

**FOR CONTRACT NO.: 06-0N6904**

# **INFORMATION HANDOUT**

## **MATERIALS INFORMATION**

Alternative Flared Terminal System

**ROUTE: 06-Ker-99-PM 19.5**

Installation Instructions  
for the  
**FLEAT 350**



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

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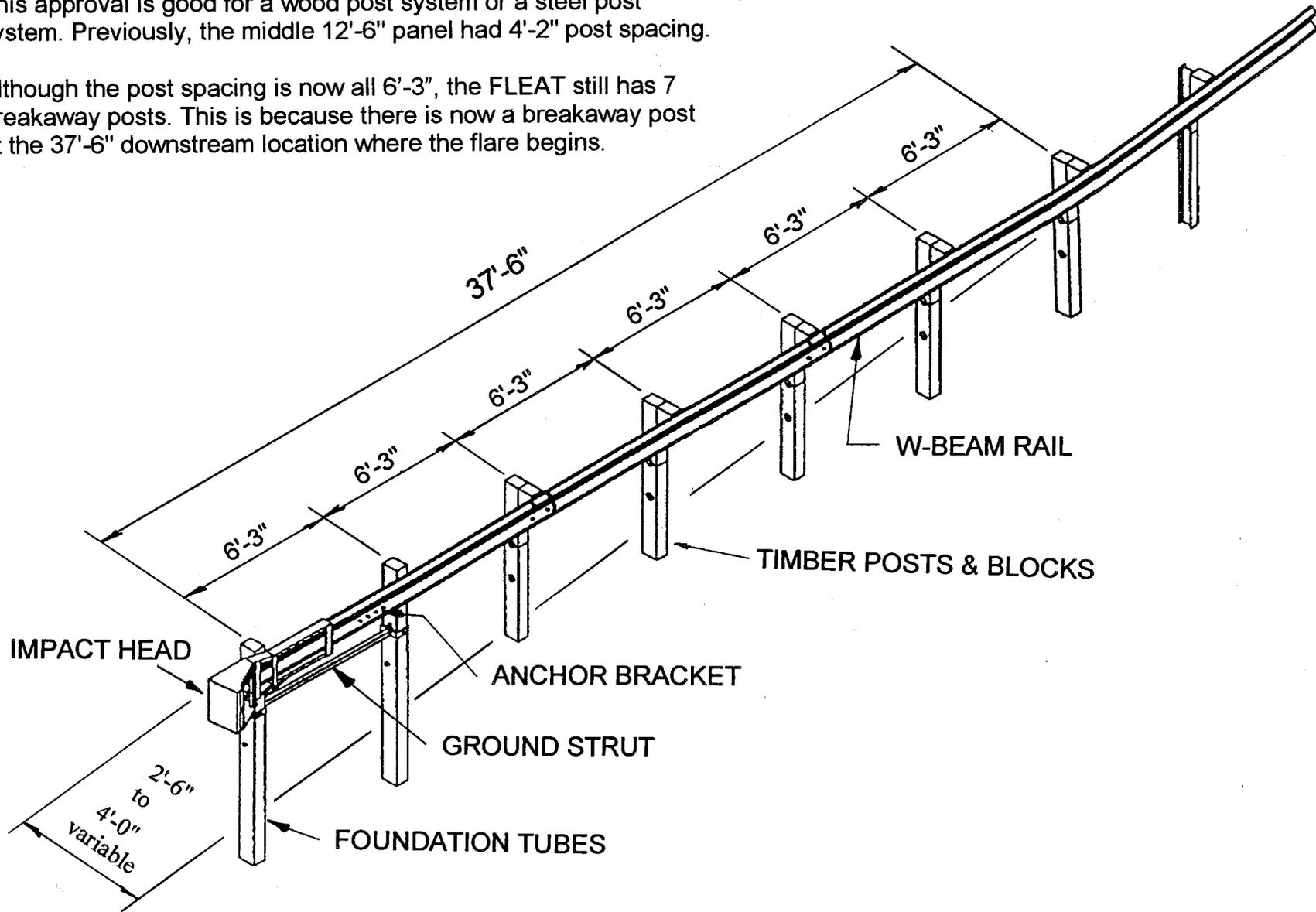
This Installation Manual can be downloaded from RSI web site  
[www.roadsystems.com](http://www.roadsystems.com)

# ADDENDUM

June 2001

The FLEAT may now be installed with all 6'-3" post spacing. This approval is good for a wood post system or a steel post system. Previously, the middle 12'-6" panel had 4'-2" post spacing.

Although the post spacing is now all 6'-3", the FLEAT still has 7 breakaway posts. This is because there is now a breakaway post at the 37'-6" downstream location where the flare begins.



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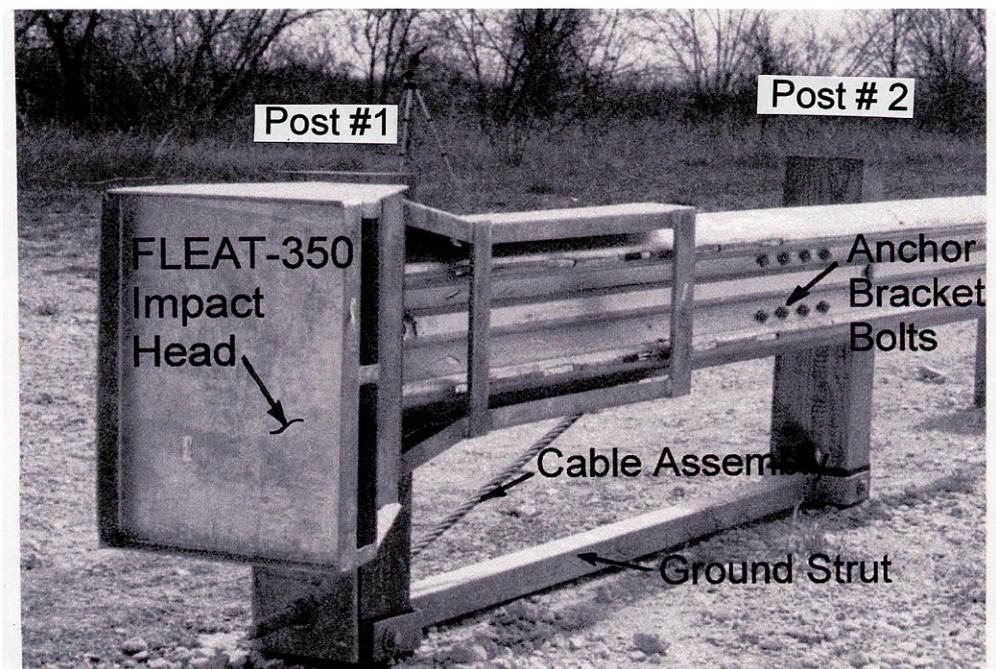
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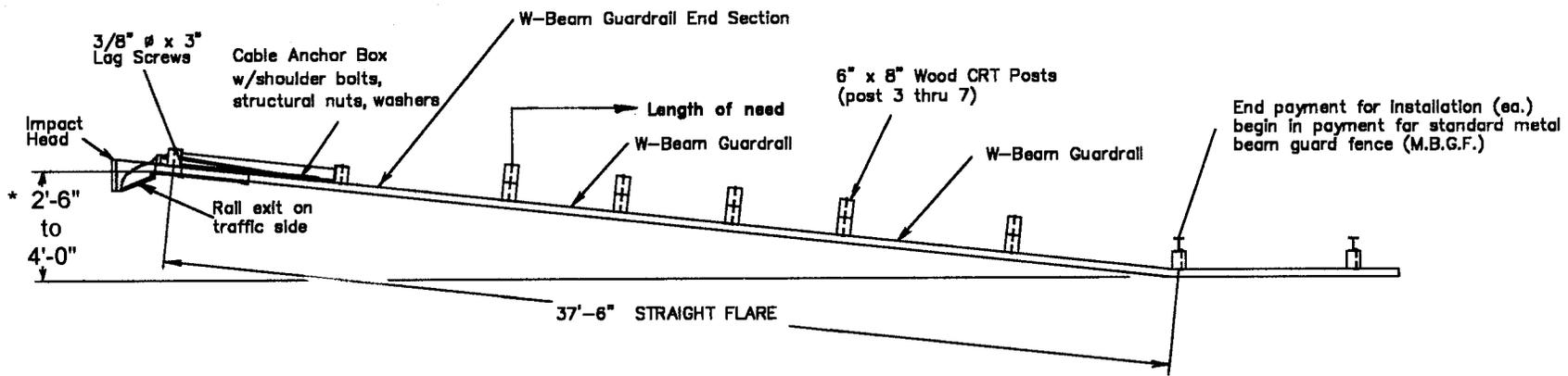
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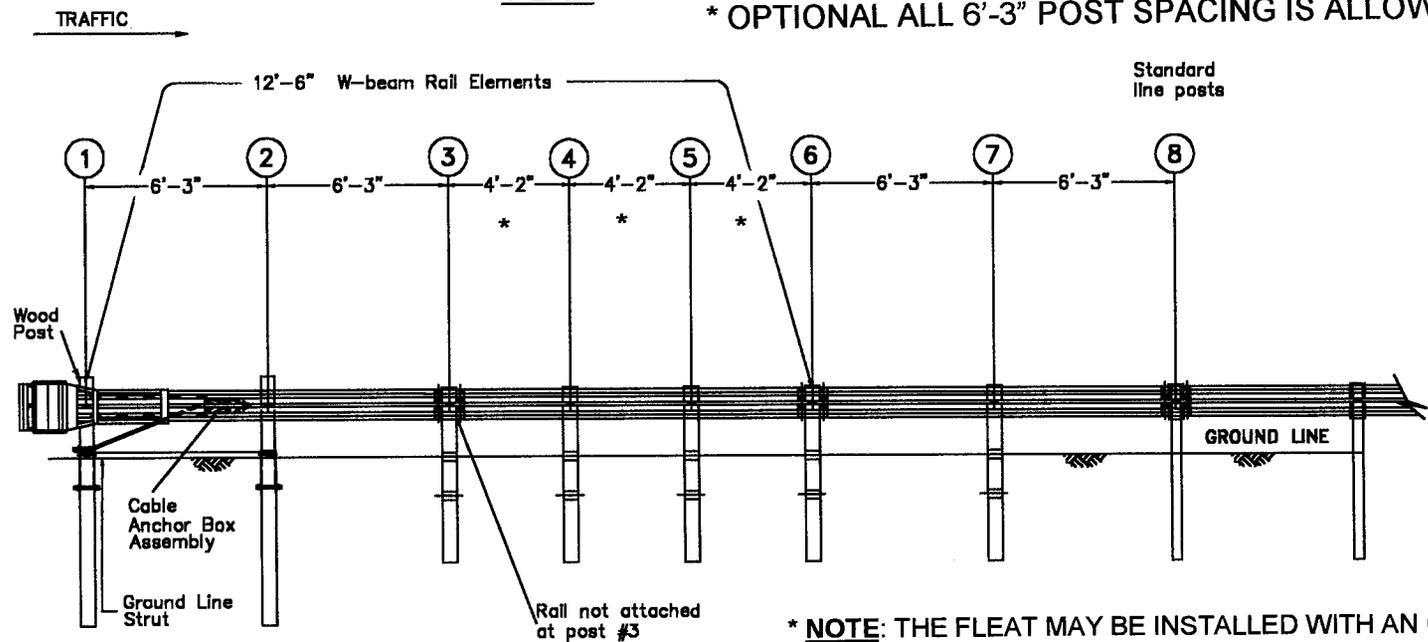


**Figure 1. Isometric view of the *FLEAT 350*.**



**PLAN**

\* OPTIONAL ALL 6'-3" POST SPACING IS ALLOWABLE



**ELEVATION**

NOTE: Posts 1 and 3 that are not bolted through the rail should be driven with sufficient accuracy that the slot in the rail is aligned with the post bolt hole after installation.

\* NOTE: THE FLEAT MAY BE INSTALLED WITH AN OFFSET ANYWHERE BETWEEN 2'-6" AND 4'-0". REFER TO THE CONTRACT PLANS FOR THE REQUIRED OFFSET.

Figure 2. Plan and Elevation Views of *FLEAT 350*.

# Installing the *FLEAT 350*

## Materials

As packaged, the *FLEAT 350* system includes all materials needed for a complete installation except for the impact face object marker. The length of the system in this configuration is 37'-6".

## Design Options

There are four foundation tube options as shown in **Table 1** below.

**Table 1. *FLEAT 350* Design Options**

<b><i>FLEAT 350</i> Design Options</b>	<b>Total Foundation Tubes</b>	<b>Number of Standard BCT Posts</b>	<b>Number of CRT Posts</b>	<b>Total Number of Posts</b>
6'-0" split Foundation Tube	2	2	5	7
6'-0" solid Foundation Tube	2	2	5	7
5'-0" or 4'-6" Foundation Tubes with soil plate	2	2	5	7

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

**Figure 7** shows a section with the 5'-0" or 4'-6" foundation tubes with soil plates.

**Table 2. FLEAT 350 Bill of Materials**

<b>Code #</b>	<b>Quantity</b>	<b>Description</b>
F3000	1	Impact Head
F1303	1	W-Beam Guardrail End Section, 12 Ga., 12'-6"
F1304	1	W-Beam Guardrail, Center Section (4'-2" spacing) 12 Ga., 12'-6"
G1203	1	W-Beam Guardrail, (6'-3" spacing) 12 Ga., 12'-6"
S730	2	* Foundation Soil Tubes, 6" x 8" x 6'-0" ( <b>SEE NOTE BELOW</b> )
E740	1	Pipe Sleeve - 2" Standard Pipe x 5-1/2"
E750	1	Bearing Plate - 8" x 8" x 5/8"
S760	1	Cable Anchor Bracket
E770	1	BCT Cable Anchor Assembly
E780	1	Ground Strut
P650	2	5-1/2" x 7-1/2" x 45" Wood Posts
P671	5	6" x 8" x 6'-0" Wood CRT Posts
P675	5	6" x 8" x 14" Timber Blockouts
<b>Hardware</b>		* 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.
B580122	24	5/8" x 1 1/4" Splice Bolts
B580754	2	5/8" x 7 1/2" Hex Bolts
B581004	2	5/8" x 10" Hex Bolts
B581002	1	5/8" x 10" H.G.R. Post Bolt (Post 2 Only / NO BOLT USED AT POST #1)
B581802	5	5/8" x 18" H.G.R. Post Bolts (Posts 3 through 7)
N050	34	5/8" H.G.R. Nuts (Splice - 24, Soil Tubes - 4, Posts 2 to 7 - 6)
W050	10	5/8" Flat Washers (2 each at Soil Tubes + 6 Posts)
N100	2	1" Anchor Cable Hex Nuts
W100	2	1" Anchor Cable Washers
E350	2	3/8" x 3" Lag Screws
SB58A	8	Cable Anchor Bracket Shoulder Bolts
N055A	8	1/2" A325 Structural Nuts
W050A	16	1-1/16" OD x 9/16" ID A325 Structural Washers

## **Site Preparation**

The *FLEAT 350* is installed with a **straight flare offset anywhere between 2'-6" and 4'-0"**. **Refer to the contract plans for the required offset.** Simply measure the offset distance over the 37'-6" length with a straight string line. This offset becomes the location of post #1. A parabolic curve is not required. Minor site grading may be necessary to prevent the foundation tubes from extending more than 4" above the ground (see Section on Installation).

## **Tools Required**

The tools required for installation of the *FLEAT 350* 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 350* (post location 8) to ensure that the terminal matches up with the standard section of guardrail. The major steps in the installation of the *FLEAT 350* are as follows:

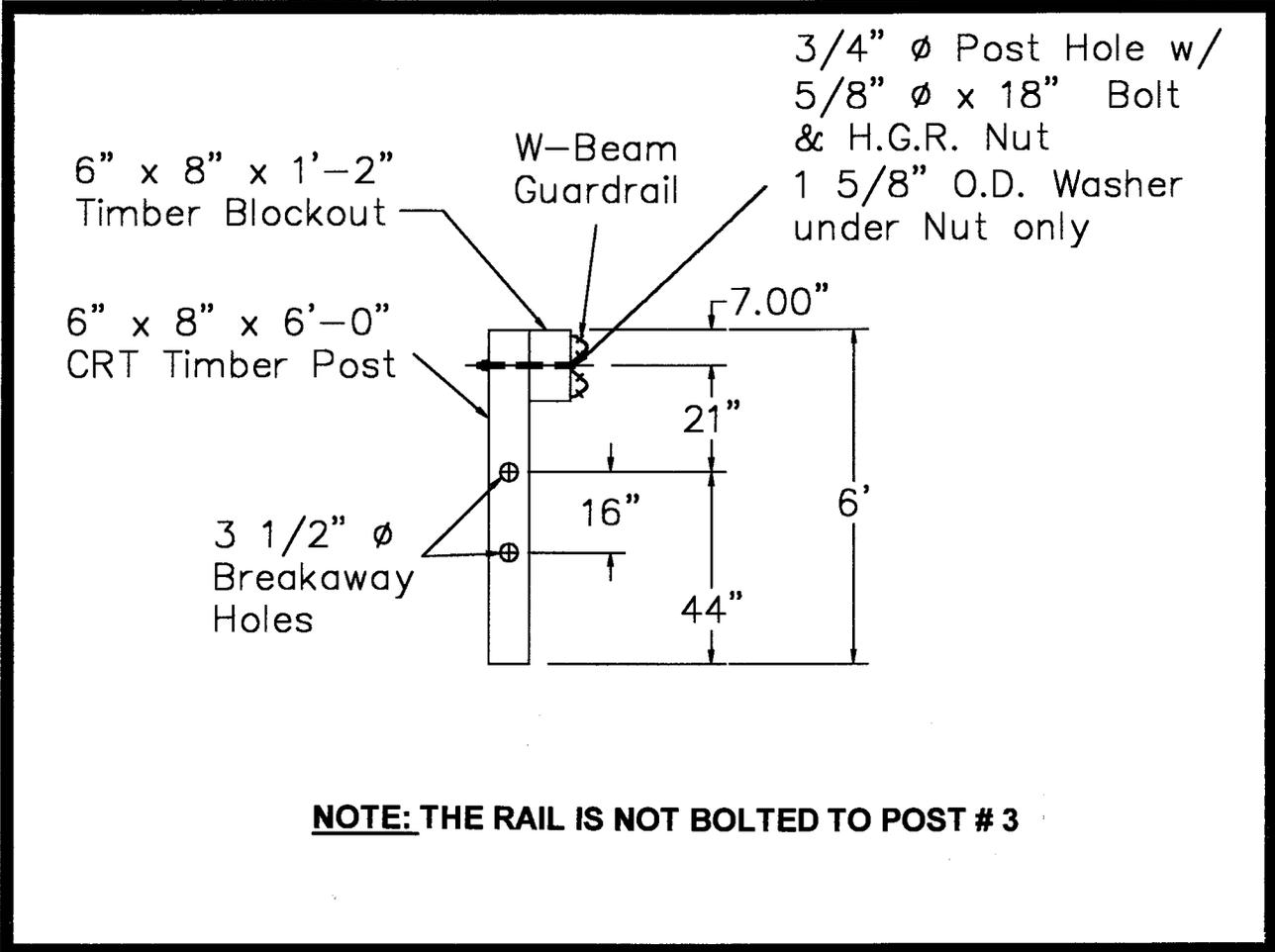
- Install posts 3 through 7,
- Install posts 1 and 2 with groundline strut,
- Install guardrail,
- Install cable anchor bracket,
- Install the *FLEAT 350* impact head, and
- Install cable assembly.

NOTE: The impact head must be placed over the rail prior to tightening the rail to post # 2.

### ***Installing Posts 3 Through 7***

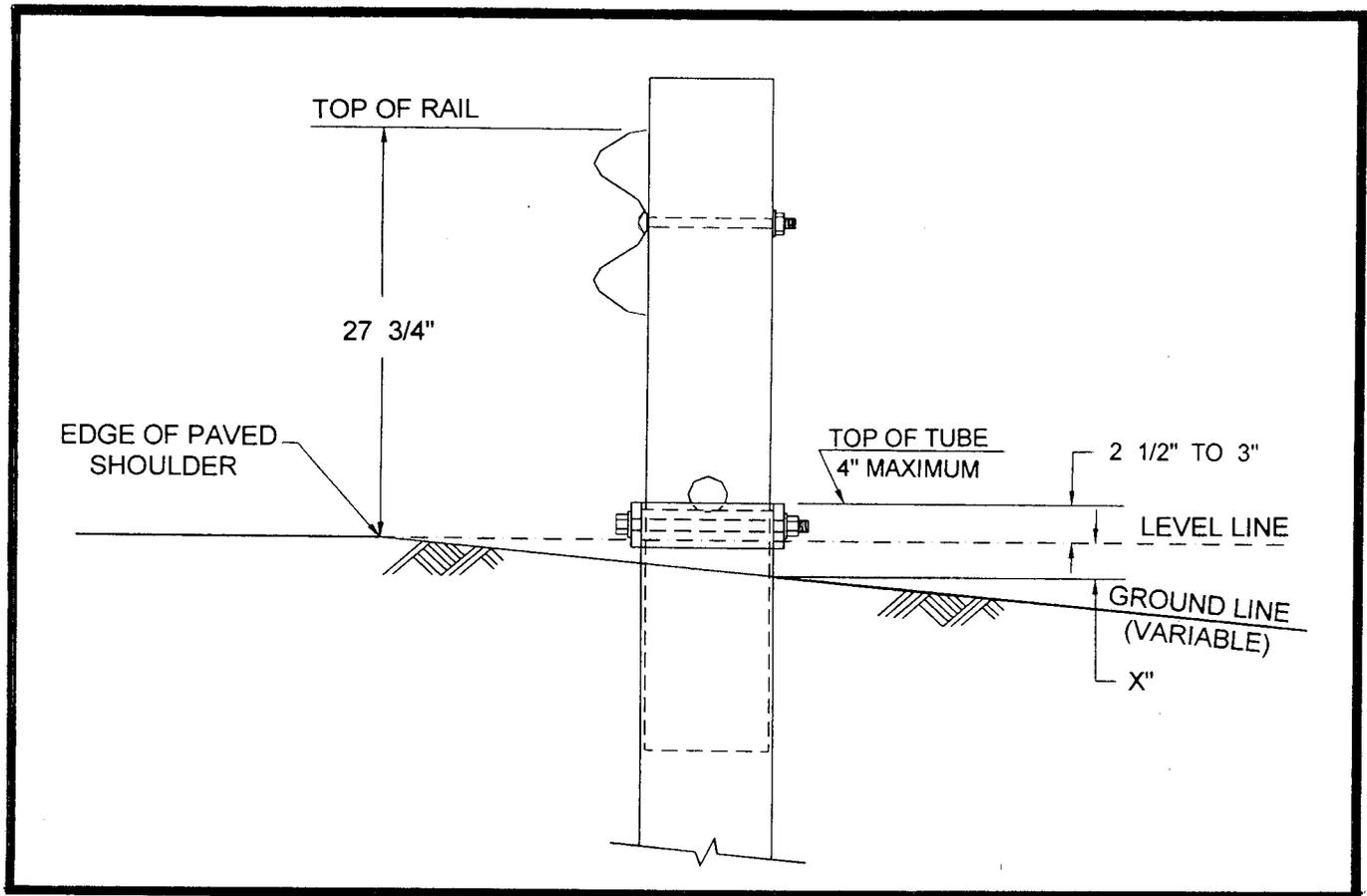
Posts 3 through 7 are 6" x 8" x 6'-0" CRT posts (P671). When installed properly, the hole at the ground line of these CRT posts will be parallel to the roadway. **Figure 3** shows the section of a CRT post. The CRT post may be driven with an approved driving head. For stiff soils, drill a 6" pilot hole 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 TYPICAL AT POSTS 3 - 7

**Figure 3. Section at CRT Post**



**Figure 4. Proper Placement of Foundation Tubes**

**Figure 4** 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 4**, 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 1 and 2 with Groundline Strut***

**Figure 5** shows the above ground details and **Figure 6** shows the section at post locations 1 and 2. Posts 1 and 2 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 7** shows the optional 5'-0" or 4'-6" foundation tubes with soil plates.

For the **6'-0" long split foundation tube**, 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.

*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 4**).

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 **standard 5'-0" long foundation tubes** with soil plates or the **standard 4'-6" long foundation tubes** with soil plates is shown in **Figure 7**. 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 the 5-1/2" x 7-1/2" x 45" wood post (P650) and install the post in the foundation tube at post location 1. Install the second 5-1/2" x 7-1/2" x 45" wood post in the foundation tube at post location 2, and fit the groundline strut (E780) between the two posts. Secure the post to each 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 6**.

NOTE that there is  
no Bolt at Post #1

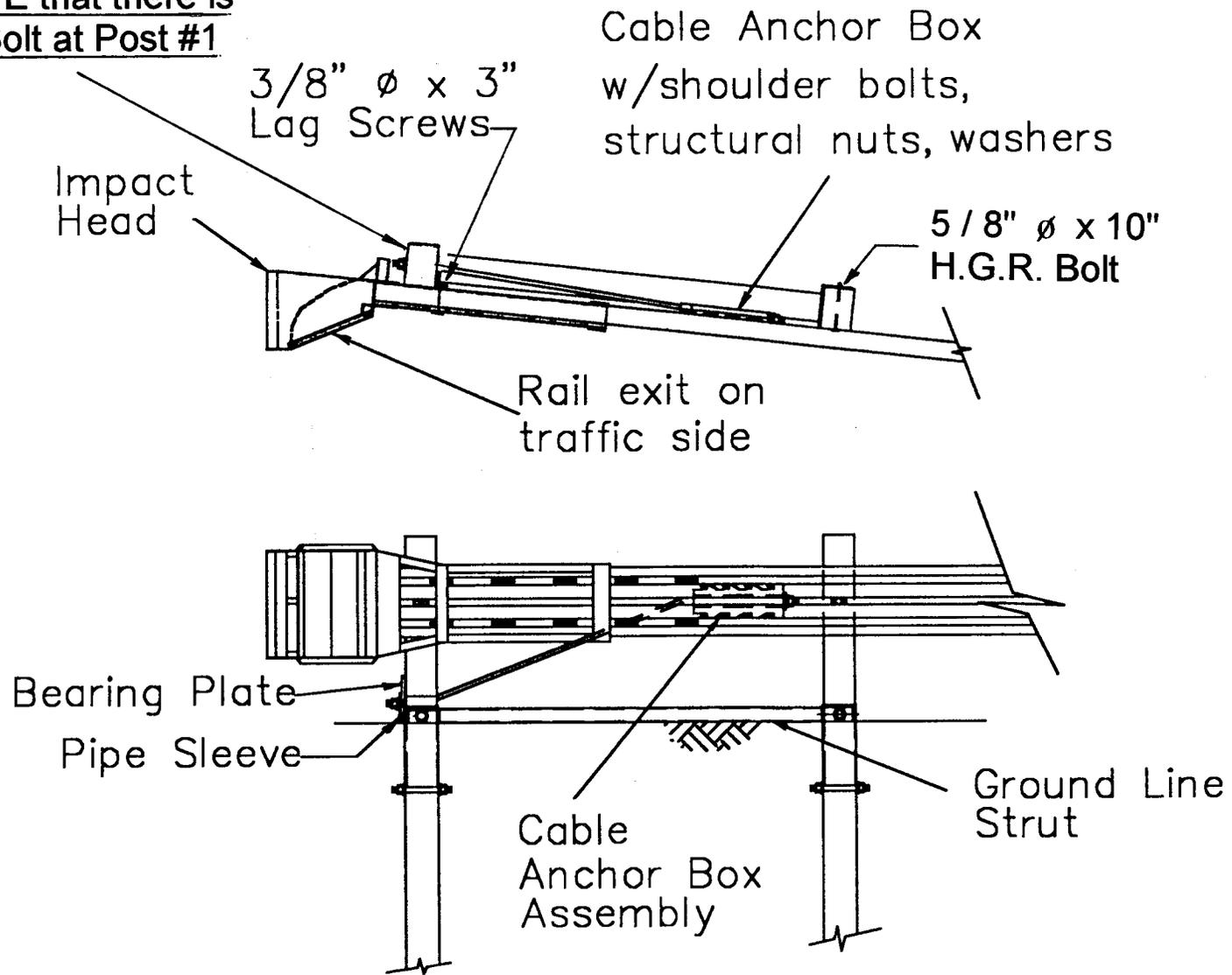
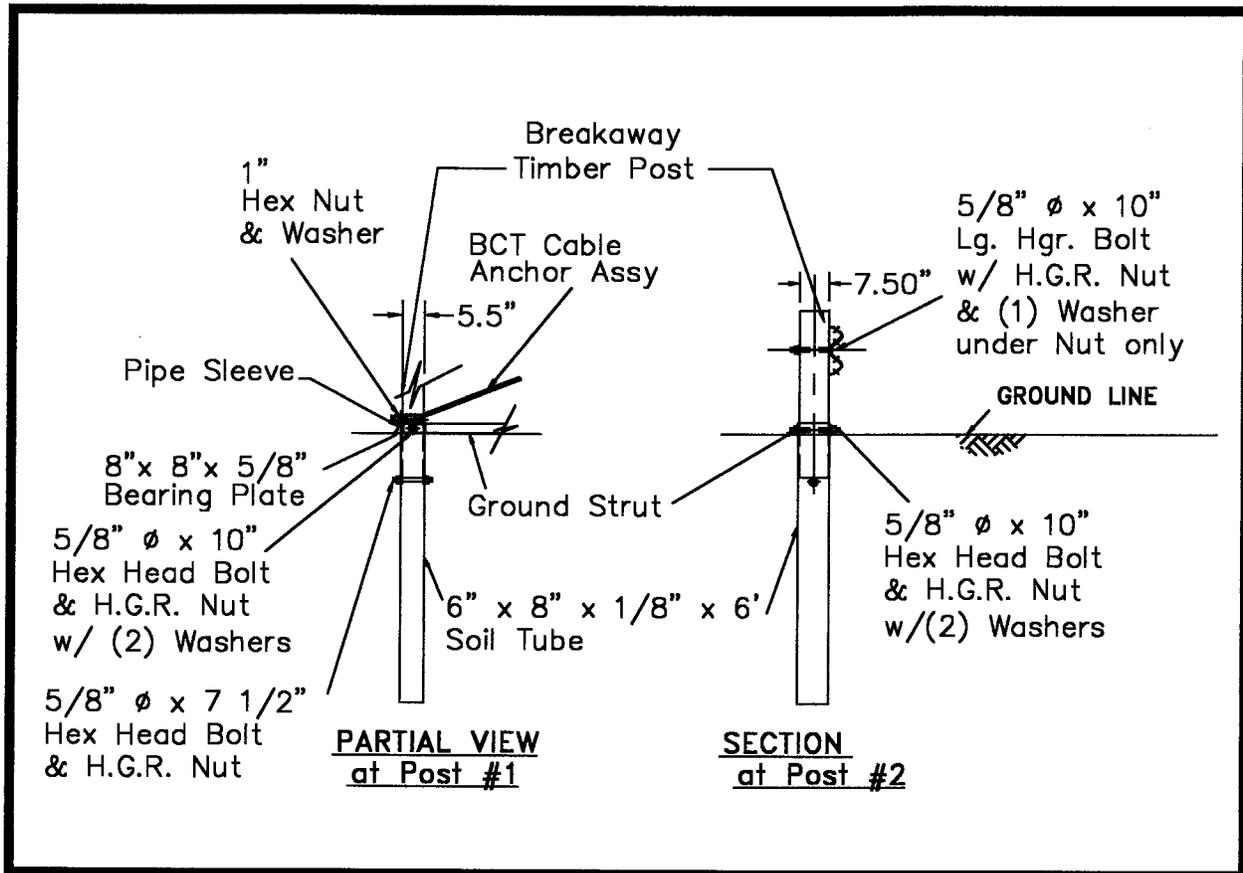


Figure 5. Above-Ground Details at Post Locations 1 and 2.



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 6. Section at Post Locations 1 and 2.**

Deep Beam Guardrail

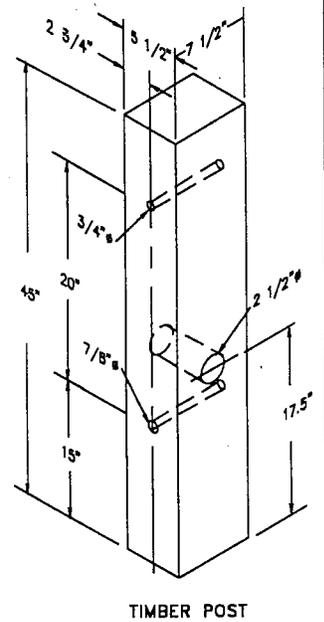
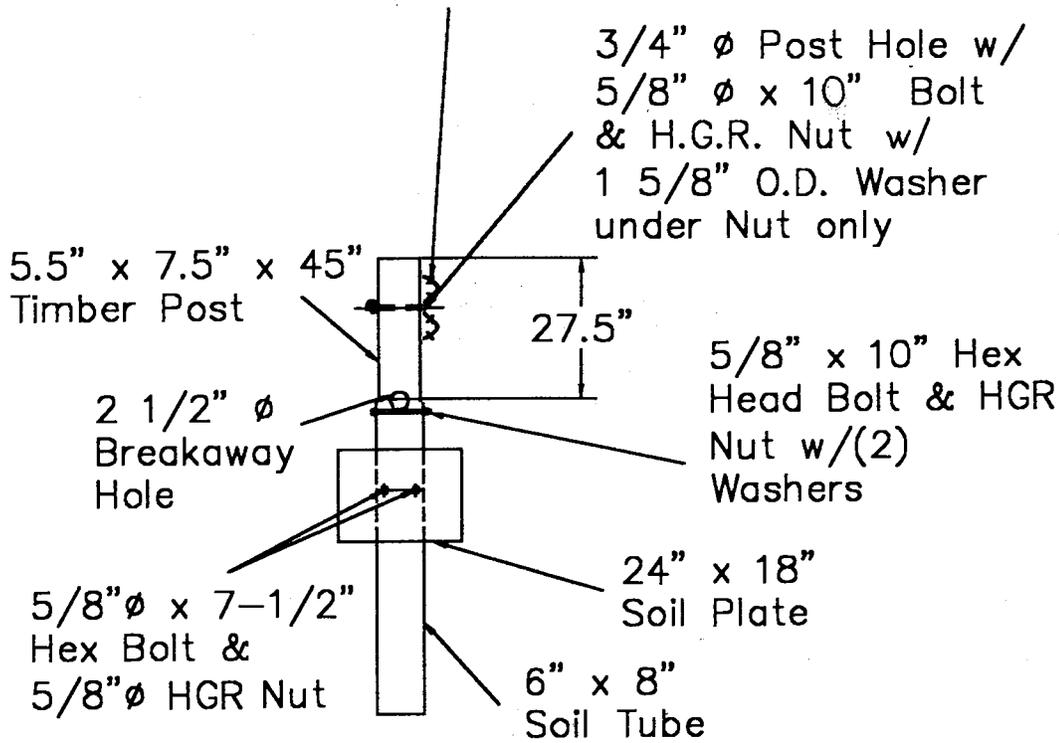


Figure 7. Optional 5'-0" or 4'-6" Foundation Tubes with Soil Plates

## ***Installing Guardrail***

The required offset is achieved by first splicing the guardrail panels together and then manually pushing the rails back. Shop curving or bending is not required.

Attach the standard 12'-6" W-beam guardrail section with 6'-3" post spacing (G1203) beginning at post 8 and spanning to post 6. Then attach the standard 12'-6" W-beam guardrail section with 4'-2" post spacing (F1304) which will span from post 6 to post 3. **Note that the rail is not bolted to post #3.** Attach the 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. The rail is 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 the W-beam guardrail end section prior to attaching the guardrail to the posts. See Section on "Installing Cable Anchor Bracket" for details.

The rails are to be attached to posts and blockouts at post locations 4 through 7 with 5/8" x 18" H.G.R. bolts (B581802) and nuts (N050). **At post location 3, the rail is not bolted to the post.** The bolt only holds the blockout to the post. There is no blockout on posts 1 and 2, and the rail is attached to post 2 only with a 5/8" x 10" H.G.R. bolt (B581002). **Note that no bolt is used at post #1.** Be sure to place a 5/8" flat washer (W050) on the backside of posts 2 through 7 under each nut (N050).

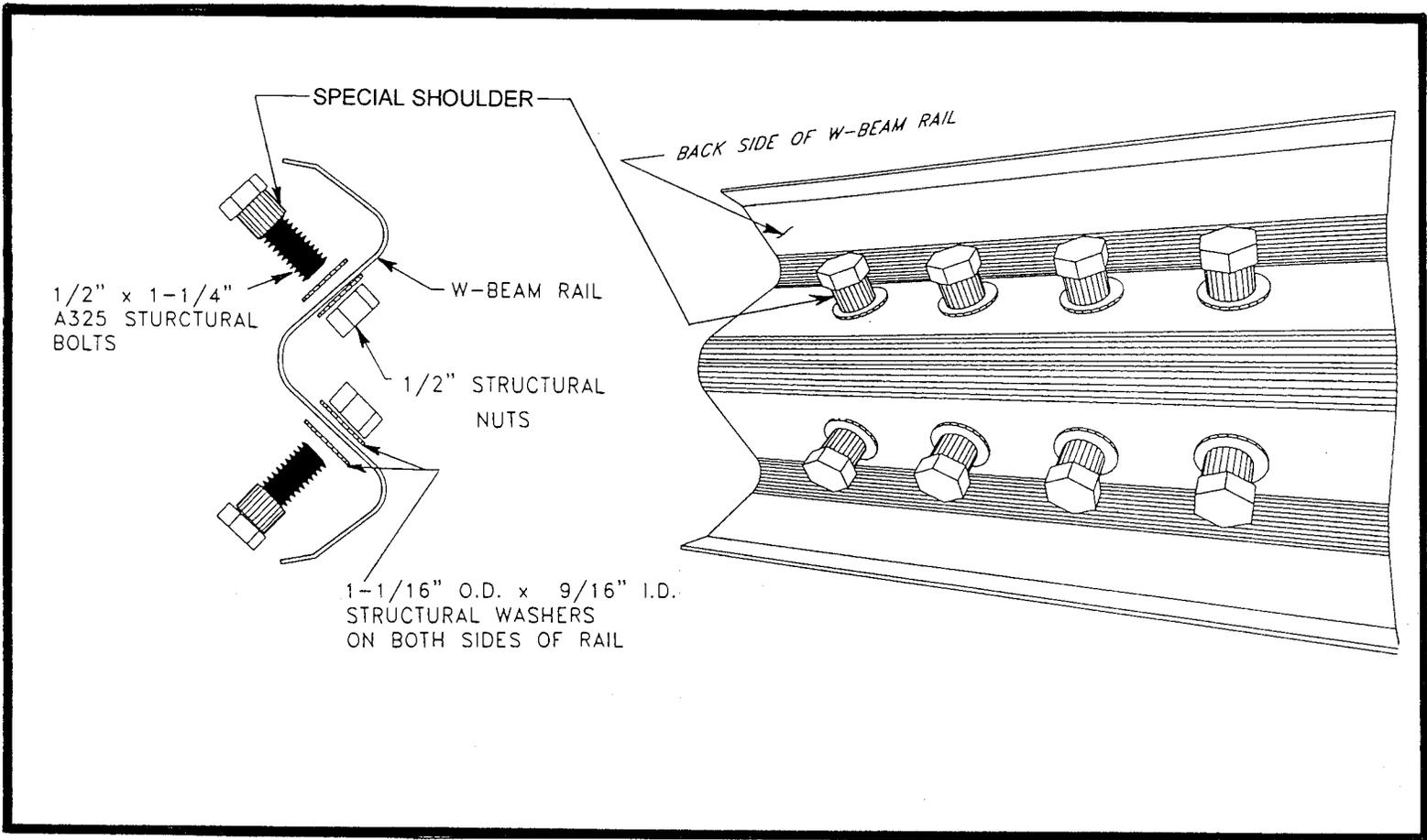
**NOTE:** After the blockout is attached, drive a galvanized steel 10d common nail through the block and into the post (toe nailed) to prevent rotation if the wood shrinks.

## ***Installing Cable Anchor Bracket***

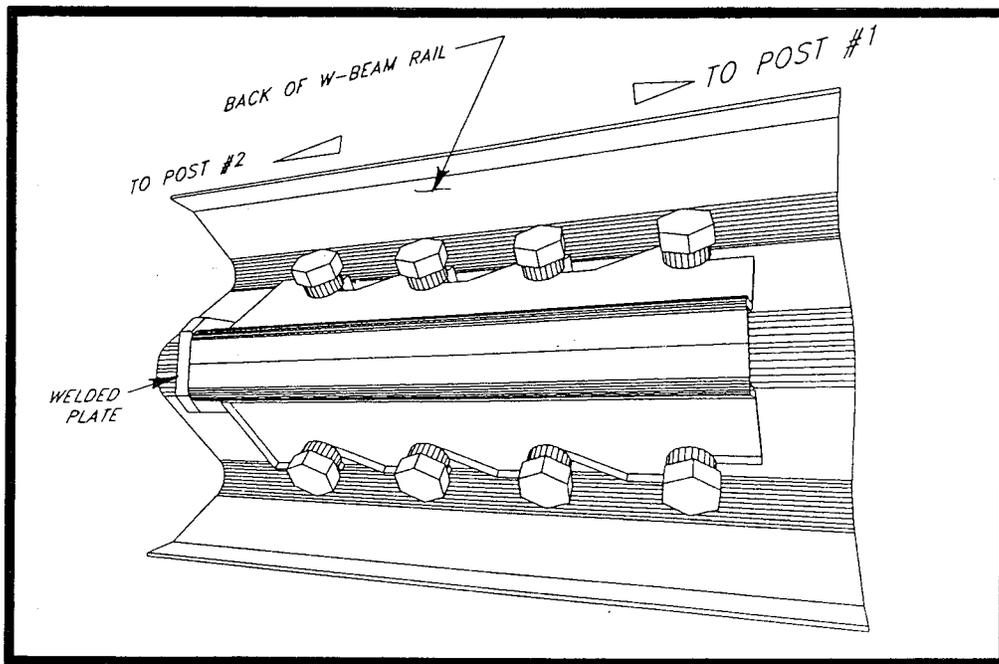
For ease of installation, it is recommended to have the eight 1/2" cable anchor bracket shoulder bolts (SB58A) and the cable anchor bracket (S760) attached to the W-beam guardrail end section prior to attaching the guardrail to the posts. If this procedure is not followed, Post #2 may interfere with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

The eight 1/2" cable anchor bracket shoulder bolts (SB58A) are attached to the W-beam guardrail end section with two 1-1/16" OD x 9/16" ID 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 8**.

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, as shown in **Figure 9**.



**Figure 8. Installation of Cable Anchor Bracket Shoulder Bolts.**



**Figure 9. Installation of Cable Anchor Bracket.**

## ***Installing the FLEAT 350 Impact Head***

The eight cable anchor bracket shoulder bolts and the cable anchor bracket should be attached to the W-beam guardrail end section prior to attaching the **FLEAT 350** impact head to the first post with lag screws.

Prior to tightening the rail to post # 2, place the impact head (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 backside of the guardrail, away from traffic as shown in **Figure 2** and **Figure 5**. Slide the impact head forward until the post angle attachments on the impact head are aligned with the downstream side of the first post. This is the side facing post #2. Attach the impact head to the first 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 to avoid breaking the lag screw.

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 is not included as part of the shipped materials for the **FLEAT 350** unless specifically requested in the contract plans.

## ***Installing Cable Assembly***

Place the cable assembly (E770) through the cable anchor bracket and through the 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 both ends of the cable assembly with a 1" hex nut (N100) and washer (W100). While tightening 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.

Upon completion of the installation, the cable should be taut and the cable anchor bracket 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.*

## **FLEAT 350 Installation Checklist**

State: \_\_\_\_\_

Date: \_\_\_\_\_

Project #: \_\_\_\_\_

Location: \_\_\_\_\_

- 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 flare (offset between 2'-6" & 4'-0") over the 37'-6" terminal length.
- The rail is not attached to the post at post location #3 or post location #1.
- The 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 foundation tubes are not over-tightened, deforming the walls of the tubes.
- The guide chute of the impact head is parallel to the top of the rail and the exit slot of the impact head is facing traffic.
- The two lag screws holding the impact head to post 1 are snug.
- 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. A nail has been placed over the bearing plate to prevent rotation.
- The cable anchor bracket shoulder bolts are properly attached to the W-beam guardrail and the cable anchor bracket is fully seated on the shoulder portion of the bolts.
- Posts #1 and #2 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 through 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.
- No washers are used on the face of the rail except at the cable anchor bracket bolts.

Additional notes: \_\_\_\_\_

Inspection performed by: \_\_\_\_\_

# Installation Instructions



**SRT-350 8 POST™**  
**Guardrail End Treatment**  
**Revised June 24, 2008**



**HIGHWAY SAFETY SOLUTIONS TODAY**

# ***SRT-350 8 POST™ System***

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## **Guardrail End Treatment**

### **Installation, Maintenance, and Repair Manual**



**Trinity Highway Products, LLC  
2525 Stemmons Freeway  
Dallas, Texas 75207**



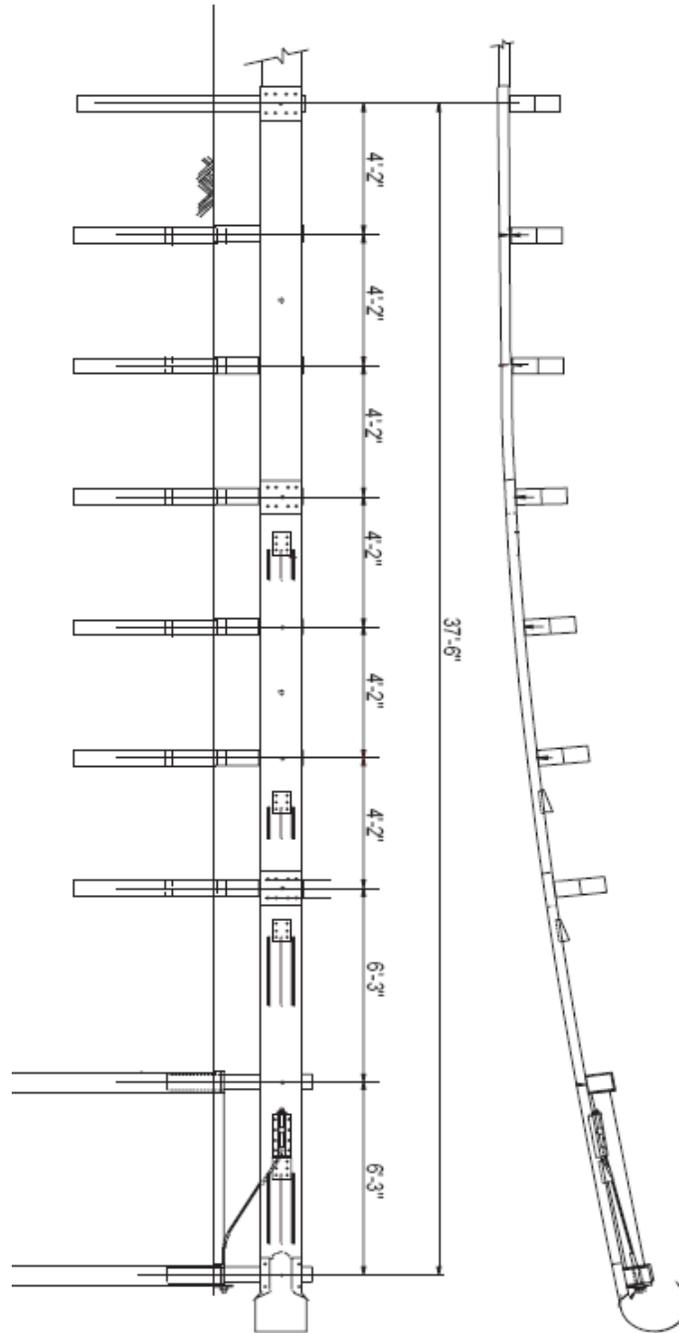
**IMPORTANT:** These instructions are to be used only in conjunction with the installation of the SRT-350 8 POST™ system. These instructions are for standard installations specified by the appropriate state/specifying agency. In the event the specified system installation requires or involves special circumstances, contact the appropriate state/specifying agency before proceeding. Trinity Highway Products, LLC (THP) representative is available for consultation if required.

**This Manual should be available to the installation/  
maintenance/repair workers at all times. For additional copies,  
contact Trinity Highway Products, LLC at 800-527-6050.**

All information, illustrations, and specifications in this Manual are based on the latest SRT-350 8 POST™ system information available at the time of printing. We reserve the right to make changes at any time.

# KNOW YOUR SRT-350 8 POST™ SYSTEM

**SRT 8-POST™ SYSTEM**  
FOR SPECIFIC INSTALLATION, MAINTENANCE,  
OR REPAIR DETAILS,  
REFER TO THE STATE/SPECIFYING  
AGENCY'S STANDARD DRAWING



NOTES:	
1.	Alternate to long foundation tube without soil plate is short tube with soil plate.
2.	Alternate to two 12' 6" (3.81 m) long rail panel is one 25' 0" (7.62 m) long rail panel.

## INSTALLING THE SRT-350 8 POST™ SYSTEM

Use Trinity Highway Products' drawings for the SRT-350™ 8 POST system with these instructions. Review the state/specifying agency's standard drawing(s) for this system, details will be specific to the project or site locations. The installation of the SRT-350 8 POST™ system is similar to the Breakaway Cable Terminal (BCT) installation. The same equipment and expertise is required for both systems.



**WARNING:** Ensure that there is proper site grading for tube and post placement as dictated by the state/specifying agency, pursuant to FHWA acceptance. Failure to follow this warning could result in serious injury or death in the event of a collision.



**WARNING:** Ensure that all Guardrail products and delineation used meet all federal, state/specifying agency, and local specifications. Failure to follow this warning could result in serious injury or death in the event of a collision.

### MATERIALS

As packaged, the SRT-350 8 POST SRT system includes all materials needed for the installation of the 37' 6" (11.43 m) of the SRT-350 8 POST™ system. Note that concrete footings or foundations are NOT required.

### TOOLS REQUIRED

The following list shows required tools for **installation** of the SRT-350 8 POST™ system:

- Calibrated tape measure
- $\frac{9}{16}$ " (14 mm) Socket or Wrench
- $\frac{15}{16}$ " (24 mm) Socket or Wrench
- $1\frac{1}{4}$ " (32 mm) Socket or Wrench
- $1\frac{1}{2}$ " (38 mm) Socket or Wrench
- Augers
- Post pounders (commonly used in driving posts)
- Vise grip pliers

The following list shows recommended tools for the **repair** of the SRT-350 8 POST™ system. However, since repair is directed by the state/specifying agency, they may have more specific guidelines.

- Channel lock pliers
- Sledge hammer
- Post removal tool and other normal guardrail tools
- Eye bolts connected to heavy duty chain (to remove the posts from tubes)
- Vehicle to pull the posts from the tubes

### SITE PREPARATION

Site grading is usually necessary for the proper placement of the steel tubes and the Control Release Terminal ("CRT") posts. Use the state/specifying agency's standard specifications and drawings for the site grading. Trinity does not direct grading. Complete this grading before the start of the installation of the SRT-350 8 POST™ system.



**WARNING:** Ensure that there is proper site grading for tube and post placement as dictated by the state/specifying agency, pursuant to FHWA acceptance. Failure to follow this warning could result in serious injury or death in the event of a collision.

## INSTALLATION

The post installation of the SRT-350 should be per the following Post Installation Section. If the system is installed on a curve, see figures on page 16 for the layout. If there are special field conditions encountered when installing the SRT-350 8 POST™ system, contact the state/specifying agency. Trinity Highway Products, LLC at 1-800-644-7976, is available to assist the state/specifying agency, if needed.

### POST INSTALLATION

Complete the following instructions for the installation of the CRT posts and the foundation tubes with wood posts.

### POST LAYOUT

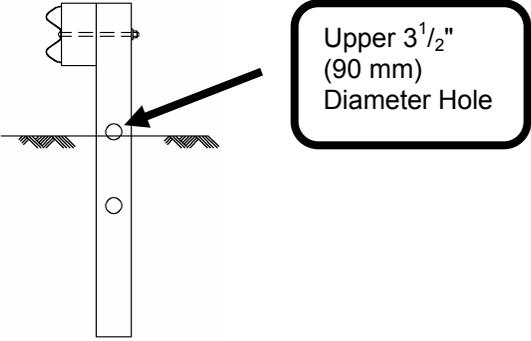
Complete the following steps and use the table below to layout the posts for the SRT-350 8 POST™ system:

Step	Actions
1.	Start at the <b>location 9</b> end of the Guardrail run that is the connection point for the terminal. The length of the installation is 37' 6" (11.43 m).
2.	Layout the post locations starting at <b>location 8</b> , which is the first offset post. (Dimensions are from a tangent line along the back of the Guardrail to the center of the post.)
3.	Measure the offset points from a tangent line of the Guardrail run extending from <b>post 9</b> towards <b>post 1</b> .
4.	Locate the offset points by chord measurements at the center of the post, equal to the post spacing.
5.	Ensure that the Posts are approximately tangent to the railing at each post location.

POST LAYOUT MEASUREMENTS TABLE						
Post Location	Offsets					
	3'	(.91 m)	3.5'	(1.07 m)	4'	(1.22 m)
	Ft.	mm	Ft.	mm	Ft.	mm
9	1.00	305	1.00	305	1.00	305
<b>4' 2" (1270 mm) Post Spacing</b>						
8	1.00	305	1.00	305	1.05	320
<b>4' 2" (1270 mm) Post Spacing</b>						
7	1.00	305	1.06	325	1.20	365
<b>4' 2" (1270 mm) Post Spacing</b>						
6	1.06	325	1.23	375	1.45	440
<b>4' 2" (1270 mm) Post Spacing</b>						
5	1.25	380	1.50	460	1.79	545
<b>4' 2" (1270 mm) Post Spacing</b>						
4	1.56	475	1.88	570	2.22	675
<b>4' 2" (1270 mm) Post Spacing</b>						
3	1.97	600	2.36	720	2.76	840
<b>6' 3" (1905 mm) Post Spacing</b>						
2	2.17	660	2.62	805	3.10	945
<b>6' 3" (1905 mm) Post Spacing</b>						
1	3.30	1005	3.80	1160	4.30	1320

## INSTALLING THE CRT POSTS

Complete the following steps to install the CRT posts:

Step	Actions				
<b>1.</b>	<p>Install the wood posts (PC-4063B) at <b>locations 8 through 3</b>, spaced at 4' 2" (1270 mm) apart. Select Option A or Option B for the post installation.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%; text-align: center;"><b>Option A</b></td> <td>Drive posts into the ground.</td> </tr> <tr> <td style="text-align: center;"><b>Option B</b></td> <td> <ol style="list-style-type: none"> <li>1. Drill 12" (300 mm) maximum diameter holes approximately 44" (1120 mm) deep.</li> <li>2. Insert the 6' 0" (1830 mm) wood post into these holes.</li> <li>3. Backfill the hole with compactable materials in 6" (150 mm) lifts and compact with pneumatic equipment to optimum compaction.</li> </ol> <p><b>Note:</b> If compactable, the material removed from the hole may be used for the backfill.</p> </td> </tr> </table> <div style="text-align: center; margin-top: 10px;">  <p><b>Figure 1</b></p> </div> <p><b>Note:</b> In either option within the previous step, the bottom of the upper 3 1/2" (90 mm) diameter hole in the post is approximately at the finished grade. (See Figure 1)</p>	<b>Option A</b>	Drive posts into the ground.	<b>Option B</b>	<ol style="list-style-type: none"> <li>1. Drill 12" (300 mm) maximum diameter holes approximately 44" (1120 mm) deep.</li> <li>2. Insert the 6' 0" (1830 mm) wood post into these holes.</li> <li>3. Backfill the hole with compactable materials in 6" (150 mm) lifts and compact with pneumatic equipment to optimum compaction.</li> </ol> <p><b>Note:</b> If compactable, the material removed from the hole may be used for the backfill.</p>
<b>Option A</b>	Drive posts into the ground.				
<b>Option B</b>	<ol style="list-style-type: none"> <li>1. Drill 12" (300 mm) maximum diameter holes approximately 44" (1120 mm) deep.</li> <li>2. Insert the 6' 0" (1830 mm) wood post into these holes.</li> <li>3. Backfill the hole with compactable materials in 6" (150 mm) lifts and compact with pneumatic equipment to optimum compaction.</li> </ol> <p><b>Note:</b> If compactable, the material removed from the hole may be used for the backfill.</p>				

## PLACING FOUNDATION TUBES FOR WOOD POSTS

Complete the following steps to position foundation tubes and wood posts:

### TUBE OPTIONS

Step	Actions				
<b>1.</b>	<p>Select Option A or Option B for this installation.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%; text-align: center;"><b>Option A</b></td> <td> <p><b>6' 0" (1830 mm) Tube, no Soil Plate</b></p> <ol style="list-style-type: none"> <li>1. No assembly required.</li> <li>2. Install the foundation tube (PC-742G), as described below.</li> </ol> </td> </tr> <tr> <td style="text-align: center;"><b>Option B</b></td> <td> <p><b>4' 6" (1375 mm) Tube with Soil Plate</b></p> <ol style="list-style-type: none"> <li>1. Assemble the soil tubes and soil plates.</li> <li>2. Insert two (2) 5/8" x 7 1/2" (16 mm x 190 mm) Hex Head Bolts through the soil plate (PC-766G) and the foundation tube (PC-740G).</li> <li>3. Place HGR nuts (no washers) on the inserted bolts to secure. Tighten the bolts to a snug position. (There is no torque requirement for these bolts.)</li> <li>4. Install the foundation tube (PC-766G) with soil plate as described below.</li> </ol> </td> </tr> </table> <p><b>Note:</b> Do not over tighten the bolts and deform the tubes, as that will complicate possible post replacement.</p>	<b>Option A</b>	<p><b>6' 0" (1830 mm) Tube, no Soil Plate</b></p> <ol style="list-style-type: none"> <li>1. No assembly required.</li> <li>2. Install the foundation tube (PC-742G), as described below.</li> </ol>	<b>Option B</b>	<p><b>4' 6" (1375 mm) Tube with Soil Plate</b></p> <ol style="list-style-type: none"> <li>1. Assemble the soil tubes and soil plates.</li> <li>2. Insert two (2) 5/8" x 7 1/2" (16 mm x 190 mm) Hex Head Bolts through the soil plate (PC-766G) and the foundation tube (PC-740G).</li> <li>3. Place HGR nuts (no washers) on the inserted bolts to secure. Tighten the bolts to a snug position. (There is no torque requirement for these bolts.)</li> <li>4. Install the foundation tube (PC-766G) with soil plate as described below.</li> </ol>
<b>Option A</b>	<p><b>6' 0" (1830 mm) Tube, no Soil Plate</b></p> <ol style="list-style-type: none"> <li>1. No assembly required.</li> <li>2. Install the foundation tube (PC-742G), as described below.</li> </ol>				
<b>Option B</b>	<p><b>4' 6" (1375 mm) Tube with Soil Plate</b></p> <ol style="list-style-type: none"> <li>1. Assemble the soil tubes and soil plates.</li> <li>2. Insert two (2) 5/8" x 7 1/2" (16 mm x 190 mm) Hex Head Bolts through the soil plate (PC-766G) and the foundation tube (PC-740G).</li> <li>3. Place HGR nuts (no washers) on the inserted bolts to secure. Tighten the bolts to a snug position. (There is no torque requirement for these bolts.)</li> <li>4. Install the foundation tube (PC-766G) with soil plate as described below.</li> </ol>				

Step	Actions
2.	<p>Install the foundation tubes at <b>locations 1 and 2</b>. Use the strut as a guide for the spacing of the tubes. Position the soil plate on the side of the post, away from the impacting end, if applicable.</p> <p><b>Note:</b> Do not drive tubes with the wood post inserted, as that will complicate possible post replacement.</p>

## INSTALLATION OPTIONS FOR FOUNDATION TUBES

Select the steps below for Permeable Soil or Non-Permeable Soil to install foundation tubes:

### FOR PERMEABLE SOIL

Step	Actions
1.	<p>If the soil is permeable (water will drain from the tubes), drive the tubes with an approved driving head to the optimum height where the top of the tube is <math>2\frac{5}{8}</math>" (67 mm) above the finished grade.</p> <p><b>Note:</b> Take extra care to prevent settlement or lateral displacement of the tubes, to ensure the posts attach to the Guardrail correctly.</p>
2.	<p>Ensure that the finished Guardrail height will be approximately <math>27\frac{3}{4}</math>" (706 mm) above the finished grade, or as the state/specifying agency plans indicate, by placing a wood post in the tube and checking the height of the bolt hole. Correct, if needed.</p>
3.	<p>Ensure that the tubes do not project more than 4" (100 mm) above the finished grade.</p>

### FOR NON-PERMEABLE SOIL

Step	Actions						
1.	<p>Select Method A, Method B, or Method C below, if soil is non-permeable.</p> <table border="1" style="width: 100%;"> <tr> <td style="text-align: center;"><b>Method A</b></td> <td> <p><b>For Tube Only</b></p> <ol style="list-style-type: none"> <li>1. Drill a 12" (300 mm) diameter pilot hole approximately 75" (1905 mm) deep.</li> <li>2. Insert the tube into the hole to the optimum height where the top of the tube is <math>2\frac{5}{8}</math>" (67 mm) above the finished grade.</li> </ol> <p><b>For Tube with Soil Plate</b></p> <ol style="list-style-type: none"> <li>1. Drill a 12" (300 mm) diameter pilot hole approximately 75" (1905 mm).</li> <li>2. Insert the soil plate/tube assembly into the hole by impact or vibratory means with an approved driving head.</li> <li>3. Drive the tube to the optimum height where the top of the tube is <math>2\frac{5}{8}</math>" (67 mm) above the finished grade.</li> </ol> </td> </tr> <tr> <td style="text-align: center;"><b>Method B</b></td> <td> <p>Cut slots for the soil plates out by hand or by using a rock bar. Follow all of the steps of Option A, above.</p> </td> </tr> <tr> <td style="text-align: center;"><b>Method C</b></td> <td> <p>Drill three adjacent 12" (300 mm) diameter holes or one 24" (610 mm) diameter hole to accommodate the soil plate/tube assembly. Follow all of the steps of Option A, above.</p> <p><b>Note:</b> If Option C is used, material must be placed in 6" (150 mm) lifts and compact with pneumatic equipment to optimum compaction.</p> </td> </tr> </table> <p><b>Note:</b> Take extra care to prevent settlement or lateral displacement of the tubes, to ensure the posts attach to the Guardrail, correctly.</p>	<b>Method A</b>	<p><b>For Tube Only</b></p> <ol style="list-style-type: none"> <li>1. Drill a 12" (300 mm) diameter pilot hole approximately 75" (1905 mm) deep.</li> <li>2. Insert the tube into the hole to the optimum height where the top of the tube is <math>2\frac{5}{8}</math>" (67 mm) above the finished grade.</li> </ol> <p><b>For Tube with Soil Plate</b></p> <ol style="list-style-type: none"> <li>1. Drill a 12" (300 mm) diameter pilot hole approximately 75" (1905 mm).</li> <li>2. Insert the soil plate/tube assembly into the hole by impact or vibratory means with an approved driving head.</li> <li>3. Drive the tube to the optimum height where the top of the tube is <math>2\frac{5}{8}</math>" (67 mm) above the finished grade.</li> </ol>	<b>Method B</b>	<p>Cut slots for the soil plates out by hand or by using a rock bar. Follow all of the steps of Option A, above.</p>	<b>Method C</b>	<p>Drill three adjacent 12" (300 mm) diameter holes or one 24" (610 mm) diameter hole to accommodate the soil plate/tube assembly. Follow all of the steps of Option A, above.</p> <p><b>Note:</b> If Option C is used, material must be placed in 6" (150 mm) lifts and compact with pneumatic equipment to optimum compaction.</p>
<b>Method A</b>	<p><b>For Tube Only</b></p> <ol style="list-style-type: none"> <li>1. Drill a 12" (300 mm) diameter pilot hole approximately 75" (1905 mm) deep.</li> <li>2. Insert the tube into the hole to the optimum height where the top of the tube is <math>2\frac{5}{8}</math>" (67 mm) above the finished grade.</li> </ol> <p><b>For Tube with Soil Plate</b></p> <ol style="list-style-type: none"> <li>1. Drill a 12" (300 mm) diameter pilot hole approximately 75" (1905 mm).</li> <li>2. Insert the soil plate/tube assembly into the hole by impact or vibratory means with an approved driving head.</li> <li>3. Drive the tube to the optimum height where the top of the tube is <math>2\frac{5}{8}</math>" (67 mm) above the finished grade.</li> </ol>						
<b>Method B</b>	<p>Cut slots for the soil plates out by hand or by using a rock bar. Follow all of the steps of Option A, above.</p>						
<b>Method C</b>	<p>Drill three adjacent 12" (300 mm) diameter holes or one 24" (610 mm) diameter hole to accommodate the soil plate/tube assembly. Follow all of the steps of Option A, above.</p> <p><b>Note:</b> If Option C is used, material must be placed in 6" (150 mm) lifts and compact with pneumatic equipment to optimum compaction.</p>						

Step	Actions
2.	Ensure that the finished Guardrail height will be approximately 27 <sup>3</sup> / <sub>4</sub> " (706 mm) above the finished grade, or, as the state/specifying agency plans indicate, by placing a wood post in the tube and checking the height of the bolt hole. Correct, if needed.
3.	Ensure that the tubes do not project more than 4" (100 mm) above the finished grade.

## INSTALLING TUBES WHEN ENCOUNTERING ROCK

Complete the following steps to install foundation tubes when encountering rock:

Step	Actions				
1.	<p>Select Option A or Option B below when encountering rock, unless there is a more restrictive state/specifying agency specification.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%; text-align: center; vertical-align: top;"><b>Option A</b></td> <td> <p><b>If rock is encountered with 20" (510 mm) or less depth for full installation</b></p> <ol style="list-style-type: none"> <li>1. Drill a 12" - 16" (300 mm - 400 mm) diameter hole into the rock 2" (50 mm) deeper than required full embedment depth.</li> <li>2. Place granular material or small pieces of the drilled rock in the bottom 2" (50 mm) of the hole for drainage.</li> <li>3. Insert the tube into the hole to the proper mounting height.</li> <li>4. Backfill the hole with compactable materials in 6" (150 mm) lifts and compact with pneumatic equipment to optimum compaction. (If compactable, the material removed from the hole may be used for the backfill.)</li> <li>5. Ensure that the finished Guardrail height is approximately 27<sup>3</sup>/<sub>4</sub>" (706 mm) above the finished grade, or as the state/specifying agency plans indicate.</li> <li>6. Ensure that the tubes do not project more than 4" (100 mm) above the finished grade.</li> </ol> <p><b>Note:</b> Take extra care to prevent settlement or lateral displacement of the tubes, to ensure the posts attach to the Guardrail, correctly.</p> </td> </tr> <tr> <td style="width: 15%; text-align: center; vertical-align: top;"><b>Option B</b></td> <td> <p><b>If rock is encountered with greater than 20" (510 mm) depth for full installation</b></p> <ol style="list-style-type: none"> <li>1. Drill a 12" - 16" (300 mm - 400 mm) diameter hole 22" (560 mm) deep into the rock.</li> <li>2. Insert the tube into the hole and measure from the bottom of the tube to the finished grade.</li> <li>3. Determine the proper length of tube to install to ensure the tube is fully embedded in the hole and does not project more than 4" (100 mm) above the finished grade. (The optimum height for tube projection is 2<sup>5</sup>/<sub>8</sub>".)</li> <li>4. Remove tube from the hole. Measure and mark from the top of the tube the length to remove from the bottom.</li> <li>5. Cut off the measured length from the bottom of the tube.</li> <li>6. Place granular material or small pieces of the drilled rock in the bottom 2" (50 mm) of the hole for drainage.</li> </ol> <p style="text-align: center; font-size: small;">Continues on next page.</p> </td> </tr> </table>	<b>Option A</b>	<p><b>If rock is encountered with 20" (510 mm) or less depth for full installation</b></p> <ol style="list-style-type: none"> <li>1. Drill a 12" - 16" (300 mm - 400 mm) diameter hole into the rock 2" (50 mm) deeper than required full embedment depth.</li> <li>2. Place granular material or small pieces of the drilled rock in the bottom 2" (50 mm) of the hole for drainage.</li> <li>3. Insert the tube into the hole to the proper mounting height.</li> <li>4. Backfill the hole with compactable materials in 6" (150 mm) lifts and compact with pneumatic equipment to optimum compaction. (If compactable, the material removed from the hole may be used for the backfill.)</li> <li>5. Ensure that the finished Guardrail height is approximately 27<sup>3</sup>/<sub>4</sub>" (706 mm) above the finished grade, or as the state/specifying agency plans indicate.</li> <li>6. Ensure that the tubes do not project more than 4" (100 mm) above the finished grade.</li> </ol> <p><b>Note:</b> Take extra care to prevent settlement or lateral displacement of the tubes, to ensure the posts attach to the Guardrail, correctly.</p>	<b>Option B</b>	<p><b>If rock is encountered with greater than 20" (510 mm) depth for full installation</b></p> <ol style="list-style-type: none"> <li>1. Drill a 12" - 16" (300 mm - 400 mm) diameter hole 22" (560 mm) deep into the rock.</li> <li>2. Insert the tube into the hole and measure from the bottom of the tube to the finished grade.</li> <li>3. Determine the proper length of tube to install to ensure the tube is fully embedded in the hole and does not project more than 4" (100 mm) above the finished grade. (The optimum height for tube projection is 2<sup>5</sup>/<sub>8</sub>".)</li> <li>4. Remove tube from the hole. Measure and mark from the top of the tube the length to remove from the bottom.</li> <li>5. Cut off the measured length from the bottom of the tube.</li> <li>6. Place granular material or small pieces of the drilled rock in the bottom 2" (50 mm) of the hole for drainage.</li> </ol> <p style="text-align: center; font-size: small;">Continues on next page.</p>
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		<p>7. Insert the tube in the hole to the proper mounting height.</p> <p>8. Backfill the hole with compactable materials in 6" (150 mm) lifts and compact with pneumatic equipment to optimum compaction. (If compactable, the material removed from the hole may be used for the backfill.)</p> <p>9. Ensure that the finished Guardrail height is approximately 27<sup>3</sup>/<sub>4</sub>" (706 mm) above the finished grade, or as the state/specifying agency plans indicate.</p> <p>10. Ensure that the tubes do not project more than 4" (100 mm) above the finished grade.</p> <p><b>Note:</b> Take extra care to prevent settlement or lateral displacement of the tubes, to ensure the posts attach to the Guardrail, correctly.</p>
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### INSTALLING WOOD POSTS IN TUBES

Complete the following steps to install wood posts in tubes:

Step	Actions
1.	Insert the Pipe Sleeve (PC-705G) in post (PC-6058B) and install in steel tube at <b>location 1</b> .  <b>Note:</b> A metal band must be around the post under the post bolt hole.
2.	Install second (PC-6058B) post in steel tube at <b>location 2</b> .  <b>Note:</b> A metal band must be around the post under the post bolt hole.

### INSTALLING THE STRUT

Complete the following steps to install the strut:

Step	Actions
1.	Place the slotted yokes of the ground strut (PC-9852A) over the top of the foundation tubes for <b>posts 2 and 1</b> .
2.	Place a washer on a <sup>5</sup> / <sub>8</sub> " X 9 <sup>1</sup> / <sub>2</sub> " (16 mm x 240 mm) Hex Head Bolt.
3.	Insert the bolt through the strut, foundation tube, and the wood post from the embankment side.
4.	Install a second washer and a nut on the inserted bolt. Tighten the bolt to a snug position. (There is no torque requirement for these bolts.)  <b>Note:</b> Do not over tighten the bolt and deform the tubes, as that will complicate possible post replacement.

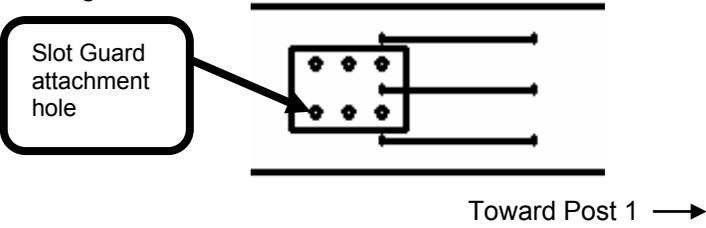
### INSTALLING WOOD BLOCKOUTS AT POSTS 8 & 7

Complete the following steps to install the Wood Blockouts at posts 8 and 7:

Step	Actions
1.	Insert a <sup>5</sup> / <sub>8</sub> " x 18" (16 mm x 460 mm) post bolt through the Wood Blockout (PC-4075B) and the post at <b>posts 8 and 7</b> .  <b>Note: Do not bolt the Guardrail panel to posts 8 and 7.</b>
2.	Place a round washer under a Hex Nut on the inserted bolt to secure. Tighten the bolt to a snug position. (There is no torque requirement for these bolts.)

## ARRANGING RAIL PANELS

Complete the following steps to arrange the rail panels:

Step	Actions
1.	Layout that Guardrail panels (PC-30G and PC-39G and PC-69G) with slots between <b>posts 6 and 5, 4 and 3, 3 and 2, and 2 and 1.</b>
2.	Position the Guardrail panels so that the Slot Guard attachment holes are at the end of the slots away from <b>Post 1.</b> (See Figure 2) Position the Guardrail panels and Slot Guards the same for a trailing end installation. <div style="text-align: center;">  <p>Figure 2</p> </div>
3.	Ensure that the 12' 6" (3.81m) Guardrail panel (PC-39G) or 25' 0" (7.62 m) Guardrail panel (PC-69G) slots are between <b>posts 6 and 5 and posts 4 and 3.</b>
4.	Ensure that the 12' 6" (3.81m) Guardrail panel (PC-30G) anchor bracket holes are between <b>posts 2 and 1.</b>

## INSTALLING RAIL PANELS

Complete the following steps to install the rail panels:

Step	Actions				
1.	Splice and post bolt the 12' 6" (3.81m) rail panel (PC-9G) or the 25' 0" (7.62 m) rail panel (PC-60G) at <b>post 9</b> to the run of Guardrail. Use hardware provided by the standard Guardrail supplier.  <b>Note:</b> Lap the terminal rail in the direction of traffic, unless the state/specifying agency's policy dictates otherwise.				
2.	Select Option A or Option B for this installation. <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;">Option A</th> <th>For Installing Two 12' 6" (3.81 m) Panels</th> </tr> </thead> <tbody> <tr> <td></td> <td> <ol style="list-style-type: none"> <li>1. Splice the 12' 6" (3.81m) rail panel to the other 12' 6" (3.81m) rail panel (PC-39G) at <b>post 6</b>, with eight (8) <math>\frac{5}{8}</math>" x <math>1\frac{1}{4}</math>" (16 mm x 32 mm) Splice Bolts and Hex Nuts.</li> <li>2. Insert a <math>\frac{5}{8}</math>" x 18" (16 mm x 460 mm) post bolt through the rail panel, Wood Blockout, and the wood post, at <b>posts 6, 5 and 4.</b></li> <li>3. Place a round washer under a Hex Nut on the inserted bolt to secure. Tighten the bolt to a snug position. (There is no torque requirement for these bolts.)</li> <li>4. Splice the 12' 6" (3.81 m) rail panel (PC-39G) to the other 12' 6" (3.81 m) rail panel (PC-30G) , at <b>post 3</b>, with eight (8) <math>\frac{5}{8}</math>" x <math>1\frac{1}{4}</math>" (16 mm x 32 mm) Splice Bolts and Hex Nuts.</li> <li>5. Insert a <math>\frac{5}{8}</math>" x 18" (16 mm x 460 mm) post bolt through the rail panels, Wood Blockout, and the wood post at <b>post 3.</b></li> <li>6. Place a round washer under a Hex Nut on the inserted bolt to secure. Tighten the bolt to a snug position. (There is no torque requirement for these bolts.)</li> <li>7. Insert a <math>\frac{5}{8}</math>" x 10" (16 mm x 255 mm) post bolt through the rail panel and the post, at <b>posts 2 and 1.</b></li> <li>8. Place a round washer under a Hex Nut on the inserted bolt to secure. Tighten the bolt to a snug position. (There is no torque requirement for these bolts.)</li> </ol> </td> </tr> </tbody> </table>	Option A	For Installing Two 12' 6" (3.81 m) Panels		<ol style="list-style-type: none"> <li>1. Splice the 12' 6" (3.81m) rail panel to the other 12' 6" (3.81m) rail panel (PC-39G) at <b>post 6</b>, with eight (8) <math>\frac{5}{8}</math>" x <math>1\frac{1}{4}</math>" (16 mm x 32 mm) Splice Bolts and Hex Nuts.</li> <li>2. Insert a <math>\frac{5}{8}</math>" x 18" (16 mm x 460 mm) post bolt through the rail panel, Wood Blockout, and the wood post, at <b>posts 6, 5 and 4.</b></li> <li>3. Place a round washer under a Hex Nut on the inserted bolt to secure. Tighten the bolt to a snug position. (There is no torque requirement for these bolts.)</li> <li>4. Splice the 12' 6" (3.81 m) rail panel (PC-39G) to the other 12' 6" (3.81 m) rail panel (PC-30G) , at <b>post 3</b>, with eight (8) <math>\frac{5}{8}</math>" x <math>1\frac{1}{4}</math>" (16 mm x 32 mm) Splice Bolts and Hex Nuts.</li> <li>5. Insert a <math>\frac{5}{8}</math>" x 18" (16 mm x 460 mm) post bolt through the rail panels, Wood Blockout, and the wood post at <b>post 3.</b></li> <li>6. Place a round washer under a Hex Nut on the inserted bolt to secure. Tighten the bolt to a snug position. (There is no torque requirement for these bolts.)</li> <li>7. Insert a <math>\frac{5}{8}</math>" x 10" (16 mm x 255 mm) post bolt through the rail panel and the post, at <b>posts 2 and 1.</b></li> <li>8. Place a round washer under a Hex Nut on the inserted bolt to secure. Tighten the bolt to a snug position. (There is no torque requirement for these bolts.)</li> </ol>
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<b>Option B</b>	<p><b>For Installing One 25' 0" (7.62 m) Panel</b></p> <ol style="list-style-type: none"> <li>1. Insert a <math>\frac{5}{8}</math>" x 18" (16 mm x 460 mm) post bolt through the 25' 0" (7.62 m) rail panel (PC-69G), Wood Blockout, and the wood post, at <b>posts 6, 5, and 4.</b></li> <li>2. Place a round washer under a Hex Nut on the inserted bolt to secure. Tighten the bolt to a snug position. (There is no torque requirement for these bolts.)</li> <li>3. Splice the 25' 0" (7.62 m) rail panel to the 12' 6" (3.81 m) rail panel (PC-30G), at <b>post 3</b>, with eight (8) <math>\frac{5}{8}</math>" x <math>1\frac{1}{4}</math>" (16 mm x 32 mm) Splice Bolts and Hex Nuts.</li> <li>4. Insert a <math>\frac{5}{8}</math>" x 18" (16 mm x 460 mm) post bolt through the rail panels, Wood Blockout, and the wood post at <b>post 3.</b></li> <li>5. Place a round washer under a Hex Nut on the inserted bolt to secure.</li> <li>6. Tighten the bolt to a snug position. (There is no torque requirement for these bolts.)</li> <li>7. Insert a <math>\frac{5}{8}</math>" x 10" (16 mm x 255 mm) post bolt through the rail panel and the wood posts, at <b>posts 2 and 1.</b></li> <li>8. Place a round washer under a Hex Nut on the inserted bolt to secure. Tighten the bolt to a snug position. (There is no torque requirement for these bolts.)</li> </ol>
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### TOE NAILING THE WOOD OFFSET BLOCKS

Complete the following step to toe nail the wood offset blocks to the posts:

Step	Actions
1.	Toe nail the wood offset blocks at all post locations with 16d hot-dipped galvanized nails to prevent the blocks from rotating. Install the nails approximately 3" (75 mm) from the top of the post or block, one on each side of the block.

### INSTALLING THE SLOT GUARDS

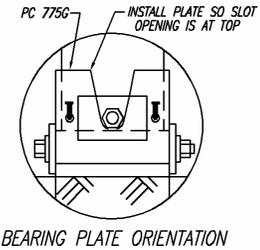
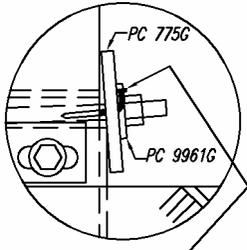
Complete the following steps to install the Slot Guards:

Step	Actions
1.	Place the Slot Guards (PC-9960G) against the backside of the Guardrail panels with the deflector angle gap opening toward (closest to) the elongated slots. Align the six holes in the Slot Guard with the six holes in the Guardrail panel near the elongated slots.
2.	Bolt each Slot Guard to the backside of the Guardrail panels with six (6) $\frac{5}{8}$ " x $1\frac{1}{4}$ " (16 mm x 32 mm) Splice Bolts and Hex Nuts.

### INSTALLING THE CABLE ANCHOR ASSEMBLY

Complete the following steps to install the cable anchor assembly:

Step	Actions
1.	Place a round washer on each of the eight (8) $\frac{5}{8}$ " x $1\frac{1}{2}$ " (16 mm x 38 mm) Hex Head Bolts needed.
2.	Insert the bolts through the traffic side of the rail panel and the Cable Anchor Bracket (PC-700A) on the backside of the Guardrail panel. Secure the Hex Head Bolts with a Hex Nut on each bolt. Tighten each bolt to a snug position. (There is no torque requirement for these bolts.)
3.	Slide one end of the cable (PC-3000G) into the Cable Anchor Bracket and the other end through the Pipe Sleeve (PC-705G) in <b>post 1.</b>
4.	Place a 1" (25 mm) washer and a 1" (25 mm) Hex Nut on the end of the cable that extends through the Cable Anchor Bracket. Tighten the nut, until at least 2 threads are completely through the nut.

Step	Actions
5.	<p>Place the Bearing Plate (PC-775G), so that the open side of the V-notch is at the top and connect it to <b>post 1</b>, by driving a nail through each of the 2 holes provided. Bend the nails to attach the Bearing Plate. (See Figures 3 and 4.)</p> <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;">  <p><b>Figure 3</b></p> </div> <div style="text-align: center;">  <p><b>Figure 4</b></p> </div> </div>
6.	Place the Plate Washer (PC-9961G) and a 1" (25 mm) Hex Nut on the end of the cable that extends through <b>post 1</b> .
7.	Restrain the cable with vise grip pliers at the end being tightened, to avoid twisting the cable.
8.	Tighten the Hex Nuts on the cable ends, until the cable is taut. The cable is considered taut, when it does not deflect more than 1 inch, when pressure is applied by hand in an up or down direction.

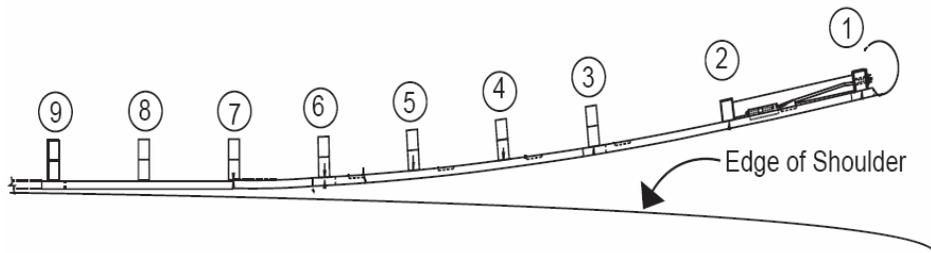
## INSTALLING THE END SECTION AND DELINEATION

Complete the following steps to install the end section and delineation:

Step	Actions
1.	Connect the end section (PC-907G) to the end of the Guardrail panel with four (4) $\frac{5}{8}$ " x $1\frac{1}{4}$ " (16 mm x 32 mm) Splice Bolts and Hex Nuts. Tighten the bolts to a snug position. (There is no torque requirement for these bolts.)
2.	<p>Install high intensity reflective sheeting (PC-6665B) on the front face of the end section, per the state/specifying agency's MUTCD for options or proper delineation.</p> <p><b>Note:</b> The reflective sheeting is an option to the SRT-350 8 POST™ and needs to be ordered separate from the SRT-350 8 POST™ package.</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <div style="display: flex; align-items: center;">  <p><b>WARNING:</b> Ensure that all Guardrail products and delineation used meet all federal, state/specifying agency, and local specifications. Failure to follow this warning could result in serious injury or death in the event of a collision.</p> </div> </div>

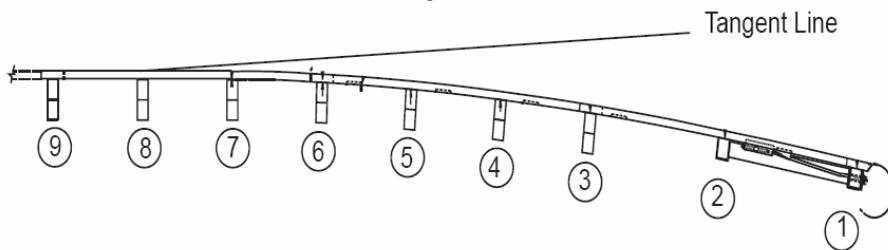
## LAYOUT OF SRT-350 8 POST™ SYSTEM ON A CURVE

### Outside of Curve Edge of Shoulder



The SRT-350 8 POST™ system offsets are measured at the edge of shoulder from the start of the SRT-350 8 POST™ system.

### Inside of Curve Tangent Line



The SRT-350 8 POST™ system offsets are measured at a tangent line from the start of the SRT-350 8 POST™ system. If an offset places a post on the shoulder, then the face of the rail must be on the edge of the shoulder for that offset.

**Note:** Refer to Post Layout Measurement table on page 8 of this Manual.

## INSTALLATION CHECKLIST

STATE: \_\_\_\_\_ PROJECT: \_\_\_\_\_

DATE: \_\_\_\_\_ LOCATION: \_\_\_\_\_

- The finished Guardrail height is approximately 27<sup>3</sup>/<sub>4</sub>" (706 mm) above the finished grade, or as the state/specifying agency plans indicate.
- Any site grading needed was completed, before the start of the installation of the SRT-350 8 POST™ system.
- The steel tubes do not protrude more than 4" (100 mm) above the finished grade measured by the American Association of State Highway and Transportation Officials ("AASHTO") 5' 0" (1.5 m) cord method. Site grading may be necessary to meet this requirement.
- The bolts at the top of the steel tubes are not over tightened. The walls of the steel tubes are not collapsed.
- The 6" x 8" (150 mm x 200 mm) Bearing Plate at **post 1** is correctly positioned and the anchor cable is taut and correctly installed (it should be rechecked after installation to be sure it has not relaxed). The taut cable does not deflect more than 1 inch, when pressure is applied by hand in an up or down direction. A nail is driven through each of the holes and bent to prevent the plate from rotating.
- The rail panel is not attached to **posts 7 and 8**.
- No rectangular washers are used on the face of the rail.
- Slot Guards are in place against the backside of the Guardrail panels with the deflector angle gap opening toward (closest to) the elongated slots.
- Rail panels are oriented correctly and lapped in the direction of traffic, unless the state/specifying agency's policy dictates otherwise.
- All blockouts have been toe nailed to the posts with 16d hot-dipped galvanized nails.
- If backfilled, the backfill material around the posts is properly compacted.
- The CRT post has two 3<sup>1</sup>/<sub>2</sub>" (90 mm) breakaway holes (checked prior to installation). The breakaway holes are located parallel to the roadway with the bottom edge of the top hole located approximately at the finished grade.
- The tube bolts are installed with the nuts on the pavement side of the tube for ease of future removal.
- Posts 1 and 2** have metal bands around them, under the post bolt hole.

# Installation and Maintenance Manual

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## X-Tension™ Guardrail End Terminal



Step by Step Instructions for the *Tangent*, *Flared* and *Median* Applications



### Barrier Systems Sales and Service

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[www.BarrierSystemsInc.com](http://www.BarrierSystemsInc.com)

# X-Tension Introduction

## Introduction

The X-Tension Guardrail End Terminal has been designed and tested to meet the evaluation criteria of NCHRP 350 Test Level 3.

The system has been tested to the guidelines in NCHRP 350 for a non-gating, re-directive guardrail end treatment. When correctly installed and maintained, the system is capable of stopping, containing, or re-directing an errant vehicle in a safe manner under NCHRP 350 impact conditions.

The X-Tension Guardrail End Terminal is the world's first fully re-directive, non-gating guardrail terminal end. The unique X-Tension technology is a tension based solution rather than compression based. It offers exceptional vehicle control and energy absorbing capabilities in head on impacts, where the energy is absorbed with resistance at the impact head rather than being transferred down the rail as occurs with other systems. Even head on, high angle (15° during testing) impacts on the nose resulted in the vehicle being redirected and controlled.

## System Overview

The X-Tension Guardrail End Terminal is designed and constructed to provide acceptable structural adequacy, minimal occupant risk and safe trajectory as set forth in NCHRP 350 for guardrail terminal ends.

When impacted head on with an 820 – 2000kg (1800 – 4400lb) vehicle at speeds of up to 100kph (62 mph), the impacting vehicle is brought to a controlled stop or allowed to penetrate to the back side, depending on the impact conditions.

## Before Installation

Placement and use of the X-Tension Guardrail End Terminal should be done in accordance with the guidelines and recommendations set forth in the "AASHTO Roadside Design Guide", FHWA memoranda and other state and local standards.

Depending on the application and circumstances at the site, installation and assembly of a Test Level 3 system should take a two person crew less than two hours.

The X-Tension Guardrail End Terminal is a highly engineered safety device made up of a relatively small number of parts. Before starting installation ensure that one is familiar with the make up of the system.

# X-Tension – Preparation for all Applications

## Preparation

Before installing an X -Tension, ensure that all materials required for an 11.4 m (38 ft) system are on site and have been identified. See bill of materials for the particular application and parts identification sheet.

Ensure that the area where the X-Tension is to be installed is flat enough so that the soil anchor will not protrude more than 100mm (4 in) from ground level, when measured with a straight line over a 1.5m (5 ft) cord. Minor site grading may be required.

## Soil Conditions

The X-Tension has been designed to be installed in median or edge of road locations and in soil that meets or exceeds the AASHTO “standard soil” specification. If rock is encountered during post installation, refer to appropriate State specifications. Guidelines will vary from State to State.

## Tools Required

The same tools required to install standard highway guardrail will also install an X-Tension.

**Specifically:** Sockets (commonly used in Guardrail), Drill, Wrenches, Large Crow Bar, String line, Level, Augers, Tampers and Post Pounders commonly used in driving posts.

## Before Starting

**For all applications,** begin the installation from the downstream end of the terminal at the point where it joins the standard guardrail (post 7).

For the tangent and flared applications, the X-Tension connects directly to standard steel post or timber post strong post W – beam highway guardrail, SGR04a-b.

The median application X-Tension connects directly to standard steel post or timber post strong post W-beam median barrier SGM04a-b

Follow step by step instructions for the appropriate application.

## Important Note about posts and blockouts:

### Tangent & Flared Systems:

Post 1 steel – Post 2 either CRT timber or crimped steel

Post 3-6 either CRT timber or standard steel I beam posts

### Median system:

Posts 1 & 2 are always crimped steel.

Posts 3 – 6 are standard steel I beam posts

Blockouts may be either composite or timber.

# INSTALLATION CHECKLIST FOR X-Tension Systems

<b>Location</b>			
<b>Installed By</b>		<b>Date</b>	
<b>Inspected By</b>		<b>Date</b>	
<b>X-Tension Tangent and Flared Systems [System Length 11.4m (38ft)]</b>			
		<b>Y/N</b>	<b>NA</b>
<ul style="list-style-type: none"> <li>• Rail is bolted at all posts <u>except</u> post 3.</li> <li>• Post 1, post bolt notches face impact head. Bolted to ground strut.</li> <li>• Post 3 to 6 standard steel posts (or timber CRT posts).</li> <li>• Friction plate is turned fully and bolted in place.</li> <li>• Nuts are fitted on traffic face of rail at impact head.</li> <li>• Nosing is fitted to impact head.</li> </ul>			
<ul style="list-style-type: none"> <li>• Ground Strut lays flush with ground. Front of ground strut should be level or lower at the anchor end than at the post end.</li> <li>• Ground anchor does not protrude more than 100mm (4 in) [preferred 75mm (3 in)] above the ground.</li> <li>• The entire Terminal End (11.4m; 38 ft) is installed straight with flare as per design (offset between 0 to 1.2m) (0 to 4 ft).</li> </ul>			
<ul style="list-style-type: none"> <li>• Slider Panel is connected to end of first rail. All 4 holes bolted with <b>nuts on traffic face</b>.</li> <li>• Slider Bracket affixed to back of rail 2, with 4 bolts and <b>nuts on backside of rail</b>.</li> <li>• <b>Angle bar is fitted closest to impact head end</b>. Bolts MUST be wrenched tight.</li> </ul>			
<ul style="list-style-type: none"> <li>• Guardrail for terminal end (i.e. 3 lengths) is 2.7mm (12 gauge) highway rail.</li> </ul>			
<ul style="list-style-type: none"> <li>• <b>Yellow Shear Bolts correctly installed at post 5</b> (washer only between nut &amp; rail).</li> </ul>			
<ul style="list-style-type: none"> <li>• <b>Cables</b> should be “taut”, not visibly sagging between posts.</li> </ul>			
<p><b>X-Tension Median Application only - as above plus:</b></p> <ul style="list-style-type: none"> <li>• Yellow Shear Bolts are correctly installed at post 5.</li> <li>• Slider Panel is bolted to end of first rail. All 4 holes bolted with <b>nuts on traffic face</b>.</li> <li>• Slider Bracket affixed to back of rail 2, with 4 bolts and <b>nuts on backside of rail</b>.</li> <li>• <b>Angle bar is fitted closest to impact head end</b>. Bolts MUST be wrenched tight.</li> <li>• Post bolt at post 2 is in notched post flange and fixed with 50mm x 50mm (2 in x 2 in) washer and nut.</li> <li>• Secondary Impact Head is connected to main impact head.</li> <li>• Additional Guardrails are 2.7mm (12 gauge) highway rail.</li> </ul>			

# X-Tension Maintenance (Traffic Face Impacts)

*Types of repair are divided into two categories:  
Traffic Face Impacts and Head on Impacts (Next Page)*

## Traffic Face Impacts

### Key Repair Steps:

1. Remove cables
2. Remove damaged rail
3. Remove components from rails
4. Remove damaged posts
5. Assess damage
6. Reassemble

### Step 1: Remove Cables

Undo nuts at downstream cable bracket (post 7). Take out the bolts on the side of the impact head that hold the friction plate in place and rotate the locking bar backwards. Pull one cable at a time from the front side of the impact head and completely remove them. Rotating the cables as you pull them will help. Undo nuts at ground anchor end and remove cables.

### Step 2: Remove Rails

Unbolt the splice bolts first. Then unbolt the post bolts and lower rails to ground.

### Step 3: Remove X-Tension Components

All the X-Tension components are attached to the rails with standard splice bolts. Unbolt and remove the components.

### Step 4: Remove Posts

Undo the bolt at the bottom of Post 1 and pull out post. For all other damaged line posts, attach a chain to the top half of the post and pull out of the ground with either a crane truck or digger. Note it is sometimes possible to remove steel posts by hand.

### Step 5: Assess the Damage

Any part that cannot be reused must be replaced with a new part. Always replace the yellow shear bolts. Cables can be reused.

Generally, all the specialized components of the system such as the head and brackets should be undamaged.

### Step 6: Reassemble

Reassemble as per system installation instructions.

# X-Tension Maintenance (Head on Impacts)

## Head on Impacts

### Key Repair Steps:

1. Remove the cables
2. Pull the rails back
3. Remove components from rails
4. Remove damaged posts
5. Assess damage
6. Reassemble

### Step 1: Remove Cables

After a head on impact the cables may appear to be slack but may in fact still retain some tension from the impact. Care must be taken when removing the cables. **DO NOT UNDO THE CABLES FROM THE GROUND ANCHOR END FIRST, ALWAYS UNDO THE CABLES FROM THE CABLE BRACKET (post 7) FIRST.**

Undo nuts at downstream cable bracket (post 7). Take out the bolts on the side of the impact head that hold the friction plate in place and turn the friction plate back. Pull one cable at a time from the front side of the impact head and completely remove them. Rotating the cables as you pull them will help. Undo nuts at ground anchor end last and remove cables.

### Step 2: Pull Rails Back Out

Attach a chain or two ton strap to the front of the impact head and pull upstream to its' original position with a light truck or utility vehicle. The components are easier to unbolt when the rails are separated.

### Step 3: Remove X-Tension Components

All components are attached to the rails with standard splice bolts. Unbolt and remove parts.

### Step 4: Remove Posts

Undo the bolt at the bottom of Post 1 and pull out post. For all other damaged line posts, attach a chain to the top half of the post and pull out of the ground with either a crane truck or digger. Note it is sometimes possible to remove steel posts by hand.

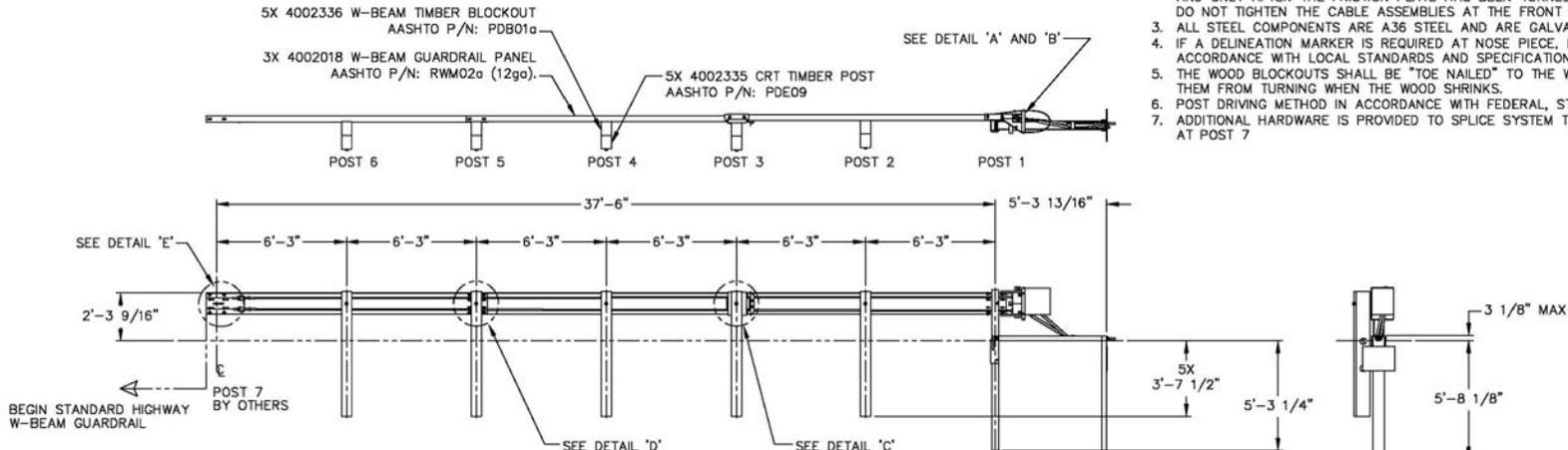
### Step 5: Assess The Damage

Any part that cannot be reused must be replaced with a new part. In minor impacts (rails telescoped less than 3 meters (10 feet ) the cables can be reused by turning them end for end. If additional damage has occurred, replace the cables. Generally, all the specialized components of the system such as the head and brackets should be undamaged.

### Step 6: Reassemble

Reassemble as per system installation instructions.

**X-TENSION GUARDRAIL TERMINAL SYSTEM, STANDARD, WOOD BLOCKOUT TO WOOD POST, XGTSS1**



- NOTES: UNLESS OTHERWISE SPECIFIED
1. X-TENSION SYSTEM TO BE INSTALLED PER MANUFACTURER INSTRUCTIONS.
  2. ONLY TIGHTEN THE CABLE ASSEMBLIES USING THE HEX NUTS AT CABLE BRACKETS AND ONLY AFTER THE FRICTION PLATE HAS BEEN TURNED AT THE HEAD WELDMENT. DO NOT TIGHTEN THE CABLE ASSEMBLIES AT THE FRONT OF THE GROUND ANCHOR.
  3. ALL STEEL COMPONENTS ARE A36 STEEL AND ARE GALVANIZED PER ASTM A123.
  4. IF A DELINEATION MARKER IS REQUIRED AT NOSE PIECE, MARKER SHALL BE IN ACCORDANCE WITH LOCAL STANDARDS AND SPECIFICATIONS.
  5. THE WOOD BLOCKOUTS SHALL BE "TOE NAILED" TO THE WOOD POST TO PREVENT THEM FROM TURNING WHEN THE WOOD SHRINKS.
  6. POST DRIVING METHOD IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL STANDARDS.
  7. ADDITIONAL HARDWARE IS PROVIDED TO SPLICE SYSTEM TO EXISTING GUARDRAIL AT POST 7

- 5X 4002336 W-BEAM TIMBER BLOCKOUT AASHTO P/N: PDB01a
- 3X 4002018 W-BEAM GUARDRAIL PANEL AASHTO P/N: RWM02a (12ga).
- 5X 4002335 CRT TIMBER POST AASHTO P/N: PDE09

- 4X 2001642, GUARDRAIL BOLT, 5/8-11 X 1 1/4" LONG
- 4X 4001116, GUARDRAIL NUT, 5/8-11
- B061083 CABLE BRACKET
- 4X A070426, SPECIAL SHEAR BOLT, 5/8-11
- 4X 4001116, GUARDRAIL NUT, 5/8-11
- 4X 4002056, ROUND WASHER, 5/8
- 5X 2001656, POST BOLT, 5/8-11 X 18" LONG
- 5X 4001116, GUARDRAIL NUT, 5/8-11
- 5X 4002056, ROUND WASHER, 5/8
- B061079 SLIDER BRACKET
- 4X 2001642, GUARDRAIL BOLT, 5/8-11 X 1 1/4" LONG
- 4X 4001116, GUARDRAIL NUT, 5/8-11
- 4X 2001642, GUARDRAIL BOLT, 5/8-11 X 1 1/4" LONG
- 4X 4001116, GUARDRAIL NUT, 5/8-11 (HEXNUTS ON TRAFFIC SIDE).
- B061088 SLIDER PANEL

- 8X 2001642, GUARDRAIL BOLT, 5/8-11 X 1 1/4" LONG
- 8X 4001116, GUARDRAIL NUT, 5/8-11 (HEX NUTS ON TRAFFIC SIDE)
- B061058 CABLE FRICTION PLATE
- B061072 HEAD UNIT WELDMENT
- 4X 4002305, NYLON RIVET
- B071001 NOSE PIECE
- 4X HEX BOLT, M20-2.5 X 75mm LONG METRIC BOLT SPECIFIED ARE REQUIRED FOR HEAD UNIT WELDMENT.
- 2X B061109 CABLE ASSEMBLIES WITH 1" HEX NUTS AND WASHERS BOTH ENDS.
- B061094 GROUND STRUT
- B061099 TOP POST
- 1X 2001717, HEX BOLT, 5/8-11 X 8" LONG
- 2X 4002056, ROUND WASHER, 5/8
- 1X 4001116, GUARDRAIL NUT, 5/8-11
- B061098 BOTTOM POST

- 1X 2000302, POST BOLT, 5/8-11 X 2" LONG
- 1X B070805, WASHER, 2" X 2" WITH 3/4" HOLE
- 1X 4001116, GUARDRAIL NUT, 5/8-11

Part#	Qty	Part Description
B061072	1	HEAD UNIT WELDMENT
B061058	1	CABLE FRICTION PLATE, HEAD UNIT
B061079	1	SLIDER BRACKET WELDMENT
B061088	1	SLIDER PANEL WELDMENT, W-BEAM
B061083	1	CABLE BRACKET WELDMENT
B061109	2	CABLE ASSEMBLY
B061094	1	GROUND STRUT WELDMENT
B061104	1	SOIL ANCHOR WELDMENT
B061088	1	BOTTOM POST WELDMENT
B061089	1	L-BEAM POST, TOP
B071001	1	NOSE PIECE
4002018	3	W-Beam Guardrail RWM02a
4002336	5	W-Beam Timber Blockout PDB01a
4002335	5	CRT Timber Post PDE09
4002305	4	Nylon Rivet
2001642	24	Guardrail Bolt 5/8-11 x 1 1/4"
2000302	1	Post Bolt, 5/8-11 x 2"
2001656	5	Post Bolt, 5/8-11 x 18"
4001116	31	Guardrail Nut, 5/8-11
2001717	1	Hex Bolt, 5/8-11 x 8"
2001615	4	Hex Bolt, M20-2.5x75mm
4002056	7	Round Washer, 5/8
A070426	8	Special Shear Bolt w/ nut & washer
B070805	1	Washer, 2" x 2" w/ 3/4" hole

SCALE: NOT TO SCALE  
 Standard Tolerance  
 Angular ± 1/2'  
 Fractional ± 1/16"  
 Dec .XXX = ± .010  
 Dec .XX = ± .030

**BARRIER SYSTEMS**  
 180 RIVER RD, RIO VISTA, CA 94571  
 TEL: 707-374-6800 FAX: 707-374-6801

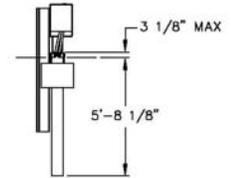
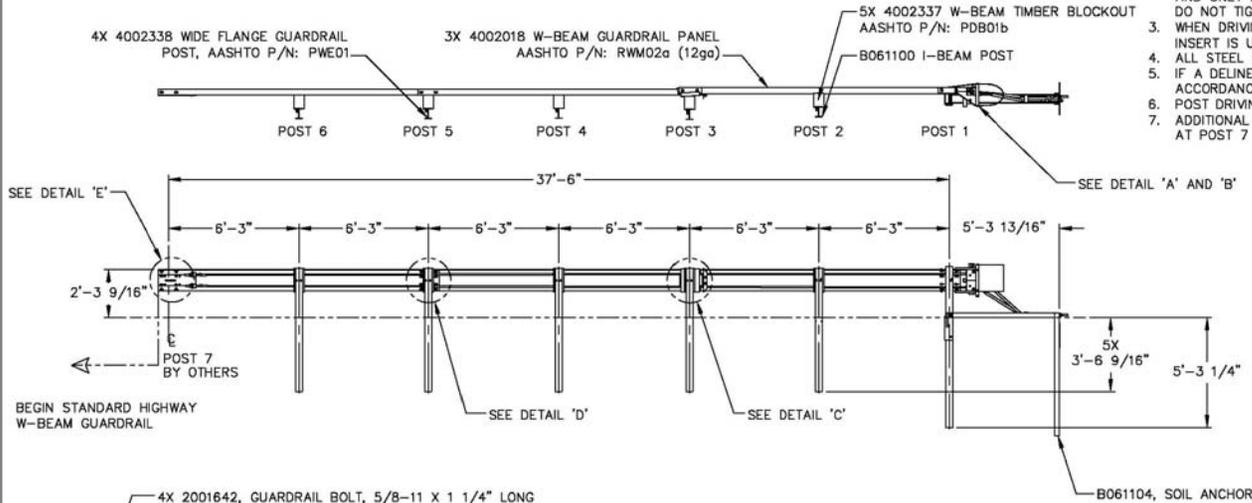
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0	NEW DRAWING	4/21/08	AEM			

DRAWN BY 4/21/08 AEM		DATE INIT.		TITLE : X-TENSION GUARDRAIL TERMINAL SYSTEM DRAWINGS, METRIC & US	
APPR'D BY				SHEET 1 OF 10	
				DRAWING NUMBER B080439	
				REV. 0	

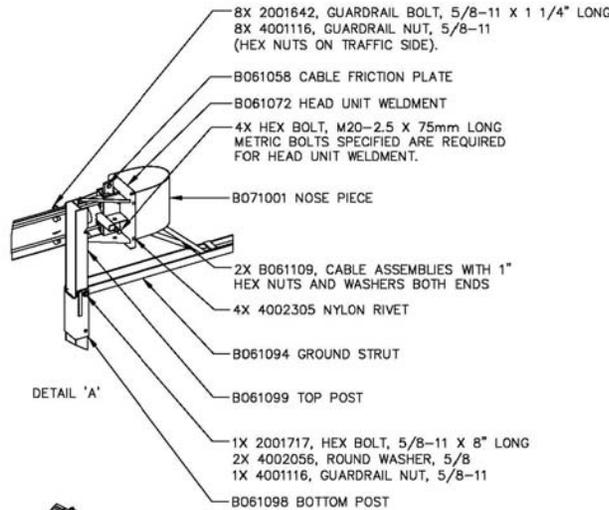
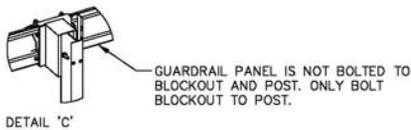
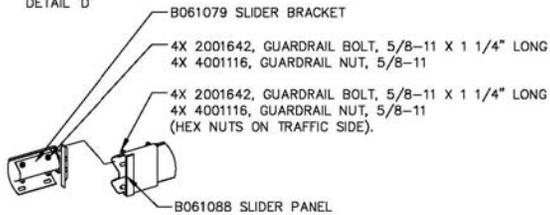
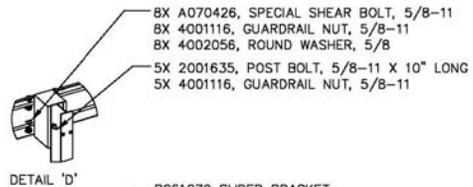
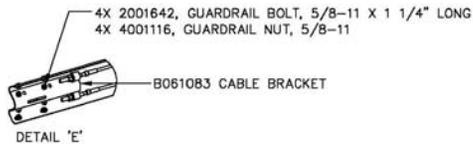
**X-TENSION GUARDRAIL TERMINAL SYSTEM, STANDARD, WOOD BLOCKOUT TO STEEL POST, XTGTSS2**

NOTES: UNLESS OTHERWISE SPECIFIED

1. X-TENSION SYSTEM TO BE INSTALLED PER MANUFACTURER INSTRUCTIONS.
2. ONLY TIGHTEN THE CABLE ASSEMBLIES USING THE HEX NUTS AT CABLE BRACKETS AND ONLY AFTER THE FRICTION PLATE HAS BEEN TURNED AT THE HEAD WELDMENT. DO NOT TIGHTEN THE CABLE ASSEMBLIES AT THE FRONT OF THE GROUND ANCHOR.
3. WHEN DRIVING STEEL POST, ENSURE THAT A DRIVING CAP WITH TIMBER OR PLASTIC INSERT IS USED TO PREVENT DAMAGE TO THE GALVANIZING AT THE TOP OF THE POST.
4. ALL STEEL COMPONENTS ARE A36 STEEL AND ARE GALVANIZED PER ASTM A123.
5. IF A DELINEATION MARKER IS REQUIRED AT NOSE PIECE, MARKER SHALL BE IN ACCORDANCE WITH LOCAL STANDARDS AND SPECIFICATIONS.
6. POST DRIVING METHOD IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL STANDARDS.
7. ADDITIONAL HARDWARE IS PROVIDED TO SPLICE SYSTEM TO EXISTING GUARDRAIL AT POST 7



BEGIN STANDARD HIGHWAY W-BEAM GUARDRAIL

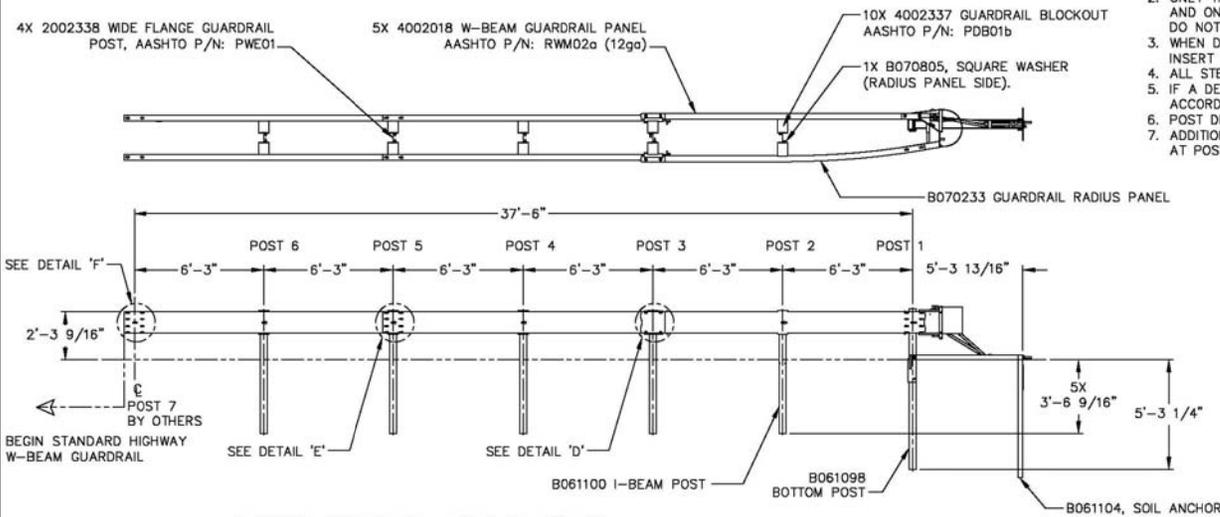


Part#	Qty	Part Description
B061072	1	HEAD UNIT WELDMENT
B061058	1	CABLE FRICTION PLATE, HEAD UNIT
B061079	1	SLIDER BRACKET WELDMENT
B061088	1	SLIDER PANEL WELDMENT, W-BEAM
B061083	1	CABLE BRACKET WELDMENT
B061109	2	CABLE ASSEMBLY
B061094	1	GROUND STRUT WELDMENT
B061104	1	SOIL ANCHOR WELDMENT
B061098	1	BOTTOM POST WELDMENT
B061099	1	I-BEAM POST, TOP
B071001	1	NOSE PIECE
B061100	1	I-BEAM POST, POST 2
4002018	3	W-Beam Guardrail RWM02a
4002337	5	W-Beam Timber Blockout PDB01b
4002338	4	Wide Flange Guardrail Post PWE01
4002305	4	Nylon Rivet
2001642	24	Guardrail Bolt, 5/8-11 x 1 1/4"
2000302	1	Post Bolt, 5/8-11 x 2"
2001635	5	Post Bolt, 5/8-11x10"
4001116	31	Guardrail Nut, 5/8-11
2001717	1	Hex Bolt, 5/8-11 x 8"
2001615	4	Hex Bolt, M20-2.5x75mm
4002056	2	Round Washer, 5/8
A070426	8	Special Shear Bolt w/ nut & washer
B070805	1	Washer, 2" x 2" w/ 3/4" hole

SHEET	DRAWING NUMBER	REV.
2 OF 10	B080439	0

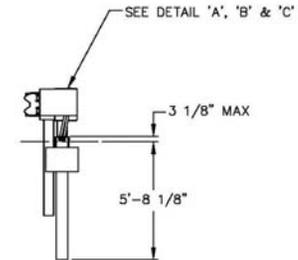
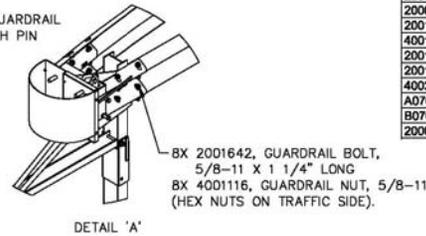
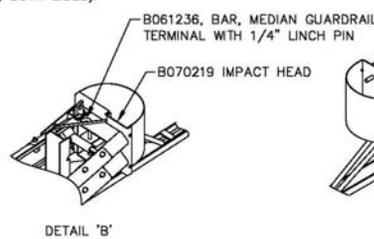
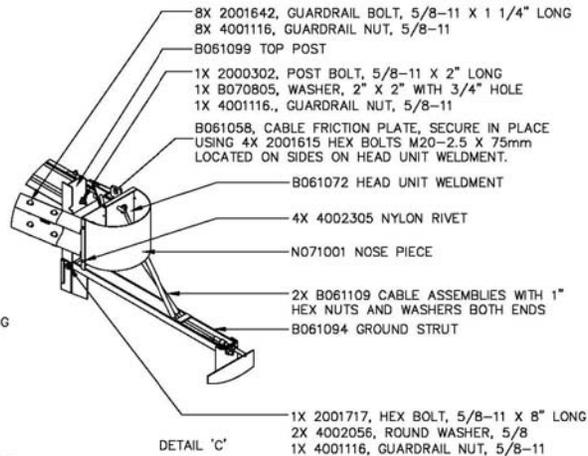
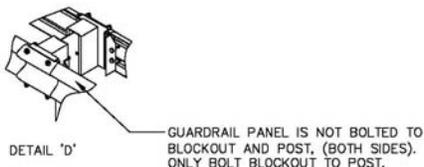
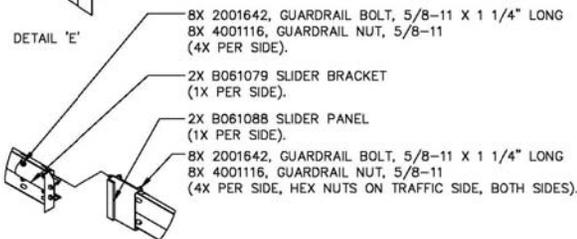
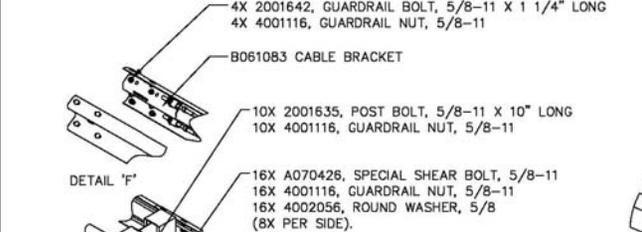


X-TENSION MEDIAN TERMINAL SYSTEM, STANDARD, WOOD BLOCKOUT TO STEEL POST, XTMTSS2



NOTES: UNLESS OTHERWISE SPECIFIED

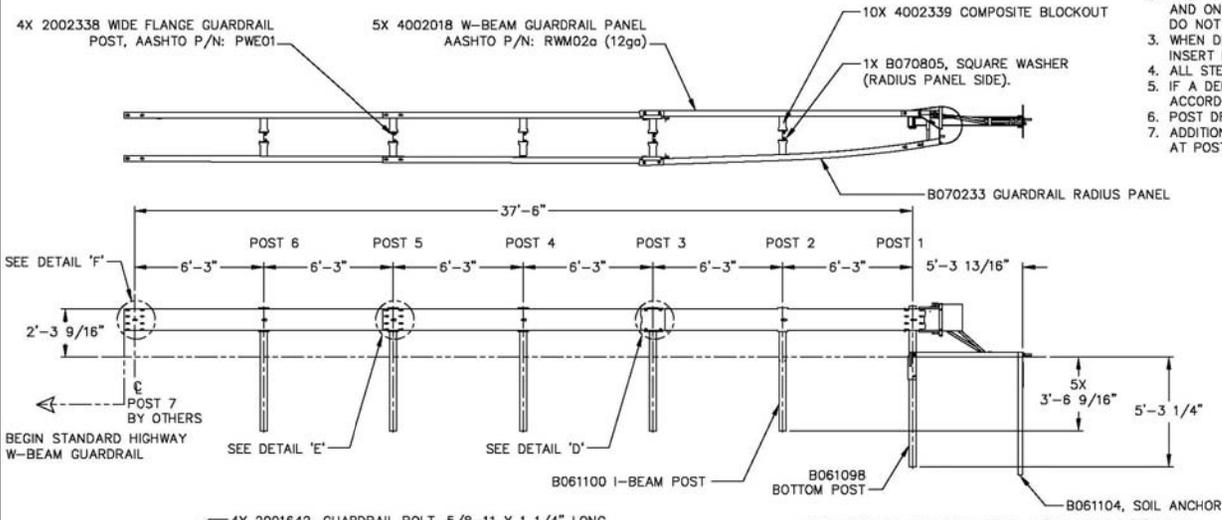
1. X-TENSION SYSTEM TO BE INSTALLED PER MANUFACTURER INSTRUCTIONS.
2. ONLY TIGHTEN THE CABLE ASSEMBLIES USING THE HEX NUTS AT CABLE BRACKETS AND ONLY AFTER THE FRICTION PLATE HAS BEEN TURNED AT THE HEAD WELDMENT. DO NOT TIGHTEN THE CABLE ASSEMBLIES AT THE FRONT OF THE GROUND ANCHOR.
3. WHEN DRIVING STEEL POST, ENSURE THAT A DRIVING CAP WITH TIMBER OR PLASTIC INSERT IS USED TO PREVENT DAMAGE TO THE GALVANIZING AT THE TOP OF THE POST.
4. ALL STEEL COMPONENTS ARE A36 STEEL AND ARE GALVANIZED PER ASTM A123.
5. IF A DELINEATION MARKER IS REQUIRED AT NOSE PIECE, MARKER SHALL BE IN ACCORDANCE WITH LOCAL STANDARDS AND SPECIFICATIONS.
6. POST DRIVING METHOD IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL STANDARDS.
7. ADDITIONAL HARDWARE IS PROVIDED TO SPLICE SYSTEM TO EXISTING GUARDRAIL AT POST 7



Part#	Qty	Part Description
B061072	1	HEAD UNIT WELDMENT
B061058	1	CABLE FRICTION PLATE, HEAD UNIT
B061079	2	SLIDER BRACKET WELDMENT
B061088	2	SLIDER PANEL WELDMENT, W-BEAM
B061083	1	CABLE BRACKET WELDMENT
B061109	2	CABLE ASSEMBLY
B061094	1	GROUND STRUT WELDMENT
B061104	1	SOIL ANCHOR WELDMENT
B061098	1	BOTTOM POST WELDMENT
B061099	1	I-BEAM POST, TOP
B061100	1	I-BEAM POST, POST 2
B071001	1	NOSE PIECE
B070219	1	IMPACT HEAD WELDMENT, MEDIAN TERMINAL, X-TENSION
B061236	1	BAR, MEDIAN GUARDRAIL TERMINAL
B070233	1	PANEL, RADIUS GUARDRAIL, W-BEAM, X-TENSION TERMINAL
4002018	5	W-Beam Guardrail RWM02a
4002337	10	W-Beam Timber Blockout PDB01b
4002338	4	Wide Flange Guardrail Post PWED1
4002305	4	Nylon Rivet
2001642	48	Guardrail Bolt 5/8-11 x 1 1/4"
2000302	1	Post Bolt 5/8-11 x 2"
2001635	10	Post Bolt 5/8-11 x 10"
4001116	60	Guardrail Nut, 5/8-11
2001717	1	Hex Bolt, 5/8-11x 8"
2001615	4	Hex Bolt, M20-2.5x75mm
4002056	2	Round Washer, 5/8
A070426	16	Special Shear Bolt w/ nut & washer
B070805	2	Washer, 2" x 2" w/ 3/4" hole
2000090	1	1/4" Linch Pin

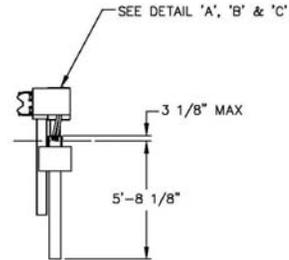
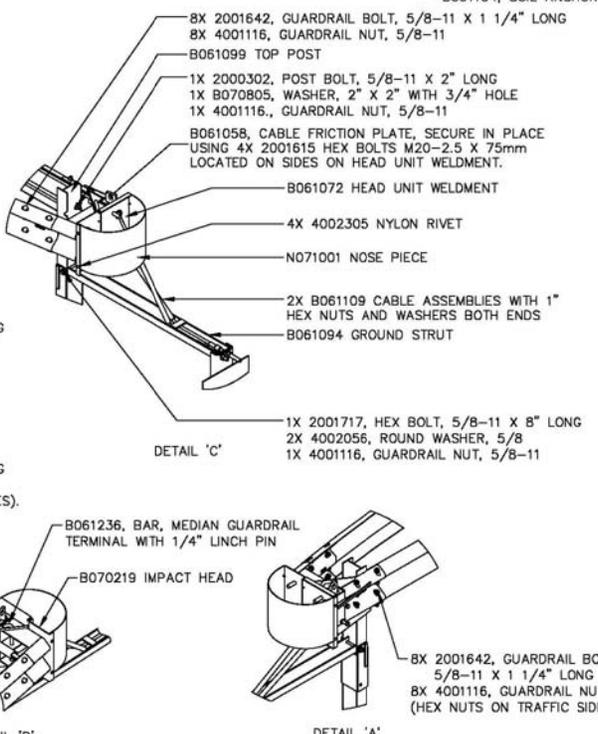
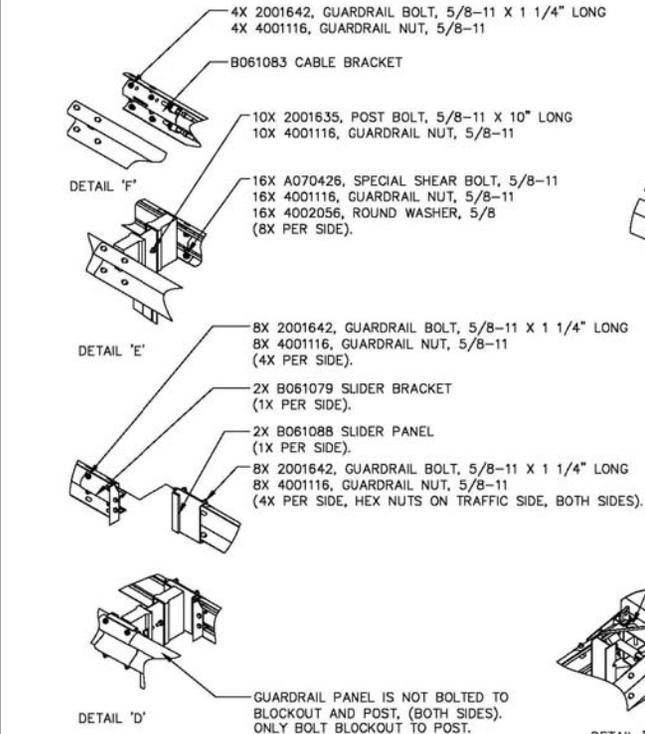
SHEET	DRAWING NUMBER	REV.
4 OF 10	B080439	0

**X-TENSION MEDIAN TERMINAL SYSTEM, STANDARD, COMPOSITE BLOCKOUT TO STEEL POST, XTMTSS3**



**NOTES: UNLESS OTHERWISE SPECIFIED**

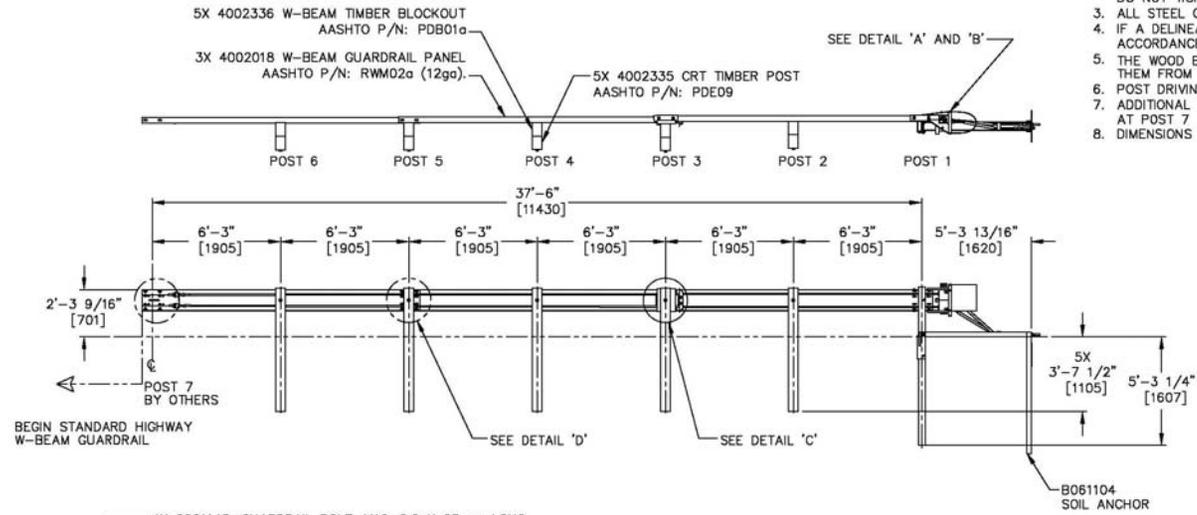
1. X-TENSION SYSTEM TO BE INSTALLED PER MANUFACTURER INSTRUCTIONS.
2. ONLY TIGHTEN THE CABLE ASSEMBLIES USING THE HEX NUTS AT CABLE BRACKETS AND ONLY AFTER THE FRICTION PLATE HAS BEEN TURNED AT THE HEAD WELDMENT. DO NOT TIGHTEN THE CABLE ASSEMBLIES AT THE FRONT OF THE GROUND ANCHOR.
3. WHEN DRIVING STEEL POST, ENSURE THAT A DRIVING CAP WITH TIMBER OR PLASTIC INSERT IS USED TO PREVENT DAMAGE TO THE GALVANIZING AT THE TOP OF THE POST.
4. ALL STEEL COMPONENTS ARE A36 STEEL AND ARE GALVANIZED PER ASTM A123.
5. IF A DELINEATION MARKER IS REQUIRED AT NOSE PIECE, MARKER SHALL BE IN ACCORDANCE WITH LOCAL STANDARDS AND SPECIFICATIONS.
6. POST DRIVING METHOD IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL STANDARDS.
7. ADDITIONAL HARDWARE IS PROVIDED TO SPLICE SYSTEM TO EXISTING GUARDRAIL AT POST 7



Part#	Qty	Part Description
B061072	1	HEAD UNIT WELDMENT
B061058	1	CABLE FRICTION PLATE, HEAD UNIT
B061078	1	CABLE BRACKET WELDMENT
B061088	2	SLIDER PANEL, WELDMENT, W-BEAM
B061083	1	CABLE BRACKET WELDMENT
B061109	2	CABLE ASSEMBLY
B061094	1	GROUND STRUT WELDMENT
B061104	1	SOIL ANCHOR WELDMENT
B061098	1	BOTTOM POST WELDMENT
B061099	1	I-BEAM POST, TOP
B061100	1	I-BEAM POST, POST 2
B071001	1	NOSE PIECE
B070219	1	IMPACT HEAD WELDMENT, MEDIAN TERMINAL, X-TENSION
B061236	1	BAR, MEDIAN GUARDRAIL TERMINAL
B070233	1	PANEL, RADIUS GUARDRAIL, W-BEAM, X-TENSION TERMINAL
4002018	5	W-Beam Guardrail RWM02a
4002339	10	W-Beam Composite Blockout
4002338	4	Wide Flange Guardrail Post PWEO1
4002305	4	Nylon Rivet
2001642	48	Guardrail Bolt 5/8-11 x 1 1/4"
2000302	1	Post Bolt 5/8-11 x 2"
2001635	10	Post Bolt 5/8-11 x 10"
4001116	60	Guardrail Nut, 5/8-11
2001717	1	Hex Bolt, 5/8-11x 8"
2001615	4	Hex Bolt, M20-2.5x75mm
4002056	2	Round Washer, 5/8
A070426	16	Special Shear Bolt w/ nut & washer
B070805	2	Washer, 2" x 2" w/ 3/4" hole
2000090	1	1/4" Linch Pin

SHEET	DRAWING NUMBER	REV.
5 OF 10	B080439	0

X-TENSION GUARDRAIL TERMINAL SYSTEM, METRIC, WOOD BLOCKOUT TO WOOD POST, XTGTSM1



- NOTES: UNLESS OTHERWISE SPECIFIED
1. X-TENSION SYSTEM TO BE INSTALLED PER MANUFACTURER INSTRUCTIONS.
  2. ONLY TIGHTEN THE CABLE ASSEMBLIES USING THE HEX NUTS AT CABLE BRACKETS AND ONLY AFTER THE FRICTION PLATE HAS BEEN TURNED AT THE HEAD WELDMENT. DO NOT TIGHTEN THE CABLE ASSEMBLIES AT THE FRONT OF THE GROUND ANCHOR.
  3. ALL STEEL COMPONENTS ARE A36 STEEL AND ARE GALVANIZED PER ASTM A123.
  4. IF A DELINEATION MARKER IS REQUIRED AT NOSE PIECE, MARKER SHALL BE IN ACCORDANCE WITH LOCAL STANDARDS AND SPECIFICATIONS.
  5. THE WOOD BLOCKOUTS SHALL BE "TOE NAILED" TO THE WOOD POST TO PREVENT THEM FROM TURNING WHEN THE WOOD SHRINKS.
  6. POST DRIVING METHOD IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL STANDARDS.
  7. ADDITIONAL HARDWARE IS PROVIDED TO SPLICE SYSTEM TO EXISTING GUARDRAIL AT POST 7
  8. DIMENSIONS IN BRACKETS ARE mm.

- 4X 2001143, GUARDRAIL BOLT, M16-2.0 X 25mm LONG
- 4X 2000109, GUARDRAIL NUT, M16-2.0

B061083 CABLE BRACKET



DETAIL 'E'

- 8X A070425, SPECIAL SHEAR BOLT, M16-2.0
- 8X 2000109, GUARDRAIL NUT, M16-2.0
- 8X 2001145, ROUND WASHER, M16

- 5X 2001657, POST BOLT, M16-2.0 X 460mm LONG
- 5X 2000109, GUARDRAIL NUT, M16-2.0
- 5X 20001145, ROUND WASHER, M16

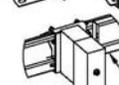


DETAIL 'D'

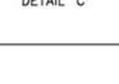
- B061079 SLIDER BRACKET
- 4X 2001143, GUARDRAIL BOLT, M16-2.0 X 25mm LONG
- 4X 2000109, GUARDRAIL NUT, M16-2.0



- 4X 2001143, GUARDRAIL BOLT, M16-2.0 X 25mm LONG
- 4X 2000109, GUARDRAIL NUT, M16-2.0 (HEX NUTS ON TRAFFIC SIDE).



- B061088 SLIDER PANEL



DETAIL 'C'

GUARDRAIL PANEL IS NOT BOLTED TO BLOCKOUT AND POST. ONLY BOLT BLOCKOUT TO POST.

- 8X 2001143, GUARDRAIL BOLT, M16-2.0 X 25mm LONG
- 8X 2000109, GUARDRAIL NUT, M16-2.0 (HEX NUTS ON TRAFFIC SIDE).

B061058 CABLE FRICTION PLATE

B061072 HEAD UNIT WELDMENT

4X 4002305 NYLON RIVET

B071001 NOSE PIECE

2X B061109 CABLE ASSEMBLIES WITH 1" HEX NUTS AND WASHERS BOTH ENDS.



DETAIL 'A'

4X HEX BOLT, M20-2.5 X 75mm LONG METRIC BOLTS SPECIFIED ARE REQUIRED FOR HEAD UNIT.

B061094 GROUND STRUT

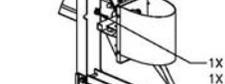
B061099 TOP POST

1X D001718, HEX BOLT, M16-2.0 X 200mm LONG

2X 2001145, ROUND WASHER, M16

1X 2000109, GUARDRAIL NUT, M16-2.0

B061098 BOTTOM POST

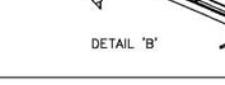


DETAIL 'A'

1X 2000431, POST BOLT, M16-2.0 X 50mm LONG

1X B070805, WASHER, 2" X 2" WITH 3/4" HOLE

1X 2000109, GUARDRAIL NUT, M16-2.0

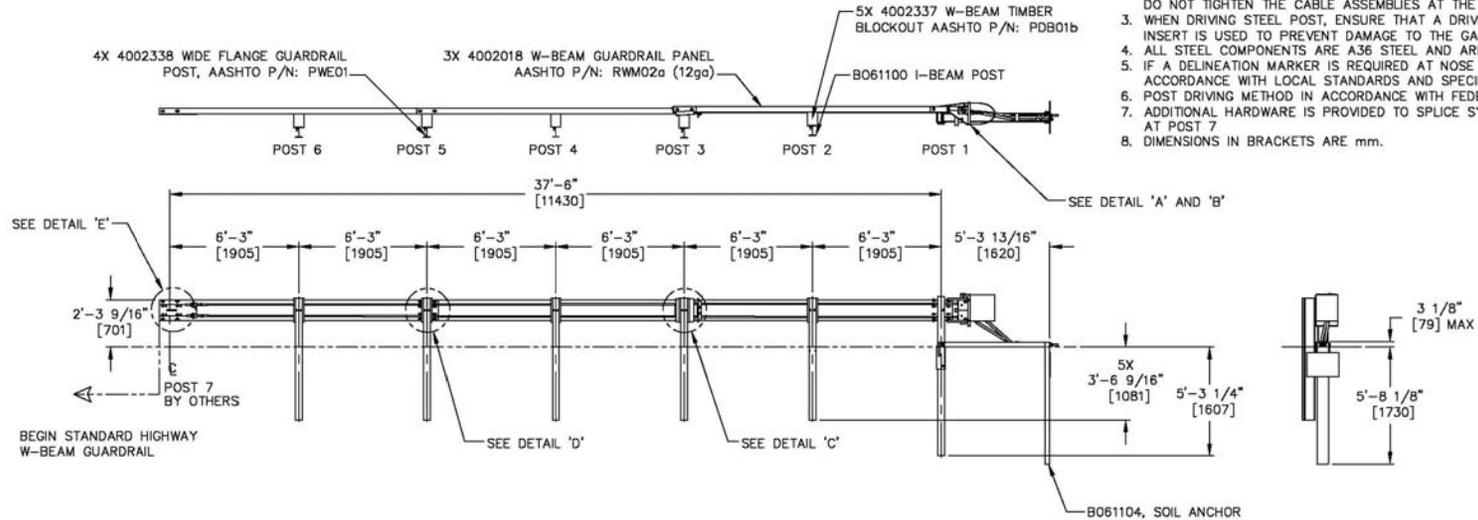


DETAIL 'B'

Part#	Qty	Part Description
B061072	1	HEAD UNIT WELDMENT
B061058	1	CABLE FRICTION PLATE, HEAD UNIT
B061079	1	SLIDER BRACKET WELDMENT
B061088	1	SLIDER PANEL WELDMENT, W-BEAM
B061083	1	CABLE BRACKET WELDMENT
B061109	2	CABLE ASSEMBLY
B061094	1	GROUND STRUT WELDMENT
B061104	1	SOIL ANCHOR WELDMENT
B061088	1	BOTTOM POST WELDMENT
B061099	1	I-BEAM POST, TOP
B071001	1	NOSE PIECE
4002018	3	W-Beam Guardrail RWM02a
4002336	5	W-Beam Timber Blockout PDB01a
4002335	5	CRT Timber Post PDE09
4002305	4	Nylon Rivet
2001143	24	Guardrail Bolt M16-2.0 x 25mm
2000431	1	Post Bolt, M16-2.0 x 50mm
2001657	5	Post Bolt, M16-2.0 x 460mm
2000109	31	Guardrail Nut, M16-2.0
2001718	1	Hex Bolt, M16-2.0 x 200mm
2001815	4	Hex Bolt, M20-2.5x75mm
2001145	7	Round Washer, M16
A070425	8	Special Shear Bolt w/ nut & washer
B070805	1	Washer, 2" x 2" w/ 3/4" hole

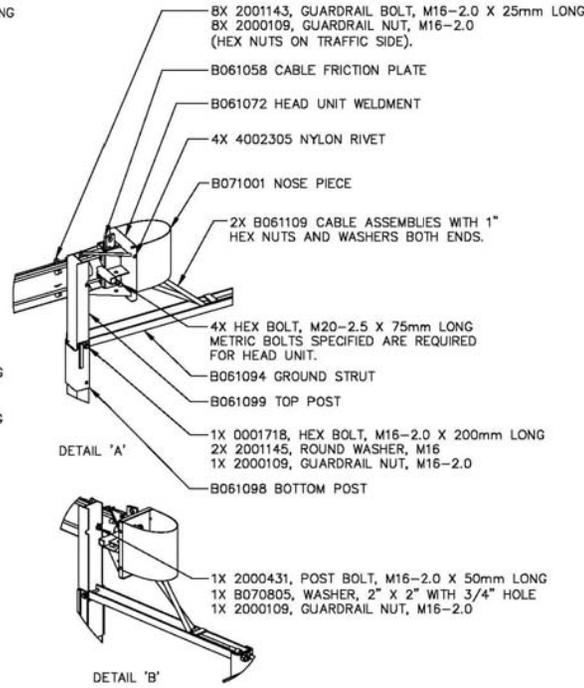
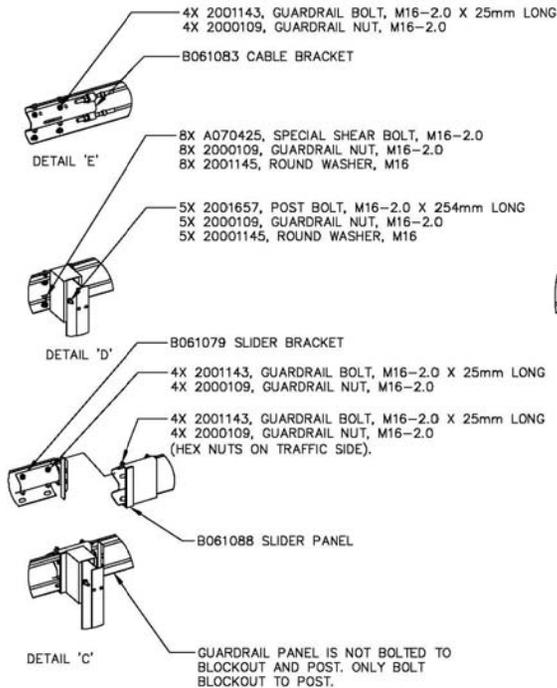
SHEET	DRAWING NUMBER	REV.
6 OF 10	B080439	0

X-TENSION GUARDRAIL TERMINAL SYSTEM, METRIC, WOOD BLOCKOUT TO STEEL POST, XTGTSM2



NOTES: UNLESS OTHERWISE SPECIFIED

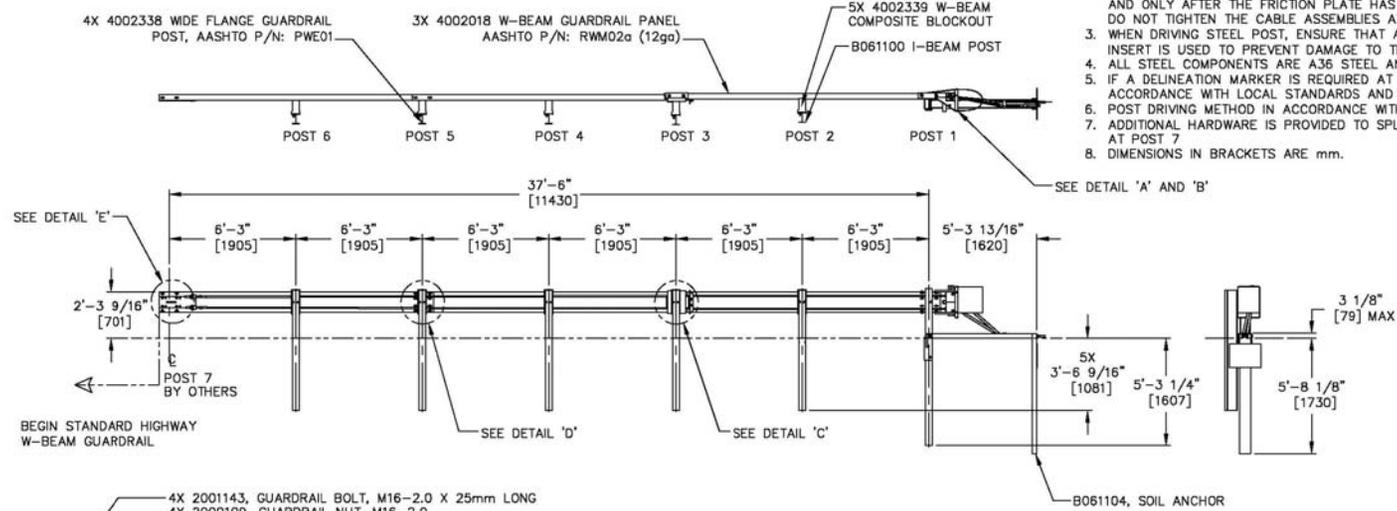
1. X-TENSION SYSTEM TO BE INSTALLED PER MANUFACTURER INSTRUCTIONS.
2. ONLY TIGHTEN THE CABLE ASSEMBLIES USING THE HEX NUTS AT CABLE BRACKETS AND ONLY AFTER THE FRICTION PLATE HAS BEEN TURNED AT THE HEAD WELDMENT. DO NOT TIGHTEN THE CABLE ASSEMBLIES AT THE FRONT OF THE GROUND ANCHOR.
3. WHEN DRIVING STEEL POST, ENSURE THAT A DRIVING CAP WITH TIMBER OR PLASTIC INSERT IS USED TO PREVENT DAMAGE TO THE GALVANIZING AT THE TOP OF THE POST.
4. ALL STEEL COMPONENTS ARE A36 STEEL AND ARE GALVANIZED PER ASTM A123.
5. IF A DELINEATION MARKER IS REQUIRED AT NOSE PIECE, MARKER SHALL BE IN ACCORDANCE WITH LOCAL STANDARDS AND SPECIFICATIONS.
6. POST DRIVING METHOD IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL STANDARDS.
7. ADDITIONAL HARDWARE IS PROVIDED TO SPLICE SYSTEM TO EXISTING GUARDRAIL AT POST 7
8. DIMENSIONS IN BRACKETS ARE mm.



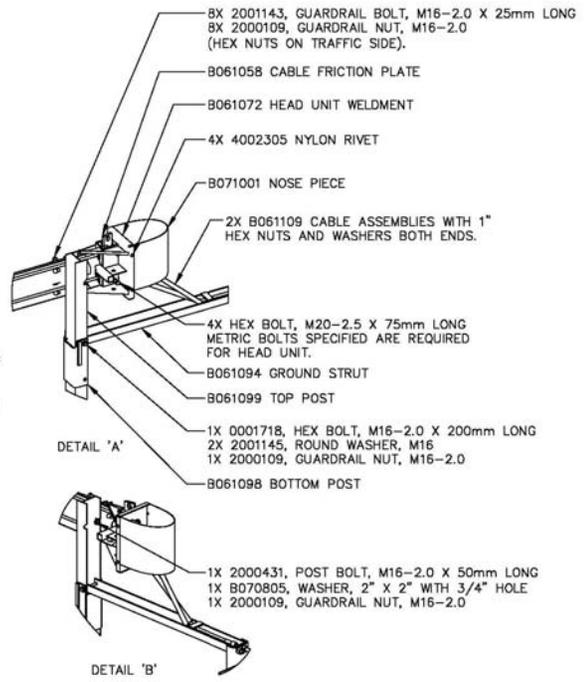
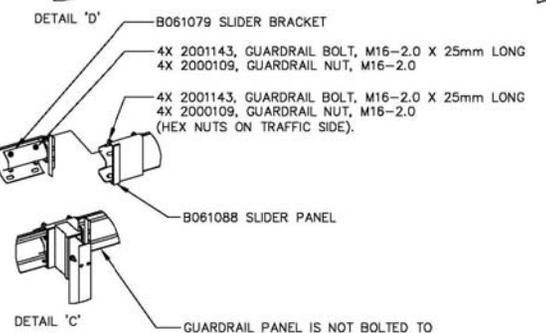
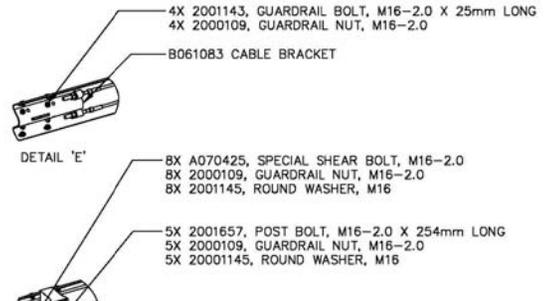
Part#	Qty	Part Description
B061072	1	HEAD UNIT WELDMENT
B061058	1	CABLE FRICTION PLATE, HEAD UNIT
B061079	1	SLIDER BRACKET WELDMENT
B061088	1	SLIDER PANEL WELDMENT, W-BEAM
B061083	1	CABLE BRACKET WELDMENT
B061109	2	CABLE ASSEMBLY
B061094	1	GROUND STRUT WELDMENT
B061104	1	SOIL ANCHOR WELDMENT
B061088	1	BOTTOM POST WELDMENT
B061099	1	I-BEAM POST, TOP
B071001	1	NOSE PIECE
4002018	3	W-Beam Guardrail RWM02a
4002337	5	W-Beam Timber Blockout PDB01b
4002338	5	Wide Flange Guardrail Post PWE01
4002305	4	Nylon Rivet
2001143	24	Guardrail Bolt M16-2.0 x 25mm
2000431	1	Post Bolt, M16-2.0 x 50mm
2001643	5	Post Bolt, M16-2.0 x 254mm
2000109	31	Guardrail Nut, M16-2.0
2001718	1	Hex Bolt, M16-2.0 x 200mm
2001615	4	Hex Bolt, M20-2.5x75mm
2001145	7	Round Washer, M16
A070425	8	Special Shear Bolt w/ nut & washer
B070805	1	Washer, 2" x 2" w/ 3/4" hole

SHEET	DRAWING NUMBER	REV.
7 OF 10	B080439	0

X-TENSION GUARDRAIL TERMINAL SYSTEM, METRIC, COMPOSITE BLOCKOUT TO STEEL POST, XTGTSM3



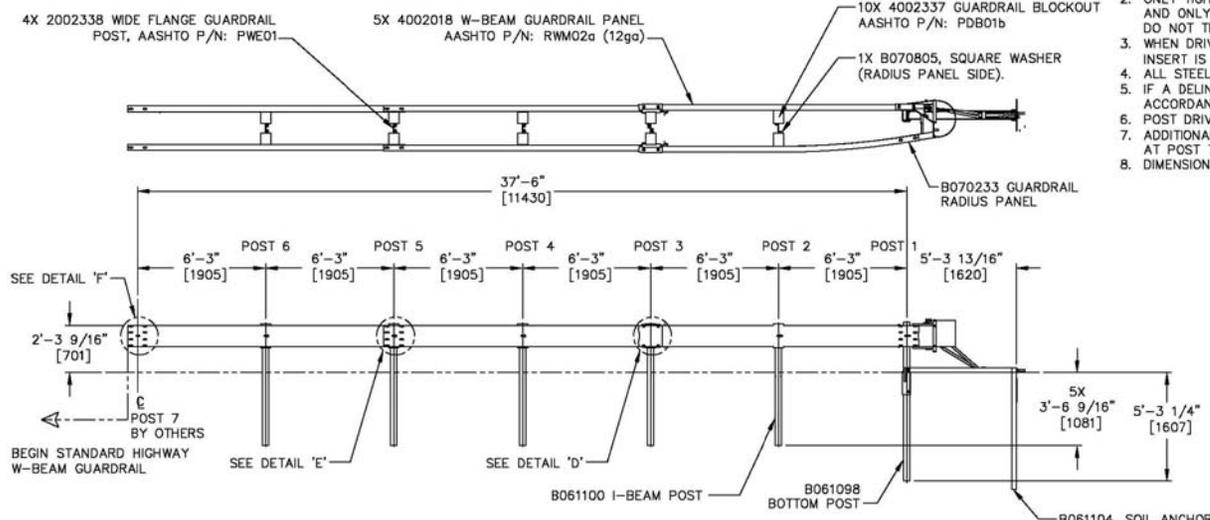
- NOTES: UNLESS OTHERWISE SPECIFIED
1. X-TENSION SYSTEM TO BE INSTALLED PER MANUFACTURER INSTRUCTIONS.
  2. ONLY TIGHTEN THE CABLE ASSEMBLIES USING THE HEX NUTS AT CABLE BRACKETS AND ONLY AFTER THE FRICTION PLATE HAS BEEN TURNED AT THE HEAD WELDMENT. DO NOT TIGHTEN THE CABLE ASSEMBLIES AT THE FRONT OF THE GROUND ANCHOR.
  3. WHEN DRIVING STEEL POST, ENSURE THAT A DRIVING CAP WITH TIMBER OR PLASTIC INSERT IS USED TO PREVENT DAMAGE TO THE GALVANIZING AT THE TOP OF THE POST.
  4. ALL STEEL COMPONENTS ARE A36 STEEL AND ARE GALVANIZED PER ASTM A123.
  5. IF A DELINEATION MARKER IS REQUIRED AT NOSE PIECE, MARKER SHALL BE IN ACCORDANCE WITH LOCAL STANDARDS AND SPECIFICATIONS.
  6. POST DRIVING METHOD IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL STANDARDS.
  7. ADDITIONAL HARDWARE IS PROVIDED TO SPLICE SYSTEM TO EXISTING GUARDRAIL AT POST 7
  8. DIMENSIONS IN BRACKETS ARE mm.



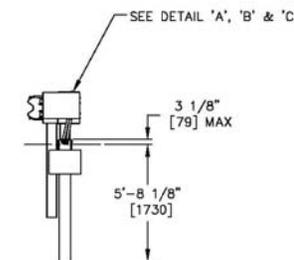
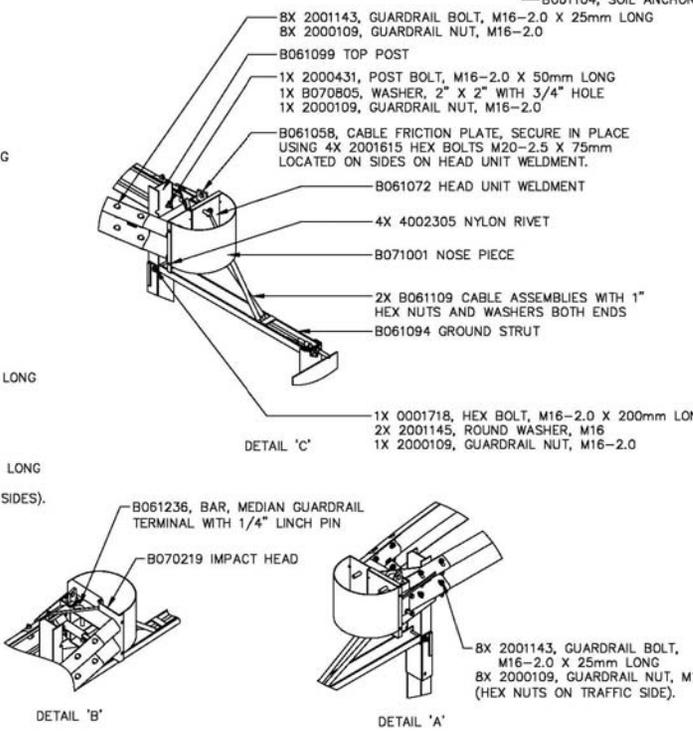
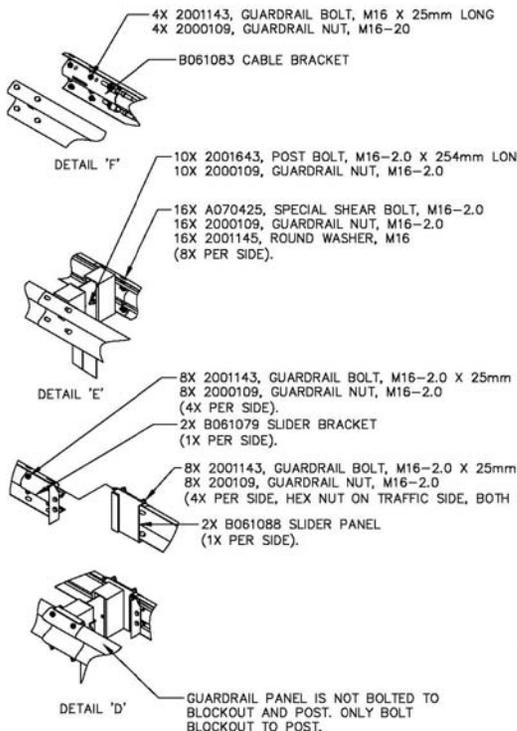
Part#	Qty	Part Description
B061072	1	HEAD UNIT WELDMENT
B061058	1	CABLE FRICTION PLATE, HEAD UNIT
B061079	1	SLIDER BRACKET WELDMENT
B061088	1	SLIDER PANEL WELDMENT, W-BEAM
B061083	1	CABLE BRACKET WELDMENT
B061109	2	CABLE ASSEMBLY
B061094	1	GROUND STRUT WELDMENT
B061104	1	SOIL ANCHOR WELDMENT
B061098	1	BOTTOM POST WELDMENT
B061099	1	I-BEAM POST, TOP
B071001	1	NOSE PIECE
B061100	1	I-BEAM POST, POST 2
4002018	3	W-Beam Guardrail RWM02a
4002339	5	W-Beam Composite Blockout
4002338	5	Wide Flange Guardrail Post PWE01
4002305	4	Nylon Rivet
2001143	24	Guardrail Bolt M16-2.0 x 25mm
2000431	1	Post Bolt, M16-2.0 x 50mm
2001643	5	Post Bolt, M16-2.0 x 254mm
2000109	31	Guardrail Nut, M16-2.0
2001718	1	Hex Bolt, M16-2.0 x 200mm
2001615	4	Hex Bolt, M20-2.5x75mm
2001145	7	Round Washer, M16
A070425	8	Special Shear Bolt w/ nut & washer
B070805	1	Washer, 2" x 2" w/ 3/4" hole

SHEET	DRAWING NUMBER	REV.
8 OF 10	B080439	0

X-TENSION MEDIAN TERMINAL SYSTEM, METRIC, WOOD BLOCKOUT TO STEEL POST, XTMTSM2



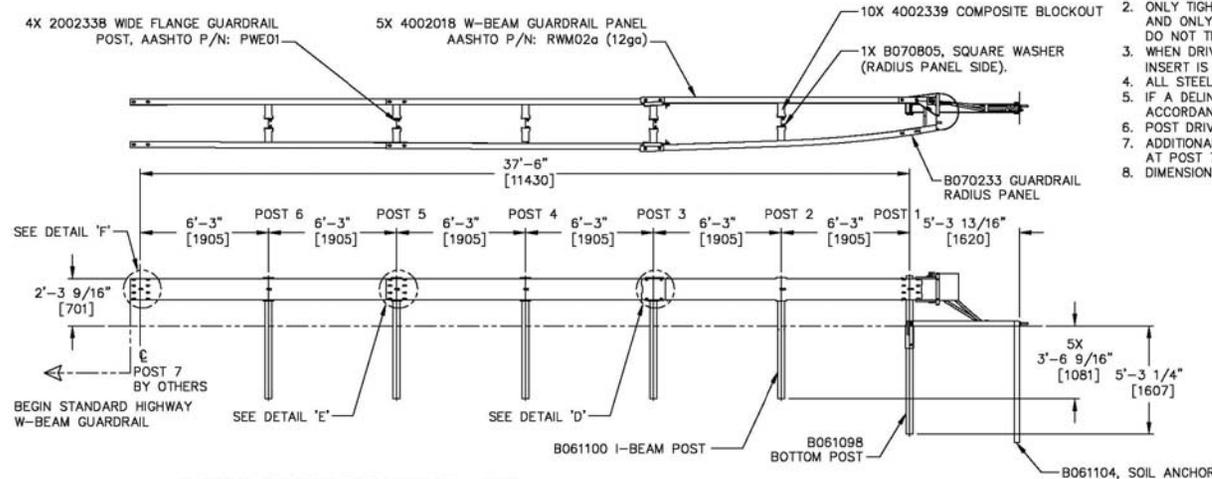
- NOTES: UNLESS OTHERWISE SPECIFIED
1. X-TENSION SYSTEM TO BE INSTALLED PER MANUFACTURER INSTRUCTIONS.
  2. ONLY TIGHTEN THE CABLE ASSEMBLIES USING THE HEX NUTS AT CABLE BRACKETS AND ONLY AFTER THE FRICTION PLATE HAS BEEN TURNED AT THE HEAD WELDMENT. DO NOT TIGHTEN THE CABLE ASSEMBLIES AT THE FRONT OF THE GROUND ANCHOR.
  3. WHEN DRIVING STEEL POST, ENSURE THAT A DRIVING CAP WITH TIMBER OR PLASTIC INSERT IS USED TO PREVENT DAMAGE TO THE GALVANIZING AT THE TOP OF THE POST.
  4. ALL STEEL COMPONENTS ARE A36 STEEL AND ARE GALVANIZED PER ASTM A123.
  5. IF A DELINEATION MARKER IS REQUIRED AT NOSE PIECE, MARKER SHALL BE IN ACCORDANCE WITH LOCAL STANDARDS AND SPECIFICATIONS.
  6. POST DRIVING METHOD IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL STANDARDS.
  7. ADDITIONAL HARDWARE IS PROVIDED TO SPLICE SYSTEM TO EXISTING GUARDRAIL AT POST 7
  8. DIMENSIONS IN BRACKETS ARE mm.



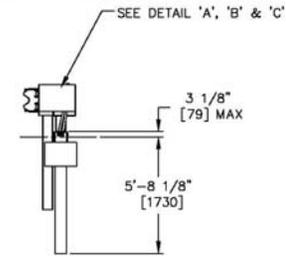
Part#	Qty	Part Description
B061072	1	HEAD UNIT WELDMENT
B061058	1	CABLE FRICTION PLATE, HEAD UNIT
B061079	2	SLIDER BRACKET WELDMENT
B061088	2	SLIDER PANEL WELDMENT, W-BEAM
B061083	1	CABLE BRACKET WELDMENT
B061109	2	CABLE ASSEMBLY
B061094	1	GROUND STRUT WELDMENT
B061104	1	SOIL ANCHOR WELDMENT
B061098	1	BOTTOM POST WELDMENT
B061099	1	I-BEAM POST, TOP
B061100	1	I-BEAM POST, POST 2
B071001	1	NOSE PIECE
B070219	1	IMPACT HEAD WELDMENT, MEDIAN TERMINAL, X-TENSION
B061236	1	BAR, MEDIAN GUARDRAIL TERMINAL
B070233	1	PANEL, RADIUS GUARDRAIL, W-BEAM, X-TENSION TERMINAL
4002018	5	W-Beam Guardrail RWM02a
4002337	10	W-Beam Timber Blockout PDB01b
4002338	4	Wide Flange Guardrail Post PWE01
4002305	4	Nylon Rivet
2001143	48	Guardrail Bolt M16-2.0 x 25mm
2000431	1	Post Bolt M16-2.0 x 50mm
2001643	10	Post Bolt M16-2.0 x 254mm
2000109	60	Guardrail Nut, M16-2.0
2001718	1	Hex Bolt, M16-2.0 x 200mm
2001615	4	Hex Bolt, M20-2.5x75mm
2001145	2	Round Washer, M16
A070426	16	Special Shear Bolt w/ nut & washer
B070805	2	Washer, 2" x 2" w/ 3/4" hole
2000090	1	1/4" Linch Pin

SHEET	DRAWING NUMBER	REV.
9 OF 10	B080439	0

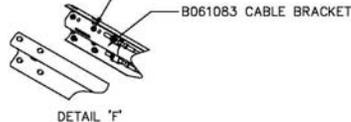
X-TENSION MEDIAN TERMINAL SYSTEM, METRIC, COMPOSITE BLOCKOUT TO STEEL POST, XTMTSM3



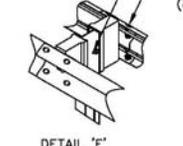
- NOTES: UNLESS OTHERWISE SPECIFIED
1. X-TENSION SYSTEM TO BE INSTALLED PER MANUFACTURER INSTRUCTIONS.
  2. ONLY TIGHTEN THE CABLE ASSEMBLIES USING THE HEX NUTS AT CABLE BRACKETS AND ONLY AFTER THE FRICTION PLATE HAS BEEN TURNED AT THE HEAD WELDMENT. DO NOT TIGHTEN THE CABLE ASSEMBLIES AT THE FRONT OF THE GROUND ANCHOR.
  3. WHEN DRIVING STEEL POST, ENSURE THAT A DRIVING CAP WITH TIMBER OR PLASTIC INSERT IS USED TO PREVENT DAMAGE TO THE GALVANIZING AT THE TOP OF THE POST.
  4. ALL STEEL COMPONENTS ARE A36 STEEL AND ARE GALVANIZED PER ASTM A123.
  5. IF A DELINEATION MARKER IS REQUIRED AT NOSE PIECE, MARKER SHALL BE IN ACCORDANCE WITH LOCAL STANDARDS AND SPECIFICATIONS.
  6. POST DRIVING METHOD IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL STANDARDS.
  7. ADDITIONAL HARDWARE IS PROVIDED TO SPLICE SYSTEM TO EXISTING GUARDRAIL AT POST 7
  8. DIMENSIONS IN BRACKETS ARE mm.



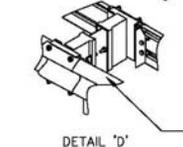
- 4X 2001143, GUARDRAIL BOLT, M16 X 25mm LONG
- 4X 2000109, GUARDRAIL NUT, M16-20



- B061083 CABLE BRACKET
- 10X 2001643, POST BOLT, M16-2.0 X 254mm LONG
- 10X 2000109, GUARDRAIL NUT, M16-2.0
- 16X A070425, SPECIAL SHEAR BOLT, M16-2.0
- 16X 2000109, GUARDRAIL NUT, M16-2.0
- 16X 2001145, ROUND WASHER, M16 (8X PER SIDE).

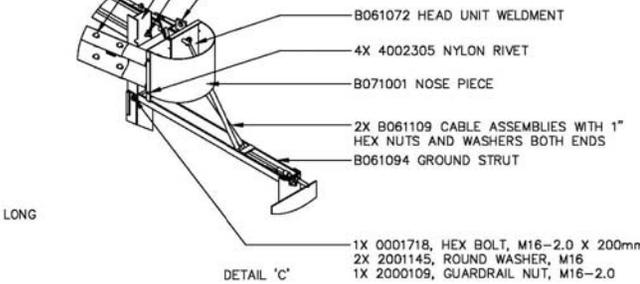


- 8X 2001143, GUARDRAIL BOLT, M16-2.0 X 25mm LONG
- 8X 2000109, GUARDRAIL NUT, M16-2.0 (4X PER SIDE).
- 2X B061079 SLIDER BRACKET (1X PER SIDE).
- 8X 2001143, GUARDRAIL BOLT, M16-2.0 X 25mm LONG
- 8X 2000109, GUARDRAIL NUT, M16-2.0 (4X PER SIDE, HEX NUT ON TRAFFIC SIDE, BOTH SIDES).
- 2X B061088 SLIDER PANEL (1X PER SIDE).

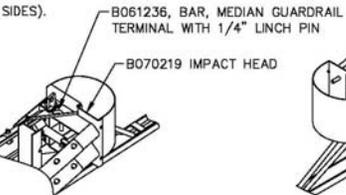


DETAIL 'D' GUARDRAIL PANEL IS NOT BOLTED TO BLOCKOUT AND POST. ONLY BOLT BLOCKOUT TO POST.

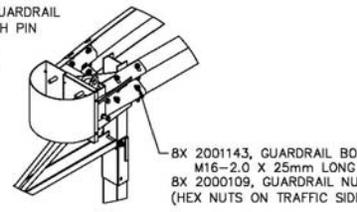
- 8X 2001143, GUARDRAIL BOLT, M16-2.0 X 25mm LONG
- 8X 2000109, GUARDRAIL NUT, M16-2.0
- B061099 TOP POST
- 1X 2000431, POST BOLT, M16-2.0 X 50mm LONG
- 1X B070805, WASHER, 2" X 2" WITH 3/4" HOLE
- 1X 2000109, GUARDRAIL NUT, M16-2.0
- B061058, CABLE FRICTION PLATE, SECURE IN PLACE USING 4X 2001615 HEX BOLTS M20-2.5 X 75mm LOCATED ON SIDES ON HEAD UNIT WELDMENT.
- B061072 HEAD UNIT WELDMENT
- 4X 4002305 NYLON RIVET
- B071001 NOSE PIECE
- 2X B061109 CABLE ASSEMBLIES WITH 1" HEX NUTS AND WASHERS BOTH ENDS
- B061094 GROUND STRUT



- 1X 0001718, HEX BOLT, M16-2.0 X 200mm LONG
- 2X 2001145, ROUND WASHER, M16
- 1X 2000109, GUARDRAIL NUT, M16-2.0



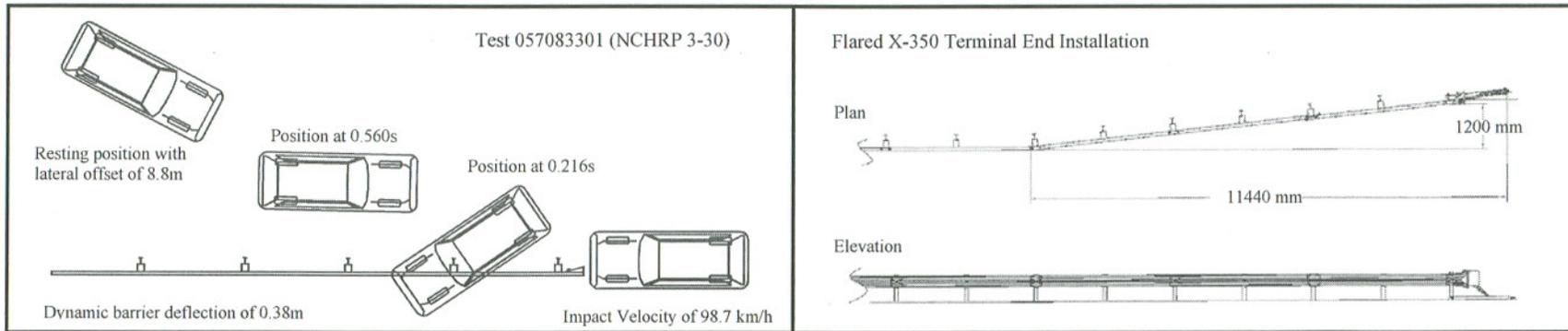
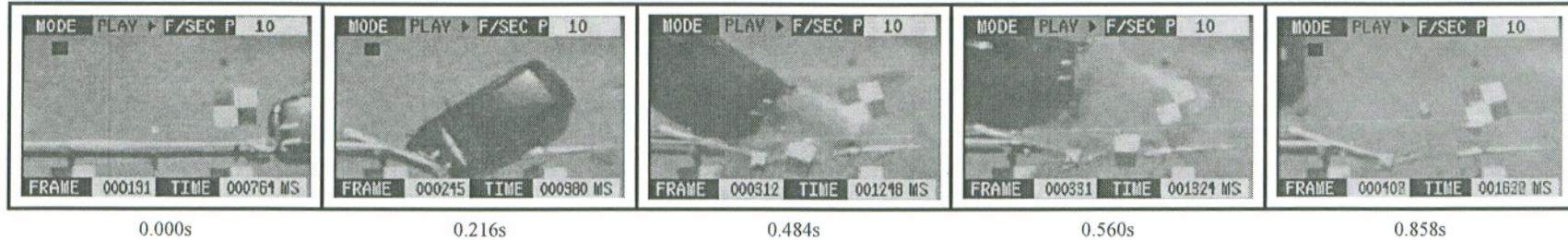
DETAIL 'B'



DETAIL 'A' 8X 2001143, GUARDRAIL BOLT, M16-2.0 X 25mm LONG 8X 2000109, GUARDRAIL NUT, M16-2.0 (HEX NUTS ON TRAFFIC SIDE).

Part#	Qty	Part Description
B061072	1	HEAD UNIT WELDMENT
B061058	1	CABLE FRICTION PLATE, HEAD UNIT
B061079	2	SLIDER BRACKET WELDMENT
B061088	2	SLIDER PANEL WELDMENT, W-BEAM
B061083	1	CABLE BRACKET WELDMENT
B061109	2	CABLE ASSEMBLY
B061094	1	GROUND STRUT WELDMENT
B061104	1	SOIL ANCHOR WELDMENT
B061098	1	BOTTOM POST WELDMENT
B061099	1	I-BEAM POST, TOP
B061100	1	I-BEAM POST, POST 2
B071001	1	NOSE PIECE
B070219	1	IMPACT HEAD WELDMENT, MEDIAN TERMINAL, X-TENSION
B061236	1	BAR, MEDIAN GUARDRAIL TERMINAL
B070233	1	PANEL, RADIUS GUARDRAIL, W-BEAM, X-TENSION TERMINAL
4002016	5	W-Beam Guardrail RWM02a
4002339	10	W-Beam Composite Blockout
4002338	4	Wide Flange Guardrail Post PWE01
4002305	4	Nylon Rivet
2001143	48	Guardrail Bolt M16-2.0 x 25mm
2000431	1	Post Bolt M16-2.0 x 50mm
2001643	10	Post Bolt M16-2.0 x 254mm
2000109	60	Guardrail Nut, M16-2.0
2001718	1	Hex Bolt, M16-2.0 x 200mm
2001615	4	Hex Bolt, M20-2.5x75mm
2001145	2	Round Washer, M16
A070426	16	Special Shear Bolt w/ nut & washer
B070805	2	Washer, 2" x 2" w/ 3/4" hole
2000090	1	1/4" Lynch Pin

SHEET	DRAWING NUMBER	REV.
10 OF 10	B080439	0



**General Information**

Test Agency ..... Holmes Solutions Limited  
 Test Designation ..... NCHRP 350 Test 3-30  
 Test No..... 057083301  
 Date..... 13<sup>th</sup> December 2006

**Test Article**

Type ..... Flared Guardrail Terminal End  
 Name or Manufacturer ..... Armorflex Ltd  
 Installation Length ..... 38 m  
 Material or Key Elements ..... AASHTO SGR04a-b Guardrail with Armorflex X350 Terminal End

**Soil Type and Condition** .....

AASHTO 'standard' soil M147-64 (1990)

**Test Vehicle**

Type ..... Production Model  
 Designation ..... 820C  
 Model ..... 1997 Toyota Starlet  
 Mass (kg)  
 Curb..... 873.0  
 Test Inertial ..... 837.0  
 Dummy ..... 75.0  
 Gross Static ..... 912.0

**Impact Conditions**

Speed (km/h) ..... 98.7  
 Angle (deg) ..... 0

**Exit Conditions**

Speed (km/h) ..... 27.5  
 Angle (deg) ..... n/a

**Occupant Risk Values**

Impact Velocity (m/s)  
 x-direction ..... 9.4  
 y-direction ..... -0.8  
 THIV (km/h) ..... 34.9  
 Ridedown Accelerations (g's)  
 x-direction ..... -18.8  
 y-direction ..... 7.0  
 PHD (g's) ..... 19.5  
 ASI ..... 1.09  
 Max. 0.050-s Average (g's)  
 x-direction ..... -13.0  
 y-direction ..... -4.0  
 z-direction ..... 7.3

**Test Article Deflections**

Dynamic (m) ..... 0.38  
 Permanent (m)..... 0.34

**Vehicle Damage**

Exterior  
 VDS ..... 12-FC-5  
 CDC..... 12FLEN2

Maximum Exterior  
 Vehicle Crush (mm) ..... 300

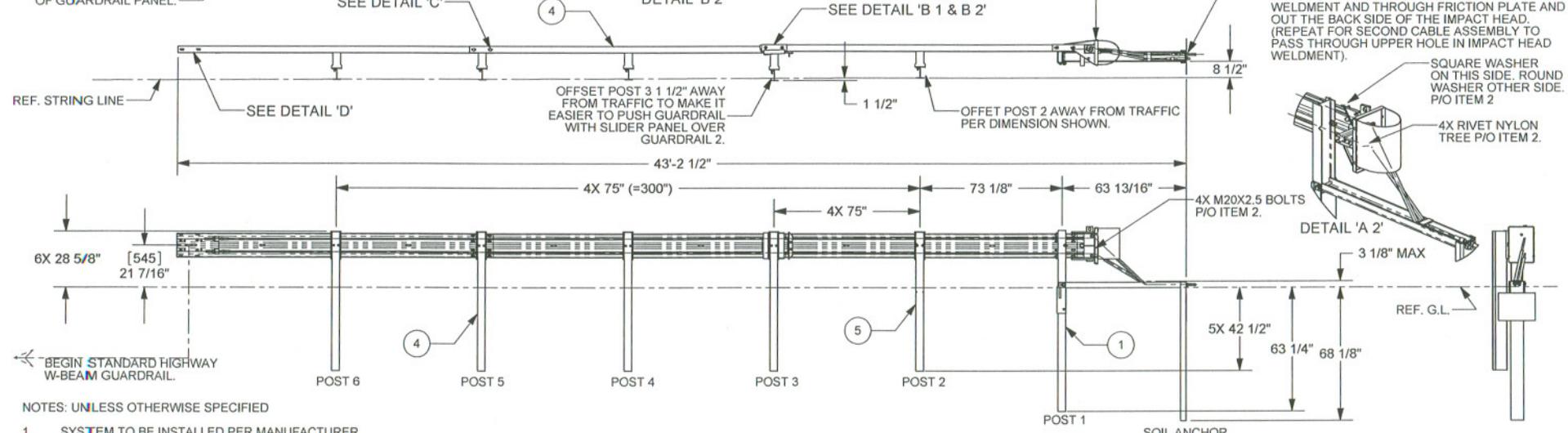
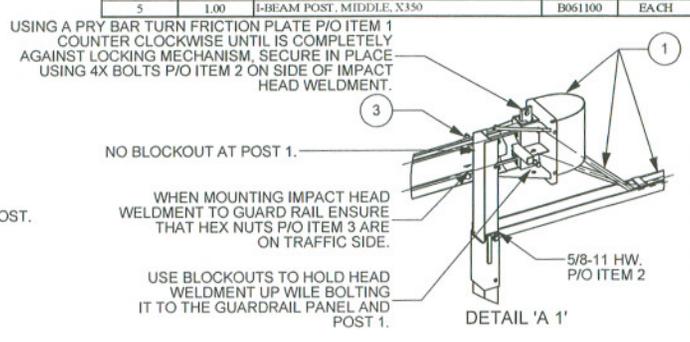
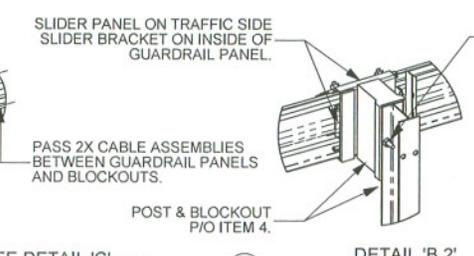
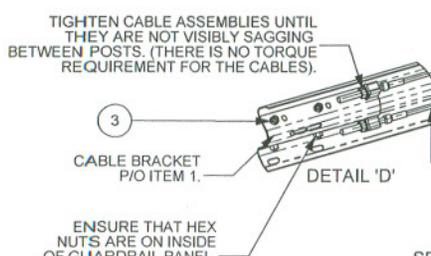
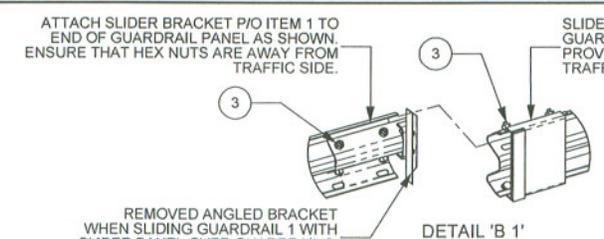
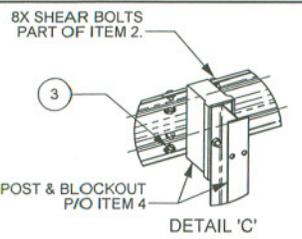
Interior  
 OCDI ..... AS0000000

Max. Occ. Compartment.  
 Deformation (mm) ..... 30

**Post-Impact Behaviour**

Max. Yaw Angle (deg)..... 497.1  
 Max. Pitch Angle (deg)..... 47.0  
 Max Roll Angle (deg) ..... 27.7

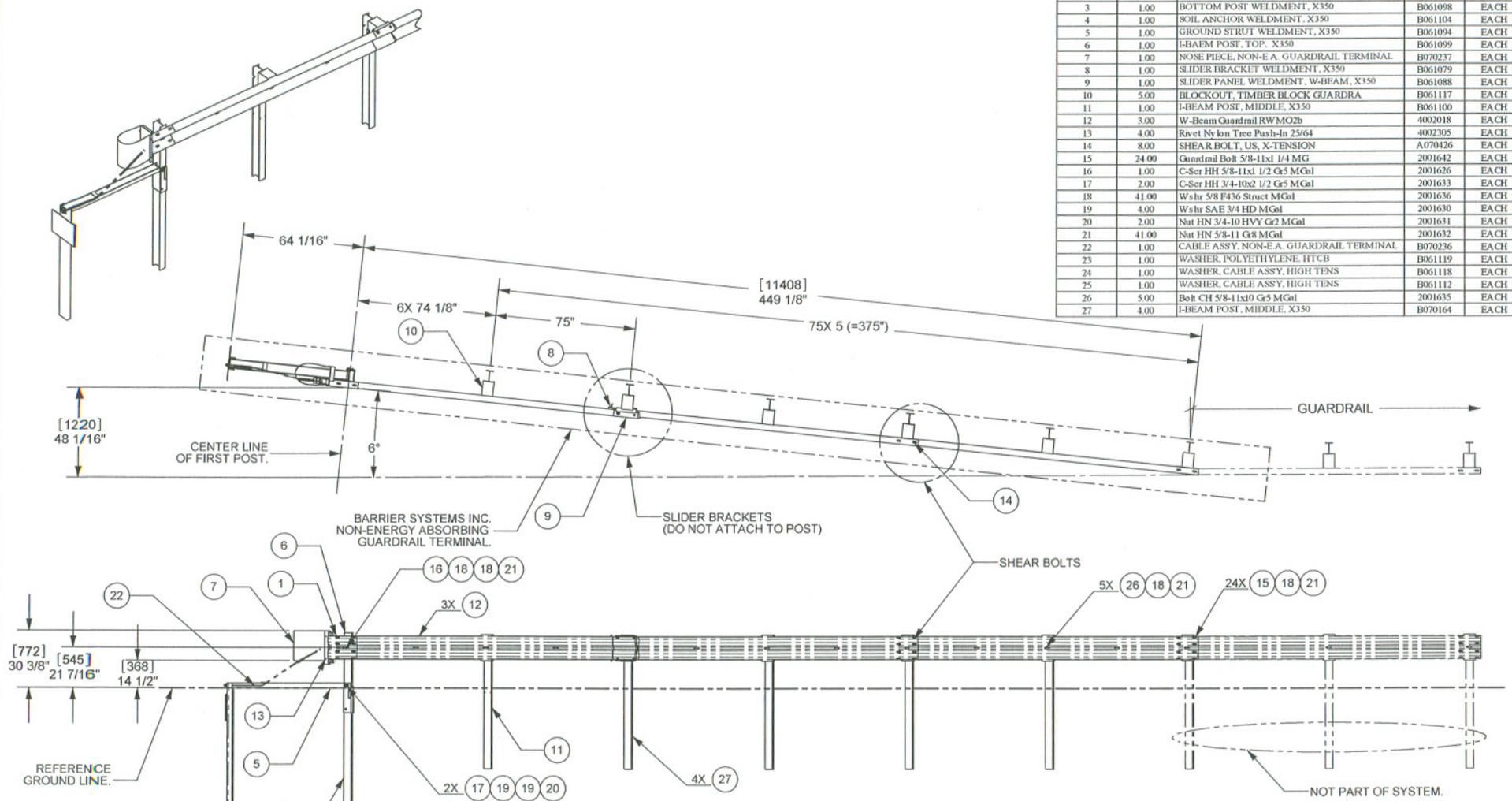
Item	Qty	Part Description	Part#	U/M
1	1.00	X-Tension Terminal Component Kit	K070201	EACH
2	1.00	X-Tension Hardware Kit, GT, Std For XTGTK	K070202	EACH
3	1.00	X-Tension System Hardware Kit, GT, Std, XTGTSS2 or	K070206	EACH
4	1.00	X-Tension GT Guardrail Component Kit 3	K070210	EACH
5	1.00	I-BEAM POST, MIDDLE, X150	B061100	EACH



- NOTES: UNLESS OTHERWISE SPECIFIED
1. SYSTEM TO BE INSTALLED PER MANUFACTURER SPECIFICATIONS.
  2. ONLY TIGHTEN THE CABLE ASSEMBLIES USING THE NUTS AT THE CABLE BRACKET (SEE DETAIL 'D'). DO NOT TIGHTEN THE CABLES AT THE FRONT OF THE GROUND ANCHOR.
  3. WHEN DRIVING STEEL POST, ENSURE THAT A DRIVING CAP WITH TIMBER OR PLASTIC INSERT IS USED TO PREVENT DAMAGE TO THE GALVANIZING TO THE TOP OF THE POST.

© 2007 Barrier Systems Inc.		SCALE: 1:50		Standard Tolerance Angular ± 1/2° Fractional ± 1/16" Dec XXX ± .010 Dec XX ± .030		<b>BARRIER SYSTEMS INC</b> 180 RIVER RD, RIO VISTA, CA 94571 TEL: 707-374-6800 FAX: 707-374-6801	
The information here on is proprietary to Barrier Systems Inc. shall not be disclosed, duplicated or used otherwise without the express written approval of Barrier Systems Inc.		DRAWN BY: 08/06/07 APP'D BY: AEM		DATE: 08/06/07 INIT: AEM		SHEET: 1 OF 1 DRAWING NUMBER: XTGTSS3 REV: B	
B	SEE ECN# 942	8/31/07	AEM				
A	SEE ER# 531	8/08/07	AEM				
REV.	CHANGES	DATE	BY	REQ'D	NEXT ASSY.	ITEM	

Item	Qty	Part Description	Part#	U/M
1	1.00	HEAD UNIT WELDMENT, NON-E.A. TERMINAL	B061214	EACH
2	1.00	TRIGGER HEAD WELDMENT, NON-E.A. TERMINAL	B061222	EACH
3	1.00	BOTTOM POST WELDMENT, X350	B061098	EACH
4	1.00	SOIL ANCHOR WELDMENT, X350	B061104	EACH
5	1.00	GROUND STRUT WELDMENT, X350	B061094	EACH
6	1.00	I-BEAM POST, TOP, X350	B061099	EACH
7	1.00	NOSE PIECE, NON-E.A. GUARDRAIL TERMINAL	B070237	EACH
8	1.00	SLIDER BRACKET WELDMENT, X350	B061079	EACH
9	1.00	SLIDER PANEL WELDMENT, W-BEAM, X350	B061088	EACH
10	5.00	BLOCKOUT, TIMBER BLOCK GUARDRA	B061117	EACH
11	1.00	I-BEAM POST, MIDDLE, X350	B061100	EACH
12	3.00	W-Beam Guardrail RWM02b	4002018	EACH
13	4.00	Rivet Nylon Tree Push-In 25/64	4002305	EACH
14	8.00	SHEAR BOLT, US, X-TENSION	A070426	EACH
15	24.00	Guardrail Bolt 5/8-11x1 1/4 MG	2001642	EACH
16	1.00	C-Ser HH 5/8-11x1 1/2 G5 MGal	2001626	EACH
17	2.00	C-Ser HH 3/4-10x2 1/2 G5 MGal	2001633	EACH
18	41.00	Wshr 5/8 F436 Struct MGal	2001636	EACH
19	4.00	Wshr SAE 3/4 HD MGal	2001630	EACH
20	2.00	Nut HN 3/4-10 HVY Gr2 MGal	2001631	EACH
21	41.00	Nut HN 5/8-11 Gr8 MGal	2001632	EACH
22	1.00	CABLE ASSY, NON-E.A. GUARDRAIL TERMINAL	B070236	EACH
23	1.00	WASHER, POLYETHYLENE, HTC/B	B061119	EACH
24	1.00	WASHER, CABLE ASSY, HIGH TENS	B061118	EACH
25	1.00	WASHER, CABLE ASSY, HIGH TENS	B061112	EACH
26	5.00	Bolt CH 5/8-11x10 G5 MGal	2001635	EACH
27	4.00	I-BEAM POST, MIDDLE, X350	B070164	EACH



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	B	SEE ECN# 834	2/13/07	AEM		
	A	SEE ECN# 821	1/25/07	AEM		
	0	NEW DRAWING	12/04/06	AEM		
	REV.	CHANGES	DATE	BY	REQ'D	NEXT ASSY.

SCALE: 1:50

Standard Tolerance  
 Angular ± 1/2°  
 Fractional ± 1/16"  
 Dec XXX ± .010  
 Dec XX ± .030

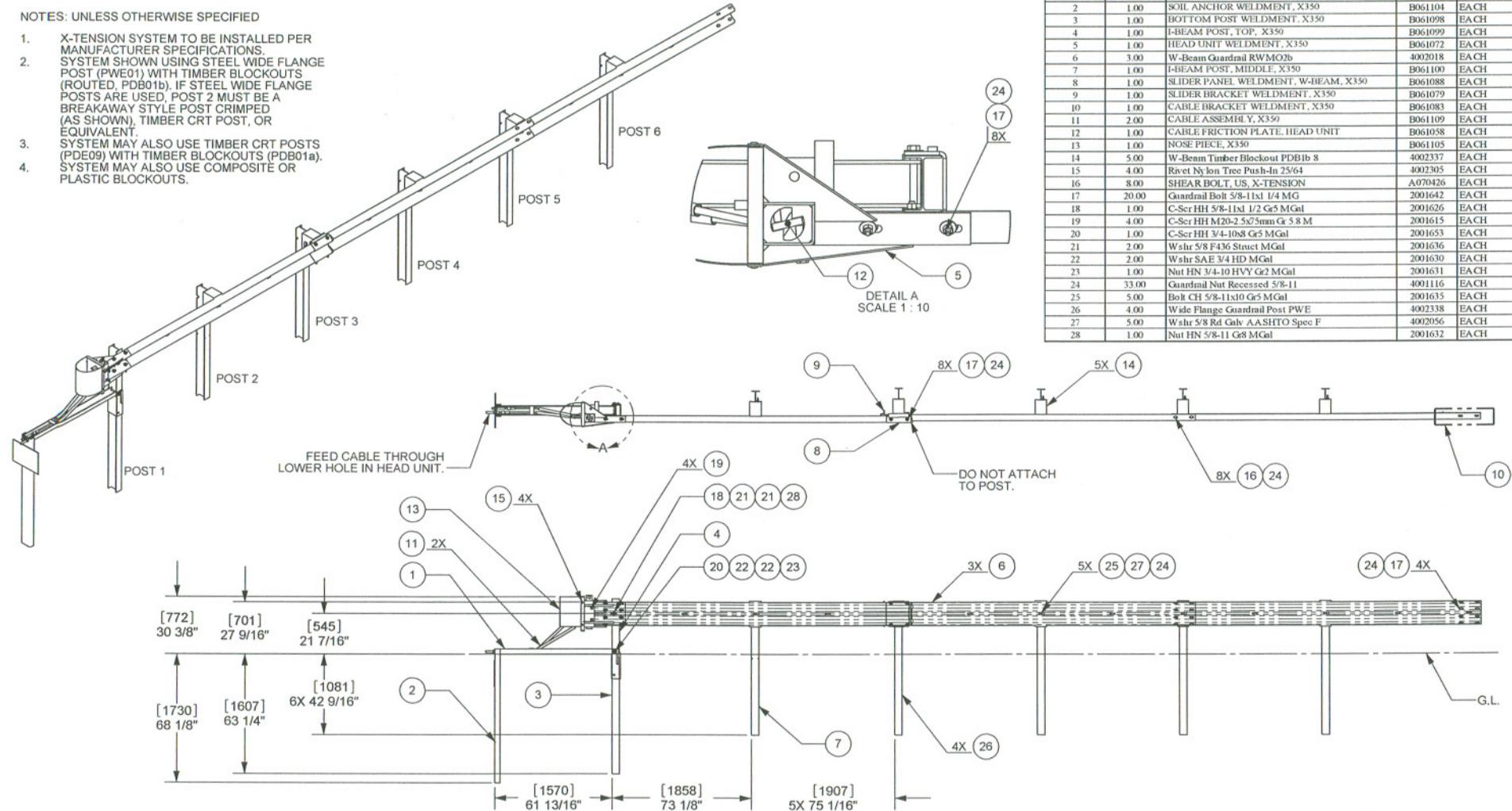
DRAWN BY: [Signature]  
 DATE: 12/04/06  
 INIT: [Signature]  
 APPROV BY: [Signature]  
 DATE: [Signature]  
 TITLE: SYSTEM, NON-ENERGY ABSORBING GUARDRAIL TERMINAL

**BARRIER SYSTEMS INC**  
 180 RIVER RD, RIO VISTA, CA 94571  
 TEL: 707-374-6800 FAX: 707-374-6801

SHEET	DRAWING NUMBER	REV
1 OF 1	B061226	C

NOTES: UNLESS OTHERWISE SPECIFIED

1. X-TENSION SYSTEM TO BE INSTALLED PER MANUFACTURER SPECIFICATIONS.
2. SYSTEM SHOWN USING STEEL WIDE FLANGE POST (PWE01) WITH TIMBER BLOCKOUTS (ROUTED, PDB01b). IF STEEL WIDE FLANGE POSTS ARE USED, POST 2 MUST BE A BREAKAWAY STYLE POST CRIMPED (AS SHOWN), TIMBER CRT POST, OR EQUIVALENT.
3. SYSTEM MAY ALSO USE TIMBER CRT POSTS (PDE09) WITH TIMBER BLOCKOUTS (PDB01a).
4. SYSTEM MAY ALSO USE COMPOSITE OR PLASTIC BLOCKOUTS.

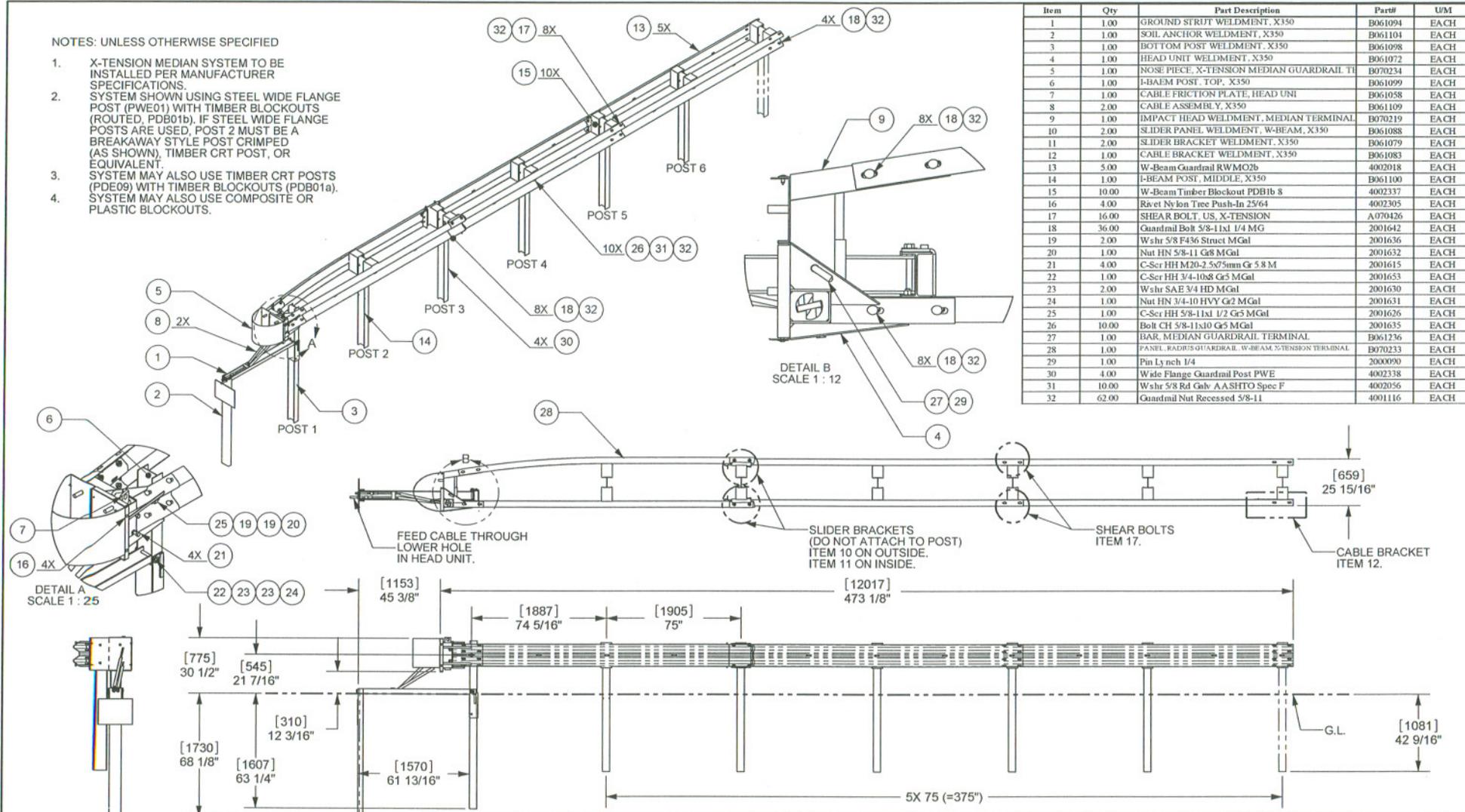


Item	Qty	Part Description	Part#	U/M
1	1.00	GROUND STRUT WELDMENT, X350	B061094	EACH
2	1.00	SOIL ANCHOR WELDMENT, X350	B061104	EACH
3	1.00	BOTTOM POST WELDMENT, X350	B061098	EACH
4	1.00	I-BEAM POST, TOP, X350	B061099	EACH
5	1.00	HEAD UNIT WELDMENT, X350	B061072	EACH
6	3.00	W-Beam Guardrail RWM02b	4002018	EACH
7	1.00	I-BEAM POST, MIDDLE, X350	B061100	EACH
8	1.00	SLIDER PANEL WELDMENT, W-BEAM, X350	B061088	EACH
9	1.00	SLIDER BRACKET WELDMENT, X350	B061079	EACH
10	1.00	CABLE BRACKET WELDMENT, X350	B061083	EACH
11	2.00	CABLE ASSEMBLY, X350	B061109	EACH
12	1.00	CABLE FRICTION PLATE, HEAD UNIT	B061058	EACH
13	1.00	NOSE PIECE, X350	B061105	EACH
14	5.00	W-Beam Timber Blockout PDB1b 8	4002337	EACH
15	4.00	Rivet Nylon Tree Push-In 25/64	4002305	EACH
16	8.00	SHIELD BOLT, US, X-TENSION	A070426	EACH
17	20.00	Guardrail Bolt 5/8-11x 1/4 MG	2001642	EACH
18	1.00	C-Scr HH 5/8-11x 1/2 G5 MGal	2001626	EACH
19	4.00	C-Scr HH M20-2.5x75mm G5 5.8 M	2001615	EACH
20	1.00	C-Scr HH 3/4-10x8 G5 MGal	2001653	EACH
21	2.00	Wshr 5/8 F46 Struct MGal	2001636	EACH
22	2.00	Wshr SAE 3/4 HD MGal	2001630	EACH
23	1.00	Nut HN 3/4-10 HVY Gr2 MGal	2001631	EACH
24	33.00	Guardrail Nut Recessed 5/8-11	4001116	EACH
25	5.00	Bolt CH 5/8-11x10 G5 MGal	2001635	EACH
26	4.00	Wide Flange Guardrail Post PWE	4002338	EACH
27	5.00	Wshr 5/8 Rd Galv AASHTO Spec F	4002056	EACH
28	1.00	Nut HN 5/8-11 G8 MGal	2001632	EACH

© 2006 Barrier Systems Inc.					SCALE: 1:50			Standard Tolerance Angular ± 1/2° Fractional ± 1/16" Dec XXX± ± .010 Dec XX± ± .030		<b>BARRIER SYSTEMS INC</b> 180 RIVER RD, RIO VISTA, CA 94571 TEL: 707-374-8800 FAX: 707-374-8801		
C	SEE ECN# 871	12/5/07	AEM		DRAWN BY	DATE	INIT		SHEET	DRAWING NUMBER	REV	
B	SEE ECN# 840	2/21/07	AEM		APPROD BY	10/26/06	AEM		1 OF 1	B061113	C	
A	SEE ECN# 821	1/25/07	AEM		TITLE: SYSTEM, X-TENSION GUARDRAIL TERMINAL							
REV.	CHANGES	DATE	BY	REQ'D	NEXT ASSY.	ITEM						

NOTES: UNLESS OTHERWISE SPECIFIED

1. X-TENSION MEDIAN SYSTEM TO BE INSTALLED PER MANUFACTURER SPECIFICATIONS.
2. SYSTEM SHOWN USING STEEL WIDE FLANGE POST (PWE01) WITH TIMBER BLOCKOUTS (ROUTED, PDB01b). IF STEEL WIDE FLANGE POSTS ARE USED, POST 2 MUST BE A BREAKAWAY STYLE POST CRIMPED (AS SHOWN), TIMBER CRT POST, OR EQUIVALENT.
3. SYSTEM MAY ALSO USE TIMBER CRT POSTS (PDE09) WITH TIMBER BLOCKOUTS (PDB01a).
4. SYSTEM MAY ALSO USE COMPOSITE OR PLASTIC BLOCKOUTS.



Item	Qty	Part Description	Part#	U/M
1	1.00	GROUND STRUT WELDMENT, X350	B061094	EACH
2	1.00	SOIL ANCHOR WELDMENT, X350	B061104	EACH
3	1.00	BOTTOM POST WELDMENT, X350	B061098	EACH
4	1.00	HEAD UNIT WELDMENT, X350	B061072	EACH
5	1.00	NOSE PIECE, X-TENSION MEDIAN GUARDRAIL TH	B070234	EACH
6	1.00	I-BEAM POST, TOP, X350	B061099	EACH
7	1.00	CABLE FRICTION PLATE, HEAD UNI	B061058	EACH
8	2.00	CABLE ASSEMBLY, X350	B061109	EACH
9	1.00	IMPACT HEAD WELDMENT, MEDIAN TERMINAL	B070219	EACH
10	2.00	SLIDER PANEL WELDMENT, W-BEAM, X350	B061088	EACH
11	2.00	SLIDER BRACKET WELDMENT, X350	B061079	EACH
12	1.00	CABLE BRACKET WELDMENT, X350	B061083	EACH
13	5.00	W-Beam Guardrail RWM02b	4002018	EACH
14	1.00	I-Beam Post, Middle, X350	B061100	EACH
15	10.00	W-Beam Timber Blockout PDB1b 8	4002337	EACH
16	4.00	Rivet Nylon Tree Push-In 25/64	4002305	EACH
17	16.00	SHEAR BOLT, US, X-TENSION	A070426	EACH
18	36.00	Guardrail Bolt 5/8-11x1/4 MG	2001642	EACH
19	2.00	Wshr 5/8 F436 Struct MGal	2001636	EACH
20	1.00	Nut HN 5/8-11 Gr8 MGal	2001632	EACH
21	4.00	C-Ser HH M20-2.5x75mm Gr 5.8 M	2001615	EACH
22	1.00	C-Ser HH 3/4-10x8 Gr5 MGal	2001633	EACH
23	2.00	Wshr SAE 3/4 HD MGal	2001630	EACH
24	1.00	Nut HN 3/4-10 HVY Gr2 MGal	2001631	EACH
25	1.00	C-Ser HH 5/8-11x1/2 Gr5 MGal	2001626	EACH
26	10.00	Bolt CH 5/8-11x10 Gr5 MGal	2001635	EACH
27	1.00	BAR, MEDIAN GUARDRAIL, TERMINAL	B061236	EACH
28	1.00	PANEL, RADIIUS GUARDRAIL, W-BEAM, X-TENSION TERMINAL	B070233	EACH
29	1.00	Pin Lynch 1/4	2000090	EACH
30	4.00	Wide Flange Guardrail Post PWE	4002338	EACH
31	10.00	Wshr 5/8 Rd Galv AASHTO Spec F	4002056	EACH
32	62.00	Guardrail Nut Recessed 5/8-11	4001116	EACH

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	C	SEE ECN# 840	2/21/07	AEM			
	B	SEE ECN# 830	2/9/07	AEM			
	A	SEE ECN# 821	1/25/07	AEM			
	REV.	CHANGES	DATE	BY	REQ'D	NEXT ASSY.	ITEM

SCALE: 1:50		Standard Tolerance	
DATE	INIT.	Angular	± 1/2°
12/09/06	AEM	Fractional	± 1/16"
DRAWN BY		Dec .XXX°	± .010
APPROV BY		Dec .XX°	± .030
TITLE: SYSTEM, X-TENSION MEDIAN GUARDRAIL TERMINAL			

<b>BARRIER SYSTEMS INC</b> 180 RIVER RD, RIO VISTA, CA 94571 TEL: 707-374-6800 FAX: 707-374-6801		
SHEET	DRAWING NUMBER	REV
1 OF 1	B061228	D