

Assembly Instructions

MBEAT MASH Terminal

For 6" x 6" Roadside Box Beam Barrier



ROAD SYSTEMS, INC.

P. O. Box 2163

Big Spring, Texas 79721

Phone: (432) 263-2435 FAX: (432) 267-4039

Technical Support & Marketing Phone: (330) 346-0721

Sales Support & Marketing Phone: (330) 799-9291

www.roadsystems.com

On-Line Training www.training.roadsystems.com

Table of Contents

	<u>Page</u>
1. General Information	2-3
2. MBEAT and NCHRP 350 BEAT Comparison	4-5
3. Begin Assembly – Drawing & Photo Details	6
3.1 Bill of Materials for MBEAT	6
3.2 MBEAT Layout / Figure 1	7
3.3 MBEAT Assembly/ Figure 2	8
3.4 View of MBEAT Steel End Post #1 / Figure 3	9
3.5 Post #1 Connection Detail for MBEAT / Figure 4	10
3.6 Post #2 Connection Detail for MBEAT / Figure 5	11
3.7 Ground Strut Detail for MBEAT / Figure 6	12
3.8 End Rail Splice Attachment for MBEAT/ Figure 7	13
3.9 Cable Anchor Assembly Attachment for MBEAT/ Figure 8	14
3.10 Retention Plate Channel Bolted at Post #2 / Figure 9	15
3.11 Impact Head, Post Breaker, Support Bracket for MBEAT / Figure 10 ...	16
3.12 Grading Recommendations for MBEAT / Figure 11	17
4. Installing the MBEAT	18
4.1 Materials	18
4.2 Site Preparation	18
4.3 Tools Required	18
4.4 Installation Procedures	18
4.4.1 Installing the 3" Weak Posts with Standard Box Beam	19
4.4.2 Installing Bottom & Top Post #2 Sections	19
4.4.3 Installing Bottom & Top Post #1 Sections	19-20
4.4.4 Installing Ground Strut	20
4.4.5 Installing Post Breaker	20
4.4.6 Installing the 6" x 6" End Tube Rail, Splices, Support Brackets	20
4.4.7 Installing Retention Plate	21
4.4.8 Installing MBEAT Impact Head / Figure 12	21
4.4.9 Installing Cable Anchor Assembly & Bearing Plate / Figure 13	22
5. Inspection Checklist for MBEAT	23-24
6. Repairing the MBEAT	25-28
7. MBEAT Applications	29

1 General Information

This Installation Manual is for the MBEAT, MASH Box Beam Terminal. The MBEAT is intended for use with MASH 6" x 6" roadside Box Beam Barriers.

The MBEAT was designed and crash tested as a redirective gating terminal to meet the requirements of the American Association of State and Highway Transportation Officials (AASHTO) Manual for Assessing Safety Hardware (MASH) criteria Test Level 3 (100 km/hr.). The MBEAT is eligible for Federal-aid reimbursement for use on the National Highway System. It is the responsibility of the installer to utilize an application approved by the State DOT and to follow all required State procedures and these instructions when installing the MBEAT terminal.

This Installation Manual is divided into 7 sections

1. General Information for MBEAT – An overall summary of information about the MBEAT terminal. (pages 2-3)
2. MBEAT and NCHRP 350 BEAT Comparison – Description of the differences between the characteristics and components of the MASH MBEAT system and the NCHRP 350 BEAT system. (pages 4-5)
3. MBEAT Drawing & Photo Details – A Bill of Materials and assembly details for the MBEAT. (pages 6-17)
4. Installing the MBEAT – A step-by-step procedure on the proper assembly of MBEAT system. (pages 18-22)
5. Inspection Checklist for MBEAT – A checklist to inspect new installations or recently maintained/repaired installations. (pages 23-24)
6. Repairing the MBEAT – General repair procedures for the MBEAT system. (page 25-28)
7. MBEAT Applications – The FHWA letter and applications for the MBEAT. (page 29)



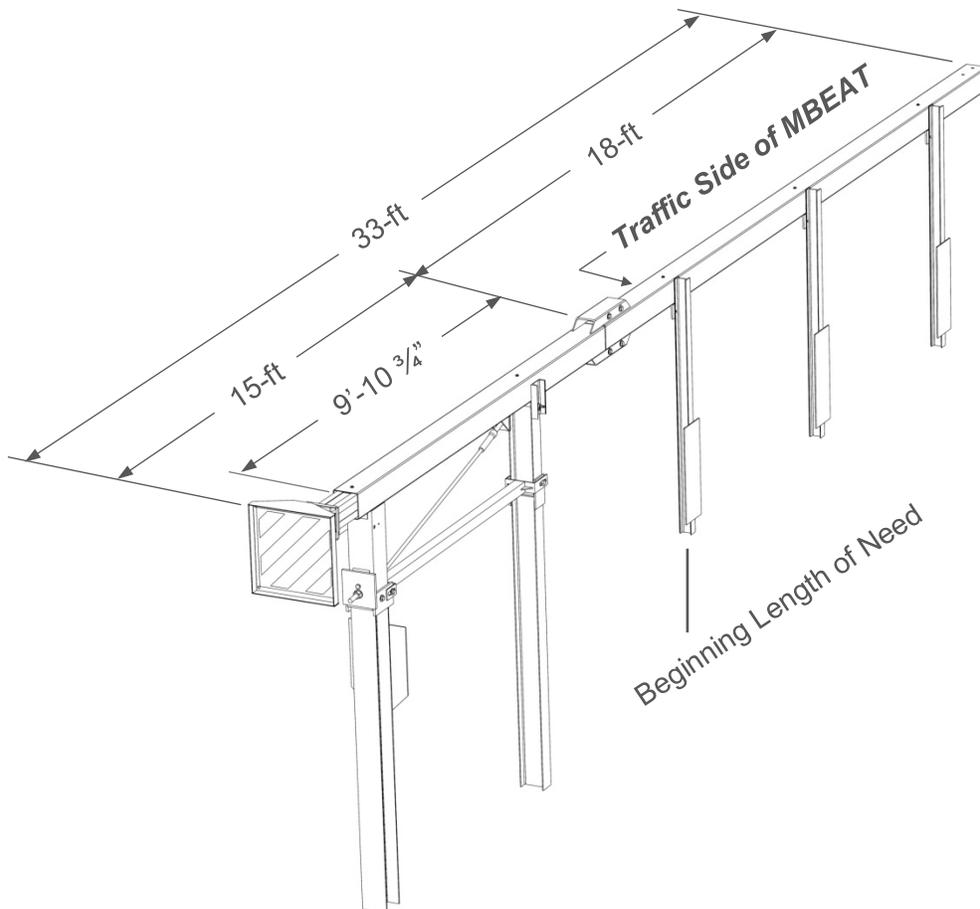
General Information (continued)

The MBEAT (MASH BEAT) is a roadside energy-absorbing terminal used to protect the ends of 6" x 6" box beam barriers that have been designed and tested under MASH criteria. During end-on impacts, the vehicle forces the mandrel portion of the MBEAT impact head into the end of the box beam section causing the tube to burst. The four walls of the tube are then peeled back.

The end tube rail wall thickness is 1/8", which is thinner than the 3/16" downstream box beam rail sections. The MBEAT is supported by two steel breakaway end posts connected by a strut and standard 3" x 5.7# I beam weak posts. The system is approximately 15 feet long from the front face of the impact head to the end of the first box beam tube rail and has a rail height of 2'-4". The additional energy absorbing capacity is achieved as the impact head bursts a standard downstream box beam section. The MBEAT requires an 18'-0" long (minimum) section of standard 6"x 6" x 3/16" box beam rail connected to the 9'-10 3/4" long first end tube rail. Longer sections of the standard 6"x 6" box beam rail are permissible.

The MBEAT is a cable-anchored system. When impacted on the traffic side within the length of need (post #3) and within design limits, the MBEAT contains and redirects the errant vehicle. A gusset plate is welded to the end tube rail section to anchor the downstream end of the cable. The cable is bolted into place for traffic face redirection impacts. The tension in the cable is released for end-on impacts when breakaway post #1 is fractured.

Design, selection & placement of the MBEAT system shall conform to the *AASHTO Roadside Design Guide* and the details shown on the contract plans. The assembly of the MBEAT shall be in accordance with the recommendations of Road Systems, Inc. shown in this installation manual.



2 MBEAT and NCHRP 350 BEAT Comparison

The MASH MBEAT characteristics include:

- 9'-10 ¾" long x 1/8" End Tube Rail plus the need for a Standard 6" x 6" x 3/16" x 18-ft long (minimum) second tube.
- Two steel bolted posts (#1, #2) having 6-ft embedment.
- The first 2 posts are spaced at 6'-3". Remaining posts spaced at 6'-0".
- Ground Strut between posts #1 and #2 needed.
- Length of Need point at post #3.

The NCHRP 350 BEAT characteristics include:

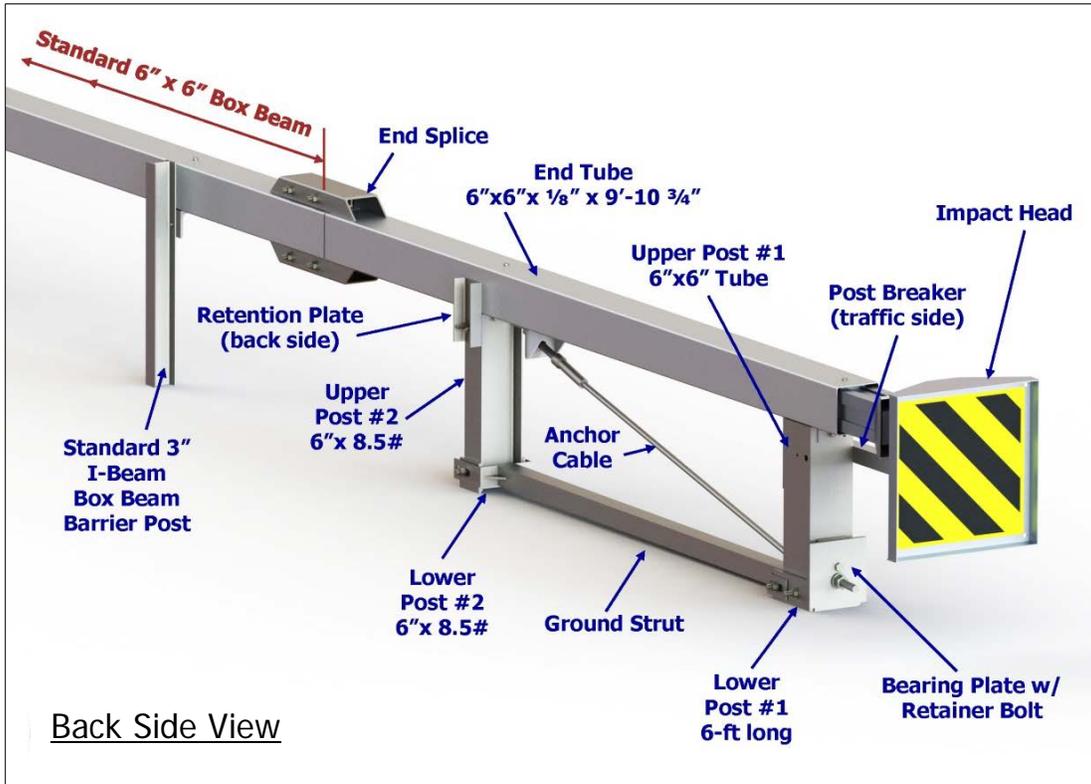
- 12'-0" long x 1/8" End Tube Rail plus the need for a Standard 6" x 6" x 3/16" x 18-ft (minimum) long second tube.
- One steel bolted post (#1) having 8-ft embedment.
- The first 2 posts are spaced at 8'-6 ¼". Remaining posts spaced at 6'-0".
- No Ground Strut needed.
- Length of Need point between posts #2 and #3.

MASH MBEAT and NCHRP 350 BEAT share the following components:

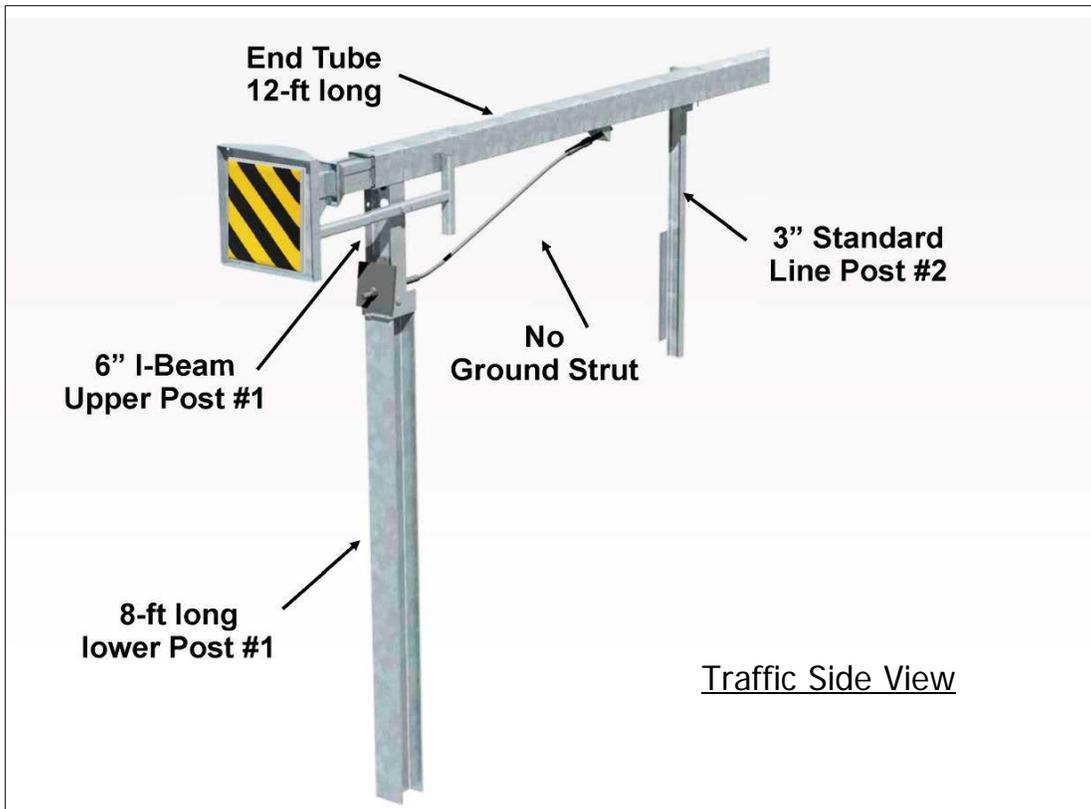
- Impact Head
- End Splice Channels
- Standard 6" x 6" x 3/16" x 18-ft long second tube, 3" Weak Posts with Soil Plate
- Support Brackets
- Cable Anchor Assembly
- Some Hardware

MBEAT components that are different than BEAT:

- MBEAT 1/8" End Tube Rail is shorter (9'-10 ¾" vs. 12-ft)
- Top and Bottom bolted Posts #1
- Top and Bottom bolted Posts #2
- Post Breaker
- Ground Strut added
- Retention Plate added
- MASH Bearing Plate with 5/8" x 5" full thread retention bolt
- Some Hardware



MASH MBEAT



NCHRP 350 BEAT (Reference Only)

3 Begin Assembly – Drawing & Photo Details

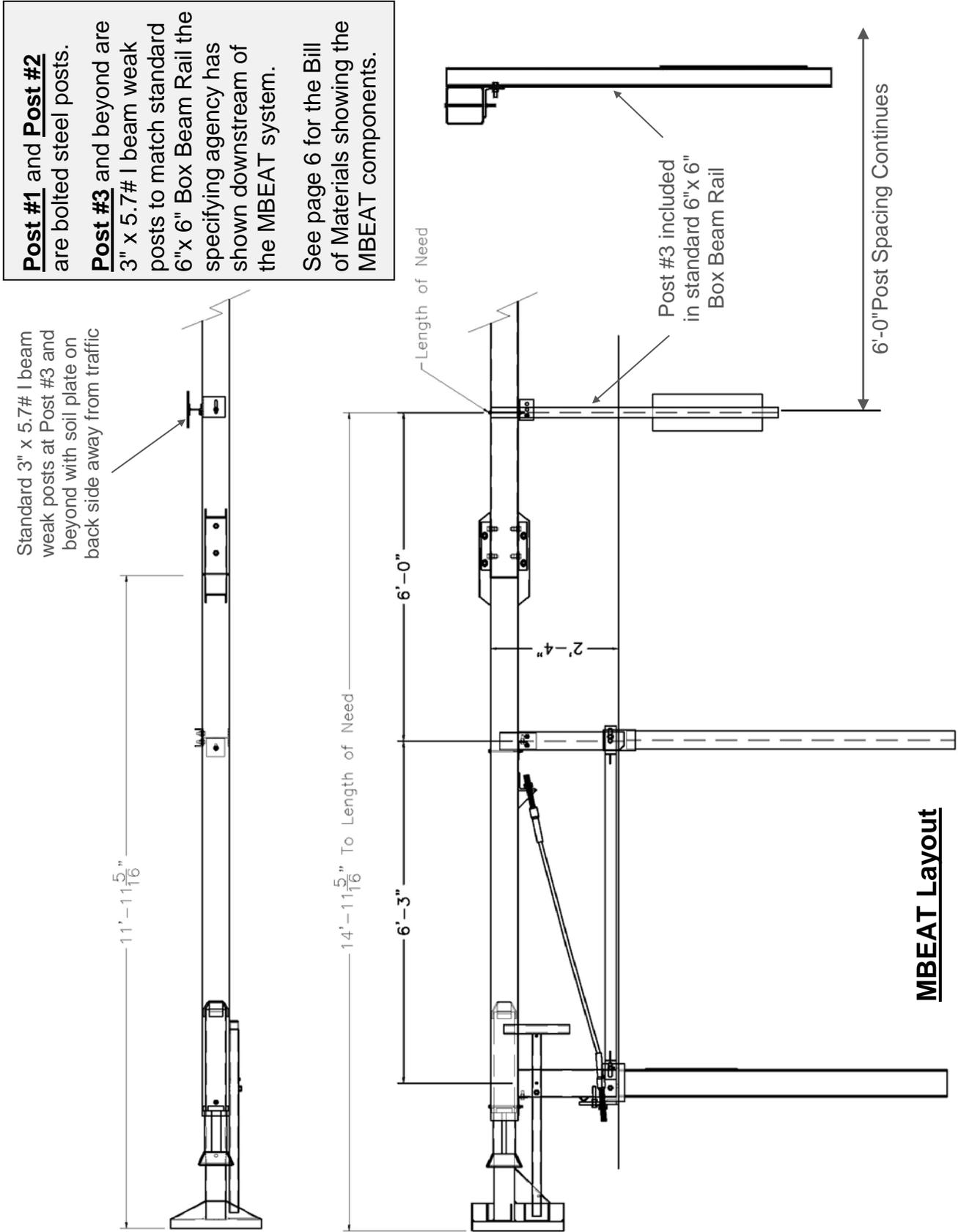
3.1 Bill of Materials for MBEAT

ITEM	QTY	DESCRIPTION	PART #
A	1	Box-Beam Impact Head	B3000
B	1	End Post Upper 6"x6"HSS (21 1/2")	MBEAT MP1A
C	1	End Post Lower W6x15x6'	MP1B
D	2	Support Bracket L 4"x2"x4"	BEAT-SB
E	1	Post Breaker	MBEAT-PB
F	1	Cable Anchor Assembly	E770
G	1	MASH Cable Anchor Bearing Plate	ME750
H	1	End Tube Rail 9'-10 3/4"	MBEAT ETR
J	1	Mash Ground Strut	MS785
K	1	MBEAT Hinge Post Top	MBEAT HP2A
L	1	Hinge Post Bottom	HP2B
M	2	End Section Splice Channel	BP-SC
N	1	Retention Plate C4x5.4 (Post #2)	MBEAT RP
		HARDWARE	
a	1	1/4" x 3" Hex Bolt Grade 5	B140304A
b	1	1/4" Hex Nut	N014
c	1	1/4" Washer	W014
d	2	5/16" x 7" Hex Bolt Grade 5	B5160704A
e	2	5/16" Hex Nut	N0516
f	4	5/16" Washer	W0516
g	4	1/2" x 2" Hex Bolt A325	B120204A
h	4	1/2" Hex Nut	N012A
i	8	1/2" Washer	W012
j	4	5/8" x 2" Hex Bolt Grade 5	B580204A
k	1	5/8" x 3" Hex Bolt Grade 5	B580304A
m	1	5/8" x 5" Hex Bolt Full Thread A449	B580504A
n	4	5/8" x 6" Hex Bolt Grade 5	B580604A
p	2	5/8" x 9" Hex Bolt Grade 5	B580904A
q	16	5/8" Hex Nut	N055
r	20	5/8" Washer	W050
s	1	3/4" x 8 1/2" Hex Bolt Grade 5	B340854A
t	1	3/4" Hex Nut	N030
u	2	1" Hex Nut	N100
v	2	1" Washer	W100

Post #3 and beyond are 3" x 5.7# I Beam Weak Posts

The second box beam tube is standard 6" x 6" x 3/16" x 18-ft long (minimum)

3.2 MBEAT Layout



Post #1 and Post #2 are bolted steel posts.

Post #3 and beyond are 3" x 5.7# I beam weak posts to match standard 6" x 6" Box Beam Rail the specifying agency has shown downstream of the MBEAT system.

See page 6 for the Bill of Materials showing the MBEAT components.

Figure 1.

3.3 MBEAT Assembly



1. Impact Head (20" x 20" Face)
2. End Tube Rail (6" x 6" x 1/8" x 9'-10 3/4")
3. Top Post #1 (6" x 6" x 1/8" Tube) w/ Support Bracket
4. Bottom Post #1 (W6" x 15# x 6-ft)
5. Top Post #2 (W6" x 8.5# or 9#) w/ Support Bracket
6. Bottom Post #2 (W6" x 8.5# or 9# x 6-ft)
7. Ground Strut
8. Cable Anchor Assembly
9. MASH Bearing Plate w/ Retainer Bolt
10. Post Breaker
11. End Splice
12. Retention Plate (C4 x 5.4# on Backside of Post #2)
13. Standard 6" x 6" Box Beam x 18-ft w/ Standard 3" x 5.7# Weak Posts

Figure 2.

3.4 View of MBEAT Steel End Post #1

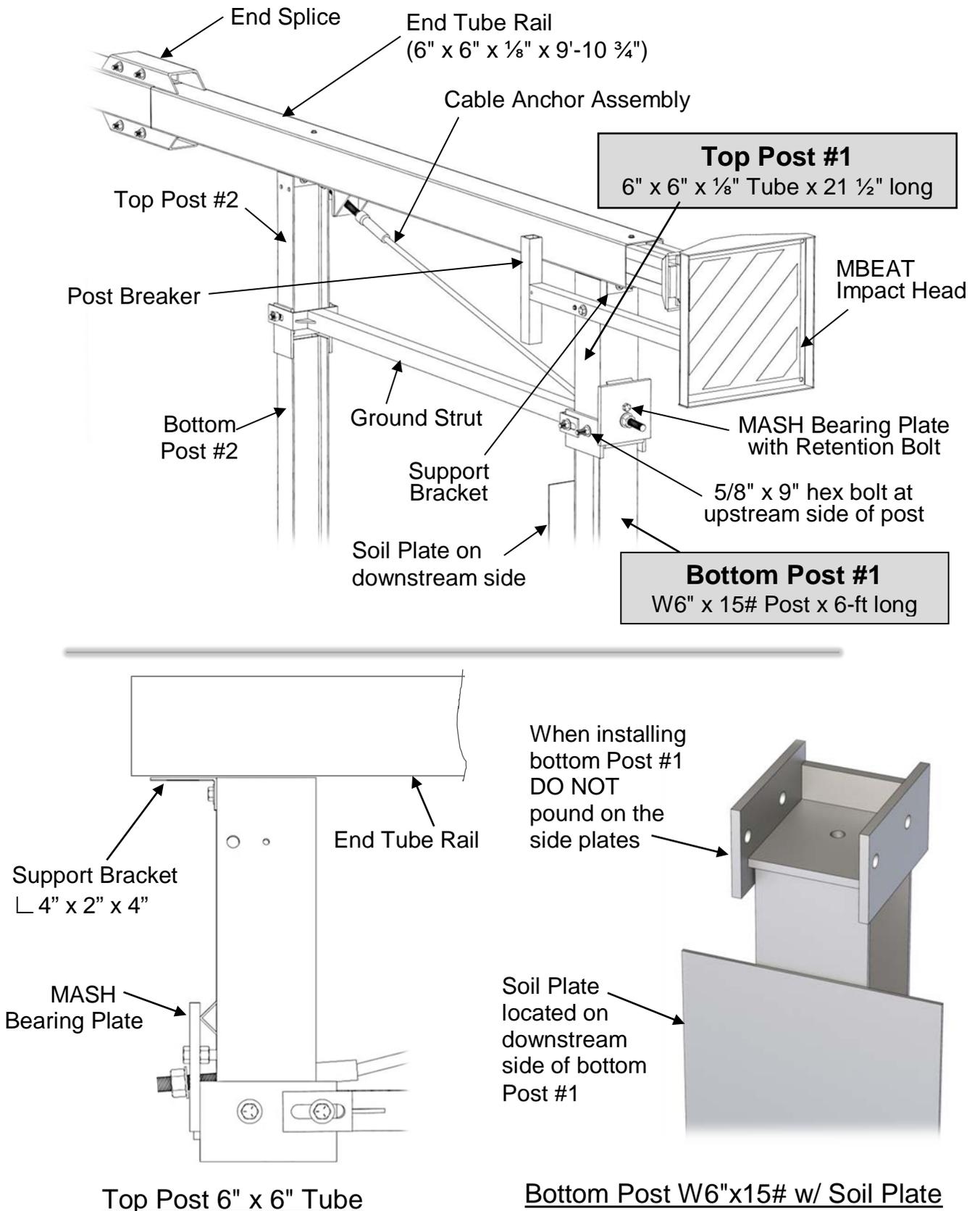


Figure 3.

3.5 Post #1 Connection Detail for MBEAT

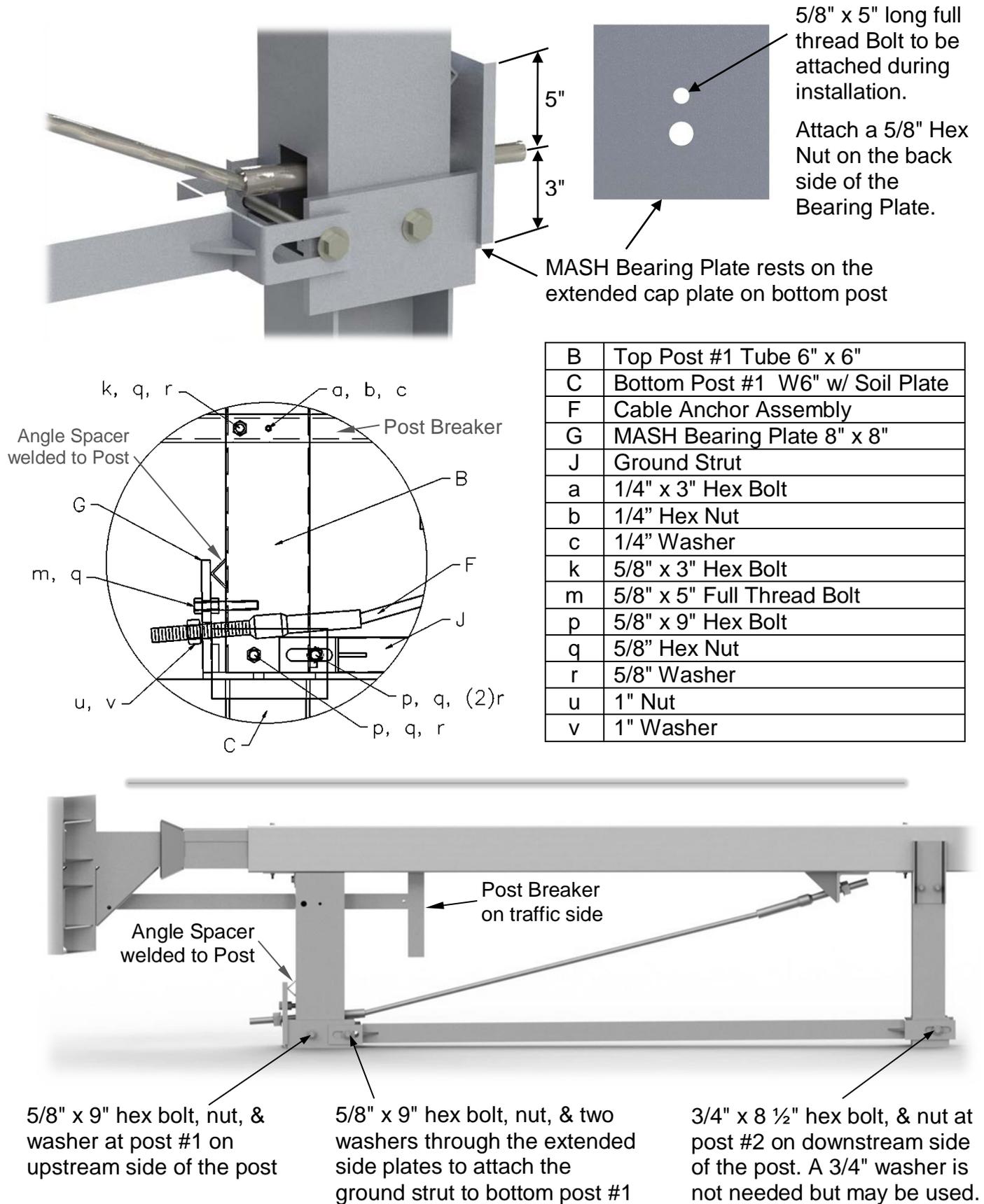
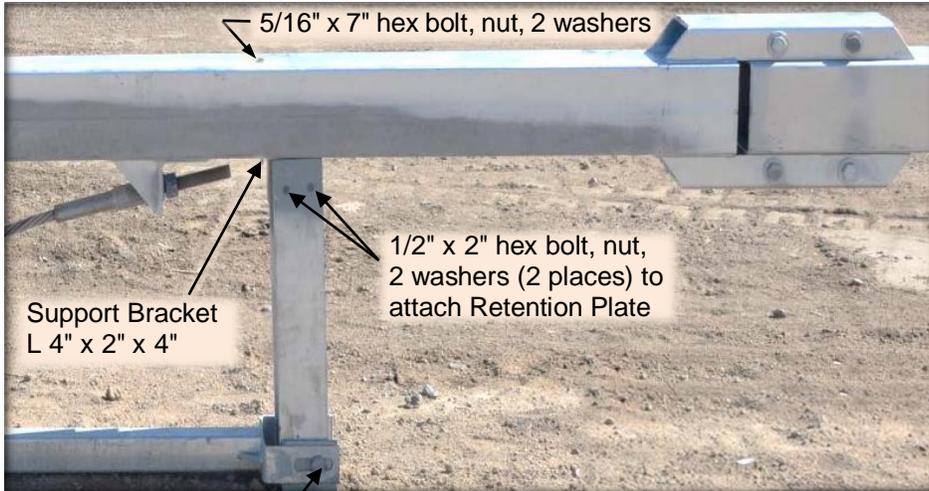
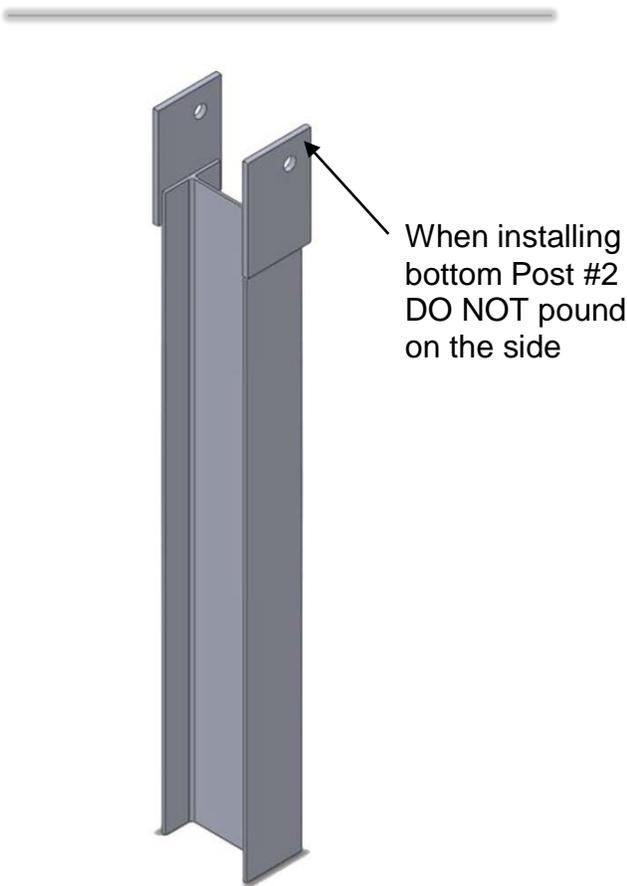
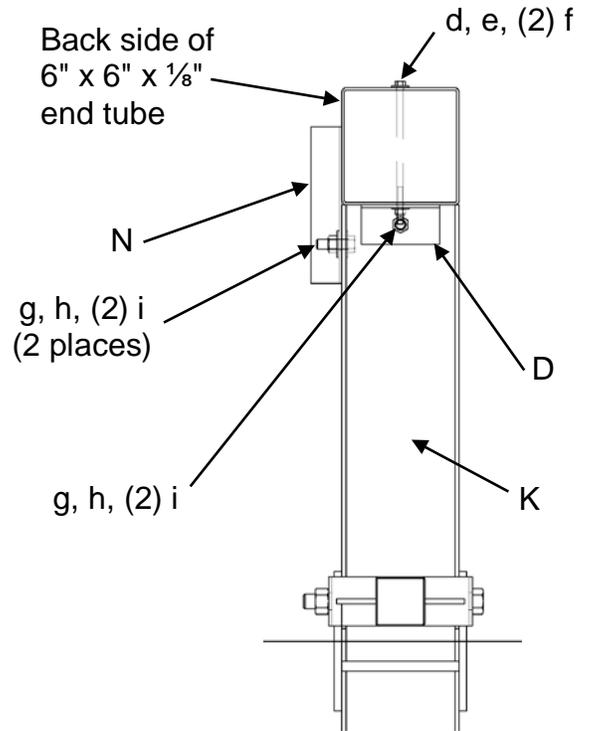


Figure 4.

3.6 Post #2 Connection Detail for MBEAT



3/4" x 8 1/2" hex bolt, & nut at post #2 on downstream side of the post. A 3/4" washer is not needed but may be used.



D	Support Bracket L 4" x 2" x 4"
K	MBEAT Hinge Post Top
N	Retention Plate C4 x 5.4#
d	5/16" x 7" Hex Bolt
e	5/16" Hex Nut
f	5/16" Washer
g	1/2" x 2" Hex Bolt
h	1/2" Nut
i	1/2"Washer

Figure 5.

3.7 Ground Strut Detail for MBEAT

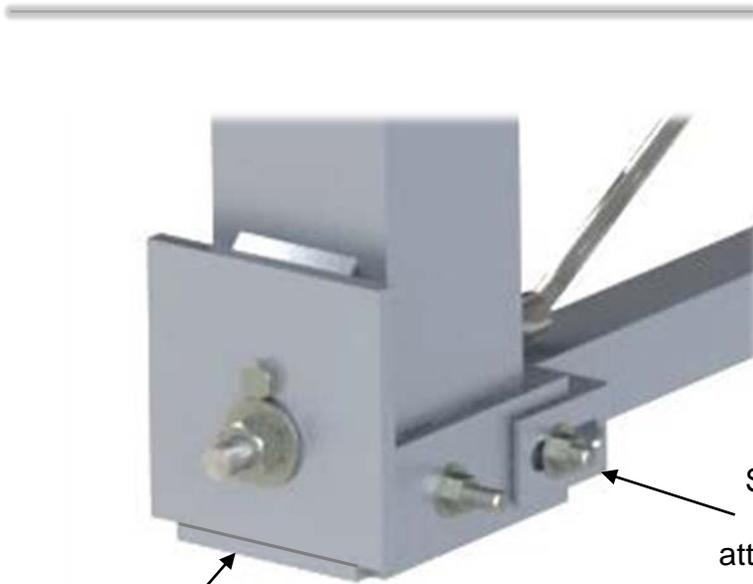


5/8" x 9" hex bolt, nut, & washer at post #1 on upstream side of the post

5/8" x 9" hex bolt, nut, and two washers through the extended side plates of bottom post #1 to attach the ground strut

Longer tabs on Ground Strut attached to post #2

3/4" x 8 1/2" hex bolt, & nut at post #2 on downstream side of the post. A 3/4" washer is not needed but may be used.



MASH Bearing Plate rests on the extended cap plate on bottom post

Shorter tabs on Ground Strut attached to post #1

Figure 6.

3.8 End Rail Splice for MBEAT

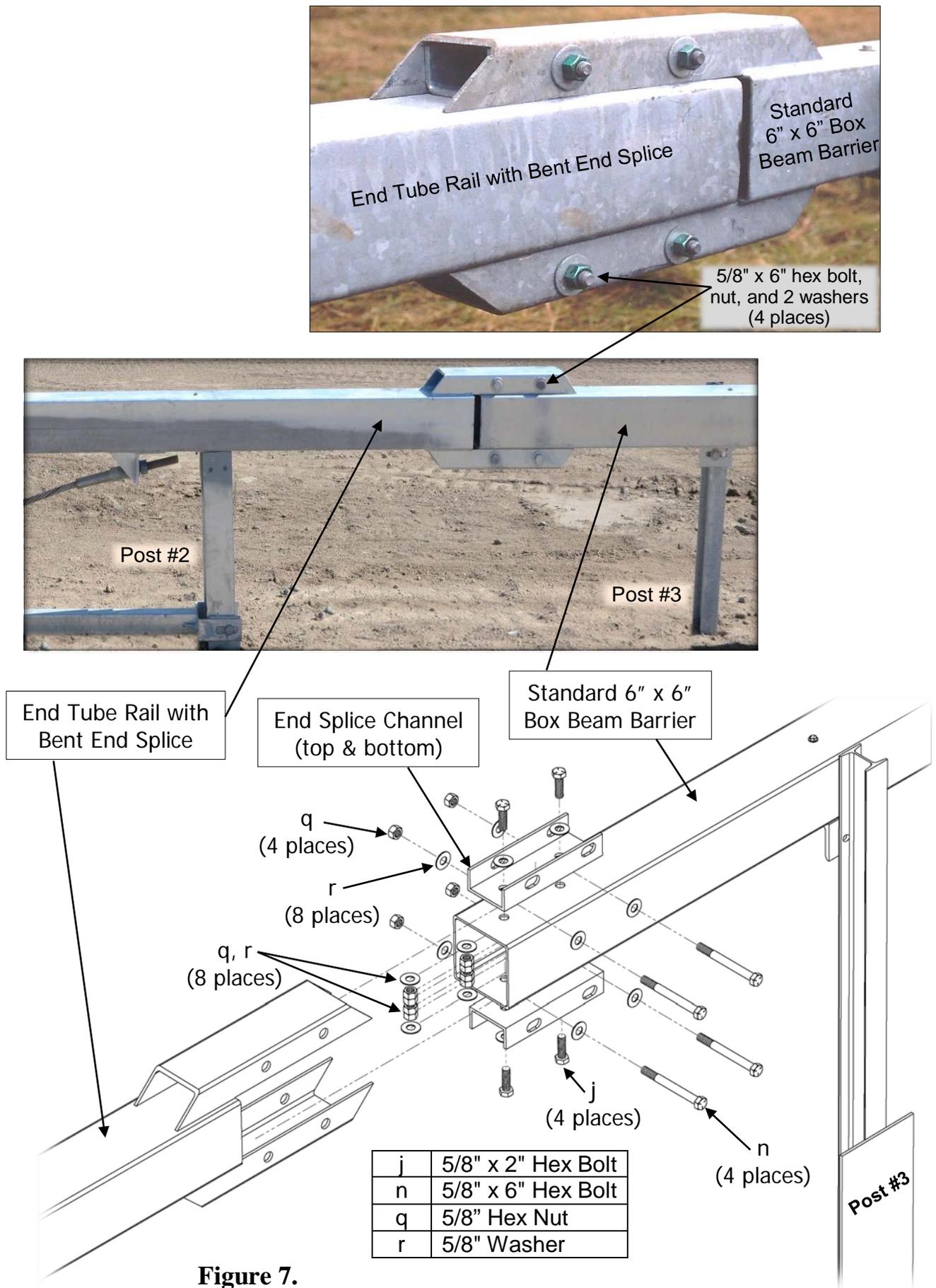
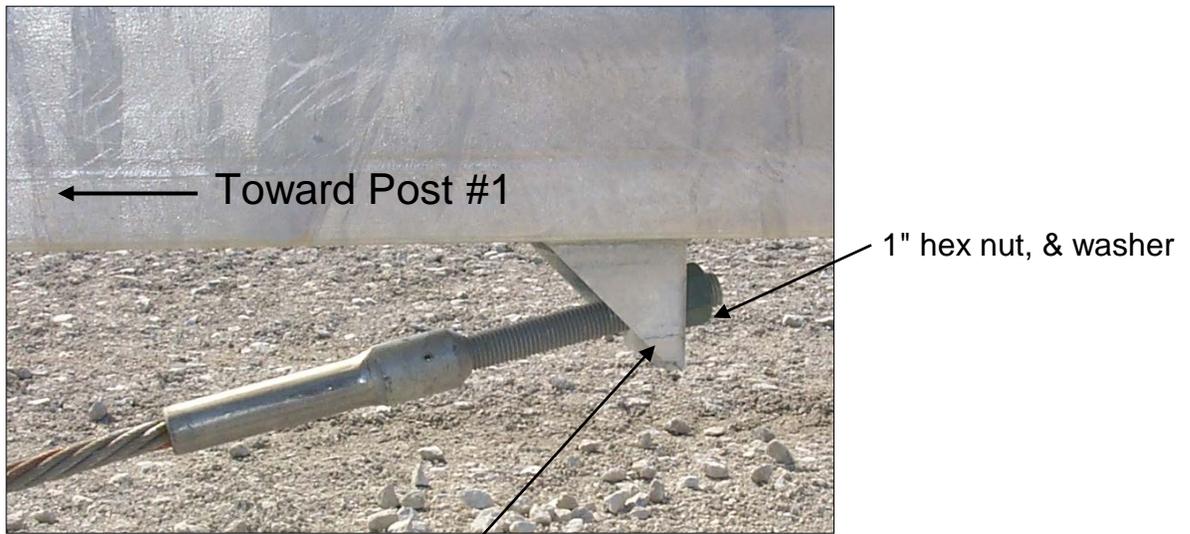
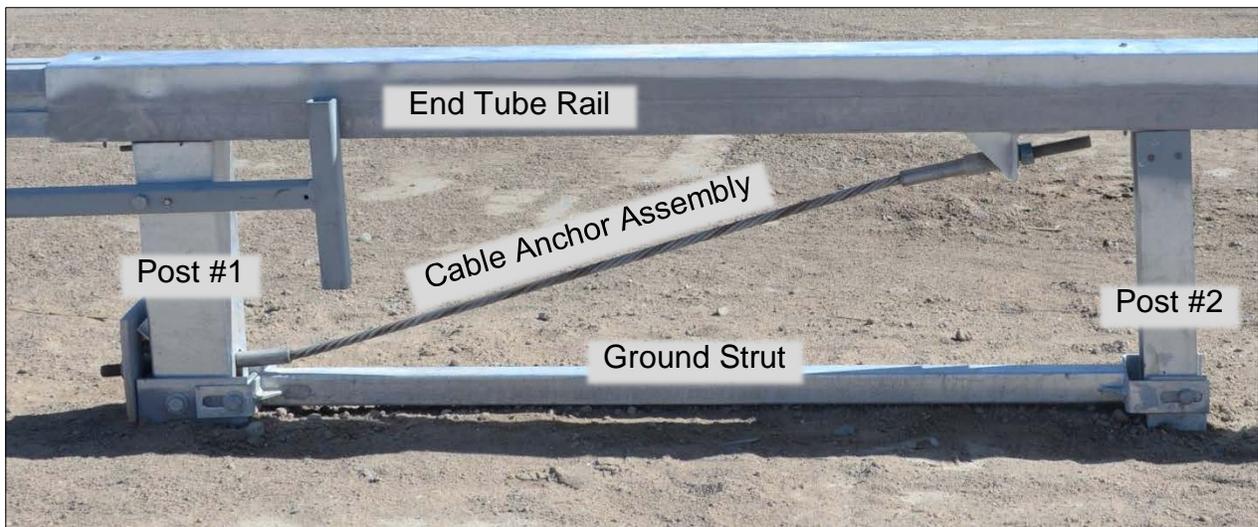


Figure 7.

3.9 Cable Anchor Assembly Attachment for MBEAT



Downstream Cable Anchor Attachment Gusset Plate



End Tube Rail

Figure 8.

3.10 Retention Plate Channel C4 x 5.4 Bolted at Post #2

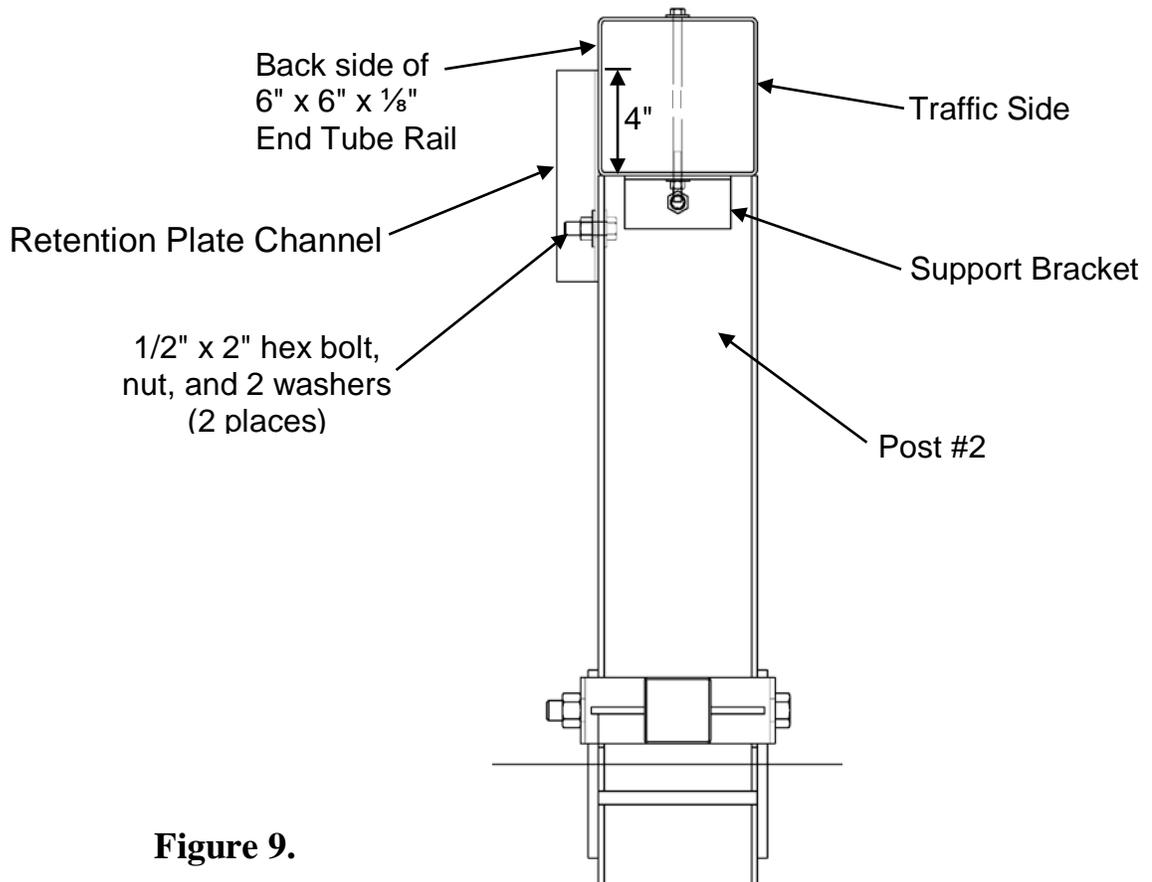
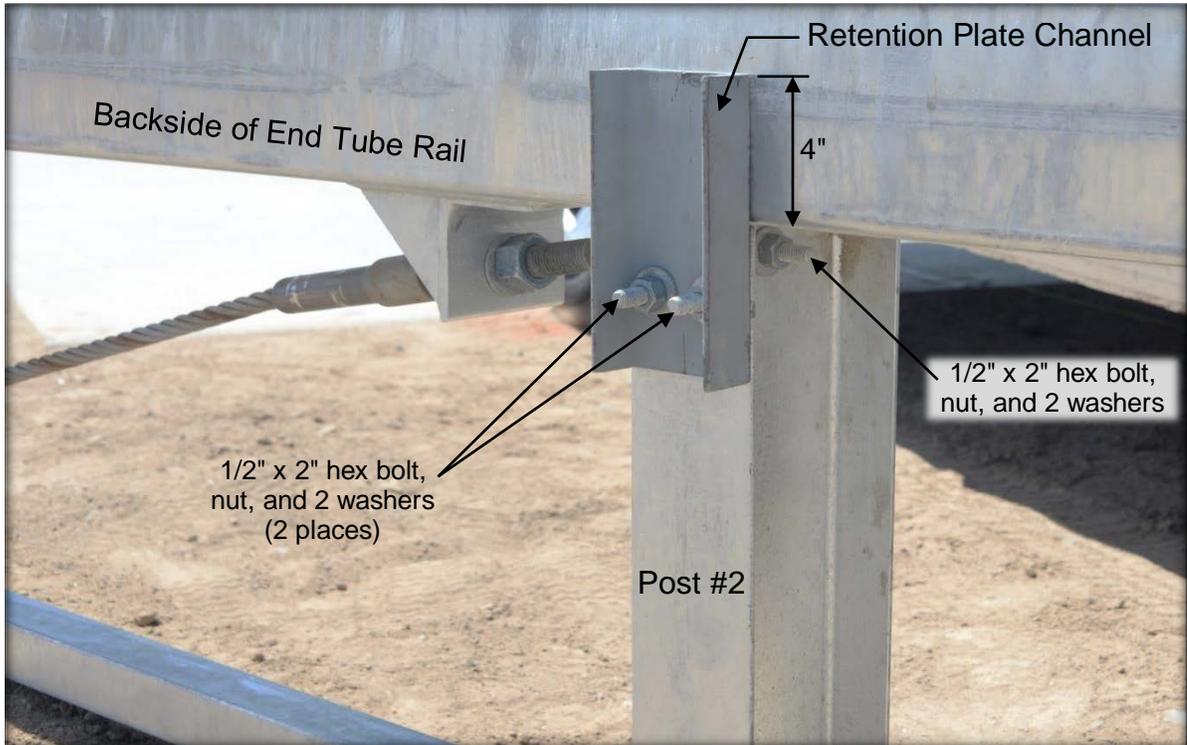
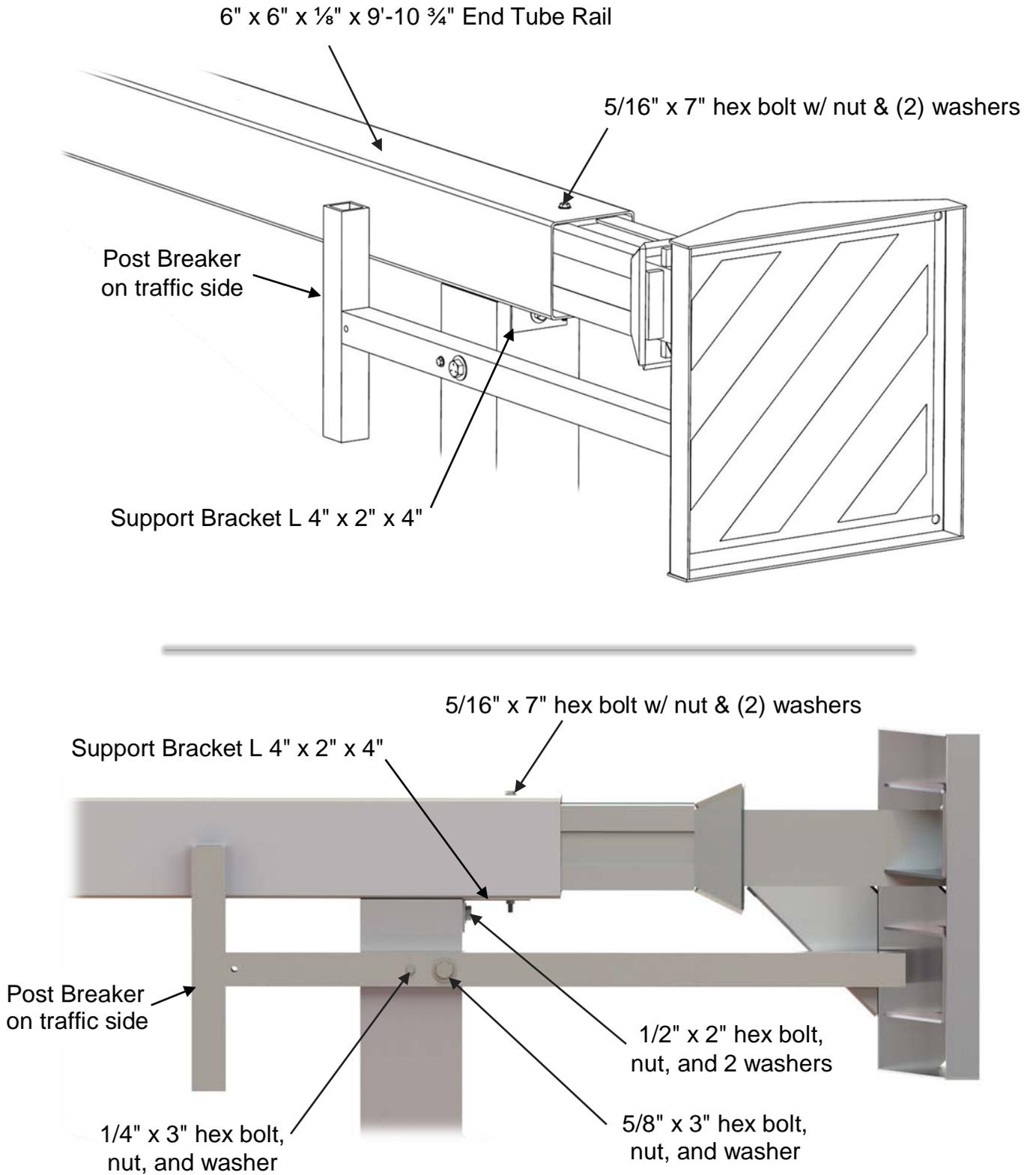


Figure 9.

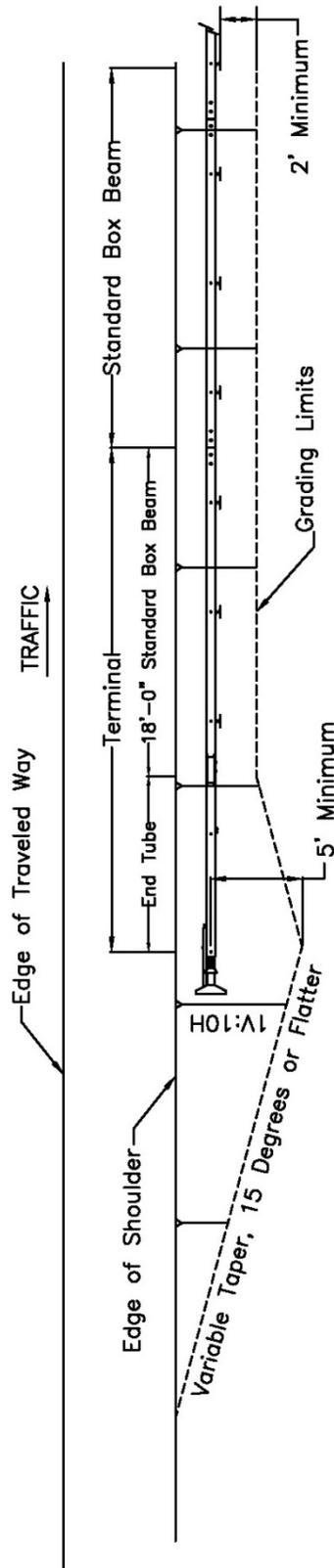
3.11 Impact Head, Post Breaker, Support Bracket Details for MBEAT



NOTE: The Post Breaker and the Support Bracket (at post #1) must be attached before installing the End Tube Rail in order to make the bolted connection.

Figure 10.

3.12 Grading Recommendations for MBEAT



The MBEAT is shown parallel to the travelway. The system can taper parallel with the State allowed box beam taper up to a 25:1 flare rate.

(Reference AASHTO Roadside Design Guide)

Figure 11.

4 Installing the MBEAT

4.1 Materials

A list of the materials required for installation of the MBEAT are shown in the Bill of Materials section on page 6. The MBEAT requires a minimum length 18'-0" long section of standard 6"x 6" x 3/16" box beam rail connected to the 9'-10 3/4" long first end tube rail section. Longer sections of standard 6"x 6" box beam rail are permissible. See **Figure 1** for a layout of the MBEAT.

4.2 Site Preparation

Be sure there are no hazards in the vicinity of the MBEAT system that would compromise its performance. Site grading may be necessary to prevent the bottom section of the breakaway steel posts from extending more than 4" above the ground. Refer to **Figure 11** for the grading recommendations.

4.3 Tools Required

The tools required for installation of the MBEAT system are the same as those used to install standard box beam guardrails, including sockets/wrenches, a hammer, vice grips or pipe wrench, and other equipment such as augers, tampers, & post pounders commonly used in driving guardrail posts. In addition, the installer should provide the *proper driving caps* to be sure they do not pound on side plates of bottom posts #1 and #2. The installer should provide driving caps to accommodate the equipment used to install the posts.

4.4 Installation Procedures

Begin the installation at the downstream end of the MBEAT to ensure that the terminal matches up with the standard downstream section of box beam. The major steps in the installation of the MBEAT are as follows:

- Installing the 3" Weak Posts with Standard Box Beam
- Installing Bottom & Top Post #2 Sections
- Installing Bottom & Top Post #1 Sections
- Installing Ground Strut
- Installing Post Breaker
- Installing the 6"x 6" End Tube Rail, Splices, Support Brackets
- Installing Retention Plate
- Installing MBEAT Impact Head
- Installing Cable Anchor Assembly & MASH Bearing Plate

4.4.1 Installing the 3" Weak Posts with Standard Box Beam

Layout a string line and mark off the required 6'-0" post spacing beginning at MBEAT post #3. The top of rail height should be 2'-4". See **Figure 1** for layout.

The soil plates welded to the 3" x 5.7# I beam weak posts must be positioned on the back side away from traffic. 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. Posts 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.*

A minimum length of 18'-0" long section of standard 6"x 6" x 3/16" box beam rail is required. Longer sections may be used. Attach the standard 6"x 6" box beam rail to the standard 3" I beam weak posts using standard box beam support brackets (5" x 3 1/2") and attachment hardware (3/8" x 7 1/2" hex bolt & 1/2" x 1 1/2" hex bolt). Splice the 6"x 6" box beam rail to the existing box beam rail using two standard splice plates (5/8" x 5 3/8" x 27" plate) and attachment hardware (3/4" x 2" hex bolt). All standard box beam, posts, and associated components/hardware should be as shown in the applicable State standards.

4.4.2 Installing Bottom & Top Post #2 Sections

Post #2 is a bolted steel post. This post must have the bottom section installed before attaching the top section. *Be sure an adequate driving cap is used so welds on the side plates of post #2 are not damaged. The bottom section of post #2 should not be driven with the top post attached.* Posts #2 & #3 are spaced at 6'-0" centers.

Bottom and Top Post #2 are W6x9# or W6x8.5# sections. The top and bottom sections of post #2 are bolted together with a 3/4" x 8 1/2" hex bolt and nut. A 3/4" washer is not needed but may be used. One end of the ground strut will be placed at post #2 using this 3/4" x 8 1/2" hex bolt so do not make the connection at this time. Be sure when the post is installed, the 3/4" bolt is on the downstream side of the post (opposite the impact head). See **Figure 5** for post #2 details.

4.4.3 Installing Bottom & Top Post #1 Sections

Post #1 is a bolted steel post. This post must have the bottom section installed before attaching the top section. *Be sure an adequate driving cap is used so welds on the cap plate and side plates of post #1 are not damaged. The bottom section of post #1 should not be driven with the top post attached.* Posts #1 & #2 are spaced at 6'-3" centers.

Top Post #1 is a 6" x 6" x 1/8" tube section. The post will be placed so the angle spacer is facing oncoming traffic. The MASH bearing plate will rest on this angle spacer. Bottom Post #1 is a W6x15# post with a soil plate welded to the post. Bolt top and bottom post #1 together with a 5/8" x 9" hex bolt, nut and washer. Be sure when the post is installed, the 5/8" bolt is on the upstream side of the post (toward the impact head). One end of the ground strut will be placed at post #1 against the extended side plates, not the post itself, and will use another 5/8" hex bolt, nut and two washers. Be sure when bottom post #1 is installed, the soil plate is on the downstream side of the post (opposite the impact head). See **Figure 4** for post #1 details.

For stiff soils, drill a pilot hole and force the post to the proper depth by impact or vibratory means with an appropriate driving cap. **Do not drive or pound on the side plates of bottom posts #1 or #2 as this may cause damage.**

The posts may also be installed by augering and backfilling if the contractor so prefers. 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.*

If rock is encountered during driving or excavation, refer to appropriate State specifications for how to proceed or contact Road Systems, Inc. for options on anchor posts #1 and/or #2. These posts may be altered if drilling into solid rock or by providing a concrete footer.

The stubs at bottom posts #1 and #2 should not project more than 4" above the ground line when measured along a 5' cord, in compliance with AASHTO specifications. Site grading may be required if the top of the lower post sections project more than 4" above the ground line.

4.4.4 Installing Ground Strut

The ground strut attaches to post #2 utilizing the same the $\frac{3}{4}$ " x 8 $\frac{1}{2}$ " hex bolt and nut that that holds the top and bottom post sections together. At post #1 a second $\frac{5}{8}$ " x 9" hex bolt, hex nut, and two washers are placed through the extended side plates on bottom post#1, not through the post itself. Note the ground strut is not symmetrical. The end with the longer tabs is attached at post #2 and the end with the shorter tabs is attached at post #1. See **Figure 6**.

4.4.5 Installing Post Breaker

THE POST BREAKER MUST BE ATTACHED BEFORE INSTALLING THE END TUBE RAIL. Attach the post breaker to the traffic side of post #1 with a $\frac{5}{8}$ "x 3" hex bolt, nut and washer and a $\frac{1}{4}$ "x 3" hex bolt, nut and washer. See **Figure 10**.

4.4.6 Installing the 6"x 6" End Tube Rail, Splices, Support Brackets

At this point all of the standard roadside 6"x 6" box beam barrier and 3" x 5.7# I beam weak posts should be in place. Attach the 9'-10 $\frac{3}{4}$ " long 6"x 6" x $\frac{1}{8}$ " end tube rail to the standard 6"x 6" x $\frac{3}{16}$ " tube section. This end tube rail is a special $\frac{1}{8}$ " thickness tube as supplied by the manufacturer and has the corners cut at the approach end where the impact head is placed. The two end splice channels will set on the top and bottom of the second rail. The bent plates welded to the end of the $\frac{1}{8}$ " end tube rail will set on top of the end splice channels. Use four $\frac{5}{8}$ " x 2" hex bolts, nuts and washers to connect the end splice channels to the second rail. Two washers and two nuts are used for each bolted connection. Use four $\frac{5}{8}$ " x 6" hex bolts, nuts and washers to connect the end splice channels to the bent plates welded to the end of the end tube rail. Two washers and one nut are used for each bolted connection. See **Figure 7**.

THE SUPPORT BRACKET AT POST #1 MUST BE ATTACHED BEFORE INSTALLING THE END TUBE RAIL. Attach the end tube rail to post #1 and post #2 using the L 4" x 2" x 4" long support brackets. A $\frac{1}{2}$ " x 2" hex bolt, nut and two washers are used to connect the support bracket to the posts. A $\frac{5}{16}$ " x 7" hex bolt, nut and two washers are used to connect the support brackets to the end tube rail. Do not attach the end tube to the support bracket at post #1 until the impact head is installed. See **Figure 5** and **Figure 10**.

4.4.7 Installing Retention Plate

The C4 x 5.4 retention plate is attached to the back side of post #2 using two ½" x 2" hex bolts, nuts and 2 washers. The retention plate will extend 4" above the post to provide additional support for the end tube rail. See **Figure 9**.

4.4.8 Installing MBEAT Impact Head

Place the impact head inside the end tube rail. The end tube rail is 1/8" thick and has the corners cut at the approach end where the impact head is placed. The impact head should be positioned so the holes at the end of the end tube rail, the hole in the support bracket, and the hole in the impact head are aligned. See **Figure 12**. Be sure the impact head is inserted into the end tube rail with the large triangular gusset plates facing down as shown below. Secure the impact head using a 5/16"x 7" hex bolt, nut and 2 washers. See **Figure 10**.

NOTE: It is recommended that the face of the impact head be delineated with an object marker that meets State specifications for better night visibility. *However, the impact face object marker may not be included as part of the shipped materials for the terminal unless specifically requested in the contract plans or by the customer.*

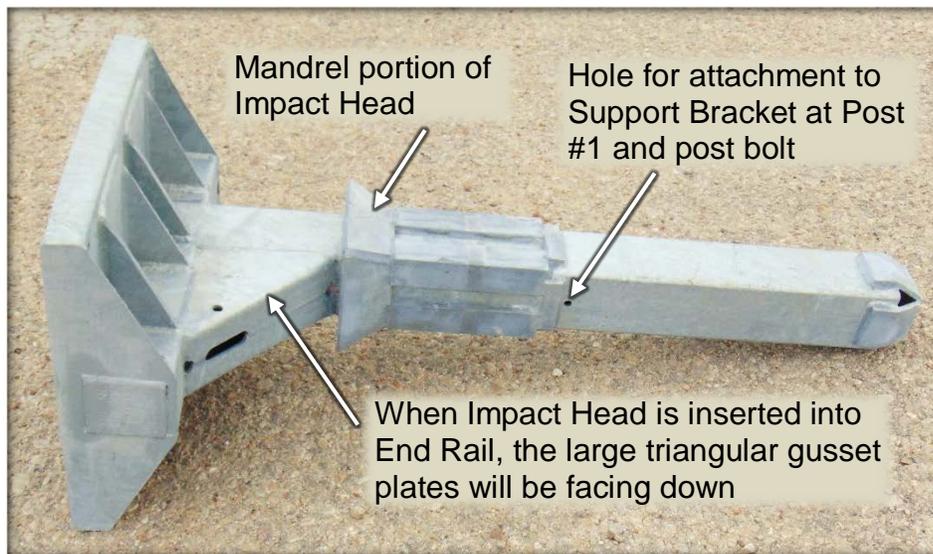


Figure 12.

4.4.9 Installing Cable Anchor Assembly & MASH Bearing Plate

Place one end of the cable assembly through the attachment gusset plate welded to the underside of the end tube rail near post #2 and the other end through the base of post #1. See **Figure 8**.

Insert the 5/8" x 5" long fully threaded bolt into the smaller hole of the bearing plate. Secure the bolt to the bearing plate with a 5/8" hex nut. This bolt is not attached to the post.

Place the MASH bearing plate at the base of post 1 with the 5" dimension up and 3" dimension down. The bearing plate will rest on the angle spacer welded to top post #1 and on the cap plate of bottom post #1. The threads of the 5/8" x 5" long bolt will set inside the hole of top post #1. See **Figure 13**.

Secure both ends of the cable assembly with a 1" hex nut and washer. Restrain the cable at the end being tightened with vice grips or channel lock pliers to avoid twisting the cable. Upon completion of the installation, the cable should be taut.

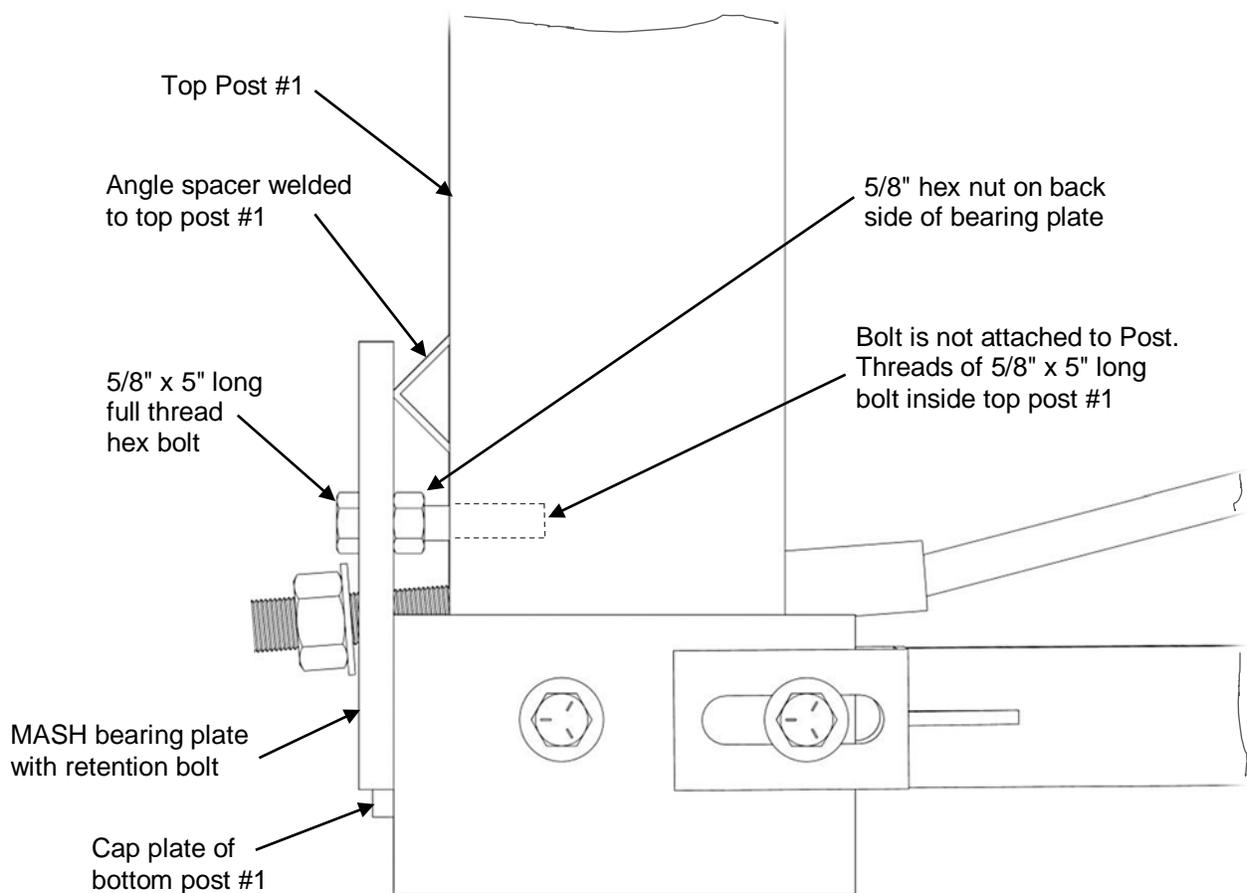


Figure 13.

5 MBEAT Inspection Checklist

State: _____

Date: _____

Project #: _____

Location: _____

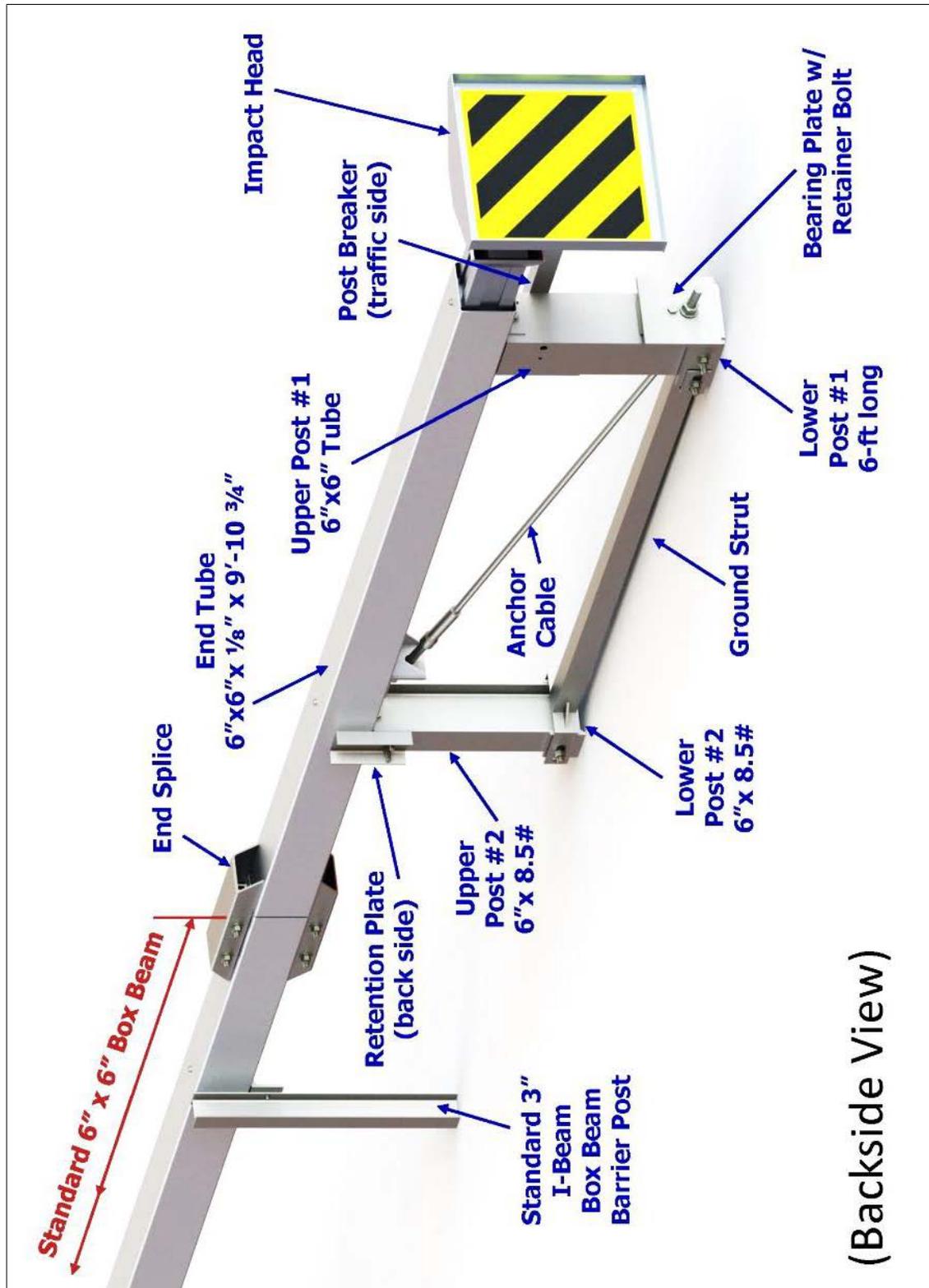
- The height of the 6" x 6" box beam tubing is in accordance with the contract plans. This should be 28" ±1" above the edge of the finished grade.
- The 6" x 6" x 9'-10³/₄" long end tube rail is the special 1/8" thickness tube as supplied by the manufacturer with the four corners cut at the approach end where the impact head is placed.
- The MBEAT terminal has at least one 18'-0" long (minimum) 6" x 6" x 3/16" standard tube section joining with the special 9'-10³/₄" long 1/8" end tube rail section.
- The 1/8" end tube rail is bolted to the standard tube section with two end splice channels.
- There is a 3" weak post at post location #3 plus at least two more 3" weak posts spaced at 6'-0" within the standard downstream 6" x 6" x 3/16" box beam barrier. The 3" weak posts have the soil plate positioned on the back side away from traffic.
- The 3/4" x 8 1/2" hex bolt connecting the hinge post top and bottom #2 is on the downstream side of the post. Top and bottom post #2 are W6 x 9# (or W6 x 8.5#) material.
- The 5/8" x 9" hex bolt connecting top & bottom post #1 is on the upstream side of the post. Top post #1 is 6" x 6" x 1/8" tubing. Bottom post #1 is W6 x 15# material.
- The stubs at bottom posts #1 and #2 are spaced at 6'-3" and do not protrude more than 4" above the ground line (measured by the AASHTO 5' cord method). Site grading may be necessary to meet this requirement.
- The 6" x 6" box beam tubing is attached to rail support brackets with 5/16" x 7" hex bolts.
- The rail support brackets are attached to posts #1 & #2 with 1/2" x 2" hex bolts.
- The impact head is properly inserted into the end tube rail section with the large triangular gusset plates facing down.
- The ground strut is secured between posts #1 & #2 using a 3/4" x 8 1/2" hex bolt at post #2 and a second 5/8" x 9" hex bolt, nut and two washers at post location #1.
- The 8" x 8" MASH bearing plate at the base of post #1 is correctly positioned with the 5" dimension up and the 3" dimension down and is setting on the extended cap plate of bottom post #1. The 5/8" x 5" retention bolt is secured to the bearing plate with a hex nut and the threads of the bolt extend inside the 6" x 6" top post #1.
- The cable anchor assembly is taut and secured with a 1" hex nut and washer at both ends.
- The post breaker is installed on the traffic side of post #1 and stabilized with a 1/4" x 3" hex bolt and a 5/8" x 3" hex bolt.
- The retention plate channel is bolted to the backside of post #2 with two 1/2" x 2" hex bolts.
- If the posts were augered, be sure the backfill material around the posts is compacted.
- The grading and finished installation is in accordance with all specific State DOT guidelines.

Additional notes:

Inspection performed by: _____

Inspection (continued)

As with all roadside safety products, guardrail terminals require inspection to be sure they are in working order. The appropriate authorities should have inspection programs in place and track accidents to assure adequate repairs are made. Regular inspections of MBEAT systems should be made based on site conditions, traffic volumes, and crash history.



6 Repairing the MBEAT

Equipment Needed for Repair Operation

- Acetylene torch or metal saw to cut or burn off the damaged rail,
- Heavy duty chain to remove the impact head may be required,
- Tools used to install standard highway guardrails, including sockets & wrenches, etc.,
- Sledge hammer.

Be sure proper traffic control is deployed to protect workers and motorists. Follow the requirements shown in the *Manual on Uniform Traffic Control Devices (MUTCD)* or local agency standards.

General Repair Procedures

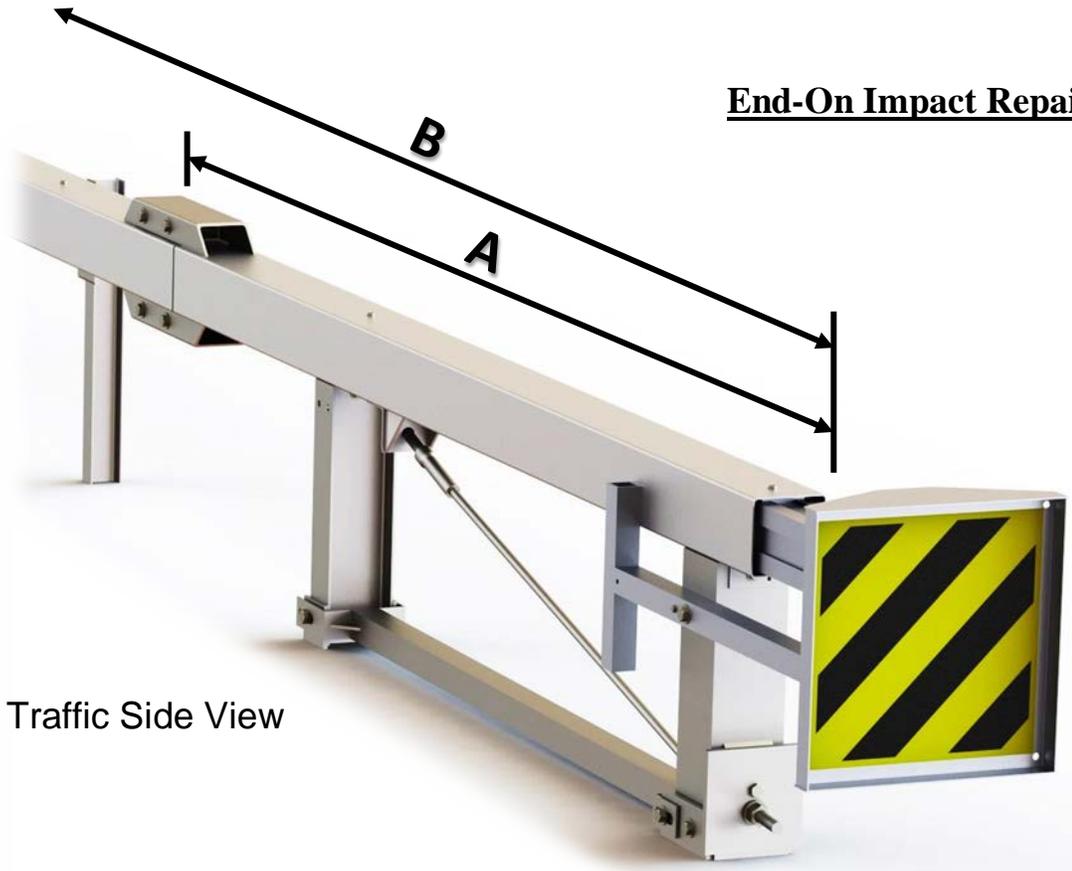
After an end-on impact occurs with the MBEAT, it will require replacement of the 9'-10 ¾" end tube rail and the second tube (if damaged) as well as any damaged post(s). For a traffic face impact downstream of the impact head, the damage will typically be to the end tube rail, the downstream tube, and associated posts.

The general step-by-step procedure for repairing a damaged MBEAT terminal is as follows:

- (1) Check the impact head for damage.
- (2) Check the cable assembly for damage. The cable anchor and the MASH bearing plate may be reusable.
- (3) Check the number of broken posts and brackets that need to be replaced, along with any damaged hardware. Inventory and pick up the reusable parts.
- (4) Disconnect and remove the damaged tubing from the posts.
- (5) Remove the damaged posts. Bolted posts #1 and #2 can be unbolted. Remove the damaged standard 3" weak posts.
- (6) Reinstall the system following the procedures listed in this manual.

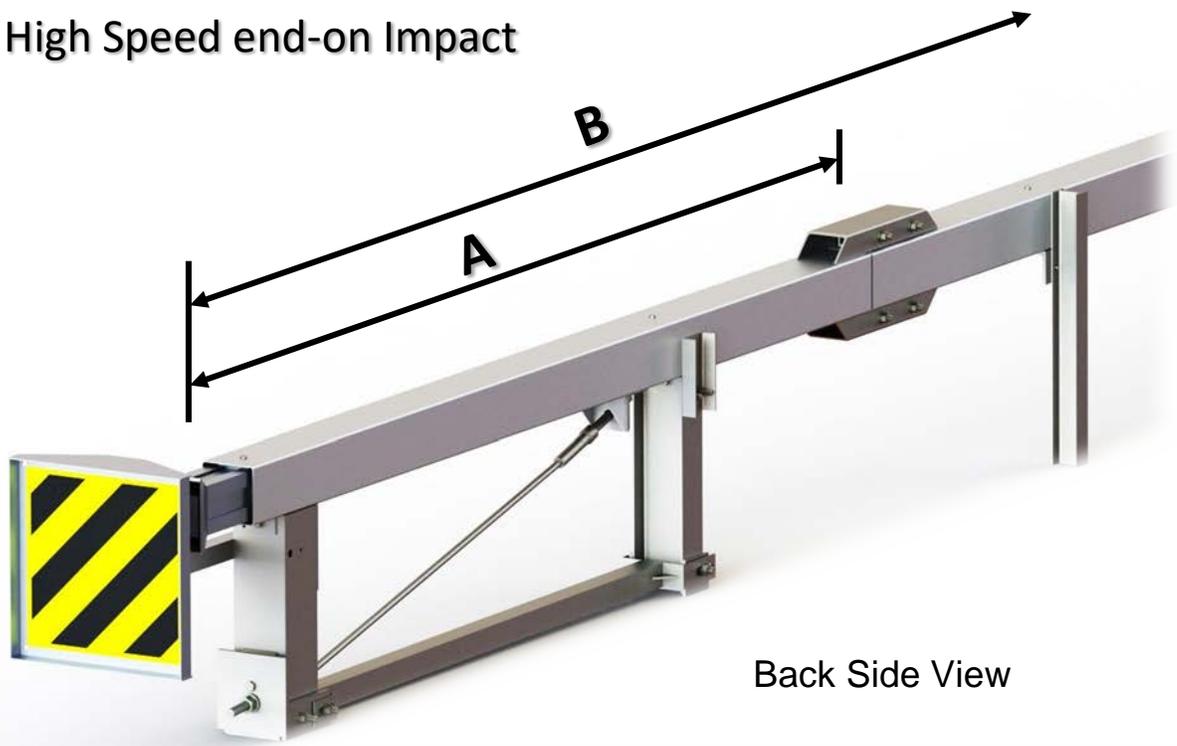


End-On Impact Repairs



Traffic Side View

- A. Low Speed end-on Impact
- B. High Speed end-on Impact



Back Side View

End-On Impact Repairs

A – Low Speed end-on Impact

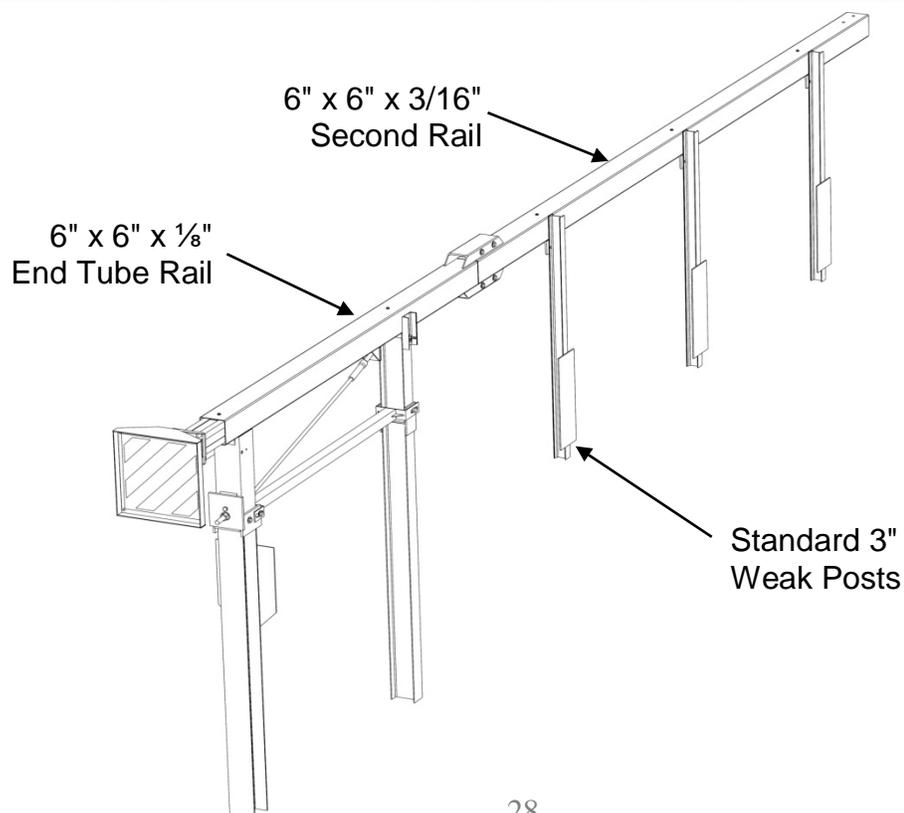
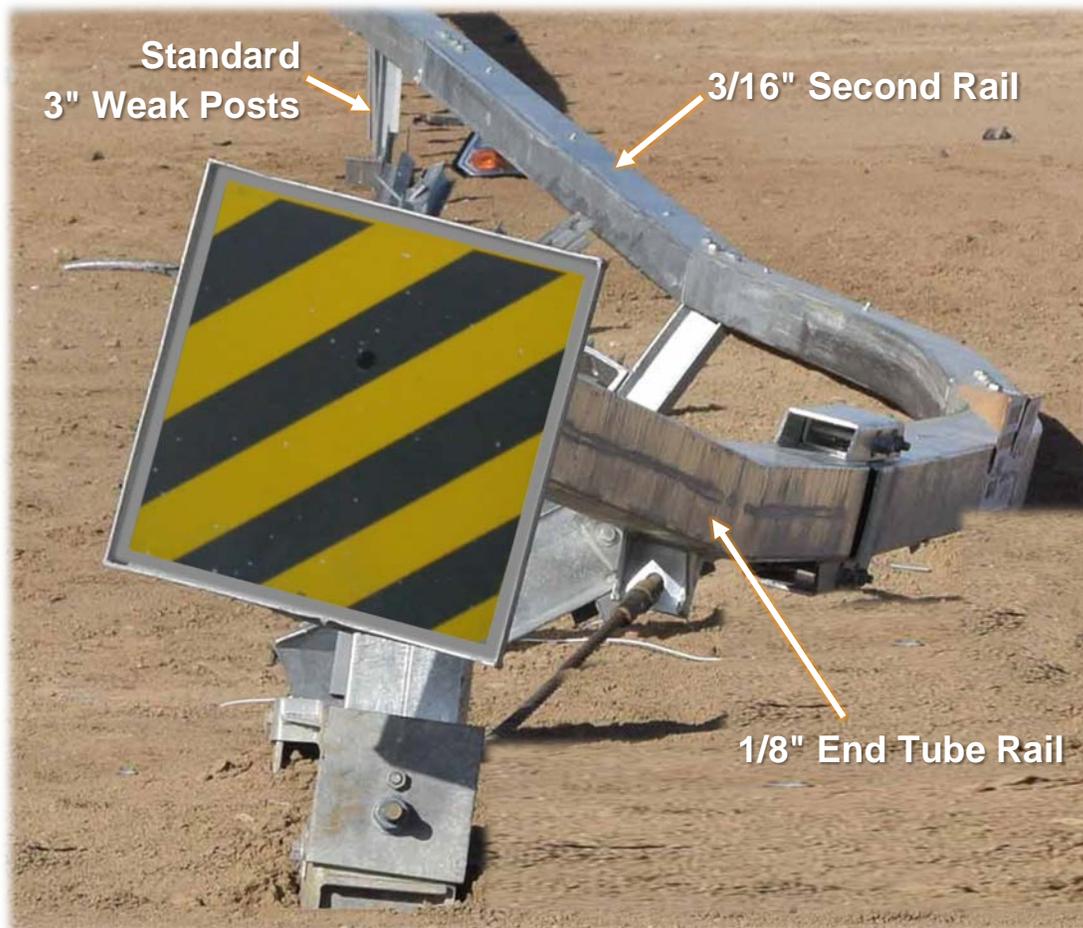
1. Install bottom post #2 W6"x8.5# section.
2. Install bottom post #1 W6"x15# section.
3. Install top post #1 6"x 6" x 1/8" section.
4. Install top post #2 W6"x8.5# section.
5. Install ground strut.
6. Install post breaker on traffic side.
7. Install end tube rail 6"x 6" x 1/8" x 9'-10 3/4" box beam using two support brackets.
8. Install end section splice channels.
9. Install retention plate on the backside of post #2.
10. Install MBEAT impact head.
11. Install cable anchor assembly.
12. Install MASH bearing plate with retainer bolt.

B – High Speed end-on Impact

1. Install the standard 3" weak posts spaced at 6'-0" beginning at post #3.
2. Install bottom post #2 W6"x8.5# section.
3. Install bottom post #1 W6"x15# section.
4. Install top post #1 6"x 6" x 1/8" section.
5. Install top post #2 W6"x8.5# section.
6. Install ground strut.
7. Install post breaker on traffic side.
8. Install standard 6" x 6" x 3/16" x 18'-0" (minimum) box beam tube on 3" weak posts.
9. Install end tube rail 6"x 6" x 1/8" x 9'-10 3/4" box beam using two support brackets.
10. Install end section splice channels.
11. Install retention plate on the backside of post #2.
12. Install MBEAT impact head.
13. Install cable anchor assembly.
14. Install MASH bearing plate with retainer bolt.

Traffic Face Impact Repairs

For MBEAT traffic face impacts, replace 1/8" end tube rail and/or 3/16" second rail with associated posts that have been damaged.



7 MBEAT Applications

The MBEAT is a roadside energy-absorbing terminal used to protect the ends of 6" x 6" box beam barriers that have been designed and tested under MASH criteria. The MBEAT is approximately 15 feet long from the front face of the impact head to the end of the first box beam tube rail and has a rail height of 2'-4". The additional energy-absorbing capacity is achieved as the impact head activates the standard downstream box beam sections. The MBEAT FHWA letter is for a Test Level 3 (100 km/hr.) system.

- CC-157 – MBEAT Test Level 3 (03/13/20)

The MBEAT must have a galvanized surface. No paint or other finishes are permitted.

A wood post version of the MBEAT is not available.

For Test Level 2 (70 km/hr.) applications, the system layout does not change.

The MBEAT is typically installed parallel to the travelway. The system can taper parallel with the State allowed box beam taper up to a 25:1 flare rate.



