

Assembly Instructions for

**metric**

# **SKT-SP** Tangent Terminal & **FLEAT-SP** Flared Terminal

***SP – Standard Post System Guardrail Terminals***



***ROAD SYSTEMS, INC.***

P. O. Box 2163

Big Spring, Texas 79721

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

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

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

All RSI Installation Manuals can be downloaded from RSI web site

**[www.roadsystems.com](http://www.roadsystems.com)**

# Table of Contents

	<u>Page</u>
General Information SKT-SP & FLEAT-SP Designs.....	2-3
SKT & FLEAT Design Options .....	4-5
Begin Assembly – Drawing & Photo Details .....	6
Bill of Materials for SKT-SP .....	6
Plan and Elevation View of SKT-SP System / <b>Figure 1</b> .....	7
Optional Flared Installation for SKT-SP / <b>Figure 2</b> .....	8
Bill of Materials for FLEAT-SP .....	9
Plan and Elevation View of FLEAT-SP System / <b>Figure 3</b> .....	10
View of SKT-SP End Post #1 / <b>Figure 4</b> .....	11
View of FLEAT-SP End Post #1 / <b>Figure 5</b> .....	12
Post #1 Connection Detail for SKT-SP & FLEAT-SP / <b>Figure 6</b> .....	13
Post #2 Connection Detail for SKT-SP & FLEAT-SP / <b>Figure 7</b> .....	14
Installation of Cable Anchor Bracket Shoulder Bolts / <b>Figure 8</b> .....	15
Installation of Cable Anchor Bracket for SKT-SP & FLEAT-SP / <b>Figure 9</b> ...	15
Impact Head Connection for SKT-SP & FLEAT-SP / <b>Figure 10</b> .....	16
Grading Recommendations for SKT-SP / <b>Figure 11</b> .....	17
Grading Recommendations for FLEAT-SP / <b>Figure 12</b> .....	18
Installing the SKT-SP & FLEAT-SP .....	19
Materials .....	19
Site Preparation .....	19
Tools Required .....	19
Installation Procedures .....	19
Installing Standard Steel Guardrail Posts #3 and Beyond.....	20
Installing Breakaway Steel End Posts #1 and #2.....	20
Installing Guardrail .....	21
Installing Cable Anchor Bracket.....	21
Installing SKT-SP or FLEAT-SP Impact Head.....	22
Installing Cable Assembly .....	22
Inspection Checklist for SKT-SP & FLEAT-SP .....	23
Repairing the SKT-SP & FLEAT-SP .....	24

# General Information

## For **SKT-SP** & **FLEAT-SP**

### Steel Post Designs

The **SKT-SP** & **FLEAT-SP** were crash tested to meet the requirements of NCHRP Report 350 Test Level 3 (100 km/hr) and Test Level 2 (70 km/hr). Refer to specific State DOT standards and specifications for allowable design alternatives. It is the responsibility of the installer to utilize a design approved by the State DOT and to follow all required State procedures in installing the **SKT-SP** and **FLEAT-SP**.

#### **This Installation Manual is divided into 6 sections**

- General Information for **SKT-SP** & **FLEAT-SP** Steel Post Designs.
- **SKT** & **FLEAT** Design Options – This area describes the many different post options (steel and wood posts) to choose from for the **SKT** & **FLEAT**. (pages 4 - 5)
- **SKT-SP** & **FLEAT-SP** Drawing & Photo Details – This area shows a bill of materials and assembly details for the **SKT-SP** and **FLEAT-SP**. (pages 6 - 18)
- Installing the **SKT-SP** & **FLEAT-SP** – This section gives a step-by-step procedure on the proper assembly of **SKT-SP** & **FLEAT-SP** Standard Post systems. (pages 19 - 22)
- Inspection Checklist for **SKT-SP** & **FLEAT-SP** – Use the checklist to inspect new installations or recently maintained/repaired installations. (page 23)
- Repairing the **SKT-SP** & **FLEAT-SP** – This section gives general repair procedures for the **SKT-SP** & **FLEAT-SP** Standard Post systems. (page 24)

#### **The Following Pay Limit Lengths are accepted for use with the **SKT-SP****

Measurement and payment shall be for each **SKT-SP** Standard Post Guardrail End Treatment measured complete and in place as shown in the installation instructions and on the contract plans. The pay limit options may be as shown below:

- 3.81 m – **Hinged Posts #1 & #2**. Posts #3 - #7 shall be W150 x 13.5 x 1.83 m standard guardrail posts (for a TL-3 system).
- 7.62 m – **Hinged Posts #1 & #2**. Posts #3 - #7 shall be W150 x 13.5 x 1.83 m standard guardrail posts (for a TL-3 system). If this is a TL-2 (70 km/h), requires 5 total posts.
- 11.43 m – **Hinged Posts #1 & #2**. Posts #3 - #7 shall be W150 x 13.5 x 1.83 m standard guardrail posts.
- 15.24 m – **Hinged Posts #1 & #2**. Posts #3 - #8 shall be W150 x 13.5 x 1.83 m standard guardrail posts. This is a TL-3 system and has a 15.24 m pay limit.

If the **SKT-SP** is designed to attach to a rigid barrier, a transition to gradually increase the stiffness in the W-Beam shall be required. The terminal would have a length of 15.24 m for TL-3 applications.

Check the State standard sheets or contract plans to see which option is approved in your State.

# General Information (continued)

The **SKT-SP** is a tangent terminal and no offset is required. However to avoid nuisance impacts, a straight flare offset of 300 mm but no more than 600 mm is recommended over a 15.24 m length. For TL-2 applications, the flare rate is the same and the allowable offset is variable anywhere between zero and 300 mm over a 7.62 m length. Design, selection & placement of the **SKT-SP** system shall conform to the *AASHTO Roadside Design Guide* and the details shown on the contract plans. The assembly of the **SKT-SP** shall be in accordance with the recommendations of Road Systems, Inc.

## **The Following Pay Limit Lengths are accepted for use with the FLEAT-SP**

Measurement and payment shall be for each **FLEAT-SP** Standard Post Guardrail End Treatment measured complete and in place as shown in the installation instructions and on the contract plans. The pay limit options may be as shown below:

- 3.81 m – **Hinged Posts #1 & #2**. Posts #3 - #7 shall be W150 x 13.5 x 1.83 m standard guardrail posts (for a TL-3 system).
- 7.62 m – **Hinged Posts #1 & #2**. Posts #3 - #7 shall be W150 x 13.5 x 1.83 m standard guardrail posts (for a TL-3 system). If this is a TL-2 (70 km/h), requires 5 total posts.
- 11.43 m – **Hinged Posts #1 & #2**. Posts #3 - #7 shall be W150 x 13.5 x 1.83 m standard guardrail posts.

If the **FLEAT-SP** is designed to attach to a rigid barrier, a transition to gradually increase the stiffness in the W-Beam shall be required. The terminal would have a length of 11.43 m for TL-3 applications.

Check the State standard sheets or contract plans to see which option is approved in your State.

The **FLEAT-SP** shall be installed on a straight flare. The allowable offset is variable anywhere between 760 mm and 1.22 m over a 11.43 length. For TL-2 applications, the flare rate is the same and the allowable offset is variable anywhere between 510 mm and 810 mm over a 7.62 m length. Design, selection and placement of the **FLEAT-SP** system shall conform to the *AASHTO Roadside Design Guide* and the details shown on the contract plans. The assembly of the **FLEAT-SP** shall be in accordance with the recommendations of Road Systems, Inc.

# SKT & FLEAT Design Options

There are many different support post options available for the SKT & FLEAT as shown below.

<u>SKT or FLEAT Support Post Design Options</u>	Number of Bolted Hinged <b>Steel</b> Posts	Number of <b>Standard Steel</b> Guardrail Posts	Number of Plug Weld <b>Steel</b> Posts	Number of <b>Wood</b> BCT Posts 3'-9" long	Number of <b>Wood</b> CRT Posts 6'-0" long	Number of <b>Foundation Tubes</b>
<b>SKT-SP &amp; FLEAT-SP</b> Standard Steel Guardrail Post System	SKT - 2 FLEAT - 2  <i>Post #1 is 150 mm x 150 mm upper tube with W150 x 22 lower post</i> <i>Post #2 is W150 x 13.5 upper &amp; lower post</i>	SKT - 6 FLEAT - 5	- 0-	- 0-	- 0-	- 0-
All <u>Hinged Steel</u> Post System	SKT - 2 long, 6 medium FLEAT - 2 long, 5 medium	- 0-	- 0-	- 0-	- 0-	- 0-
All <u>Plug Weld Steel</u> Post System	- 0-	- 0-	SKT - 2 short, 6 medium FLEAT - 2 short, 5 medium	- 0-	- 0-	SKT - 2 FLEAT - 2
<u>Hinged &amp; Plug Weld Steel</u> Post System	SKT - 2 long FLEAT - 2 long	- 0-	SKT - 6 medium FLEAT - 5 medium	- 0-	- 0-	- 0-
<u>Hinged Steel &amp; Wood</u> Post System	SKT - 2 long FLEAT - 2 long	- 0-	- 0-	- 0-	SKT - 6 FLEAT - 5	- 0-
All <u>Breakaway Wood</u> Post System	- 0-	- 0-	- 0-	SKT - 2, 4 or 8 FLEAT - 2 only	SKT - 6, 4 or 0 FLEAT - 5 only	SKT - 2, 4 or 8 FLEAT - 2 only

NOTE: The above is based on a 15.24 m long SKT system and a 11.43 m long FLEAT system.

See next page for the approximate lengths of the posts that are shown in the above table.

Refer to other Wood Post & Steel Post Installation Manuals for additional information on installation of SKT & FLEAT other than "SP" Standard Post option.

## SKT & FLEAT Design Options (continued)

**Post Lengths & Descriptions:** Shown below are the different posts identified in the table on the previous page. The approximate lengths of posts that are shown are for reference only and are for the purpose of identifying a general length relative to the other posts. These post lengths may not be an exact length.

- **Standard Steel Guardrail Posts** are used for the **SKT-SP** and **FLEAT-SP**. They are W150 x 13.5 and are 1.83 m long.
- **BCT Wood Posts** are 140 mm x 190 mm x 1.14 m long having (1) breakaway hole and they are inserted in a steel foundation tube.
- **CRT Wood Posts** are 150 mm x 200 mm x 1.83 m long and have (2) breakaway holes.
- **Long Hinged Steel Posts** are approximately 2.6 m long and must be bolted together in the field.
- **Medium Hinged Steel Posts** are 1.83 m long and must be bolted together in the field.
- **Medium Plug Weld Steel Posts** are 1.83 m long and are shipped as a welded assembly.
- **Short Plug Weld Steel Posts** are approximately 1.07 m long and inserted in a foundation tube. They are shipped as a welded assembly.
- **Steel Foundation Tubes** at post locations #1 & #2 may be either 1.83 m long (no soil plate needed) or 1.37 m or 1.52 m long (with a soil plate). When foundation tubes are used at post locations #3 and beyond (for the SKT only) they are 1.37 m long and do not require soil plates.

# Begin Assembly – Drawing & Photo Details

ITEM	QTY	BILL OF MATERIALS	ITEM NO.
A	1	SKT IMPACT HEAD	S3000
B	1	SKT ANCHOR RAIL 3810	SF1303
C	3	W-BEAM GUARDRAIL 3810	G1203
D	1	FIRST POST TOP (150X150X3 Tube)	TPHP1A
E	1	FIRST POST BOTTOM (W150X22)	TPHP1B
F	1	UNIVERSAL HINGE POST #2 UPPER	UHP2A
G	1	HINGED POST LOWER	HP-B
H	6	STEEL LINE POST 1829 (W150x13.5)	P621
J	1	BEARING PLATE	E750
K	1	CABLE ANCHOR BOX	S760
L	1	BCT CABLE ANCHOR ASSEMBLY	E770
M	6	RECYCLED PLASTIC BLOCK OR EQUIV.	CBSP-14
HARDWARE (ALL DIMENSIONS IN MM)			
a	2	8 x 25 HEX BOLT GRD 5	B5160104A
b	4	8 WASHER	W0516
c	2	8 HEX NUT	N0516
d	25	16 x 32 SPLICE BOLT	B580122
e	1	16 x 229 HEX BOLT GRD 5	B580904A
f	6	16 x 254 H.G.R. BOLT	B581002
g	3	16 WASHER	W050
h	31	16 H.G.R NUT	N050
j	1	16 NUT	N055
k	1	19 x 216 HEX BOLT GRD A449	B340854A
l	1	19 HEX NUT	N030
m	2	25 ANCHOR CABLE HEX NUT	N100
n	2	25 ANCHOR CABLE WASHER	W100
o	8	13 RSI SHOULDER BOLT W/WASHER	SB12A
p	8	13 STRUCTURAL NUT	N012A
q	8	13 STRUCTURAL WASHER	W012A
r	1	BEARING PLATE RETAINER TIE	CT-100ST

Post #3 and beyond are W150 x 13.5 x 1.83 m long standard steel guardrail posts.

Note that a ground strut is not used with the SKT-SP system.

**Bill of Materials for SKT-SP (NOTE: 15.24 m Pay Limit shown)**

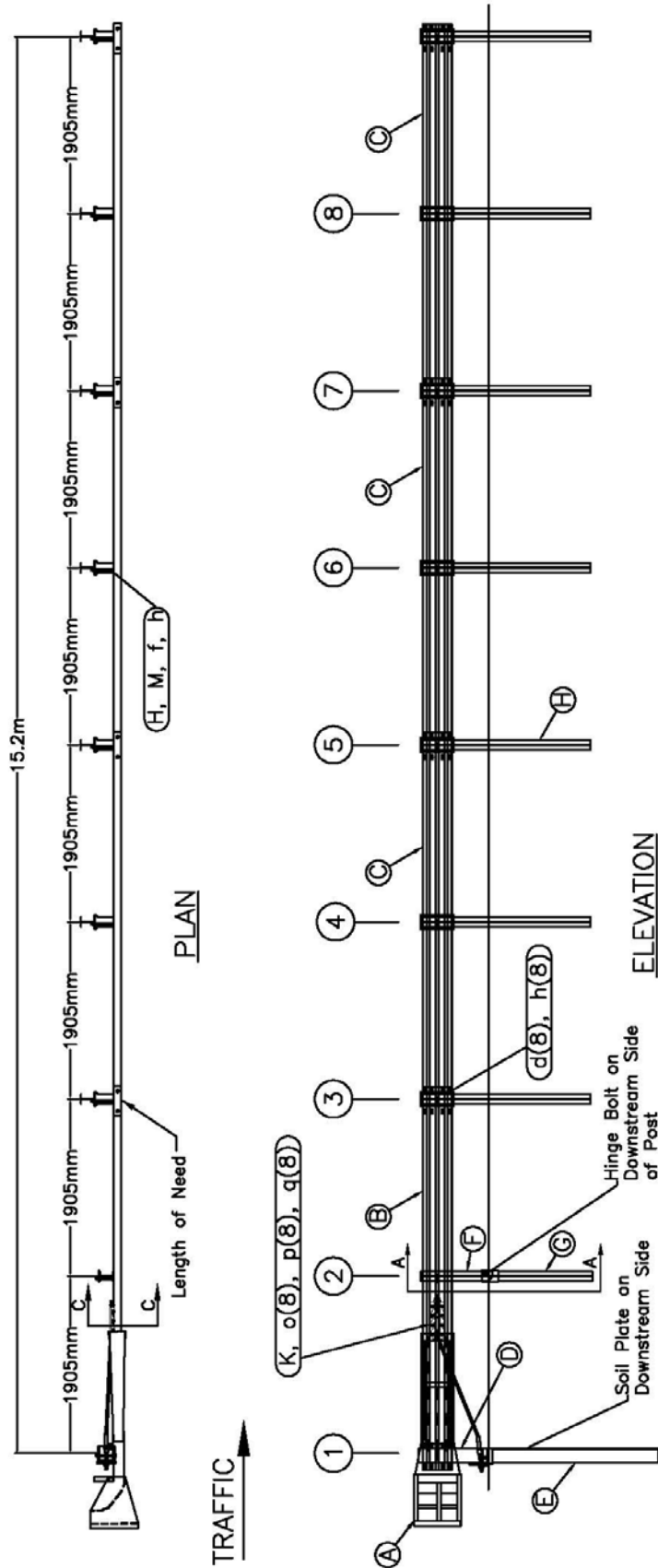
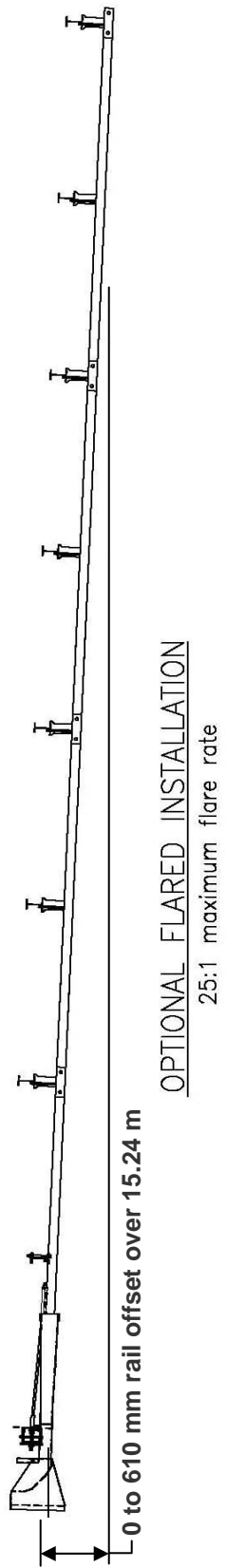


Figure 1. Plan and Elevation View of SKT-SP Standard Post System





Impact Head Feeder Guide Chute



Figure 2. Optional Flared Installation for SKT-SP

ITEM	QTY	BILL OF MATERIALS	ITEM NO.
A	1	FLEAT IMPACT HEAD	F3000
B	1	FLEAT ANCHOR RAIL 3810	SF1303
C	2	W-BEAM GUARDRAIL 3810	G1203
D	1	FIRST POST TOP (150X150X3 Tube)	TPHP1A
E	1	FIRST POST BOTTOM (W150X22)	TPHP1B
F	1	UNIVERSAL HINGE POST #2 UPPER	UHP2A
G	1	HINGED POST LOWER	HP-B
H	5	STEEL LINE POST 1829 (W150x13.5)	P621
J	1	BEARING PLATE	E750
K	1	CABLE ANCHOR BOX	S760
L	1	BCT CABLE ANCHOR ASSEMBLY	E770
M	5	RECYCLED PLASTIC BLOCK OR EQUIV.	CBSP-14
HARDWARE (ALL DIMENSIONS IN MM)			
a	2	8 x 25 HEX BOLT GRD 5	B5160104A
b	4	8 WASHER	W0516
c	2	8 HEX NUT	N0516
d	17	16 x 32 SPLICE BOLT	B580122
e	1	16 x 229 HEX BOLT GRD 5	B580904A
f	5	16 x 254 H.G.R. BOLT	B581002
g	3	16 WASHER	W050
h	22	16 H.G.R NUT	N050
j	1	16 NUT	N055
k	1	19 x 216 HEX BOLT GRD A449	B340854A
l	1	19 HEX NUT	N030
m	2	25 ANCHOR CABLE HEX NUT	N100
n	2	25 ANCHOR CABLE WASHER	W100
o	8	13 RSI SHOULDER BOLT W/WASHER	SB12A
p	8	13 STRUCTURAL NUT	N012A
q	8	13 STRUCTURAL WASHER	W012A
r	1	BEARING PLATE RETAINER TIE	CT-100ST

Post #3 and beyond are W150 x 13.5 x 1.83 m long standard steel guardrail posts.

Note that a ground strut is not used with the FLEAT-SP system.

**Bill of Materials for FLEAT-SP (NOTE: 11.43 m Pay Limit shown)**

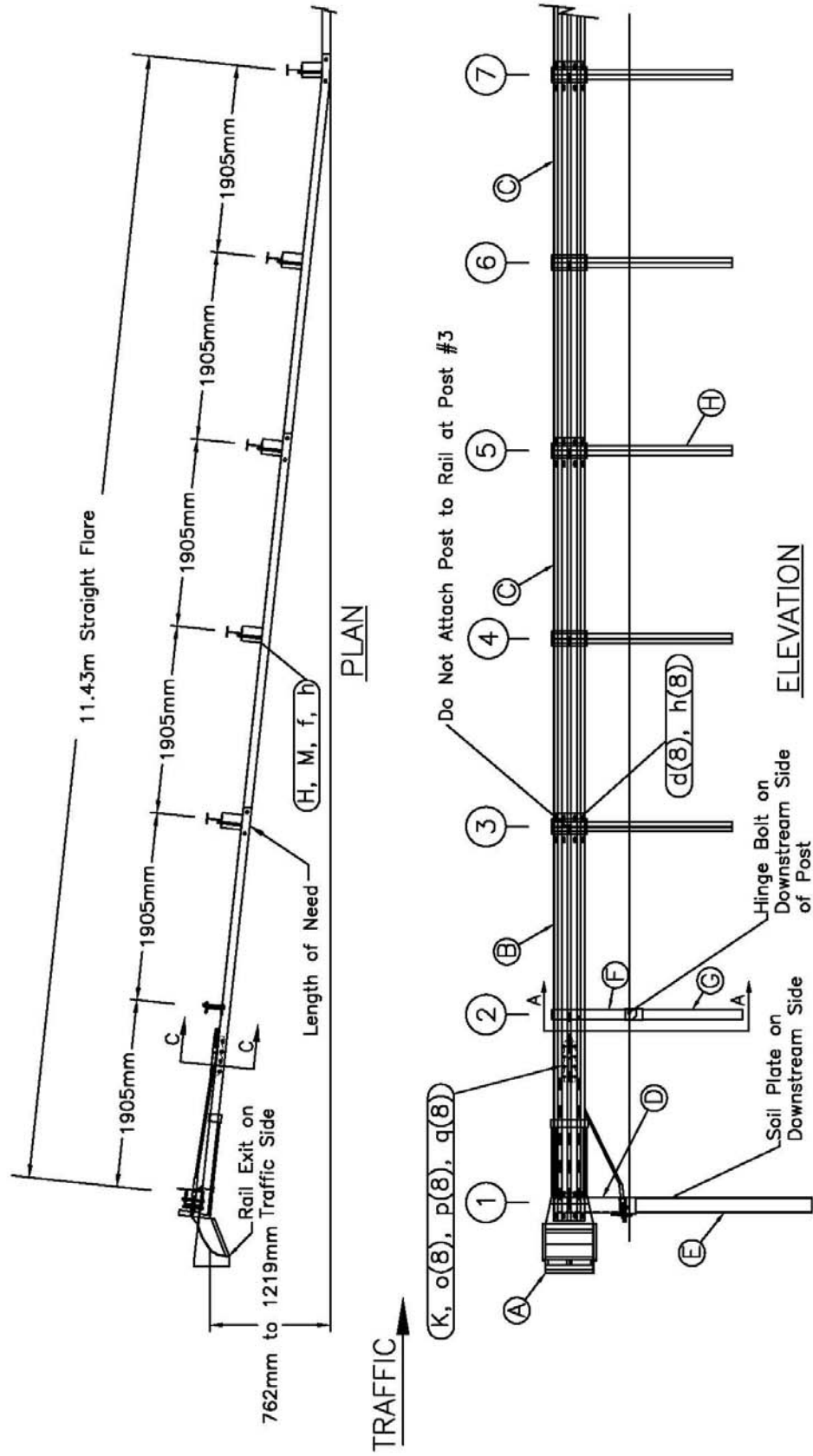
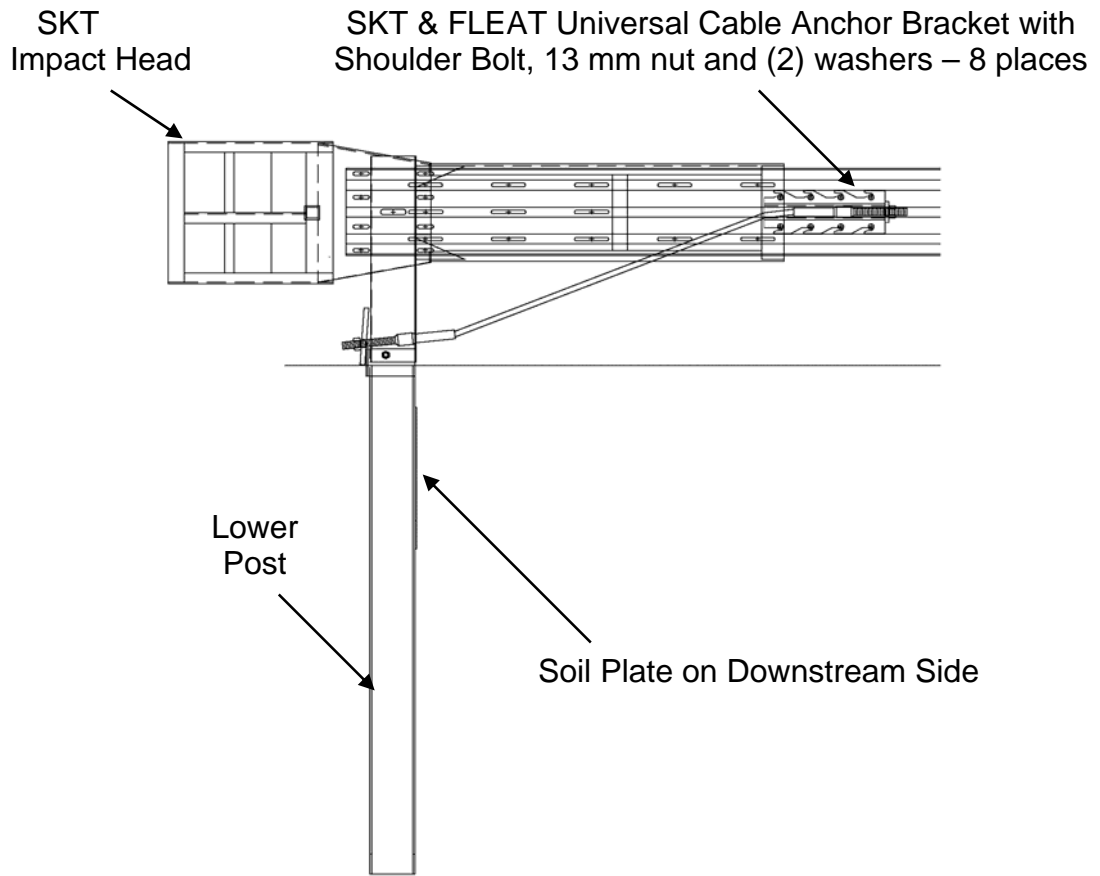
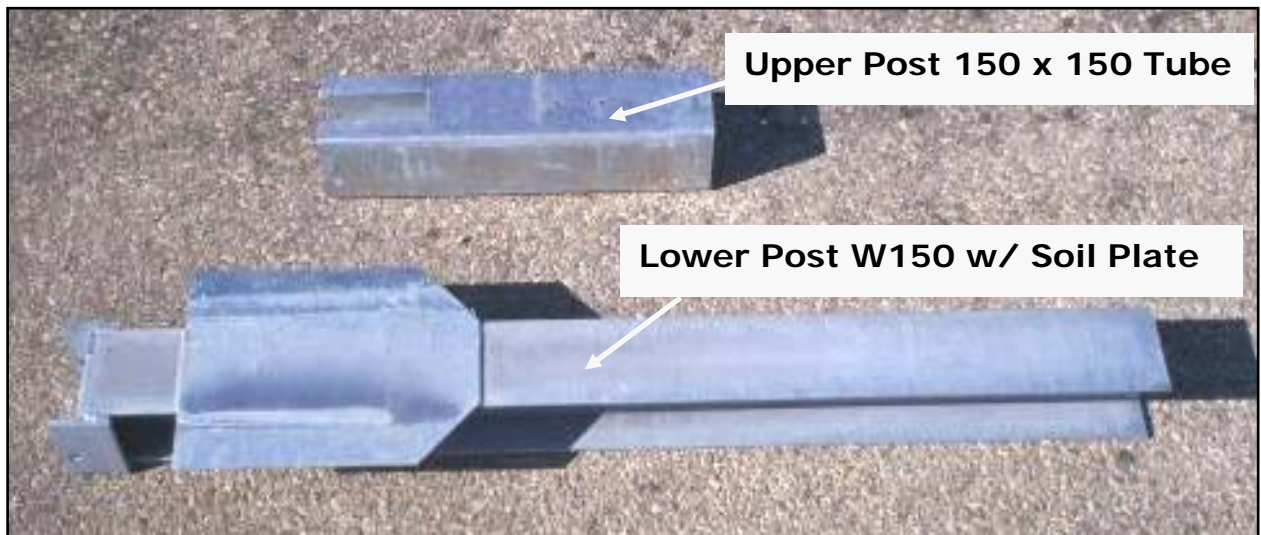


Figure 3. Plan and Elevation View of **FLEAT-SP** Standard Post System

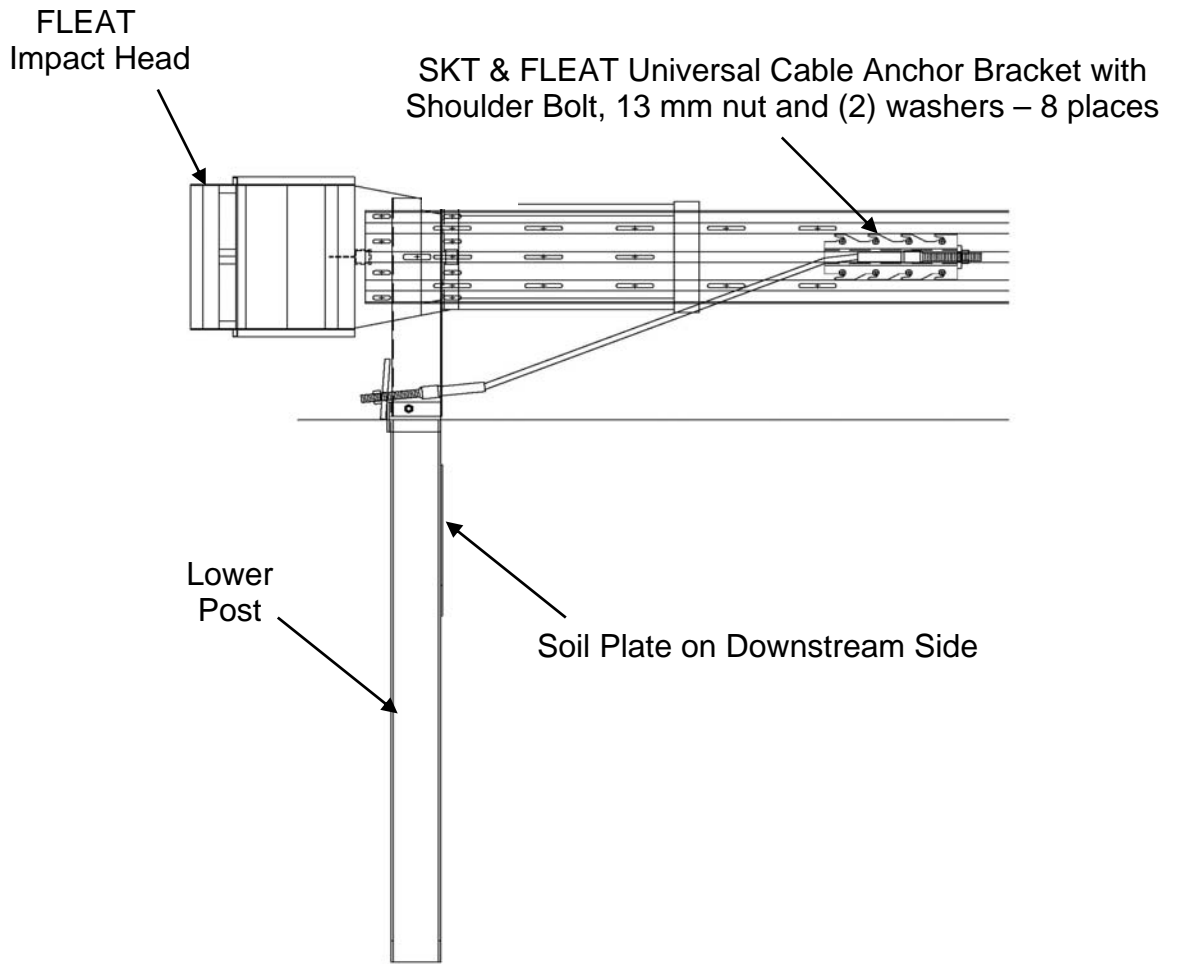


**NOTE:** Be sure the 16 mm x 229 mm hex bolt at Hinged Post #1 is on the upstream side of the post.



**NOTE:** The upper and lower posts are used for both the SKT-SP and FLEAT-SP

**Figure 4. View of SKT-SP Steel End Post #1**



**NOTE:** Be sure the 16 mm x 229 mm hex bolt at Hinged Post #1 is on the upstream side of the post.

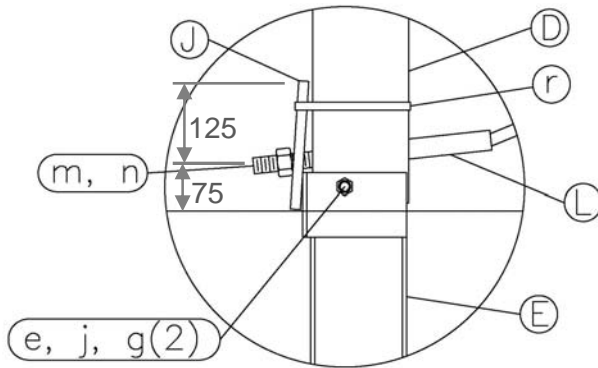


**Figure 5. View of FLEAT-SP Steel End Post #1**



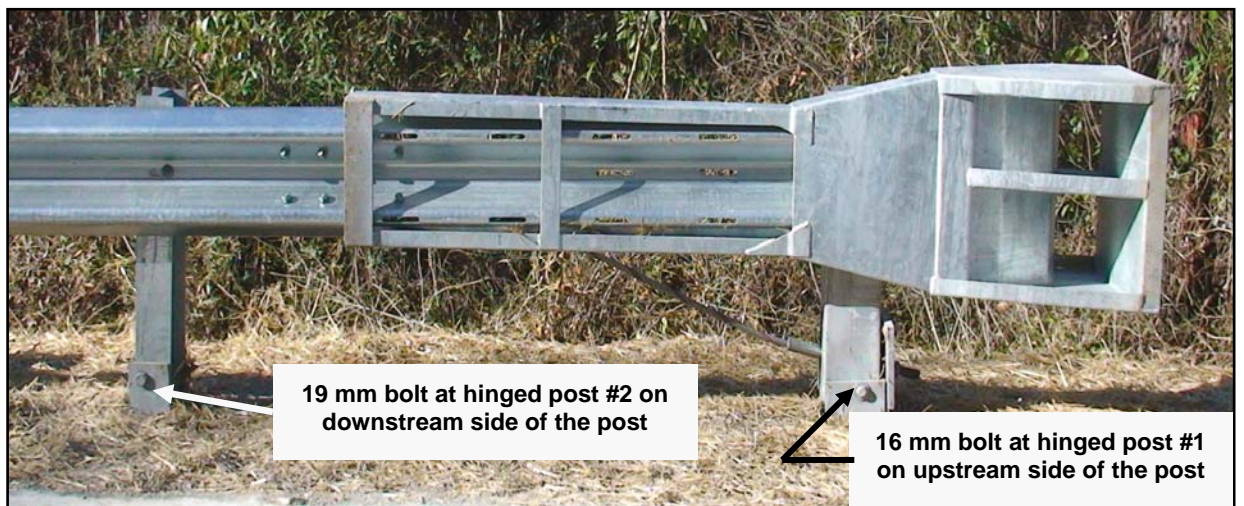


(Note that retainer tie to keep bearing plate from rotating is not shown in this photo.)

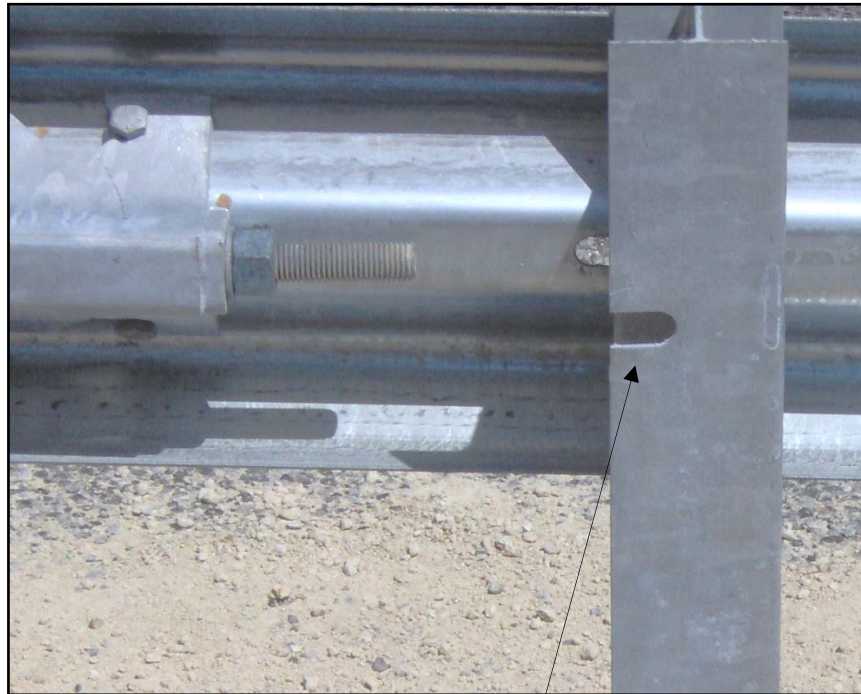


D	Upper Post #1 Tube 150 x 150
E	Lower Post #1 W150 with Soil Plate
J	Bearing Plate
L	Cable Anchor Assembly
e	16 x 229 Hex Bolt
g	16 Washer
j	16 Nut
m	25 Nut
n	25 Washer
r	Retainer Tie

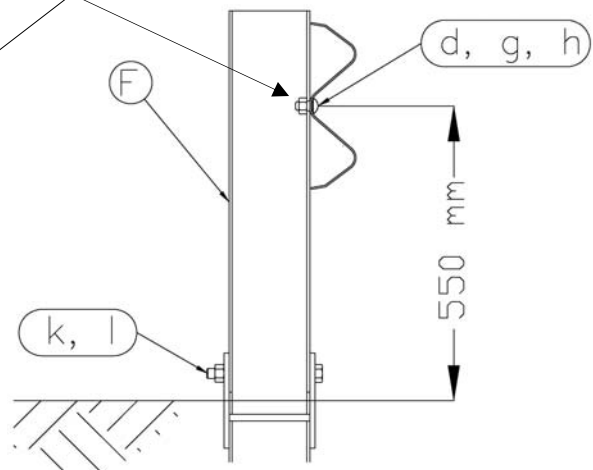
(SKT-SP shown. FLEAT-SP details similar.)



**Figure 6. Post #1 Connection Detail for SKT-SP & FLEAT-SP**



There is an open-ended slot in the flange of the post at the post bolt connection. Be sure upper post #2 is installed with this slot facing post #1.

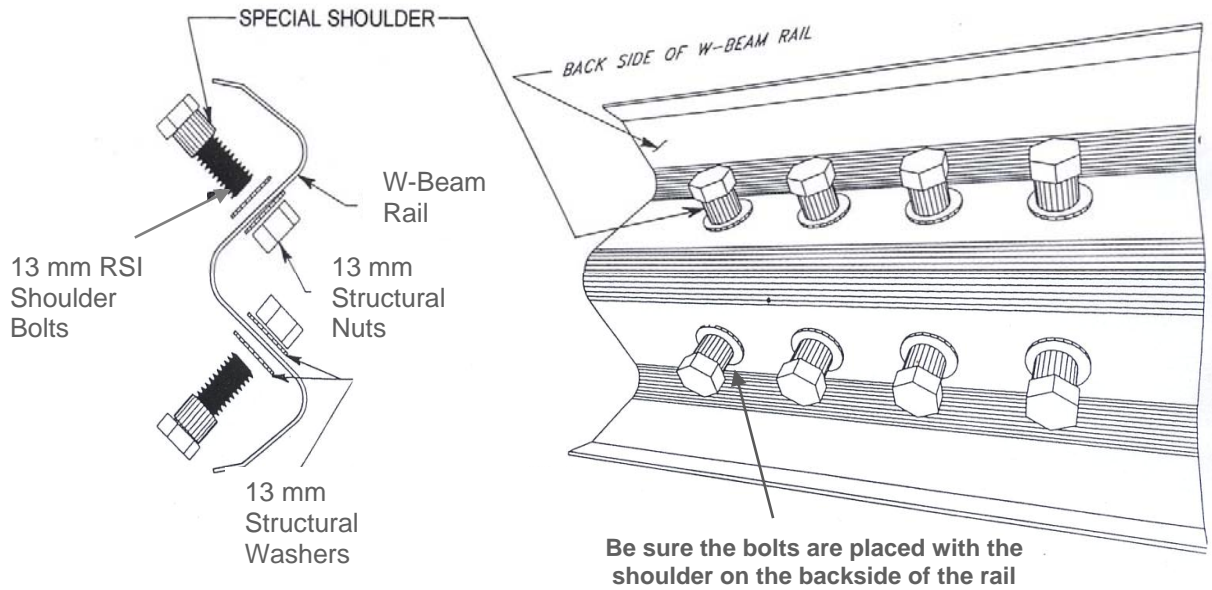


F	Upper Post #2 W150"
d	16 x 32 Guardrail Splice Bolt
g	16 Washer
h	16 HGR Nut
k	19 x 216 Hex Bolt
l	19 Hex Nut

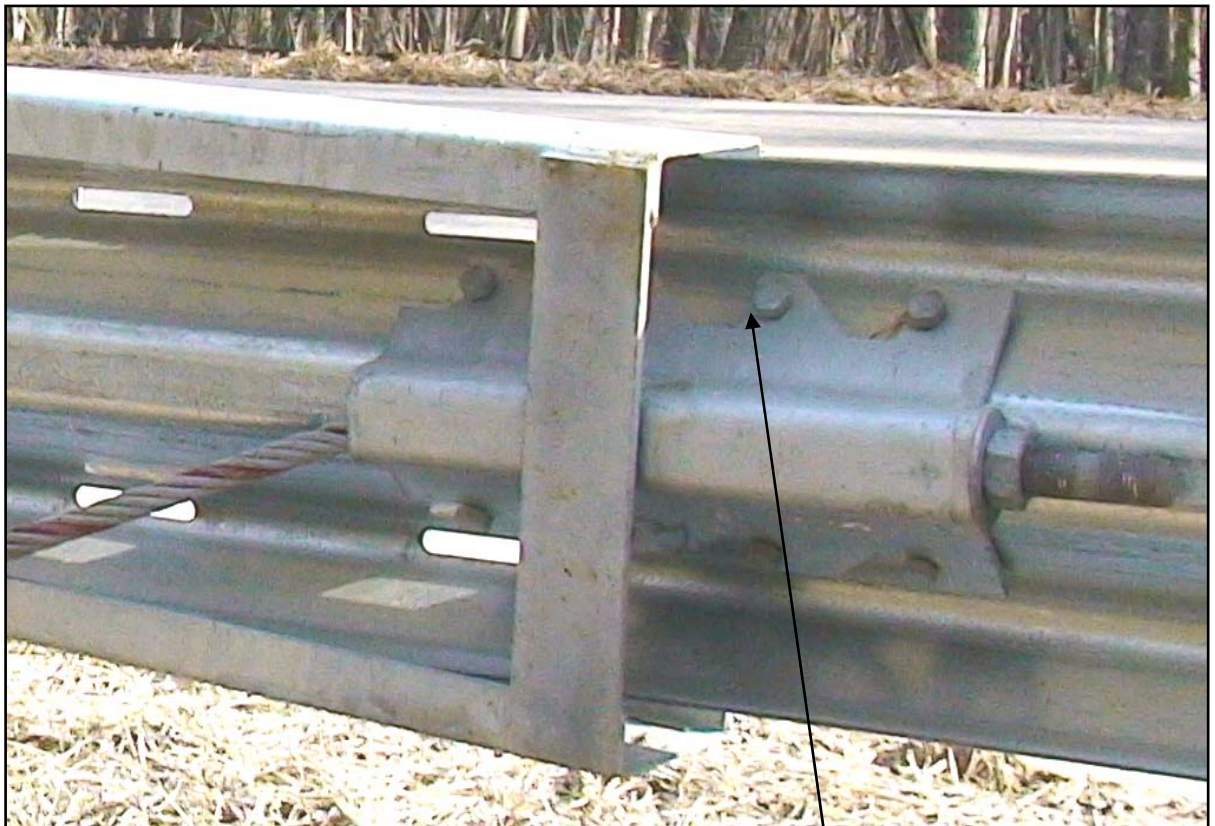
**NOTE:** Be sure the 19 mm x 216 mm hex bolt at Hinged Post #2 is on the downstream side of the post (toward post #3).

**Figure 7. Post #2 Detail for SKT-SP & FLEAT-SP**





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



It is important that the anchor bracket be fully seated on the shoulder portion of the cable anchor bolts

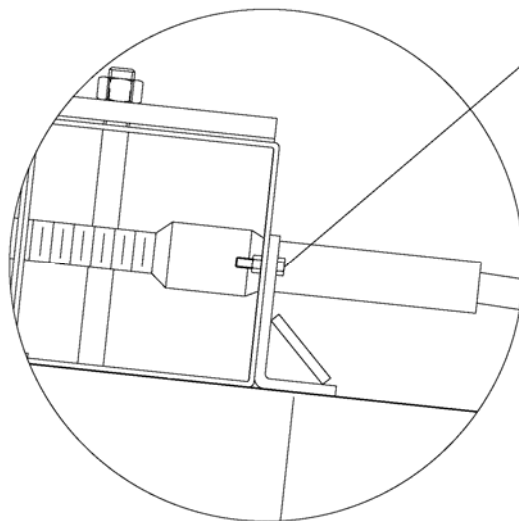
**Figure 9. Installation of Cable Anchor Bracket for SKT-SP & FLEAT-SP**



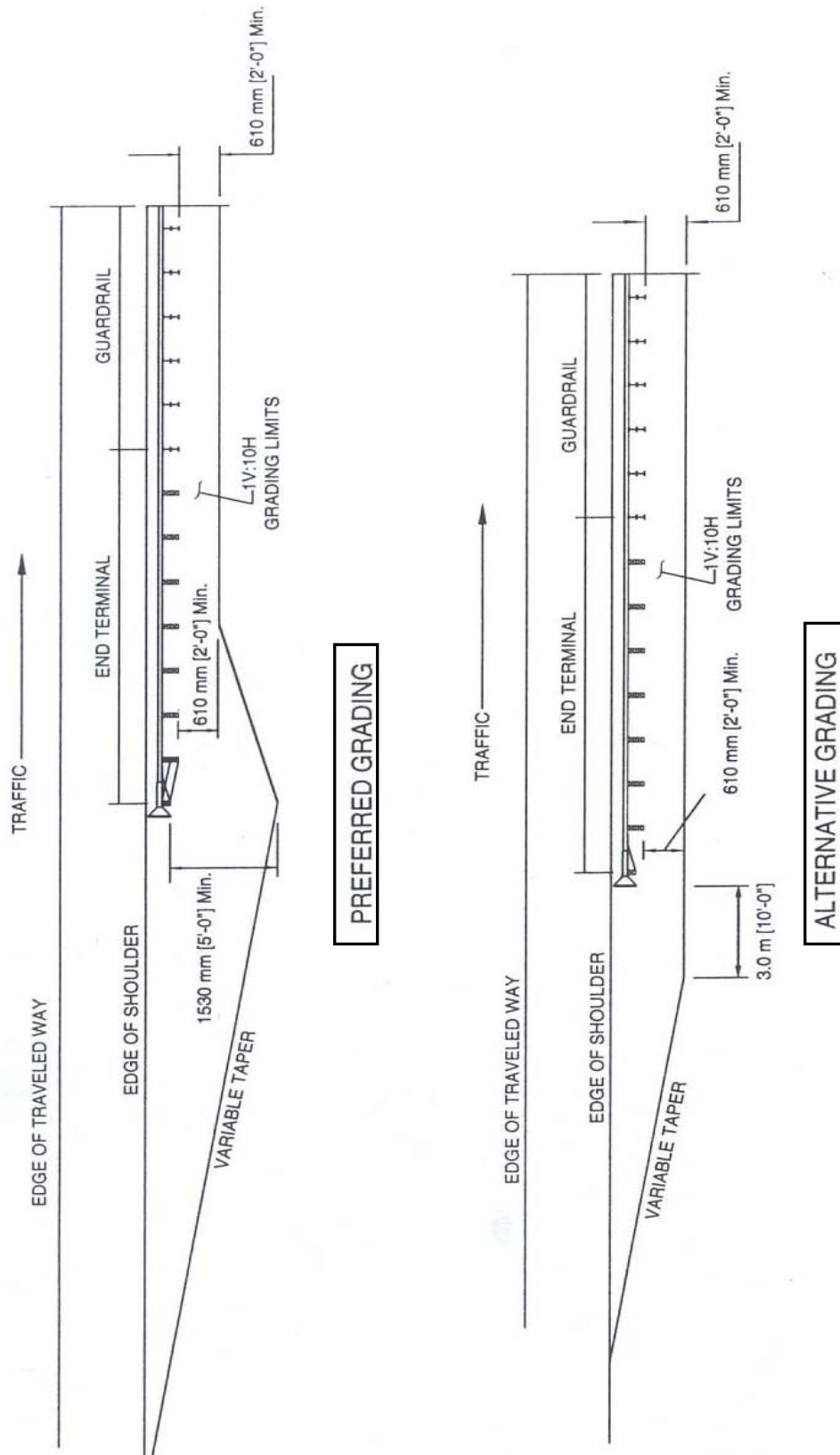


(SKT-SP shown. FLEAT-SP details similar.)

8 mm x 25 mm hex bolt w/  
nut & (2) washers – 2 places



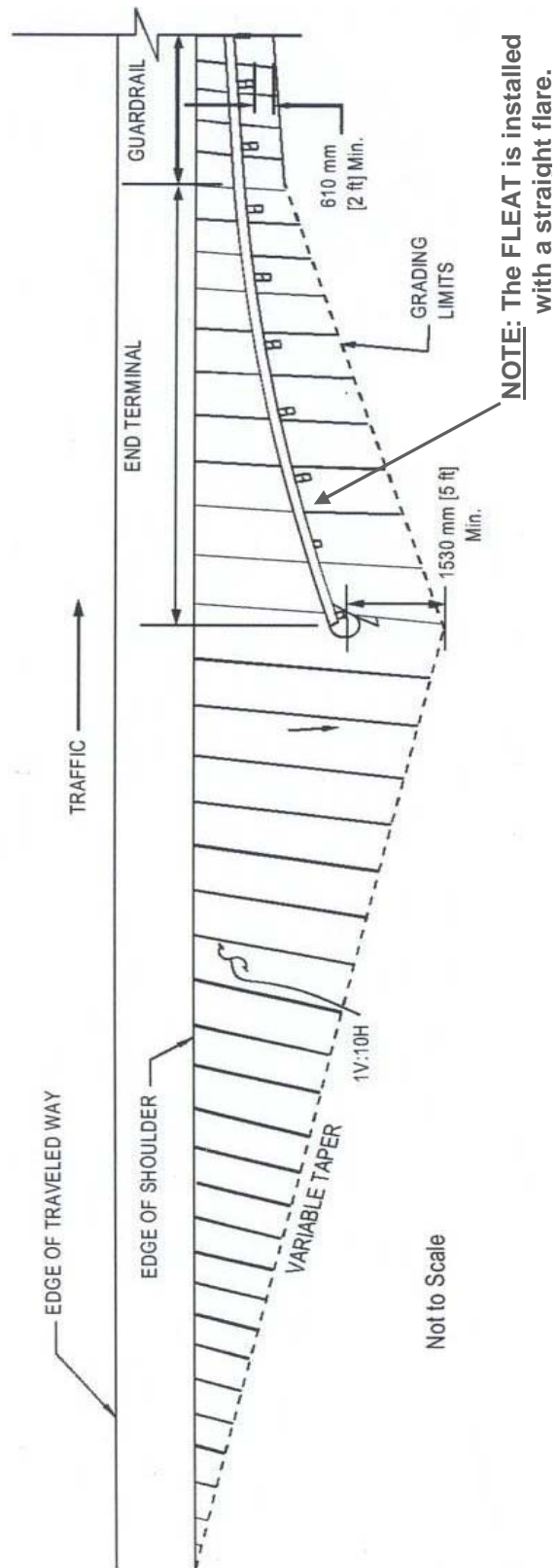
**Figure 10. Impact Head Connection Detail for SKT-SP & FLEAT-SP**



(Reference AASHTO Roadside Design Guide)

Figure 11. Grading Recommendations for **SKT-SP**

\*The preferred grading layout should be used wherever practical. However, because of site limitations, when upgrading an existing terminal with a crashworthy terminal meeting NCHRP Report 350 criteria, the alternative grading layout may be used.



Grading for flared guardrail end treatment

(Reference AASHTO Roadside Design Guide)

Figure 12. Grading Recommendations for **FLEAT-SP**

# Installing the SKT-SP & FLEAT-SP

## Materials

The pay limit lengths of the **SKT-SP** & **FLEAT-SP** are described under the **General Information** section on pages 2 and 3. The Test Level 2 systems are 7.62 m long. Refer to contract plans.

## Site Preparation

When the guardrail is installed parallel to the edge of the shoulder, for the **SKT-SP** a 25:1 (or less) flare away from the roadway is recommended so the impact head will not encroach on the shoulder thereby reducing the potential for nuisance impacts. The flare is not required and may be decreased or eliminated. See **Figure 2**.

The **FLEAT-SP** is installed with a straight flare having an offset anywhere between 760 mm and 1.22 m over a 11.43 length. Most times the offset will be 1.22 m. Refer to the contract plans for the required offset.

Site grading may be necessary for installations placed beyond the edge of the shoulder to prevent the lower section of the breakaway Steel Posts from extending more than 100 mm above the ground. See **Figure 11** for the **SKT-SP** and **Figure 12** for the **FLEAT-SP** grading recommendations.

## Tools Required

The tools required for installation of the **SKT-SP** & **FLEAT-SP** systems are the same as those used to install standard highway guardrails, including sockets & wrenches, a drill, and other equipment such as augers, tampers, & post pounders commonly used in driving guardrail posts.

## Installation Procedures

Begin the installation at the downstream end of the **SKT-SP** or **FLEAT-SP** to ensure that the terminal matches up with the standard downstream section of guardrail. The major steps in the installation of the terminal are as follows:

- Install standard steel guardrail posts #3 and beyond.
- Install breakaway steel end posts #1 and #2.
- Install guardrail. All posts are spaced at 1.905 m.
- Install cable anchor bracket.
- Install the **SKT-SP** or **FLEAT-SP** impact head.
- Install cable assembly.

## ***Installing Standard Steel Guardrail Posts #3 and Beyond***

All posts at locations #3 and beyond are W150 x 13.5 x 1.83 m long standard steel guardrail posts. All posts are spaced at 1.905 m centers. The finished guardrail height should be approximately 705 mm above the edge of the shoulder or the finished grade. A height of up to 762 mm is allowable.

For the **SKT-SP**, if the pay limit for the system is 15.24 m long, posts #3 - #8 will be standard steel guardrail posts. See **Figure 1**.

For the **FLEAT-SP**, if the pay limit for the system is 11.43 m long, posts #3 - #7 will be standard steel guardrail posts. See **Figure 3**.

The acceptable pay limit lengths of the **SKT-SP** & **FLEAT-SP** are described under the **General Information** section on pages 2 and 3.

## ***Installing Breakaway Steel End Posts #1 and #2***

Steel posts #1 & #2 are hinged steel posts. These bolted posts must have the lower section installed before attaching the top section. The lower section of the bolted hinged steel posts should not be driven with the upper post attached. *Note that a ground line strut is not required.* Since there is no ground line strut, be sure posts #1 and #2 are spaced at 1.905 m centers.

Upper and lower Post #2 are W150 x 13.5 sections. Bolt upper and lower post #2 together with a 19 x 216 hex bolt and nut. Since a ground strut is not used with the **SKT-SP** or **FLEAT-SP**, an 203 hex bolt will also work. Be sure when the lower segment of the post is installed, the hinge bolt is on the downstream side of the post (opposite the impact head). The upper post #2 has an open-ended slot for the post bolt. Be sure this slot is on the upstream side of the post (toward the impact head). See **Figure 7** for both the **SKT-SP** & **FLEAT-SP** post #2.

Upper Post #1 is a 150 x 150 tube section. Lower Post #1 is a W150 x 22 post with a soil plate welded to the post. Bolt upper and lower post #1 together with a 16 x 229 hex bolt, nut and (2) washers. Be sure when the post is installed, the hinge bolt is on the upstream side of the post (toward the impact head). Be sure when the lower segment of the post is installed, the soil plate is on the downstream side of the post (opposite the impact head). For the **SKT-SP** post #1 see **Figures 4 & 6**. For the **FLEAT-SP** post #1 see **Figures 5 & 6**.

The top of the lower post #1 & #2 stubs should not project more than 100 mm above the ground line when measured along a 1.5 m cord, in compliance with AASHTO specifications. Site grading may be required if the top of the lower post section project more than 100 mm above the ground line.

For stiff soils, drill a pilot hole and force the post to the proper depth by impact or vibratory means with an appropriate driving head. Be careful not to drive on the side plates of the lower posts as they may be damaged.

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 for how to proceed. Guidelines will vary from State to State.



## ***Installing Guardrail***

Attach the standard W-beam guardrail sections (3.81 or 7.62 m long) downstream of post #3. Attach the **SKT-SP** or **FLEAT-SP** W-beam guardrail end section to span from post 1 to 3 for a 3.81 m long rail, or from post 1 to 5 for a 7.62 m long rail. Most times a universal end panel with 1.905 m post spacing would be supplied. The *universal end panel* can be identified with eight (8) holes 19 mm diameter to attach the cable anchor bracket and thirteen (13) slots. Ten (10) slots 13 x 100 mm are in the corrugations of the rail and three (3) slots 13 x 100 mm are in the valley of the rail.



The **SKT-SP** may use an end panel with only three (3) slots 13 x 100 mm in the valley of the rail. The **FLEAT-SP** may use an end panel with only ten (10) slots 13 x 100 mm in the corrugations of the rail. The other W-Beam railing sections in the **SKT-SP** or **FLEAT-SP** shall be the same used in highway guardrail with 1.905 m post spacing.

The required offset for the **FLEAT-SP** is achieved by first splicing the guardrail panels together then manually pushing the rails back. Shop curving or bending is not required. All rails are spliced with 16 x 32 mm H.G.R. (Highway Guard Rail) bolts and 16 mm H.G.R. nuts.

The **SKT-SP** rails are to be attached to posts and blockouts at post locations #3 and beyond with 16 x 254 mm H.G.R. bolts and nuts. The **FLEAT-SP** rails are to be attached to posts and blockouts at post locations #4 and beyond. There is no blockout used on posts 1 and 2. The end rail for the **SKT-SP** & **FLEAT-SP** is attached to post #2 with a 16 x 32 mm H.G.R. bolt and nut. A post bolt is never used at post #1 for the **SKT-SP** & **FLEAT-SP**.

**NOTE:** The **FLEAT-SP** rail is not bolted to post #3.

It is recommended that the post bolt for the **SKT-SP** be placed through the rail at post location #5 where the rail splice occurs as that's how the system was crash tested. However, the system will still function properly if post bolt #5 is not attached to the rail.

**NOTE:** All of the W-Beam railing within the **SKT-SP** & **FLEAT-SP** terminal must be straight. Curving the rail within the terminal is not permitted.

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

The eight 13 mm cable anchor bracket (RSI) shoulder bolts are attached to the W-beam guardrail end section with two 13 mm structural washers, one on each side of the guardrail, and a 13 mm structural nut. Be sure the shoulder bolts are placed with the shoulders of the bolts installed 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 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. The welded plate on the cable anchor bracket should be toward Post #2, as shown in **Figure 9**. Be sure the bracket is fully seated on the shoulder portion of the bolts.

## ***Installing the SKT-SP or FLEAT-SP 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 **SKT-SP** or **FLEAT-SP** impact head to the first post. Note the **FLEAT-SP** impact head will be installed with the rail exit slot on the traffic side.

Place the impact head with the feeder guide chute over the end of the W-beam guardrail. The impact head should be positioned so that the protruding tube is on the backside of the guardrail, away from traffic as shown in **Figures 5 & 6**. Slide the impact head forward until the post angle attachments on the impact head are aligned with the holes in post #1 (150 x 150 x 3 mm tube) as shown in **Figure 10**. Attach the impact head to the first post with two 8 x 25 mm hex bolts, nut and (2) washers, one each for the top and bottom post angle attachments.

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

## ***Installing Cable Assembly***

Place the cable assembly through the cable anchor bracket and through the base of post #1. Note that for the **SKT-SP**, the cable assembly is fed inside through the feeder chute of the impact head. For the **FLEAT-SP** be sure the cable assembly is NOT fed through the feeder chute of the impact head.



The **SKT-SP** cable is fed inside through the feeder chute.  
The SKT feeder chute is longer than the FLEAT



The **FLEAT-SP** cable NOT  
to be fed inside the feeder chute

Place the bearing plate at the base of post 1 with the 125 mm dimension up and 75 mm dimension down. See **Figure 6**. Secure the bearing plate with a retainer/tie to prevent the plate from rotating. Secure both ends of the cable assembly with a 25 mm hex nut and washer. While tightening the cable, use a hammer to tap the cable anchor bracket from the downstream end to ensure that it is securely interlocked with the shoulder bolts. Restrain the cable at the end being tightened with vice grips or channel lock pliers to avoid twisting the cable.

Upon completion of the installation, the cable should be taut and the cable anchor bracket should be fully seated on the shoulder portion of the cable anchor bolts.

**NOTE:** It is very important that the cable anchor bracket be fully seated on the shoulder portion of the cable anchor bolts as shown in **Figure 9**.

# **SKT-SP & FLEAT-SP Inspection Checklist**

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

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

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

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

- The rail height is in accordance with the contract plans. This is approximately 705 mm above the edge of the finished grade. A height of up to 762 mm is allowable.
- There is no curved rail within the SKT-SP 15.24 m or FLEAT-SP 11.43 m (TL-3) length.
- The end rail section is not attached to the post at post location #1.
- The **FLEAT-SP** rail is not attached to the post at post location #3.
- The end rail panel has special slots and all rails are lapped in the proper direction.
- The 19 x 216 mm hinge bolt at post #2 is on the downstream side of the post.
- The 16 x 229mm hinge bolt at post location #1 is on the upstream side of the post.
- The lower stub at posts #1 and #2 do not protrude more than 100 mm above the ground line (measured by the AASHTO 1.5 m cord method). Site grading may be necessary to meet this requirement.
- At post #2, the open-ended slot at the post bolt is on the upstream side of the post.
- Standard steel W150 x 13.5 x 1.83 m guardrail posts are used at post locations #3 & beyond.
- All posts within the **SKT-SP** or **FLEAT-SP** are spaced at 1.905 m centers.
- The **SKT-SP** impact head does not encroach on the shoulder (a maximum 25:1 taper is permitted to eliminate the potential for encroachment).
- The **FLEAT-SP** is installed with a straight flare (offset between 760 mm and 1.22 m) over a 11.43 m terminal length.
- The two 8 x 25 mm hex bolts holding the impact head to post #1 are secured.
- The 200 x 200 mm bearing plate at post #1 is correctly positioned with the 125 mm dimension up and the 75 mm dimension down. The anchor cable is taut and correctly installed. A retainer/tie 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.
- If the posts were augered, the backfill material around the posts is properly compacted.
- No washers are used on the face of the rail except at the cable anchor bracket bolts.
- The finished installation is in accordance with all specific State DOT guidelines.

Additional notes:

\_\_\_\_\_  
\_\_\_\_\_

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



# Repairing the SKT-SP & FLEAT-SP

## Equipment Needed for Repair Operation

- Acetylene torch to cut off the damaged rail,
- Heavy duty chain to remove the impact head is sometimes required,
- Tools used to install standard highway guardrails, including sockets & wrenches, etc.,
- Vice grip or channel lock pliers,
- Sledge hammer,

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

## General Repair Procedures

After an end-on impact occurs with the **SKT-SP** or **FLEAT-SP**, it will normally require replacement of the first 3.81 or 7.62 m end section of rail and any other damaged rail section(s) and any broken post(s). For a traffic face impact downstream of the impact head, the damage will typically be to the downstream rail section(s) and associated posts.

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

- (1) Check the impact head for damage.
- (2) Check the cable assembly for damage. The cable anchor bracket, bearing plate, nuts, washers, cable anchor bracket, and the special cable anchor bracket shoulder bolts are rarely damaged.
- (3) Check the number of broken posts and blockouts that need to be replaced, along with any damaged bolts. Inventory and pick up the reusable parts.
- (4) Torch off the kinked rail at the exit opening near the outlet of the impact head. The impact head may be able to be removed by hand at this point. If not, then hook up a chain attachment through the opening behind the impact plate of the impact head. Pull the impact head off the rail with the chain attached to a truck frame with the W-beam guardrail still attached to the downstream guardrail posts.
- (5) Disconnect and remove the damaged rail from the posts.
- (6) Remove the damaged posts. Hinged posts #1 and #2 can be unbolted. Remove the standard steel “SP” standard guardrail posts.
- (7) Reinstall the system following the procedures listed in this manual.

