KYTC Steel Thrie-Beam Bullnose Manual

Assembly, Maintenance, and Repair

Version 1

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Disclaimer

This document is an installation manual for the non-proprietary bullnose terminal system developed through the Midwest Roadside Safety Facility (MwRSF) and Midwest Pooled Fund Program. The bullnose system is a redirective, non-gating crash cushion that meets American Association of State and Highway Transportation Officials (AASHTO) Manual for Assessing Safety Hardware (MASH) Test Level 3 (TL-3) criteria. Installers are responsible for using a design approved by a state DOT and following all required state procedures and instructions when installing the steel thrie-beam bullnose terminal.

Instructions presented in this manual are for standard assembly specified by the appropriate highway authority. If system assembly, maintenance, or repair requires a deviation from standard assembly parameters, contact the Kentucky Transportation Cabinet (KYTC) standards engineer:

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This material is based on work supported by the Federal Highway Administration, U.S. Department of Transportation and the Midwest Pooled Fund Program — TPF-5(193). This manual's contents reflect the views and opinions of the authors, who are responsible for the facts and accuracy of data presented herein. Its contents do not necessarily reflect the official views or policies of the University of Nebraska-Lincoln, Commonwealth of Kentucky, or the Federal Highway Administration, U.S. Department of Transportation. This report does not constitute a standard, specification, or regulation. Trade or manufacturers' names, which may appear in this report, are cited only because they are considered essential to the manual's objectives. The U.S. government, State of Nebraska, and Commonwealth of Kentucky do not endorse products or manufacturers.

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1 GENERAL INFORMATION

The MASH TL-3 steel thrie-beam bullnose terminal system is a non-proprietary, thrie beam, median barrier system used to shield obstacles located in medians between divided highways. The system consists of a semi-rigid guardrail system that wraps completely around obstacles. When a vehicle impacts the radiused nose of a bullnose system, the barrier captures the vehicle, collapses inward, and dissipates energy, safely decelerating the vehicle. Impacts along barrier sides are redirected in a manner similar to standard guardrail systems. Figure 1 shows isometric and overhead views of the bullnose system.

The bullnose system is a non-gating, redirective crash cushion that meets American Association of State and Highway Transportation Officials (AASHTO) Manual for Assessing Safety Hardware (MASH 2016) Test Level 3 (TL-3) criteria, which specify impact at 62 mph. The system is eligible for Federal-aid reimbursement when used on the National Highway System. Installers are responsible for using a state DOT–approved design and following all required state procedures and these instructions when installing a bullnose system.

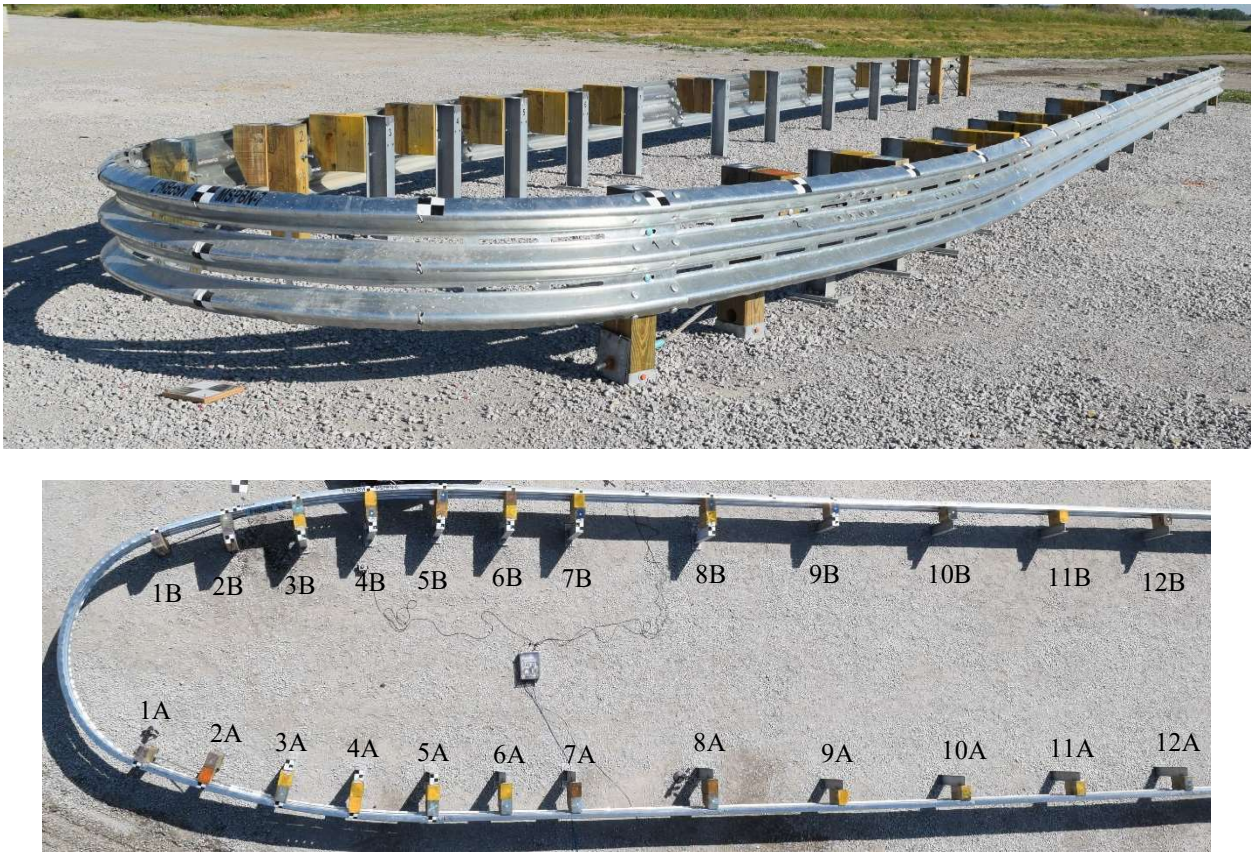


Figure 1 Bullnose System: Isometric and Overhead View with Post Numbers

The bullnose system consists of a guardrail envelope made of thrie-beam panels mounted at a height of 31⅝ in. and supported by a series of Universal Breakaway Steel Posts (UBSPs) and W6x8.5 or W6x9 steel posts. The nose rail section and adjacent rail section are radiused and slotted, the third section is slotted, and the fourth rail section is standard thrie beam. The combination of the radiused and slotted rail segments and breakaway posts allows the system to safely capture and decelerate vehicles that impact the system near its end or nose and redirect vehicles impacting along its side.

This manual contains general information on the steel thrie-beam bullnose terminal system, site preparation and grading, system parts and assemblies, installation procedures, alternative system configurations, an inspection checklist, and maintenance and repair guidance.

2 PARTS AND ASSEMBLIES

2.1 System Overview

This section describes bullnose system parts and assemblies. The pay limit for the bullnose system is defined from the nose through post 12 (**Figure 2**). A standard layout includes:

- A slotted thrie-beam nose section with reinforcing nose cables
- One curved and slotted thrie-beam section on each side of the system
- One straight and slotted thrie-beam section on each side of the system
- Two standard thrie-beam sections on each side of the system

In this manual, details and standards depicting posts labeled 'A' are on the oncoming traffic side; posts labeled 'B' are on the opposing side of traffic. Details for individual post assemblies, guard-rail sections, anchorages, and nose cables are provided in later sections. **Table 1** is the bill of materials for the bullnose system.

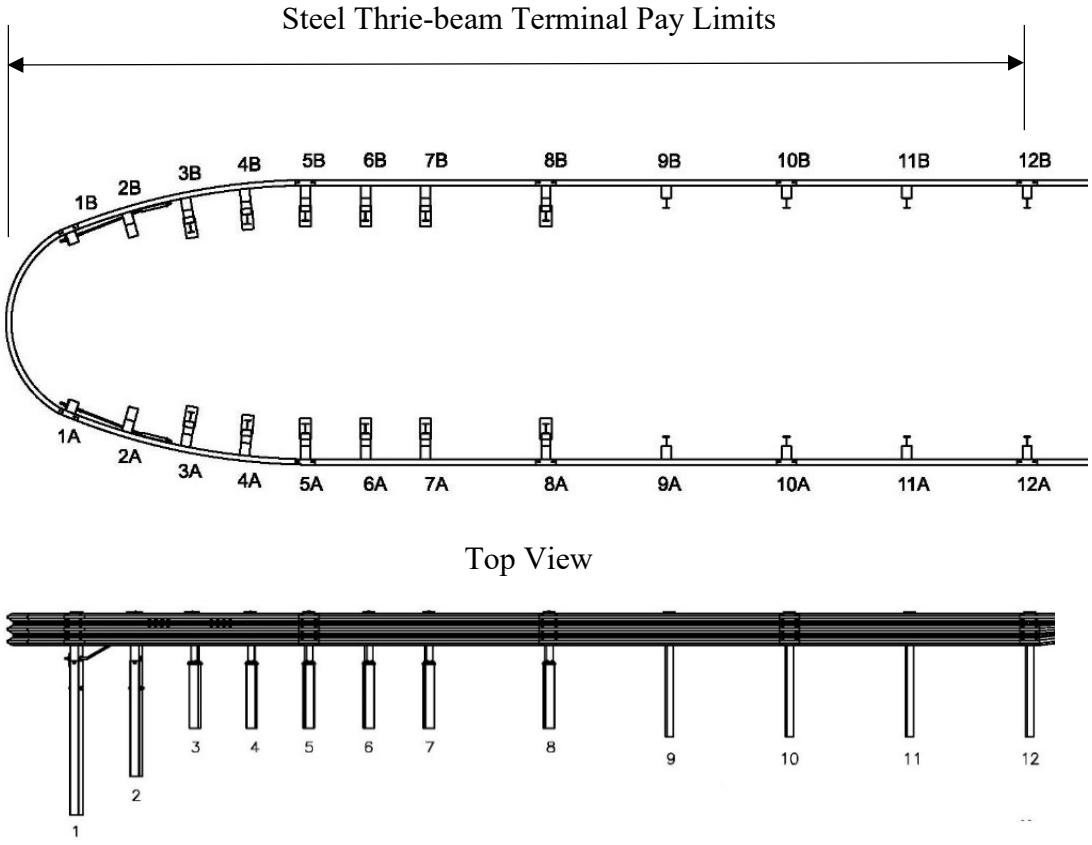


Figure 2 Thrie-Beam Bullnose System Diagram, Top View and Side View

Table 1 Thrie-Beam Bullnose System Bill of Materials

Part Number	Quantity	Description	Hardware Guide	Material Descriptions
A1	2	LONG FOUNDATION TUBE	PTE07	ASTM A500 GRADE B OR ASTM A501
A2	2	FOUNDATION TUBE	PTE06	ASTM A500 GRADE B OR ASTM A501
A3	2	BCT BEARING PLATE	FPB01	ASTM A36 MIN. STRENGTH 36 KSI SEE SPEC. SECTION 812.01.01 FOR ALTERNATIVE STEEL GRADES
B1	12	LOWER SHEAR PLATE	PTE08	ASTM A36 MIN. STRENGTH 36 KSI SEE SPEC. SECTION 812.01.01 FOR ALTERNATIVE STEEL GRADES
B2	12	FOUNDATION TUBE	PTE08	ASTM A500 GRADE B OR ASTM A501
C1	12	UPPER SHEAR PLATE	PWE11	ASTM A36 MIN. STRENGTH 36 KSI SEE SPEC. SECTION 812.01.01 FOR ALTERNATIVE STEEL GRADES
C2	12	STEEL POST	PWE11	W6X9 OR W6X8.5 STEEL POST / ASTM A36 MIN. STRENGTH 36 KSI
D1	20	BLOCKOUT FOR STEEL POST - WOOD	PDB09	SYP GRADE NO. 1 OR BETTER / SEE SPEC. SECTION 814.04.02 FOR TIMBER USE
D2	12	TAPERED BLOCKOUT FOR STEEL POST - WOOD	PDB20	SYP GRADE NO. 1 OR BETTER / SEE SPEC. SECTION 814.04.02 FOR TIMBER USE
D3	2	TAPERED BLOCKOUT FOR BCT POST - WOOD	PDB12	SYP GRADE NO. 1 OR BETTER / SEE SPEC. SECTION 814.04.02 FOR TIMBER USE
E1	1	SLOTTED THRIE BEAM RAIL - SHOP BENT AND PUNCHED	RTM07a	12 GUAGE / CURVE QUADRAIL (IN SHOP) / MARK THE RADIUS OF CURVATURE ON EACH OF THE CURVED ELEMENTS
E2	2	SLOTTED THRIE BEAM RAIL - SHOP BENT AND PUNCHED	RTM07d	12 GUAGE / CURVE QUADRAIL (IN SHOP) / MARK THE RADIUS OF CURVATURE ON EACH OF THE CURVED ELEMENTS / NOTE: IN AN ASYMMETRICAL ROLLOVER, THE OPPOSING TRAF-FIC SIDE E2 THRIE BEAM IS STRAIGHT AND NOT CURVED WITH A LENGTH OF 13' 6 1/2"
E3	2	SLOTTED THRIE BEAM RAIL - PUNCHED	RTM07e	12 GUAGE
E4	4	UNBENT STANDARD THRIE BEAM RAIL	RTM02a	12 GUAGE
F1	4	5/8" DIA. HEX HEAD GROUND STRUT AND YOKE BOLT - 11 - UNC 10" LONG	FBX16a	ASTM A307
F2	8	5/8" DIA. HEX HEAD GROUND STRUT AND YOKE BOLT - WASHER 1 3/4" OUTSIDE DIAMETER, 11/16” INSIDE DIAMETER, 1/8" THICK	FWC16a	ASTM F844
F3	4	5/8" DIA. HEX HEAD GROUND STRUT AND YOKE BOLT – 5/8” NUT, 9/16” THICK	FBX16a	ASTM A563, GRADE A OR BETTER
G1a	14	5/8" DIA. POST BOLT - 11 UNC - 18" LONG	FBB04	
G1b	12	5/8" DIA. POST BOLT - 11 UNC - 10" LONG	FBB03	
G2	6	POST BOLT - WASHER 1 3/4" OUTSIDE DIAMETER, 11/16" INSIDE DIAMETER, 1/8" THICK	FWC16a	ASTM F844

Part Number	Quantity	Description	Hardware Guide	Material Descriptions
G3	26	POST BOLT - 10" NUT, 9/16" THICK	FBB03/FBB04	ASTM A563, GRADE A OR BETTER
H1	4	7/8" DIA. HEX HEAD SOIL TUBE BOLT - 9 UNC - 8" LONG.	NA	ASTM A307 / AASHTO M232 CLASS C
H2	8	7/8" DIA. HEX HEAD SOIL TUBE BOLT - WASHER 2 1/4" OUTSIDE DIAMETER, 15/16" INSIDE DIAMETER, 3/16" THICK.	NA	ASTM F844 / AASHTO M232 CLASS C
H3	4	7/8" DIA. HEX HEAD SOIL TUBE BOLT - 7/8" NUT, 3/4" THICK.	NA	ASTM A563, GRADE A OR BETTER / AASHTO M232 C
J1	38	16D DOUBLE HEAD NAIL	NA	AASHTO M232 CLASS D
L1	4	BCT TIMBER POST	PDF04	SYP GRADE NO. 1 OR BETTER / NO KNOTS +/- 18" FROM GROUND ON TENSION FACE / SEE SPEC. SECTION 814.04.02 FOR TIMBER USE
L2	2	BCT POST SLEEVE	FMM02	
M1	8	W6X8.5 OR W6X9 STEEL POST	NA	W6X9 OR W6X8.5 STEEL POST / ASTM A36 MIN. STRENGTH 36 KSI
N1	2	ANCHOR BRACKET ASSEMBLY	FPA01	ASTM A36 MIN. STRENGTH 36 KSI SEE SPEC. SECTION 812.01.01 FOR ALTERNATIVE STEEL GRADES
N2	2	ANCHOR BRACKET END PLATE	FPA01	ASTM A36 MIN. STRENGTH 36 KSI SEE SPEC. SECTION 812.01.01 FOR ALTERNATIVE STEEL GRADES
P1	16	5/8" DIA. HEX HEAD ANCHOR BRACKET BOLT - 11 UNC - 1 1/2" LONG	FBX16a	ASTM A307
P2	32	5/8" DIA. HEX HEAD ANCHOR BRACKET BOLT - WASHER 1 3/4" OUTSIDE DIAMETER, 11/16" INSIDE DIAMETER, 1/8" THICK	FWC16a	ASTM F844
P3	16	5/8" DIA. HEX HEAD ANCHOR BRACKET BOLT - 5/8" NUT, 9/16" THICK.	FBX16a	ASTM A563 GRADE A OR BETTER
Q1	3	5/8" DIA. NOSE CABLE 6X19 XIPS IWRC	RCM02	AASHTO M30 CLASS A COATING / NOMINAL BREAKING STRENGTH OF 41.2 KIPS
Q2	6	NOSE CABLE - SWAGE BUTTON	RCM02	COLD TUFF BUTTON, S-409 SIZE NO. 12 SB STOCK NUMBER 1040395 FOR 5/8" DIAMETER (6X19) WIRE ROPE (OR ANY SIMILARLY SIZED SWAGE-GRIP BUTTON FERRULES) / AASHTO M30 CLASS A COATING
R1	6	NOSE CABLE ANCHOR BRACKET	FPA04	ASTM A36 MIN. STRENGTH 36 KSI SEE SPEC. SECTION 812.01.01 FOR ALTERNATIVE STEEL GRADES
S1	120	5/8" DIA. SPLICE BOLT - 11 UNC - 1 1/4" LONG	FBB01	
S2	120	5/8" DIA. SPLICE BOLT - 5/8" NUT, 9/16" THICK	FBB01	ASTM A563, GRADE A OR BETTER
T1	9	1/4" DIA. NOSE CABLE U-BOLT - 20 UNC	NA	ASTM A307 / AASHTO M232 CLASS C

Part Number	Quantity	Description	Hardware Guide	Material Descriptions
T2	9	1/4" DIA. NOSE CABLE U-BOLT - PLATE WASHER, 1/8" THICK	NA	ASTM A1011 TYPE SS GRADE 36 / AASHTO M232 CLASS C
T3	18	1/4" DIA. NOSE CABLE U-BOLT - 1/4" NUT, 1/4" THICK	NA	ASTM A563, GRADE A OR BETTER / AASHTO M232 CLASS C
U1	48	SLIP POST ASSEMBLY - BREAKAWAY 7/16" DIA. HEX HEAD BOLT - 14 UNC - 2 1/2" LONG	FBX12b	ASTM A449 OR SAE J429 GRADE 5
U2	192	SLIP POST ASSEMBLY - BREAKAWAY 7/16" DIA. HEX HEAD BOLT - WASHER, 1 1/4" OUTSIDE DI-AMETER, 1/2" INSIDE DIAMETER, 3/32" THICK	FWC12a	ASTM F844
U3	48	SLIP POST ASSEMBLY - BREAKAWAY 7/16" DIA. HEX HEAD BOLT - 7/16" NUT, 1/2" THICK	FBX12b	ASTM A563DH OR SAE J995 GRADE 5
V1	2	3/4" DIA. BCT CABLE	FCA01	
V2	4	ANCHOR CABLE-SWAGE FITTING, 1 1/4" DI-AMATER	FCA01	FITTING ASTM A576 GRADE 1035 / STUD ASTM F568 CLASS C
V3	4	1" DIA. ANCHOR CABLE-WASHER	FWC24a	ASTM F844
V4	4	1" DIA. ANCHOR CABLE NUT	FNX24a	ASTM A563, GRADE A OR BETTER
W1	3	REFLECTOR	NA	SEE SPEC. SECTION 838 AND KYTC LIST OF APPROVED MATERIALS

1. The Hardware Guide number is referenced in the *Task Force 13 Guide to Standardized Roadside Hardware*, available at https://tf13.org/guides/. When AASHTO and ASTM material specifications are available for a component, they are listed in the guide.

2. If the *Task Force 13 Guide to Standardized Roadside Hardware* does not reference the AASHTO and ASTM specifications, they are provided in the Material Descriptions column. Additional material specifications can be found in Kentucky Standard Specifications, Section 814 - Guardrail Systems.

3. If there are discrepancies in material or dimensions between the *Task Force 13 Guide to Standardized Roadside Hardware* and this Standard Drawing set, the details in the Standard Drawing set shall take precedence.

2.2 Parts and Assemblies

The bullnose system is made up of four main components/assemblies:

- Posts and blockouts
- System anchorage
- Guardrail
- Nose cables

2.2.1 Posts and Blockouts

Twenty-four posts are used to construct the bullnose system. Posts 1 and 2 are Breakaway Cable Terminal (BCT) posts, Posts 3 – 8 are Universal Breakaway Steel Posts (UBSPs), and posts 9 – 12 are thrie-beam guardrail steel posts.

Breakaway Cable Terminal (BCT) Posts

Posts 1 and 2 are BCT posts. Post 1 does not use a blockout. **Table 2** is the bill of materials for post 1, while **Figure 3** and **Figure 5** are diagrams of post 1. Post 2 uses a tapered 6 in. x 8 in. x 14¼ in. timber blockout. **Table 3** is the bill of materials for post 2, with diagrams shown in **Figure 4** and **Figure 6**. **Figure 7** is a photograph of posts 1 and 2 installed in the final system.

Table 2 Post 1 Bill of Materials

Part Number	Quantity	Description	Hardware Guide
A1	1	LONG FOUNDATION TUBE	PTE07
A3	1	BCT BEARING PLATE	FPB01
E1	1*	SLOTTED THRIE-BEAM RAIL - SHOP BENT AND PUNCHED	RTM07a
E2	1*	SLOTTED THRIE-BEAM RAIL - SHOP BENT AND PUNCHED	RTM07d
F1	1	5/8" DIA. HEX HEAD GROUND STRUT AND YOKE BOLT - 11 UNC - 10" LONG	FBX16a
F2	2	5/8" DIA. HEX HEAD GROUND STRUT AND YOKE BOLT - WASHER 1 3/4" OUTSIDE DIAMETER, 11/16" INSIDE DIAMETER, 1/8" THICK	FWC16a
F3	1	5/8" DIA. HEX HEAD GROUND STRUT AND YOKE BOLT - 5/8" NUT, 9/16" THICK	FBX16a
G1b	2	5/8" DIA. POST BOLT - 11 UNC - 10" LONG	FBB03
G2	2	POST BOLT - WASHER 1 3/4" OUTSIDE DIAMETER, 11/16" INSIDE DIAMETER, 1/8" THICK	FWC16a
G3	2	POST BOLT - 5/8" NUT, 9/16" THICK	FBB03
H1	1	7/8" DIA. HEX HEAD SOIL TUBE BOLT - 9 UNC - 8" LONG	NA
H2	2	7/8" DIA. HEX HEAD SOIL TUBE BOLT - WASHER 2 1/4" OUTSIDE DIAMETER, 15/16" INSIDE DIAMETER, 3/16" THICK	NA
H3	1	7/8" DIA. HEX HEAD SOIL TUBE BOLT - 7/8" NUT, 3/4" THICK	NA
J1	2	16D DOUBLE HEAD NAIL	NA
L1	1	BCT TIMBER POST	PDF04
L2	1	BCT POST SLEEVE	FMM02
Q1	3**	5/8" DIA. NOSE CABLE 6X19 XIPS IWRC	RCM02
Q2	3	NOSE CABLE - SWAGE BUTTON	RCM02
R1	3	NOSE CABLE ANCHOR BRACKET	FPA04
S1	12	5/8" DIA. SPLICE BOLT - 11 UNC - 1 1/4" LONG	FBB01
S2	12	5/8" DIA. SPLICE BOLT - 5/8" NUT, 9/16" THICK	FBB01
V1	1***	3/4" DIA. BCT CABLE	FCA01
V2	1	ANCHOR CABLE-SWAGE FITTING, 1 1/4" DIAMTER	FCA01
V3	1	1" DIA. ANCHOR CABLE-WASHER	FWC24a
V4	1	1" DIA. ANCHOR CABLE-NUT	FNX24a

* E1 AND E2 CONNECT AT POST 1A AND POST 1B
** 5/8" DIA. NOSE CABLE 6X19 XIPS IWRC RUNS BETWEEN POST 1A AND POST 1B
*** 3/4" DIA. BCT CABLE CONNECTS TO POST 1 AND CABLE ANCHOR ASSEMBLY ATTACHED TO E2

Table 3 Post 2 Bill of Materials

Part Number	Quantity	Description	Hardware Guide
A2	1	FOUNDATION TUBE	PTE06
D3	1	TAPERED BLOCKOUT FOR BCT POST - WOOD	PDB12
E2	1*	SLOTTED THRIE-BEAM RAIL - SHOP BENT AND PUNCHED	RTM07d
F1	1	5/8" DIA. HEX HEAD GROUND STRUT AND YOKE BOLT - 11 UNC - 10" LONG	FBX16a
F2	2	5/8" DIA. HEX HEAD GROUND STRUT AND YOKE BOLT - WASHER 1 3/4" OUTSIDE DIAMETER, 11/16" INSIDE DIAMETER, 1/8" THICK	FWC16a
F3	1	5/8" DIA. HEX HEAD GROUND STRUT AND YOKE BOLT - 5/8" NUT, 9/16" THICK	FBX16a
G1a	1	5/8" DIA. POST BOLT - 11 UNC - 18" LONG	FBB04
G2	1	POST BOLT - WASHER 1 3/4" OUTSIDE DIAMETER, 11/16" INSIDE DIAMETER, 1/8" THICK	FWC16a
G3	1	POST BOLT - 5/8" NUT, 9/16" THICK	FBB04
H1	1	7/8" DIA. HEX HEAD SOIL TUBE BOLT - 9 UNC - 8" LONG	NA
H2	2	7/8" DIA. HEX HEAD SOIL TUBE BOLT - WASHER 2 1/4" OUTSIDE DIAMETER, 15/16" INSIDE DIAMETER, 3/16" THICK	NA
H3	1	7/8" DIA. HEX HEAD SOIL TUBE BOLT - 7/8" NUT, 3/4" THICK	NA
J1	1	16D DOUBLE HEAD NAIL	NA
L1	1	BCT TIMBER POST	PDF04

* E2 SPANS BETWEEN POSTS 1 AND 5

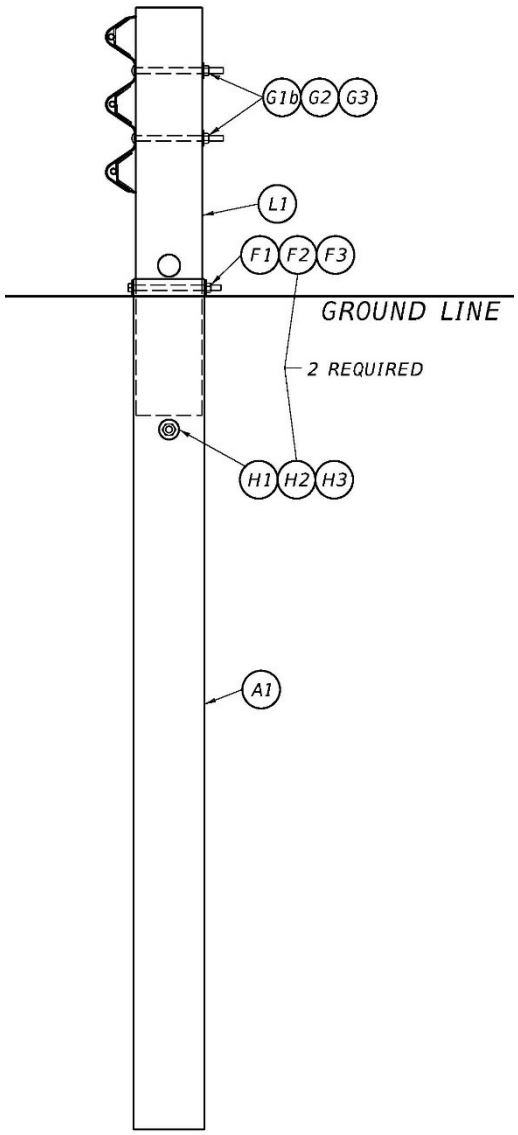


Figure 3 Post 1 – Diagram

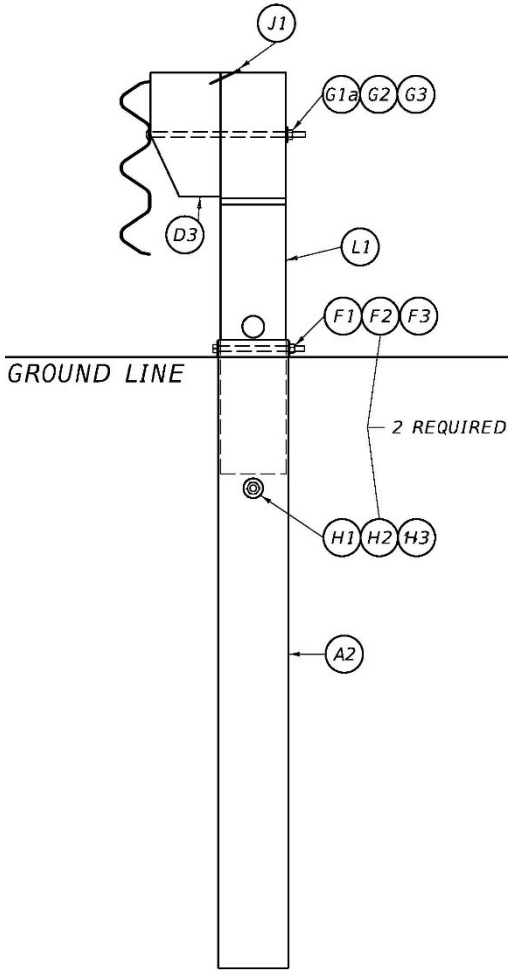


Figure 4 Post 2 – Diagram

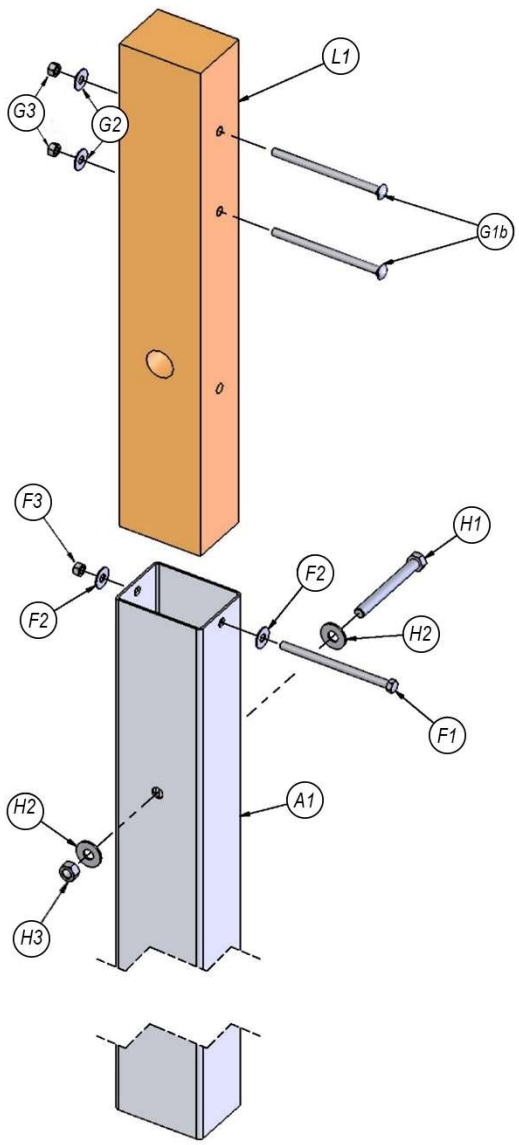


Figure 5 Post 1 – Exploded View (Rail Not Shown)

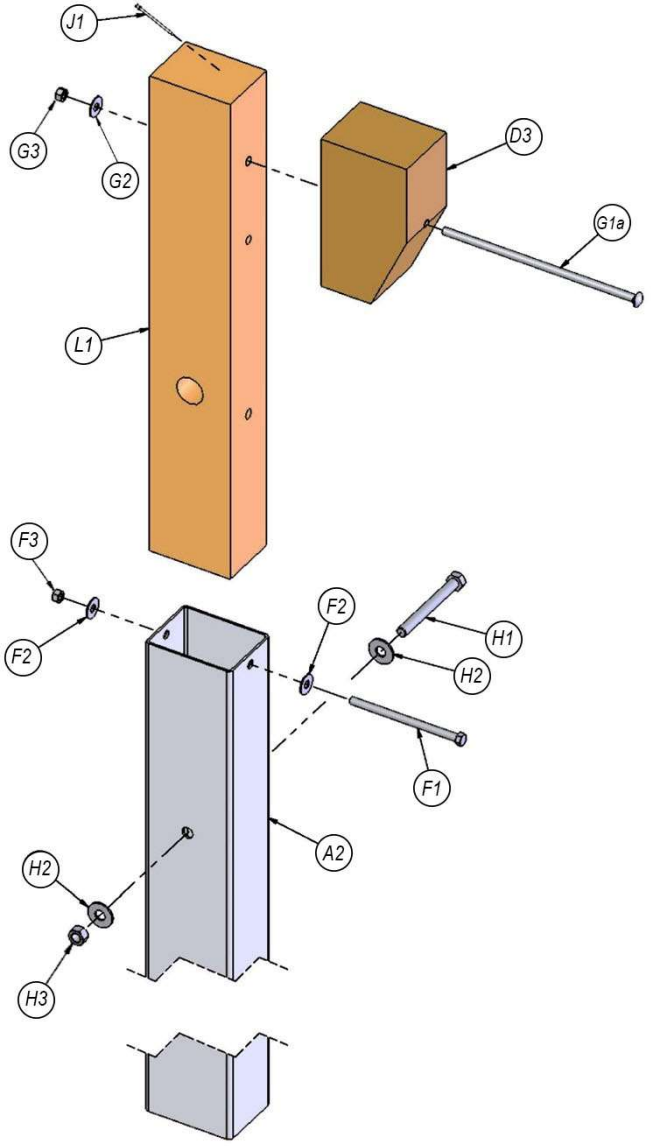


Figure 6 Post 2 – Exploded View (Rail Not Shown)

Figure 7 Posts 1 and 2 Installed in System

Universal Breakaway Steel Posts (UBSPs)
Posts 3 – 8 are UBSPs. The lower portion of a UBSP consists of a foundation tube and lower base plate, while the upper portion is made up of a post and an upper base plate. A series of four bolts connects the upper and lower halves. UBSPs use dual blockouts:

- One rectangular blockout measuring 6 in. x 8 in. x 14¼ in.
- One tapered blockout measuring 6 in. x 8 in. x 14¼ in.

Table 4 is the bill of materials for posts 3 – 8; **Figure 8** and 9 are diagrams of these posts. **Figure 10** shows assembled UBSPs.

Table 4 Posts 3 – 8 Bill of Materials

Part Number	Quantity	Description	Hardware Guide
B1	1	LOWER SHEAR PLATE	PTE08
B2	1	FOUNDATION TUBE	PTE08
C1	1	UPPER SHEAR PLATE	PWE11
C2	1	STEEL POST	PWE11
D1	1	BLOCKOUT FOR STEEL POST - WOOD	PDB09
D2	1	TAPERED BLOCKOUT FOR STEEL POST - WOOD	PDB20
E2	1*	SLOTTED THRIE-BEAM RAIL - SHOP BENT AND PUNCHED	RTM07d
E3	1*	SLOTTED THRIE-BEAM RAIL - PUNCHED	RTM07e
G1a	1	5/8" DIA. POST BOLT - 11 UNC - 18" LONG	FBB04
G3	1	POST BOLT - 5/8" NUT, 9/16" THICK	FBB04
J1	2	16D DOUBLE HEAD NAIL	NA
S1	12**	5/8" DIA. SPLICE BOLT - 11 UNC - 1 1/4" LONG	FBB01
S2	12**	5/8" DIA. SPLICE BOLT - 5/8" NUT, 9/16" THICK	FBB01
U1	4	SLIP POST ASSEMBLY - BREAKAWAY 7/16" DIA. HEX HEAD BOLT - 14 UNC - 2 1/2" LONG	FBX12b
U2	16	SLIP POST ASSEMBLY - BREAKAWAY 7/16" DIA. HEX HEAD BOLT - WASHER, 1 1/4" OUTSIDE DIAMETER, 1/2" INSIDE DIAMETER, 3/32" THICK	FWC12a
U3	4	SLIP POST ASSEMBLY - BREAKAWAY 7/16" DIA. HEX HEAD BOLT - 7/16" NUT, 1/2" THICK	FBX12b

* E2 BETWEEN POSTS 3 AND 5, SPLICE AT POST 5, AND E3 BETWEEN POSTS 5 AND 8, SPLICE AT POST 8
** S1 AND S2 USED FOR RAIL SPLICES AT POST 5 AND 8

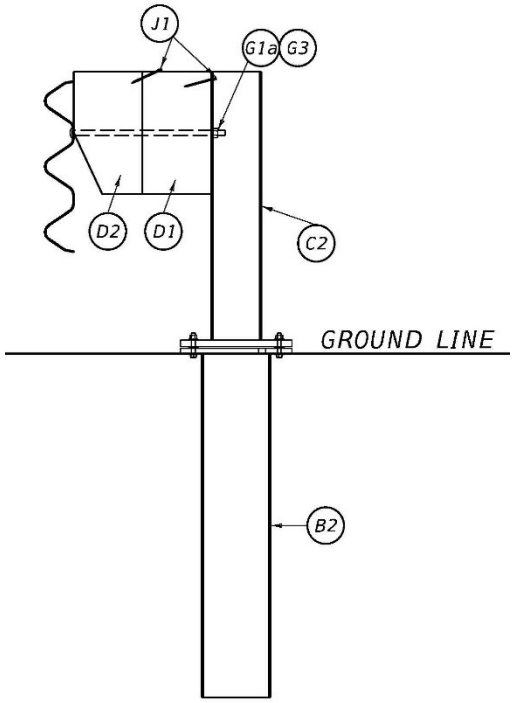


Figure 8 Posts 3–8 — Diagram

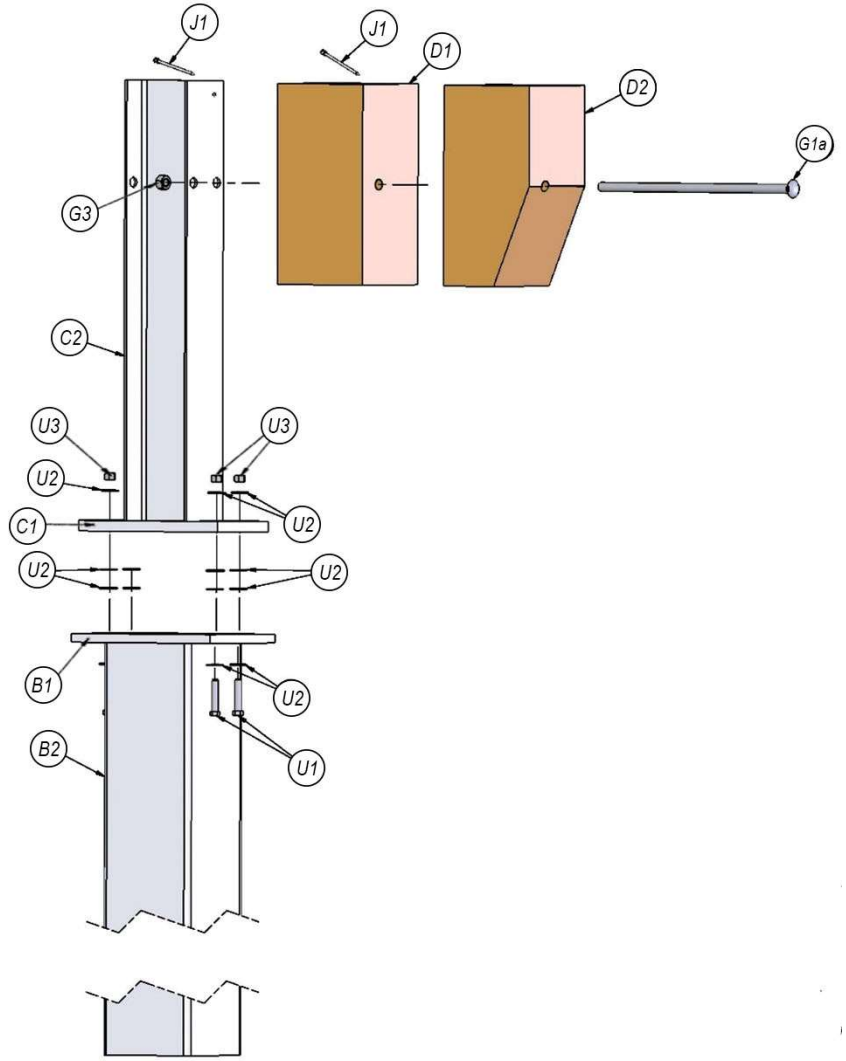


Figure 9 Posts 3–8 (Rail Not Shown) — Exploded View

Figure 10 Assembled (Top) and Installed (Middle, Bottom) UBSPs

Thrie-Beam Guardrail Posts

Posts 9 – 12 are 78-in. long thrie-beam guardrail steel posts that use 6 in. x 8 in. x 14¼ in. block-outs. **Table 5** lists the bill of materials for posts 9 – 12. **Figure 11** and **Figure 12** are diagrams of posts 9 – 12 .

Table 5 Posts 9 – 12 Bill of Materials

Part Number	Quantity	Description	Hardware Guide
D1	1	BLOCKOUT FOR STEEL POST - WOOD	PDB09
E4	1*	UNBENT STANDARD THRIE-BEAM RAIL	RTM02a
G1b	1	5/8" DIA. POST BOLT - 11 UNC - 10" LONG	FBB03
G3	1	POST BOLT - 5/8" NUT, 9/16" THICK	FBB03
J1	1	16D DOUBLE HEAD NAIL	NA
M1	1	W6X8.5 OR W6X9 STEEL POST	NA
S1	12**	5/8" DIA. SPLICE BOLT - 11 UNC - 1 1/4" LONG	FBB01
S2	12**	5/8" DIA. SPLICE BOLT - 5/8" NUT, 9/16" THICK	FBB01

* RAIL E4 CONNECTS BETWEEN POSTS 8 AND 12
** S1 AND S2 USED FOR RAIL SPLICES AT POST 10 AND 12

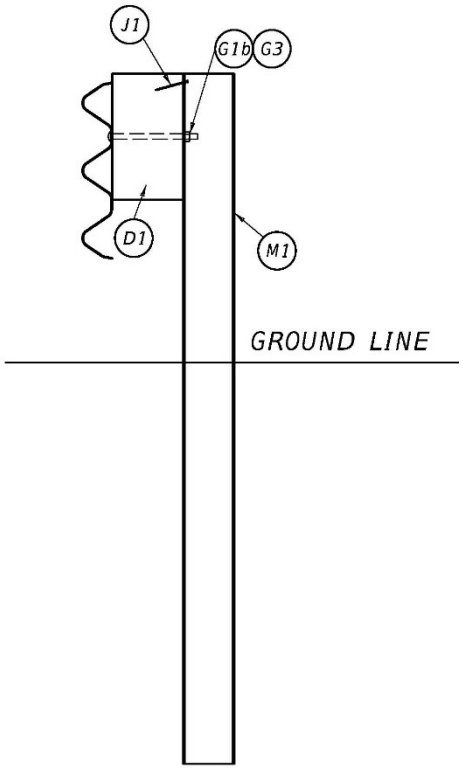


Figure 11 Posts 9–12 — Diagram

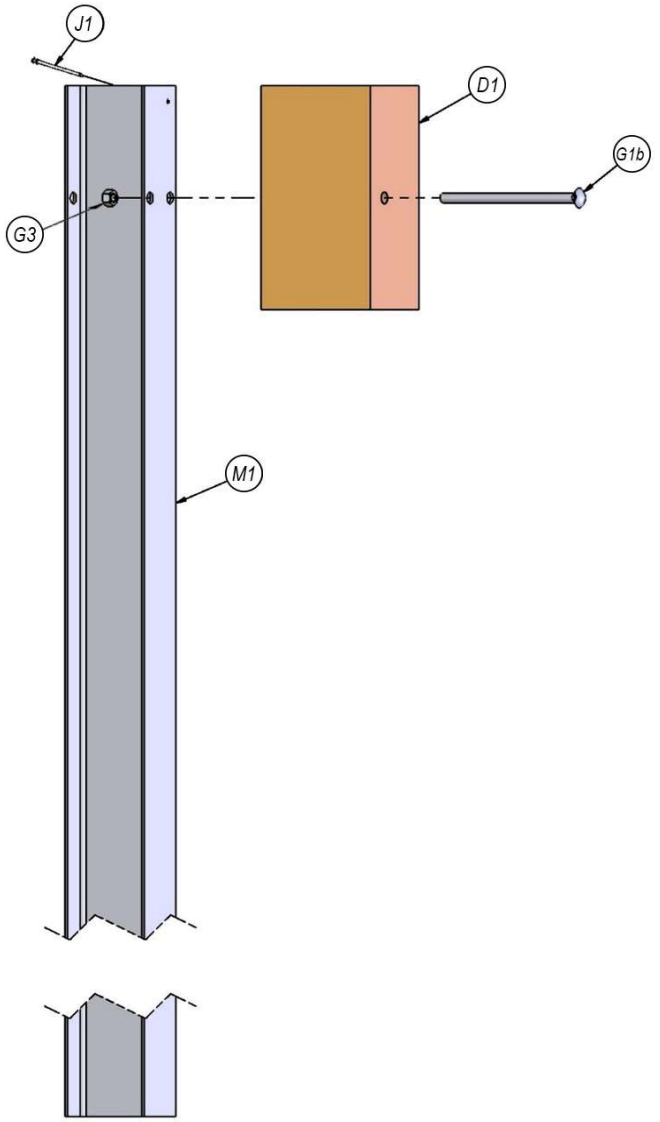


Figure 12 Posts 9–12 — Exploded View
(Rail Not Shown)

Beyond Post 12

Beyond post 12, the guardrail can continue either with a thrie-beam guardrail or transition to W-Beam guardrail. When continuing with thrie-beam guardrail, a modified thrie-beam (bullnose) can be used. Thrie-beam posts shall match posts 9 – 12 (i.e., 78 in. long thrie-beam guardrail steel posts, with standard 6 in. x 8 in. x 14¼ in. blockouts).

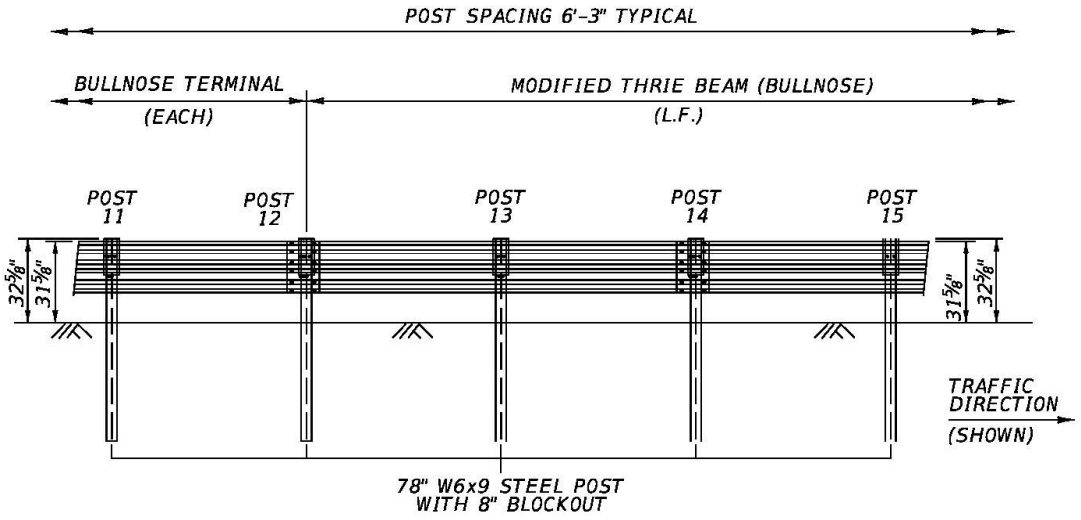


Figure 13 Bullnose Terminal to Modified Thrie-Beam (Bullnose) — Diagram

For W-Beam installations, transition the rail using a thrie-beam connector followed by a standard post and block. Use half spacing with the first post and block so the rail can be spliced midspan. These posts shall be a standard 72 in. long W-beam guardrail steel posts and standard 6 in. x 8 in. x 14¼ in. blockouts.

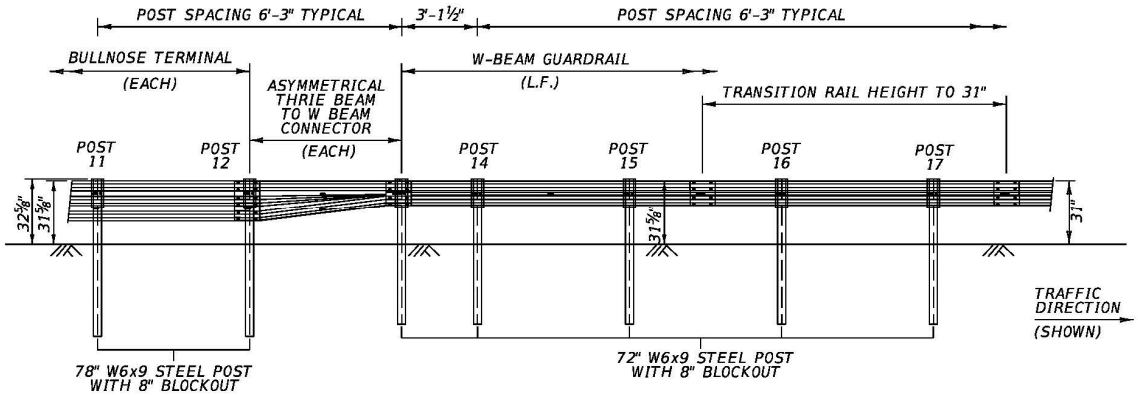


Figure 14 Bullnose to Standard W-Beam Guardrail

2.2.2 System Anchorage

The bullnose system anchorage consists of two BCT posts (posts 1 and 2) and the anchorage components (

and Figure 16). Diagrams of the anchorage are shown in Figure 17 and

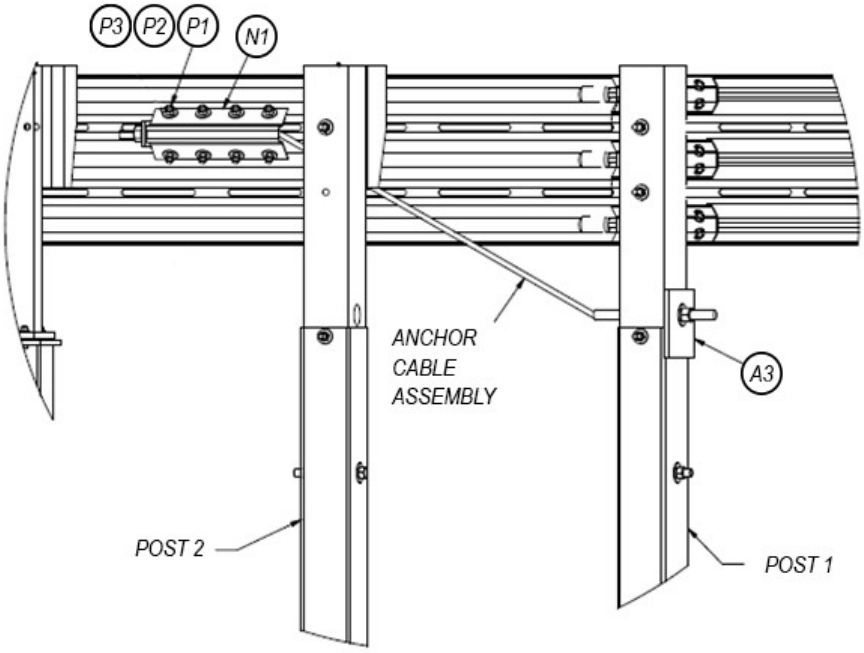


Figure 18. Figure 19 and Figure **20** illustrate the anchor cable and cable plate along with their assemblies at post 1.

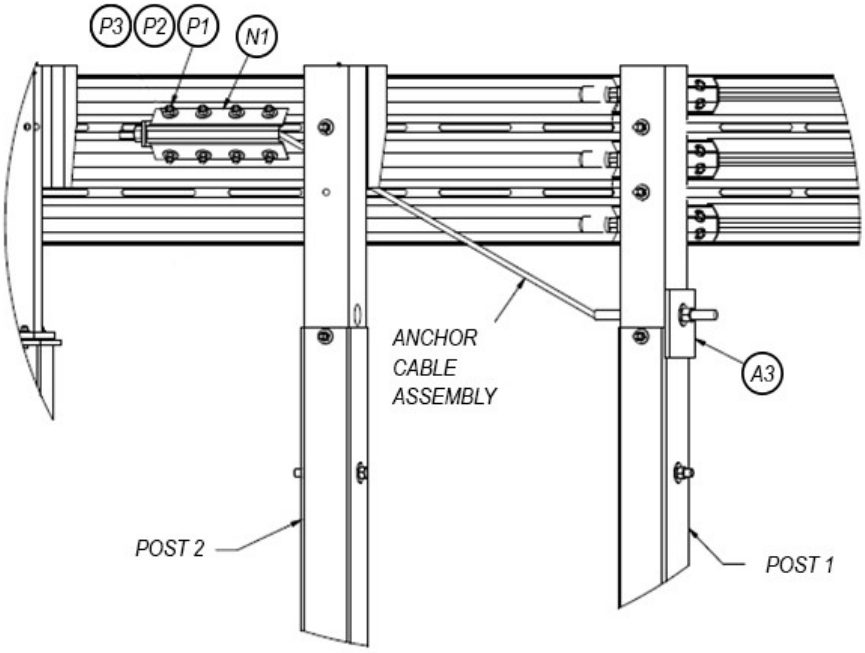


Figure 15 Photograph of Anchorage

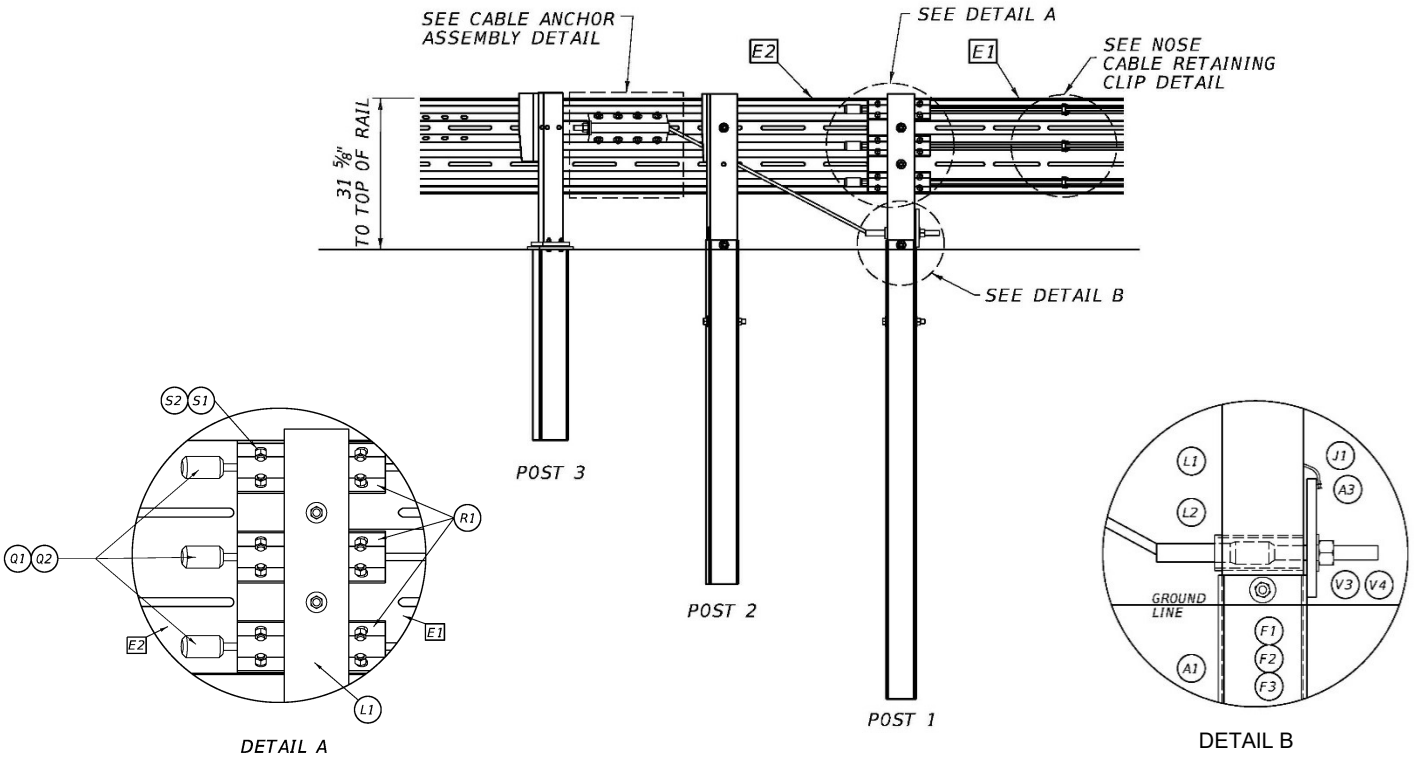


Figure 16 Diagram of Posts 1–3 and Anchorage

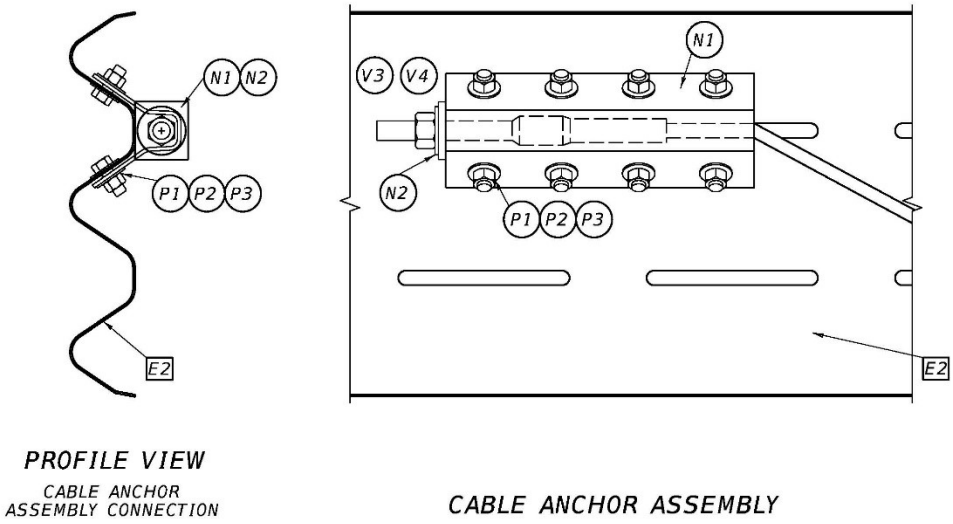


Figure 17 Diagram of Cable Anchor Assembly Profile View and Plan View

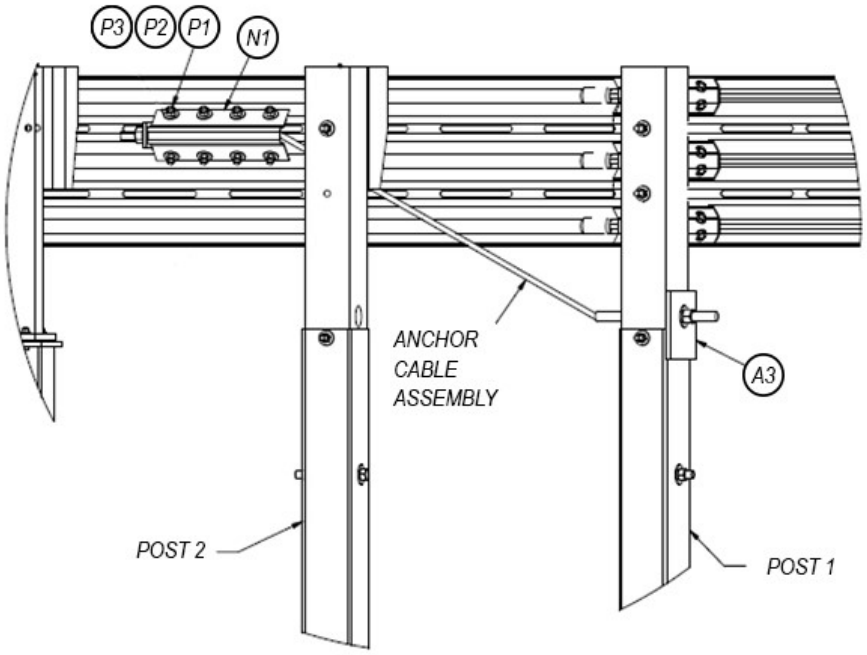


Figure 18 Diagram of Front Anchorage

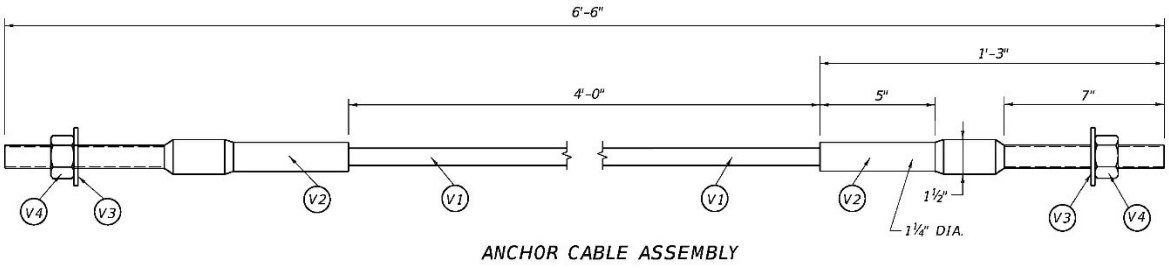


Figure 19 BCT Anchor Cable

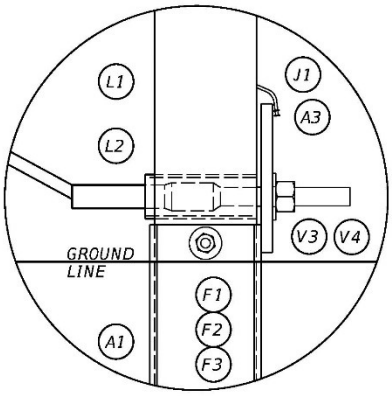


Figure 20 Post 1 Cable and Post Assembly

2.2.3 Guardrail

Four thrie-beam sections make up the bullnose system. The first three rail sections are cut with slots in the rail valleys to dissipate energy and manage rail deformation and kinking during impact. The fourth rail section is standard thrie-beam guardrail section with no slots. Beyond section 4, the guardrail transitions to either a modified thrie-beam (bullnose) guardrail section or uses a W-to-thrie transition section. All thrie-beam rail sections in the bullnose barrier consist of 12-gauge steel thrie beam, while the W-to-thrie transition is 10-gauge material. Rail segments are spliced with standard lap splices. Figure *21* depicts the four thrie-beam guardrail sections in an installed system.

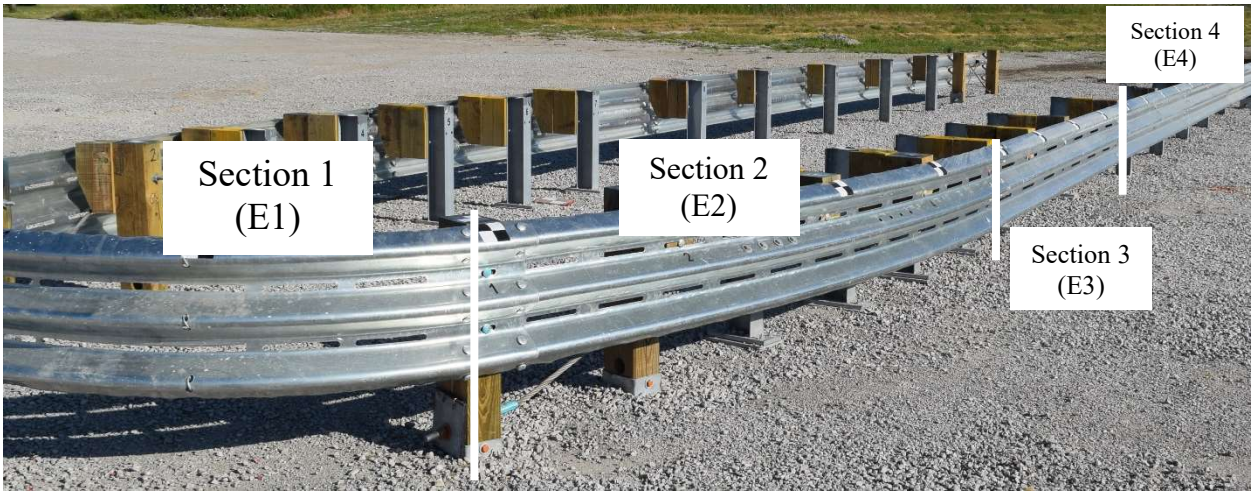
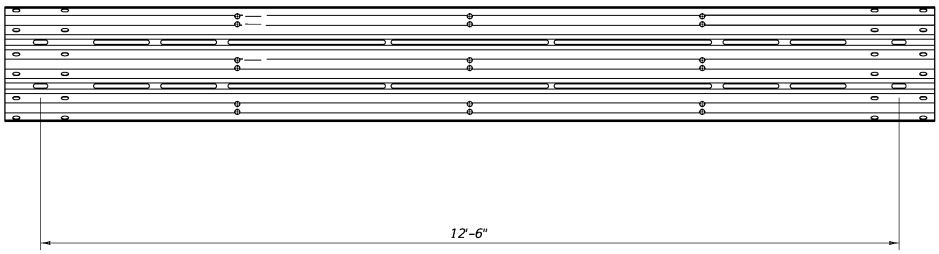


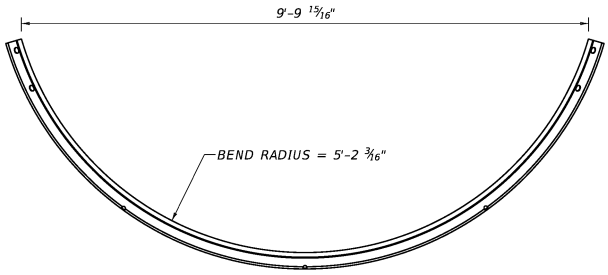
Figure 21 Installed Guardrail Sections 1–4

Guardrail Section 1 – Beam E1

Beam E1 makes up the system's nose and consists of a section 12 ft. 6 in. long that is bent into a 5 ft. $2^{3}/_{16}$ in. radius. This guardrail has three slots measuring 2 ft. 3½ in. (**Figure 22**).



ELEVATION VIEW NON-RADIUSED
SLOTTED THRIE BEAM RAIL E1

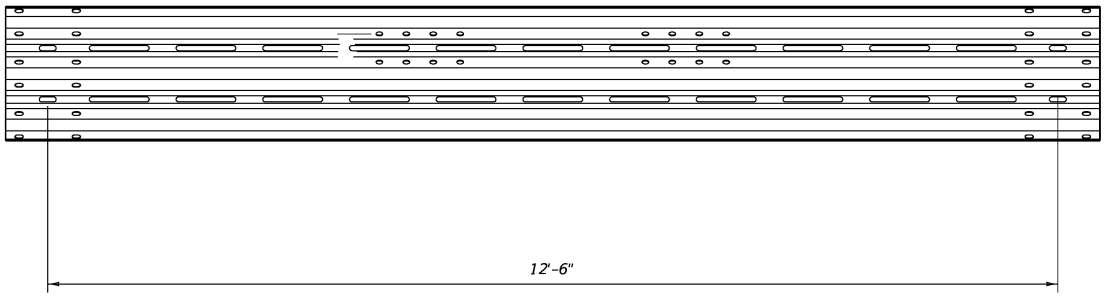


PLAN VIEW

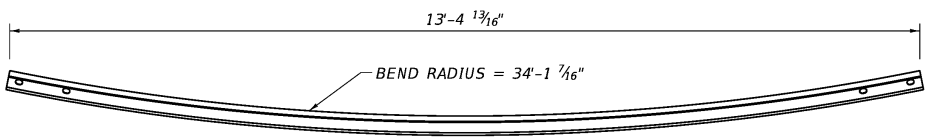
Figure 22 Guardrail Section 1 — Beam E1

Guardrail Section 2 – Beam E2

Beam E2 extends from posts 1 – 5 on each side of the bullnose system. It is bent to form a 34 ft. $1^{7}/_{16}$ in. radius curve and has 11 slots measuring ¾ in. x 8⅞ in. (**Figure 23**). KYTC standards allow for the use of an asymmetrical bullnose system (see Section 6.3). On asymmetrical bullnose system installations, the second rail section on the side of the bullnose opposite oncoming traffic is straight rather than curved, however, the rail slot pattern is unchanged.



ELEVATION VIEW NON-RADIUSED
SLOTTED THRIE BEAM RAIL E2



PLAN VIEW

Figure 23 Guardrail Section 2 — Beam E2

Guardrail Section 3 – Beam E3

Beam E3 extends from posts 5 – 8 on each side of the system. It consists of a 12 ft. 6 in. long thrie-beam guardrail section with six slots measuring ¾ in. x 11¾ in. long (**Figure 24**).

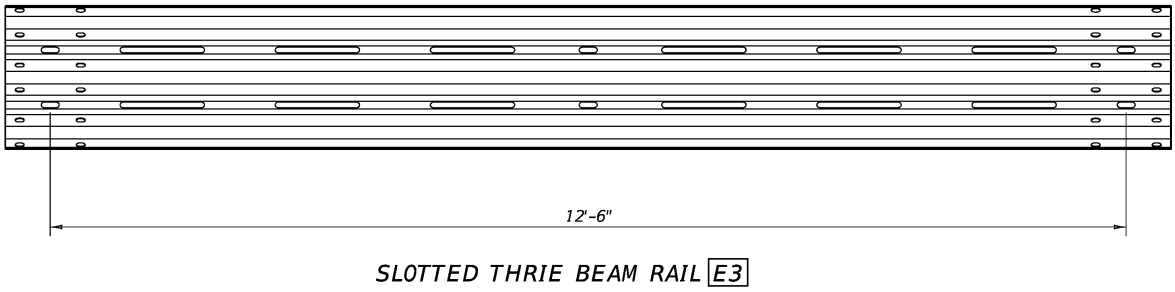


Figure 24 Guardrail Section 3 — Beam E3

Guardrail Section 4 – Beam E4

Beam E4 extends from posts 8 – 12 on each side of the system. It consists of a standard 12 ft. 6 in. long thrie-beam guardrail section with no slots (**Figure 25**).

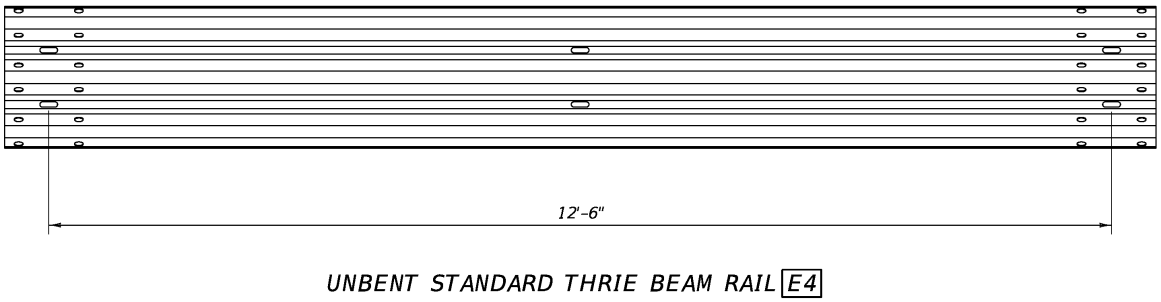


Figure 25 Guardrail Section 4

Transition Section

Beyond post 12, the guardrail can continue with either thrie-beam guardrail or transition to W-Beam guardrail. When continuing with thrie-beam guardrail, a modified thrie-beam (bullnose) shall be used. The rail height continues at $31^{5}/_{8}$ in.

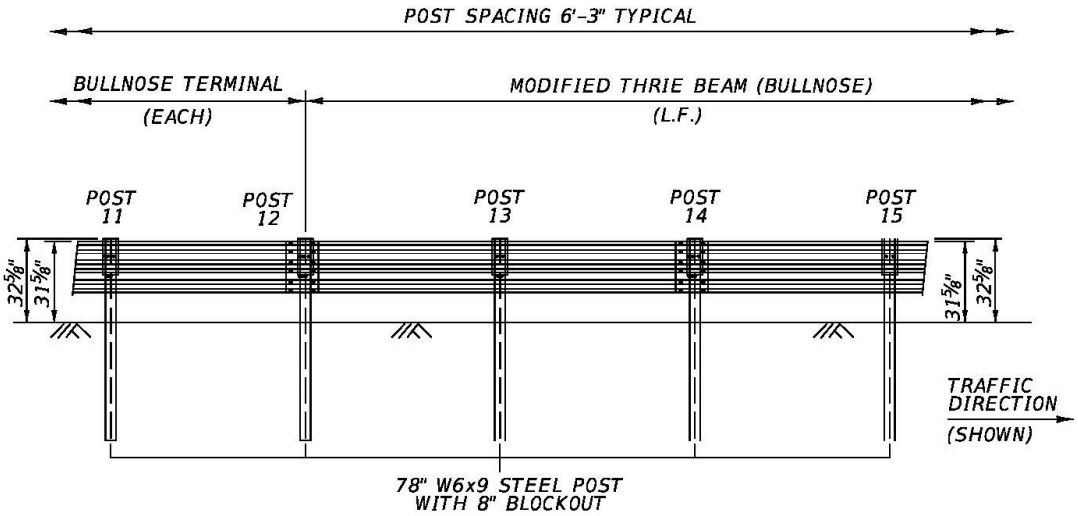


Figure 26 Bullnose Terminal to Modified Thrie-Beam (Bullnose)

For W-Beam installations, transition the rail using a thrie-beam connector followed by a standard W-Beam guardrail at $31^{5}/_{8}$ in. Then transition the rail to 31 in. with the next run of guardrail.

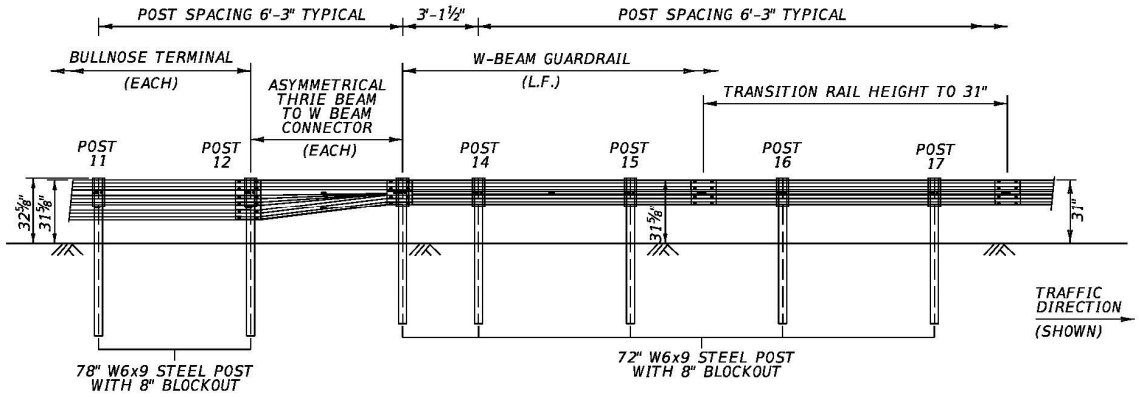


Figure 27 Bullnose to Standard W-Beam Guardrail

2.2.4 Nose Cables

A set of three steel cable retention devices must be located behind the system nose to contain impacting vehicles in the event of rail fracture. A 14 ft. 6 in. long by ⅝ in. diameter, 6x19 XIPS IWRC cable should be used behind the top, middle, and lower humps of the nose section of thrie-beam rail (**Figure 28** provides a schematic; **Figure 29** and **Figure 31** are photos of installed cables). **Figure 32** is a diagram of the nose cable attachment at post 1, while **Figure 33** offers an exploded view of the nose assembly.

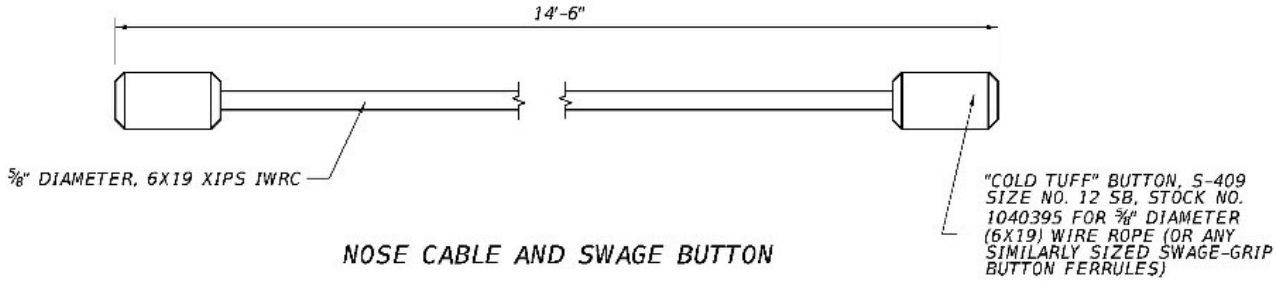


Figure 28 Nose Cable Diagram

Figure 29 Cables Lining System Nose (Back View)

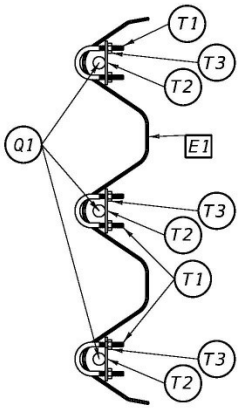


Figure 30 Nose Cable Retaining Clip

Figure 31 Nose Cable Attachment at Post 1

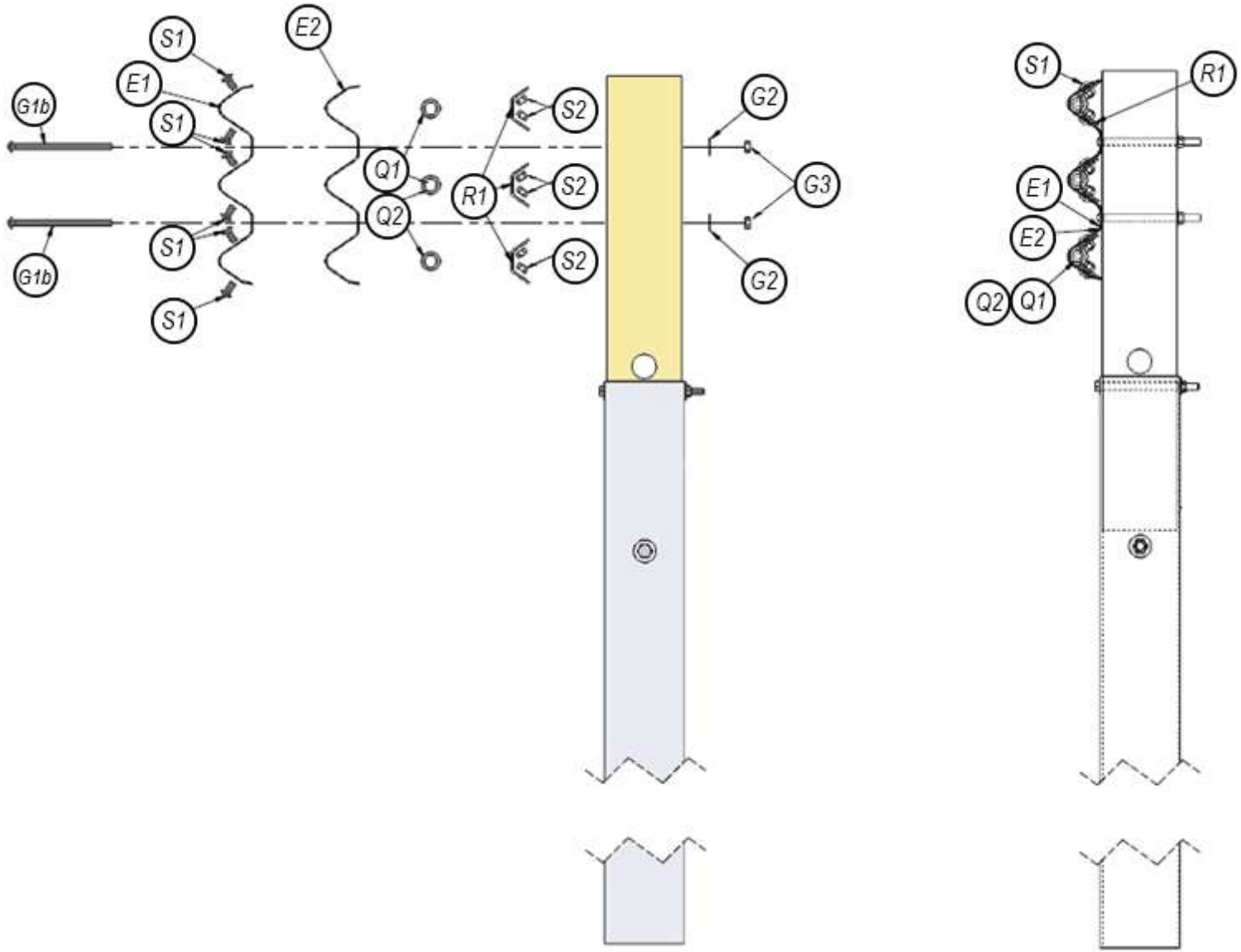


Figure 32 Rail at Post 1 — Exploded View and Detail

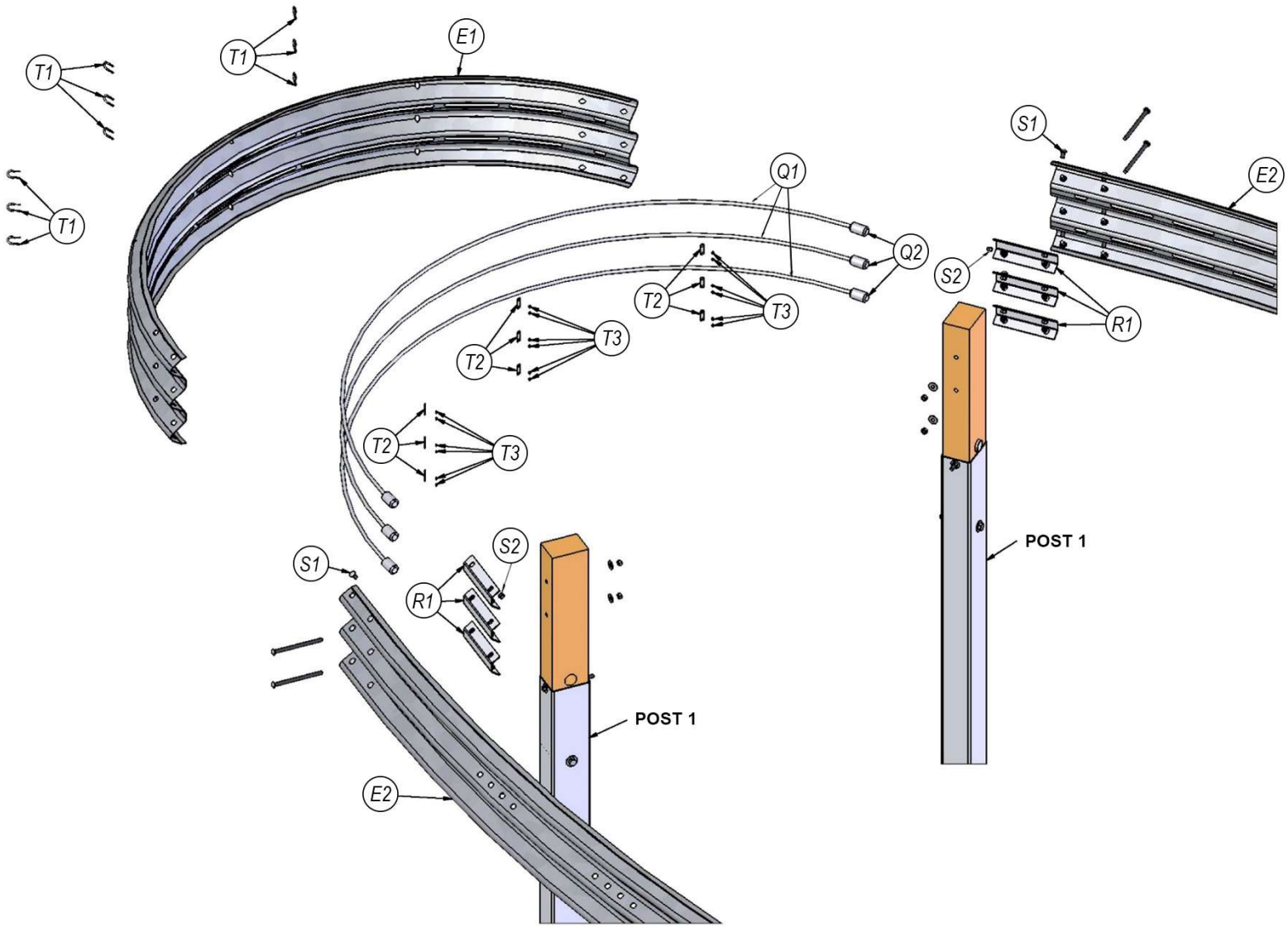


Figure 33 Nose Details — Exploded View

3 SITE PREPARATION/GRADING

3.1 Grading Limits

Terrain adjacent to the bullnose system must be graded properly before installation to ensure the system functions as designed.

The bullnose system should be installed on a pad with a maximum slope of 10H:1V, including the area for adjacent traffic in advance of the terminal. The 10H:1V slope area should extend at least 60 ft in front of the nose of the bullnose system so there is sufficient space to improve stable tracking of errant vehicles prior to impact. Both symmetrical bullnose system and asymmetrical bullnose system installation require the same grading (Figure 34) See the Thrie-Beam Bullnose Standard Drawing for details at twin structures.

For longitudinal slopes in advance of 10H:1V grading directly adjacent to the system nose, use a 10H:1V slope or flatter to transition to the ditch. Ensure drainage flows to inlets if required.

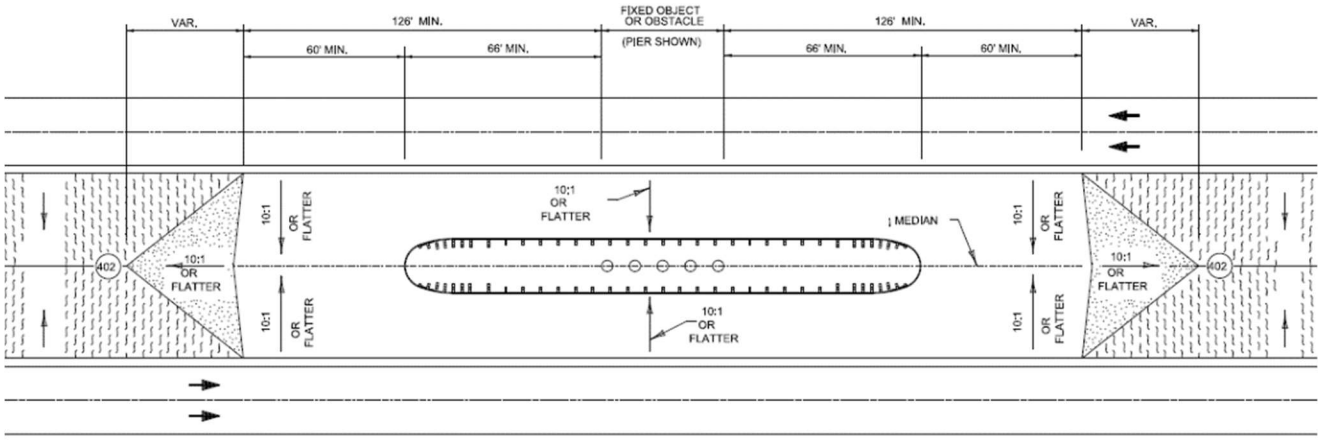


Figure 34 KYTC Grading Diagram

3.2 Working Widths

When preparing installation sites, be mindful of appropriate working widths and distances from the barrier system to an obstacle or other roadway elements. To prevent vehicles from contacting a shielded obstacle during head-on impacts with the bullnose system, a minimum longitudinal distance of 50 ft from post 5 (or four sections of thrie-beam guardrail downstream from post 5 of the system) is recommended in front of any obstacle (**Figure 35**). This is equivalent to 66 ft measured longitudinally from the center of the system's front section (Beam E1).

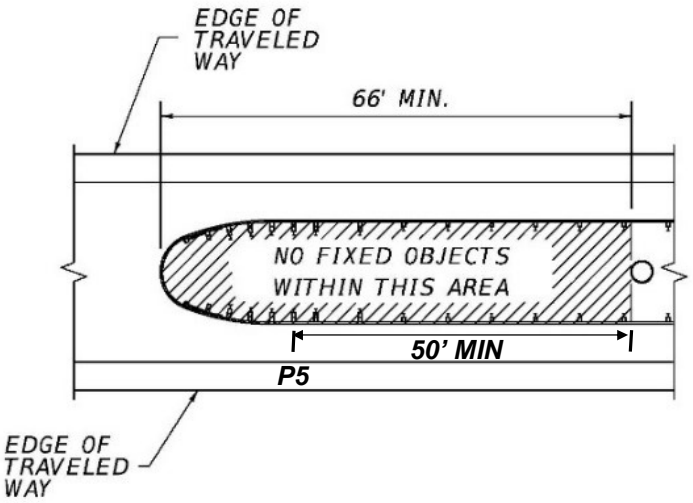


Figure 35 Distance to Obstacle Diagram

Outside the bullnose system limits, standard guardrail requirements shall apply. Working width (Figure 36) is the lateral clearance between the rail face and the face of the fixed object. For thrie-beam bullnose systems that transition to Midwest Guardrail System (MGS) or modified thrie-beam (bullnose) guardrail, use those systems' working widths to establish the lateral barrier offset to the obstacle. Table 6 lists working widths for multiple guardrails. For standard guardrail (beyond the limits of the steel thrie-beam bullnose), grading may be adjusted for drainage if at least 2 ft. of fill are placed behind the posts to maintain adequate system support.

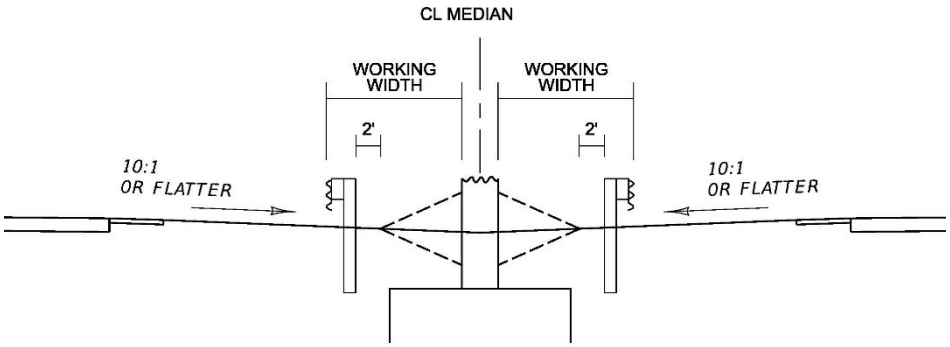


Figure 36 Grading Behind Thrie Beam

Table 6 Working Widths

Guardrail Type	Post Spacing	Working Width
Standard W-Beam	6’3”	5’
One Half Post Spacing W-Beam	3’ 1.5”	4’ 6”
Modified Thrie-Beam (Bullnose)	6’3”	4’ 6”
Standard Thrie-Beam	6’3”	4’6”

3.3 Materials

At the engineer’s discretion, within the bullnose terminal limits any of the following materials can be used:

- Earth and grass
- 6 in. of DGA with asphalt seal coat and asphalt seal aggregate
- 4 in. – 6 in. of #2 stone

4 INSTALLATION

4.1 Materials

Chapter 2 reviews details of system pay limits, basic system configuration, and the multiple parts and assemblies.

4.2 Recommended Tools

Use the following tools to install a bullnose system:

- Sockets/wrenches,
- Hammer
- Vice grips or pipe wrench
- Augers
- Tampers
- Post pounders (commonly used in driving guardrail posts)

Drift pins for installing rail splices may be useful for the system assembly as well. Use appropriate post driving techniques when driving posts and foundation tubes to prevent damage to their components. Contractors shall provide driving caps compatible with their equipment.

4.3 Installation Procedure

Major installation steps for bullnose systems are as follows:

A. Site preparation/grading
B. Determine system layout
C. Lay out materials
D. Splice rail sections, install nose cables, and assemble UBSPs
E. Install BCT posts
F. Install UBSPs
G. Install standard guardrail posts
H. Install blockouts and mount guardrail to posts
I. Install cable anchorage
J. Tighten connections and complete final inspection

Installers may complete these steps in a different order if each step is completed correctly.

4.3.1 Site Preparation and Grading

Chapter 3 discusses site preparation and grading.

4.3.2 Determine System Layout

The designer provides the location of the bullnose system relative to the roadway or obstacle being shielded. System layout can be determined using the relative position of system posts via coordinate geometry. Figure 37 is a diagram of the post layout and numbering scheme for a symmetrical bullnose terminal, with the origin starting at the center of post 5A.

Figure 38 shows post flange angle relative to the roadway for posts 1 – 5. Relative coordinates for post locations are listed in **Table 7** (both symmetrical and asymmetrical configurations). All dimensions and coordinates are measured to the center of guardrail posts. Site grading with the nose location staked out is shown in **Figure 39**.

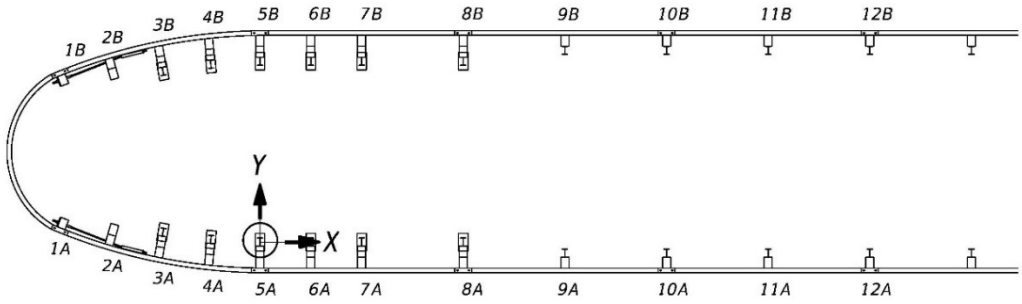
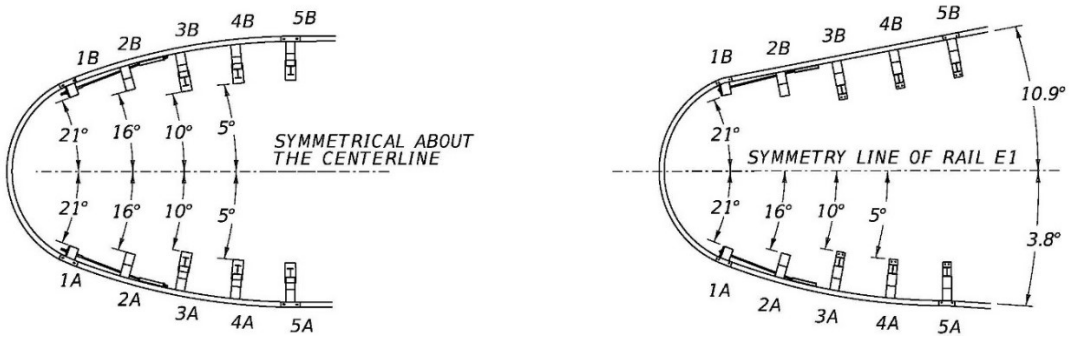


Figure 37 Guardrail Post Layout Schematic



Symmetrical Bullnose Asymmetrical Bullnose

Figure 38 Face of Post Flange Angle Relative to Roadway

Table 7 Coordinates for Post Layout

SYMMETRICAL BULLNOSE POST COORDINATES (APPROXIMATE)			
POST NUMBER	**X (FT, IN)**	**Y (FT, IN)**	**ANGLE OF POST (FLANGE FACE)**
12A	37' - 6"	- 0' - 8 1/8"	0
11A	31' - 3"	- 0' - 8 1/8"	0
10A	25' - 0"	- 0' - 8 1/8"	0
9A	18' - 9"	- 0' - 8 1/8"	0
8A	12' - 6"	- 0' - 8 1/8"	0
7A	6' - 3"	0' - 0"	0
6A	3' - 1 1/2"	0' - 0"	0
5A	0' - 0"	0' - 0"	0
4A	- 3' - 1/4"	0' - 2"	5
3A	- 5' - 11 5/8"	0' - 7 1/4"	10
2A	- 9' - 1/4"	0' - 9"	16
1A	- 12' - 1 3/8"	1' - 1 5/8"	21
1B	- 12' - 1 3/8"	9' - 10 3/4"	21
2B	- 9' - 1/4"	10' - 3 3/8"	16
3B	- 5' - 11 5/8"	10' - 5 1/8"	10
4B	- 3' - 1/4"	10' - 10 3/8"	5
5B	0' - 0"	11' - 3/8"	0
6B	3' - 1 1/2"	11' - 3/8"	0
7B	6' - 3"	11' - 3/8"	0
8B	12' - 6"	11' - 3/8"	0
9B	18' - 9"	11' - 8 1/2"	0
10B	25' - 0"	11' - 8 1/2"	0
11B	31' - 3"	11' - 8 1/2"	0
12B	37' - 6"	11' - 8 1/2"	0

ASYMMETRICAL BULLNOSE POST COORDINATES (APPROXIMATE)			
POST NUMBER	X (FT, IN)	Y (FT, IN)	ANGLE OF POST (FLANGE FACE)
12A	37' - 5 5/8"	- 3' - 2"	3.8
11A	31' - 3 1/8"	- 2' - 9"	3.8
10A	25' - 0"	- 2' - 4"	3.8
9A	18' - 9 1/8"	- 1' - 11"	3.8
8A	12' - 6 7/8"	- 0' - 10"	3.8
7A	6' - 4 1/4"	- 0' - 5 1/8"	3.8
6A	3' - 2 5/8"	- 0' - 2 5/8"	3.8
5A	0' - 0"	0' - 0"	0
4A	- 2' - 11 3/4"	0' - 1 5/8"	5
3A	- 5' - 11 3/4"	0' - 6 1/2"	10
2A	- 9' - 1/4"	0' - 7 5/8"	16
1A	- 12' - 1 1/2"	0' - 11 5/8"	21
1B	- 12' - 1 1/2"	10' - 7/8"	21
2B	- 9' - 1/8"	9' - 11 5/8"	10.9
3B	- 5' - 9 1/2"	10' - 0"	10.9
4B	- 2' - 8 5/8"	10' - 7"	10.9
5B	0' - 4 1/8"	11' - 2 1/8"	10.9
6B	3' - 5"	11' - 9 1/4"	10.9
7B	6' - 5 3/4"	12' - 4 3/8"	10.9
8B	12' - 7 1/2"	13' - 6 1/2"	10.9
9B	18' - 7 5/8"	15' - 4 1/2"	10.9
10B	24' - 9 1/4"	16' - 6 3/4"	10.9
11B	30' - 10 7/8"	17' - 8 7/8"	10.9
12B	37' - 1/2"	18' - 11 1/8"	10.9

Figure 39 Site Grading

4.3.3 Lay Out Materials

Lay out system materials in their approximate final locations. At a minimum, Section 1 (Beam E1) and Section 2 (E2) shall be laid out to ensure posts are installed in their proper locations.

Figure 40 Beams Laid Out (Unassembled)

Figure 41 Beams Loosely Connected as a System Template

Figure 42 Beams E1, E2A, and E2B Connected to the System Layout
The linestring marks the back of posts for installation.

4.3.4 Connect Nose Guardrail, Assemble UBSPs, and Install Nose Cables

Connect Guardrail

Depending on design complexity, connect necessary rail sections at the splices while on the ground before attaching them to posts. This creates a template for system layout. At a minimum, ensure section 1 (Beam E1) and both section 2s (Beams E2 A&B) are connected and positioned correctly. Do not fully tighten bolts until all components are assembled and the rail is mounted on the posts. Both rail section 2s (Beam E2 A&B) should have cable anchor bracket attachment holes located on the upper thrie-beam valley between posts 2 and 3 to facilitate proper installation of the cable anchorage later in the assembly process. For complex layouts (e.g., an asymmetrical bullnose or

installation in a horizontal curve or gore) the contractor may need to connect bullnose beams E1 – E4 to establish post locations.

Splice Lapping

Always orient lap splices based on the traffic flow on each side of the system so the upstream rail segment overlaps the downstream rail segment (**Figure 43**). For median installations, thrie-beam bullnose lap splicing should proceed in a continuous manner around the system in its entirety in the direction of oncoming traffic. For gore installations, lap splicing is reversed on one side to match the traffic direction.

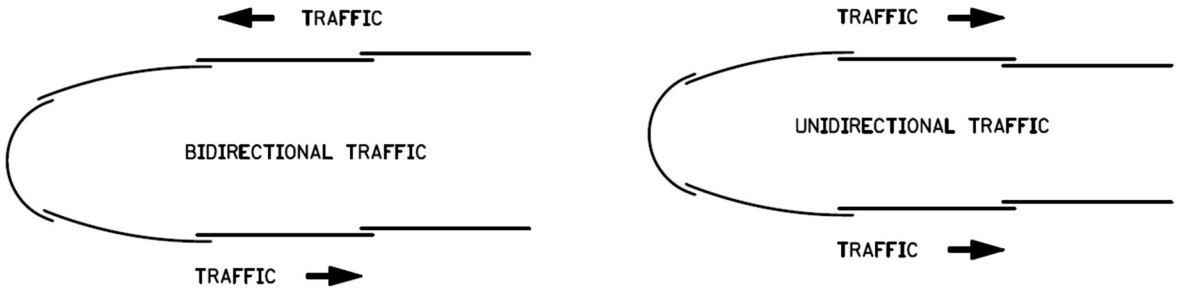


Figure 43 Lap Splicing Diagram

Assemble UBSPs

Assemble UBSPs with one upper UBSP assembly (plate and tube, parts C1, C2) and one lower UBSP assembly (plate and tube, parts B1, B2) per post. Bolt the upper and lower UBSP assemblies together using four hex bolts and nuts measuring $^{7}/_{16}$ in. diameter and 2¼ in. long (parts U1, U2, U3) (Figures 8 and 9). Install bolts connecting upper and lower base plates with nuts on the upper base plate so they can be accessed for maintenance. **Figure 44** shows assembled UBSPs.

Figure 44 UBSP Assembly

Install Nose Cables

Install the three nose cables on the back side of rail section 1 (beam E1) by securing the end of the cables behind the 12⅝ in. x $4^{7}/_{16}$ in. x $^{3}/_{16}$ in. nose cable anchor plates (part R1) located at the splice between rail sections 1 and 2 (Figure 45). Secure anchor plates with guardrail splice bolts. There is sufficient cable length for button ferrule ends on the cable to extend slightly past the anchor plates. Insert U-bolts, nuts, and washers (parts T1, T2, T3) at the middle and quarter points of rail section 1 to secure nose cables to the backsides of rail corrugations in rail section 1, ensuring the U-bolt radius is on the side of the guardrail facing traffic (Figure 45 –Figure 47).

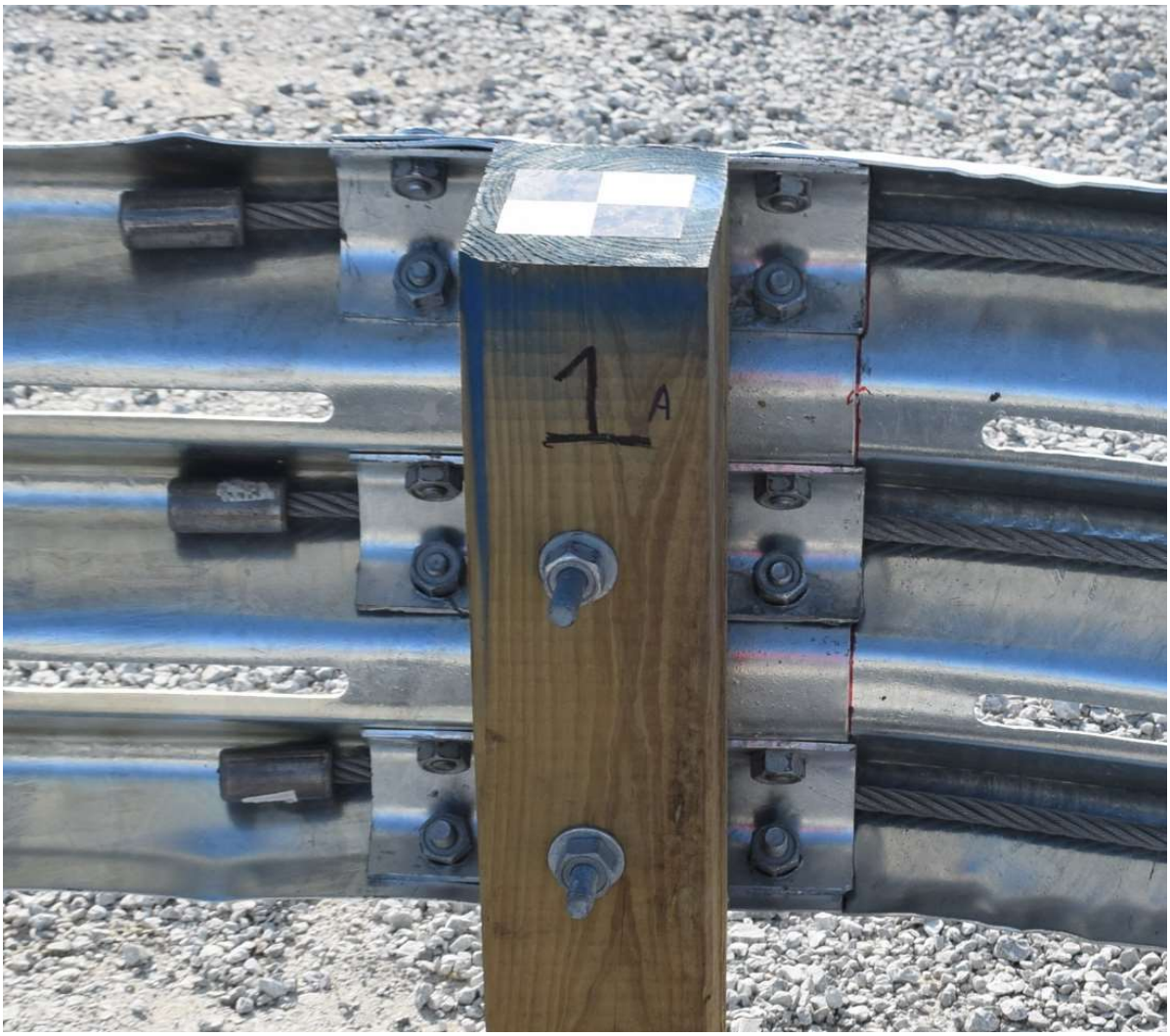


Figure 45 Nose Cable and Cable Anchor Plate Configuration

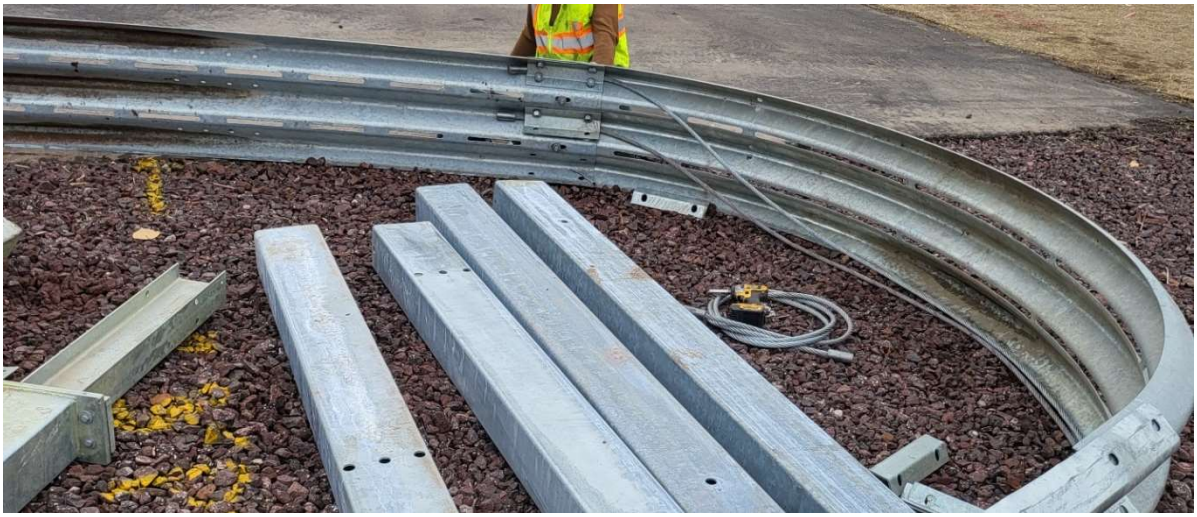


Figure 46 Partial Nose Cable Installation

Figure 47 Nose Cable U-Bolt Orientation

4.3.5 Install Breakaway Cable (BCT) Posts — Posts 1 and 2

Posts 1 and 2 are 3 ft. 10 in. long. BCT timber posts are inserted into foundation tubes 32 ⅝ in. above the ground. A 6 in. wide x 8 in. deep x 8 ft. long foundation tube is used for post 1, and a 6 in. wide x 8 in. deep x 6 ft. long foundation tube is used for post 2. Foundation tubes must be installed before inserting the timber post.

Tubes must be installed so the narrow sides face the rail. Using an appropriate driving cap, drive foundation tubes until their tops extend 2 in. above the ground. Figure 48 shows the driving process. Ensure that driven tubes do not fill with soil so timber posts can be inserted to the correct embedment depth. A ⅞ in -9 UNC, 8 in. long hex head bolt must be installed into the lower hole in the foundation tube and secured with nut and ⅞ in. washer (parts H1, H2, H3) prior to driving. This bolt prevents the BCT post from dropping to the bottom of the tube when installed.

Note: All bullnose posts may also be installed by auguring and backfilling if the contractor prefers. The initial hole must be large enough to allow adequate room for proper soil compaction during backfill.

Figure 48 Driving BCT Foundation Tubes

After foundation tubes are installed, insert timber BCT posts into the foundation tubes (parts A1 and A2) and secure with bolts and nuts. Insert a ⅝ in. 11 UNC, 10 in. long hex head bolt through upper hole in foundation tube and the bottom of each BCT post and secure with a nut and ⅝ in. diameter washer (parts F1, F2, F3).

Figure 49 Installation of BCT Post in Foundation Tube

4.3.6 Install UBSPs — Posts 3 through 8

Posts 3 – 8 are UBSPs consisting of assembled upper and lower UBSP sections. Drive assembled posts into the soil using an appropriate driving cap until the underside of the lower base plate is flush with the ground. **Figure 50** shows the driving process; **Figure 51** shows an installed UBSP.

Figure 50 Driving UBSPs

Figure 51 Installed UBSP

After driving the UBSP, inspect bolts connecting the post's top and bottom halves to verify they did not become damaged, loosened, or otherwise disengaged during post driving. Replace damaged or disengaged bolts and tighten loosened bolts.

4.3.7 Install Standard Steel Guardrail Posts — Posts 9 through 12

Posts 9 – 12 are W6x9 or W6x8.5 x 6 ft. 6 in. long steel guardrail posts (part M1) spaced at 6 ft. 3 in. on center. Drive steel posts into the soil using an appropriate driving cap. The top of the post should be 32⅝ in. above grade to facilitate a finished guardrail top mounting height of 31⅝ in.

NOTE: Rail height differs from standard guardrail.

4.3.8 Attach Blockouts and Install Guardrail

Begin mounting the guardrail and blockout installation at the nose of the system.

Post 1: Begin guardrail installation at post 1 by lifting preassembled rail sections 1 – 3 into position. Rail sections 1 and 2 may need to be temporarily supported vertically before attaching the rail to post 1. Post 1 does not use a blockout, so the guardrail should be attached directly to the post using two ⅝ in. -11 UNC, 10 in. long guardrail bolts and nuts and two ⅝ in. diameter plain round washers (parts G1b, G2, G3).

Post 2: Install the blockout and guardrail at post 2, which uses a tapered 6 in. x 8 in. x 14¼ in. timber blockout (part D3) (**Figure 52**). Install the blockout behind the guardrail and flush against the post. Pass one ⅝ in. -11 UNC, 18 in. long guardrail bolt through the front of the guardrail and through the blockout and post. Secure it with one nut and one ⅝ in. diameter plain round washer (parts G1a, G2, G3) at the back of the post. Insert one nail (part J1) through the top of the post and into the blockout at a downward angle to prevent blockout rotation.

Figure 52 Attaching Blockouts and Installing Guardrail

UBSPs: Install guardrail at UBSPs (posts 3 – 8), which use a combination of rectangular 6 in. x 8 in. x 14¼ in. blockouts (part D1) and tapered blockouts (part D2). Install the rectangular blockout behind the guardrail and flush against the post, with the tapered blockout attached to the adjacent blockout and to the back side of the thrie-beam rail. Pass one ⅝ in. -11 UNC, 18 in. long guardrail bolt (part G1a) through the front of the guardrail and through the tapered blockout, standard block-out, and post flange. Secure it with one nut (part G3) behind the post flange. Two nails (part J1) must be inserted at the top of the post and blockouts to prevent blockout rotation:

1. Insert one nail through the steel post flange into the rectangular blockout at a downward angle
2. Insert one nail through the top of the rectangular blockout and into the tapered blockout at a downward angle.

Steel Guardrail Posts with Thrie-Beam Guardrail: Install guardrail and blockouts on posts 9 – 12 (part M1). Install the 6 in. x 8 in. x 14¼ in. standard blockout (part D1) behind the guardrail and flush against the post. Pass one ⅝ in. -11 UNC, 10 in. long guardrail bolt (part G1b) through the front of the guardrail and through the blockout and post flange. Secure it with one nut (part G3) behind the post flange. Insert one nail (part J1) through the post flange and into the blockout at a downward angle to prevent blockout rotation. Install thrie-beam rail section 4 between posts 8 – 12.

4.3.9 Install Cable Anchor Anchorage

Attach the cable anchor to the back side of the upper thrie-beam valley on rail section 2 down-stream from post 2. Secure it using the cable anchor bracket assembly (part N1), eight ⅝ in. -11 UNCs, 1½ in. long hex head bolts (part P1), sixteen ⅝ in. diameter plain round washers (part P2),

and eight ⅝ in. nuts (part P3). The cable should pass below the tapered blockout at post 2. Insert the 2⅜ in. O.D. x 6 in. long BCT post sleeve (part L2) into the hole at the base of post 1. Place the 8 in. x 8 in. x ⅝ in. anchor bearing plate (part A3) on the upstream side of post 1. Orient the anchor bearing plate with the hole in the plate near the lower end of the plate vertically (5 in. of plate above the hole and 3 in. of plate below the hole) so the plate can be installed with the hole in the plate aligned with the hole in the BCT post with the plate entirely above grade. Pass the end of the cable through the BCT post sleeve in the base of post 1 and the anchor bearing plate. Secure it with one washer (part V3) and one 1 in. diameter hex nut (part V4) on each end of the cable. Tighten the cable anchor until the anchor cable is taut and has no slack. To prevent plate rotation in the field, install two nails (part J1) above the anchor plate and bent down over a portion of the plate (**Figure 53**).

Figure 53 Cable Anchorage Installation

4.3.10 Tighten Connections

Once all system components are assembled, tighten all connections, including all splice bolts, U-bolts, post bolts, and cable anchorages. Verify nose cables are tensioned.

4.3.11 Final Inspection

Complete the inspection checklist in Section 5. The contractor/installer must immediately address any items flagged in the checklist.

5 INSPECTION CHECKLIST

Inspection Performed By: _____ Date: _____

Location: _____

Rail	
	Rail is continuous.
	No vertical tears.
	No horizontal tears.
	No sections of flattened rail.
	No excessive deflection.
	No non-manufactured holes.
	Nominal height of rail is $31^{5}/_{8}$ in.
	No threaded ends of mechanical fasteners or washers on face of rail.
	Rail is secured — no separation at posts.
	Three cables are present in the nose section and anchored with anchor plates and U-bolts.
Splices	
	No missing splice bolts or bolts torn through the rail.
	All bolts secure and tightened.
	Splice lapping is consistent with direction of traffic.
	Splices in correct location.
Posts	
	No missing posts.
	No broken/damaged posts.
	Post spacing matches the standard.
	Posts are plumb.
	BCT wood posts installed per Specification Section.
	BCT foundation tubes installed per Specification Section.

	Universal Breakaway Steel Posts installed per Specification Section.
	Steel guardrail posts installed per Specification Section.
	Timber blockouts installed properly on all posts, including tapered blockouts adjacent to the rail at posts 2 – 8.
	No steel posts severely twisted.
	No tears in steel posts.
	Nuts/bolts secure.
	Non-breakaway components are no more than 4 in. above ground (includes foundation tubes for wood posts).
	No significant erosion around posts.
	Grading behind and in front of posts matches the standard.
Blockouts	
	No missing blockouts (at locations per standard).
	No significant section loss.
	No twisted/rotated blockouts.
Anchor Cable	
	Cable is properly installed between posts 1 and 3.
	Cable is taut.
	Cable anchor bracket is firmly attached to rail.
	Bearing plates are oriented with long side up and secured with bent-over nails.
General	
	All metallic components are free of significant rust or deterioration.
	All wooden materials are free of deterioration, rot, and excess damage.
	No slope-related lean of barrier.
	Nothing in front of the barrier could cause vehicle vaulting.
	Obstacles are located beyond the working width.
	Layout and grading match the Standard Drawings.

6 ADDITIONAL CONSIDERATIONS AND ALTERNATIVE CONFIGURATIONS

Actual installations of bullnose systems may involve dealing with site constraints and alternative installation methods not covered in the previous sections. The subsections below provide recommendations for implementing alternative configurations of the bullnose system. There are three foreseeable field applications for the bullnose barrier system:

- Protecting the gap between twin bridges
- Gore area protection
- Protecting narrow median obstacles, such as bridge piers and overhead sign support structures.

For each application, installation and design factors should be addressed before the system can be used properly. Additional considerations for each application are addressed below. For non-standard bullnose system installations not discussed in this chapter, see the KYTC Standard Drawings (Appendix A).

6.1 Breakaway Posts

Bolts used to hold the upper and lower sections of UBSPs together are potentially difficult to install/repair due to the lower base plate being flush with the ground. One solution is to use welded nuts on the lower base plate, eliminating the need for excavation. While this solution makes installation easier, removing fractured bolts is often difficult. It is up to end users to determine whether the welded nut option is appropriate.

6.2 Transitioning at Bridges Ends

The thrie-beam bullnose system is often attached directly to a thrie-beam guardrail transition when used to shield twin-bridge median locations. When attaching the bullnose system to the thrie-beam guardrail transition, consider both the length of the bullnose system required upstream as well as how the connection of the thrie-beam guardrail to the bridge is configured. Any transitions used in conjunction with the bullnose median terminal should be placed no closer than the end of rail section 4 or post 12. This should allow for the necessary deformation of the thrie-beam guardrail in advance of any transition.

Figure 54 is schematic of the proposed transition from the thrie-beam bullnose system to a bridge end using a standard thrie-beam guardrail transition. Contrary to Standard Drawings BHS-013 and BHS-014, if modified thrie-beam (bullnose) is used to connect a thrie-beam guardrail transition, the asymmetrical thrie-beam-to-W-beam connector is replaced with a 12 ft. 6 in. long thrie-beam rail with post spacing (**Figure 54**). Use 6 in. x 8 in. x 18 in. blockouts in this section of thrie beam. Beyond this, use standard blockouts for guardrail thrie-beam (Bullnose).

If curb is required for the thrie-beam guardrail transition, extend the curb to the end of the second thrie-beam rail from the bridge end. Taper the curb to a 4 in. height over the last 3 ft. 1½ in.

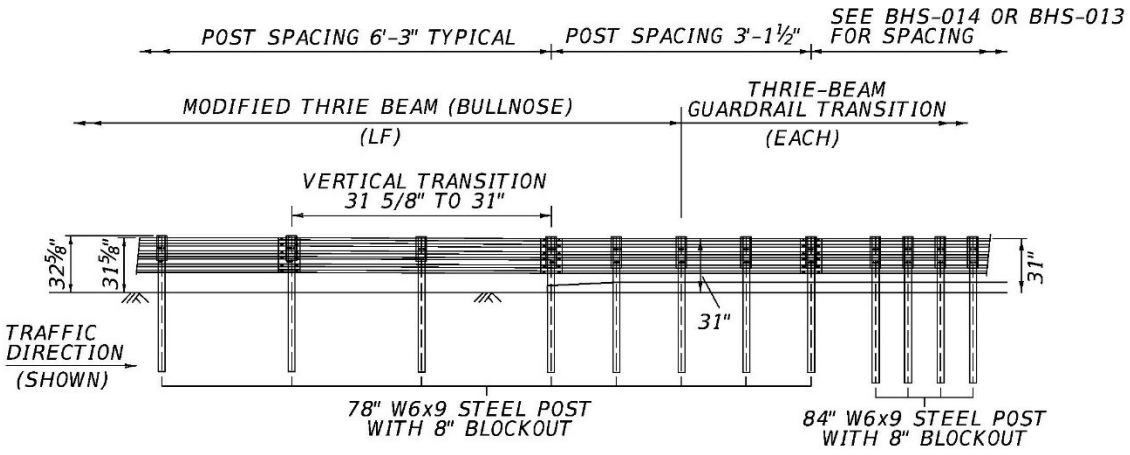


Figure 54 Thrie-Beam Bullnose Transition to Thrie-Beam Guardrail Transition

6.3 Flaring

Current guidance permits a 15:1 flare rate from approaching traffic, while opposing traffic shall have a 26:5 flare rate. Flares shall begin no sooner than the start of rail post 5. While the shape of rail section 2 should not be changed, it can be straightened to meet the specified flare rate. Such a configuration facilitates a smooth transition from the curved guardrail to the flare. **Figure 55** is a flared bullnose schematic from KYTC's standards.

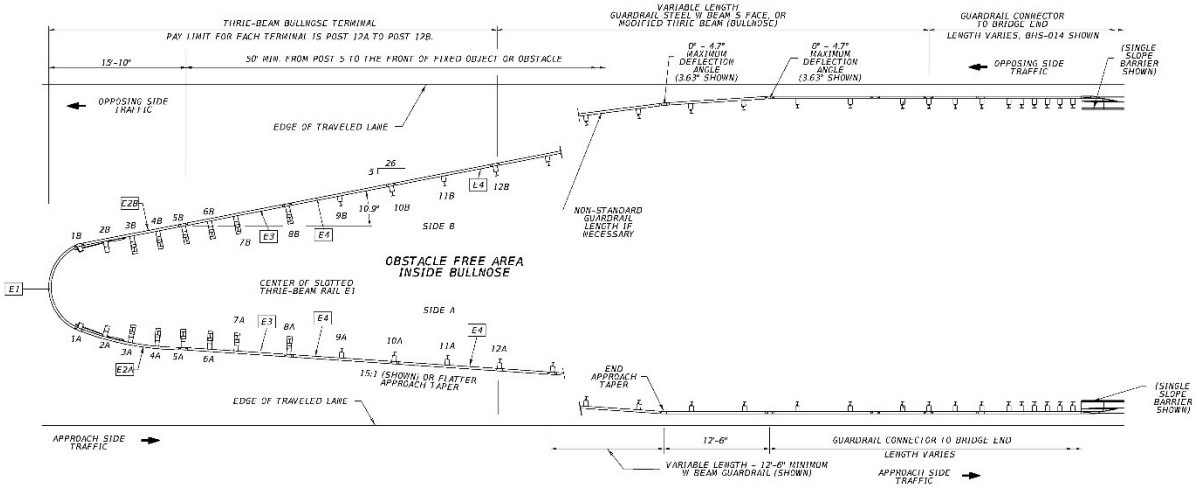


Figure 55 Flared Bullnose System

7 MAINTENANCE AND REPAIR

7.1 Maintenance

The bullnose system relies on components similar to those used on many existing guardrail systems. As such, maintenance guidance for the bullnose system should follow state guidance and procedures used for W-beam and thrie-beam guardrail systems.

7.2 Repair

Use the inspection checklist provided in Chapter 5 when inspecting a bullnose system for damage. Reinstallation of any components or portions of the bullnose system following a crash event inspection or maintenance inspection should follow procedures outlined in this manual.

Repair guidance in this manual applies to only the MASH TL-3 version of the bullnose system. Older versions of the bullnose system could exist but may differ from the MASH TL-3 version of the system in terms of rail sections, nose cables, timber breakaway posts, and other critical components.

7.2.1 Equipment Needed for Repair

The equipment used to repair bullnose systems is similar to equipment used for general guardrail repair. Hydraulic post removal equipment may be necessary to remove and replace damaged posts and foundation tubes.

Repair crews need bullnose-specific hardware to replace damaged portions of the system, including UBSP posts and bolts, bullnose timber blockouts, bullnose-specific curved and/or slotted rail sections, and other hardware not consistent with typical beam guardrail.

7.2.2 Additional Repair Guidance

Guidance in this section applies to the reuse of components that are found to be *undamaged* following a crash event inspection or maintenance inspection.

The lower half of a UBSP, including the tube and lower base plate, can be reused if the tube or base plate does not exhibit plastic or permanent deformation. Examples of plastic deformation include deformation of the base plate and/or hinging or buckling of the lower tube. Additionally, if the lower half of the UBSP is not deflected more than ½ in. in the soil, soil around the post base may be re-compacted and a new top section (i.e., post and upper base plate) mounted to the lower base plate to reset the post. Soil deflections greater than ½ in. require pulling the post base, checking for damage, and resetting the post. To measure deflection of the post in the soil, use a tape or ruler to measure the gap between the soil and the side of the lower tube on the post after impact. Alternatively, if the top of the post is out of plumb more than 1⅛ in., it indicates more than ½ in. of post displacement in the soil and requires pulling the post base, checking for damage, and resetting the post.

Foundation tubes at posts 1 and 2 may be reused if they do not exhibit plastic or permanent deformation and have not deflected in the soil more than ½ in. Soil deflections greater than ½ in. require pulling the foundation, checking for damage, and resetting the tube. If the foundation tube is permanently deformed, it should be replaced. BCT posts at posts 1 and 2 should be replaced following impacts that damage the post itself or displace the foundation tube in the soil over ½ in. Reinstall and re-tension the cable anchorage following resetting or reinstalling posts 1 and 2.

8 REFERENCES

1. *Manual for Assessing Safety Hardware* (MASH), *Second Edition*, American Association of State Highway and Transportation Officials (AASHTO), Washington, D.C., 2016.

2. Bielenberg, R.W., Faller, R.K., Stolle, C.S., "MASH TL-3 Development and Evaluation of the Thrie-Beam Bullnose Attenuator," Paper submitted to 18th IRF World Meeting & Exhibition, 2021.

3. Bielenberg, R.W., Faller, R.K., Ammon, T.J., Holloway, J.C., and Lechtenberg, K.A., *Phase I Testing of a Thrie-beam Bullnose with Breakaway Steel Posts (Test Nos. MSPBN-1, -2, and -3)*, Final Report, Report No. 03-389-20, Midwest Roadside Safety Facility, University of Nebraska-Lincoln, Lincoln, Nebraska, August 27, 2020.

4. Bielenberg, R.W., Faller, R.K., Ammon, T.J., Holloway, J.C., and Lechtenberg, K.A., *MASH Testing of Bullnose with Break Away Steel Posts (Test Nos. MSPBN-4 through MSPBN-8)*, Final Report, Report No. 03-418-20, Midwest Roadside Safety Facility, University of Nebraska-Lincoln, Lincoln, Nebraska, September 1, 2020.

Appendix A. KYTC Standard Plans

~ NOTES ~

(100) *ON THE PLAN SHEETS, THE DESIGNER MUST DOCUMENT THE APPROXIMATE STATION AND OFFSET, OR APPROXIMATE COORDINATES FOR THE CENTER OF POSTS 5A AND 5B. THESE VALUES ARE INTENDED TO SERVE AS GUIDANCE FOR CONSTRUCTION LAYOUT AND SHOULD ALLOW FOR TYPICAL CONSTRUCTION TOLERANCES. REFER TO SHEET 3 FOR INSTALLATION DETAILS AND BULLNOSE TERMINAL LAYOUT.*

(101) *U-BOLT CABLE CLIPS (3 PER CABLE) SPACED OUT ON NOSE, TO HOLD CABLE TO BACKSIDE OF THE RAIL.*

(102) *NOSE CABLE WITH SWAGGED END BUTTONS.*

(103) *NOSE CABLE ANCHOR BRACKET (BACKSIDE OF SPLICE).*

(104) *THE SLACK IN THE NOSE CABLES SHALL BE EVENLY DISTRIBUTED BETWEEN THE CABLE CLIP FASTENERS AND POST NO. 1 ON EITHER SIDE OF THE NOSE.*

(105) *MODIFIED THRIE-BEAM (BULLNOSE) MINIMUM WORKING WIDTH 4' - 6". GUARDRAIL-STEEL W BEAM-S FACE MINIMUM WORKING WIDTH 5' - 0".*

GRADING INSIDE W-BEAM GUARDRAIL OR MODIFIED THRIE-BEAM (BULLNOSE) GUARDRAIL BEYOND POST 12 MAY BE ADJUSTED FOR DRAINAGE, PROVIDED THERE IS A MINIMUM OF 2' OF FILL BEHIND THE POSTS TO ENSURE ADEQUATE SUPPORT FOR THE SYSTEM.

(106) *MINIMUM WIDTH OF SYSTEM FROM POST 5 TO POST 12 IS 14' - 9¼" MEASURED FROM FACE OF GUARDRAIL TO FACE OF GUARDRAIL.*

(107) *FIXED OBJECT OR OTHER OBSTACLE.*

108 *PARTS E1 THROUGH E4 ARE THRIE-BEAM RAILS. SEE SHEET 9 FOR DETAILS.*

- E1 *SLOTTED THRIE-BEAM RAIL (POST 1B TO POST 1A)*
- E2 *SLOTTED THRIE-BEAM RAIL (POST 1 TO POST 5)*
- E3 *SLOTTED THRIE-BEAM RAIL (POST 5 TO POST 8)*
- E4 *UNBENT STANDARD THRIE-BEAM RAIL (POST 8 TO POST 12 AND BEYOND POST 12 WHEN MODIFIED THRIE-BEAM (BULLNOSE) USED)*

(109) *BEYOND POST 12, EITHER MODIFIED THRIE-BEAM (BULLNOSE) OR W-BEAM GUARDRAIL MAY BE CONSTRUCTED. BOTH OPTIONS ARE PAID PER LINEAR FOOT. INDICATE THE SELECTED TYPE IN THE ROADWAY PLANS.*

(110) *MODIFIED THRIE-BEAM (BULLNOSE) IS SHOWN IN PLAN VIEW - TYPICAL BULLNOSE LAYOUT. TRANSITIONING TO W-BEAM GUARDRAIL WILL HAVE A DIFFERENT LAYOUT. SEE SHEET 4 DETAIL B.*

111 *SEE SHEET 6 FOR DETAILS ON THE INSTALLATION OF DELINEATOR REFLECTORS.*

112 *SEE SHEET 5 FOR MEDIAN GRADING.*

113 *THRIE-BEAM RAILS MAY NEED TO BE FIELD BENT TO FIT THE LOCATION.*

114 *IF ROCK IS ENCOUNTERED, REMOVE ROCK TO FULL DEPTH OF POST PLUS 2 1/2". MINIMUM DIAMETER OF THE ROCK REMOVAL IS 12" DIAMETER. BACKFILL WITH CUTTING SPOILS, PLACING GRANULAR MATERIAL, OR SMALL ROCK (#9 OR #57 STONE) IN THE BOTTOM 2 1/2" FOR DRAINAGE. THE REMOVAL OF ROCK AND BACKFILL MATERIAL IS INCIDENTAL.*

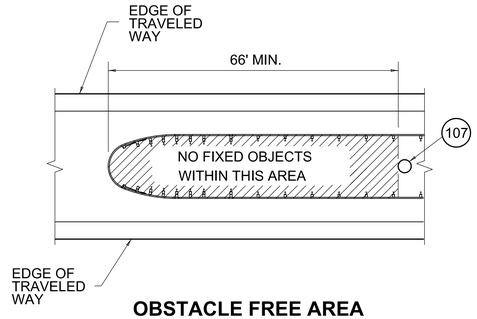
BID ITEMS AND UNIT TO BID

THRIE-BEAM BULLNOSE TERMINAL	*EACH*

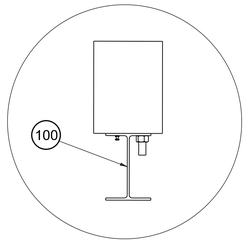
BID ITEMS AS APPLICABLE

GUARDRAIL-STEEL W BEAM-S FACE	*LF*
MODIFIED THRIE-BEAM (BULLNOSE)	*LF*
THRIE BEAM TO W BEAM CONNECTOR	*EACH*

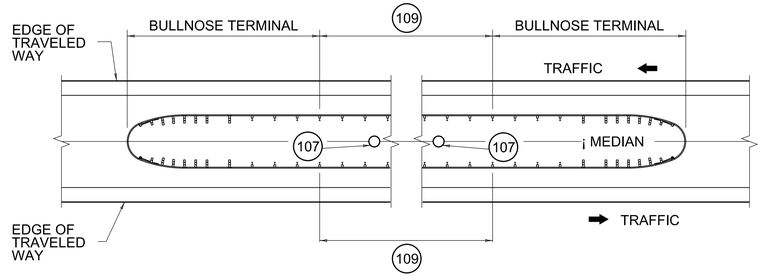
LAPPING DETAIL



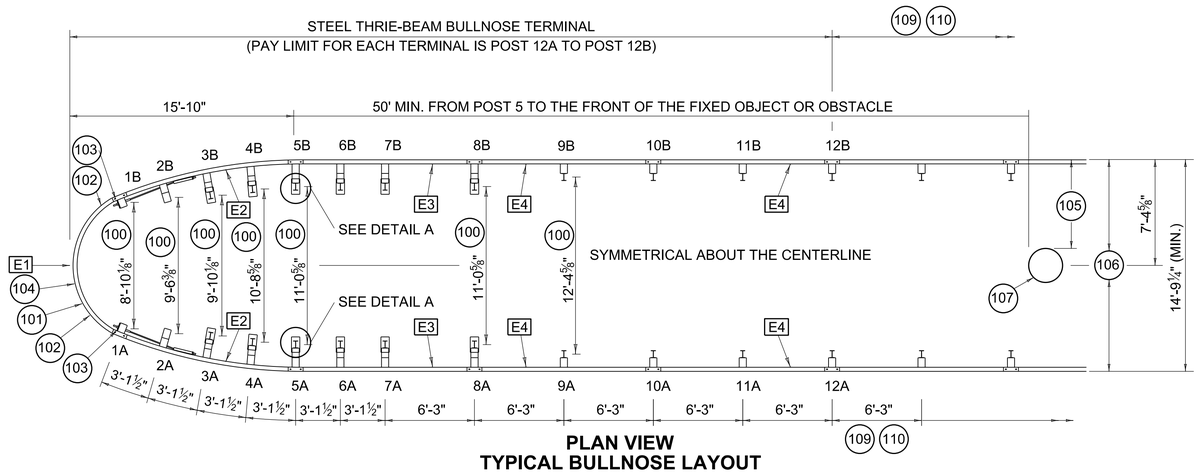
OBSTACLE FREE AREA INSIDE BULLNOSE



DETAIL A



MEDIAN FIXED OBJECT SHIELDING PAY LIMITS



PLAN VIEW
TYPICAL BULLNOSE LAYOUT

REVISION DATE: 08/11/2025
REVISION NUMBER: 0

SUBMITTED — DIVISION DIRECTOR — DATE 08-11-2025
APPROVED — STATE HIGHWAY ENGINEER — DATE 08-11-2025

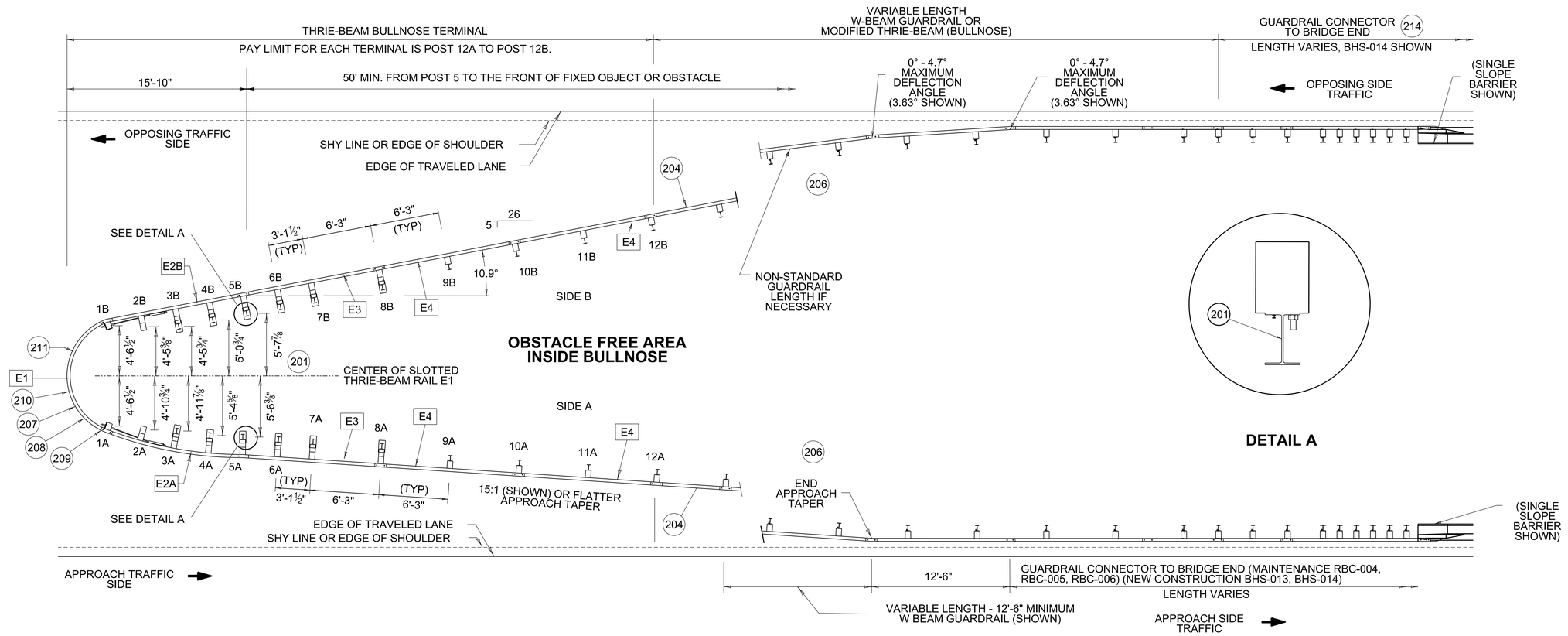
BARRIERS

COMMONWEALTH OF KENTUCKY
DEPARTMENT OF HIGHWAYS
TEAM KENTUCKY TRANSPORTATION CABINET

STEEL THRIE-BEAM BULLNOSE TERMINAL

SHEET 001: SYMMETRICAL BULLNOSE

STANDARD DRAWING NUMBER
RBE-210



TYPICAL LAYOUT FOR ASYMMETRICAL BULLNOSE FOR SYSTEM WIDTHS GREATER THAN 24'

~ NOTES ~

(201) *DIMENSIONS ARE MEASURED FROM THE CENTER OF SLOTTED THRIE-BEAM RAIL E1 TO THE CENTER OF EACH GUARDRAIL POST.*

ON THE PLAN SHEETS, THE DESIGNER MUST DOCUMENT THE APPROXIMATE STATION AND OFFSET, OR APPROXIMATE COORDINATES FOR THE CENTER OF POSTS 5A AND 5B. THESE VALUES ARE INTENDED TO SERVE AS GUIDANCE FOR CONSTRUCTION LAYOUT AND SHOULD ALLOW FOR TYPICAL CONSTRUCTION TOLERANCES. REFER TO SHEET 3 FOR INSTALLATION DETAILS AND BULLNOSE TERMINAL LAYOUT.

202 *SAW, DRILL, OR PUNCH THE RAIL AS REQUIRED. DO NOT TORCH-CUT. REPAIR GALVANIZED COATINGS IN ACCORDANCE WITH ASTM A780 (THIS IS INCIDENTAL). SPACING BETWEEN INDIVIDUAL POSTS FROM POST 1 TO POST 7 IS 3'-1½"*

203 *PARTS E1 THROUGH E4 ARE THRIE-BEAM RAILS. SEE SHEET 9 FOR DETAILS.*

- E1 *SLOTTED THRIE-BEAM RAIL (POST 1B TO POST 1A)*
- E2 *SLOTTED THRIE-BEAM RAIL (POST 1 TO POST 5) WITH A RADIAL OPTION ON THE APPROACH SIDE AND A TANGENT OPTION ON THE OPPOSING SIDE.*
- E3 *SLOTTED THRIE-BEAM RAIL (POST 5 TO POST 8)*
- E4 *UNBENT STANDARD THRIE-BEAM RAIL (POST 8 TO POST 12, AND BEYOND POST 12 WHEN MODIFIED THRIE-BEAM (BULLNOSE) USED)*

(204) *BEYOND POST 12, EITHER MODIFIED THRIE-BEAM (BULLNOSE) OR W-BEAM GUARDRAIL MAY BE CONSTRUCTED. BOTH OPTIONS ARE PAID PER LINEAR FOOT. INDICATE THE SELECTED TYPE IN THE ROADWAY PLANS.*

FOR WIDER MEDIANS, TAPER THE OPPOSING TRAFFIC SIDE BEFORE TAPERING THE APPROACH TRAFFIC SIDE, AS SHOWN.

EXTEND THE RAIL BEYOND POST 12 AT A TAPER RATE OF 15:1 OR FLATTER ON THE APPROACH SIDE, AND UP TO A MAXIMUM TAPER RATE OF 26:5 ON THE OPPOSING TRAFFIC SIDE, AS NEEDED. THE LENGTH OF EXTENSION WILL VARY BASED ON MEDIAN WIDTH OR WORKING WIDTH REQUIREMENTS.

205 *SEE SHEET 5 FOR MEDIAN GRADING.*

(206) *MODIFIED THRIE-BEAM (BULLNOSE) MINIMUM WORKING WIDTH 4' - 6". GUARDRAIL-STEEL W BEAM-S FACE MINIMUM WORKING WIDTH 5' - 0".*

GRADING INSIDE W-BEAM GUARDRAIL OR MODIFIED THRIE-BEAM (BULLNOSE) GUARDRAIL BEYOND POST 12 MAY BE ADJUSTED FOR DRAINAGE, PROVIDED THERE IS A MINIMUM OF 2' OF FILL BEHIND THE POSTS TO ENSURE ADEQUATE SUPPORT FOR THE SYSTEM.

(207) *U-BOLT CABLE CLIPS (3 PER CABLE) SPACED OUT ON NOSE, TO HOLD CABLE TO BACKSIDE OF THE RAIL.*

(208) *NOSE CABLE WITH SWAGGED END BUTTONS.*

(209) *NOSE CABLE ANCHOR BRACKET (BACKSIDE OF SPLICE).*

(210) *THE SLACK IN THE NOSE CABLES SHALL BE EVENLY DISTRIBUTED BETWEEN THE CABLE CLIP FASTENERS AND POST NO. 1 ON EITHER SIDE OF THE NOSE.*

(211) *BEND THE RAIL IN THE FIELD AS NEEDED TO MAKE CONNECTIONS. THE MAXIMUM DEFLECTION ANGLE IS 4.7° (3.63° SHOWN).*

212 *IF ROCK IS ENCOUNTERED, REMOVE ROCK TO FULL DEPTH OF POST PLUS 2 1/2". MINIMUM DIAMETER OF THE ROCK REMOVAL IS 12" DIAMETER. BACKFILL WITH CUTTING SPOILS, PLACING GRANULAR MATERIAL, OR SMALL ROCK (#9 OR #57 STONE) IN THE BOTTOM 2 1/2" FOR DRAINAGE. THE REMOVAL OF ROCK AND BACKFILL MATERIAL IS INCIDENTAL.*

213 *SEE SHEET 6 FOR DETAILS ON THE INSTALLATION OF DELINEATOR REFLECTORS.*

(214) *GUARDRAIL CONNECTOR TO BRIDGE END. FOR NEW CONSTRUCTION USE BHS-013 OR BHS-014. FOR MAINTENANCE ONLY RBC-004, RBC-005, RBC-006.*

BID ITEM AND UNIT TO BID

THRIE-BEAM BULLNOSE TERMINAL	*EACH*

BID ITEMS AS APPLICABLE

MODIFIED THRIE-BEAM (BULLNOSE)	*LF*
GUARDRAIL-STEEL W BEAM-S FACE	*LF*
THRIE BEAM TO W BEAM CONNECTOR	*EACH*
THRIE-BEAM GUARDRAIL TRANSITION TL-3	*EACH*
THRIE-BEAM GUARDRAIL TRANSITION TL-2	*EACH*

REVISION DATE: 08/11/2025
REVISION NUMBER: 0

SUBMITTED — DIVISION DIRECTOR — 08-11-2025 DATE

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BARRIERS

COMMONWEALTH OF KENTUCKY
DEPARTMENT OF HIGHWAYS
TEAM KENTUCKY TRANSPORTATION CABINET

STEEL THRIE-BEAM BULLNOSE TERMINAL

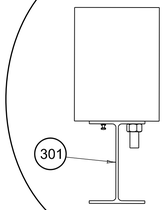
SHEET 002: ASYMMETRICAL BULLNOSE

STANDARD DRAWING NUMBER
RBE-210

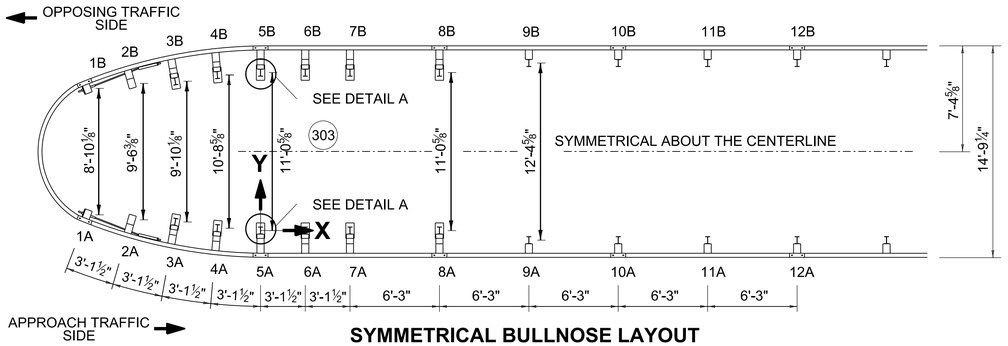
BULLNOSE TERMINAL INSTALLATION LAYOUT GUIDE

SYMMETRICAL BULLNOSE POST COORDINATES (APPROXIMATE)			
POST NUMBER	X (FT, IN)	Y (FT, IN)	ANGLE OF POST (FLANGE FACE)
12A	37' - 6"	- 0' - 8 1/8"	0
11A	31' - 3"	- 0' - 8 1/8"	0
10A	25' - 0"	- 0' - 8 1/8"	0
9A	18' - 9"	- 0' - 8 1/8"	0
8A	12' - 6"	0' - 0"	0
7A	6' - 3"	0' - 0"	0
6A	3' - 1 1/2"	0' - 0"	0
5A	0' - 0"	0' - 0"	0
4A	- 3' - 1/4"	0' - 2"	5
3A	- 5' - 11 5/8"	0' - 7 1/4"	10
2A	- 9' - 1/4"	0' - 9 "	16
1A	- 12' - 1 3/8"	1' - 1 5/8"	21
1B	- 12' - 1 3/8"	9' - 10 3/4"	21
2B	- 9' - 1/4"	10' - 3 3/8"	16
3B	- 5' - 11 5/8"	10' - 5 1/8"	10
4B	- 3' - 1/4"	10' - 10 3/8"	5
5B	0' - 0"	11' - 3/8"	0
6B	3' - 1 1/2"	11' - 3/8"	0
7B	6' - 3"	11' - 3/8"	0
8B	12' - 6"	11' - 3/8"	0
9B	18' - 9"	11' - 8 1/2"	0
10B	25' - 0"	11' - 8 1/2"	0
11B	31' - 3"	11' - 8 1/2"	0
12B	37' - 6"	11' - 8 1/2"	0

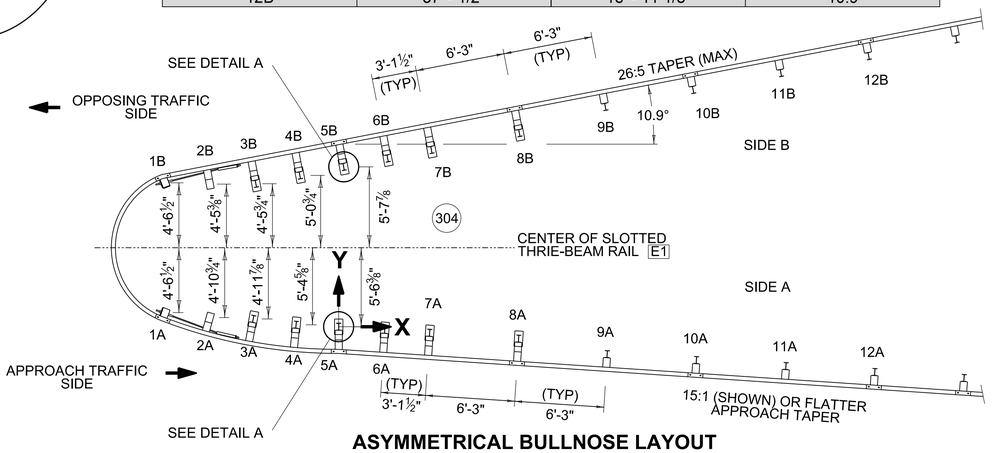
DETAIL A



ASYMMETRICAL BULLNOSE POST COORDINATES (APPROXIMATE)			
POST NUMBER	X (FT, IN)	Y (FT, IN)	ANGLE OF POST (FLANGE FACE)
12A	37' - 5 5/8"	- 3' - 2"	3.8
11A	31' - 3 1/8"	- 2' - 9"	3.8
10A	25' - 0"	- 2' -4"	3.8
9A	18' - 9 1/8"	- 1' - 11"	3.8
8A	12' - 6 7/8"	- 0' - 10"	3.8
7A	6' - 4 1/4"	- 0' - 5 1/8"	3.8
6A	3' - 2 5/8"	- 0' - 2 5/8"	3.8
5A	0' - 0"	0' - 0"	0
4A	- 2' - 11 3/4"	0' - 1 5/8"	5
3A	- 5' - 11 3/4"	0' - 6 1/2"	10
2A	- 9' - 1/4"	0' - 7 5/8"	16
1A	- 12' - 1 1/2"	0' - 11 5/8"	21
1B	- 12' - 1 1/2"	10' - 7/8"	21
2B	- 9' - 1/8"	9' - 11 5/8"	10.9
3B	- 5' - 9 1/2"	10' - 0"	10.9
4B	- 2' - 8 5/8"	10' - 7"	10.9
5B	0' - 4 1/8"	11' - 2 1/8"	10.9
6B	3' - 5"	11' - 9 1/4"	10.9
7B	6' - 5 3/4"	12' - 4 3/8"	10.9
8B	12' - 7 1/2"	13' - 6 1/2"	10.9
9B	18' - 7 5/8"	15' - 4 1/2"	10.9
10B	24' - 9 1/4"	16' - 6 3/4"	10.9
11B	30' - 10 7/8"	17' - 8 7/8"	10.9
12B	37' - 1/2"	18' - 11 1/8"	10.9



SYMMETRICAL BULLNOSE LAYOUT



ASYMMETRICAL BULLNOSE LAYOUT

~ NOTES ~

300 *ON THE PLAN SHEETS, THE DESIGNER MUST DOCUMENT THE APPROXIMATE STATION AND OFFSET, OR APPROXIMATE COORDINATES FOR THE CENTER OF POSTS 5A AND 5B. THESE VALUES ARE INTENDED TO SERVE AS GUIDANCE FOR CONSTRUCTION LAYOUT AND SHOULD ALLOW FOR TYPICAL CONSTRUCTION TOLERANCES.*

301 *DIMENSIONS ARE MEASURED TO THE CENTER OF GUARDRAIL POSTS. REFER TO DETAIL A FOR ADDITIONAL INFORMATION. THE CONTRACTOR SHALL LAYOUT THE BULLNOSE TERMINAL IN THE FIELD USING THE STATION AND OFFSET (OR OTHER LOCATION INFORMATION) FOR POST 5A, ENSURING A MINIMUM LENGTH OF 50' FROM POST 5 TO THE FRONT OF THE FIXED OBJECT OR OBSTACLE. POST COORDINATES IN THE TABLES ABOVE MAY BE USED TO LAYOUT THE REMAINING POSTS. NORMAL CONSTRUCTION TOLERANCES APPLY.*

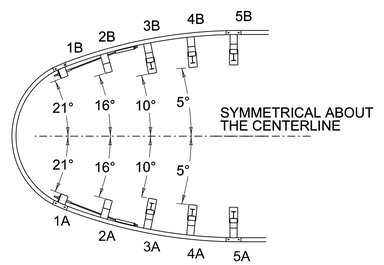
302 *TO ASSIST WITH LAYING OUT THE BULLNOSE TERMINAL, ASSEMBLE THE E1 BEAM AND E2 BEAMS (WITHOUT ATTACHING TO THE POSTS) TO SERVE AS AN ON-THE-GROUND TEMPLATE FOR THE TERMINAL SYSTEM. DURING THIS DEMONSTRATION ASSEMBLY, POST LOCATIONS MAY BE ADJUSTED TO MATCH THE LAYOUT. ERECT THE RAIL ELEMENTS TO FORM A SMOOTH, CONTINUOUS RAIL AS SHOWN IN THE PLANS AND STANDARD DRAWINGS. SET POSTS PLUMB AND ACCURATELY ALIGNED AND SPACED. KYTC WILL REVIEW THE LAYOUT PRIOR TO THE CONTRACTOR DRIVING POSTS.*

303 *FOR THE SYMMETRIC BULLNOSE, LAYOUT AND ANGLE DIMENSIONS FOR POST 1-5 ARE MEASURED FROM THE CENTER OF THE POSTS ON SIDE A TO THE CENTER OF POSTS ON SIDE B.*

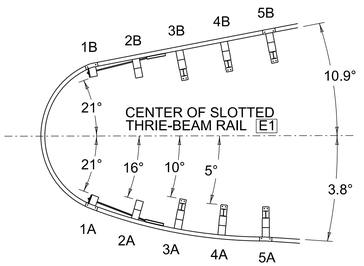
304 *FOR THE ASYMMETRIC BULLNOSE, LAYOUT AND ANGLE DIMENSIONS FOR POST 1-5 ARE MEASURED FROM THE CENTER OF SLOTTED THRIE-BEAM RAIL E1 TO THE CENTER OF EACH GUARDRAIL POST.*

305 *POSTS LABELED AS 'A' SHALL BE ALIGNED TO THE APPROACH TRAFFIC SIDE. THE ABOVE CHARTS SHALL BE MIRRORED ACCORDINGLY IF PLACED IN A DIFFERENT ORIENTATION. THE CHART SPACING SHALL STILL APPLY.*

306 *FOR ADDITIONAL ASSEMBLY INFORMATION, SCAN THE QR CODE TO ACCESS THE MASH BULLNOSE INSTALLATION MANUAL.*



SYMMETRICAL POST ANGLE (APPROX.)



ASYMMETRICAL POST ANGLE (APPROX.)

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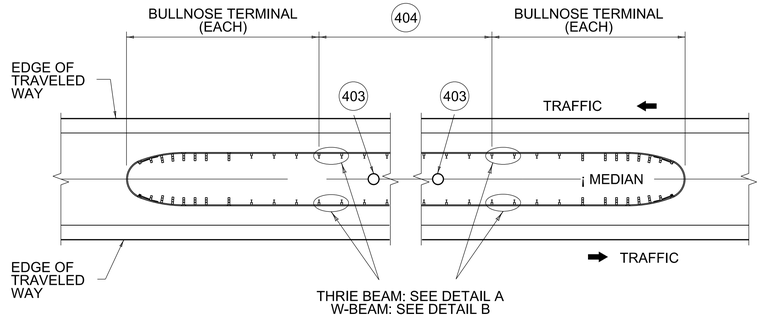
BARRIERS

COMMONWEALTH OF KENTUCKY
DEPARTMENT OF HIGHWAYS
TEAM KENTUCKY TRANSPORTATION CABINET

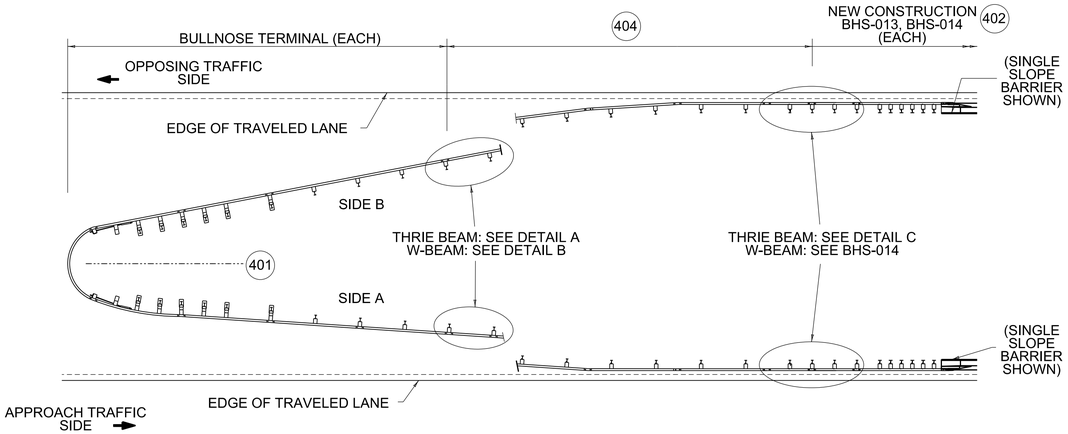
STEEL THRIE-BEAM BULLNOSE TERMINAL

SHEET 003: BULLNOSE TERMINAL INSTALLATION LAYOUT

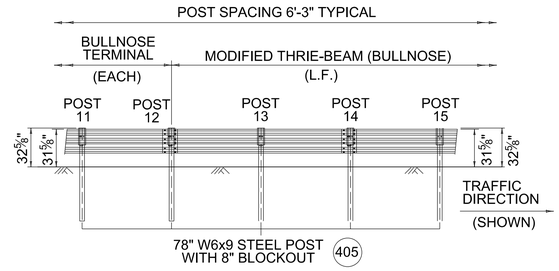
STANDARD DRAWING NUMBER
RBE-210



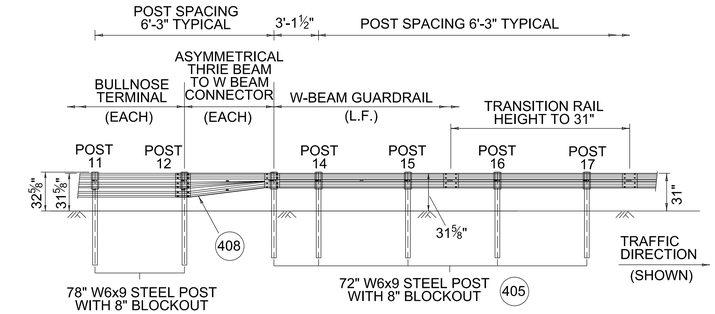
SYMMETRICAL BULLNOSE



ASYMMETRICAL BULLNOSE



DETAIL A
BULLNOSE TERMINAL TRANSITION TO MODIFIED THRIE-BEAM (BULLNOSE)



DETAIL B
BULLNOSE TERMINAL TRANSITION TO W-BEAM GUARDRAIL

~ NOTES ~

400 *SEE SHEET 5 FOR MEDIAN GRADING*

401 *SYMMETRY LINE OF SLOTTED THRIE-BEAM RAIL E1.*

402 *FOR MAINTENANCE ONLY USE RBC-004, RBC-005, RBC-006*

403 *FIXED OBJECT*

MODIFIED THRIE-BEAM (BULLNOSE) MINIMUM WORKING WIDTH 4' - 6"
GUARDRAIL-STEEL W BEAM-S FACE MINIMUM WORKING WIDTH 5' - 0"

404 *BEYOND POST 12, EITHER MODIFIED THRIE-BEAM (BULLNOSE) OR W-BEAM GUARDRAIL MAY BE CONSTRUCTED. BOTH OPTIONS ARE PAID PER LINEAR FOOT. INDICATE THE SELECTED TYPE IN THE ROADWAY PLANS.*

405 *SEE SHEET 7 FOR POST, RAIL, AND BLOCKOUT DETAILS.*

406 *CONTRARY TO BHS-013 AND BHS-014, IF MODIFIED THRIE-BEAM (BULLNOSE) IS USED TO CONNECT TO A THRIE-BEAM GUARDRAIL TRANSITION (BHS-013 OR BHS-014), THE ASYMMETRICAL THRIE BEAM TO W BEAM CONNECTOR PIECE IS REPLACED WITH A 12' - 6" LONG THRIE-BEAM RAIL WITH POST SPACING AS SHOWN IN DETAIL C. 6" X 8" X 18" BLOCKOUTS (SEE BHS-013 AND BHS-014 FOR DETAILS) ARE TO BE USED IN THIS SECTION OF THRIE BEAM. BEYOND THIS, STANDARD BLOCKOUTS FOR GUARDRAIL THRIE BEAM (BULLNOSE) IS USED.*

407 *EXTEND STANDARD HEADER CURB OR STANDARD HEADER CURB AND GUTTER TO THE END OF THE SECOND THRIE-BEAM PIECE FROM THE BRIDGE END. TAPER DOWN TO 4" IN HEIGHT OVER THE LAST 3' - 1 ½".*

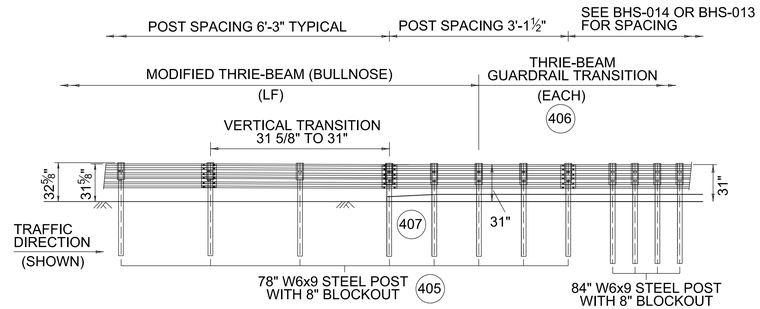
408 *THRIE BEAM TO W BEAM CONNECTOR PAID AS EACH. USE 10 GAUGE STEEL. SEE HARDWARE GUIDE DRAWING RWT02 FOR ADDITIONAL DETAILS.*

BID ITEM AND UNIT TO BID

THRIE-BEAM BULLNOSE TERMINAL	*EACH*

BID ITEMS AS APPLICABLE

MODIFIED THRIE-BEAM (BULLNOSE)	*LF*
GUARDRAIL-STEEL W BEAM-S FACE	*LF*
THRIE BEAM TO W BEAM CONNECTOR	*EACH*
THRIE-BEAM GUARDRAIL TRANSITION TL-3	*EACH*
THRIE-BEAM GUARDRAIL TRANSITION TL-2	*EACH*



DETAIL C
MODIFIED THRIE-BEAM (BULLNOSE) TO THRIE-BEAM TRANSITION (BHS-014 SHOWN)

REVISION DATE: 08/11/2025
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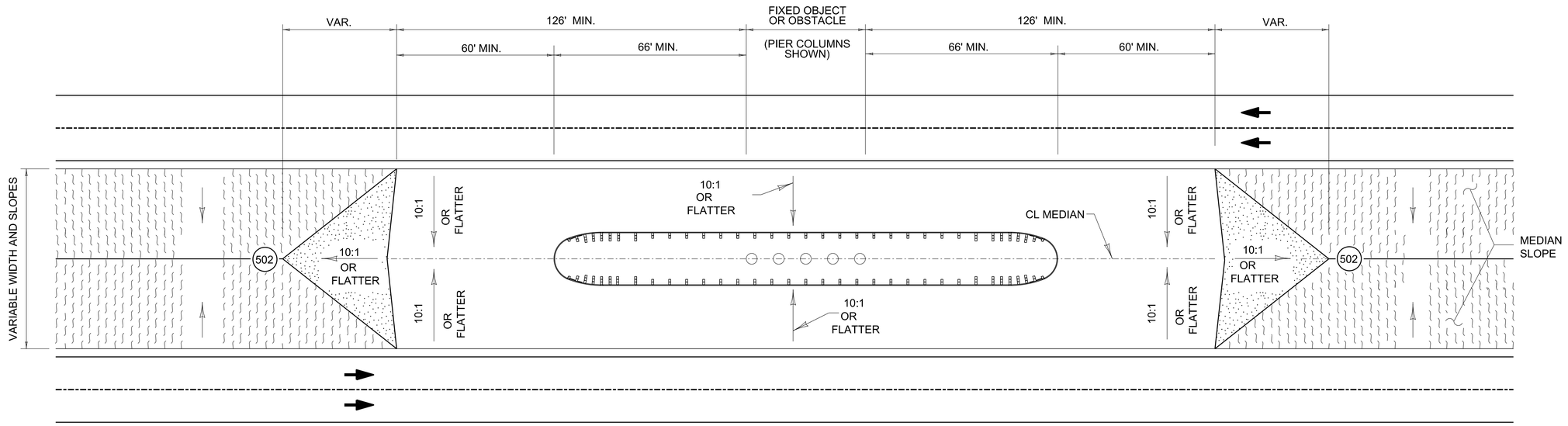
SUBMITTED — DIVISION DIRECTOR — 08-11-2025 DATE

APPROVED — STATE HIGHWAY ENGINEER — 08-11-2025 DATE

BARRIERS



GRADING AT BULLNOSE

~ NOTES ~

(500) *MODIFIED THRIE-BEAM (BULLNOSE) MINIMUM WORKING WIDTH 4' - 6". GUARDRAIL-STEEL W BEAM-S FACE MINIMUM WORKING WIDTH 5' - 0".*

GRADING FROM POST 1 TO POST 12 AND THE 60' LEADING OR TRAILING THE THRIE-BEAM TERMINAL SHALL BE 10:1 OR FLATTER.

GRADING BEYOND POST 12 MAY BE ADJUSTED FOR DRAINAGE, PROVIDED THERE IS A MINIMUM OF 2' OF FILL BEHIND THE POSTS TO ENSURE ADEQUATE SUPPORT FOR THE SYSTEM.

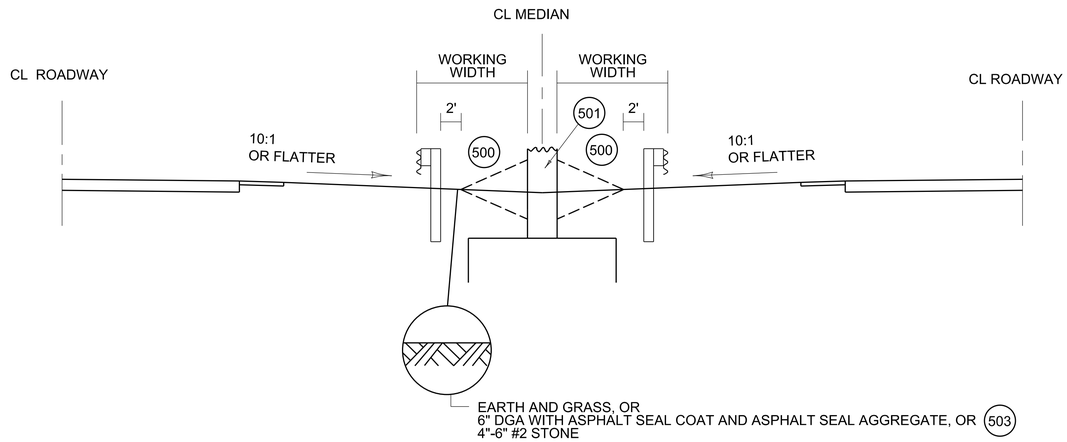
(501) *FIXED OBJECT OR OTHER OBSTACLE.*

(502) *EVALUATE MEDIAN DRAINAGE AND ENSURE POSITIVE FLOW. INCLUDE A DROP BOX INLET AND PIPING AS NEEDED, AND ENSURE THAT ALL NECESSARY BID ITEMS ARE INCLUDED.*

(503) *AT THE DISCRETION OF THE ENGINEER, MATERIAL CAN BE ANY OF THE FOLLOWING:*
EARTH AND GRASS, OR
6" DGA WITH ASPHALT SEAL COAT AND ASPHALT SEAL AGGREGATE, OR
4"-6" #2 STONE

504 *WHILE MEDIAN GRADING DETAIL DEPICTS SYMMETRICAL THRIE-BEAM BULLNOSE TERMINAL, ALL GRADING REQUIREMENTS APPLY TO ASYMMETRICAL THRIE-BEAM BULLNOSE TERMINALS ALSO.*

505 *GRADING QUANTITIES MUST BE CALCULATED AND SHOWN AS BID ITEMS.*



CROSS SECTION AT FIXED OBJECT

REVISION DATE: 08/11/2025
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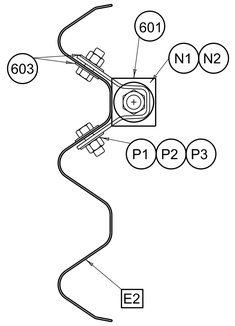
SUBMITTED — DIVISION DIRECTOR — DATE 08-11-2025

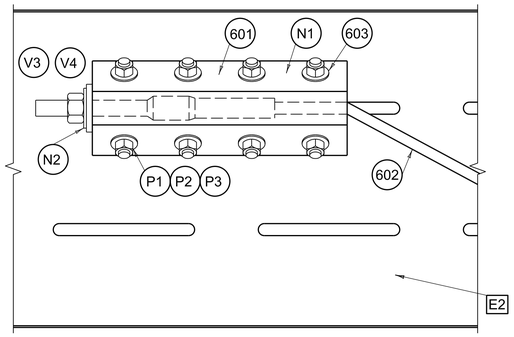
APPROVED — STATE HIGHWAY ENGINEER — DATE 08-11-2025

BARRIERS

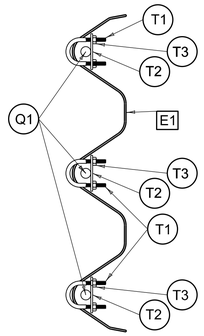


PROFILE VIEW

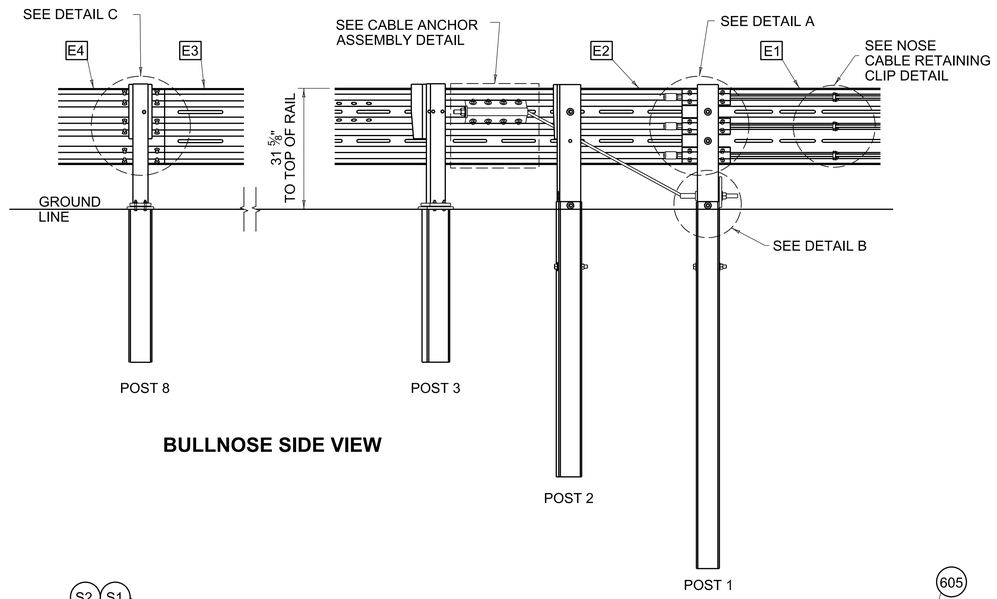
CABLE ANCHOR
ASSEMBLY CONNECTION



CABLE ANCHOR ASSEMBLY



NOSE CABLE RETAINING CLIP



BULLNOSE SIDE VIEW

~ NOTES ~

600 *SEE SHEET 10 FOR PART DESCRIPTIONS.*

(601) *SEE ANCHOR BRACKET ASSEMBLY DETAIL ON SHEET 10.*

(602) *SEE ANCHOR CABLE ASSEMBLY DETAIL ON SHEET 10.*

(603) *ONE WASHER BETWEEN BOLT HEAD AND RAIL AND BETWEEN NUT AND ANCHOR BRACKET ASSEMBLY.*

(604) *ONE WASHER BETWEEN BOLT HEAD AND FOUNDATION TUBE AND BETWEEN NUT AND FOUNDATION TUBE.*

(605) *BEND TWO NAILS OVER THE BEARING PLATE TO PREVENT ROTATION.*

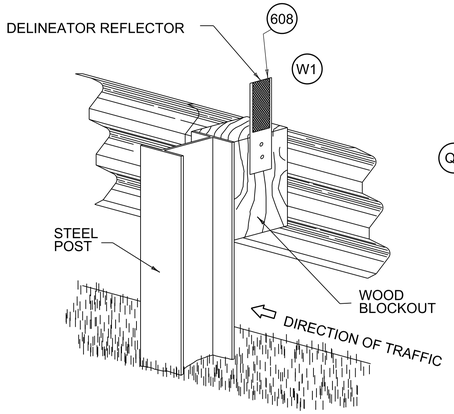
606 *NO MATERIAL IS TO BE PLACED AGAINST THE VERTICAL FACES OF BEARING PLATE.*

607 *PREVENT OR REMOVE MATERIALS THAT BLOCK ACCESS TO BOLTS FOR POST ASSEMBLIES.*

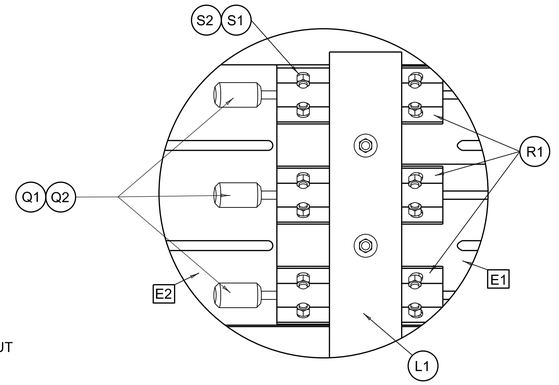
(608) *THE COLOR OF DELINEATORS MUST MATCH THE COLOR OF THE EDGELINE THEY SUPPLEMENT.*

609 *DELINEATOR SPACING SHOULD BE 100' WITH A MINIMUM OF 3 REFLECTORS. THE FIRST DELINEATOR SHOULD BE PLACED ON POST 3, ON THE ADJACENT TRAFFIC SIDE OF THE BULLNOSE.*

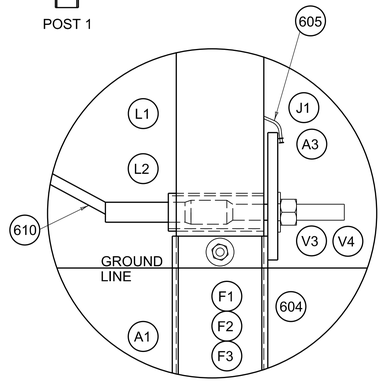
(610) *ANCHOR CABLE ASSEMBLY INCLUDES PARTS V1, V2, V3, AND V4.*



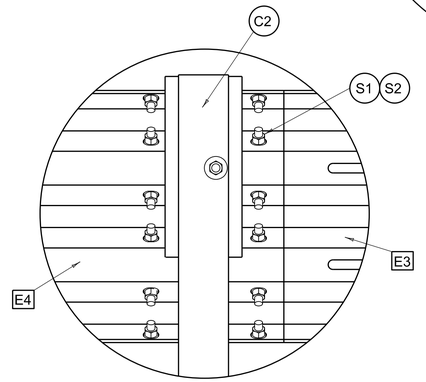
ONE-SIDED REFLECTOR DETAIL AND TYPICAL INSTALLATION



DETAIL A



DETAIL B



DETAIL C
THRIE-BEAM SPLICE

REVISION DATE: 08/11/2025
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BARRIERS

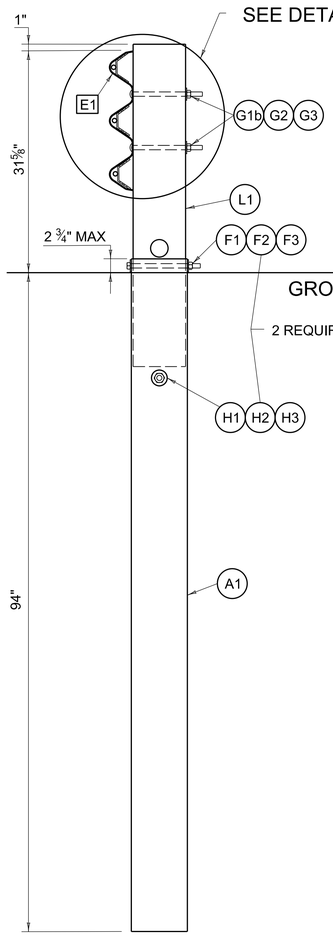
COMMONWEALTH OF KENTUCKY
DEPARTMENT OF HIGHWAYS

TEAM KENTUCKY TRANSPORTATION CABINET

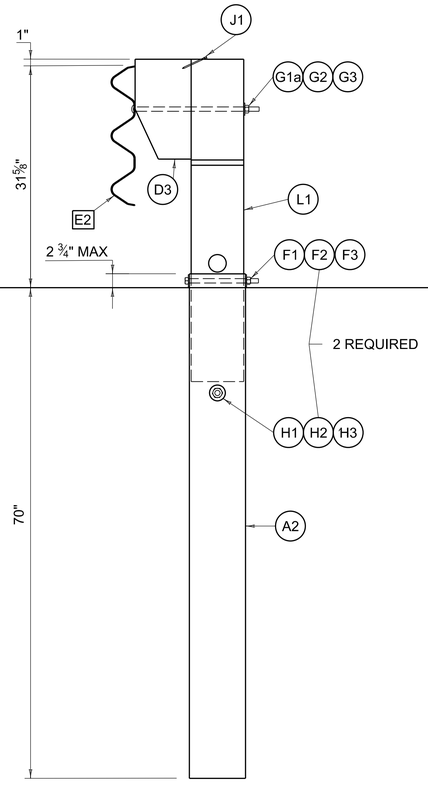
STEEL THRIE-BEAM BULLNOSE TERMINAL

SHEET 006: NOSE AND ANCHOR DETAILS

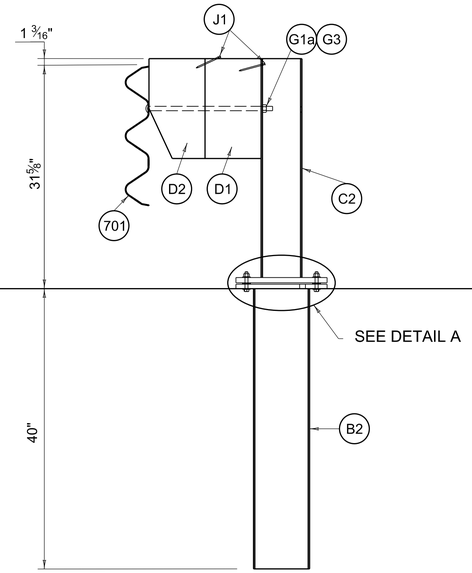
STANDARD DRAWING NUMBER
RBE-210



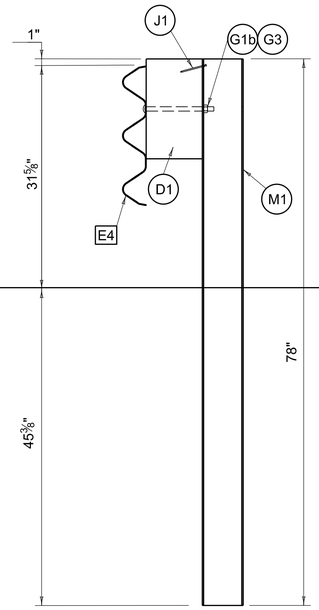
POST NO. 1



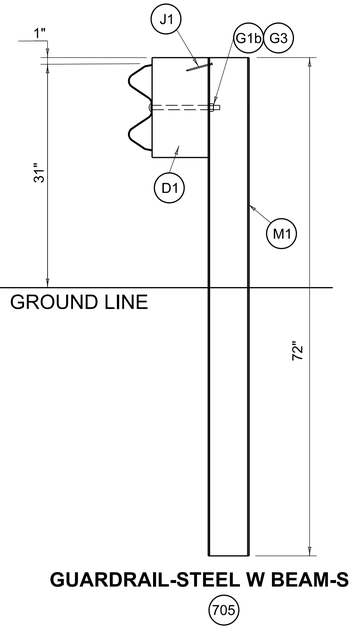
POST NO. 2



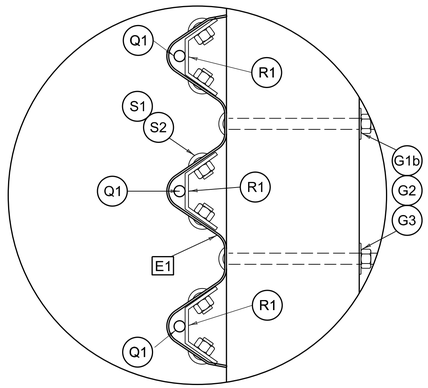
POST NOS. 3-8



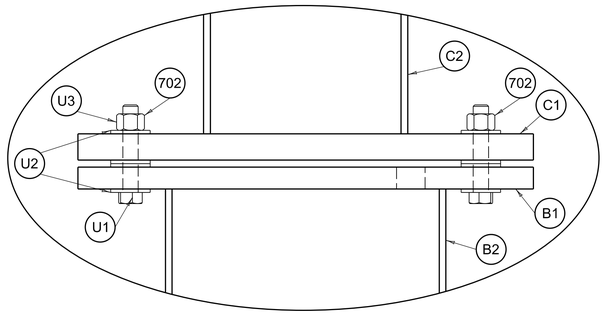
POST NOS. 9-12
AND
MODIFIED THRIE-BEAM (BULLNOSE)
704



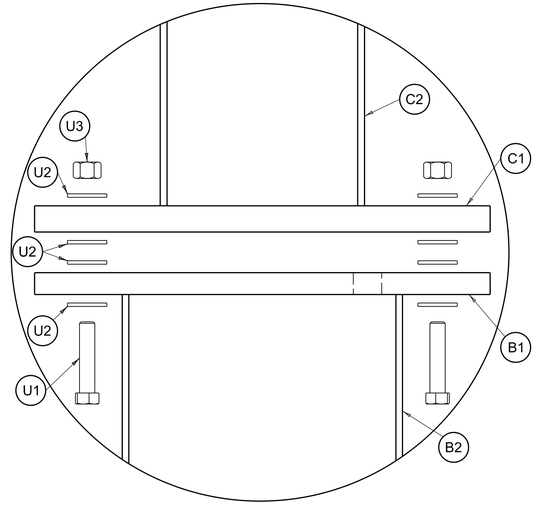
GUARDRAIL-STEEL W BEAM-S FACE
705



DETAIL B



DETAIL A



EXPLODED VIEW
DETAIL A

~ NOTES ~

700 *SEE SHEET 10 FOR PART DESCRIPTIONS.*

701 *RAIL CAN BE E2 OR E3 DEPENDING ON POST LOCATION.*

702 *TORQUE BOLT BETWEEN 60-75 FT-LB*

703 *SEE SHEET 4 FOR BULLNOSE TRANSITIONS. BEYOND POST 12 EITHER MODIFIED THRIE-BEAM (BULLNOSE) OR W-BEAM GUARDRAIL MAY BE CONSTRUCTED. BOTH OPTIONS PAID FOR AS LINEAR FOOT. INDICATE THE TYPE SELECTED IN THE ROADWAY PLANS.*

704 *IF THE MODIFIED THRIE-BEAM (BULLNOSE) OPTION IS INSTALLED BEYOND POST 12, MATCH THE CONFIGURATION, SPACING, AND COMPONENTS USED BETWEEN POSTS 9 AND 12.*

705 *BEYOND POST 12, IF W-BEAM GUARDRAIL IS SELECTED, TRANSITION THE RAIL BETWEEN POST 12 AND POST 13 USING A THRIE BEAM TO W BEAM CONNECTOR, FOLLOWED BY A STANDARD POST AND BLOCK SPACED AT 3' - 1½". CONTINUE THE BARRIER SYSTEM WITH STANDARD 6' - 3" POST SPACING, AND TRANSITION THE BULLNOSE RAIL HEIGHT TO 31" OVER A 12' -6" BEAM LENGTH. SEE SHEET 4 FOR W-BEAM TRANSITION DETAILS.*

REVISION DATE: 08/11/2025
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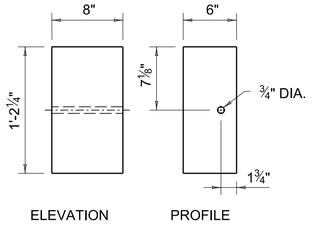
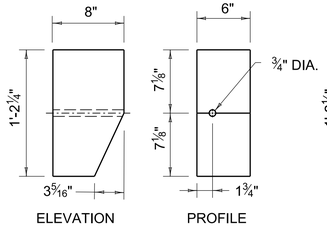
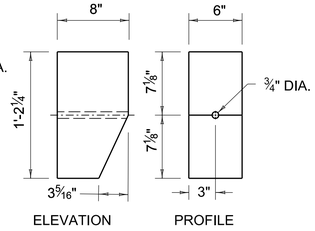
APPROVED — STATE HIGHWAY ENGINEER — DATE 08-11-2025

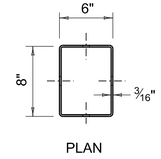
BARRIERS

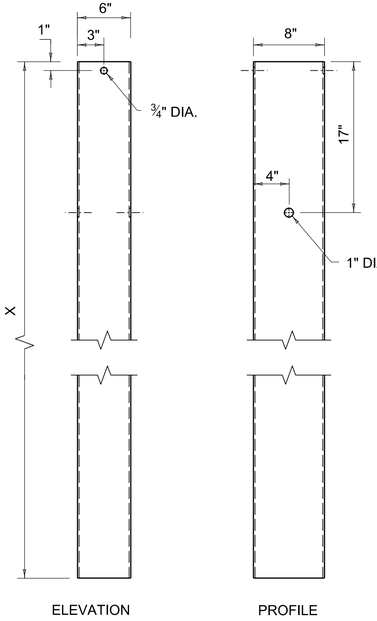


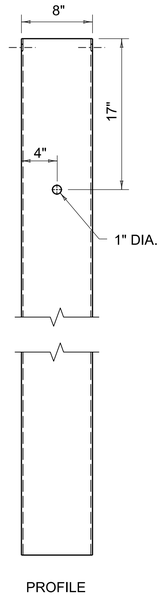




BLOCKOUT (D1) **BLOCKOUT (D2)** **BLOCKOUT (D3)**

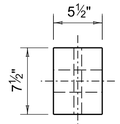


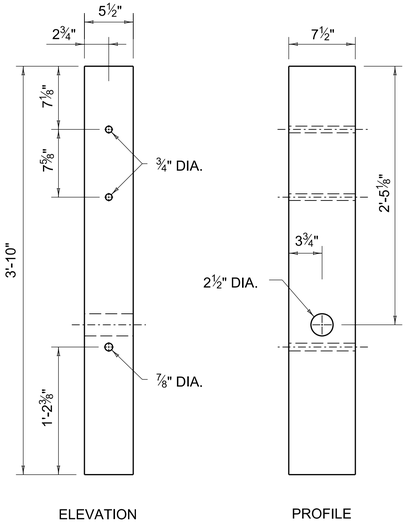




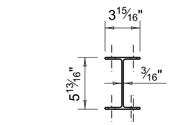
FOUNDATION TUBE (A1, A2, & B2)

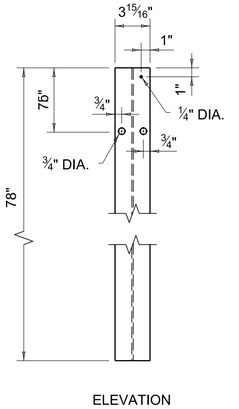
PART	LENGTH "X"
A1	96"
A2	72"
B2	40"



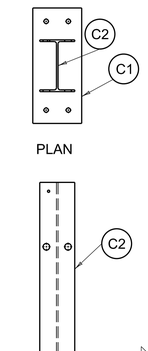


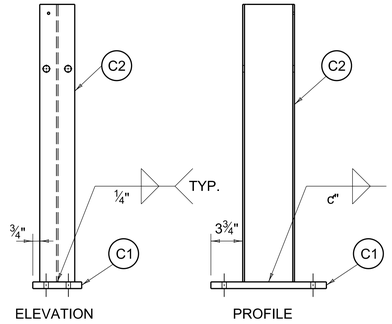
BCT TIMBER POST (L1)



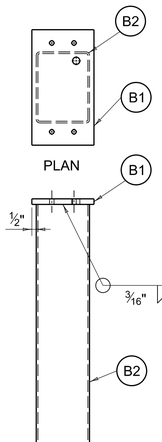


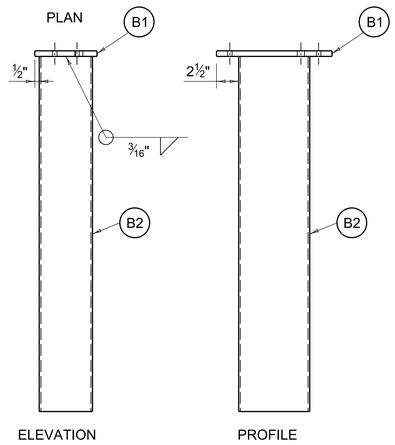
STEEL POST (M1)



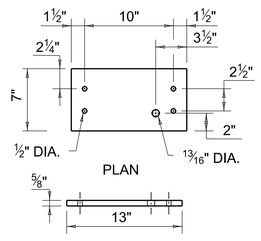


UPPER POST ASSEMBLY

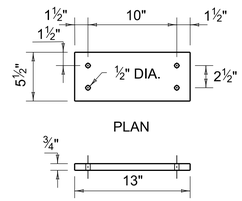




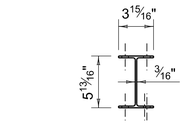
LOWER POST ASSEMBLY

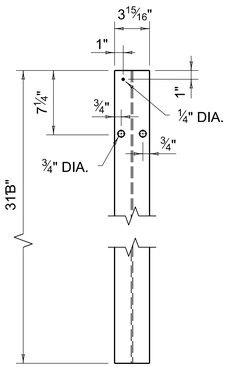


LOWER SHEAR PLATE (B1)



UPPER SHEAR PLATE (C1)





STEEL POST (C2)

~ NOTES ~

800 *SEE SHEET 10 FOR PART DESCRIPTIONS.*

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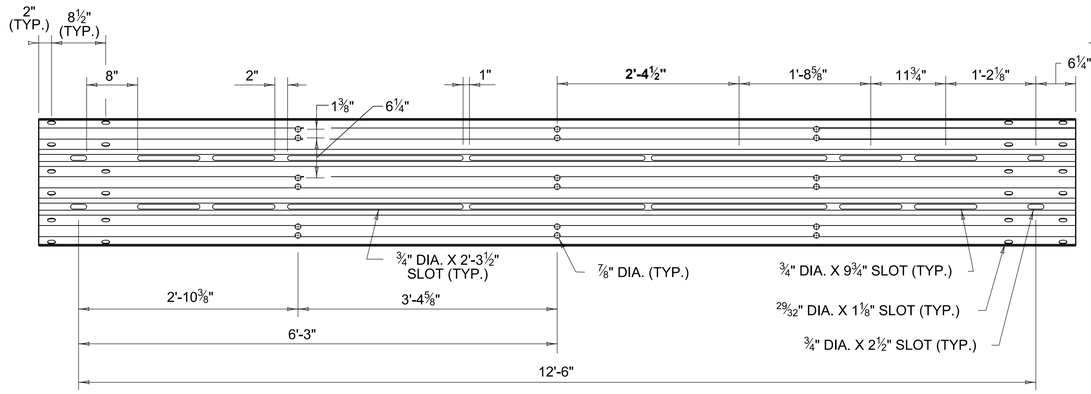
BARRIERS

COMMONWEALTH OF KENTUCKY
DEPARTMENT OF HIGHWAYS
TEAM KENTUCKY TRANSPORTATION CABINET

STEEL THRIE-BEAM BULLNOSE TERMINAL

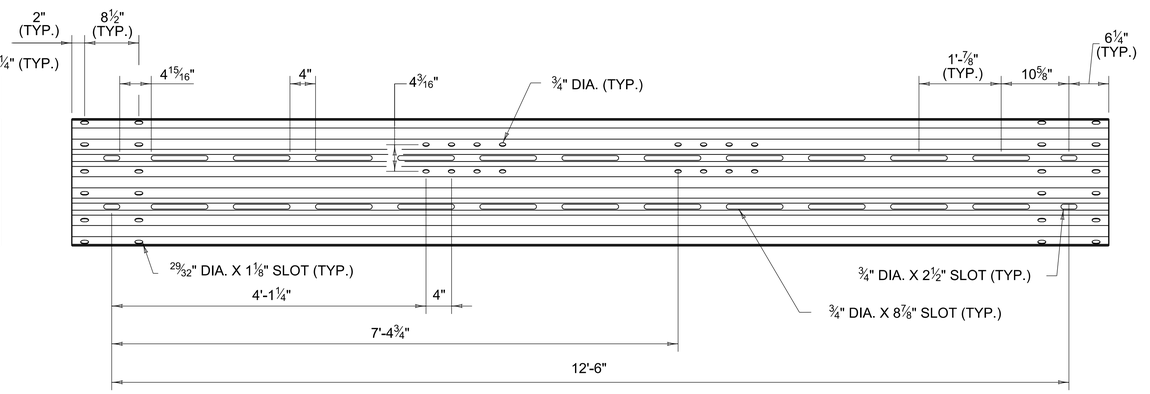
SHEET 008: POST, BLOCK, AND HARDWARE DETAILS

STANDARD DRAWING NUMBER
RBE-210



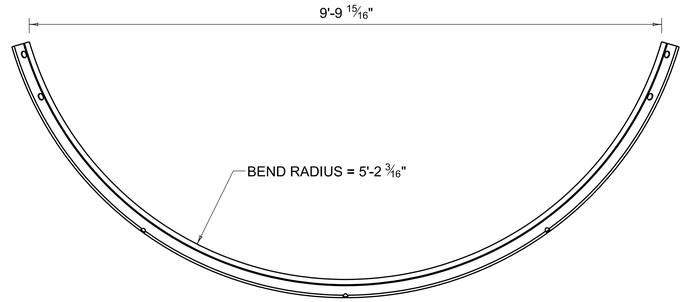
ELEVATION VIEW NON-RADIUSED

SLOTTED THRIE-BEAM RAIL E1



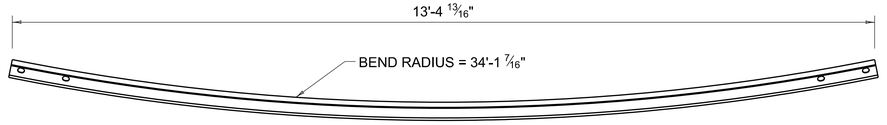
ELEVATION VIEW NON-RADIUSED

SLOTTED THRIE-BEAM RAIL E2



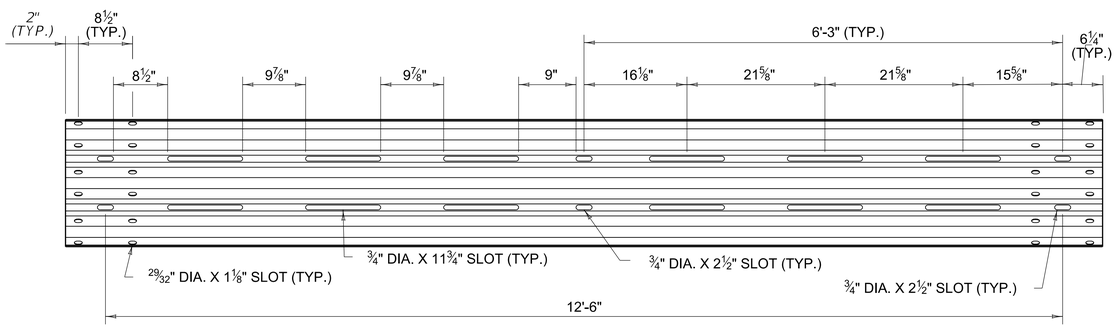
PLAN VIEW

SLOTTED THRIE-BEAM RAIL E1

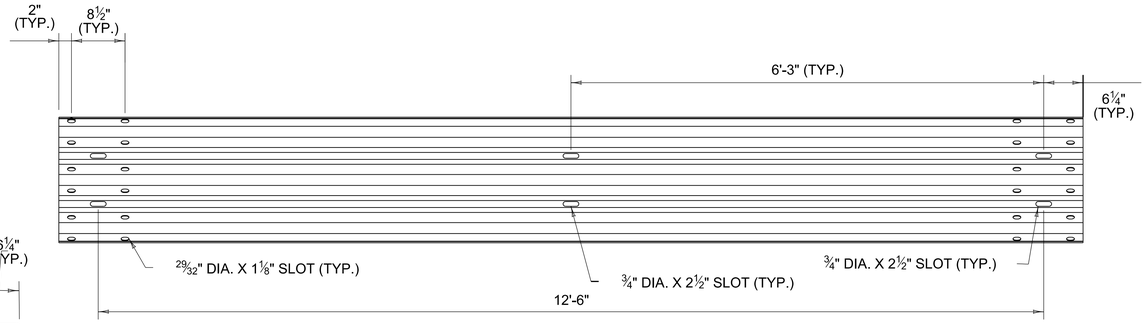


PLAN VIEW

SLOTTED THRIE-BEAM RAIL E2



SLOTTED THRIE-BEAM RAIL E3



UNBENT STANDARD THRIE-BEAM RAIL E4

~ NOTES ~

901 *FOR THRIE-BEAM RAIL, USE AASHTO M180, SPEC SECTION 814, AND GUARDRAIL MANUFACTURER FROM KYTC'S LIST OF APPROVED MATERIALS.*

902 *MARK THE RADIUS OF CURVATURE ON EACH OF THE CURVED ELEMENTS.*

903 *IN AN ASYMMETRICAL BULLNOSE, THE OPPOSING-SIDE E2 THRIE-BEAM IS STRAIGHT, NOT CURVED. THIS TANGENT BEAM HAS A LENGTH OF 13' - 6 ½".*

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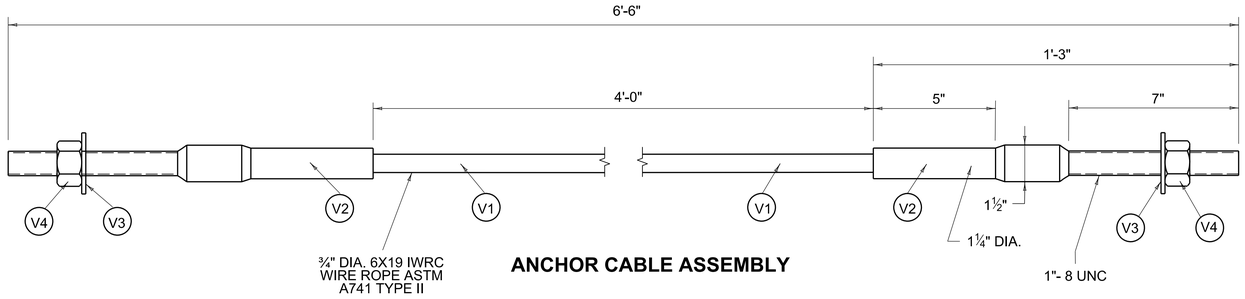
BARRIERS

COMMONWEALTH OF KENTUCKY
DEPARTMENT OF HIGHWAYS
TEAM KENTUCKY TRANSPORTATION CABINET

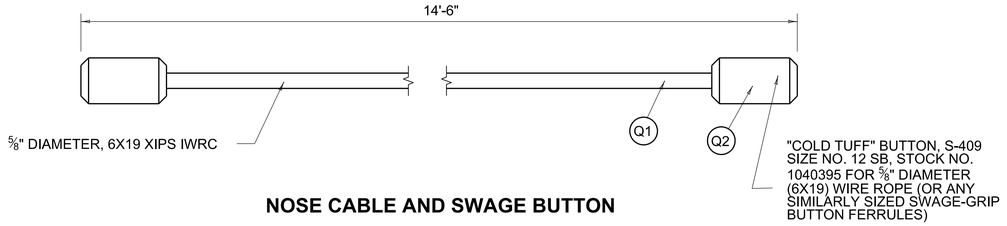
STEEL THRIE-BEAM BULLNOSE TERMINAL

SHEET 009: SLOTTED THRIE-BEAM RAIL

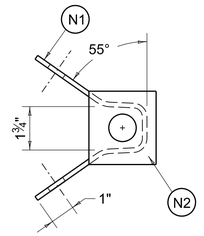
STANDARD DRAWING NUMBER
RBE-210



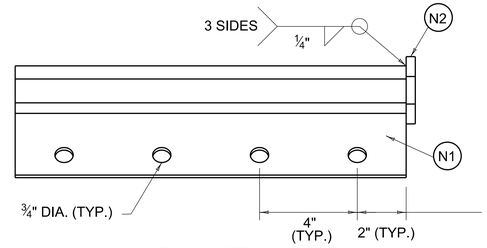
ANCHOR CABLE ASSEMBLY



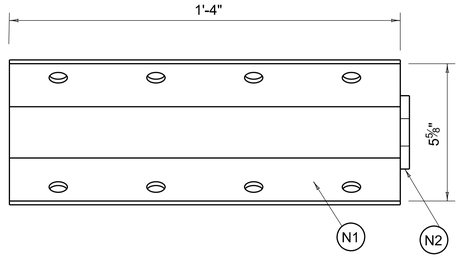
NOSE CABLE AND SWAGE BUTTON



PROFILE VIEW

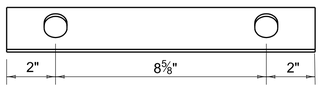


PLAN VIEW

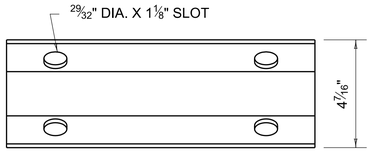


ELEVATION VIEW

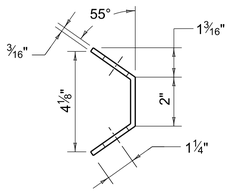
ANCHOR BRACKET ASSEMBLY (N1)



PLAN VIEW

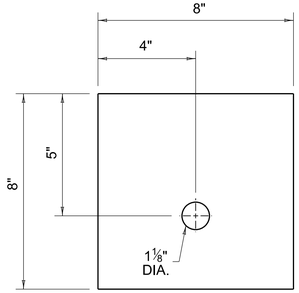


ELEVATION VIEW

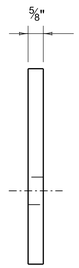


PROFILE VIEW

NOSE CABLE ANCHOR BRACKET (R1)

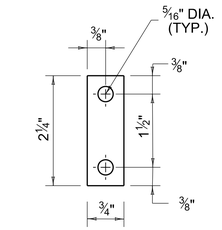


ELEVATION VIEW

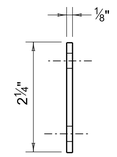


PROFILE VIEW

BCT BEARING PLATE (A3)

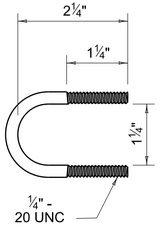


ELEVATION VIEW

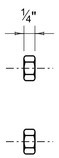


PROFILE VIEW

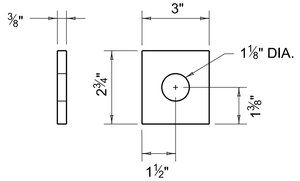
U - BOLT PLATE WASHER (T2)



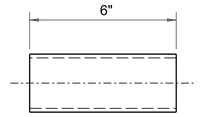
U - BOLT (T1)



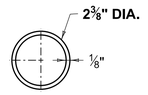
U - BOLT NUT (T3)



ANCHOR BRACKET END PLATE (N2)



ELEVATION VIEW



PROFILE VIEW

BCT POST SLEEVE (L2)

~ NOTES ~

1000 *SEE SHEET 11 FOR PART DESCRIPTIONS.*

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BARRIERS

COMMONWEALTH OF KENTUCKY
DEPARTMENT OF HIGHWAYS

TEAM KENTUCKY TRANSPORTATION CABINET

STEEL THRIE-BEAM BULLNOSE TERMINAL

SHEET 010: ASSEMBLY DETAILS

STANDARD DRAWING NUMBER
RBE-210

THRIE-BEAM BULLNOSE TERMINAL MATERIALS LIST

Part Number	Quantity	Description	Hardware Guide[1]	Material Descriptions[2,3]
A1	2	LONG FOUNDATION TUBE	PTE07	ASTM A500 GRADE B OR ASTM A501
A2	2	FOUNDATION TUBE	PTE06	ASTM A500 GRADE B OR ASTM A501
A3	2	BCT BEARING PLATE	FPB01	ASTM A36 MIN. STRENGTH 36 KSI. SEE SPEC. SECTION 812.01.01 FOR ALTERNATIVE STEEL GRADES
B1	12	LOWER SHEAR PLATE	PTE08	ASTM A36 MIN. STRENGTH 36 KSI. SEE SPEC. SECTION 812.01.01 FOR ALTERNATIVE STEEL GRADES
B2	12	FOUNDATION TUBE	PTE08	ASTM A500 GRADE B OR ASTM A501
C1	12	UPPER SHEAR PLATE	PWE11	ASTM A36 MIN. STRENGTH 36 KSI. SEE SPEC. SECTION 812.01.01 FOR ALTERNATIVE STEEL GRADES
C2	12	STEEL POST	PWE11	W 6X9 OR W 6X8.5 STEEL POST / ASTM A36 MIN. STRENGTH 36 KSI
D1	20	BLOCKOUT FOR STEEL POST - WOOD	PDB09	SYP GRADE NO. 1 OR BETTER / SEE SPEC. SECTION 814.04.02 FOR TIMBER USE
D2	12	TAPERED BLOCKOUT FOR STEEL POST - WOOD	PDB20	SYP GRADE NO. 1 OR BETTER / SEE SPEC. SECTION 814.04.02 FOR TIMBER USE
D3	2	TAPERED BLOCKOUT FOR BCT POST - WOOD	PDB12	SYP GRADE NO. 1 OR BETTER / SEE SPEC. SECTION 814.04.02 FOR TIMBER USE
E1	1	SLOTTED THRIE BEAM RAIL - SHOP BENT AND PUNCHED	RTM07a	12 GUAGE / CURVE GUADRAIL IN SHOP / MARK THE RADIUS OF CURVATURE ON EACH OF THE CURVED ELEMENTS
E2	2	SLOTTED THRIE BEAM RAIL - SHOP BENT AND PUNCHED	RTM07d	12 GUAGE / CURVE GUARDRAIL IN SHOP / MARK THE RADIUS OF CURVATURE ON EACH OF THE CURVED ELEMENTS / NOTE: IN AN ASSYMETRICAL BULLNOSE, THE OPPOSING TRAFFIC SIDE E2 THRIE BEAM IS STRAIGHT AND NOT CURVED WITH A LENGTH OF 13' 6 1/2".
E3	2	SLOTTED THRIE BEAM RAIL - PUNCHED	RTM07e	12 GUAGE
E4	4	UNBENT STANDARD THRIE BEAM RAIL	RTM02a	12 GUAGE
F1	4	5/8" DIA. HEX HEAD GROUND STRUT AND YOKE BOLT - 11 UNC - 10" LONG	FBX16a	ASTM A307
F2	8	5/8" DIA. HEX HEAD GROUND STRUT AND YOKE BOLT - WASHER 1 3/4" OUTSIDE DIAMETER, 11/16" INSIDE DIAMETER, 1/8" THICK	FWC16a	ASTM F844
F3	4	5/8" DIA. HEX HEAD GROUND STRUT AND YOKE BOLT - 5/8" NUT, 9/16" THICK	FBX16a	ASTM A563, GRADE A OR BETTER
G1a	14	5/8" DIA. POST BOLT - 11 UNC - 18" LONG	FBB04	
G1b	12	5/8" DIA. POST BOLT - 11 UNC - 10" LONG	FBB03	
G2	6	POST BOLT - WASHER 1 3/4" OUTSIDE DIAMETER, 11/16" INSIDE DIAMETER, 1/8" THICK	FWC16a	ASTM F844
G3	26	POST BOLT - 5/8" NUT, 9/16" THICK	FBB03/ FBB04	ASTM A563, GRADE A OR BETTER
H1	4	7/8" DIA. HEX HEAD SOIL TUBE BOLT - 9 UNC - 8" LONG	NA	ASTM A307 / AASHTO M232 CLASS C
H2	8	7/8" DIA. HEX HEAD SOIL TUBE BOLT - WASHER 2 1/4" OUTSIDE DIAMETER, 15/16" INSIDE DIAMETER, 3/16" THICK	NA	ASTM F844 / AASHTO M232 CLASS C
H3	4	7/8" DIA. HEX HEAD SOIL TUBE BOLT - 7/8" NUT, 3/4" THICK	NA	ASTM A563, GRADE A OR BETTER / AASHTO M232 C
J1	38	16D DOUBLE HEAD NAIL	NA	AASHTO M232 CLASS D
L1	4	BCT TIMBER POST	PDF04	SYP GRADE NO. 1 OR BETTER / NO KNOTS +/- 18" FROM GROUND ON TENSION FACE / SEE SPEC. SECTION 814.04.02 FOR TIMBER USE
L2	2	BCT POST SLEEVE	FMM02	

Part Number	Quantity	Description	Hardware Guide[1]	Material Descriptions[2,3]
M1	8	W6X8.5 OR W6X9 STEEL POST	NA	W 6X9 OR W 6X8.5 STEEL POST / ASTM A36 MIN. STRENGTH 36 KSI
N1	2	ANCHOR BRACKET ASSEMBLY	FPA01	ASTM A36 MIN. STRENGTH 36 KSI. SEE SPEC. SECTION 812.01.01 FOR ALTERNATIVE STEEL GRADES
N2	2	ANCHOR BRACKET END PLATE	FPA01	ASTM A36 MIN. STRENGTH 36 KSI. SEE SPEC. SECTION 812.01.01 FOR ALTERNATIVE STEEL GRADES
P1	16	5/8" DIA. HEX HEAD ANCHOR BRACKET BOLT - 11 UNC - 1 1/2" LONG	FBX16a	ASTM A307
P2	32	5/8" DIA. HEX HEAD ANCHOR BRACKET BOLT - WASHER, 1 3/4" OUTSIDE DIAMETER, 11/16" INSIDE DIAMETER, 1/8" THICK	FWC16a	ASTM F844
P3	16	5/8" DIA. HEX HEAD ANCHOR BRACKET BOLT - 5/8" NUT, 9/16" THICK	FBX16a	ASTM A563, GRADE A OR BETTER
Q1	3	5/8" DIA. NOSE CABLE 6X19 XIPS IWRC	RCM02	AASHTO M30 CLASS A COATING / NOMINAL BREAKING STRENGTH OF 41.2 KIPS
Q2	6	NOSE CABLE - SWAGE BUTTON	RCM02	COLD TUFF BUTTON, S-409 SIZE NO. 12 SB STOCK NUMBER 1040395 FOR 5/8" DIAMETER (6X19) WIRE ROPE (OR ANY SIMILARLY SIZED SWAGE-GRIP BUTTON FERRULES) / AASHTO M30 CLASS A COATING
R1	6	NOSE CABLE ANCHOR BRACKET	FPA04	ASTM A36 MIN. STRENGTH 36 KSI. SEE SPEC. SECTION 812.01.01 FOR ALTERNATIVE STEEL GRADES
S1	120	5/8" DIA. SPLICE BOLT - 11 UNC - 1 1/4" LONG	FBB01	
S2	120	5/8" DIA. SPLICE BOLT - 5/8" NUT, 9/16" THICK	FBB01	ASTM A563, GRADE A OR BETTER
T1	9	1/4" DIA. NOSE CABLE U BOLT - 20 UNC	NA	ASTM A307 / AASHTO M232 CLASS C
T2	9	1/4" DIA. NOSE CABLE U-BOLT - PLATE WASHER, 1/8" THICK	NA	ASTM A1011 TYPE SS GRADE 36 / AASHTO M232 CLASS C
T3	18	1/4" DIA. NOSE CABLE U-BOLT -1/4" NUT, 1/4" THICK	NA	ASTM A563, GRADE A OR BETTER / AASHTO M232 CLASS C
U1	48	SLIP POST ASSEMBLY - BREAKAWAY 7/16" DIA. HEX HEAD BOLT - 14 UNC - 2 1/2" LONG	FBX12b	ASTM A449 OR SAE J429 GRADE 5
U2	192	SLIP POST ASSEMBLY - BREAKAWAY 7/16" DIA. HEX HEAD BOLT - WASHER, 1 1/4" OUTSIDE DIAMETER, 1/2" INSIDE DIAMETER, 3/32" THICK	FWC12a	ASTM F844
U3	48	SLIP POST ASSEMBLY - BREAKAWAY 7/16" DIA. HEX HEAD BOLT - 7/16" NUT, 1/2" THICK	FBX12b	ASTM A563DH OR SAE J995 GRADE 5
V1	2	3/4" DIA. BCT CABLE	FCA01	
V2	4	ANCHOR CABLE-SWAGE FITTING, 1 1/4" DIAMTER	FCA01	FITTING ASTM A576 GRADE 1035 / STUD ASTM F568 CLASS C
V3	4	1" DIA. ANCHOR CABLE-WASHER	FWC24a	ASTM F844
V4	4	1" DIA. ANCHOR CABLE-NUT	FNX24a	ASTM A563, GRADE A OR BETTER
W1	3	REFLECTOR	NA	SEE SPEC. SECTION 838 AND KYTC LIST OF APPROVED MATERIALS

[1] The Hardware Guide number is referenced in the *Task Force 13 Guide to Standardized Roadside Hardware*, available at https://tf13.org/guides/. When AASHTO and ASTM material specifications are available for a component, they are listed in the guide.

[2] If the *Task Force 13 Guide to Standardized Roadside Hardware* does not reference the AASHTO and ASTM specifications, they are provided in the Material Descriptions column. Additional material specifications can be found in Kentucky Standard Specifications, Section 814 - Guardrail Systems.

[3] If there are discrepancies in material or dimensions between the *Task Force 13 Guide to Standardized Roadside Hardware* and this Standard Drawing set, the details in the Standard Drawing set shall take precedence.

REVISION DATE: 08/11/2025
REVISION NUMBER: 0

SUBMITTED 08-11-2025 DATE
DIVISION DIRECTOR

APPROVED 08-11-2025 DATE
STATE HIGHWAY ENGINEER

BARRIERS

COMMONWEALTH OF KENTUCKY
DEPARTMENT OF HIGHWAYS
TEAM KENTUCKY TRANSPORTATION CABINET

STEEL THRIE-BEAM BULLNOSE TERMINAL

SHEET 011: MATERIALS LIST

STANDARD DRAWING NUMBER
RBE-210

Standard Drawing Reference Report

RBE-210 STEEL THRIE-BEAM BULLNOSE TERMINAL
Effective with the December 11, 2025 Letting

Design Notes

The Steel Thrie-Beam Bullnose (Bullnose) has passed MASH 2016 crash testing. It is commonly considered for three field applications: protecting gaps between twin bridges, shielding gore areas, and addressing narrow median fixed objects such as bridge piers and overhead sign supports. Each application requires evaluation of site-specific design and installation factors to ensure appropriate use.

During a head-on impact, an errant vehicle is expected to come to a stop within the object-free area inside the Bullnose. This area—located adjacent to Posts 1 through 12—must remain clear of fixed objects and be properly graded to ensure stability for vehicle deceleration and containment. In addition, the area in front of and alongside the Bullnose must be graded to provide sufficient stability for an errant vehicle departing the roadway and approaching the Bullnose.

Bullnose posts are embedded deeper than standard guardrail posts, which increases the potential for underground conflicts. Designers must review subsurface and drainage-related features—such as utilities, drainage structures, rock, and foundations—near the Bullnose location. Roadside drainage may need to be addressed through the installation or modification of drainage structures.

Include individual construction details for each Bullnose installation in the project plans, tailored to the specific site. On the plan sheets, the designer must document the approximate station and offset—or approximate coordinates—for the center of Post 5A, ensuring a minimum length of 50 feet from Post 5 to the front of the fixed object or roadside condition. These values serve as guidance for construction layout and are intended to accommodate typical construction tolerances.

The Bullnose is a complex but highly effective system that requires careful attention during both design and construction. Designers and contractors should thoroughly review all notes on the Standard Drawings to ensure proper application and installation. If there are any questions or uncertainties, contact the Standard Drawing staff in the Division of Highway Design for guidance.

References

KYTC Standard Specifications for Road and Bridge Construction

- Section 719 – Guardrail
- Section 814 – Guardrail Systems

Highway Design Guidance Manual

- HD-800 ROADSIDE DESIGN

KYTC Steel Thrie-Beam Bullnose Manual – Assembly, Maintenance, and Repair

Crash Test Reports

MwRSF TRP-03-418-20
MwRSF TRP-03-389-20
MwRSF Pooled Fund Q&A ID 1975

Related Standard Drawings

BHS-013	THRIE-BEAM GUARDRAIL TRANSITION (TL-3)
BHS-014	THRIE-BEAM GUARDRAIL TRANSITION (TL-2)
RBB-002	GUARDRAIL AND BRIDGE END DRAINAGE FOR TWIN STRUCTURES
RBC-004	GUARDRAIL CONNECTOR TO BRIDGE END (MAINTENANCE)
RBC-005	GUARDRAIL CONNECTOR TO BRIDGE END (MAINTENANCE)
RBC-006	GUARDRAIL CONNECTOR TO BRIDGE END (MAINTENANCE)
RBR-001	STEEL BEAM GUARDRAIL (“W” BEAM)

Standard Drawing Revision History

END OF DOCUMENT