

Installation Instructions for **BEAT-SSCC**

Box Beam Bursting Energy Absorbing Terminal Single Sided Crash Cushion



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Installation Instructions for the BEAT-SSCC Single Sided Crash Cushion

INTRODUCTION:

The BEAT-SSCC consists of 8 steel posts driven into the soil, 6"x 6" box beam rail sections, a connection to a rigid barrier wall or bridge rail, a cable anchor system and an impact head. The appropriate connection to the rigid structure is a very critical component to insure proper performance of the BEAT-SSCC. The required length of the anchor bolts will vary with the wall structure and will need to be determined in the field.

As packaged, the BEAT-SSCC system includes all materials needed for a complete installation (except for the anchor bolts). The length of the BEAT-SSCC system from the end of the rigid structure to Post #1 is 25'-6". From the end of the rigid structure to the front face of the impact head, the length of the BEAT-SSCC system is approximately 28'-0".

INSTALLATION PROCEDURE GENERAL NOTES:

Begin the installation at the downstream end of the BEAT-SSCC (starting at the rigid wall) to ensure that the system matches up with the rigid hazard it is protecting. The major installation steps for the BEAT-SSCC are as follows:

- Install W6 x 9# Posts #2 through #8
- Install Upper (W6 x 9#) & Lower (W6 x 15#) Post #1 Sections
- Install Transition Support Brackets at Posts #7 & 8
- Install Rail Support Brackets at Posts #2 through 6
- Install Transition Blockout Tube at Posts #7, 8 and Rigid Wall
- Install Anchor Rail at Post #8 and Rigid Wall
- Attach Anchorage and Spacer at Rigid Wall
- Attach Splice Connections (2 locations)
- Attach Tie Plate Connections (3 locations)
- Install Second Rail at Posts #3 through 7
- Install End Tube Rail with Support Bracket at Posts #1 & 2
- Install BEAT-SSCC Impact Head
- Install Post Breaker
- Install Tether Cable
- Install Cable Assembly with Bearing Plate

NOTES:

- 1.) It is recommended that the approach slope area in front of the BEAT-SSCC should be no greater than 1V:10H
- 2.) All curbs and/or elevated objects near the BEAT-SSCC that are higher than 4" should be removed.
- 3.) If a curb must remain, it should be a maximum of 4" in height and the front face of the curb should be placed flush with the traffic face rail of the BEAT-SSCC.

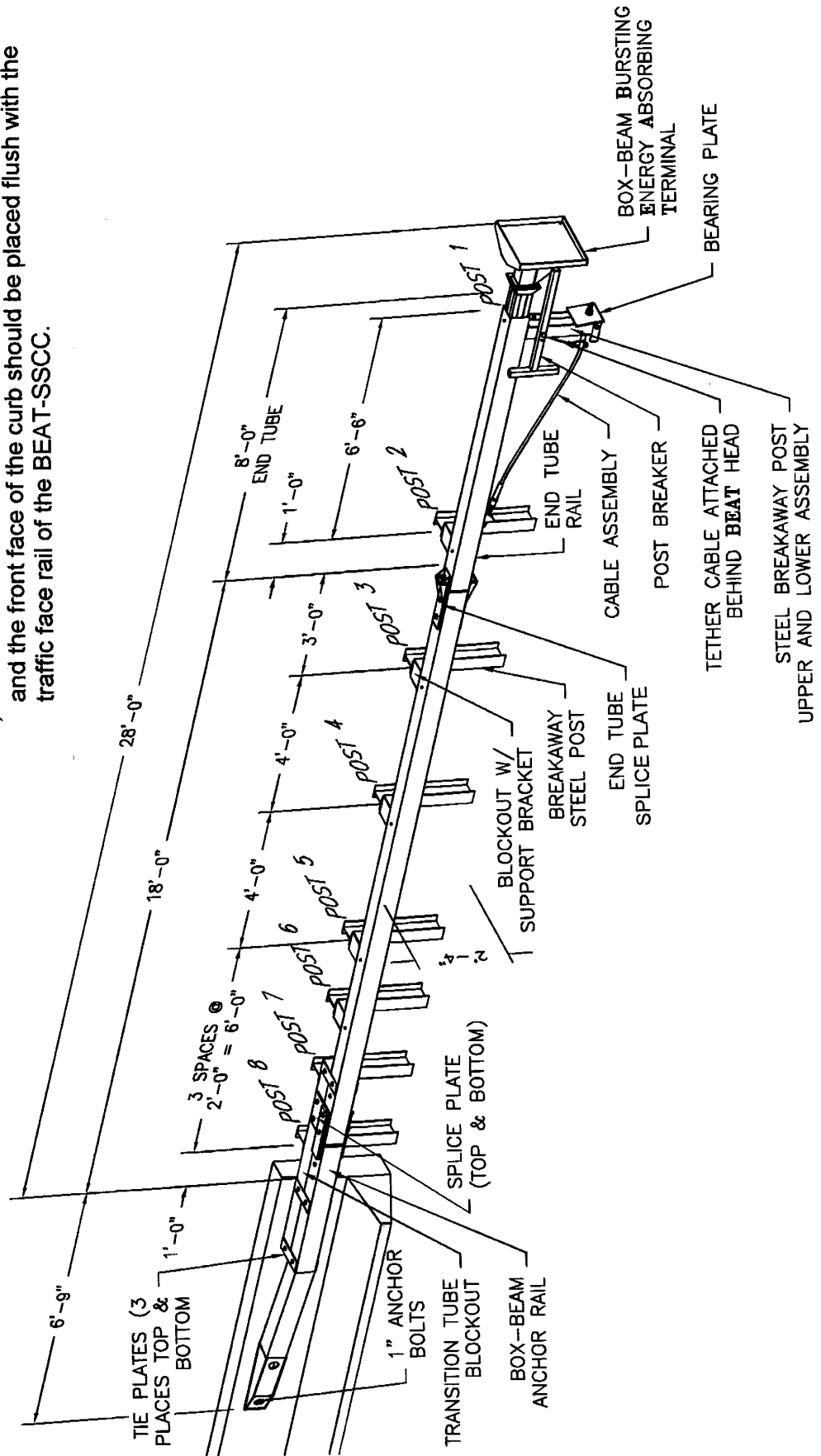


Figure 1. Isometric View of the BEAT-SSCC

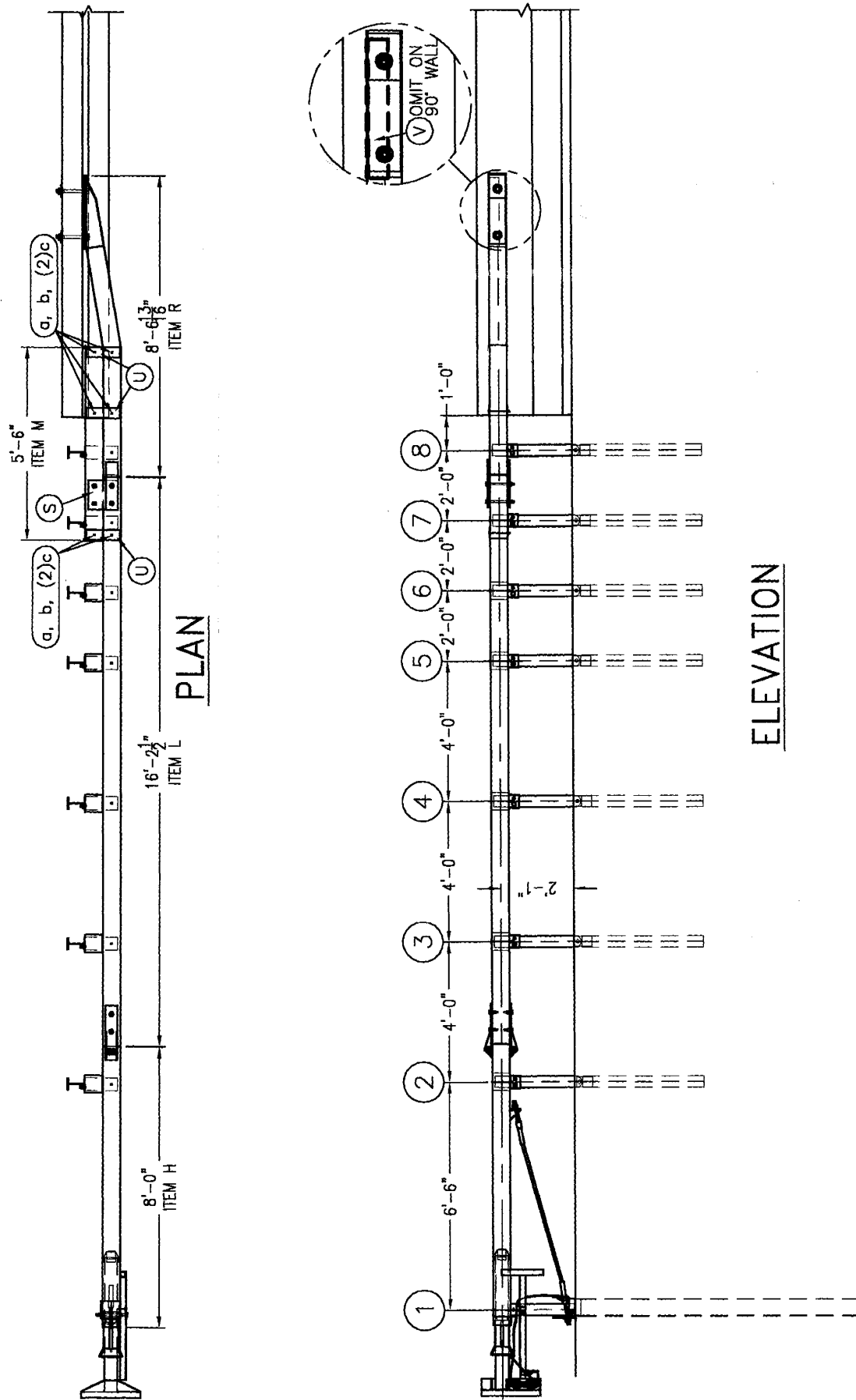


Figure 2. Plan and Elevation of the BEAT-SSCC

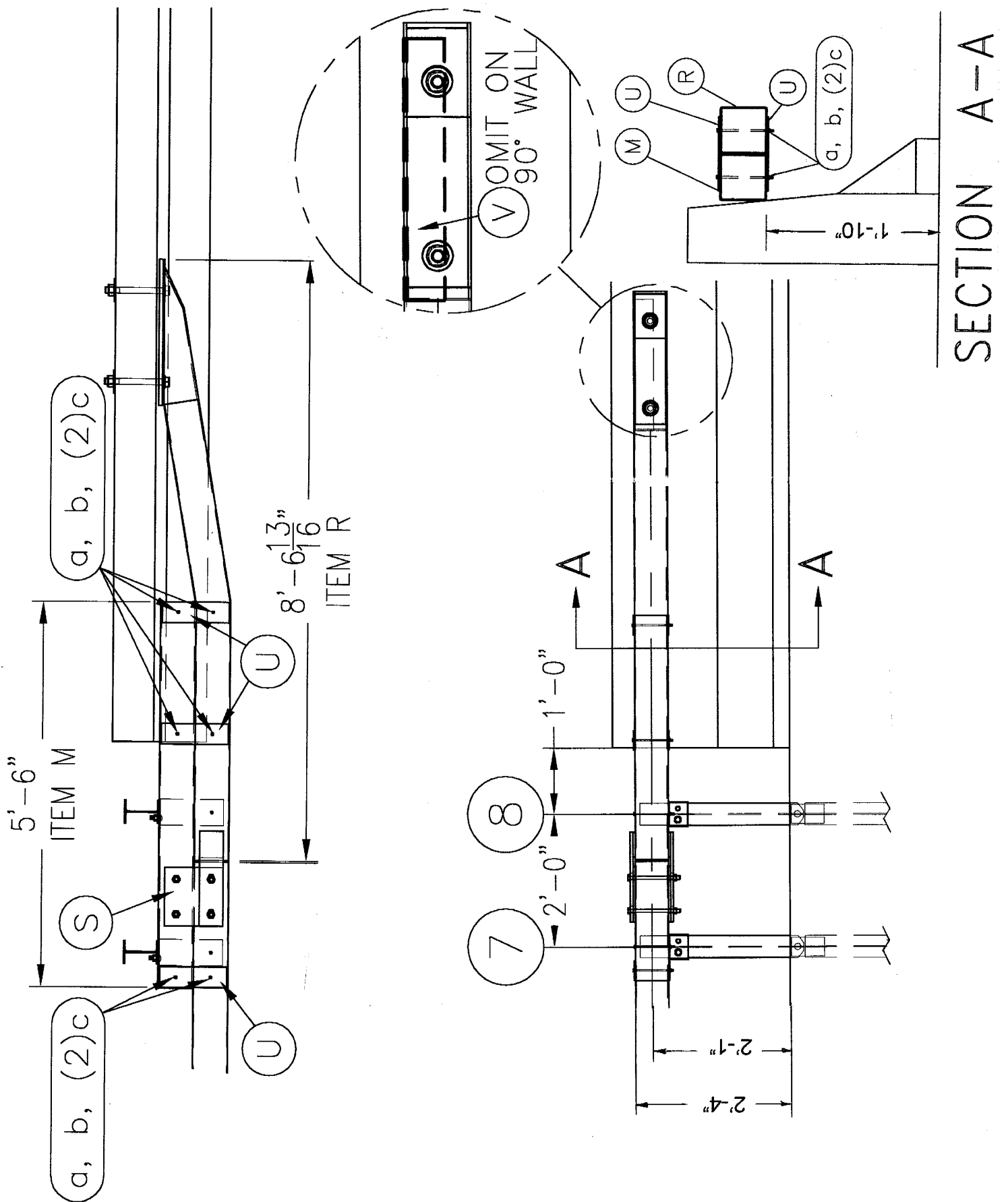


Figure 3. Detail of BEAT-SSCC Plan and Elevation at Rigid Wall

ITEM	QTY	DESCRIPTION
A	1	Box-Beam Impact Head
B	1	Upper End Post W6x9 x 1'-9 1/2" LG.
C	1	Lower End Post W6x15 x 8'-0" LG.
D	1	Support Bracket L4x2 x 4" LG.
E	1	Post Breaker Welded TS2x2x1/4"
F	1	Cable Anchor Assembly
G	1	Cable Anchor Bearing Plate
H	1	End Tube Rail x 8'-0" LG.
J	7	Steel Breakaway Post W6x9 x 6'-0" LG.
K	5	Support Bracket w/ Blockout TS6x6 w/ Bent PL.
L	1	Second Rail x 16'-2 1/2" LG.
M	1	Transition Blockout x 5'-6" LG.
N	2	Trans. Support Bracket 3/16" Bent PL. w/ Gusset
P	2	End Tube Splice Plate
Q	2	1" Square Washer PL. 4" x 4" x 1/4"
R	1	Anchor Rail x 8'-6 13/16" LG.
S	2	Splice Plate PL. 10" x 10" x 3/8"
T	1	3/8" GALV. Cable x 20'-0"
U	6	Tie Plate PL. 11 1/2" x 3 1/2" x 3/16"
V	1	Spacer (OMIT ON 90° WALL)
		HARDWARE
a	14	5/16" x 7 1/2" Hex Bolt Grade 5
b	14	5/16" Hex Nut
c	28	5/16" Washer
d	1	1/4" x 3" Hex Bolt Grade 2
e	1	1/4" Hex Nut
f	1	1/4" Washer
g	7	5/8" x 1 1/2" Guardrail Bolt
h	7	5/8" Recess Nut
i	8	5/8" x 2" Hex Bolt Grade 5
j	1	5/8" x 8" Hex Bolt Grade 5
k	18	5/8" Hex Nut
m	25	5/8" Washer
n	1	5/8" x 3" Hex Bolt Grade 5
p	4	5/8" x 9" Hex Bolt Grade 5
q	1	1/2" x 5" Hex Bolt Grade 5
r	2	1/2" Hex Nut
s	1	1/2" x 2" Hex Bolt Grade 2
t	2	1" x 10" Hex Bolt Grade 5 (Length Varies w/ Wall Sect.)
u	4	1" Hex Nut Grade 5
v	4	1" Washer Grade 5
w	2	1/2" Washer
x	2	Cable Tie

Figure 4. BEAT-SSCC Bill of Material

BEAT-SSCC Installation Procedure

Install W6 x 9# Posts #2 through #8

Layout a string line and mark off the required post spacing. See **Figures 1 & 2** for layout. Posts #2 to #8 must have the traffic side surface of the post positioned in-line with the rigid hazard. If the rigid hazard is a vertical surface, align the posts with the face of the hazard. If the rigid hazard is a sloped surface, measure a point at a 1'-10" height from the groundline and align the posts with this point as shown in **Figure 3**.

The posts should be driven with a guardrail post pounder. For stiff soils, drill a pilot hole and force the post to the appropriate depth by impact or vibratory means with a guardrail post pounder. The post may also be installed by augering and backfilling if the contractor so prefers. If augering the hole, the initial hole must be large enough to allow adequate room for proper compaction of the soil during backfill. *Care must be taken to carefully compact the backfill to prevent settlement or lateral displacement of the post.*

Install Upper (W6 x 9#) & Lower (W6 x 15#) Post #1 Sections

The first post is spaced 6'-6" from post #2 and consists of an upper and lower section. The lower section is a W6x 15# beam 8'-0" long. Post #1 must be positioned in-line with the centerline of the 6"x 6" box beam rail sections. The centerline of post #1 will be offset 12" from the centerline of post #2. Be sure the lower post is installed with the 3/4" diameter hole on the top of the post located on the front upstream side opposite post #2. See **Figure 7**. It may be driven with a guardrail post pounder. For non-penetrable soil, drill a pilot hole and force the post to the appropriate depth by impact or vibratory means with an approved guardrail post pounder. The post may also be installed by augering and backfilling if the contractor so prefers. If augering the hole, the initial hole must be large enough to allow adequate room for proper compaction of the soil during backfill. *Care must be taken to carefully compact the backfill to prevent settlement or lateral displacement of the post.* See section in back of this manual for "Installation Recommendations When Rock is Encountered".

Align the 3/4" diameter holes in the upper and lower post sections and attach the upper post section to the lower post section using one 5/8"x 8" hex bolt, nut and washer. See **Figure 7**.

Install Transition Support Brackets at Posts #7 & 8

A transition support bracket assembly is used at post locations #7 & #8. This assembly will provide a shelf to place both the transition blockout tube and the anchor box beam rail. The support brackets are attached to the posts with a 5/8"x 1 1/2" guardrail bolt, recess nut and washer. See **Figure 5**.

Install Rail Support Brackets at Posts #2 through 6

A support bracket / blockout assembly is used at post locations #2 to #6. This assembly will create a 6" offset from the post to the box beam rail section and provide a shelf to place the box beam rail. The support brackets are attached to the posts with a 5/8"x 1 1/2" guardrail bolt, recess nut and washer. See **Figure 6**.

Install Transition Blockout Tube at Posts #7, 8 and Rigid Wall

A transition blockout tube 6" x 6" x 5'-6" long is used near the connection to the rigid hazard. The blockout tube is not attached to posts #7 & #8 but is set on the support brackets that are bolted to the posts. This transition blockout is attached to the welded/tapered anchor rail at 4 places. At 3 places, 3 1/2" x 11 1/2" tie plates are used. At 1 place, a 10" x 10" splice plate is used. See below for a description of the tie plate and splice connections. Also see **Figures 3, 8 & 9**.

Install Anchor Rail at Post #8 and Rigid Wall

A welded/tapered anchor rail tube 6" x 6" x 8'-6" long is used at the connection to the rigid hazard. This tube is attached to the transition blockout tube as noted above. See **Figures 3 & 8**. It is also bolted to the rigid hazard with two 1" high strength hex bolts. In addition, it is attached to the support bracket at post #8 using a 5/16"x 7 1/2" hex bolt, nut and 2 washers. See **Figures 5**. It is suggested that this tube be aligned with post #8 and used as a template to locate the two through holes in the rigid wall.

This anchor rail has two 4" wide splice plates welded to the straight end of the tube. It is spliced to the second 6" x 6" rail section using these welded splice plates. The welded splice plates will set on top of the 10" x 10" splice plates. See below for a description of the connection at the rigid wall and the connection at the second rail. Also see **Figure 3, 8, & 9** for details.

Attach Anchorage and Spacer at Rigid Wall

The BEAT-SSCC must be connected to the rigid structure that the system is protecting. The appropriate connection to the rigid structure is a very critical component to insure proper performance. The rigid structure may have a vertical surface or a sloped surface.

If the hazard has a vertical surface, connect the anchor bracket of the welded/tapered anchor rail tube directly to the vertical surface. See **Figures 3 & 8** for details.

If the hazard has a sloped surface, use the 3 1/2" x 1'-11 5/8" spacer between the welded/tapered anchor rail tube and the rigid sloped surface. See **Figures 3 & 8** for details.

To locate the two required 1 1/4" diameter holes in the rigid structure, align the 6" x 6" x 8'-6" welded/tapered anchor rail tube with post #8 and use it as a template to locate the two through holes in the rigid wall. Attach the anchor bracket of the welded/tapered anchor rail to the rigid hazard using 1" high strength hex bolts, nuts, flat washers and 4" x 4" x 1/4" square washers. The required length of the hex bolts will vary with the wall structure and will need to be determined in the field. See **Figures 3 & 8**.

Attach Splice Connections at 2 Locations

There are 2 locations where the 6"x 6" box beam barrier sections splice together:

- **Second Tube and Anchor Rail** (Between Posts #7 & 8) – This splice uses the two 4" wide splice plates welded to end of the welded/tapered anchor rail tube & two 10" x 10" x 3/8" splice plates (1 each at top and bottom) with 5/8"x 9" hex bolts, nuts and 2 washers. The two 4" wide plates welded at the end of the anchor rail set on top of the 10" x 10" splice plates. The 10" x 10" splice plates also attach to the transition blackout tube. See **Figure 9**.
- **8'-0" Long End Tube and Second Tube** (Between Posts #2 & 3) – This splice uses the end tube splice section and 5/8"x 2" hex bolts, nuts and washers. Install the double nitted rail splice plate section to the leading end of the second rail section prior to putting the first rail section into place. Note that two nuts are used for each bolt at the inside of the second rail tube connection. See **Figure 10**.

Attach Tie Plate Connections at 3 Locations

Tie plate connections occur at 3 locations within the transition blackout tube near the rigid wall connection. A total of six tie plates 11 1/2" x 3 1/2" x 3/16" are used (1 each at top and bottom) to connect the transition blackout to either the welded/tapered anchor rail or the second rail tube. The connection is made using 5/16" x 7 1/2" hex bolts, nuts and 2 washers. See **Figures 3 & 8** for details.

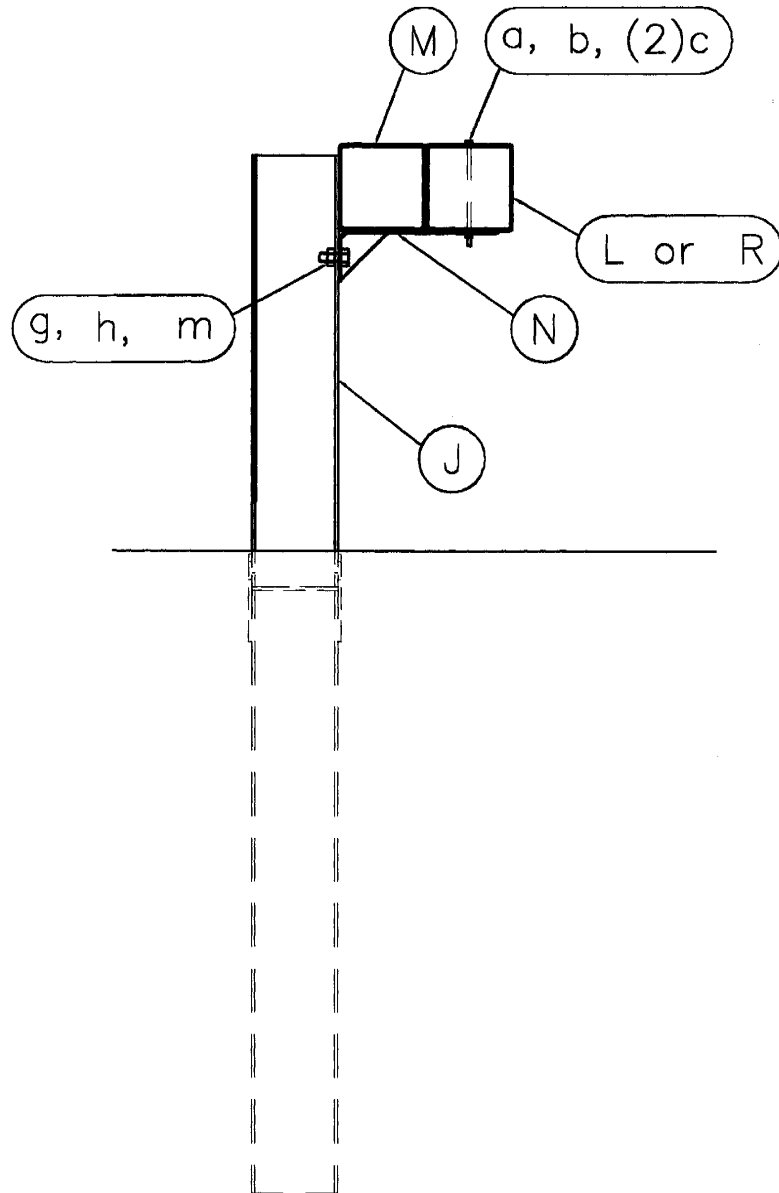
Install Second Rail at Posts #3 through 7

Attach the 6"x 6" x 3/16" x 16'-2 1/2" long second rail tube section to the 4" wide splice plates (welded to the straight end of the welded/tapered anchor rail tube as noted above) and to the 10" x 10" splice plates. See above for a description of the splice connection. At the transition blackout tube, 3 1/2" x 11 1/2" tie plates are used to attach to this rail. See above for a description of the tie plate connection. Attach this rail to the support brackets that are bolted to posts #3 to #7 using 5/16"x 7 1/2" hex bolts, nuts and 2 washers. See **Figures 2, 3, 5, 6, 8, & 9** for details.

Install End Tube Rail with Support Bracket at Posts #1 & 2

At this point all of the downstream 6"x 6" box beam barrier including the connection to the rigid wall and posts should be in place. Attach the 8 foot long 6"x 6" x 1/8" end tube section to the 6"x 6" x 3/16" second rail tube section using the end tube splice section. See above for a description of the splice connection. Also see **Figure 10**. This end tube section is a specially fabricated 1/8" thickness tube as supplied by the manufacturer and has notches cut at the approach end where the impact head is placed.

Attach the end tube to post #2 support bracket using a 5/16"x 7 1/2" hex bolt, nut and 2 washers. See **Figure 6**. The end tube is attached to post #1 using a 4"x 2" x 4" long bent plate support bracket and a 5/16"x 7 1/2" hex bolt, nut and 2 washers. This support bracket is attached to post #1 with a 1/2"x 2" hex bolt, nut and 2 washers. See **Figure 7**. Do not attach the end tube to the support bracket until the impact head is installed.



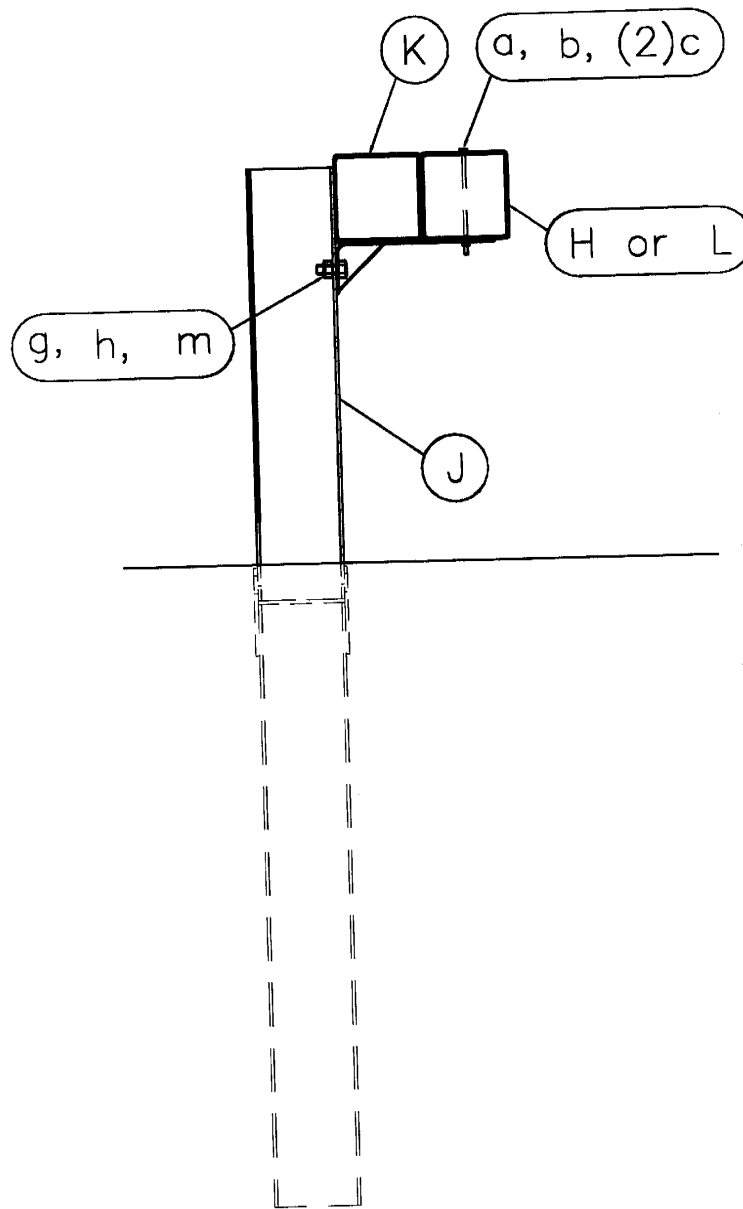
Item M is the Transition Blockout Tube 6" x 6" x 5'-6" long

Item N is the Transition Support Bracket

At Post #7, the 6" x 6" tube is Item L

At Post #8, the 6" x 6" tube is Item R

Figure 5. Posts # 7 & 8 Connection Details for the BEAT-SSCC



Item K is the Support Bracket with a Blockout Tube 6" x 6" x 6" long

At Post #2, the 6" x 6" tube is Item H

At Posts #3 to #6, the 6" x 6" tube is Item L

Figure 6. Posts #2 - #6 Connection Details for the BEAT-SSCC

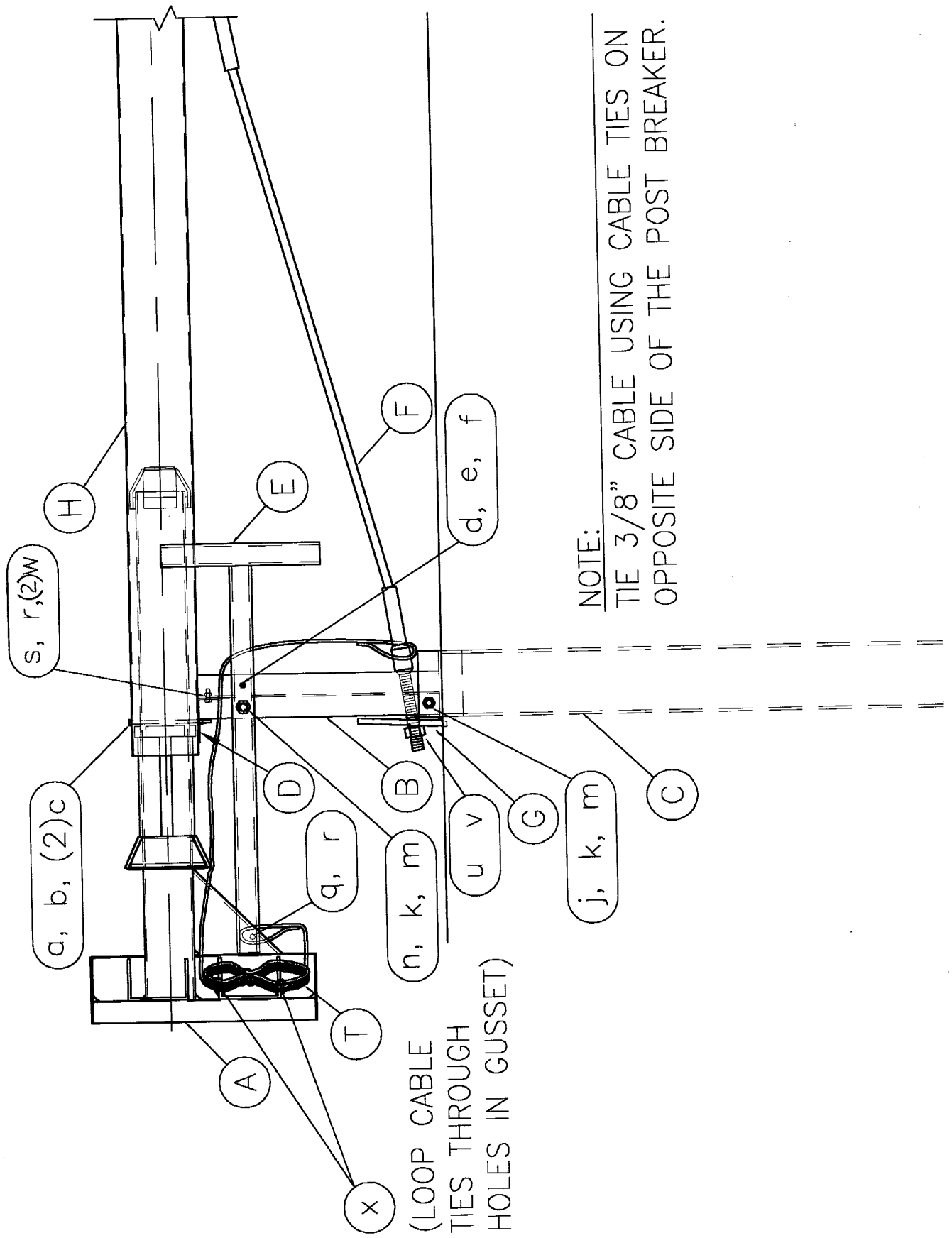
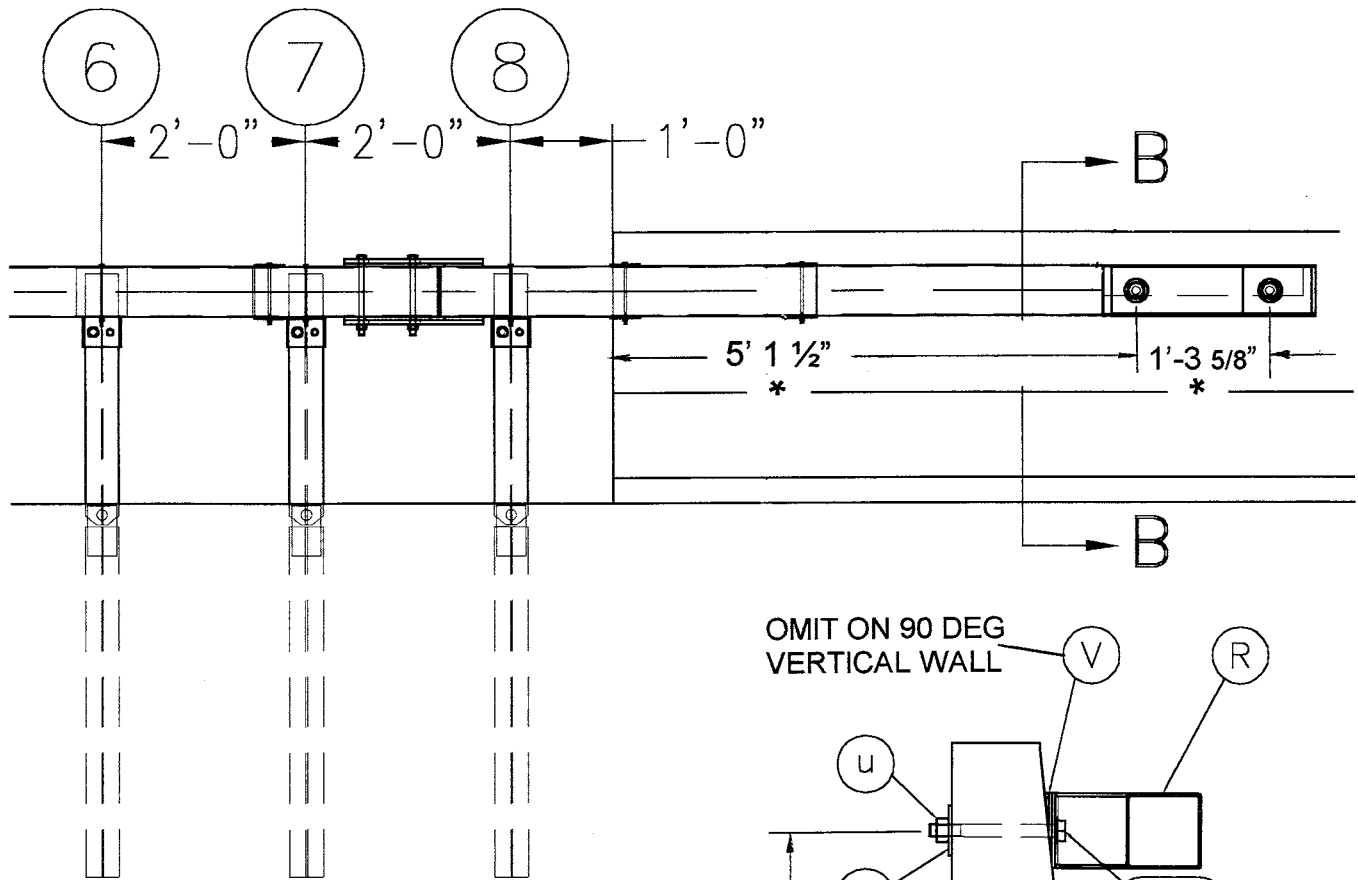
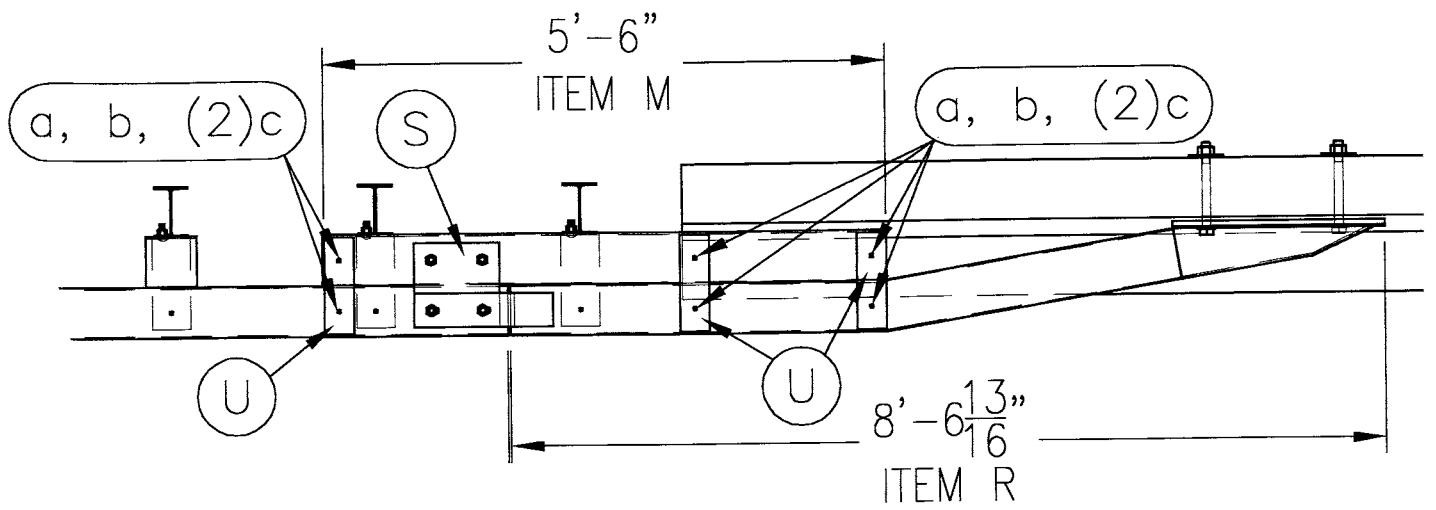
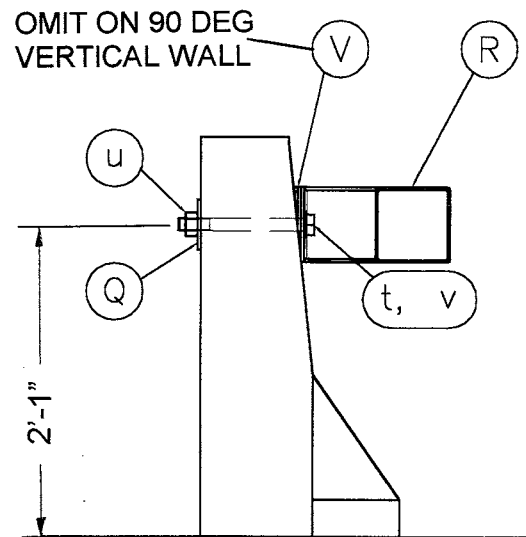


Figure 7. Post #1 Connection Details for the BEAT-SSCC

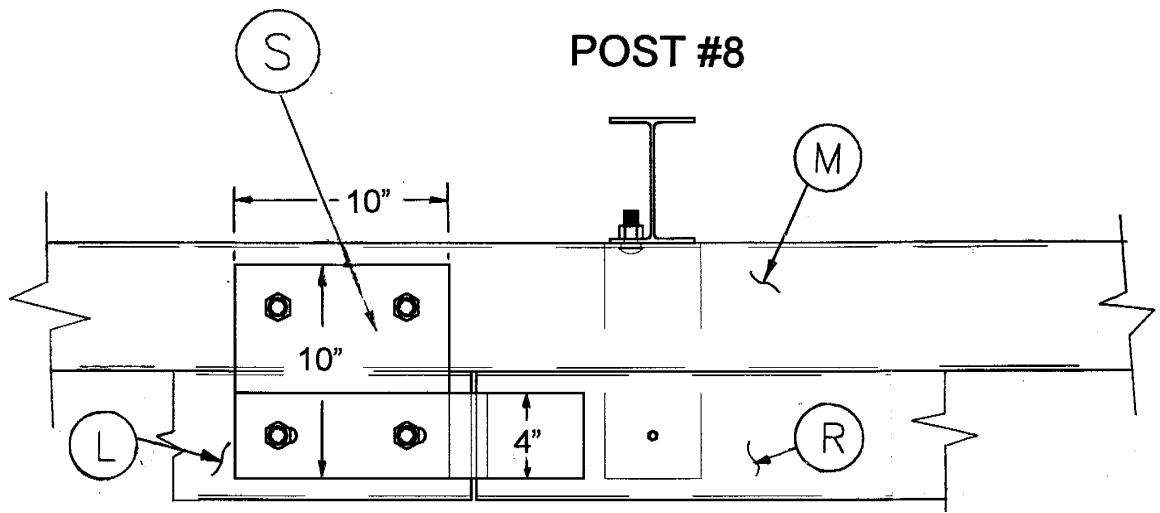


* REFERENCE DIMENSION ONLY.
USE WELDED/TAPERED ANCHOR
RAIL TUBE AS A TEMPLATE TO
LOCATE HOLES IN CONCRETE



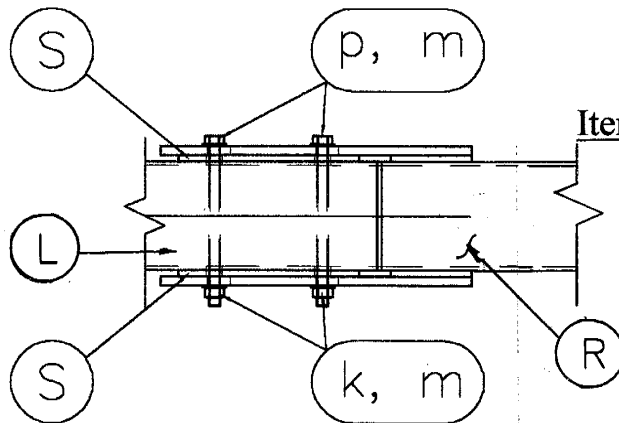
SECTION B-B

Figure 8. Anchor Bolt & Tie Plate Connections for BEAT-SSCC



Item L is the 6" x 6" second rail tube

Item M is the transition blockout tube



Item R is the 6" x 6" welded/tapered anchor rail
(with 4" wide splice plates welded at end)

Items S are the 10" x 10" x 3/8" splice plates

Item R anchor rail tube has two 4" wide splice plates welded to the straight end of the tube.
The welded splice plates will set on top of the 10" x 10" Item S splice plates.

Figure 9. Splice Plate Detail for the BEAT-SSCC

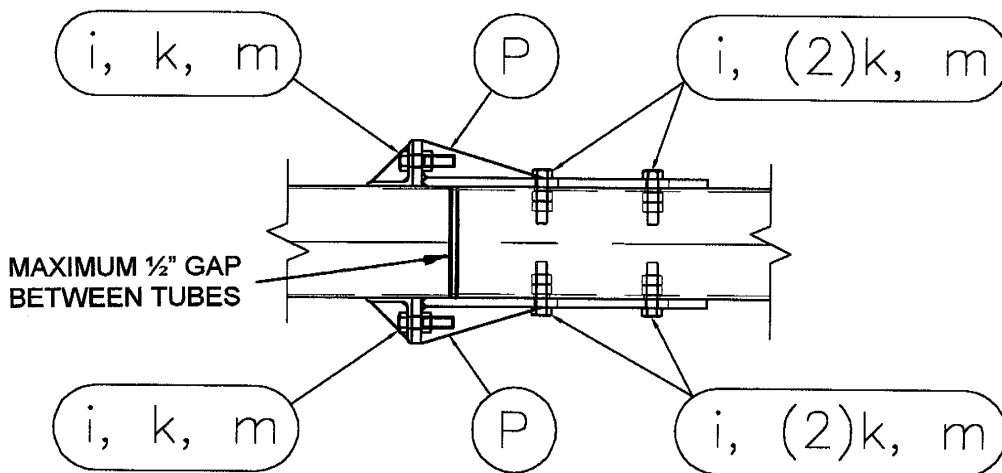


Figure 10. End Tube Splice Detail for the BEAT-SSCC

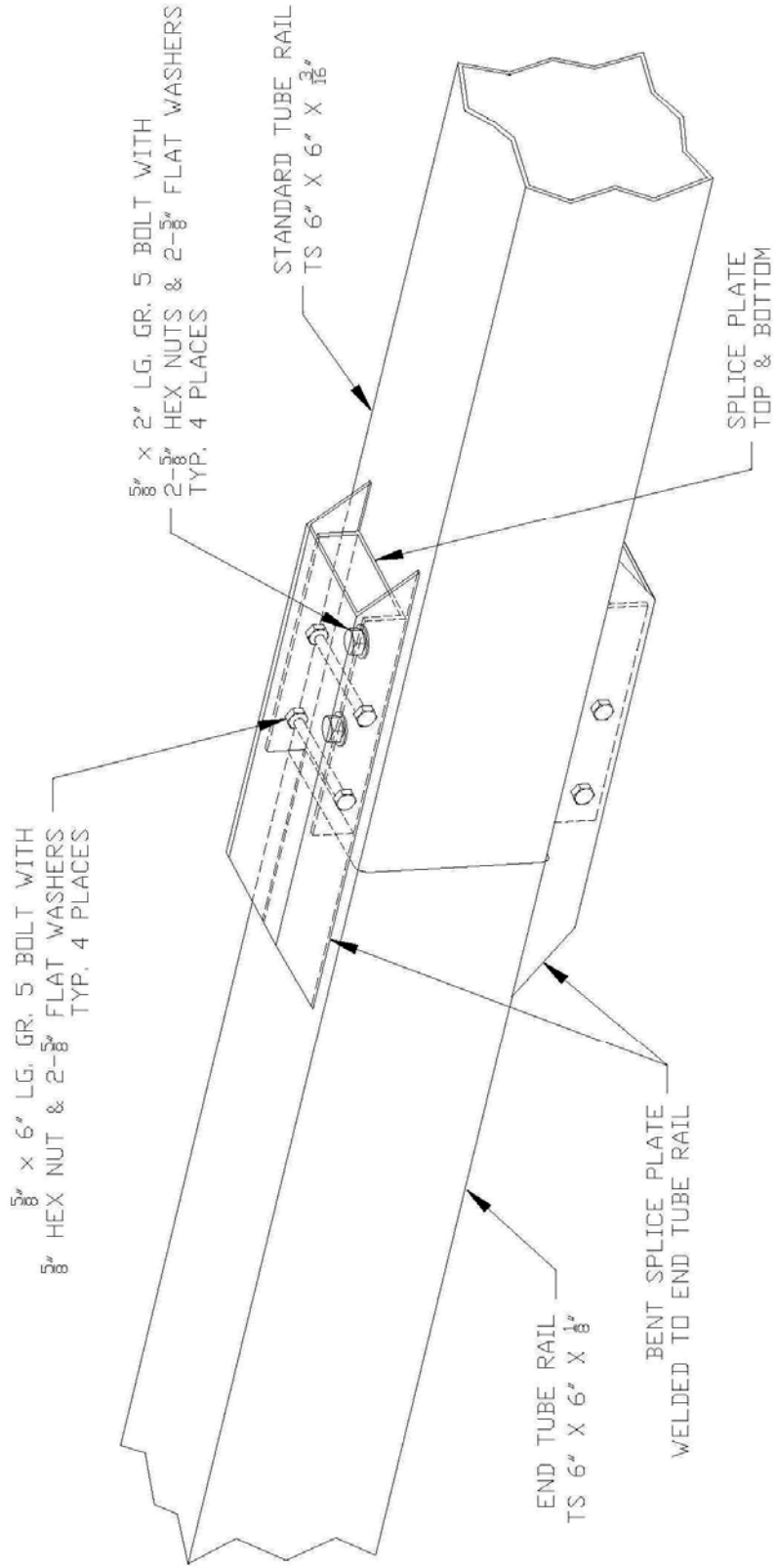


Figure 10-a. **Optional** End Tube Splice Detail for the BEAT-SSCC

Install BEAT-SSCC Impact Head

Place the impact head inside the end tube. The impact head should be positioned so the holes at the end of the tube and the hole in the impact head are aligned. Also be sure the impact head is inserted into the end tube section with the large triangular gusset plates facing down. Attach the end tube to impact head using a 5/16"x 7 1/2" hex bolt, nut and 2 washers. See **Figure 7**.

Note. It is recommended that the front face of the impact head be delineated with an object marker that meets local specifications for better night visibility. The impact face object marker is included as part of the shipped materials for the BEAT-SSCC.

Install Post Breaker

If the system is installed on the roadside, attach the post breaker to the traffic side of post #1 with a 5/8"x 3" hex bolt, nut and washer and a 1/4"x 3" hex bolt, nut and washer. If the system is installed in the median, attach the post breaker to the reverse direction traffic side of post #1. See **Figure 7**.

Install Tether Cable

The tether cable will arrive bundled into a "figure-8" with two free ends that each has swaged loops. **DO NOT CUT THE TIE ON THE CABLE.** Attach the shorter free end (≈ 28 "") to the lower backside of the impact head by putting the end loop through the slot in triangular gusset plates and passing a 1/2"x 5" hex bolt through the loop. Secure the bolt with a nut. Attach the "figure-8" to the back of the impact head using the provided cable ties passing through the upper and lower gusset notches as shown in **Figure 7**. Finally, pass the longer free end of the bundle (≈ 50 "") above the post-breaker around post one and pass the anchor cable through the end loop prior to attaching the anchor through post #1, as shown in **Figure 7**.

Install Cable Assembly w/ Bearing Plate

Place the cable assembly through the lug welded to the underside of the end tube near post #2. See **Figure 2**. The other end of the anchor cable will pass through the tether cable loop and through post #1. (See above for tether cable attachment). Place the bearing plate at the base of post #1 with the 5" dimension up and the 3" dimension down. Secure both ends of the cable assembly with a 1" hex nut and washer. While tightening the nuts at the end of the cable, restrain the cable at the end being tightened to avoid twisting the cable. See **Figure 7**.

Upon completion of the installation, the cable should be taut.

BEAT-SSCC Installation Inspection Checklist

State: _____

Date: _____

Project #: _____

Inspection performed by: _____

Location: _____

- The 6"x 6" end tube section is the special 1/8" thickness tube as supplied by the manufacturer with notched corners at the approach end where the impact head is placed.
- The BEAT-SSCC has two 6"x 6" x 3/16" tube sections (one straight and the other welded and attached to the rigid structure) joining with the special 8'-0" long end tube section.
- The end tube section is bolted to the second rail section with the special end tube splice.
- The second rail tube is bolted to the welded/tapered anchor rail and the 5'-6" blackout tube section using 11 1/2" x 3 1/2" x 3/16" tie plates and 10" x 10" x 3/8" splice plates.
- The height of the 6"x 6" box beam tubing is 2'-4".
- The box beam tubing is attached to all rail support brackets with a 5/16" x 7 1/2" hex bolt.
- The rail support brackets are attached to posts with proper hardware:
--Post #1 support bracket bolt is 1/2"x 2" hex bolt
--Posts #2 through #8 support bracket bolts are 5/8" x 1 1/2" hex bolt
- The upper and lower sections of post #1 are properly connected with a 5/8"x 8" hex bolt.
- All 8 posts are breakaway. Each has proper support bracket and/or blackout components:
--Post #1 is centered under the rail and has a support bracket only with no blackout.
--Posts #2 through 6 have a support bracket/blockout weldment piece.
--Posts #7 & 8 have individual support brackets and share a common blackout tube.
- The splice plates and tie plates are properly attached at the transition blackout near posts #7, #8 and the end of the rigid wall.
- The anchor rail is properly attached to the rigid wall with two 1" diameter high strength hex bolts. Also, if the rigid wall is not a vertical wall, a spacer plate is needed.
- The impact head is properly inserted into the end tube section with the large triangular gusset plates facing down. The bottom of the impact head is approx 12" above ground.
- The post breaker is on the approach traffic side of post #1 and stabilized with two bolts.
- The 8" x 8" bearing plate at post 1 is correctly positioned with the 5" dimension up & the 3" dimension down. The anchor cable is taut and correctly installed.
- The tether cable is properly attached to restrain the impact head.
- If the posts were augered, be sure the backfill material around the posts is compacted.

Additional notes:

Installation Recommendations When Rock is Encountered on the BEAT-SSCC System

The following recommended installation procedures are intended for installations where bedrock is encountered at a depth shallower than the eight-foot length post embedment for BEAT-SSCC post #1. When cobbles or loose rock is encountered that prevents driving the first post to full depth, it is necessary to auger to full depth or follow the "Alternative Foundation Using Concrete" option shown below. Concrete shall not be used at any other BEAT-SSCC posts.

In installations where bedrock is encountered at the depths indicated below, it will be necessary to core into the rock for the following depths. This cored hole should be 10" in diameter. The installer should assure that the rock removed out of the cored hole is reasonably solid rock.

<u>Surface of Rock</u>	<u>Required Core Depth Below Rock Surface</u>
0 to 2'	36"
2' to 4'	24"
4' to 7'	12"
7' to 8'	Core to 8'

The post may then be shortened by cutting the bottom of the post. Place granular material in the bottom of the hole so that the base rests 2.5" from the bottom of the cored hole. Cold galvanize paint the cut surfaces.

The post shall be placed in the hole and backfilled with adequately compacted material. If preferred, this post #1 may be backfilled with concrete.

These depths will provide sufficient anchorage to provide system redirection capacity and prevent the post from being pulled vertically from the ground during impact.

Alternative Foundation Using Concrete

If the BEAT-SSCC post #1 has reached a minimum depth of 48" and cannot be driven further, the following options may be followed for installation in an augered hole:

<u>Depth of Augered Hole</u>	<u>Diameter of Augered Hole</u>	<u>Concrete Depth</u>
48" to 67"	24" Diameter	Bottom 36" of hole
68" to 95"	12" Diameter	Bottom 24" of hole

