



**STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION**

ROADWAY DESIGN DIVISION
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JOHN C. SCHROER
COMMISSIONER

BILL HASLAM
GOVERNOR

INSTRUCTIONAL BULLETIN NO. 17-05

Regarding Revised Standard Drawings

Effective June 23, 2017 letting (April 5, 2017 Turn-in), the following Standard Drawings have either been revised to incorporate the new MASH Items Numbers. Also, Chapter 5 of the Roadway Design Guidelines has been revised to incorporate these changes.

Revised Standard Drawings:

DRAWING NUMBER	CURRENT REVISION DATE	DESCRIPTION
S-CC-1	03-28-17	CRASH CUSHSION
S-GR31-1	03-28-17	W-BEAM GUARDRAIL
S-GRS-1	03-28-17	SPECIAL CASE LONG SPAN GUARDRAIL ONE POST OMITTED
S-GRS-3	03-28-17	SPECIAL CASE GUARDRAIL FOOTING
S-GRT-2	03-28-17	TYPE 38 GUARDRAIL END TERMINAL
S-GRT-3	03-28-17	TYPE 21 GUARDRAIL END TERMINAL
S-GRA-3	03-28-17	TYPE 13 GUARDRAIL ANCHOR
S-GRA-4	03-28-17	IN-LINE GUARDRAIL ANCHOR
S-GRA-5	03-28-17	FLARED GUARDRAIL ANCHOR


The revised standard drawings and revised Chapter 5 of the Roadway Design Guidelines are available online.

Standard Drawings:

<http://www.tn.gov/tdot/section/chief-engineer-design-standard-drawings-library>

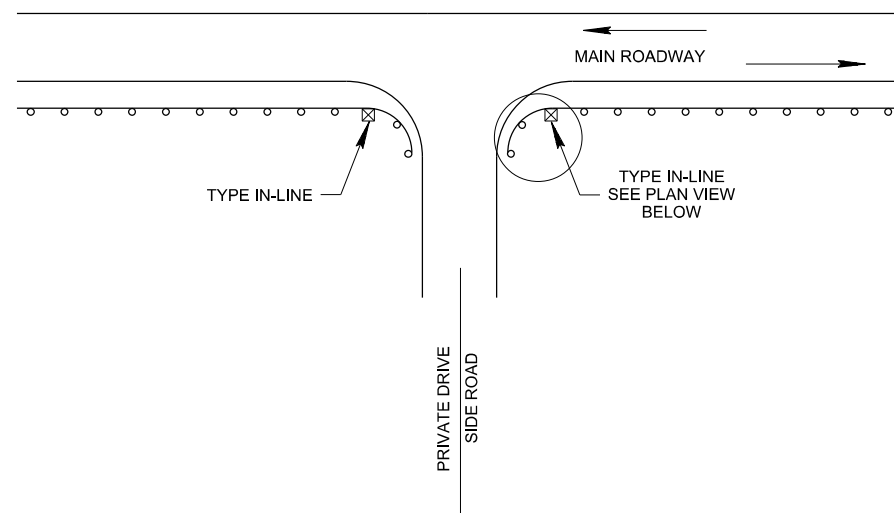
Roadway Design Guidelines:

<http://www.tn.gov/tdot/topic/chief-engineer-design-design-guidelines>

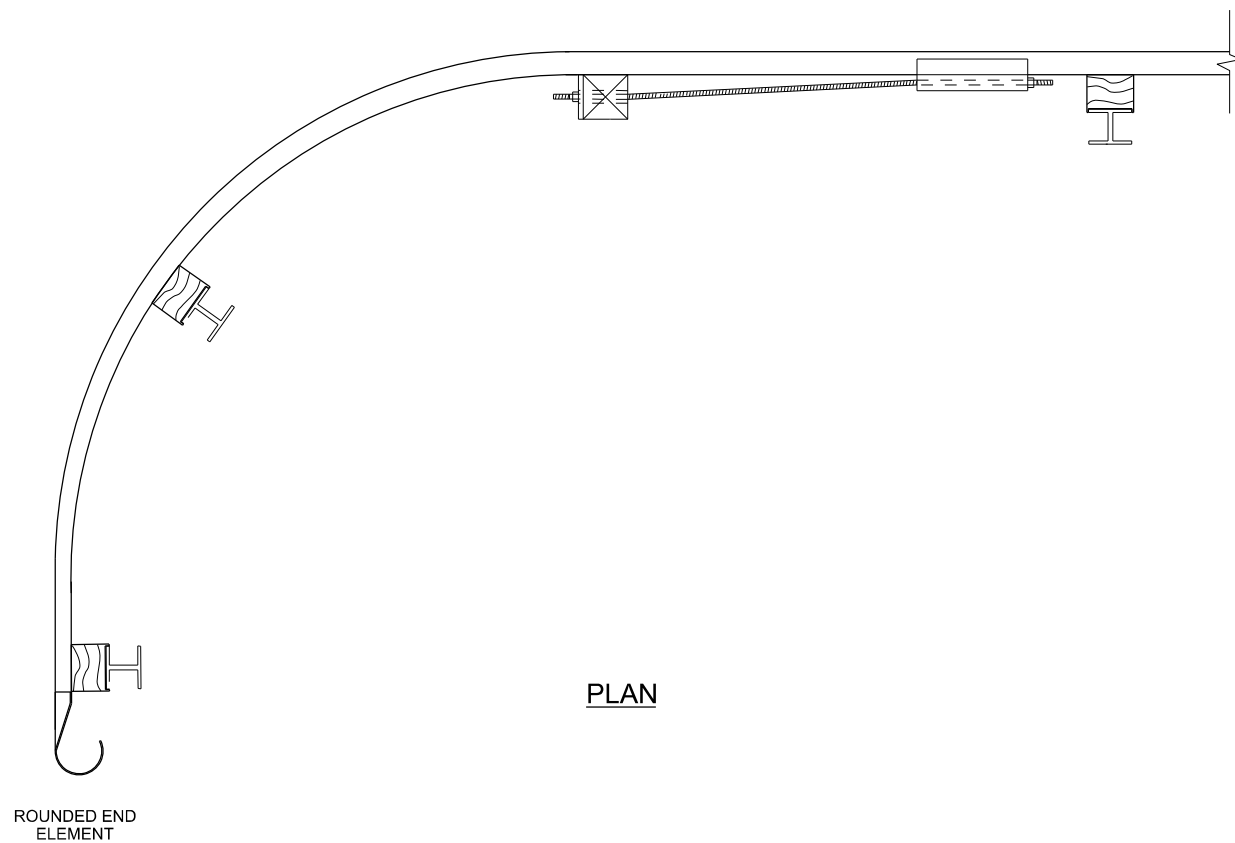

Jennifer Lloyd, PE
Civil Engineering Director
Roadway Design Division

KJL:ARH:RBB
March 28, 2017

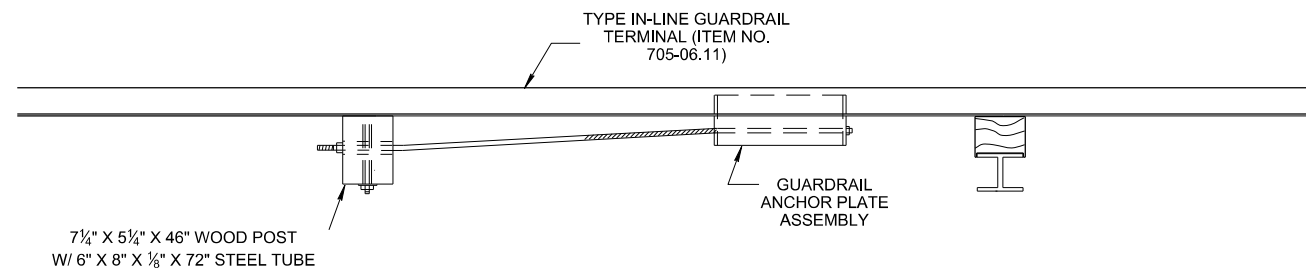
- REV. 5-27-16: REVISED POST SIZE IN PLAN VIEW. ADDED DIMENSIONS. REVISED DETAIL. REVISED NOTES.
- REV. 3-28-17: CHANGED PAY ITEM NUMBER.



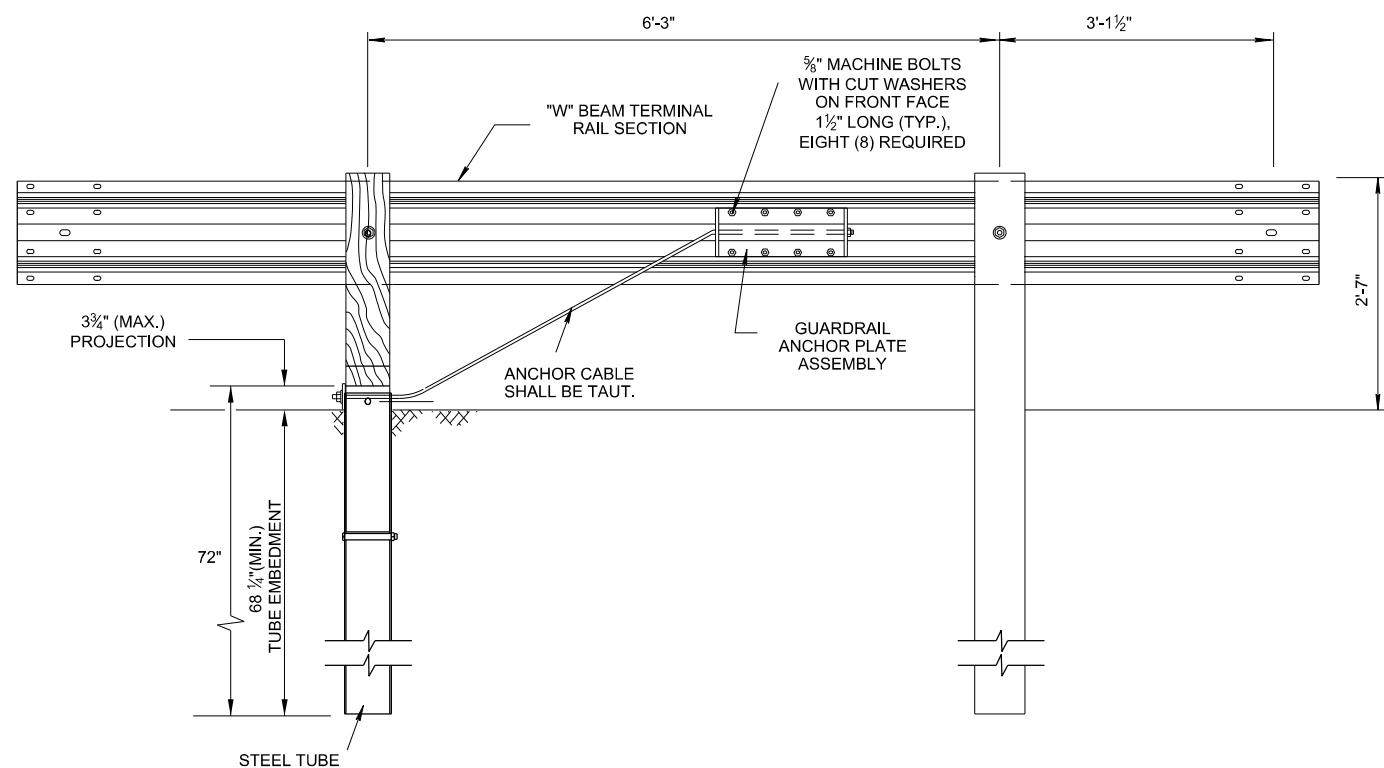
GUARDRAIL TERMINAL ANCHOR (TYPE IN-LINE) APPLICATION



PLAN



PLAN



ELEVATION FROM BEHIND GUARDRAIL
(SEE S-GRA-3 FOR HARDWARE DETAILS)

NOTE TO DESIGNER

DO NOT USE ON NATIONAL HIGHWAY SYSTEM (NHS), USE S-PL-2 ON NHS
DO NOT USE WITHOUT ALSO REFERENCING S-GRA-3.

GENERAL NOTES

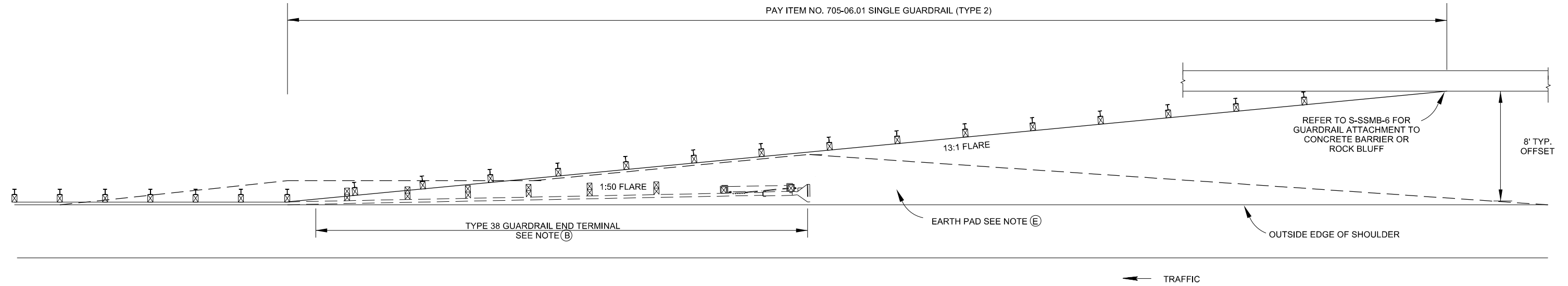
- (A) THIS ANCHORAGE MAY ONLY BE USED ON THE TRAILING END OF A BARRIER WHICH IS NOT EXPOSED TO DIRECT VEHICULAR IMPACT OR IS OUTSIDE THE CLEAR ZONE (ONLY DIVIDED HIGHWAYS OR ROADS WITH ONE WAY TRAFFIC) USE S-PL-1 TO DETERMINE LENGTH OF NEED.
- (B) IN-LINE GUARDRAIL TRMINAL TO BE PAID FOR UNDER ITEM NUMBER:
PAY ITEM NO. 705-06.11 GUARDRAIL TERMINAL (TYPE IN-LINE) MASH TL3 PER EACH

COST TO INCLUDE WOOD POST, STEEL TUBE, ANCHOR CABLE, AND CABLE ASSEMBLY.

□ MINOR REVISION -- FHWA APPROVAL NOT REQUIRED.

**STATE OF TENNESSEE
DEPARTMENT OF
TRANSPORTATION**

**IN-LINE
GUARDRAIL
ANCHOR**



PLAN VIEW OF FLARED GUARDRAIL ANCHORED TO CONCRETE BARRIER OR ROCK BLUFF

GENERAL NOTES

- (A) THIS ANCHOR MAY BE USED AT LOCATIONS WHERE THE ROADWAY SIDE SLOPE IS 6:1 OR LESS.
- (B) FOR NEW PROJECTS, FLARED GUARDRAIL ANCHORED TO CONCRETE BARRIER OR ROCK BLUFF IS AN ALTERNATE TO TYPE 38 GUARDRAIL END TERMINAL. FOR RETROFIT PROJECTS, FLARED GUARDRAIL ANCHORED TO CONCRETE BARRIER OR ROCK BLUFF REPLACES AN EXISTING TYPE 38 GUARDRAIL END TERMINAL. REFER TO S-GRT-2 FOR TYPE 38 GUARDRAIL END TERMINAL DETAILS.
- (C) PAYMENT FOR GUARDRAIL WILL BE UNDER PAY ITEM NUMBER:
705-06.01 W BEAM GUARDRAIL (TYPE 2) MASH TL3 PER LF
COST TO INCLUDE ATTACHMENT TO CONCRETE BARRIER OR ROCK BLUFF.
- (D) REFER TO S-GR31-1 FOR GUARDRAIL DETAILS.
- (E) REFER TO S-GRT-2P OR S-GRT-2R FOR EARTH PAD DETAILS.

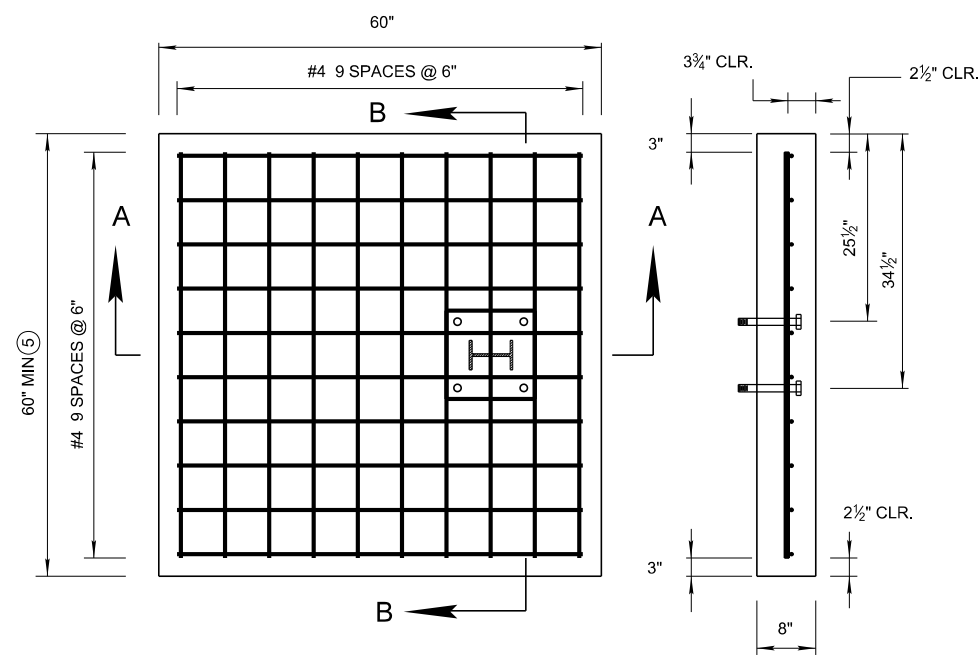
MINOR REVISION -- FHWA APPROVAL NOT REQUIRED.

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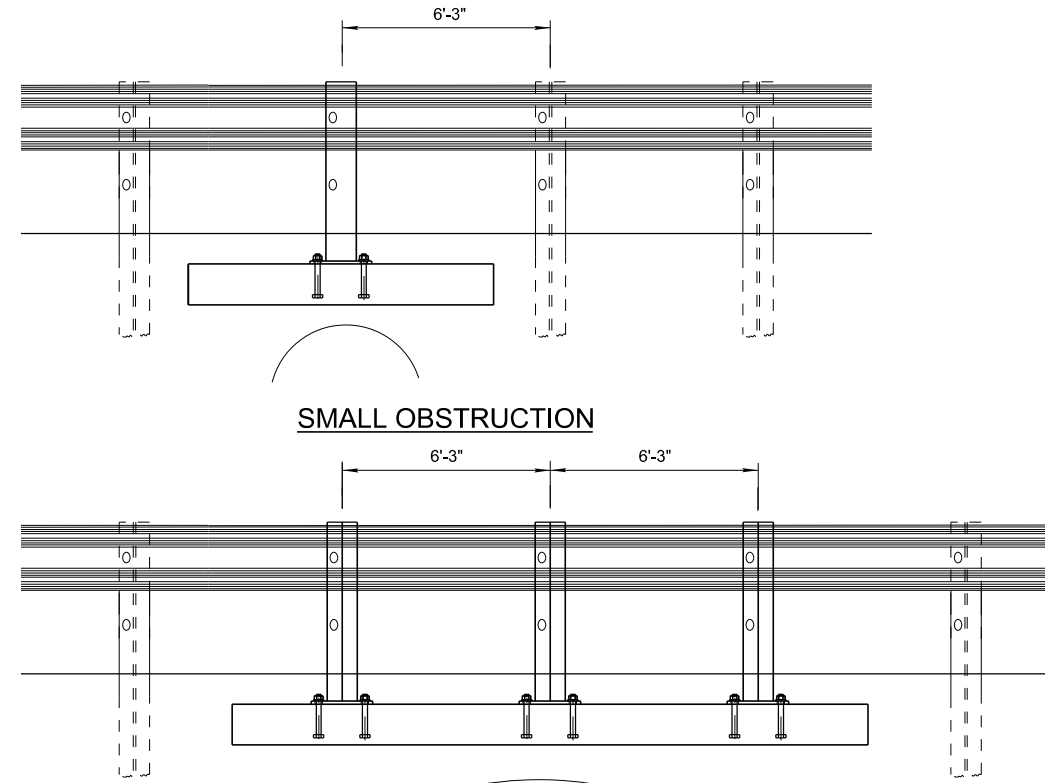
FLARED
GUARDRAIL
ANCHOR

5-26-16

S-GRA-5



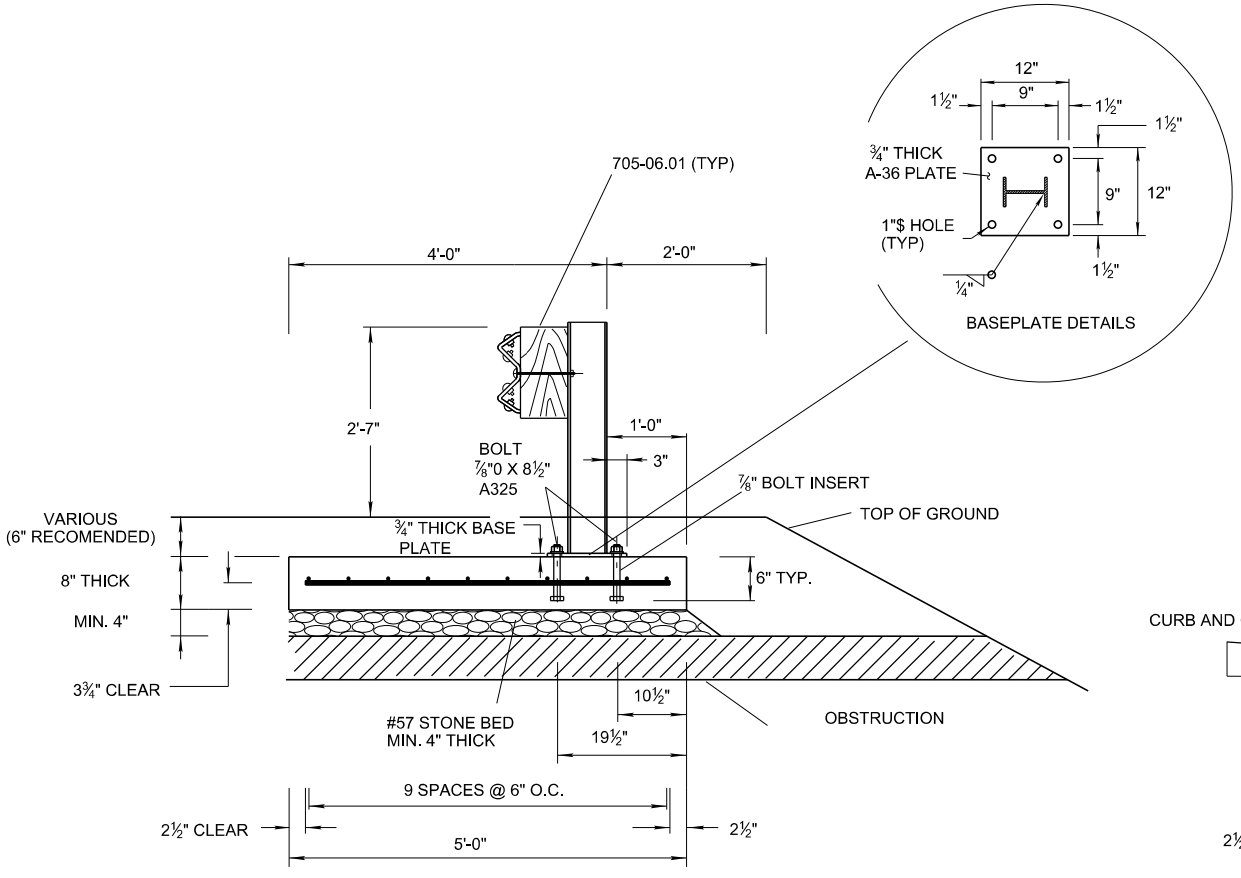
PLAN VIEW
60"X60"X8" SINGLE POST SLAB DETAIL



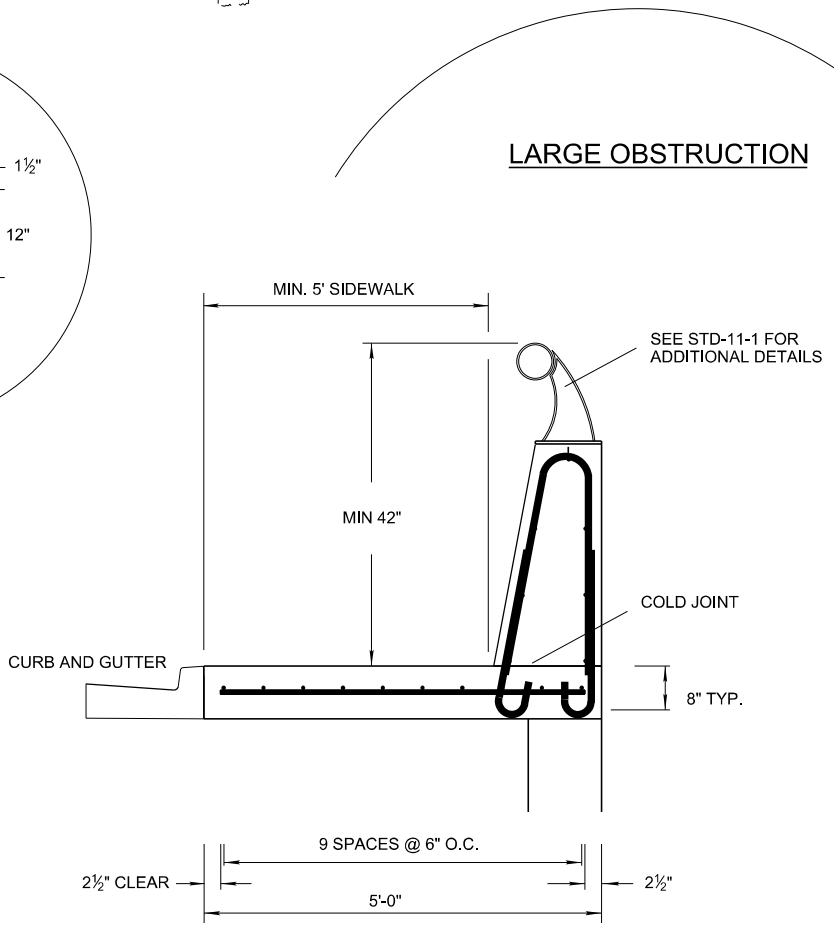
SMALL OBSTRUCTION

LARGE OBSTRUCTION

ESTIMATED QUANTITIES FOR CONCRETE PAD (PER LF)		
	604-01.01 CLASS A CONCRETE CY/LF	602-01 STRUCTURAL STEEL LB/LF
5' WIDE	0.123	12.89



SECTION A-A



ALTERNATIVE PARAPET WALL DETAIL WITH MOMENT SLAB (LENGTH AS REQUIRED)

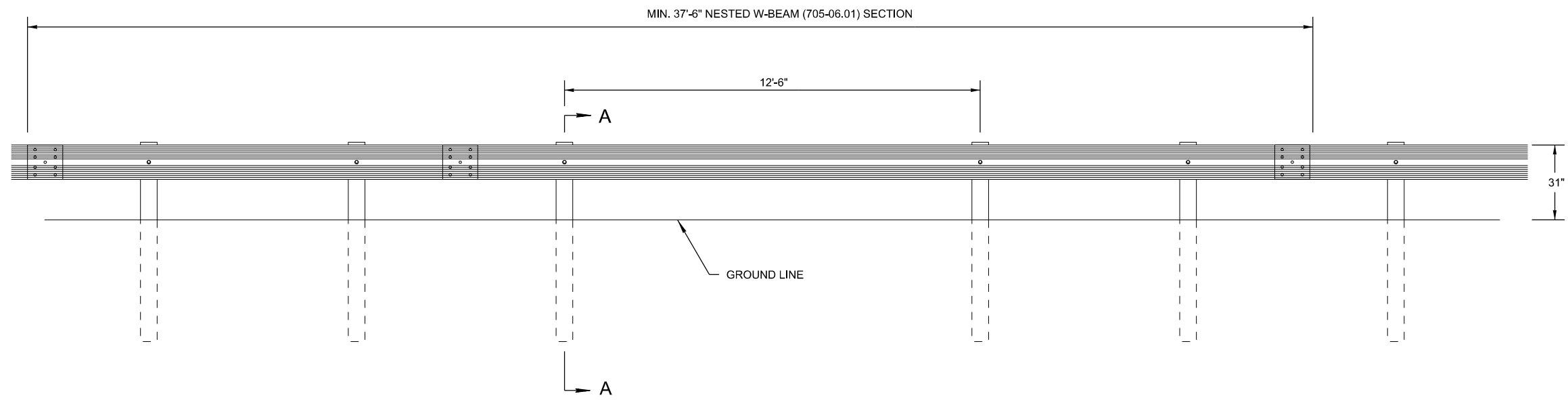
- GENERAL NOTES**
- THIS DRAWING TO BE USED WHERE AN UNDERGROUND UTILITY CONFLICT IS IDENTIFIED DURING DESIGN OR CONSTRUCTION WHERE STANDARD POST COULD NOT BE INSTALLED.
 - THE INSTALLATION HAS BEEN STUDIED UNDER ROADSIDE SAFETY POOLED FUND AND DOCUMENTED UNDER TTI REPORT 405160-12 "STEEL POSTS OVER UNDERGROUND STRUCTURES".
 - CONCRETE PAD TO BE PAID FOR UNDER ITEMS
602-01 STRUCTURAL STEEL LB
604-01.01. CLASS A CONCRETE CY
 - CONCRETE PAD IS A SUBSTITUTE FOR REGULAR LENGTH GUARDRAIL POSTS. NO SPECIAL PAYMENT SHALL BE MADE FOR GUARDRAIL. PAYMENT FOR GUARDRAIL SHALL BE INCLUDED IN THE PRICE FOR ITEM NUMBER 705-06.01 W BEAN GUARDRAIL (TYPE 2) MASH TL 3 PER LF.

MINOR REVISION -- FHWA APPROVAL NOT REQUIRED.

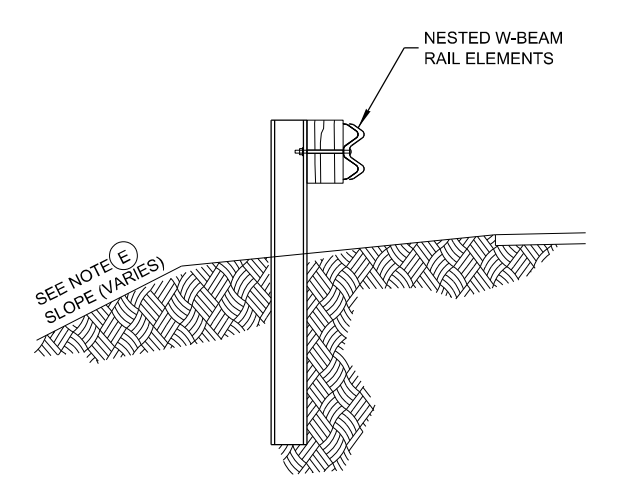
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SPECIAL CASE
GUARDRAIL
FOOTING

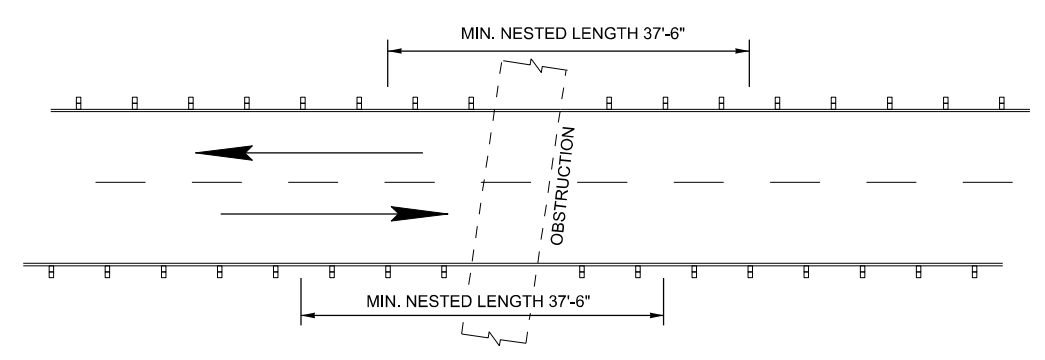
- REV. 1-29-16: CORRECTED PAY ITEM NUMBER.
- REV. 3-28-17: CLARIFIED "RD01-SERIES" TO "RD01-TS-SERIES" IN GENERAL NOTE (E) ADDED NOTE (F) CHANGED ITEM NUMBER IN ELEVATION VIEW.



ELEVATION



SECTION "A-A"



EXAMPLE TWO-WAY TRAFFIC LAYOUT

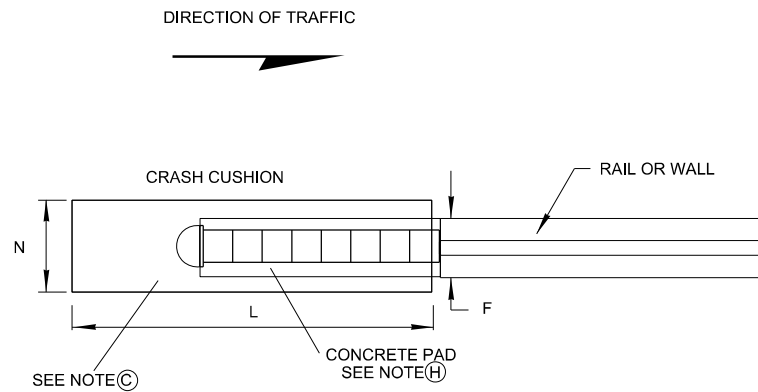
GENERAL NOTES

- (A) DRAWING TO BE USED FOR GUARDRAIL PLACEMENT WHEN ENCOUNTERING AN OBSTRUCTION WHICH WILL PREVENT GUARDRAIL POST TO BE INSTALLED PROPERLY.
- (B) A POST MAY BE OMITTED ON A RUN OF GUARDRAIL ONLY. THIS APPLICATION IS NOT TO BE USED AS PART OF AN END TERMINAL. IF OBSTRUCTION IS ENCOUNTERED AT TERMINAL LOCATION, EXTEND GUARDRAIL RUN TO A POINT WHERE TERMINAL MAY BE INSTALLED PROPERLY.
- (C) ONLY ONE POST MAY BE OMITTED AT AN OBSTRUCTION.
- (D) WHEN MORE THAN ONE OBSTRUCTION IS ENCOUNTERED ON A RUN OF GUARDRAIL, THREE CONSECUTIVE POSTS SHALL BE INSTALLED PRIOR TO OMITTING ANOTHER POST.
- (E) SEE STANDARD DRAWING RD01-TS-SERIES FOR SLOPE CRITERIA.
- (F) IF ANY OF THE CONDITIONS NOTED IN GENERAL NOTES A, C, OR D CANNOT BE MET, USE GUARDRAIL WITH FOOTING OPTION SEE S-GRS-3.
- (G) THE NESTED SECTION WILL BE BUILT AS SHOWN BUT PAYMENT WILL BE MEASURED FOR A LENGTH OF 3 POSTS ON EITHER SIDE OF THE OMITTED POST.
- (H) THIS RAIL SYSTEM HAS BEEN TESTED AND PASSED BY THE CRITERIA SET FORTH BY AASHTO MASH TEST LEVEL 3, AS DOCUMENTED IN ROADSIDE SAFETY RESEARCH PROGRAM POOLED FUND STUDY NO. TPF-5(114) DATED NOV. 11, 2011.

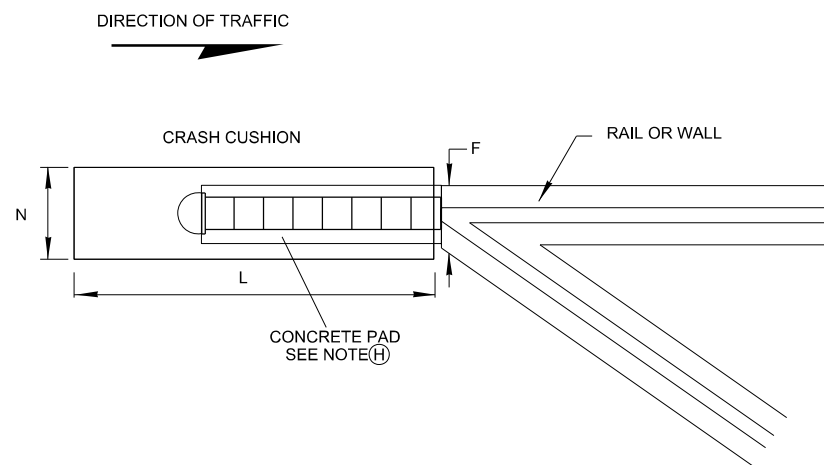
□ MINOR REVISION -- FHWA APPROVAL NOT REQUIRED.

STATE OF TENNESSEE
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SPECIAL CASE
LONG SPAN
GUARDRAIL
ONE POST OMITTED



CRASH CUSHION AT THE END OF GUARDRAIL OR BARRIER WALL



CRASH CUSHION AT THE END OF DIVERGING GUARDRAILS OR BARRIER WALLS

LEGEND

- N: APPROXIMATE WIDTH OF SPACE NECESSARY FOR THE PLACEMENT OF A CRASH CUSHION.
- L: APPROXIMATE LENGTH.
- F: WIDTH OF A FIXED OBJECT THAT WILL BE SHIELDED WITH A CRASH CUSHION.

MINIMUM CRASH CUSHION RESERVE AREA (FT)

DESIGN SPEED MPH (MAIN LINE)	MINIMUM DIMENSIONS ①				DESIRABLE DIMENSIONS	
	RESTRICTED DIMENSIONS ②		UNRESTRICTED DIMENSIONS			
	N	L	N	L	N	L
30	6	8	8	11	12	17
50	6	17	8	25	12	33
70	6	28	8	45	12	55

- ① MINIMUM DIMENSIONS SHOULD ONLY BE USED AT LOCATIONS WHERE IT IS INFEASIBLE TO PROVIDE THE DESIRABLE AREA. IN CASES WHEN MORE THAN THE MINIMUM AREA CAN BE PROVIDED, AS MUCH SPACE AS POSSIBLE SHOULD BE PROVIDED.
- ② RESTRICTED MINIMUM DIMENSIONS SHOULD ONLY BE USED IF THE MINIMUM UNRESTRICTED DIMENSIONS ARE UNATTAINABLE.

LEGEND: CRASH CUSHION

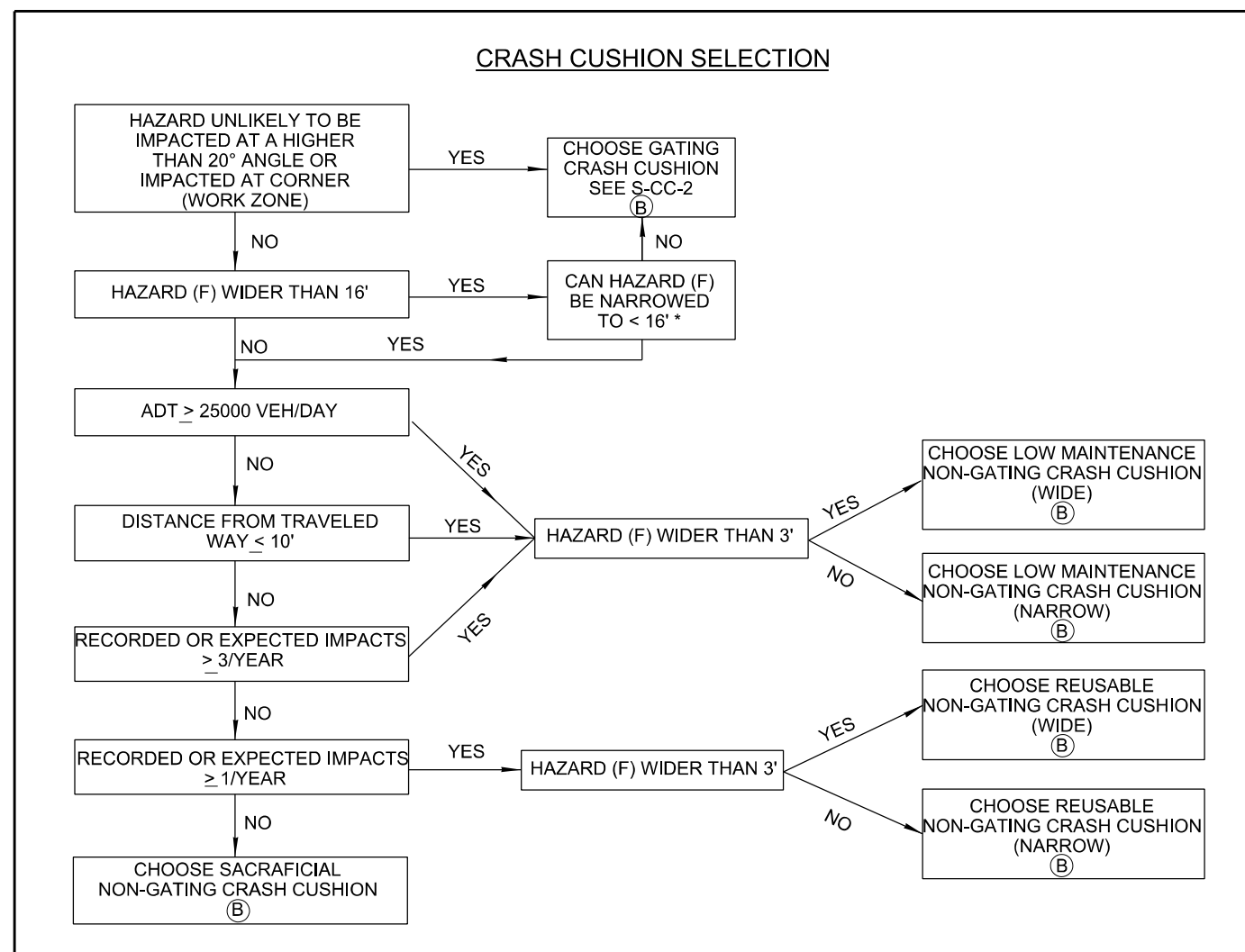
ATTENUATOR CLASSES DESCRIPTION

SACRIFICIAL: DEVICES DESIGNED FOR A SINGLE IMPACT SHOULD ONLY BE USED IF FREQUENT ATTENUATOR IMPACTS ARE NOT EXPECTED AT THE LOCATION.

REUSABLE: DEVICES FREQUENT DESIGNED THAT CAN BE REPAIRED BY SALVAGING MOST MAJOR COMPONENTS.

LOW-MAINTENANCE: DEVICES DESIGNED TO BE EASILY RESET AFTER IMPACT WITH MINIMAL REPAIR, USE IN AREAS WITH FREQUENT IMPACTS.

CRASH CUSHION SELECTION

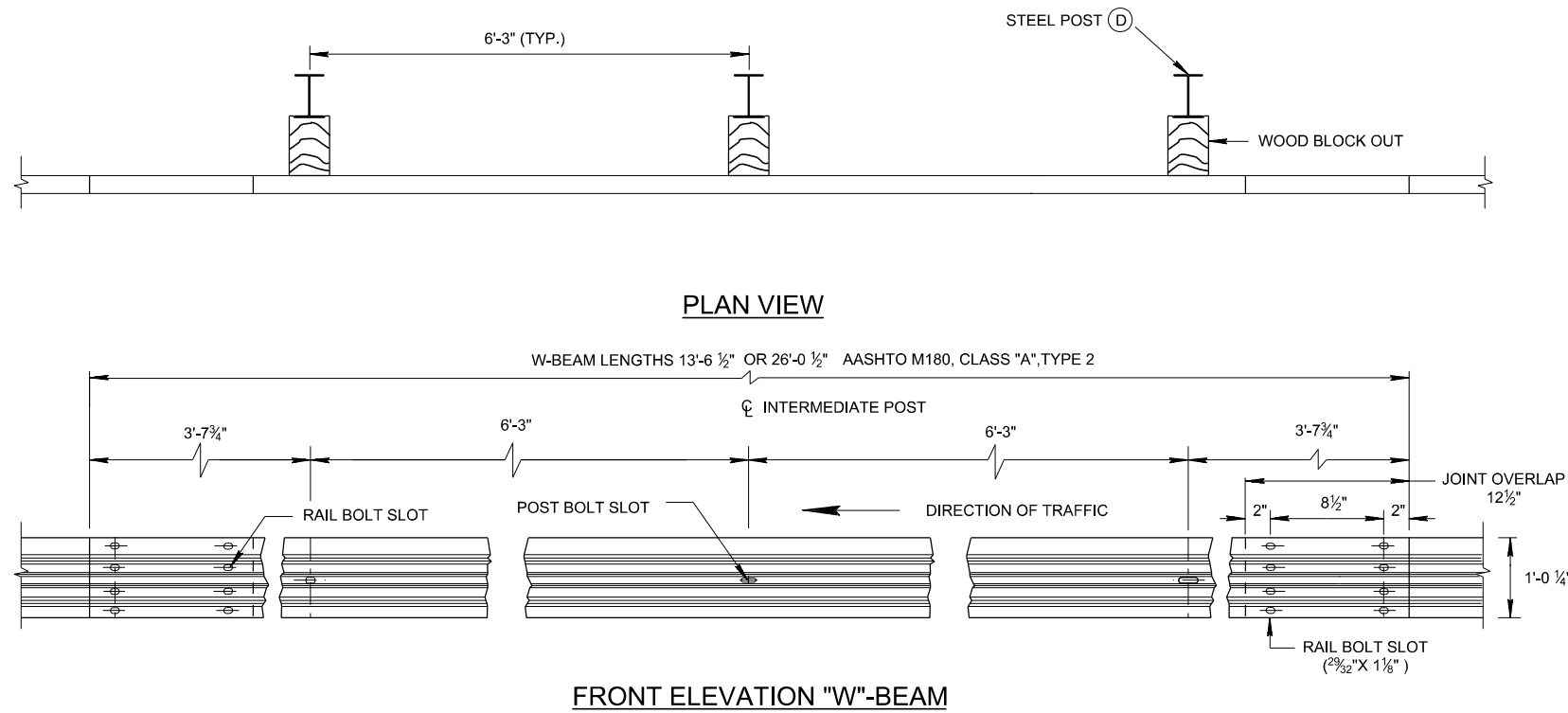


* REDUCTION TO 16' CAN BE DONE BY MODIFYING BARRIER OR TRANSITION SECTION

GENERAL NOTES

- (A) CRASH CUSHIONS SHOULD ONLY BE USED IF LIMITED SPACE (SUCH AS A GORE AREA) PRECLUDES THE USE OF GUARDRAIL END TERMINALS OR AT OTHER LOCATIONS WHERE GUARDRAIL END TERMINAL WILL NOT FUNCTION.
- (B) CRASH CUSHIONS SHALL BE INSTALLED PER MANUFACTURERS SHOP DRAWINGS. SYSTEMS APPEARING ON THE QUALIFIED PRODUCT LIST 34 SECTION C ONLY MAY BE USED FOR THE SPECIFIED CATEGORY DETERMINED.
- (C) THE NOSE OR FIRST BARREL OF THE CRASH CUSHION SHALL BE MARKED WITH OBJECT MARKER STRIPING TYPE 3 INCLUDED IN THE COST OF THE SYSTEM.
- (D) SYSTEMS SHALL BE INSTALLED ON HARD, SMOOTH SURFACES WITH SLOPES LESS THAN 5% AND VARIATION OF CROSS SLOPE LESS THAN 2% CHANGE FOR THE LENGTH OF RESERVE AREA.
- (E) ONLY TL-3 CRASH CUSHION SHALL BE USED ON TDOT PROJECTS.
- (F) CURBS SHALL NOT BE INSTALLED IN AREAS NEAR CRASH CUSHIONS, EXISTING CURBS TO BE REMOVED UNLESS OTHERWISE SPECIFIED.
- (G) IF A CRASH CUSHION WOULD COMPROMISE SIGHT DISTANCE A SYSTEM WITH REDUCED HEIGHT (LESS THAN 36" HEIGHT) MAY BE SPECIFIED.
- (H) ALL PERMANENT INSTALLATIONS REQUIRE CONCRETE FOUNDATION AS SHOWN ON MANUFACTURERS SHOP DRAWINGS.
- (I) NON-GATING CRASH CUSHIONS (ATTENUATORS) SHALL BE PAID FOR:
 - PERMANENT
 - 705-20.20 LOW MAINT CRASH CUSHION NARROW (MASH TL-3) EACH
 - 705-20.21 LOW MAINT CRASH CUSHION WIDE (MASH TL-3) EACH
 - 705-20.22 REUSABLE CRASH CUSHION NARROW (MASH TL-3) EACH
 - 705-20.23 REUSABLE CRASH CUSHION WIDE (MASH TL-3) EACH
 - THE PAYMENT OF ATTENUATOR INCLUDES CONCRETE FOUNDATION WORK ZONES
 - 705-20.25 TEMPORARY CRASH CUSHION (MASH TL-3) EACH

- REV. 12-1-14: REVISED NOTE (L)
- REV. 4-4-16: REVISED NOTES.
- REV. 10-20-16: ADDED NOTE TO ADDRESS ADDITIONAL HOLES.
- REV. 3-28-17: REMOVED NOTE (T) CHANGED PAY ITEM NUMBER IMPROVED POST SIDE VIEWS AND FRONT ELEVATION VIEWS.



GENERAL NOTES

METAL BEAM

- (A) METAL BEAMS SHALL CONFORM TO AASHTO M 180: TYPE 2, CLASS "A" UNLESS OTHERWISE NOTED ON THE PLANS.
- (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.

POSTS

- (D) 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.
- (E) 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.
- (F) WOOD POSTS SHALL CONFORM WITH TDOT CONSTRUCTION STANDARD SPECIFICATIONS.
- (G) WELDED STEEL POSTS SHALL CONFORM TO ASTM A769 AND BE GALVANIZED IN ACCORDANCE WITH ASTM A123, UNLESS OTHERWISE SPECIFIED ON THE PLANS.
- (H) ON STEEP SLOPES, WHEN GUARDRAIL IS PLACED AT SLOPE BREAK, MINIMUM POST LENGTH SHALL BE BASED ON TABLE ON STANDARD DRAWING S-PL-6. ADDITIONAL EXPENSE TO BE INCLUDED IN THE COST OF THE RUN OF GUARDRAIL.

BLOCK OUTS

- (I) 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.
- (J) ONLY WOODEN BLOCK OUTS MAY BE USED WITH WOODEN POSTS, PLASTIC OR WOODEN BLOCK OUTS MAY BE USED WITH STEEL POSTS.
- (K) ALL BLOCK OUTS SHALL MEET MASH GUIDELINES.
- (L) MIXING THE BLOCK OUT MATERIAL ON A GIVEN PROJECT SHOULD BE AVOIDED. IF MIXING OF BLOCK OUT MATERIAL IS NECESSARY, BLOCK OUTS SHALL NOT BE MIXED ON A SINGLE RUN OF GUARDRAIL.

FUTURE ADJUSTMENTS

- (M) BLOCK OUTS SHALL HAVE ONE ADDITIONAL 3/4" HOLE, FOUR INCHES BELOW THE INITIAL HOLE FOR FUTURE ADJUSTMENT.
- (N) INITIAL INSTALLATION REQUIRES ONE BOLT CONNECTION, EACH ADJUSTMENT THEREAFTER REQUIRES TWO BOLT CONNECTIONS.

END TREATMENTS

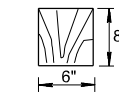
- (O) ALL RUNS OF GUARDRAIL WILL BEGIN AND END WITH AN ANCHOR SYSTEM (SEE S-GRA-SERIES).
- (P) GUARDRAIL ENDS THAT ARE INSIDE THE CLEAR ZONE AND EXPOSED TO ONCOMING TRAFFIC SHALL HAVE A CRASH WORTHY END TERMINAL AS NOTED:
 - ① ANY ROAD WITH SUITABLE BACK SLOPES SHALL USE END TERMINALS BURIED IN BACK SLOPE (SEE S-GRT-1).
 - ② ALL HIGHWAY SYSTEM ROADS WITHOUT SUITABLE BACK SLOPES SHALL USE 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

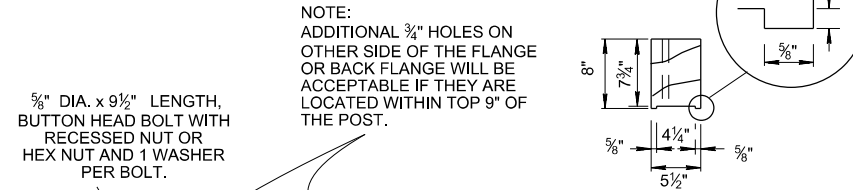
- (Q) 4 FEET BEHIND GUARDRAIL SHALL BE CLEAR OF OBSTRUCTIONS FOR DEFLECTION.
- (R) REFER TO SAFETY PLAN STANDARDS FOR HOW TO DETERMINE THE BEGINNING AND END.

PAYMENT

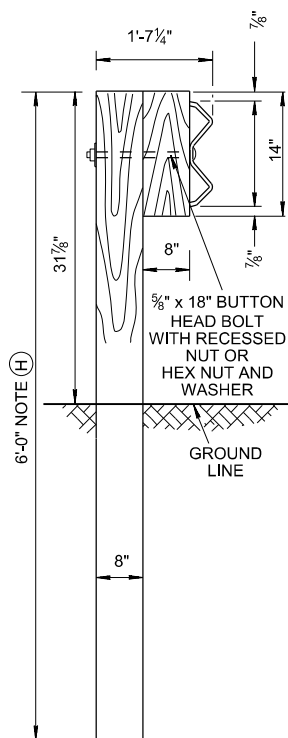
- (S) PAYMENT FOR GUARDRAIL WILL BE UNDER ITEM:
 - 705-06.01 W BEAM GUARDRAIL (TYPE 2) (MASH TL-3) PER LF
- (T) PAYMENT FOR SPECIAL CONNECTIONS AND GUARDRAIL SECTIONS REQUIRED FOR END TREATMENTS WILL BE AS NOTED ON THOSE DRAWINGS.
- (U) FOR W-GR BEAM INSTALLATION, LOCATION, AND DEFLECTION NOTES SEE S-PL-6.



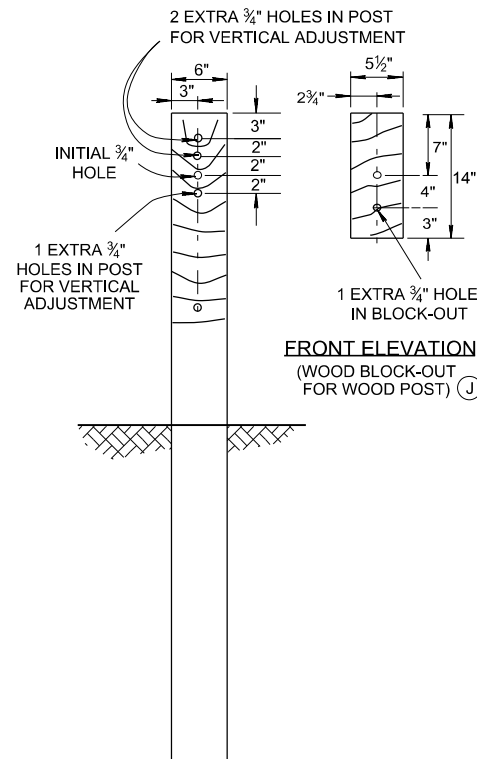
TOP VIEW



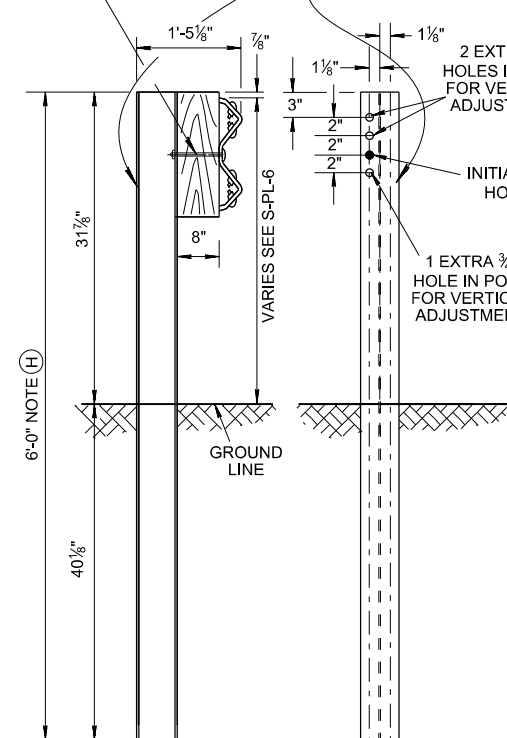
TOP VIEW



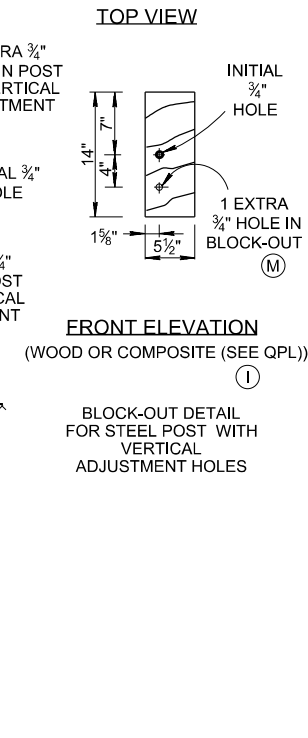
SIDE VIEW
(SINGLE GUARDRAIL WOOD POST) (D)



FRONT ELEVATION
(WOOD POST)



SIDE VIEW
(SINGLE GUARDRAIL STEEL POST) (D)



FRONT ELEVATION
(WOOD OR COMPOSITE (SEE QPL)) (I)

NOTE: SIDE VIEW FOR STEEL POST DIMENSIONS BASED ON W6 X 8.5. OTHER DETAILS APPLY TO W6 X 9.0 AND W6 X 15.0 POSTS AND BLOCK-OUTS. SEE S-GR31-1A FOR FASTENING HARDWARE DETAILS.

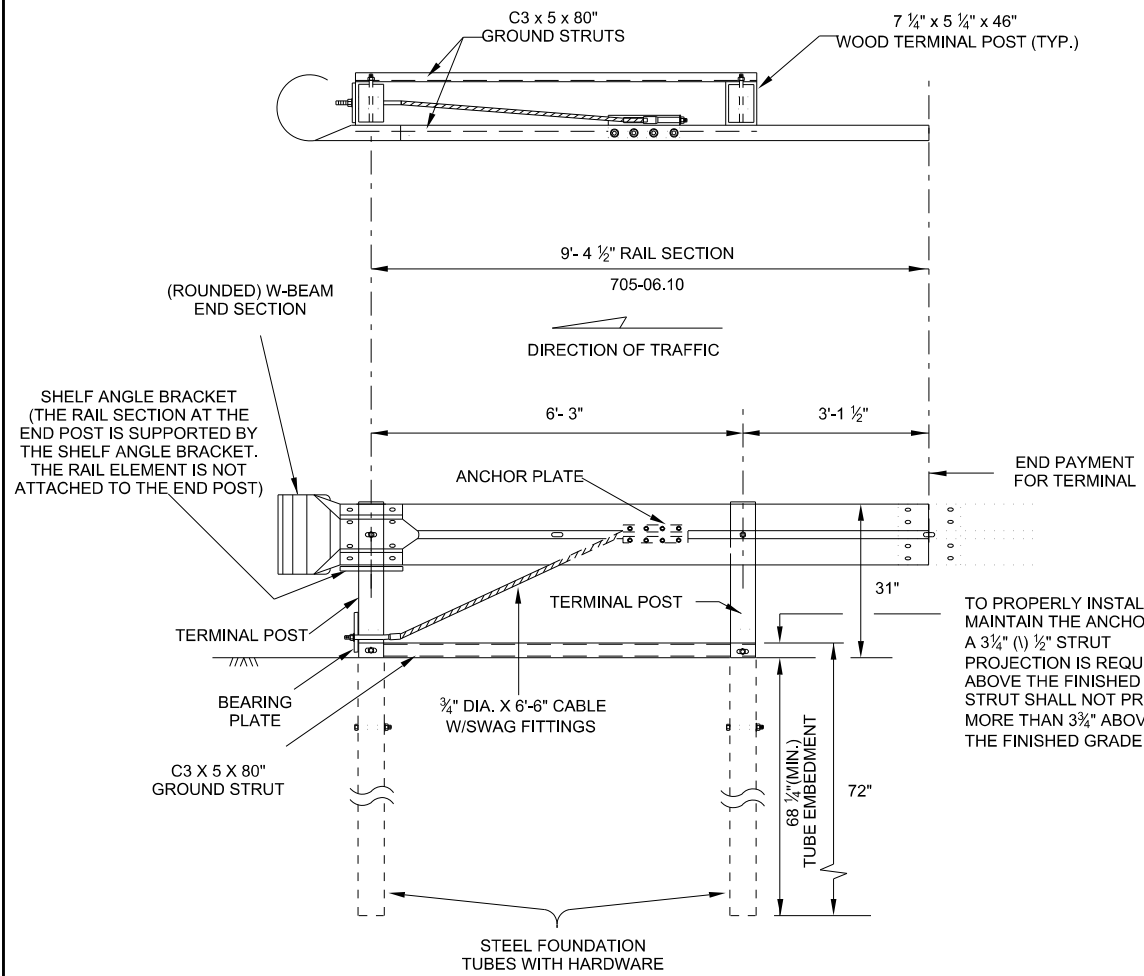
SHEET NOT TO SCALE

MINOR REVISION -- FHWA APPROVAL NOT REQUIRED.

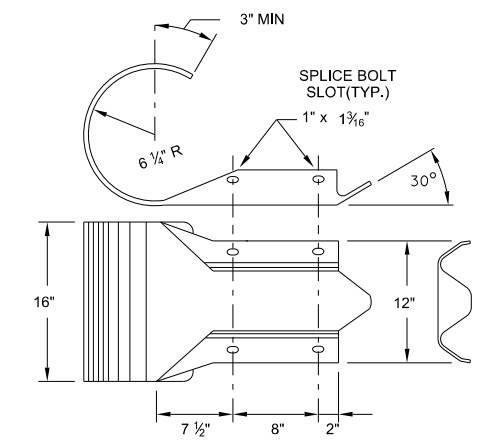
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W-BEAM
GUARDRAIL

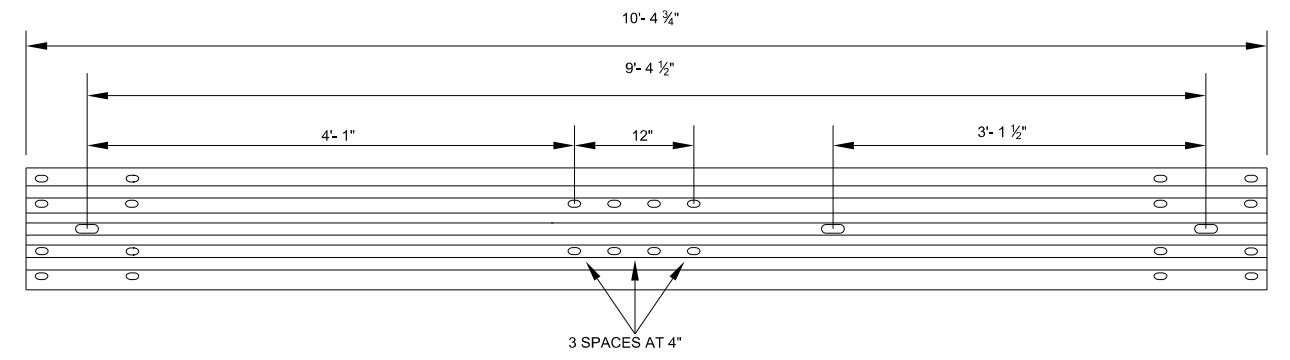
REV. 3-28-17: CHANGED PAY ITEM NUMBER.
 REV. 5-1-15: REVISED NO.1 & 2 BREAK WAY POSTS WITH 5'-0" TUBE SLEEVE.
 REV. 5-27-16: REMOVED TYPE 21 AND IN-LINE FROM TITLE, UPDATED POST DETAIL, UPDATED STRUT DETAIL, ADDED RAIL DETAIL, AND UPDATED NOTES.



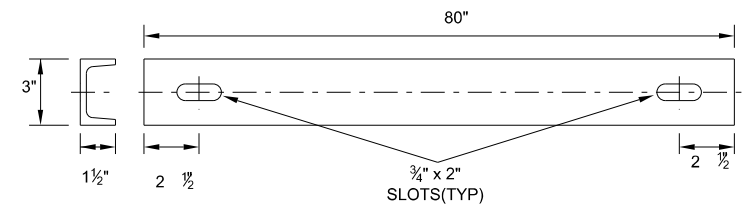
DOWNSTREAM ANCHOR TERMINAL
 ONLY FOR DOWNSTREAM USE, WHEN LOCATED OUTSIDE THE HORIZONTAL CLEARANCE AREA OF OPPOSING TRAFFIC



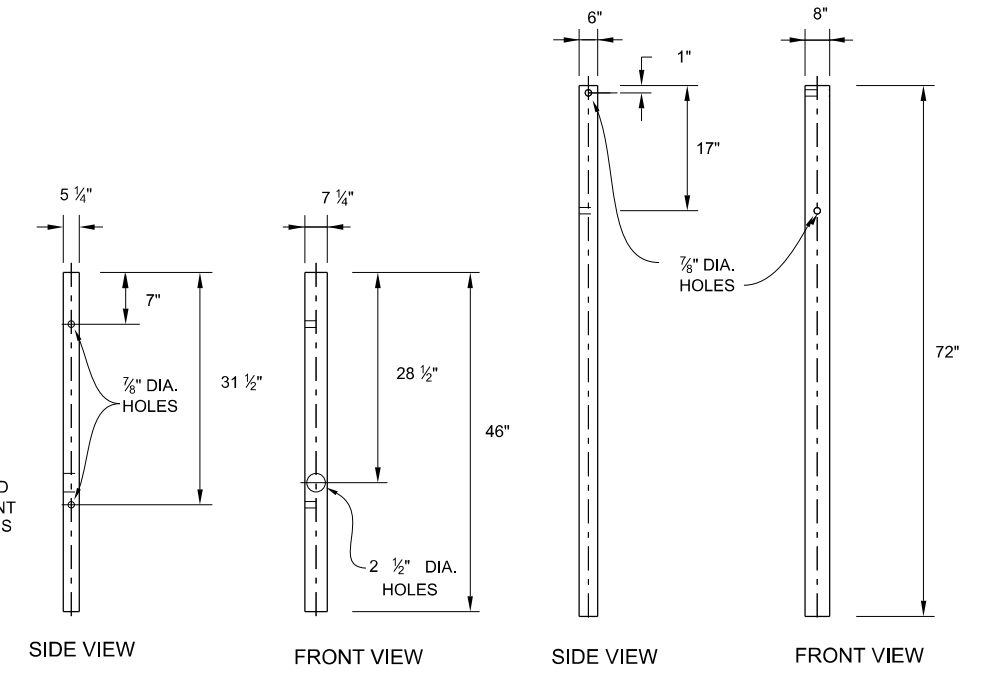
W-BEAM END SECTION (ROUNDED) (12 GA.)



TERMINAL RAIL ELEMENT

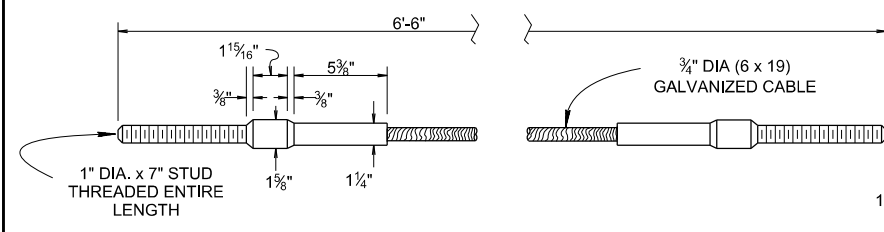


GROUND STRUT
 C3 x 5 x 80", GRADE A36

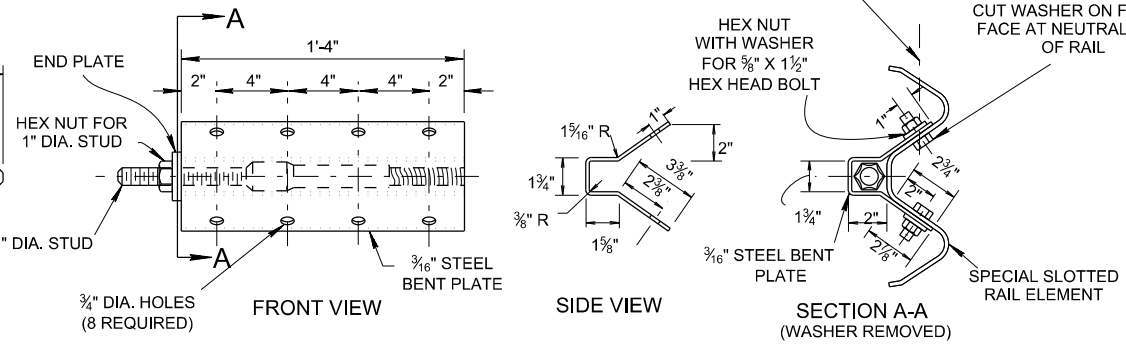


TERMINAL POST
 7 1/4" x 5 1/4" x 46" WOOD POST

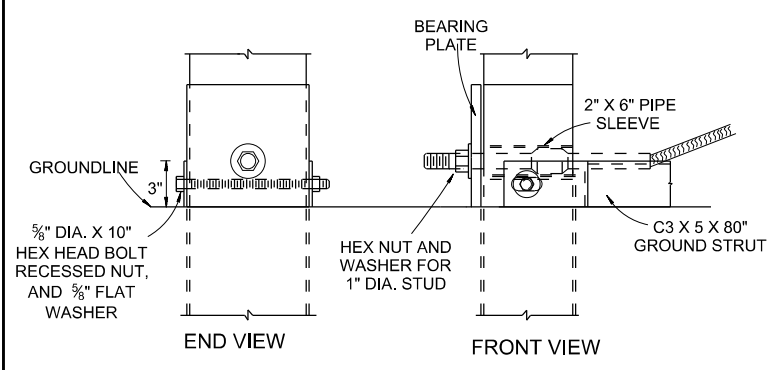
STEEL FOUNDATION TUBE
 6" x 8" x 1/8" x 72" STEEL TUBE



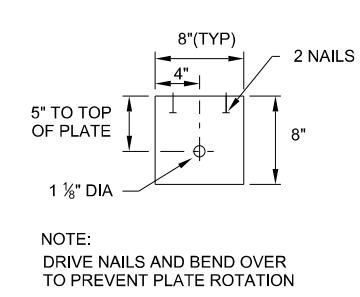
STANDARD SWAGE FITTING AND STUD
 NOTE: CABLE TO BE SWAGE-CONNECTED



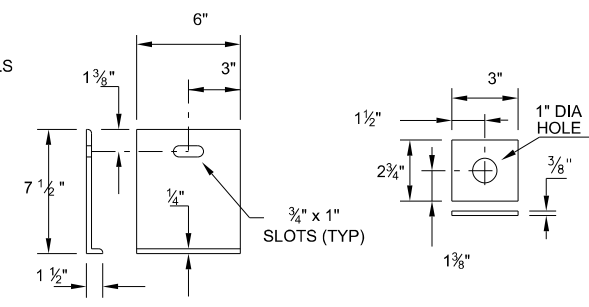
ANCHOR PLATE ASSEMBLY DETAILS
 (ANCHOR PLATE, (8) 3/8" X 1 1/2" HEX HEAD BOLTS, NUTS, AND WASHERS)



BEARING PLATE ASSEMBLY DETAIL



BEARING PLATE
 8" x 8" x 3/8" PL



SHELF ANGLE BRACKET

END PLATE

- GENERAL NOTES**
- (A) TYPE 13 GUARDRAIL TERMINAL SHALL ONLY BE INSTALLED AT TRAILING ENDS(DOWNSTREAM) WHEN LOCATED OUTSIDE THE HORIZONTAL CLEARANCE AREA OF OPPOSING TRAFFIC. SEE S-CZ-1.
 - (B) ALL HOLES IN WOOD POSTS ARE TO BE DRILLED BEFORE PRESERVATIVE TREATMENT IS APPLIED.
 - (C) ALL CUTTING, DRILLING, AND WELDING OF STEEL COMPONENTS SHALL BE DONE BEFORE GALVANIZING.
 - (D) THE FINISHED CABLE ASSEMBLY WILL NOT BE ACCEPTABLE UNLESS IT IS IN TENSION WITH NO SAG.
 - (E) OTHER ANCHOR CABLE ASSEMBLIES PROVIDING A MINIMUM BREAKING STRENGTH OF 40,000 POUNDS PER SQUARE INCH WILL BE ACCEPTABLE.
 - (F) TO BE PAID UNDER ITEM NO. 705-06.10 GUARDRAIL TERMINAL TRAILING END (TYPE 13) MASH TL-3 PER EACH. (SEE S-PL-2)
 - (G) ALL HARDWARE SHALL CONFORM TO ASTM A307 UNLESS OTHERWISE SHOWN.
 - (H) DESIGN BASED ON AASHTO MASH TL-3, TTI REPORT 9-1002-6.

MINOR REVISION -- FHWA APPROVAL NOT REQUIRED.

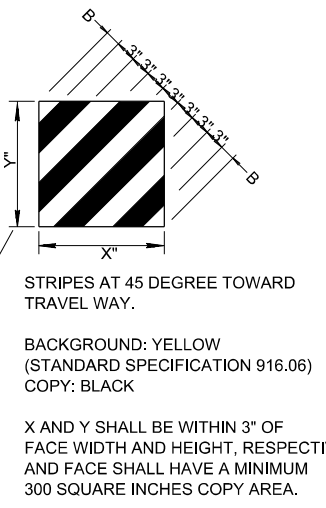
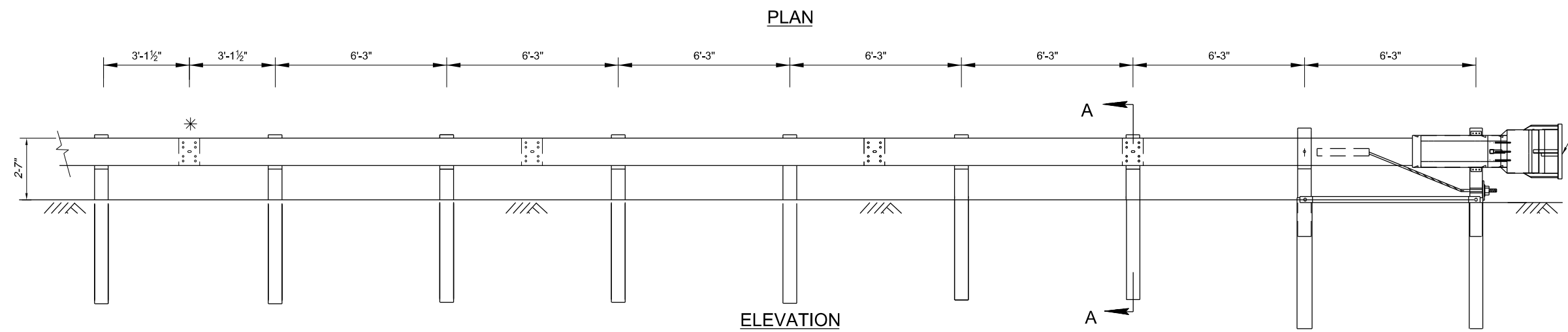
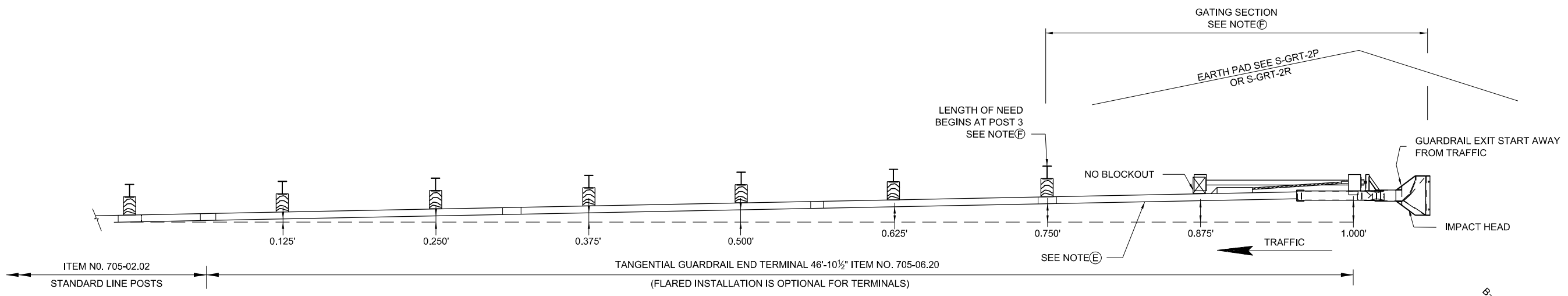
STATE OF TENNESSEE
 DEPARTMENT OF
 TRANSPORTATION

**TYPE 13
 GUARDRAIL ANCHOR**

REV. 11-3-14: MODIFIED PAY LENGTH FOR TYPE 38 END TERMINAL.

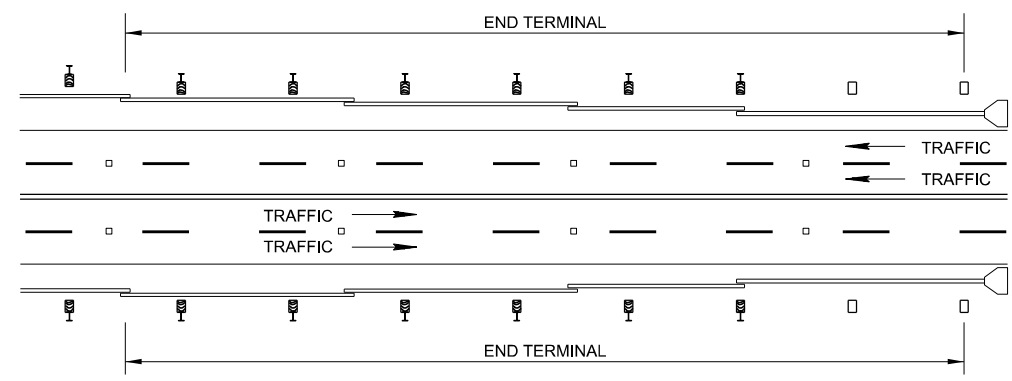
REV. 4-4-16: GENERAL REVISION.

REV. 3-28-17: UPDATED NOTES TO INSTALLER. ADDED W-BEAM OVERLAPPING DETAIL REORGANIZED SHEET. CHANGED PAY ITEM NUMBER. REPLACED "SKT350" WITH "SKT-SP-MGS" IN NOTE TO INSTALLER.

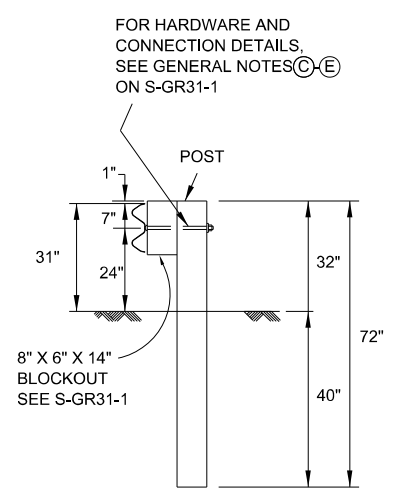


THE THIRD GUARDRAIL SECTION MAY BE EITHER 25'-0" OR 12'-6" LONG

* FOR MAINTENANCE AND REPAIR PROJECTS: IF ONLY THE TERMINAL IS TO BE REPLACED, USE S-GRS-4 TO TRANSITION BACK TO 27" HEIGHT.



W-BEAM OVERLAPPING DETAIL



SECTION A-A

GENERAL NOTES

- (A) ONLY MASH COMPLIANT TL-3 END TERMINALS ON THE TDOT QUALIFIED PRODUCTS LIST MAY BE INSTALLED. MANUFACTURER'S SHOP DRAWINGS SHALL BE REQUIRED BEFORE ANY TANGENTIAL END TERMINAL INSTALLATIONS CAN BEGIN. THE CONTRACTOR SHALL HAVE ONE COMPLETE SET OF SHOP DRAWINGS ON SITE DURING INSTALLATION OR REPAIR OF ANY TANGENTIAL GUARDRAIL TERMINAL ANCHOR. THE CONTRACTOR SHALL ALSO PROVIDE THE CONSTRUCTION OR MAINTENANCE SUPERVISOR WITH ONE COMPLETE SET OF SHOP DRAWINGS INCLUDING TDOT QUALIFIED PRODUCTS LIST EVALUATION NUMBER.
- (B) FOR THE TYPE 38 GUARDRAIL TERMINAL TO FUNCTION AS IT WAS CRASH TESTED UNDER MASH, THE EARTH PAD MUST BE CONSTRUCTED PER STANDARD DRAWING S-GRT-2P OR S-GRT-2R.
- (C) THE END TERMINAL (INCLUDING ANCHOR) IS TO BE INSTALLED UNDER ITEM NUMBER 705-06.20 TANGENT ENERGY ABSORBING TERM MASH TL-3 PER EACH.
- (D) TERMINAL SYSTEM MUST BE CONSTRUCTED SO THAT THE FULL LENGTH OF THE TERMINAL SYSTEM GUARD RAILING IS IN STRAIGHT ALIGNMENT.
- (E) DIFFERENT TERMINAL SYSTEMS OR PARTS SHALL NOT BE COMBINED ON A RUN OF GUARDRAIL.
- (F) THE FIRST 12'-6" FROM IMPACT HEAD IS GATING FOR SKT-SP-MGS, DO NOT USE THIS SECTION IN LENGTH OF NEED.
- (G) IF GUARDRAIL NEEDS TO BE EXTENDED, EXTEND GUARDRAIL IN INCREMENTS OF 12'-6".
- (H) IF WOOD POSTS ARE USED, ALL HOLES IN WOOD POSTS ARE TO BE DRILLED BEFORE PRESERVATIVE TREATMENT.
- (I) ALL CUTTING, DRILLING, AND WELDING OF STEEL COMPONENTS SHALL BE DONE BEFORE GALVANIZING.
- (J) THE FINISHED CABLE ASSEMBLY WILL NOT BE ACCEPTABLE UNLESS IT IS IN TENSION WITH NO SAG.
- (K) IF THE SHOULDER WIDTH IS LESS THAN 2'-0", END TERMINAL MUST BE FLARED. IF THE SHOULDER WIDTH IS GREATER THAN 2'-0", END TERMINAL MAY BE TANGENTIAL. IF FLARED IMPLEMENTATION IS IMPLEMENTED, USE 25:1 MAXIMUM FLARE RATE OR INSTALL END TERMINAL AS DIRECTED BY THE FIELD ENGINEER.
- (L) FOR RETROFIT PROJECTS, SEE S-GRT-2R.
- (M) FOR NEW CONSTRUCTION, INSTALL TERMINALS AT 31" HEIGHT. FOR RETROFIT PROJECTS, USE GUARDRAIL HEIGHT TRANSITION DETAIL, SEE S-GRS-4.

NOTE TO INSTALLER

SKT-SP-MGS WITH 46'-10 1/2" INSTALLATION IS SHOWN, POST MATERIAL, SIZE, GUARDRAIL SPLICING LOCATION, TAPER RATE, OFFSET, GUARDRAIL HEIGHT, IMPACT HEAD DIMENSION, AND ALL OTHER MISCELLANEOUS HARDWARE MAY BE DIFFERENT. INSTALLATION SHALL FOLLOW THE MANUFACTURER'S SHOP DRAWINGS.

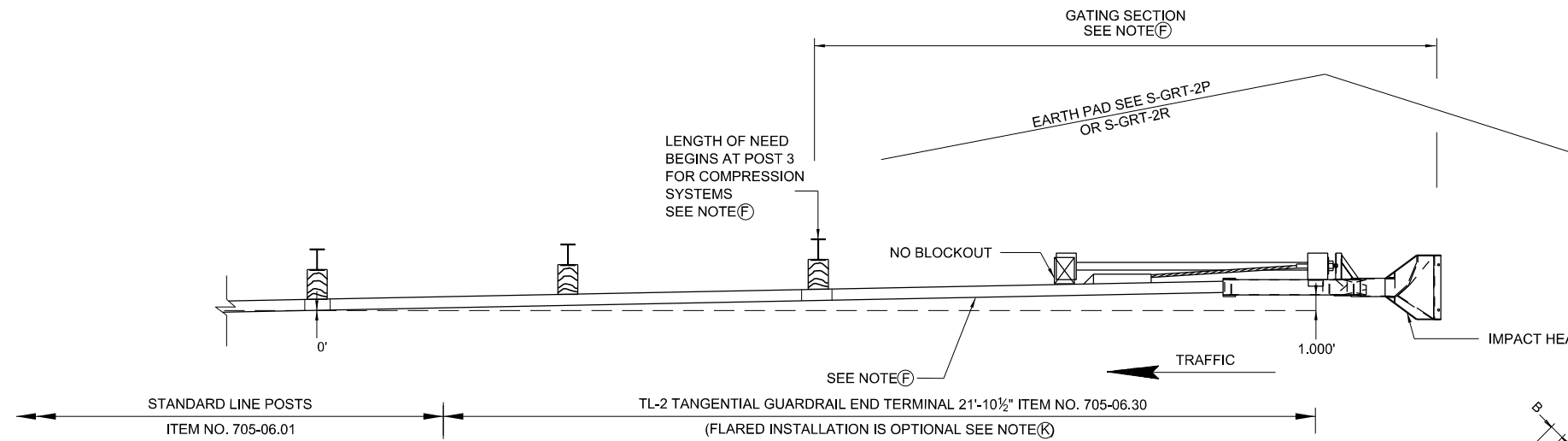
NOTES TO DESIGNER

DO NOT USE WITHOUT REFERENCING S-GRT-2P OR S-GRT-2R.

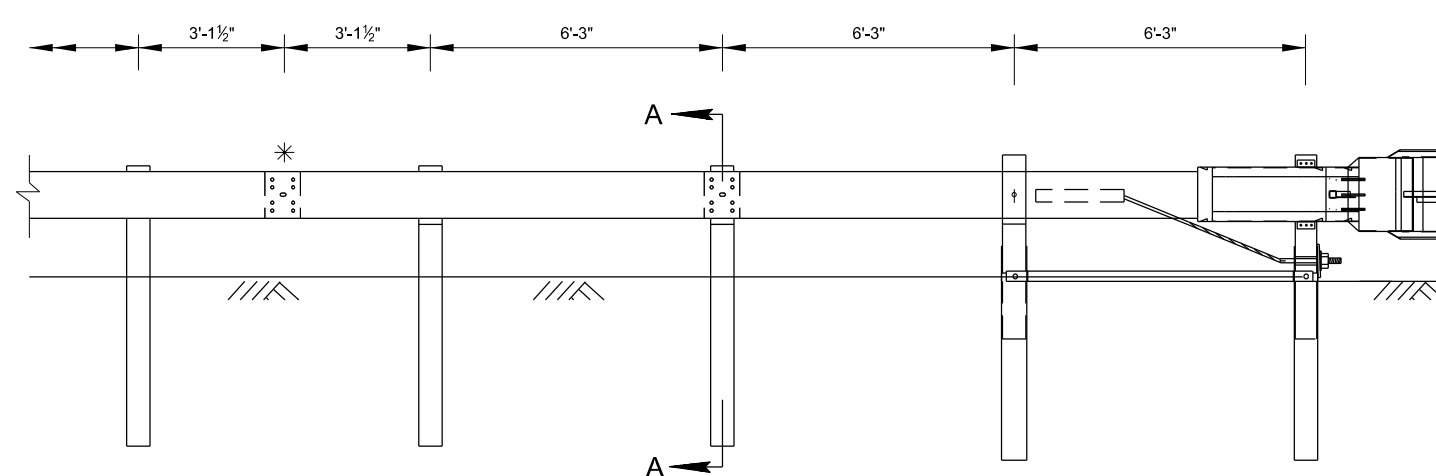
MINOR REVISION -- FHWA APPROVAL NOT REQUIRED.

STATE OF TENNESSEE
DEPARTMENT OF
TRANSPORTATION

TYPE 38
GUARDRAIL END
TERMINAL



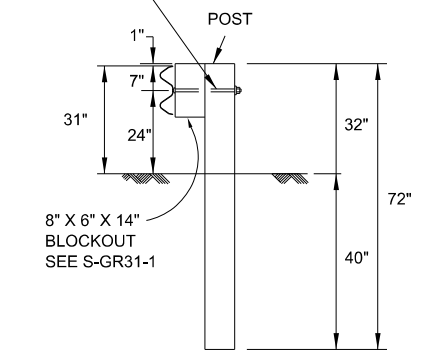
PLAN



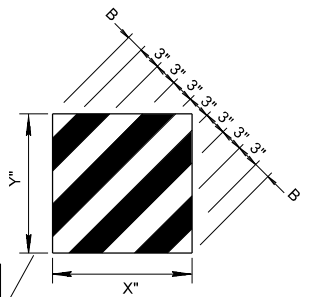
ELEVATION

* FOR MAINTENANCE AND REPAIR PROJECTS:
IF ONLY THE TERMINAL IS TO BE REPLACED,
USE S-GRS-4 TO TRANSITION BACK TO 27" HEIGHT.

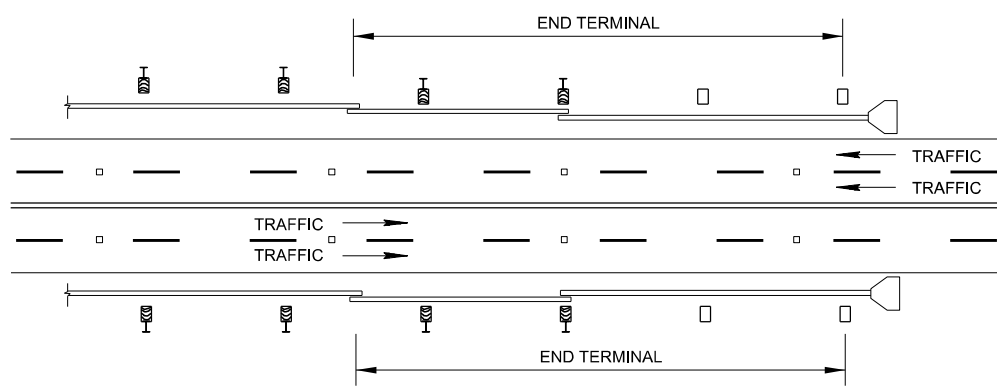
FOR HARDWARE AND CONNECTION DETAILS, SEE GENERAL NOTES (C)-(E) ON S-GR31-1



SECTION A-A



STRIPES AT 45 DEGREE TOWARD TRAVEL WAY.
BACKGROUND: YELLOW (STANDARD SPECIFICATION 916.06)
COPY: BLACK
X AND Y SHALL BE WITHIN 3" OF FACE WIDTH AND HEIGHT, RESPECTIVELY, AND FACE SHALL HAVE A MINIMUM 300 SQUARE INCHES COPY AREA.



W-BEAM OVERLAPPING DETAIL

GENERAL NOTES

- (A) ONLY MASH COMPLIANT TL-2 END TERMINALS ON THE TDOT QUALIFIED PRODUCTS LIST MAY BE INSTALLED. MANUFACTURER'S SHOP DRAWINGS SHALL BE REQUIRED BEFORE ANY TANGENTIAL END TERMINAL INSTALLATIONS CAN BEGIN. THE CONTRACTOR SHALL HAVE ONE COMPLETE SET OF SHOP DRAWINGS ON SITE DURING INSTALLATION OR REPAIR OF ANY TANGENTIAL GUARDRAIL TERMINAL ANCHOR. THE CONTRACTOR SHALL ALSO PROVIDE THE CONSTRUCTION OR MAINTENANCE SUPERVISOR WITH ONE COMPLETE SET OF SHOP DRAWINGS INCLUDING TDOT QUALIFIED PRODUCTS LIST EVALUATION NUMBER.
- (B) FOR THE TYPE 21 GUARDRAIL TERMINAL TO FUNCTION AS IT WAS CRASH TESTED UNDER MASH TL-2, THE EARTH PAD MUST BE CONSTRUCTED PER STANDARD DRAWING S-GRT-2P OR S-GRT-2R.
- (C) THE END TERMINAL (INCLUDING ANCHOR) IS TO BE INSTALLED UNDER ITEM NUMBER 705-06.30 (GUARDRAIL TERMINAL TYPE21 MASH TL-2 PER EACH)
- (D) TERMINAL SYSTEM MUST BE CONSTRUCTED SO THAT THE FULL LENGTH OF THE TERMINAL SYSTEM GUARD RAILING IS IN STRAIGHT ALIGNMENT.
- (E) DIFFERENT TERMINAL SYSTEMS OR PARTS SHALL NOT BE COMBINED ON A RUN OF GUARDRAIL.
- (F) THE FIRST 12'-6" FROM IMPACT HEAD IS GATING FOR SKT-SP-MGS, DO NOT USE THIS SECTION IN LENGTH OF NEED. TENSION SYSTEMS PROVIDE REDIRECTIVE CAPACITY AT THE FIRST POST.
- (G) IF GUARDRAIL NEEDS TO BE EXTENDED, EXTEND GUARDRAIL IN INCREMENTS OF 12'-6".
- (H) IF WOOD POSTS ARE USED, ALL HOLES IN WOOD POSTS ARE TO BE DRILLED BEFORE PRESERVATIVE TREATMENT.
- (I) ALL CUTTING, DRILLING, AND WELDING OF STEEL COMPONENTS SHALL BE DONE BEFORE GALVANIZING.
- (J) THE FINISHED CABLE ASSEMBLY WILL NOT BE ACCEPTABLE UNLESS IT IS IN TENSION WITH NO SAG.
- (K) IF THE SHOULDER WIDTH IS LESS THAN 2'-0", END TERMINAL MUST BE FLARED. IF THE SHOULDER WIDTH IS GREATER THAN 2'-0", END TERMINAL MAY BE TANGENTIAL. IF FLARED IMPLEMENTATION IS IMPLEMENTED, USE 25:1 MAXIMUM FLARE RATE OR INSTALL END TERMINAL AS DIRECTED BY THE FIELD ENGINEER.
- (L) FOR RETROFIT PROJECTS, SEE S-GRT-2R.
- (M) FOR NEW CONSTRUCTION, INSTALL TERMINALS AT 31" HEIGHT. FOR RETROFIT PROJECTS, USE GUARDRAIL HEIGHT TRANSITION DETAIL, SEE S-GRS-4.

- REV. 11-3-14: MODIFIED PAY LENGTH FOR TYPE 38 END TERMINAL.
- REV. 4-4-16: THE PREVIOUSLY SHOWN SKT75 (SLOTTED FLARED GUARDRAIL TERMINAL) IS NO LONGER AVAILABLE FOR 31" INSTALLATION. REVISED TO SHOW TL-2 T-350 TERMINAL.
- REV. 10-10-16: UPDATED LIMIT OF PAYMENT.
- REV. 3-28-17: UPDATED NOTES TO INSTALLER, ADDED W-BEAM OVERLAPPING DETAIL, REORGANIZED SHEET, CHANGED PAY ITEM NUMBER, REPLACED "SKT 350" WITH "SKT-SP-M65" IN NOTE TO INSTALLER.

MINOR REVISION -- FHWA APPROVAL NOT REQUIRED.

STATE OF TENNESSEE
DEPARTMENT OF
TRANSPORTATION

TYPE 21
GUARDRAIL END
TERMINAL

7-11-13 S-GRT-3

NOTE TO INSTALLER

SKT-SP-MGS WITH 21'- 10 1/2" INSTALLATION IS SHOWN, POST MATERIAL, SIZE, GUARDRAIL SPLICING LOCATION, TAPER RATE, OFFSET, GUARDRAIL HEIGHT, IMPACT HEAD DIMENSION, AND ALL OTHER MISCELLANEOUS HARDWARE MAY BE DIFFERENT. INSTALLATION SHALL FOLLOW THE MANUFACTURER'S SHOP DRAWINGS.

NOTES TO DESIGNER

THIS TERMINAL SHALL ONLY BE USED ON ROADWAYS WITH POSTED SPEED LIMITS OF 45 MPH OR LESS.
DO NOT USE WITHOUT REFERENCING S-GRT-2P OR S-GRT-2R.