

Installation Instructions
for the
FLEAT-MT
Median Terminal



R O A D S Y S T E M S , I N C .

P. O. Box 2163

Big Spring, Texas 79721

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

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

Technical Support & Marketing Fax: (330) 346-0722

This Installation Manual can be downloaded from RSI web site
www.roadsystems.com

Table of Contents

	<u>Page</u>
LIST OF FIGURES	ii
LIST OF TABLES	iii
Installing the <i>FLEAT-MT</i>	3
Materials / Connection to Barrier	3
Design Options	3
Site Preparation	5
Tools Required	5
Installation Procedures.....	5
Installing CRT Posts 3, 5, 6 & 7	6
Installing Posts in Foundation Tubes (Posts 1, 2 &4) / Groundline Strut	9
Installing Guardrail	14
Installing Cable Anchor Bracket.....	15
Installing <i>FLEAT-MT</i> Impact Heads at Posts #1 and #4	18
Installing Cable Assemblies	18
Installing Deflector Box	19
Installing Tether Cable	19
Installing Post Breaker	19
<i>FLEAT-MT</i> Installation Checklist.....	21
Repairing the <i>FLEAT-MT</i>	22
Equipment Needed for Repair Operation	22
General Repair Procedures	22
Procedures Immediately Following an Accident (Temporary).....	23
Blank Page for NOTES	25

List of Figures

<u>Figure</u>		<u>Page</u>
1	Isometric View of the <i>FLEAT-MT</i>	1
2	Plan & Elevation Views of the <i>FLEAT-MT</i>	2
3	Section at Single Sided Rail - CRT Post #3	6
4	Section at Double Sided Rail CRT Posts	7
5	Proper Placement of Foundation Tubes (View at Post #2)	8
6	End View at Post Location 1	10
7	Component Details at Post Location 1	11
8	Section at Post #2	12
9	Optional 5'-0" or 4'-6" Foundation Tubes with Soil Plates	13
10	Installation of Cable Anchor Bracket Shoulder Bolts	16
11	Installation of Cable Anchor Bracket	16
12	Installation of Impact Head and Cable Assembly at Post #4	17
13	Installation of Post Breaker & Impact Head at Post #1	20
14	Wood Post Pulling Tool (Pipe Option)	24
15	Wood Post Pulling Tool (Lag Screw Option)	24

List of Tables

<u>Table</u>		<u>Page</u>
1	<i>FLEAT-MT</i> Design Options / Wood Post Design	3
2	<i>FLEAT-MT</i> Bill of Materials	4

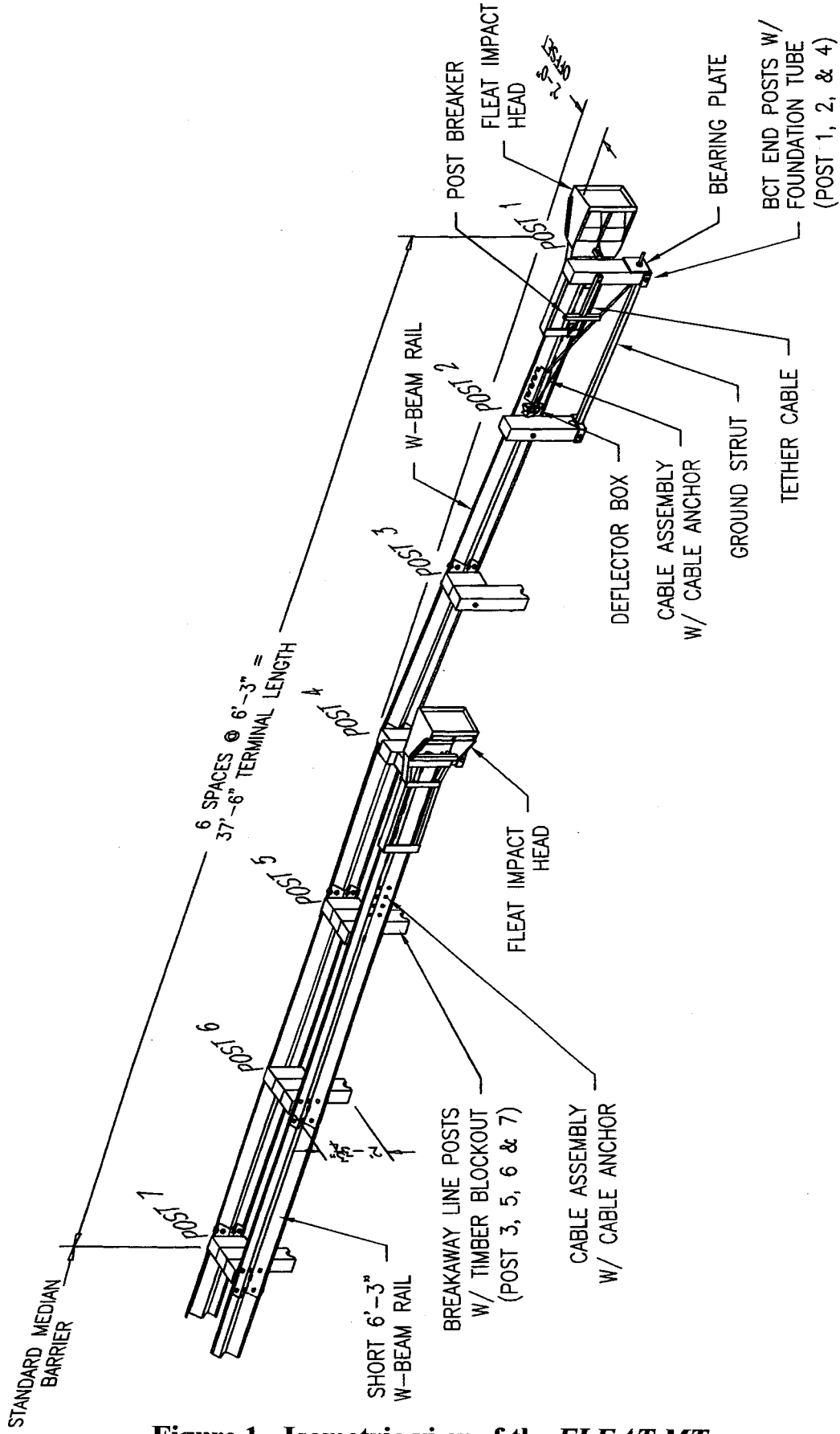


Figure 1. Isometric view of the *FLEAT-MT*.

Installing the *FLEAT-MT*

Materials / Connection to Barrier

The *FLEAT-MT* is available in a Wood Post or Steel Post option.
This manual provides installation instructions for the Wood Post System.

As packaged, the *FLEAT-MT* system includes all materials needed for a complete installation (except for the impact face object markers). The length of the *FLEAT-MT* system is 37'-6". When the *FLEAT-MT* system is attached to double faced W-beam, simply splice the terminal to the barrier. When the system is attached to double faced Thrie-beam, use "W to Thrie" transition panels then splice the terminal to the barrier. When the system is attached to a rigid barrier such as concrete safety shape, use an approved stiffness transition then splice the terminal to the transition.

Design Options

There are four foundation tube options for the Wood Post *FLEAT-MT* as shown in **Table 1** below.

Table 1. *FLEAT-MT* Design Options / Wood Post Design

<i>FLEAT-MT</i> Foundation Tube Options (Posts 1, 2 & 4)	Total Foundation Tubes Needed	Number of Standard BCT Posts Needed	Number of CRT Posts	Total Number of Posts
6'-0" split Foundation Tube	3	3	4	7
6'-0" solid Foundation Tube	3	3	4	7
5'-0" or 4'-6" Foundation Tubes with soil plate	3	3	4	7

Figure 8 shows a section with the 6'-0" foundation tubes.

Figure 9 shows a section with the 5'-0" or 4'-6" foundation tubes with soil plates.

Table 2. FLEAT-MT Bill of Materials

Item	Code #	Quantity	Description
A	F3000	2	FLEAT Impact Head
B	S730	3	* Foundation Soil Tubes, 6" x 8" x 6'-0" (SEE NOTE BELOW)
C	E750	2	Bearing Plate - 8" x 8" x 5/8"
D	C3820	1	3/8" Wire 20'-0"
E	E770	2	BCT Cable Anchor Assembly
F	S760	2	Cable Anchor Bracket
G	E780	1	Ground Strut
H	P650	3	5-1/2" x 7-1/2" x 45" Wood Posts (Locations 1, 2 & 4)
J	PBFMT	1	Post Breaker
K	P671	4	6" x 8" x 6'-0" Wood CRT Posts (Locations 3, 5, 6 & 7)
L	P675	9	6" x 8" x 14" Timber Blockouts
M	FI303	2	W-Beam Guardrail End Section, 12 Ga., 12'-6"
N	G1201	1	W-Beam Guardrail, Short Section (6'-3" spacing) 12 Ga., 6'-3"
P	G1203	2	W-Beam Guardrail, (6'-3" spacing) 12 Ga., 12'-6"
Q	DBMT	1	Deflector Box
R	E740	2	Pipe Sleeve - 2" Standard Pipe x 5-1/2"
Hardware	* The optional 6'-0" long split foundation tubes may be substituted with either solid 6'-0" long foundation tubes without soil plates or standard 5'-0" long or 4'-6" long foundation tubes with soil plates.		
a	E350	6	3/8" x 3" Lag Screws (Post 1, 4 / Impact Heads & Post Breaker)
b	SB58A	16	1/2" Cable Anchor Bracket Shoulder Bolts
c	N055A	16	1/2" A325 Structural Nuts
d	W050A	32	1/2" Structural Washers
e	B580122	40	5/8" x 1 1/4" Splice Bolts (5 splices)
f	B580754	3	5/8" x 7 1/2" Hex Bolts (Foundation Tubes)
g	B581004	3	5/8" x 10" Hex Bolts (Foundation Tubes)
h	B581002	1	5/8" x 10" H.G.R. Post Bolt (Post 2 Only / NO BOLT USED AT POST #1)
j	B581802	1	5/8" x 18" H.G.R. Post Bolts (Post 3)
k	B582502	4	5/8" x 25" H.G.R. Post Bolts (Posts 4 through 7)
m	N050	52	5/8" H.G.R. Nuts
n	W050	9	5/8" Flat Washers (2 each at Soil Tubes + Posts 2-4)
p	N100	4	1" Anchor Cable Hex Nuts
q	W100	4	1" Anchor Cable Washers
r		2	Cable Tie

Site Preparation

The *FLEAT-MT* is installed with a total length of 37'-6". The front 18'-9" of the system is single sided with a straight flare offset of 2'-0" toward the centerline of the system.

First, measure off the downstream 18'-9" of the system which is double sided and attaches directly to the median guardrail. Measure the front single-sided 18'-9" distance then measure the front 2'-0" offset distance from post #4. This 2'-0" offset becomes the location of post #1. All posts are spaced at 6'-3". Site grading may be necessary to prevent the foundation tubes from extending more than 4" above the ground (see Section on Installation).

The *FLEAT-MT* is not intended for narrow medians. There must be a minimum distance of 6'-0" from the traffic face of the *FLEAT-MT* to the edge of the paved shoulder.

Tools Required

The tools required for installation of the *FLEAT-MT* system are those used to install standard highway guardrails (H.G.R.), including: 9/16", 7/8", 15/16", 1-1/4", and 1-1/2" sockets and wrenches, a drill with a 1/4" bit, and other equipment such as augers, tampers, and post pounders commonly used in driving posts.

Installation Procedures

Begin installation at the downstream end of the *FLEAT-MT* (post location 7) to ensure that the terminal matches up with the median section of guardrail. The major steps in the installation of the *FLEAT-MT* are as follows:

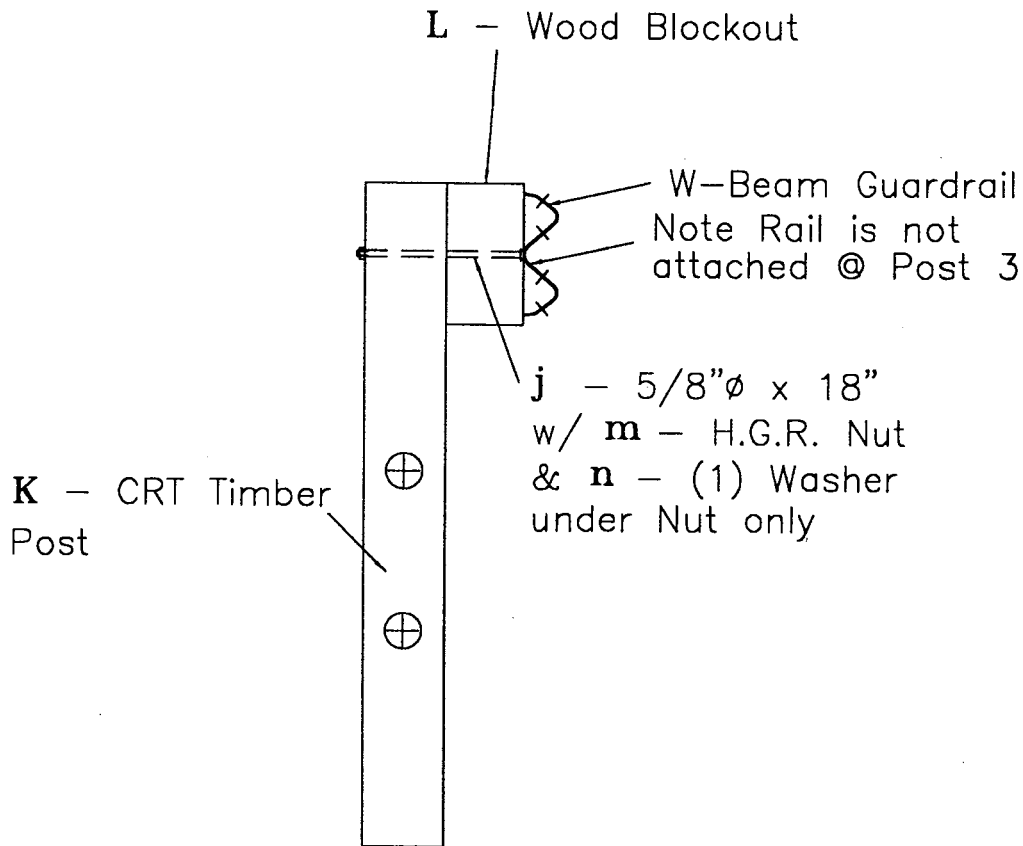
- Install posts 4 to 7 in line with the downstream median barrier (post 4 in foundation tube),
- Install posts 1 to 3 - offset 2'-0" (posts 1 & 2 in foundation tube),
- Install groundline strut,
- Install 37'-6" of guardrail (18'-9" single faced and 18'-9" double faced)
- Install (2) cable anchor brackets and (1) deflector box,
- Install (2) *FLEAT -MT* impact heads,
- Install (2) cable assemblies,
- Install 3/8" tether cable
- Install post breaker

NOTE: The impact heads (attached to post #1 and post #4) must be placed over the rail prior to tightening the rail to post # 2 and post # 5 respectively.

Installing CRT Posts (posts 3, 5, 6 & 7)

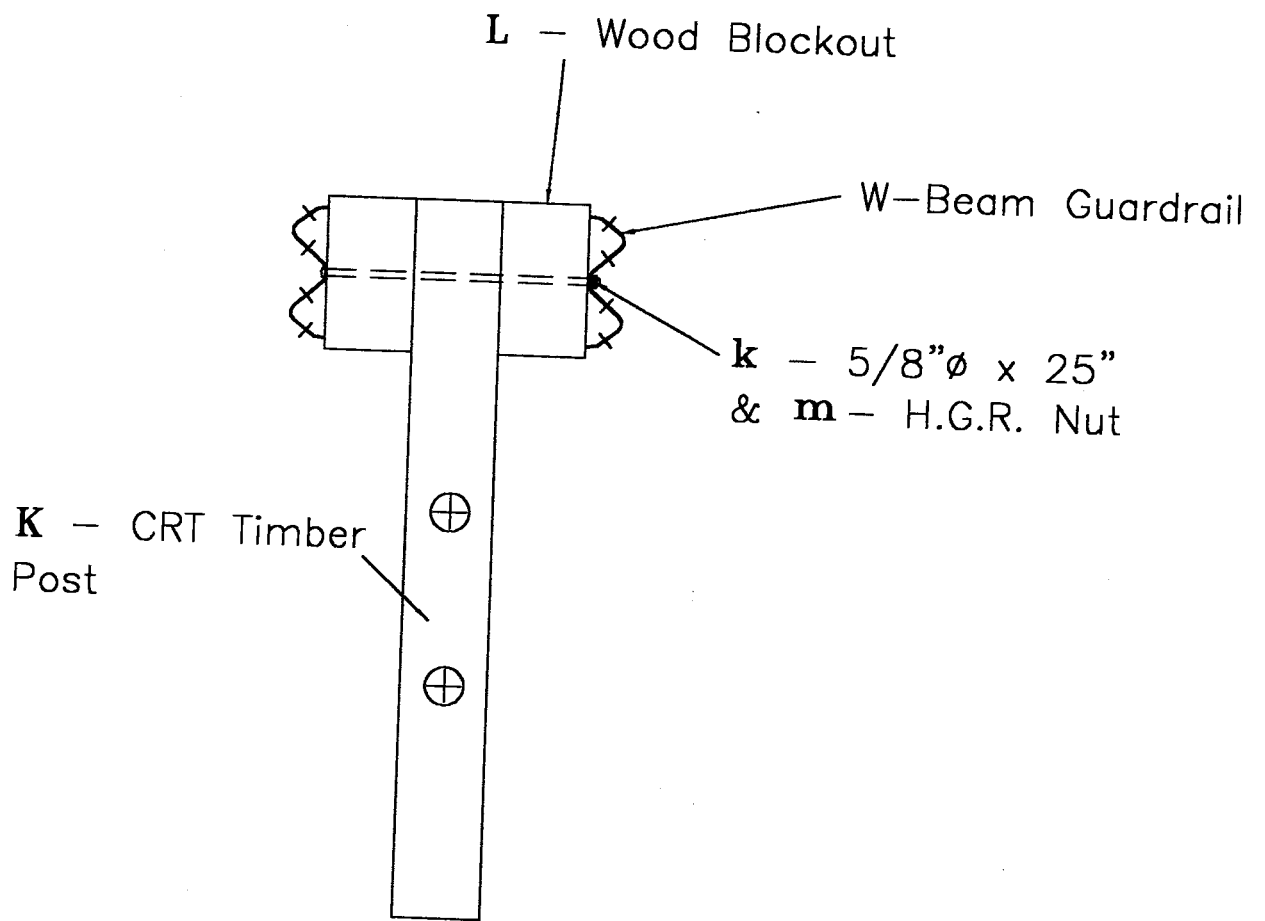
Posts 3, 5, 6 & 7 are 6" x 8" x 6'-0" CRT posts (P671). When installed properly, the hole at the ground line of these CRT posts will be parallel to the roadway. **Figure 3** shows the section of a CRT post at post #3 which is a single sided rail. **Figure 4** shows the section of a CRT post at posts #5, 6 and 7, which are double-sided rail. The CRT post may be driven with an approved driving head. For stiff soils, drill a 6" pilot hole and force the post to the appropriate depth by impact or vibratory means with an approved driving head. The post 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. Guidelines will vary from State to State.



SECTION AT POST 3

Figure 3. Section at Single Sided Rail - CRT Post #3.



SECTION TYPICAL AT POSTS 5, 6 & 7

Figure 4. Section at Double Sided Rail CRT Posts.

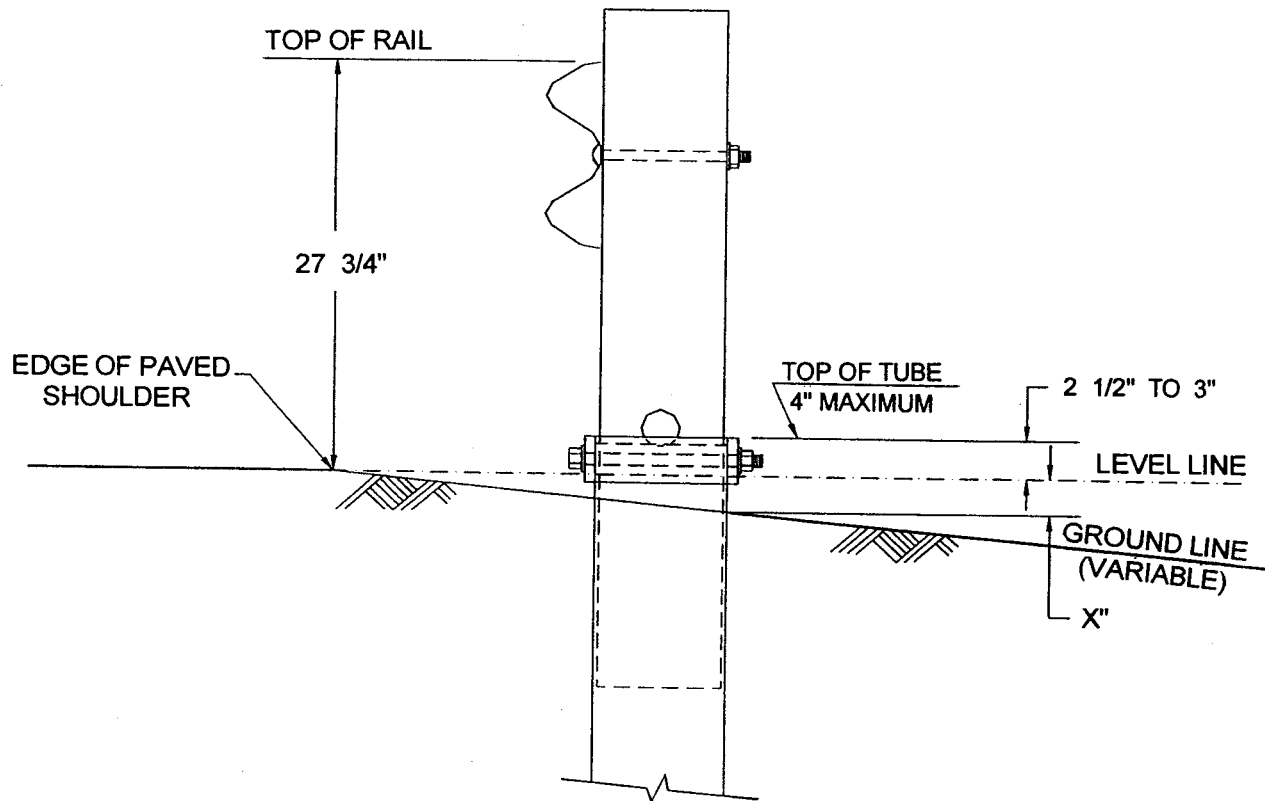


Figure 5. Proper Placement of Foundation Tubes (View at Post #2)

Figure 5 illustrates the proper placement of the foundation tubes. The top of the foundation tubes should not project more than 4" above the ground line when measured along a 5' cord, according to AASHTO specifications. Site grading may be required if the top of the foundation tubes project more than 4" above the ground line. The finished guardrail height should generally be 27-3/4" above the edge of the shoulder.

Based on a level line from the edge of the paved shoulder, the top of the foundation tube should normally be 2-1/2" to 3" above the level line. The placement of the foundation tube should be an appropriate depth below the level line in order to maintain the 27-3/4" guardrail height from the edge of the shoulder.

If the slope drops off some distance (X ") from the edge of the shoulder to the tube location, as shown in Figure 5, the depth of the foundation tube should be reduced by X " in order to maintain the proper guardrail height. The top of the foundation tube will project ($X'' + 2\ 1/2''$) to ($X'' + 3''$) above the ground. In order not to exceed the AASHTO 4" maximum projection above the ground, site grading will be necessary to assure that the " X " dimension would not be more than 1 1/2" to 1" respectively.

Installing Posts in Foundation Tubes (Posts 1, 2 & 4) /Groundline Strut

Figures 6 & 7 show the component details at post location 1. **Figure 8** shows a section at post #2. Posts #1, 2 and 4 are all installed in foundation tubes. Because posts #1 and #4 will have a cable anchor, a pipe sleeve (E740) is required for these posts. See **Figure 12** for details at post #4.

Posts 1, 2 and 4 may be installed with either 6'-0" long split foundation tubes (S730) without soil plates, solid 6'-0" long foundation tubes (E731) without soil plates, standard 5'-0" long foundation tubes (S735) with soil plates (SP600) or 4'-6" long foundation tubes (E735) with soil plates (SP600). **Figure 9** shows the optional 5'-0" or 4'-6" foundation tubes with soil plates.

Do not drive the foundation tube with wood post inserted. If the soil is penetrable so that the foundation tube does not deform, the foundation tube may be driven with an approved driving head. For non-penetrable soil, drill a 6" pilot hole and force the tube to the appropriate depth by impact or vibratory means with an approved driving head. The tube 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 foundation tubes.* If rock is encountered, refer to appropriate State specifications. Guidelines will vary from State to State.

The top of the foundation tubes should not project more than 4" above the ground line when measured along a 5' cord, according to AASHTO specifications. See **Figure 5**.

For the 6'-0" long split foundation tube option, fasten one 5/8" x 7-1/2" hex head bolt (B580754) and H.G.R. nut (N050) through the bottom hole of the foundation tube. *Do not over tighten and deform the tube.* The bolt is intended to stop the post from sliding all the way into the tube during installation.

The installation procedure for the solid 6'-0" long foundation tubes without soil plates is the same as that for the split foundation tubes.

The installation for the 5'-0" long foundation tubes with soil plates or the standard 4'-6" long foundation tubes with soil plates is shown in **Figure 9**. Fasten the soil plate to the foundation tube with two 5/8" x 7-1/2" hex head bolts (B580754) and H.G.R. nuts (N050) through the bottom holes of the foundation tubes. *Do not over tighten and deform the tubes.* These bolts attach the soil plate to the foundation tube and stop the post from sliding all the way into the tube during installation.

Insert the pipe sleeve (E740) into the 2 1/2" diameter hole near the base of two of the 5-1/2" x 7-1/2" x 45" wood posts (P650) and install these posts in the foundation tubes at post locations 1 and 4. Install the other wood post 5-1/2" x 7-1/2" x 45" in the foundation tube at post location 2, and fit the groundline strut (E780) between posts #1 and #2. A groundline strut is not used at post #4. Secure each post to the foundation tube with a 5/8" x 10" hex head bolt (B581004) and H.G.R. nut (N050) with a washer (W050) under both the bolt head and the nut. These bolts will serve to secure the posts and attach the groundline strut to the foundation tubes, as shown in **Figure 7**.

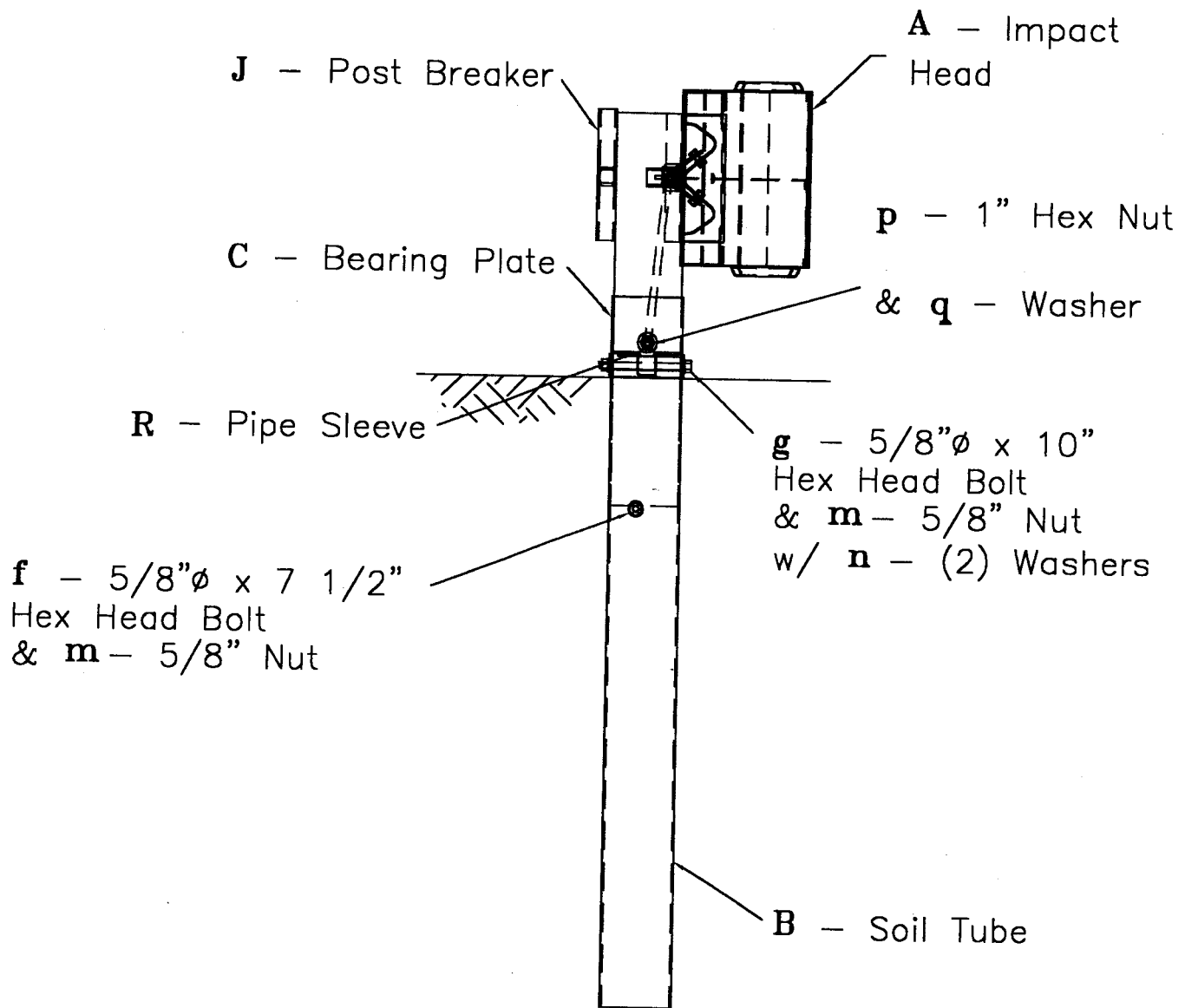


Figure 6. End View at Post Location 1.

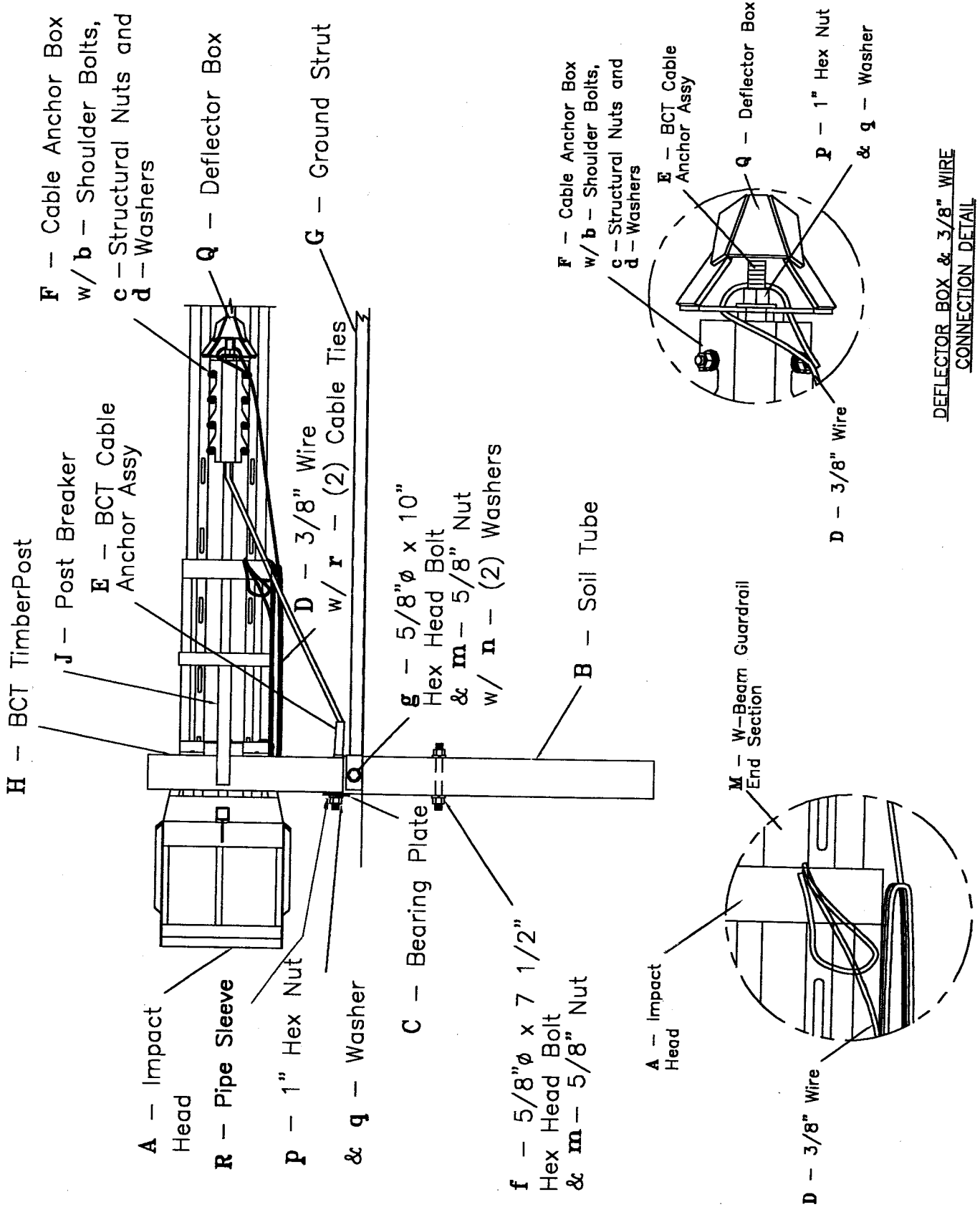
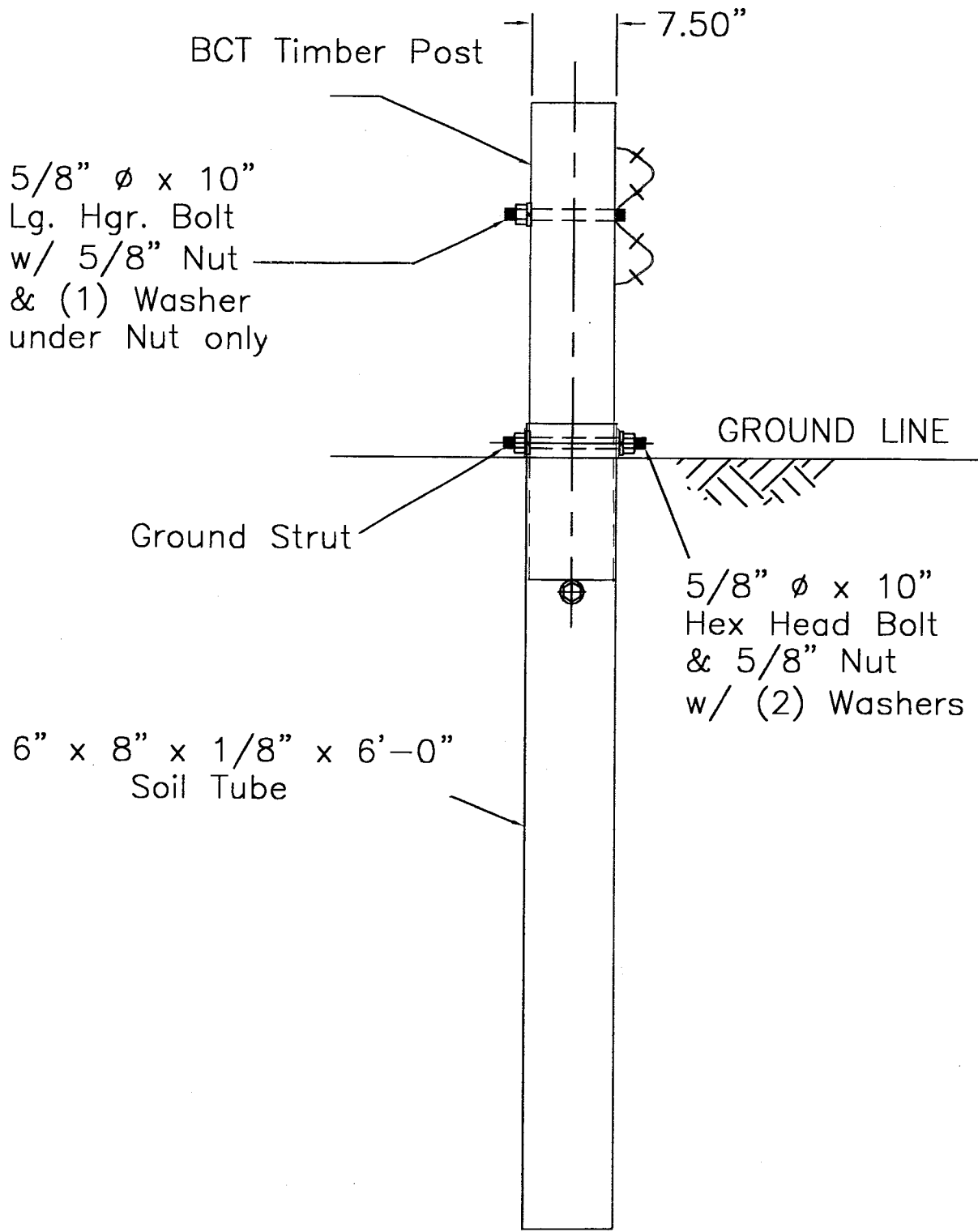


Figure 7. Component Details at Post Location 1.



Note. The optional 6'-0" long split foundation tubes may be substituted with either solid 6'-0" long foundation tubes without soil plates or standard 5'-0" or 4'-6" long foundation tubes with soil plates.

Figure 8. Section at Post #2.

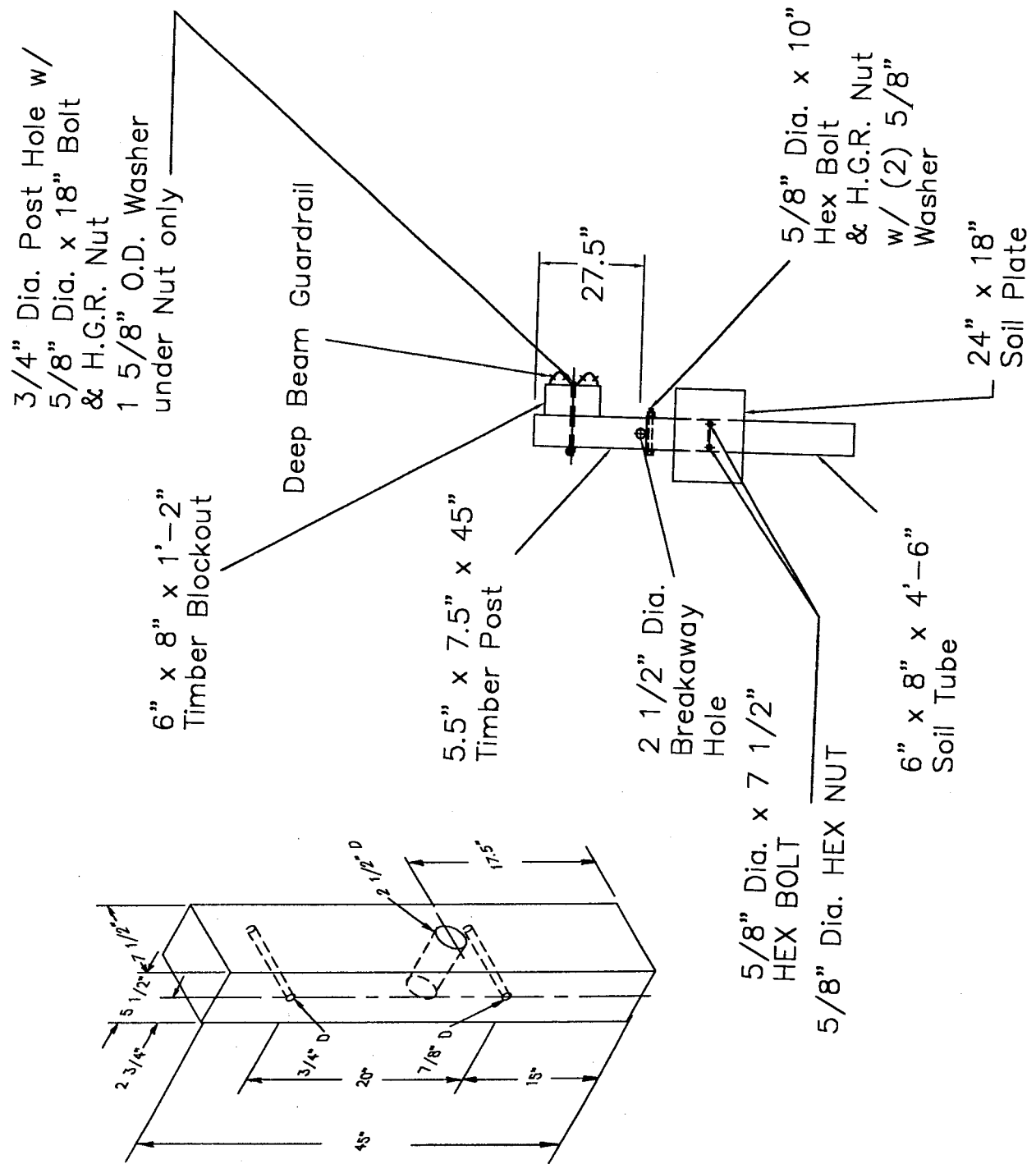


Figure 9. Optional 5'-0" or 4'-6" Foundation Tubes with Soil Plates.

Installing Guardrail

The required offset that begins at post #4 is achieved by manually pushing the rails back. Shop curving or bending is not required.

There are 5 total W-beam guardrail sections required for the ***FLEAT-MT*** as shown below.

- 2 end sections / 12'-6" long (with special slots and eight holes to attach the anchor bracket)
- 2 standard sections / 12'-6" long (one will be field bent to allow flare)
- 1 short section / 6'-3" long (used on the back side to span between posts 6 and 7)

Beginning at the downstream end at post #7 on the backside (reverse direction traffic side), attach a short 6'-3" long guardrail section (G1201) to span from post 7 to 6. Then attach a 12'-6" W-beam guardrail end section (F1303) to span from post 6 to 4. The double-faced rail will end here. An impact head (F3000) will be attached here at post #4 in a later step. Note that the impact head must be placed over the rail prior to tightening the rail to post # 5. Also **note that the rail is not bolted to post #4 at this backside only.**

Beginning at the downstream end at post #7 on the front side (approach traffic side), attach a standard 12'-6" W-beam guardrail section (G1203) to span from post 7 to 5. Next attach a second standard 12'-6" W-beam guardrail section (G1203) to span from post 5 to 3. This rail will be field bent at the midpoint (post #4) to begin a flare. **Note that the rail is not bolted to post #3.** Finally, attach the second 12'-6" W-beam guardrail end section (F1303) to span from post 3 to 1. Note that the impact head must be placed over the rail prior to tightening the rail to post # 2. All rail sections are to be spliced with 5/8" x 1-1/4" H.G.R. bolts (B580122) and 5/8" H.G.R. nuts (N050).

For ease of installation, it is recommended to have the eight 1/2" cable anchor bracket shoulder bolts (SB58A) and the cable anchor bracket (S760) attached to both W-beam guardrail end sections prior to attaching the guardrail to the posts. See Section on "Installing Cable Anchor Bracket" for details.

The backside (reverse direction traffic side) rails are to be attached to posts and blockouts at post locations 5 through 7 with 5/8" x 25" H.G.R. bolts (B582502) and nuts (N050). **At post location 4, the rail is not bolted to the post at this backside only.** The bolt only holds the blockout to the post.

The front side (approach traffic side) rails are to be attached to posts and blockouts at post locations 4 through 7 with 5/8" x 25" H.G.R. bolts (B582502) and nuts (N050). No washers are used. At post #3, a 5/8" x 18" H.G.R. bolt (B581802), nut (N050) and washer (W050) is used but **the rail is not bolted to post #3.** The bolt only holds the blockout to the post. There is no blockout used on posts 1 and 2. The rail is attached to post 2 only with a 5/8" x 10" H.G.R. bolt (B581002), nut (N050) and washer (W050). **Note that no bolt is used at post #1.** Refer to **Figure 3** and **Figure 8** for proper placement of 5/8" flat washer (W050) on posts #2 and 3 under the nut (N050). Refer to **Figure 12** for placement of flat washer (W050) on post #4 under the bolt head.

NOTE: After the blockouts are attached, drive a galvanized steel 10d common nail through the block and into the post (toe nailed) to prevent rotation if the wood shrinks.

Installing Cable Anchor Bracket

There are 2 cable anchor brackets to be installed. The one in the front of the *FLEAT-MT* system near post #2 will have a deflector box (DBMT) and 3/8" tether cable (C3820) attached to the end of the cable. See sections on attaching deflector box and tether cable for additional information.

For ease of installation, it is recommended to have the eight 1/2" cable anchor bracket shoulder bolts (SB58A) and the cable anchor bracket (S760) attached to both W-beam guardrail end sections prior to attaching the guardrail to the posts. If this procedure is not followed, post #2 and post #5 may interfere with attaching the bracket.

The eight 1/2" cable anchor bracket shoulder bolts (SB58A) are attached to the W-beam guardrail end sections with two 1/2" structural washers (W050A), one on each side of the guardrail, and a 1/2" structural nut (N055A). The shoulders of the bolts should be on the backside of the guardrail, away from traffic, as shown in **Figure 10**.

For ease of installation, attach the cable anchor bracket shoulder bolts to the rail "finger tight" only. Then align the slots on the cable anchor bracket (S760) with the shoulder bolts and tap the cable anchor bracket onto the shoulder portion of the bolts using a hammer. Tighten the bolts with a wrench when the bracket is in place. When installed properly, the welded plate on the cable anchor bracket should be toward post #2 for the front bracket and toward post #5 for the rear bracket, as shown in **Figure 11**.

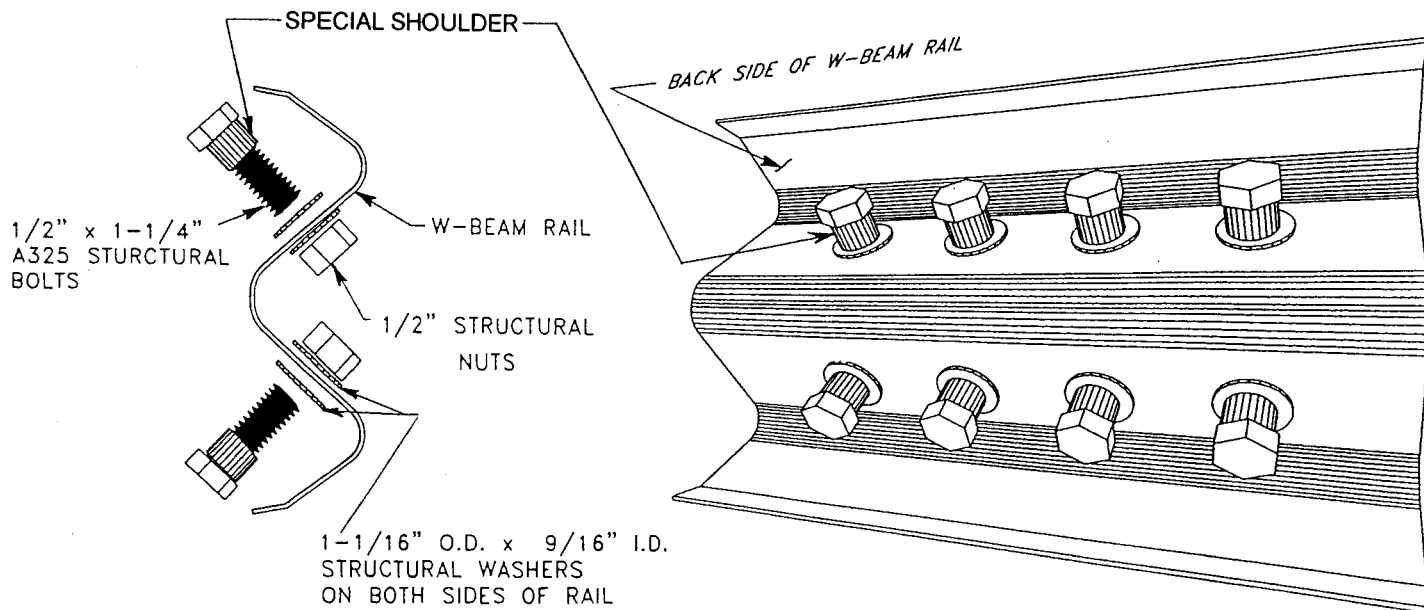


Figure 10. Installation of Cable Anchor Bracket Shoulder Bolts.

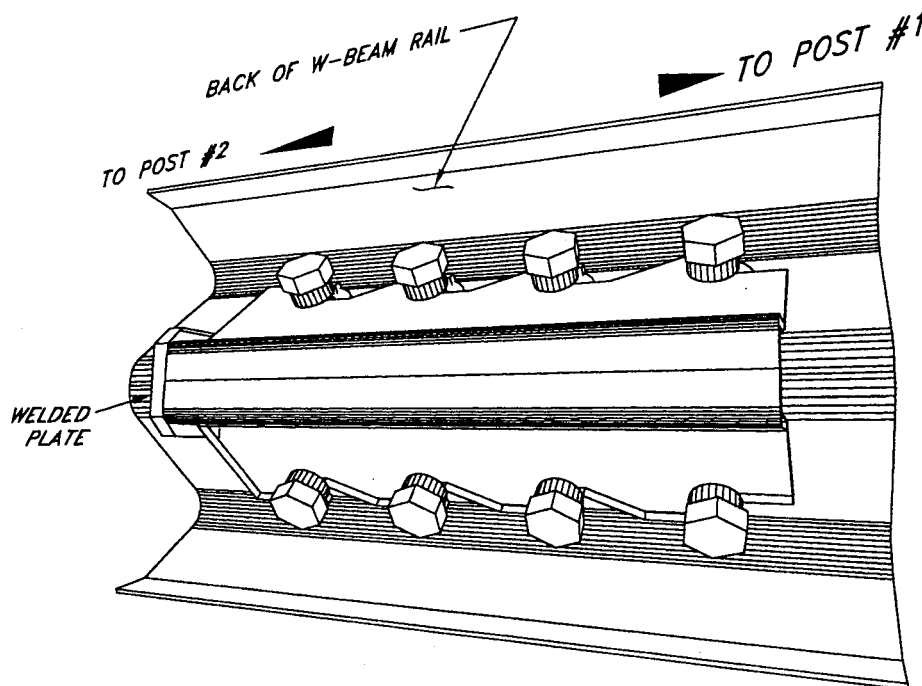


Figure 11. Installation of Cable Anchor Bracket.

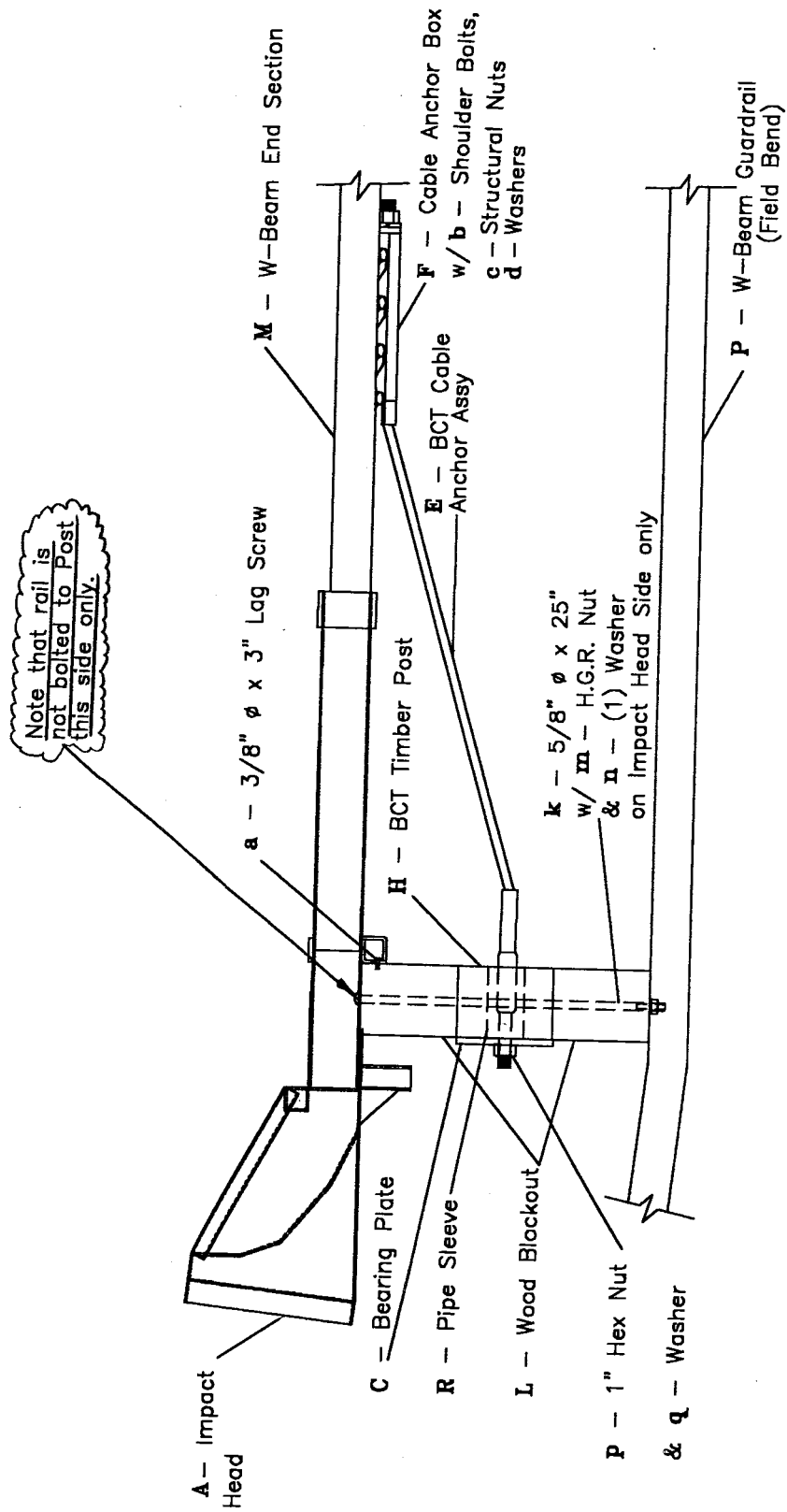


Figure 12.

Installation of Impact Head and Cable Assembly at Post #4.

Installing the FLEAT-MT Impact Heads at Posts #1 and #4

The eight cable anchor bracket shoulder bolts and the cable anchor bracket should be attached to each of the W-beam guardrail end sections prior to attaching the *FLEAT-MT* impact heads to post #1 and to post #4 with lag screws.

Prior to tightening the rail to post # 2 and post #5, place both impact heads (F3000) with the guide chute over the end of the W-beam guardrail. **The exit slot will be toward the traffic side.** The impact head should be positioned so that the protruding tube is on the inside of the guardrail, away from traffic as shown in **Figure 2, Figure 7 and Figure 13**. Slide the impact heads forward until the post angle attachments on the impact head are aligned with the downstream side of the post. This is the side facing post #2 or post #5. Attach the impact head to the post with two 3/8" x 3" lag screws (E350), one each for the top and bottom post angle attachments. A 1/4" pilot hole is required prior to turning in the screw to ease installation and to avoid breaking the lag screw.

Do not attempt to pound in the lag screw with a hammer.

Note. It is recommended that the face of both impact heads be delineated with an object marker that meets State specifications for better night visibility. However, the impact face object marker is not included as part of the shipped materials for the *FLEAT-MT* unless specifically requested in the contract plans.

Installing Cable Assemblies

There are 2 cable assemblies to be installed. The one in the front of the *FLEAT-MT* system anchors at the base of post #1. This anchor cable will have a deflector box (DBMT) and a 3/8" tether cable (C3820) attached to the downstream end of the threaded portion of the cable against the cable anchor bracket (S760) near post #2. See **Figure 7** and the section of this installation manual (on the following page) on attaching the deflector box and tether cable for additional information.

Place the front cable assembly (E770) through the cable anchor bracket and through the pipe sleeve of post #1. Place the bearing plate (E750) at the base of post #1 with 5" dimension up and 3" dimension down. Place a nail over the bearing plate to prevent the plate from rotating. Secure the front end of the cable assembly with a 1" hex nut (N100) and washer (W100). Do not attach the 1" hex nut and washer at the downstream end until the deflector box and tether cable are in place. When tightening the cable, use a 2-lb hammer to tap the cable anchor bracket from the downstream end to ensure that it is securely interlocked with the bolts. Restrain the cable at the end being tightened to avoid twisting the cable.

Repeat the process for the second cable assembly and place the bearing plate (E750) at the base of post #4. See **Figure 12**. Note that there is not a deflector box used for this second cable anchor assembly.

Upon completion of the installation, the cables should be taut and the cable anchor brackets should be fully seated on the shoulder portion of the cable anchor bolts. *It is very important that the cable anchor bracket be fully seated on the shoulder portion of the cable anchor bolts.*

Installing Deflector Box

Note that only one deflector box is required. The deflector box (DBMT) will be attached in the process of attaching the 3/8" tether cable. See below for a step-by-step procedure.

Installing Tether Cable

The 3/8" tether cable (C3820) will arrive bundled into a "figure 8" with two free ends, each with swaged loops. You will need to cut the tie and stretch the cable out prior to installation. It is important to do the following steps in order.

- (1) Pass one of the tether cable's swaged ends between the rear vertical strap of the impact head and the backside of the W-Beam.
- (2) Pass the other end of the tether cable through the swaged-end and pull the cable through. This provides the attachment to the impact head as shown in **Figure 7**.
- (3) Take the free end of the tether cable and place the loop over the threaded end of the cable anchor assembly that protrudes from the back of the cable anchor box.
- (4) While holding the cable in place, place the hole in the deflector box over the threaded anchor, as shown in **Figure 7**. The deflector box will trap the looped tether cable end.
- (5) Through the opening in the deflector box, slip a 1" washer over the end of the threaded cable anchor and thread on the 1" hex nut.
- (6) Thread the nut so it is fully engaged with at least 1/2" of thread exposed behind the nut. It is recommended that the cable anchor be tightened utilizing the opposite end passing through post #1, as previously described in the section installing cable assemblies.
- (7) Loop the excess tether cable neatly between the backside of post #1 and the back of the impact head. Attach this loop to the impact head rear vertical strap and the vertical strap adjacent to post #1 utilizing the two supplied cable ties. The appearance of this completed assembly should look like the detail in **Figure 7**. Care should be taken to minimize the excess cable exposed beneath the system.

Installing Post Breaker

Place the post breaker (PBFMT) on the non-traffic side of post 1. Position the post breaker until the post angle attachment is aligned with the downstream side of the post. The centerline of the post breaker should be at the same height as the centerline of the guardrail. Attach the post breaker to the post #1 with two 3/8" x 3" lag screws (E350) as shown in **Figure 7** and **Figure 13**. A 1/4" pilot hole is required prior to turning in the screw to ease installation and to avoid breaking the lag screw.

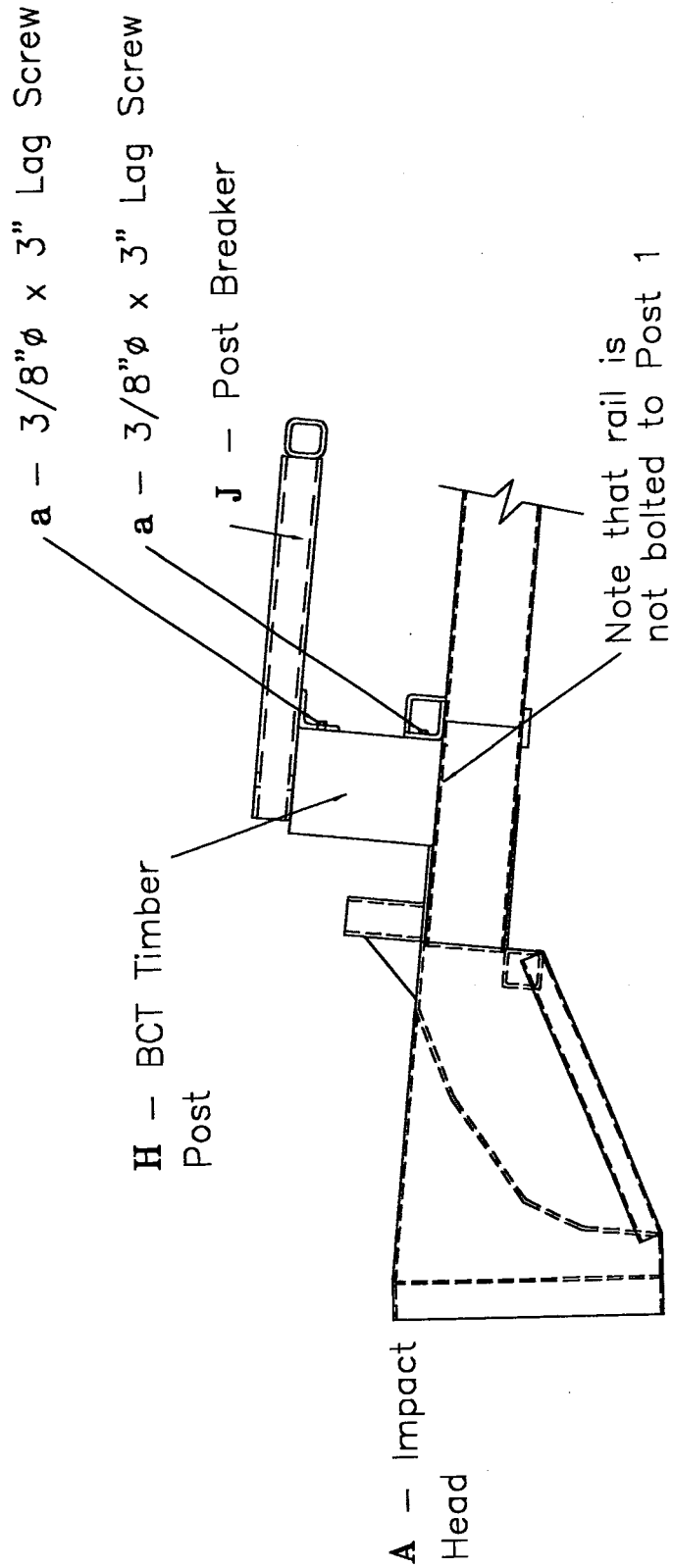


Figure13. Installation of Post Breaker & Impact Head at Post #1.

FLEAT-MT Installation Checklist

State: _____ Date: _____ Location: _____

Project #: _____ Inspection performed by: _____

- The rail height is in accordance with the plans (generally 27-3/4" above the edge of the shoulder).
- The rail at post #1 is placed at a straight single-sided flare offset 2'-0" beginning at post #4.
- The rail is not attached to the post at post location #3 or post location #1.
- The rail is not attached to the post at the impact head side only at post location #4.
- The (3) foundation tubes 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 bolts at the top of the (3) foundation tubes are not over-tightened, deforming the walls of the tubes.
- The guide chute of the (2) impact heads are parallel to the top of the rail and the exit slot of the impact heads are facing traffic.
- The two lag screws holding the impact heads to post #1 and to post #4 are snug.
- The 8" x 8" bearing plate at post #1 and #4 are correctly positioned with the 5" dimension up & the 3" dimension down. The anchor cables are taut and correctly installed. A nail has been placed over the bearing plates to prevent rotation.
- The cable anchor bracket shoulder bolts are properly attached to the (2) W-beam guardrail end sections. The cable anchor brackets are fully seated on the shoulder portion of the bolts.
- The deflector box is in place and secured behind the anchor bracket near post #2.
- Posts #1, #2 and #4 are installed in foundation tubes and have the 2-1/2" breakaway hole located parallel to the roadway with the bottom of the hole at the top of the tube.
- CRT posts at locations 3, 5, 6 and 7 have two 3-1/2" breakaway holes (checked prior to installation) located parallel to the roadway with the center of the top hole located at the ground line.
- If the posts were augered, be sure the backfill material around the posts is compacted.
- The post breaker is attached at the non-traffic side of post #1 with two lag screws.
- The 3/8" tether cable is correctly looped around the impact head at post #1, looped around the anchor cable near post #2, and tied under the impact head at post #1.
- No washers are used on the face of the rail except at the cable anchor bracket bolts.

Additional notes: _____

Repairing the *FLEAT-MT*

Equipment Needed for Repair Operation

- Acetylene torch to cut off the damaged rail,
- S.A.E. wrench or socket sizes 9/16", 7/8", 15/16", 1-1/4", and 1-1/2",
- Vice grip or channel lock pliers,
- Sledge hammer,
- Post remover tool could be very useful (see **Figures 14 and 15**),
- Other normal guardrail tools.

General Repair Procedures

After an end-on impact occurs with the *FLEAT-MT*, it will normally require replacement of the front 12'-6" end section of rail and any other damaged rail section(s), any broken post(s) and potentially the impact head. For a traffic face impact, the damage will be to the downstream rail section(s) and associated posts. For a reverse direction impact, the damage will be to the rail section(s), associated posts and potentially either of the impact heads.

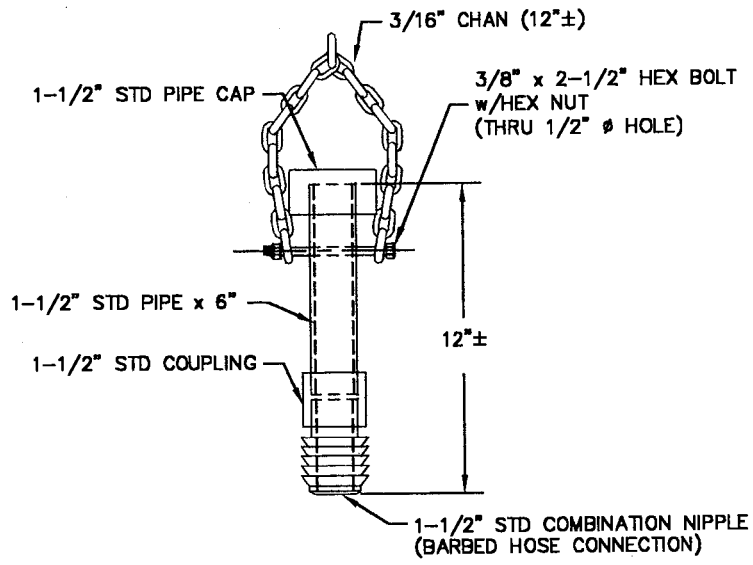
The general step-by-step procedure for repairing a damaged *FLEAT-MT* terminal is as follows:

- (1) Check the impact heads and the post breaker (which was attached to post #1) for damage.
- (2) Check the deflector box, cable anchor brackets, cable assemblies and tether cable for damage. The bearing plates, nuts, washers, cable anchor bracket, and the special cable anchor bracket shoulder bolts are rarely damaged.
- (3) Check the number of broken posts and wood blockouts that need to be replaced, along with any damaged bolts. Inventory and pick up the reusable parts.
- (4) Torch off the kinked rail near the outlet of the impact head(s). The impact head(s) should be able to be removed by hand at this point. If not, the impact head is probably not reusable.
- (5) Disconnect and remove the damaged rail from the posts.
- (6) Remove the broken posts from the foundation tubes. If needed, use one of the two post removal tools (see **Figures 14 and 15**) assembled from "off the shelf hardware" items. Pound the steel pipe or screw the lag screw into the top of the broken post stub and remove the remains of the broken post by pulling on the chain. Use a pry bar as a lever if necessary.
- (7) Reinstall the system following the procedures listed in this manual.

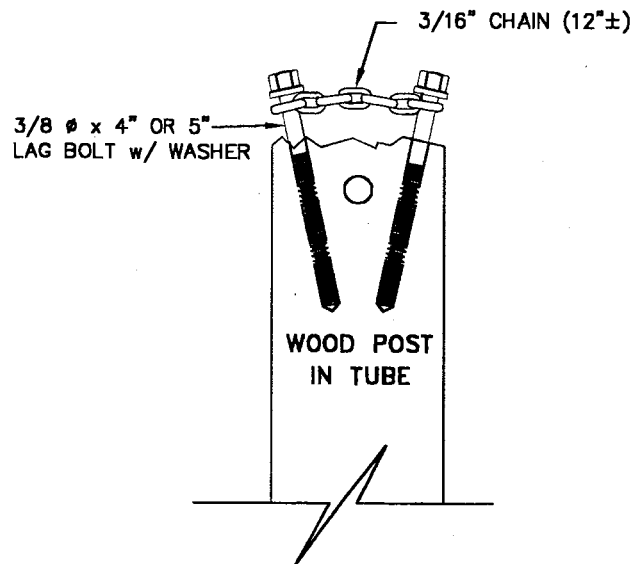
Procedures Immediately Following an Accident (Temporary)

If no repair parts are readily available immediately following an accident, the following procedure should be used to provide temporary protection of the guardrail end. It should be noted that this repair is only for temporary purposes, and the anchor cable cannot be installed to provide tension in the rail for redirection impacts.

- (1) Remove damaged rail and impact head from the roadway or shoulder area.
- (2) Using an acetylene torch, cut the kinked rail off at the outlet of the impact head and inspect the head for any damage.
- (3) Remove the impact head by hand.
- (4) On the approach traffic side, locate the first post downstream of any damaged rail and cut this rail off about 9" in front of the post. If the post is at a splice, simply unbolt the damaged rail.
- (5) On the approach non-traffic side, locate the third post downstream of the previously located post (18'-9" downstream). Remove 12'-6" of the backside rail. Cut off any excess rail to allow approximately 9" of rail in front of what is now the fourth post. If the post is at a splice, simply unbolt the rail.
- (6) Install an impact head on the exposed ends of each rail and attach it to the post with lag bolts.
- (7) Warning signs should be used where appropriate.



**Figure 14. Wood Post Pulling Tool.
(Pipe Option)**



**Figure 15. Wood Post Pulling Tool.
(Lag Screw Option)**

