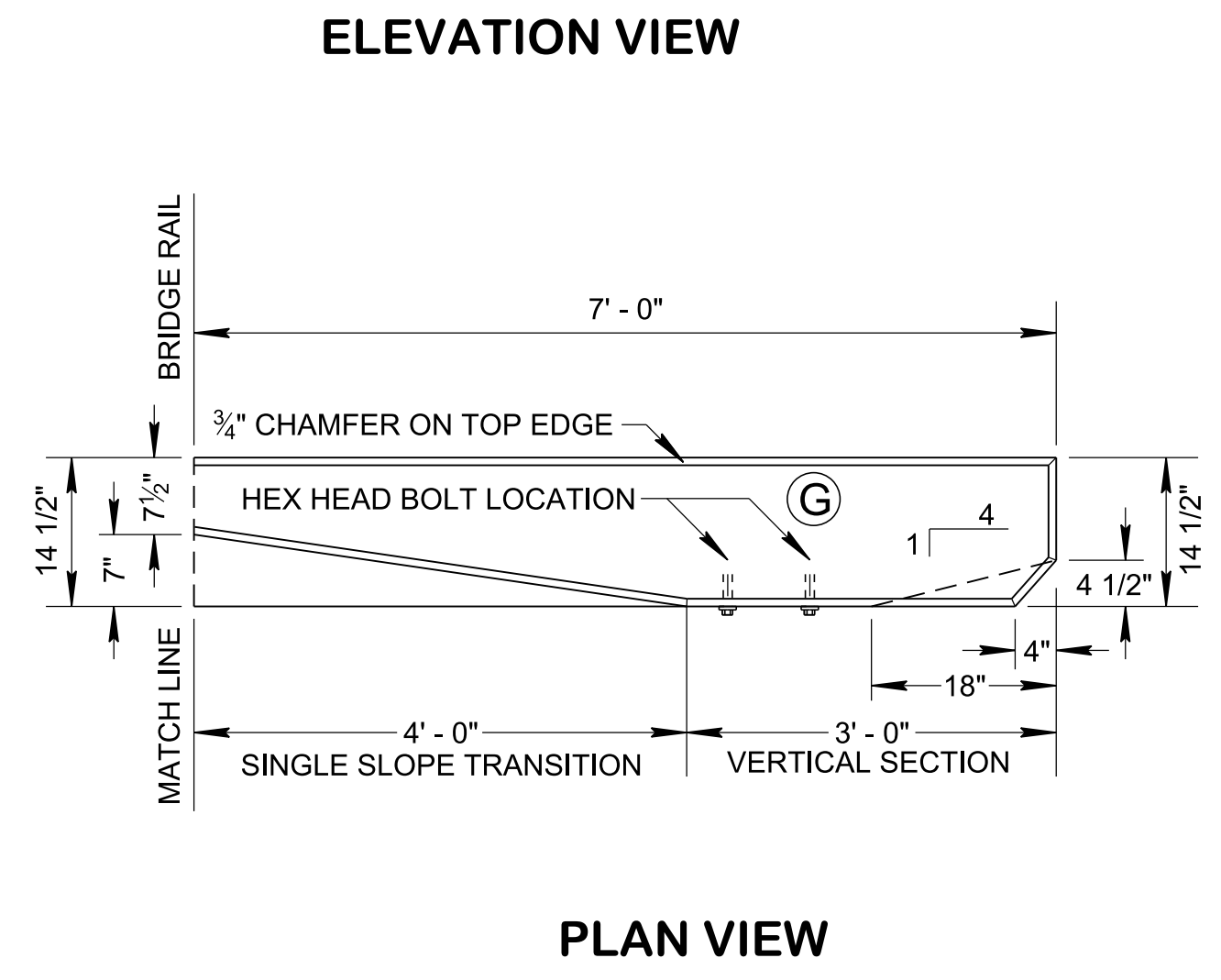
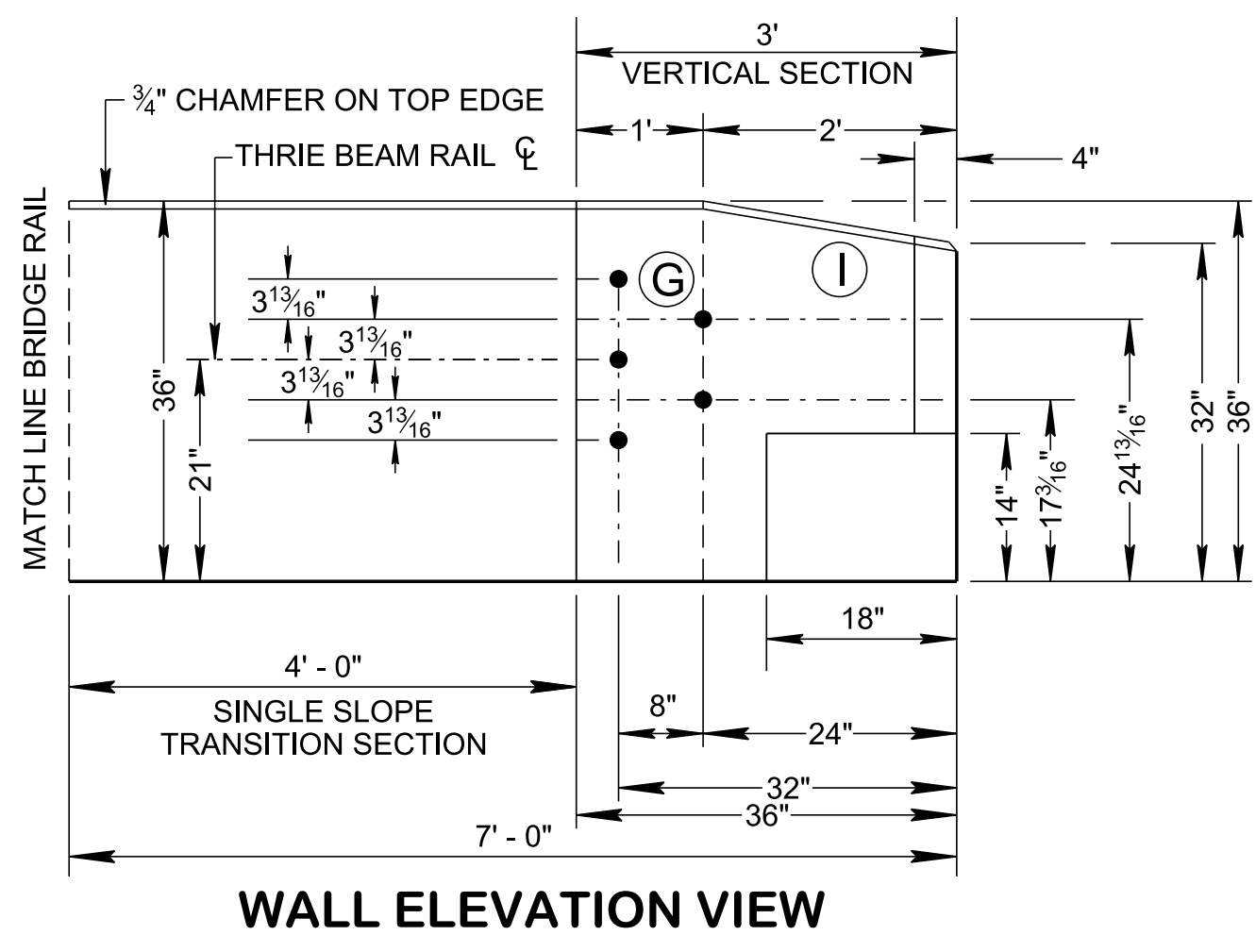
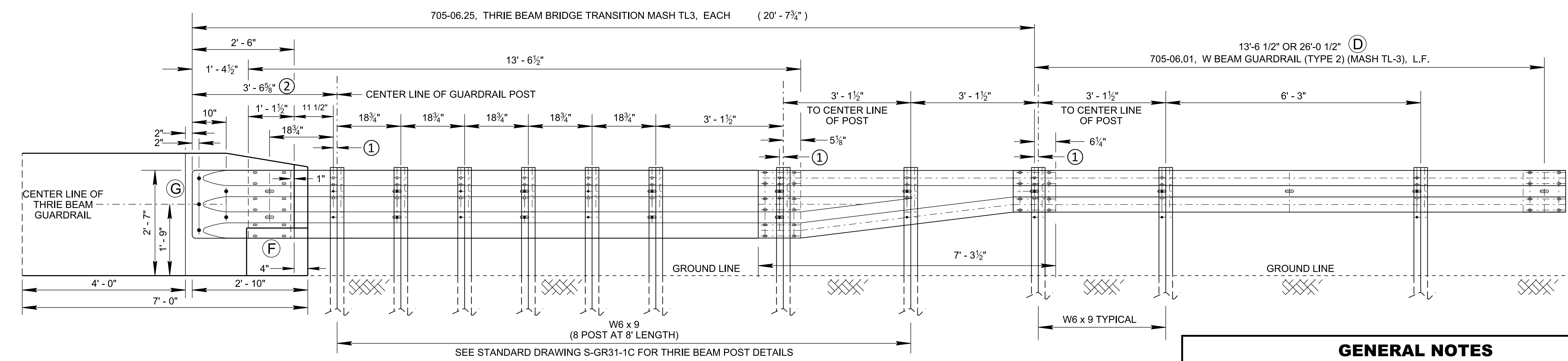
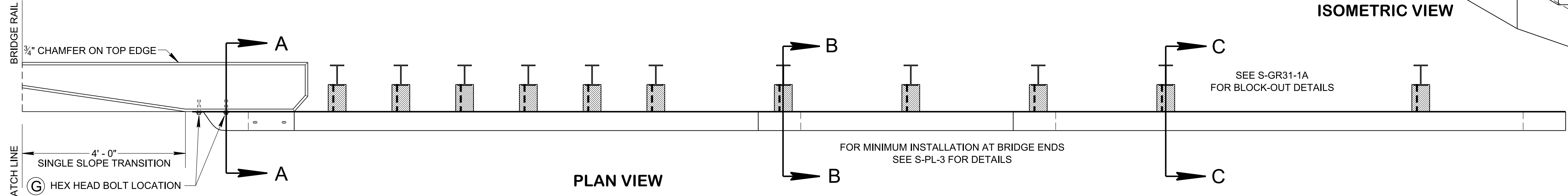
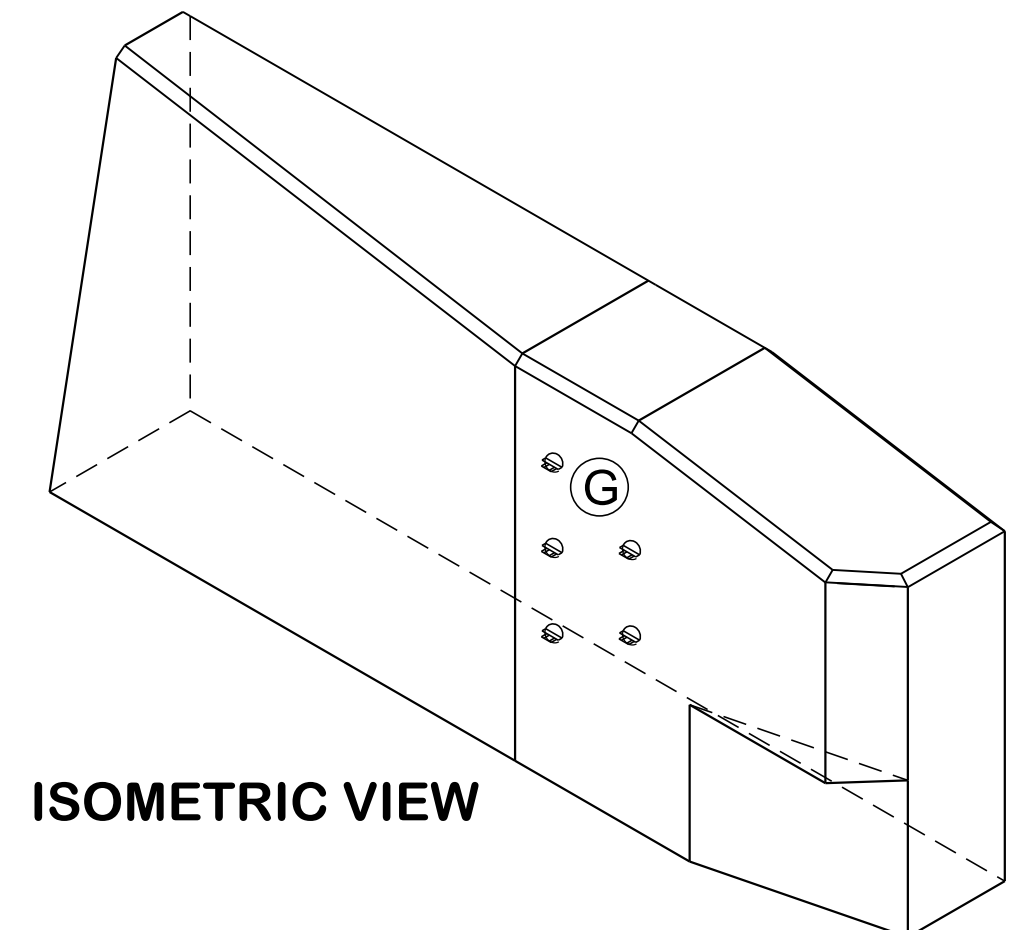
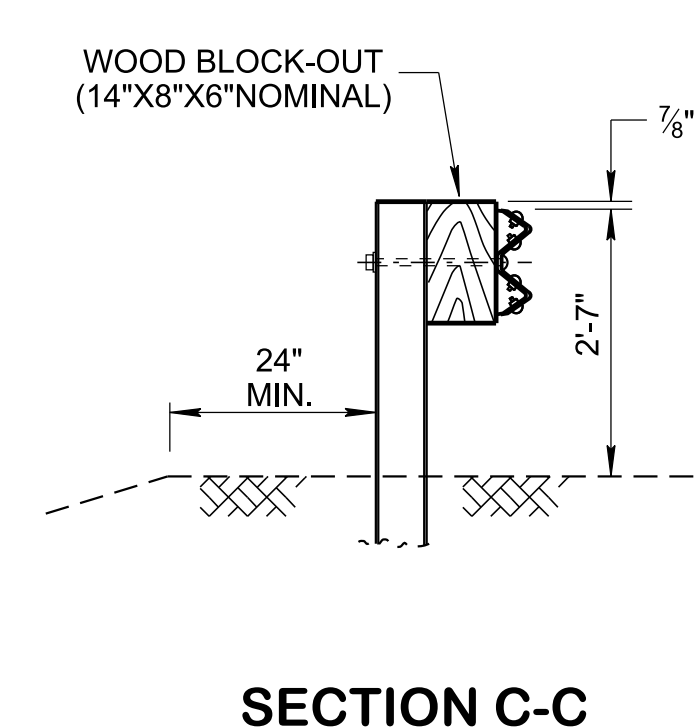
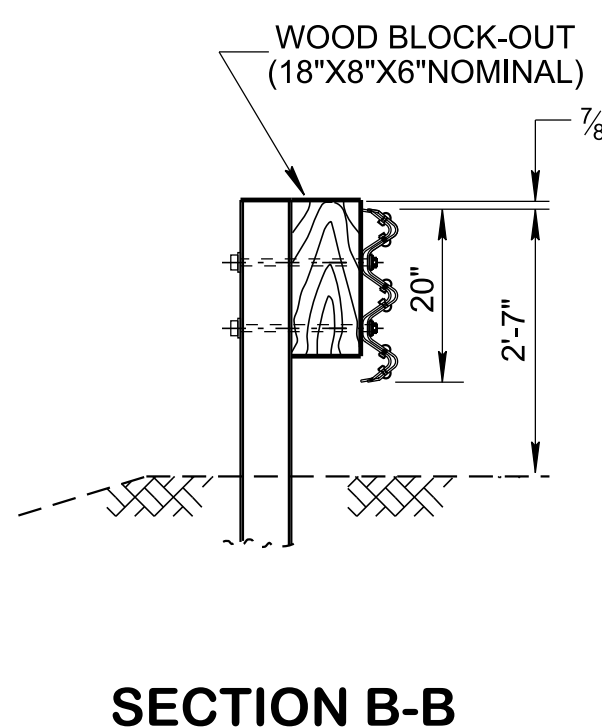
- ① BOLT HOLES ON THE BACKSIDE ARE FOR DOUBLE FACE GUARDRAIL (IF REQUIRED).
- ② AN ADDITIONAL 3/4" HOLES ON OTHER SIDE OF THE FLANGE OR BACK FLANGE WILL BE ACCEPTABLE IF THEY ARE LOCATED WITHIN TOP 9" OF THE POST (FOR SINGLE FACE).
- ③ 5/8" DIA. x 9 1/2" LENGTH, BUTTON HEAD BOLT WITH RECESSED NUT OR HEX NUT AND 1 WASHER PER BOLT.
- ④ 2 EXTRA 3/4" HOLES IN POST ABOVE INITIAL HOLE AND 1 EXTRA 3/4" HOLE BELOW FOR VERTICAL ADJUSTMENT.
- ⑤ ADDITIONAL BOLT HOLES ON THE POST BOTTOM MAY BE ACCEPTABLE FOR MANUFACTURING PURPOSES.



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- LEGEND**
- ① 1 1/8" POST OFFSET TO BOLT HOLE (TYPICAL)
  - ② FOR THE APPROACHING OPPOSITE SIDE OF THE ROADWAY THE DISTANCE IS 3' - 4 3/8" DUE TO POST BEING REVERSED AND BOLT HOLE OFFSET OF 2 1/4".



- GENERAL NOTES**
- (A) THIS DRAWING IS TO BE USED AT ALL GUARDRAIL TRANSITIONS TO BRIDGE RAIL FOR HIGH SPEED ROADWAYS WITH ADT >2000 VEH/DAY.
  - (B) CONNECTION TO BRIDGE RAIL SHOWN; FOR CONNECTION TO CONCRETE MEDIAN BARRIER WALLS, SEE STANDARD DRAWING S-SSMB-6.
  - (C) SEE STANDARD DRAWINGS STD-1 SERIES FOR BRIDGE RAILING DETAILS. S-GR31-1 SERIES FOR ALL OTHER GUARDRAIL DETAILS AND MATERIAL PROPERTIES NOT SHOWN AND S-PL-3 FOR MINIMUM LENGTH AND DELINEATOR REQUIREMENTS.
  - (D) ALL COMPONENTS AS SHOWN ON THIS DRAWING OR ANY COMPONENTS NEEDED TO INSTALL THIS GUARDRAIL SHALL BE INCLUDED UNDER PAY ITEM 705-06.25, THRIE-BEAM BRIDGE TRANSITION MASH TL3, PER EACH.
  - (E) BUTTON HEAD "POST" BOLTS (ASTM A307) SHALL BE OF SUFFICIENT LENGTH TO EXTEND THROUGH THE FULL THICKNESS OF THE NUT (ASTM A563) AND WASHER AND NOT MORE THAN 1" BEYOND IT. BUTTON HEAD "SPlice" BOLTS (ASTM 307), 5/8" DIA. X 2" (AT THRIE-BEAM RAIL SPLICES) WITH 5/8" DOUBLE RECESSED NUTS.
  - (F) GALVANIZED WASHERS USED WITH THE 5/8" DIA. POST BOLTS SHALL BE TYPE A 1-3/4" O. D. WASHERS. THE (12) PLATE WASHERS (FWR03) REQUIRED AT THE TERMINAL CONNECTOR SPLICE.
  - (G) TO CONNECT THE THRIE-BEAM GUARDRAIL AND THE TERMINAL CONNECTION TO THE BRIDGE RAIL WILL REQUIRE 5 HEX HEAD BOLTS AT 7/8" Ø X 2", WASHERS AND NUTS.
  - (H) SAFETY PERFORMANCE OF THIS DEVICE HAS BEEN EVALUATED PER TRB 2672(39) 41-51 DEVELOPMENT OF A STANDARDIZED BUTTRESS FOR APPROACH GUARDRAIL TRANSITIONS AND TTI REPORT 9-1002-12-3, FOR MASH TL-3.
  - (I) TRANSITION TO 36" MAY BE ELIMINATED WHEN 32" PARAPET WALL DESIGN IS USED.

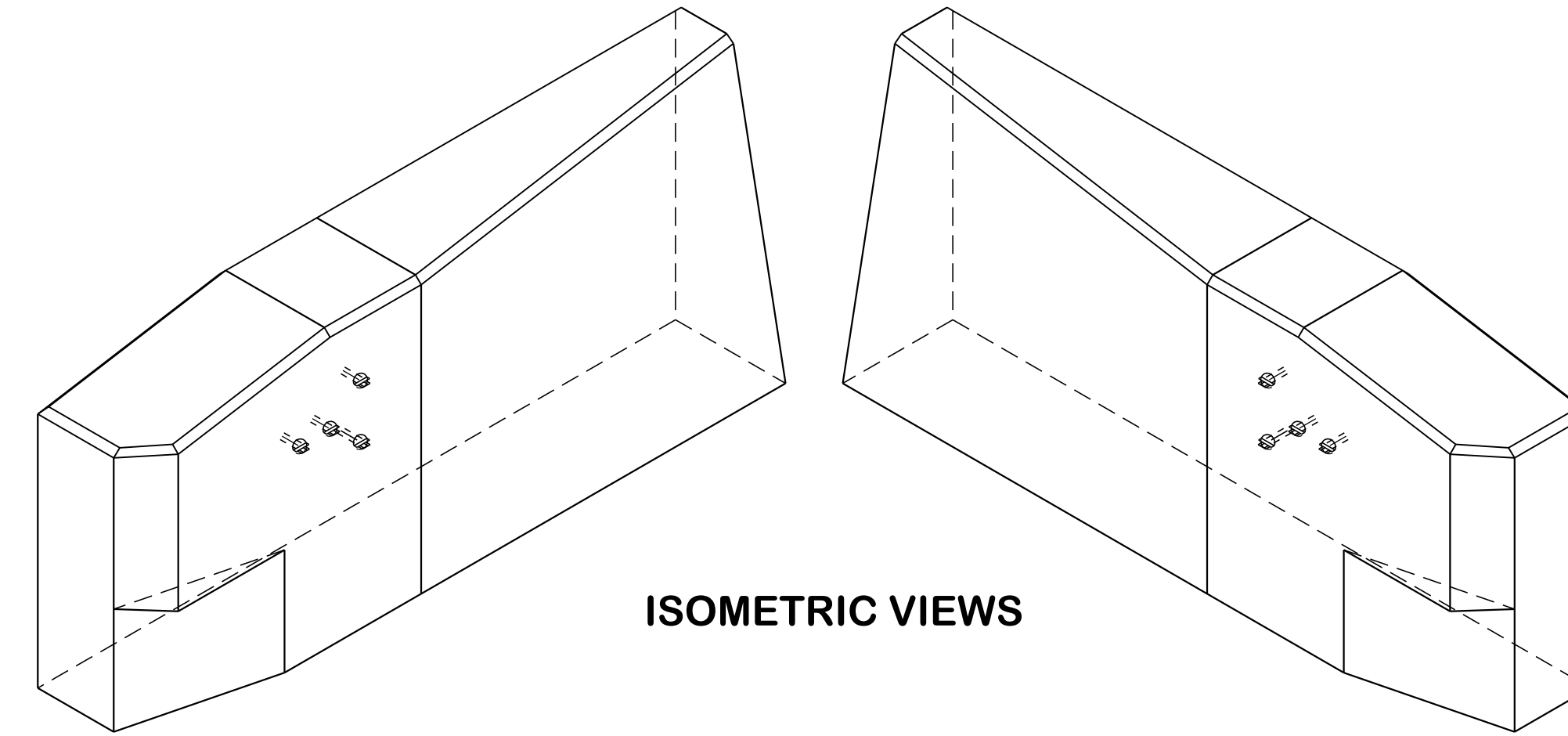
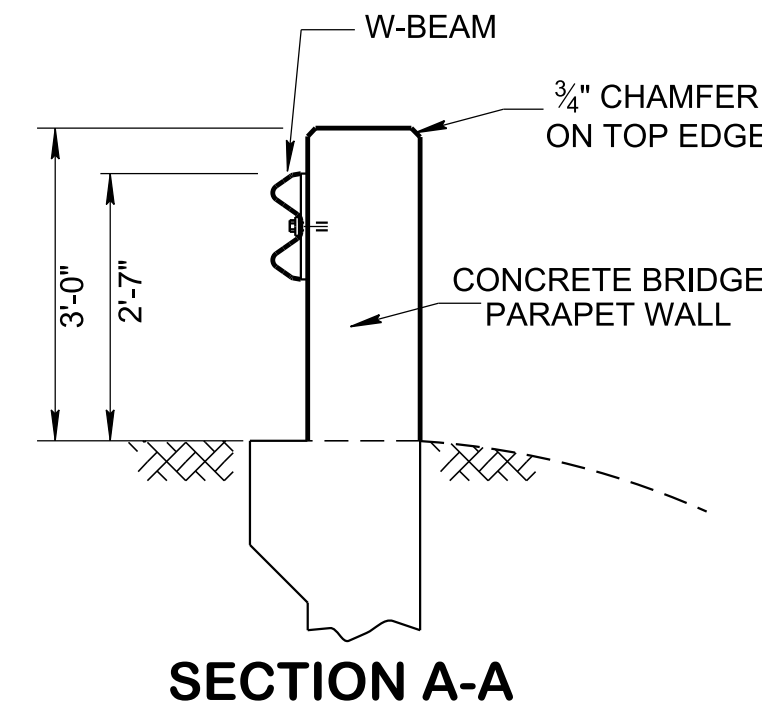
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STANDARD DRAWING  
DEPARTMENT OF TRANSPORTATION

**GUARDRAIL CONNECTION TO BRIDGE RAILING CONCRETE PARAPET**

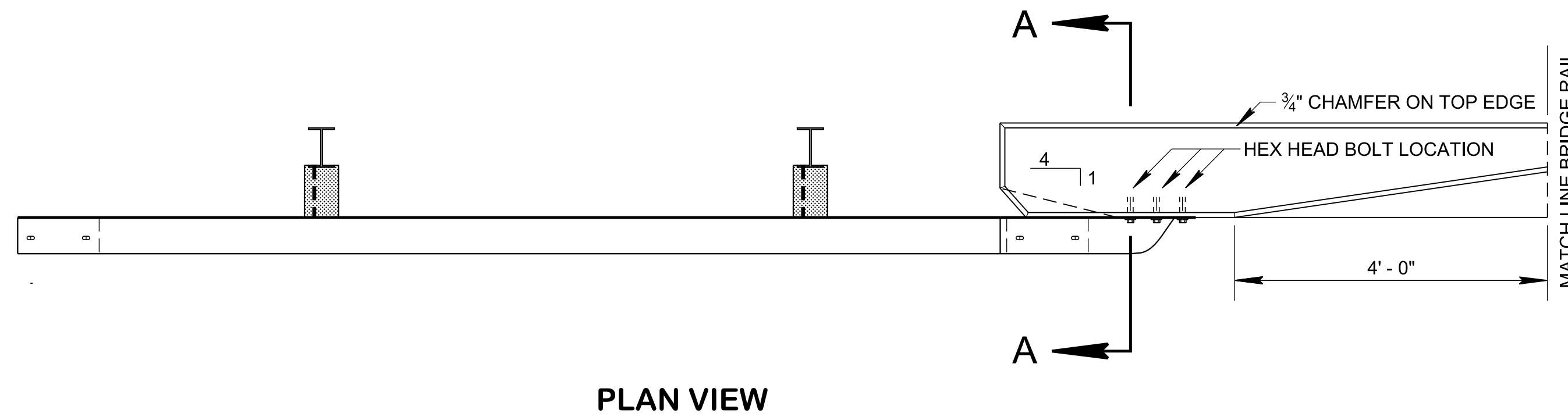
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**LEGEND**

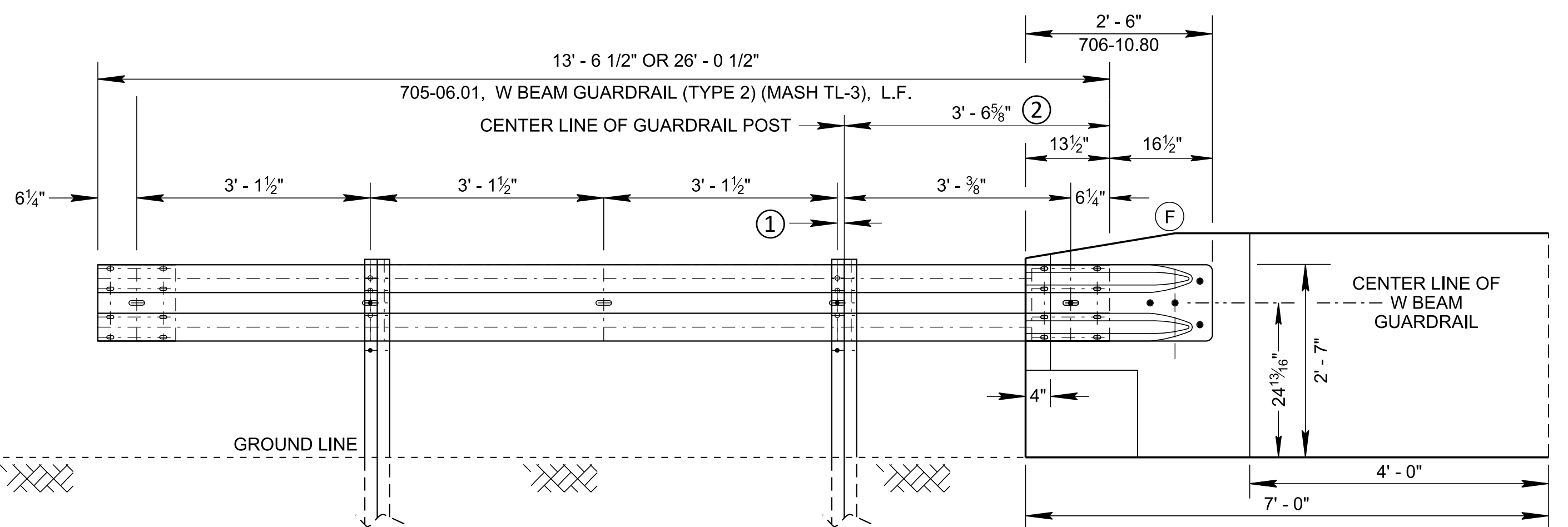
- ① 1 1/8" POST OFFSET TO BOLT HOLE (TYPICAL)
- ② FOR THE TRAILING END OPPOSITE SIDE OF THE ROADWAY THE DISTANCE IS 3' - 8 7/8" DUE TO POST BEING REVERSED AND BOLT HOLE OFFSET OF 2 1/4".



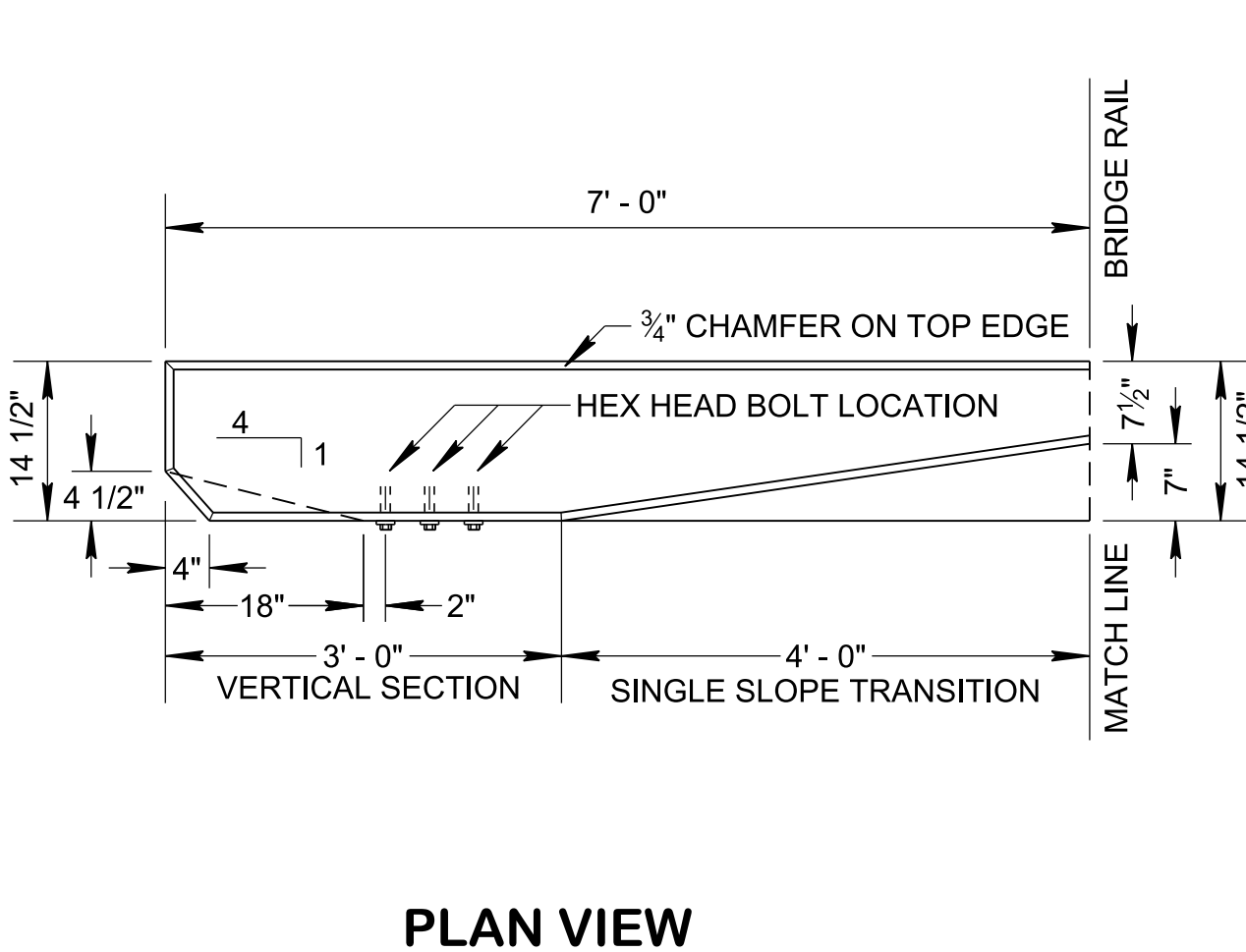
**ISOMETRIC VIEWS**



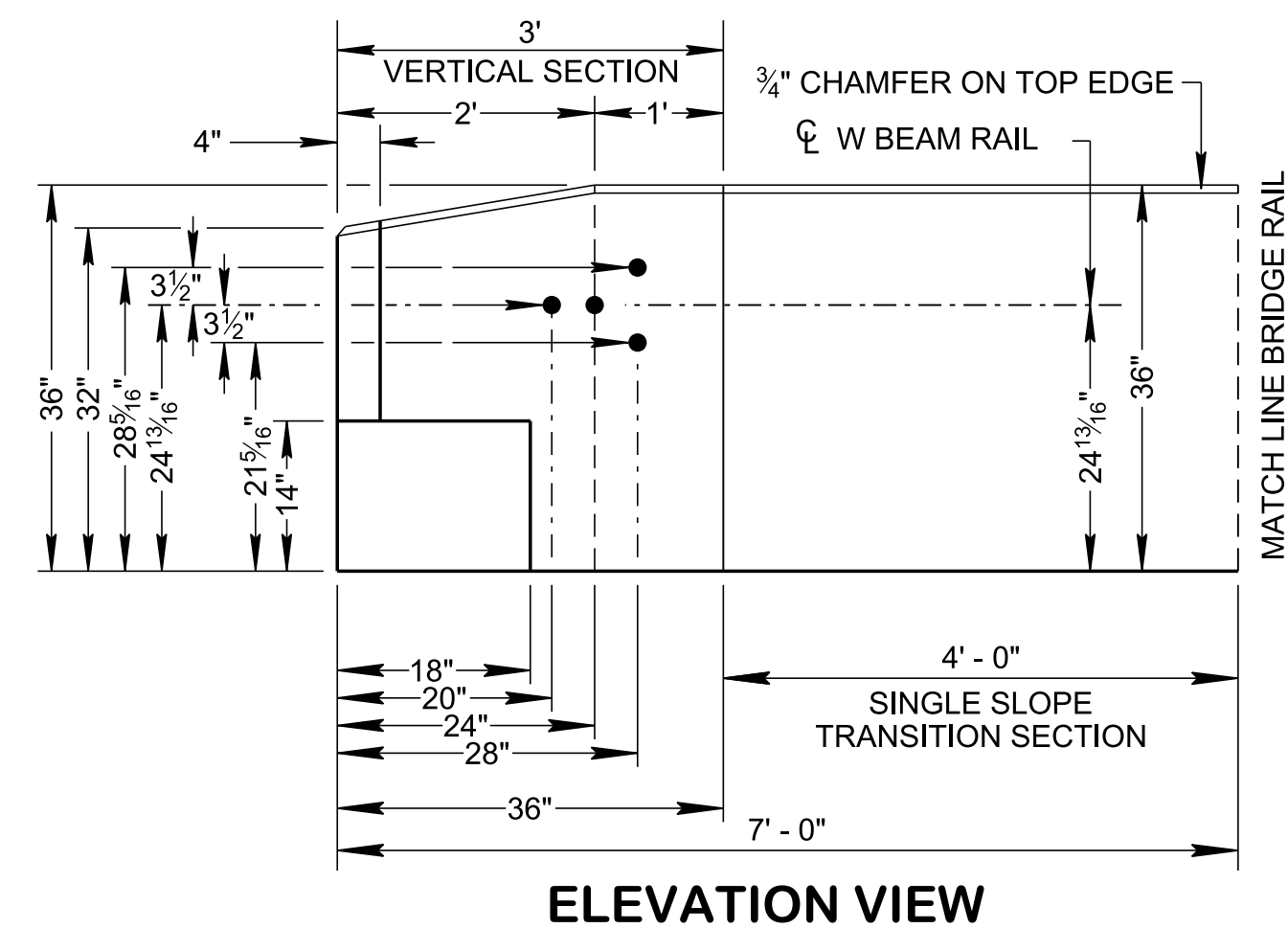
**PLAN VIEW**



**ELEVATION VIEW**



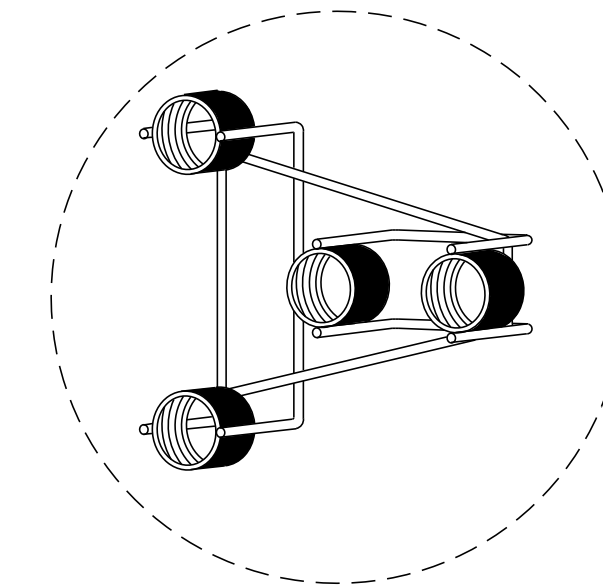
**PLAN VIEW**



**ELEVATION VIEW**

**CONCRETE BRIDGE PARAPET WALL DETAILS**

- GENERAL NOTES**
- (A) THIS DRAWING IS TO BE USED FOR CONNECTING GUARDRAIL TO BRIDGE RAIL TRAILING END IF NEEDED ON A DIVIDED HIGHWAY, ETC. PROVIDED THERE IS NO ONCOMING TRAFFIC.
  - (B) IF GUARDRAIL IS TO BE CONNECTED USING THIS DRAWING IT WILL REQUIRE W BEAM GUARDRAIL (TYPE 2) (MASH TL-3), AT 13'-6 1/2" OR 26'-0 1/2", ITEM NO. 705-06.01, PER L.F. AND ONE MICHIGAN END SHOE, ITEM NO. 706-10.80, PER EACH.
  - (C) CONNECTION TO BRIDGE RAIL SHOWN; FOR CONNECTION TO CONCRETE BARRIER WALLS, SEE S-SSMB-6.
  - (D) SEE STANDARD DRAWINGS STD-1 SERIES FOR BRIDGE RAILING DETAILS, S-GR31-1 SERIES FOR ALL OTHER GUARDRAIL DETAILS AND MATERIAL PROPERTIES NOT SHOWN AND S-PL-3 FOR MINIMUM LENGTH AND DELINEATOR REQUIREMENTS.
  - (E) ALL COST FOR THE CONNECTION REQUIREMENTS LISTED HERE BUT NOT LIMITED TO THESE ITEMS SHALL BE INCLUDED IN OTHER GUARDRAIL ITEMS. BUTTON HEAD "SPlice" BOLTS FOR CONNECTING THE W BEAM GUARDRAIL (TYPE 2) WITH THE MICHIGAN END SHOE. THIS WILL REQUIRE 8 (ASTM 307) 5/8" DIA. X 2" WITH 5/8" DOUBLE RECESSED NUTS. TO CONNECT THE W BEAM GUARDRAIL (TYPE 2) AND THE MICHIGAN END SHOE TO THE BRIDGE RAIL WILL REQUIRE 4 HEX HEAD BOLT AT 7/8" Ø x 2", WASHERS AND NUTS.
  - (F) TRANSITION TO 36" MAY BE ELIMINATED WHEN 32" PARAPET WALL DESIGN IS USED.



**INSERT ASSEMBLY**

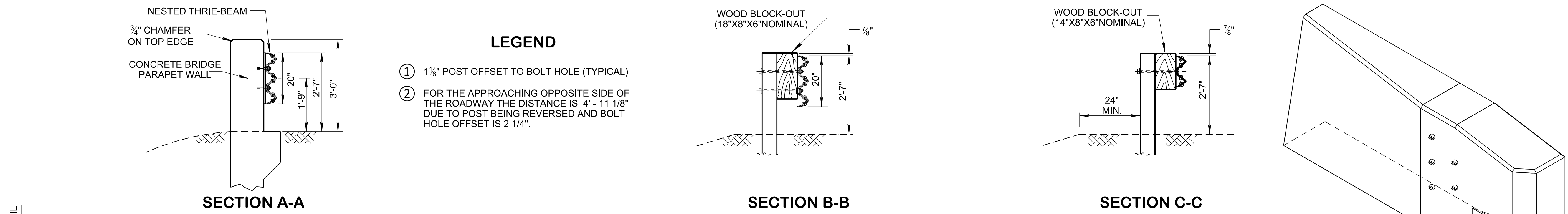
CAST IN PLACE THREADED STEEL INSERT WITH 7/8" x 2" HEX HEAD GALVANIZED BOLTS (A307) HOT DIP ZINC COATING ASTM A153

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**GUARDRAIL CONNECTION TO BRIDGE ENDS (TRAILING ENDS)**



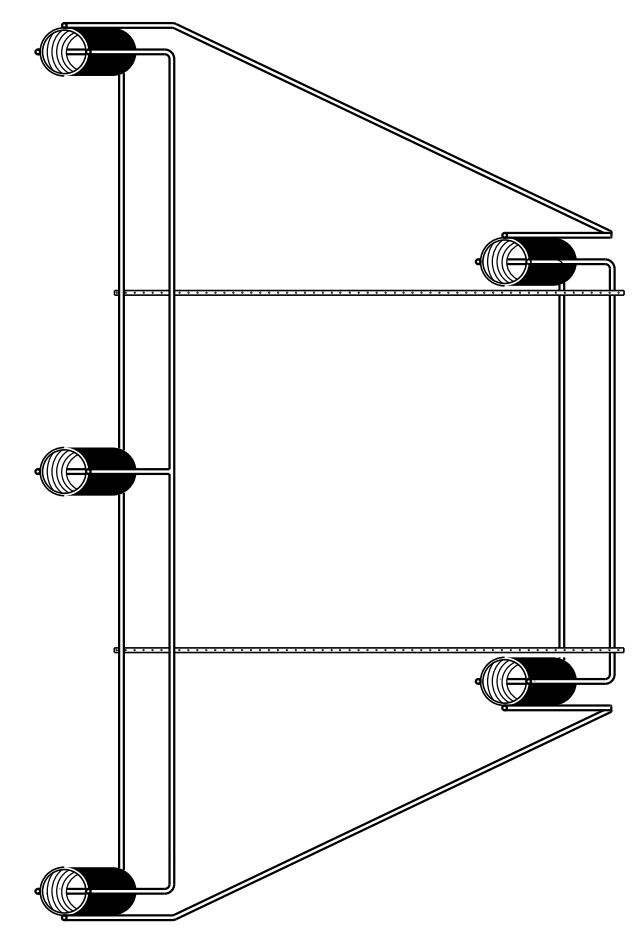
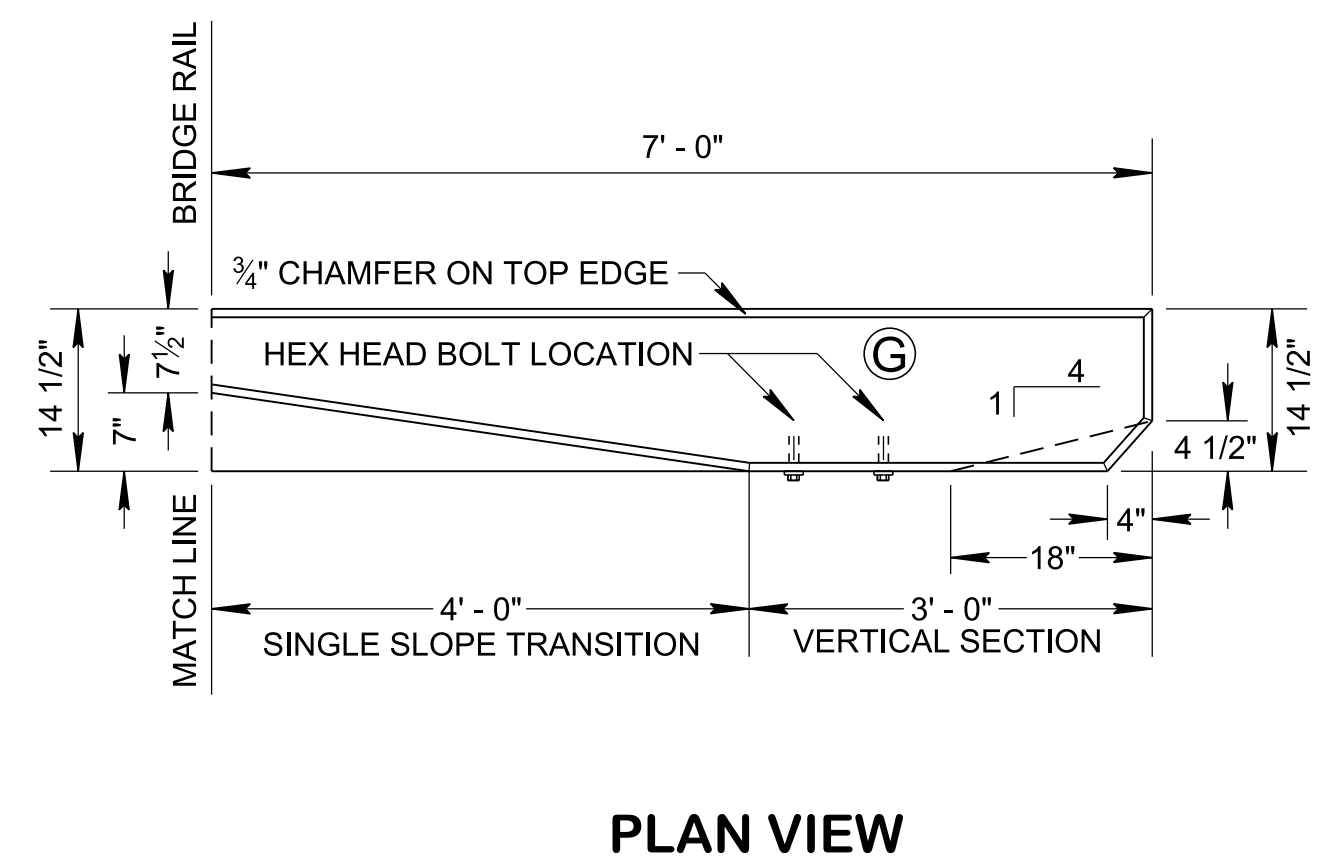
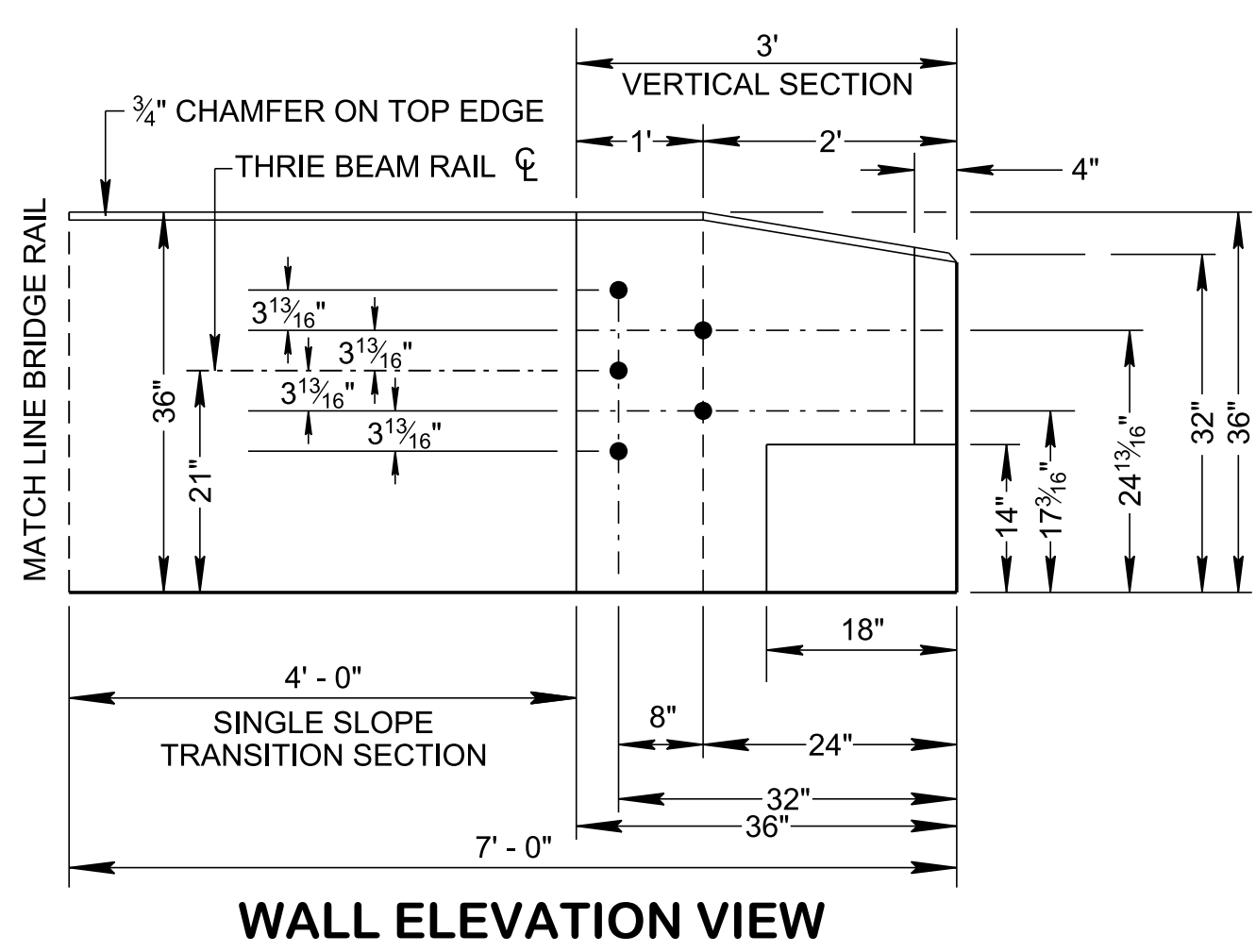
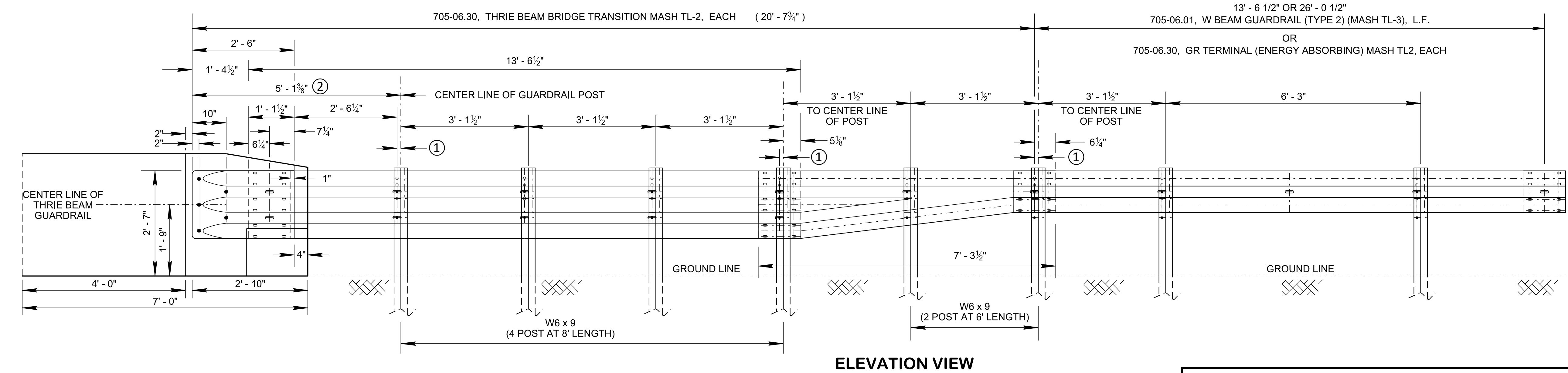
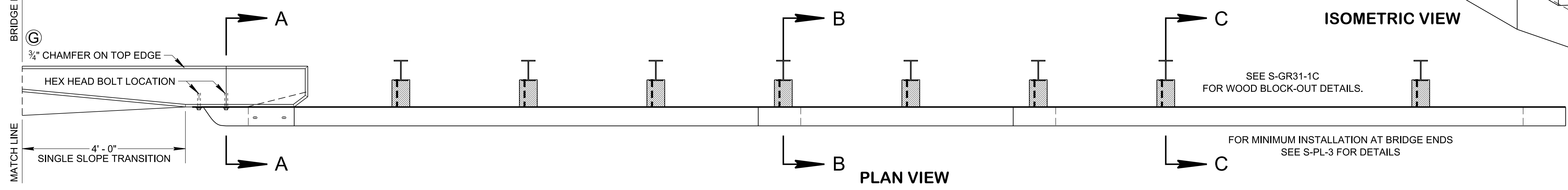
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**LEGEND**

① 1 1/8" POST OFFSET TO BOLT HOLE (TYPICAL)

② FOR THE APPROACHING OPPOSITE SIDE OF THE ROADWAY THE DISTANCE IS 4' - 11 1/8" DUE TO POST BEING REVERSED AND BOLT HOLE OFFSET IS 2 1/4".



- GENERAL NOTES**
- (A) THIS DRAWING IS TO BE USED AT ALL GUARDRAIL TRANSITIONS TO BRIDGE RAIL WITH DESIGN SPEED OF ≤ 45 M.P.H.
  - (B) CONNECTION TO BRIDGE RAIL SHOWN; FOR CONNECTION TO CONCRETE MEDIAN BARRIER WALLS, SEE S-SSMB-6.
  - (C) SEE STANDARD DRAWINGS STD-1 SERIES FOR BRIDGE RAILING DETAILS, S-GR31-1 SERIES FOR ALL OTHER GUARDRAIL DETAILS AND MATERIAL PROPERTIES NOT SHOWN AND S-PL-3 FOR MINIMUM LENGTH AND DELINEATOR REQUIREMENTS.
  - (D) ALL COMPONENTS AS SHOWN ON THIS DRAWING OR ANY COMPONENTS NEEDED TO INSTALL THIS GUARDRAIL SHALL BE INCLUDED UNDER PAY ITEM 705-06.30, THRIE BEAM BRIDGE TRANSITION MASH TL-2, PER EACH.
  - (E) BUTTON HEAD "POST" BOLTS (ASTM A307) SHALL BE OF SUFFICIENT LENGTH TO EXTEND THROUGH THE FULL THICKNESS OF THE NUT (ASTM A563) AND WASHER AND NOT MORE THAN 1" BEYOND IT. BUTTON HEAD "SPlice" BOLTS (ASTM 307) 5/8" DIA. X 2" (AT TRIPLE RAIL SPLICES) WITH 5/8" DOUBLE RECESSED NUTS.
  - (F) GALVANIZED WASHERS USED WITH THE 5/8" DIA. POST BOLTS SHALL BE TYPE A 1 3/4" O. D. WASHERS. THE (12) PLATE WASHERS (FWR03) REQUIRED AT THE TERMINAL CONNECTOR SPLICE.
  - (G) TO CONNECT THE THRIE BEAM GUARDRAIL AND THE TERMINAL CONNECTION TO THE BRIDGE RAIL WILL REQUIRE 5 HEX HEAD BOLTS AT 7/8" Ø X 2", WASHERS AND NUTS.
  - (H) SAFETY PERFORMANCE OF THIS DEVICE HAS BEEN EVALUATED PER TRB 2672(39) 41-51 DEVELOPMENT OF A STANDARDIZED BUTTRESS FOR APPROACH GUARDRAIL TRANSITIONS AND TTI REPORT 9-1002-8, FOR MASH TL-2.

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**GUARDRAIL CONNECTION TO BRIDGE ENDS FOR LOW SPEED ROADWAYS**

06-28-2019 S-GRC-6