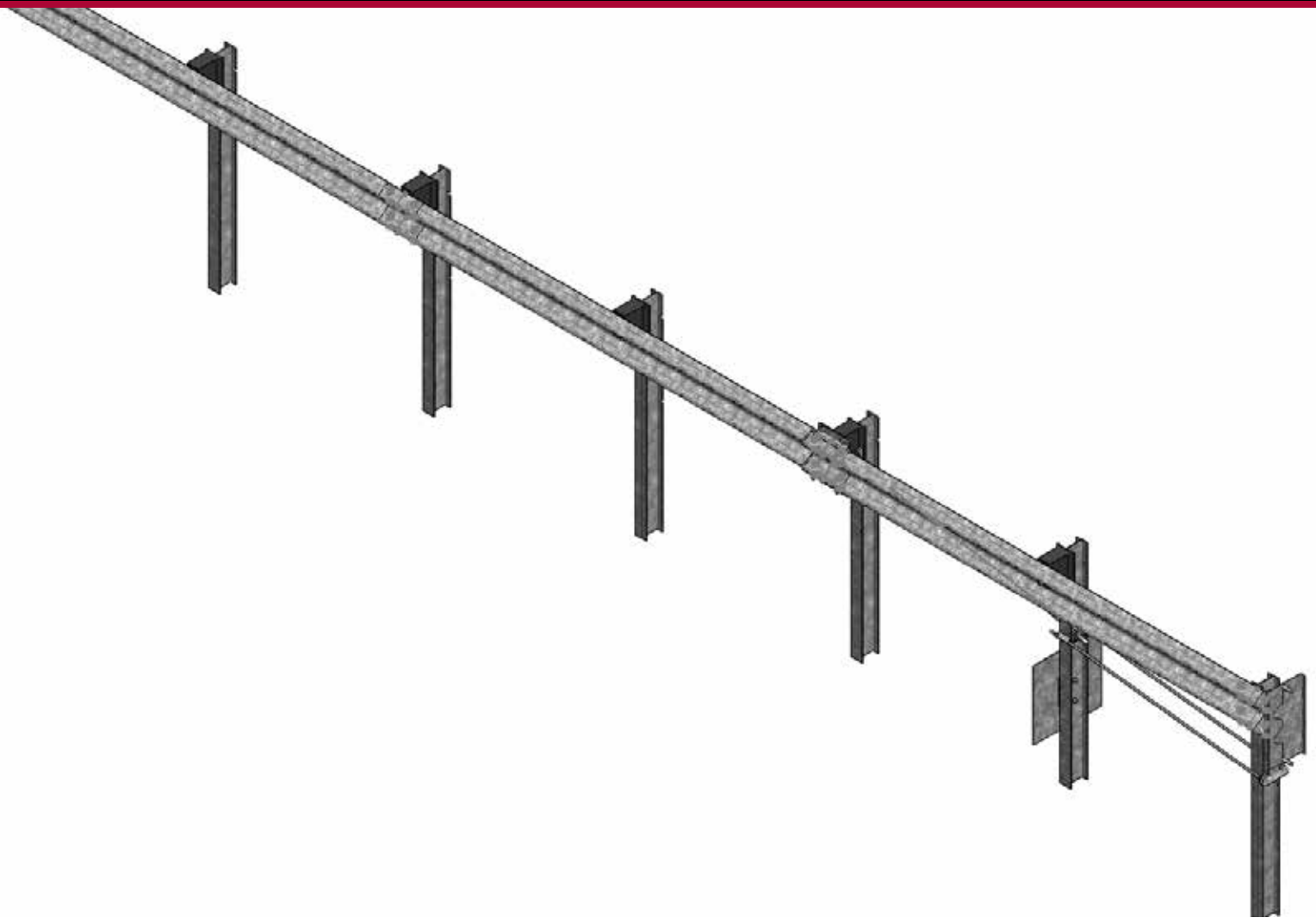
INSTALLATION MANUAL

X-LITE® FLARED

NCHRP 350 TL-3 Redirective, Gating, End Terminal



BARRIER SYSTEMS®
BY LINDSAY

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Preface

The X-Lite Guardrail End Terminal, Flared System incorporates the latest roadside safety technologies and engineering processes.

As with any roadside safety device, the X-Lite System must be installed in accordance with the manufacturer's specifications to ensure proper performance. Thoroughly review and fully understand the installation instructions and product limitations before starting the installation. Do not start the installation without the proper plans and tools required.

System Overview

The X-Lite System is a redirective, gating end terminal designed for shielding the ends of guardrail systems. The system offers exceptional vehicle control, energy absorbing capabilities in head on impacts, and is re-directive starting at Post 3. The X-Lite is comprised of a head unit, specially designed crimped posts, tension rods, cable assembly, slider assembly, and other standard guardrail components.

Before Installation

Placement and use of the X-Lite System 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 the circumstances at the site, installation should take an experienced two person crew with proper tools approximately two hours to complete.

The X-Lite System is a highly engineered safety device made up of a relatively small number of parts. It is available in both tangent and flared versions. Before starting installation, ensure that one is familiar with the make up of the system that is being installed. Prior to installation, ensure that proper manuals and components are on site.

Limitations and Warnings

The X-Lite System has been rigorously tested and evaluated per the recommendations in the National Cooperative Highway Research Program Report 350 (NCHRP Report 350) guidelines for end terminals and crash cushions. The impact conditions recommended in NCHRP Report 350 are intended to address in-service collisions.

When properly installed and maintained, the system is capable of stopping, containing, and redirective impacting vehicles in a predictable and safe manner under NCHRP Report 350 impact conditions. Vehicle impacts that vary from the NCHRP Report 350 impact conditions for gating, redirective end terminals may result significantly different than those experienced in testing.

Vehicle impact characteristics different than or in excess of those encountered in NCHRP Report 350 testing (speed and angle) may result in system performance that may not meet NCHRP Report 350 evaluation criteria.

If you need additional information, or have questions about the X-Lite System, please call the Lindsay Transportation Solutions Customer Service Department at (888) 800-3691 (U.S. toll free) or (707) 374-6800.

Preparation
Before installing the X-Lite System, ensure that all materials required for the system are onsite and have been identified.

Soil Conditions
The X-Lite has been designed to be installed in soil that meets or exceeds the AASHTO "standard soil" specification. If rock is encountered during post installation, refer to appropriate local and state specifications for installing guardrail posts in specific types of ground conditions.

Before Starting
For all applications, begin the installation from the downstream end of the system where it joins the standard guardrail system at Post 7.

Required Tools
The system uses standard tools required to install typical guardrail; the list below is a general recommendation.

- Post driver
- Tape measure
- String line
- Hammer
- Stakes
- Pry bar
- Crescent wrench
- Vice grips or clamps
- 1-5/8" (42 mm) Wrench
- ½" Ratchet
- 1-1/4" (32 mm) Socket
- Air impact wrench (optional)
- Pick ax
- Pipe wrench or large pliers
- Torque wrench
  (capable of applying 60 ft. lbs. torque)

Note: The tools list is a general recommendation. Depending on the specific characteristics of the job site, more or less tools may be necessary.
The tools listed are for US/Imperial fasteners. If metric hardware is used, use metric equivalents for the hardware as required.

The picture of the X-Lite System above illustrates how the System is referred to throughout this manual.

Required Tools

Standard Warranty

LIMITED WARRANTY

Barrier Systems, Inc. (BSI) has tested the impact performance of its barriers and crash cushion systems, and other highway safety hardware under controlled conditions, however, BSI does not represent nor warrant that the results of those controlled conditions would necessarily avoid injury to persons or property.

BSI EXPRESSLY DISCLAIMS ANY WARRANTY OR LIABILITY FOR CLAIMS ARISING BY REASONS OF DEATH OR PERSONAL INJURY OR DAMAGE TO PROPERTY RESULTING FROM ANY IMPACT, COLLISION OR HARMFUL CONTACT WITH THE PRODUCTS OR NEARBY HAZARDS OR OBJECTS BY ANY VEHICLE, OBJECTS OR PERSONS.

BSI warrants that any product or component part manufactured by BSI will be free from defects in material or workmanship. BSI will replace free of cost any product or component part manufactured by BSI that contains such a defect.

THE FOREGOING WARRANTY IS IN LIEU OF AND EXCLUDES ALL OTHER WARRANTIES NOT EXPRESSLY SET FORTH HEREIN, WHETHER EXPRESS OR IMPLIED BY OPERATION OF LAW OR OTHERWISE, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

BSI'S LIABILITY UNDER THIS WARRANTY IS EXPRESSLY LIMITED TO REPLACEMENT FREE OF COST (IN THE FORM AND UNDER THE TERMS ORIGINALLY SHIPPED), OR TO REPAIR OR TO MANUFACTURE BY BSI, PRODUCTS OR PARTS NOT COMPLYING WITH BSI SPECIFICATIONS, OR, AT BSI'S ELECTION, TO THE REPAYMENT OF AN AMOUNT EQUAL TO THE PURCHASE PRICE OF SUCH PRODUCTS OR PARTS, WHETHER SUCH CLAIMS ARE FOR BREACH OF WARRANTY OR NEGLIGENCE. BSI SHALL NOT BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL LOSSES, DAMAGES OR EXPENSES OF ANY KIND, INCLUDING, WITHOUT LIMITATION, ANY SUCH LOSSES, DAMAGES OR EXPENSES ARISING DIRECTLY OR INDIRECTLY FROM THE SALE, HANDLING OR USE OF THE PRODUCTS FROM ANY OTHER CAUSE RELATING THERETO, OR FROM PERSONAL INJURY OR LOSS OF PROFIT.

Any claim by the buyer with reference to products sold hereunder for any cause shall be deemed waived by the buyer unless BSI is notified in writing, in the case of defects apparent on visual inspection, within ninety (90) days from the delivery date, or, in the case of defects not apparent on visual inspection, within twelve (12) months from the said delivery date. Products claimed to be defective may be returned prepaid to BSI's plant for inspection in accordance with return shipping instructions that BSI shall furnish to the buyer forthwith upon receipt of the buyer's notice of claim. If the claim is established, BSI will reimburse that buyer for all carriage costs incurred hereunder.

The forgoing warranty benefits shall not apply to (i) any products that have been subject to improper storage, accident, misuse or unauthorized alterations, or that have not been installed, operated and maintained in accordance with approved procedures and (ii) any components manufactured by the buyer.

W030587 Rev. 6 revised April 3rd 2008

Parts Identification

Crimp Post (QTY. 5)
BSI-1012079-00

Post 2
BSI-1012086-00

Impact Head
BSI-1012103-00

Slider Panel (Back)
BSI-1012096-00

Slider Panel (Front)
BSI-1012093-00

Slider Bracket
BSI-1012090-00

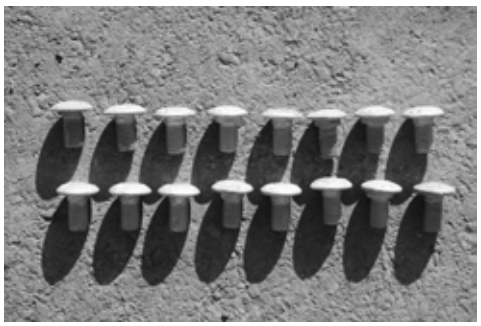
Shear Bolt Kit (8 yellow bolts per kit)
K080123

Ground Strut Kit BSI-1102097-00 (QTY. 2), Nut 4001116 (QTY.4), Angle BSI-1012098-00 (QTY. 1)

Cable Anchor Assembly
BSI-1012104-00

Square Washer (used on Post 1)
BSI-1102027-00

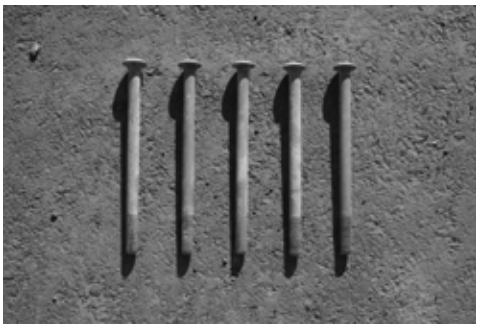
Blockouts (QTY. 5)
B090534



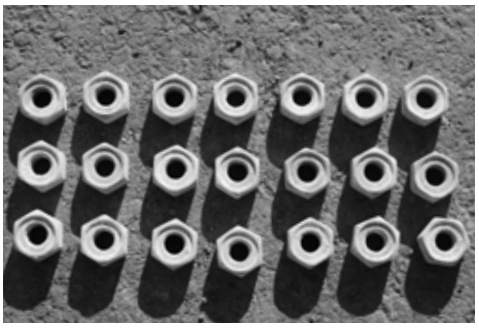
Guardrail Bolts (QTY. 16)
4001115

Parts Identification

5/8" x 1 ½" Bolt (QTY. 1)
(used on Post 1) 2000464



5/8" x 9" Bolt (QTY. 5)
2000465



Guardrail Nut (QTY. 22)
4001116

¾" Washer (QTY. 1)
(used on Slider Panel Back) 2001380

W-Beam Guardrail (QTY. 3)
4000443

Soil Plate
BSI-1012082-00

5/8" x 3 ½" Bolt (QTY. 2)
(used on Soil Plate) 2000220

5/8" Washer (QTY. 4)
(used on Soil Plate) 2001636

5/8" Nut (QTY. 2)
(used on Soil Plate) 2000312

L-Bracket
(used on cable at Post 2) BSI-1303005-00

Part 1 – Assembling Components

- Components required:
- (1) Post 2 – BSI-1012086-00
- (1) Soil Plate – BSI-1012082-00
- (2) W-Beam – 4000443
- (1) Slider Panel (FRONT)– BSI-1012093-00
- (1) Slider Bracket – BSI-1012090-00
-
- Hardware Required:
- (2) 5/8” x 3 ½” Bolt - 2000220
- (8) 5/8” x 1 ¼” Guardrail Bolt - 4001115
- (4) 5/8” Washer - 2001636
- (8) 5/8” Guardrail Nut - 4001116
- (2) 5/8” Hex Nut - 2000312

Some components require assembly and it is recommended that this step be completed prior to the start of the system assembly.

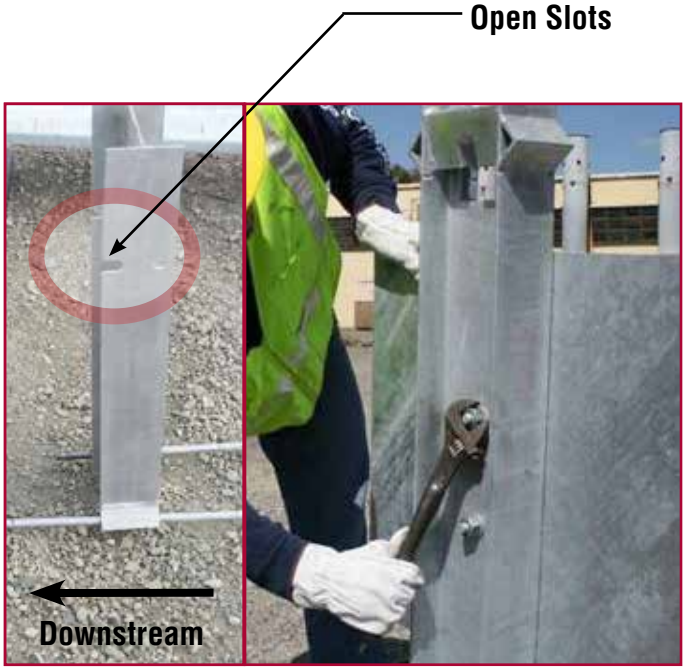
Post II Assembly:

1. Attach the soil plate to the downstream side of Post 2 using two (2) 5/8” x 3 ½” bolts, washers (4), and nuts (2). The downstream end of the post is identified by the open slots on the top of the post.

   The bolts should be installed from back to front so that the head of the bolts rests on the soil plate.

   Depending on your post driver equipment, Post 2 may need to be partially driven before this step can be accomplished.

Notes:



Attach Soil Plate to Post II

Slider Bracket and Panel Assembly:

2. Attach the slider bracket to the inside of the upstream end of Rail 2 using four (4) 5/8" x 1 ¼" guardrail bolts.

   Bolts should be installed with the bolt head on the outside and the nuts the inside.

Note: **When properly installed, a portion of the bracket will extend beyond the end of the rail and should face the downstream of the system when assembled in step 18.**

3. Attach the Slider Panel (Front) to the outside of the downstream end of Rail 1 using four (4) 5/8" x 1 ¼" guardrail bolts.

   Bolts should be installed with the bolt head on the inside and the nuts on the outside.

   The angled portion of the Slider Panel should extend beyond the end of the rail and should face the downstream of the system when assembled in step 18.

Attach Slider Bracket to Rail 2.

Attach Slider Panel (Front) to Rail 1.

Angled Portion Extends Beyond the End of the Rail.

Part 2 – Post and Blockout Installation

Components required:
- (5) Crimped Post – BSI-1012079-00
- (1) Post 2 Assembly with Soil Plate
- (3) Line Post – BSI-1012078-00
- (5) Blockout – B090534
- (1) Slider Panel (Back) – BSI-1012096-00

Hardware Required:
- (2) 5/8” x 9” Bolt - 2000467
- (2) 5/8” Guardrail Nut - 4001116
- (1) ¾” Washer - 2001380

Always start the installation at the existing W-beam barrier and assemble the system toward the impact head.

When driving the posts into stiff/rocky soil, place close attention not to bend the posts. If rock is encountered, it is acceptable to pre-auger the hole. Ensure that the hole is adequately backfilled and compacted once the post is installed.

4. Begin by running a string line from the existing posts at a 4ft. offset (1.2m). No other offset is acceptable on a Flared system.

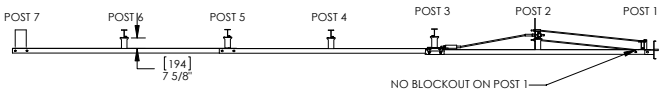
   The string should follow the roadside edge of the posts.

Note: **The front of Posts 2-6 will be 7 5/8” (195mm) from the backside of Rails 2 and 3 as blockouts are used.**

Post 1 does not require a blockout and will align with the backside of Rail 1.

Post 3 requires an additional 2” (50mm) offset away from the rail to allow space for the slider assembly (See Step 5).

Notes:



Post Identification

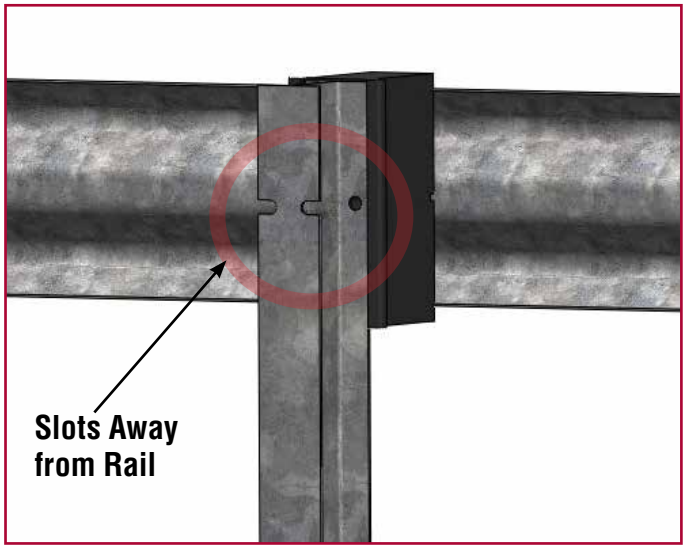
Existing Downstream Guardrail

Post Layout

5. Begin installing the posts at standard highway post spacing, 75” (1905mm) and post height, 28 1/2” (720mm) or 31 3/4” (805mm). Post spacing and post height are found on drawing BSI-1012105-00 in Appendix A.

Post 4-6: Crimped Posts

Slotted holes should face away from the rail.

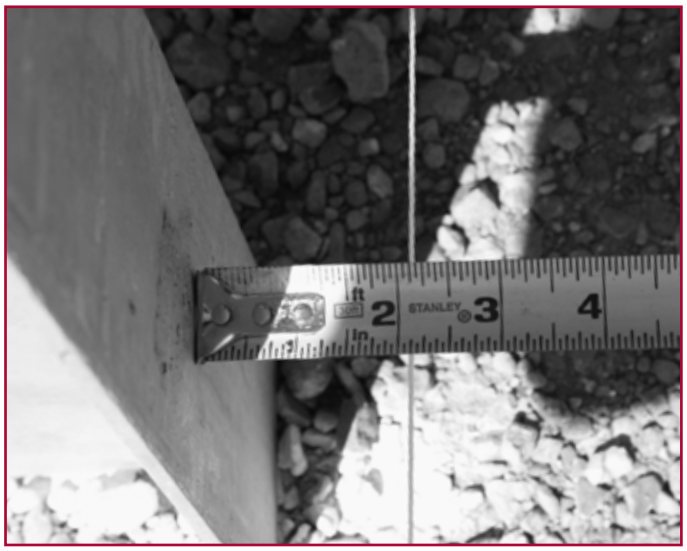


Posts 3-6 - Slots away from rail

Post 3: Crimped Post

Offset Post 3 up to 2” (up to 50mm) back from the string line to allow sufficient space for the slider bracket assembly.

Slotted holes should face away from the rail.



Post 3 Offset

Post 2: Post 2 Assembly with Soil Plate

Soil Plate should be on the downstream side of the system.

Post 2 includes a blockout, and should be aligned with Posts 4-6.

Depending on your post driver equipment, it may be necessary to partially drive Post 2 prior to attaching the Soil Plate. Begin to drive Post 2 approximately 18” (450mm), more if necessary. If the post is driven more than 18” (450mm) it will be necessary to use a pick ax or other digging tool to remove some of the soil in order to install the soil plate.

Once the soil plate is installed, continue driving the post to the desired height.

Drive Post 2

Post 1: Crimped Post

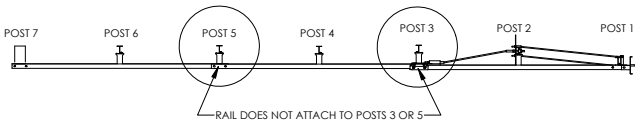
Post 1 does not include a blockout, therefore, align the post with the backside of the rail. Position the post roughly 2" (50mm) from the string line on the rail side of the string.

Slotted holes should face the rail side.

6. Install blockouts on Posts 2-6. Blockouts at Posts 3 and 5 must be bolted on before hanging the rails.

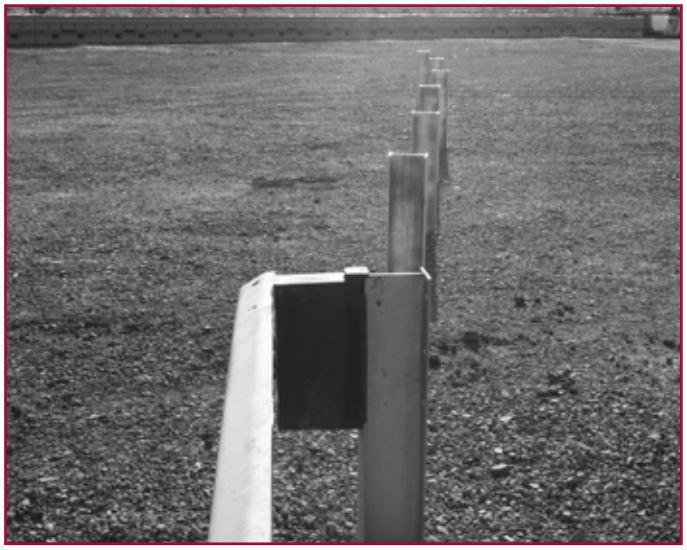
7. At Post 5, attach the blockout using the 5/8" x 9" bolt. Secure blockout using the upstream hole on the post. The rail does not attach at Post 5.

   See diagram below for post identification.



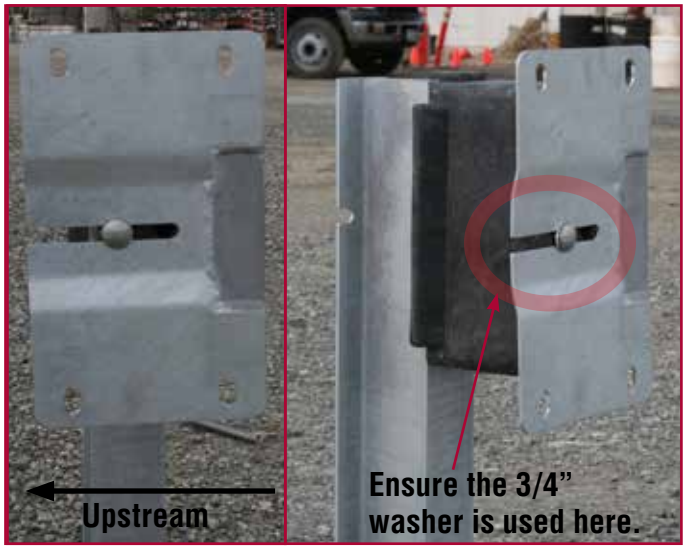
8. At Post 3, attach blockout and Slider Panel (Back) using the 5/8" x 9" bolt and ¾" washer. The slot on the slider panel should point toward the front of the system. Secure blockout using the upstream hole on the post.

   Blockouts at Posts 2, 4 and 6 are secured when the rail is bolted to the posts.



Installed Posts

Install Blockouts



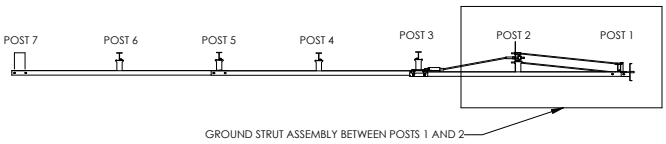
Slider Panel (Back) and Blockout on Post 3

Part 3 – Install Ground Strut Assembly

Components required:
- (2) Tension Rods – BSI-1012097-00
- (1) Ground Strut Angle – BSI-1012098-00

Hardware Required:
- (4) 5/8” Guardrail Nut - 4001116

9. Install tension rods between Posts 1 and 2 by sliding the rods through the angles on the bottom of Post 2.



10. Secure the rods at Post 1 by passing the rods through the small piece of angle with the angle sitting flush on the ground just above the crimp on the post.

    The small piece of angle will sit flush with the ground on 28” systems only. On 31” height systems, the small piece of angle will sit approximately 3” (75mm) off the ground.

11. Tighten the rods so that there are equal amount of threads exposed at both ends of the rods.

    Note: Post 2 includes a blockout while Post 1 does not; this creates a curve in the tension rods once installed.

Tension Rods Installed at Post 2

Tension Rods Attached at Post 2

Slight Bend on Tension Rods

Part 4 – Hang Rails

Components required:
- (3) W-Beam Guardrail - 4000443

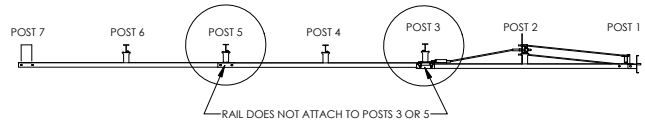
Hardware Required:
- (3) 5/8” x 9” Bolt -2000467
- (12) 5/8” x 1 ¼” Guardrail Bolt - 4001115
- (1) 5/8” x 1 ½” Bolt - 2000466
- (8) Shear Bolts – K080123 (Kit of 8; 1 Required)
- (15) 5/8” Guardrail Nut - 4001116
- (1) 5/8” Nut - 2000468
- (1) Square Washer – BSI-1102027-00
- **(8) 5/8” x 1 1/4” Guardrail Bolt - NOT INCLUDED**

12. Before installing Rail 3 ensure that the blockout at Post 5 has already been bolted on. Attach Rail 3 using the 5/8” x 9” bolt at Post 6, pass bolt through the upstream hole of post.

    Note: Rail 3 is not attached to Post 5.

13. Splice Rail 3 with the existing rail using standard 5/8” x 1 1/4” bolts. **[NOT SUPPLIED WITH THE SYSTEM.]**

Notes:



Rail Identification

Attach Rails to Posts

Standard Bolts at Rail 3 and 4 Connection

14. Before installing Rail 2 ensure that the blockout and Slider Panel (Back) at Post 3 has already been bolted on. Attach Rail 2 using the 5/8" x 9" bolt at Post 4, pass bolt through the upstream hole of post.

Attach Rail 2 at Post 4

15. Splice Rail 2 with Rail 3 using the special yellow shear bolts. The rails do not attach to Post 5.

    DO NOT USE AND AIR IMPACT WRENCH TO TIGHTEN SHEAR BOLTS.

Shear Bolts at Rail 2 and 3 Connection

16. Attach Rail 1 using the 5/8" x 9" guardrail bolt at Post 2, pass bolt through the downstream hole of post.

17. Connect Rails 1 and 2 using 5/8" x 1 ¼" guardrail bolts by connecting the slider panel assembly (front and back parts together).

    Ensure that the angled portion of the Slider Panel points toward the downstream end of the system.

Connect Rails 1 and 2 at Slider Assembly

18. Install the bolts from back to front with the nuts on the front side.

Slider Panel Assembly Installed

19. Attach Rail 1 to Post 1 using the 5/8" x 1 ½" bolt and square washer, pass bolt through the upstream slot of post.

Attach Rail 1 at Post 1

Part 5 – Install Impact Head

Components required:
- (1) Impact Head – BSI-1012103-00

Hardware Required:
- (4) 5/8” x 1 ¼” Guardrail Bolt - 4001115
- (4) 5/8” Guardrail Nut - 4001116

20. Install Impact Head to the upstream end of Rail 1 using 5/8” x 1 ¼” guardrail bolts.

    Place Impact Head on the outside of the rail.

21. Install bolts from outside in with nuts on the inside.

Notes:

Install Impact Head at the End of Rail 1

Impact Head Installed

Part 6 – Install Cable

Components required:

- (1) Cable – BSI-1012104-00

The cable is attached to the bottom of Post 2 and at the Slider Bracket at Post 3.

22. Begin to install the cable by passing the threaded end through the slot at the bottom of Post 2.

23. Thread the nut so that 1" of the threads are protruding.

    Ensure to install the small L-Shaped bracket and round washer included with the cable. This bracket and washer are critical components and help keep the cable engaged in the slot.

    Proceed to thread the nut while not exposing any threads. This will ensure you can achieve the required to torque for the cable nut in a subsequent step.

Notes:

Install Cable at Post 2

L-Bracket installed at Post 2 Prior to Tightening

24. Pass the other end of the cable through the slider bracket at Post 3.

    Install the nut. Tightening of the cable should be done at the bottom of Post 2 in the following step.

Install Downstream End of Cable Through Bracket at Post 3

25. Tighten the cable nut at Post 2. I will be necessary to use a pipe wrench or large pliers on the backside of the cable to hold it in place while tightening. If the cable is not held in place with a pipe wrench or large pliers, it will spin while you attempt to tighten the cable and you will not be able to tighten it.

    Apply a 60 ft.-lb. torque. Continue to tighten the cable nut until the required torque is achieved.

    When tightening, ensure that the L-Bracket does not shift, turn and move out of position.

Note: Standard BCT cables used on other systems may not require a specific torque on the cable nuts. The FX system requires a tensioned cable to maintain engagement in the slot on Post 2.

Torque cable nut to 60 ft.-lb. at Post 2

Cable Installed

Final Inspection Checklist

Inspection Date	Inspection By:	Item
		Post 1, slotted holes face rail
		Post 3, slotted holes face away from rail
		Rail bolted at posts 1, 2, 4 and 6 Only
		Rails not bolted to posts at Posts 3 and 5
		Square washer used at Post 1
		Post 2, rail bolted using downstream hole on post
		Posts 1, 4, 6, rails bolted using upstream hole on posts
		Rails 3 and 4 spliced using standard guardrail bolts
		Rails 2 and 3 spliced using special yellow shear bolts
		Slider assembly properly assembled with bolts from back to front with nuts on the outside
		Angled portion of Slider panel points toward the downstream end of the system
		60 ft.-lb. torque applied to cable nut at Post 2
		Blockout at Post 2
		Offset = 4 ft (1.2 m)

Appendix A - System Configuration

The X-Lite System has been tested per the National Cooperative Highway Research Program (NCHRP) Report 350 Test Level 3 and accepted for use on the National Highway System (NHS) by the Federal Highway Administration.

The X-Lite System is a gating, redirective guardrail end terminal designed to attach to the ends of guardrail systems.

As with all crash cushions and end terminals, the X-Lite System requires appropriate clear zones in accordance with the AASHTO Roadside Design Guide, FHWA memoranda, and other state and local standards.

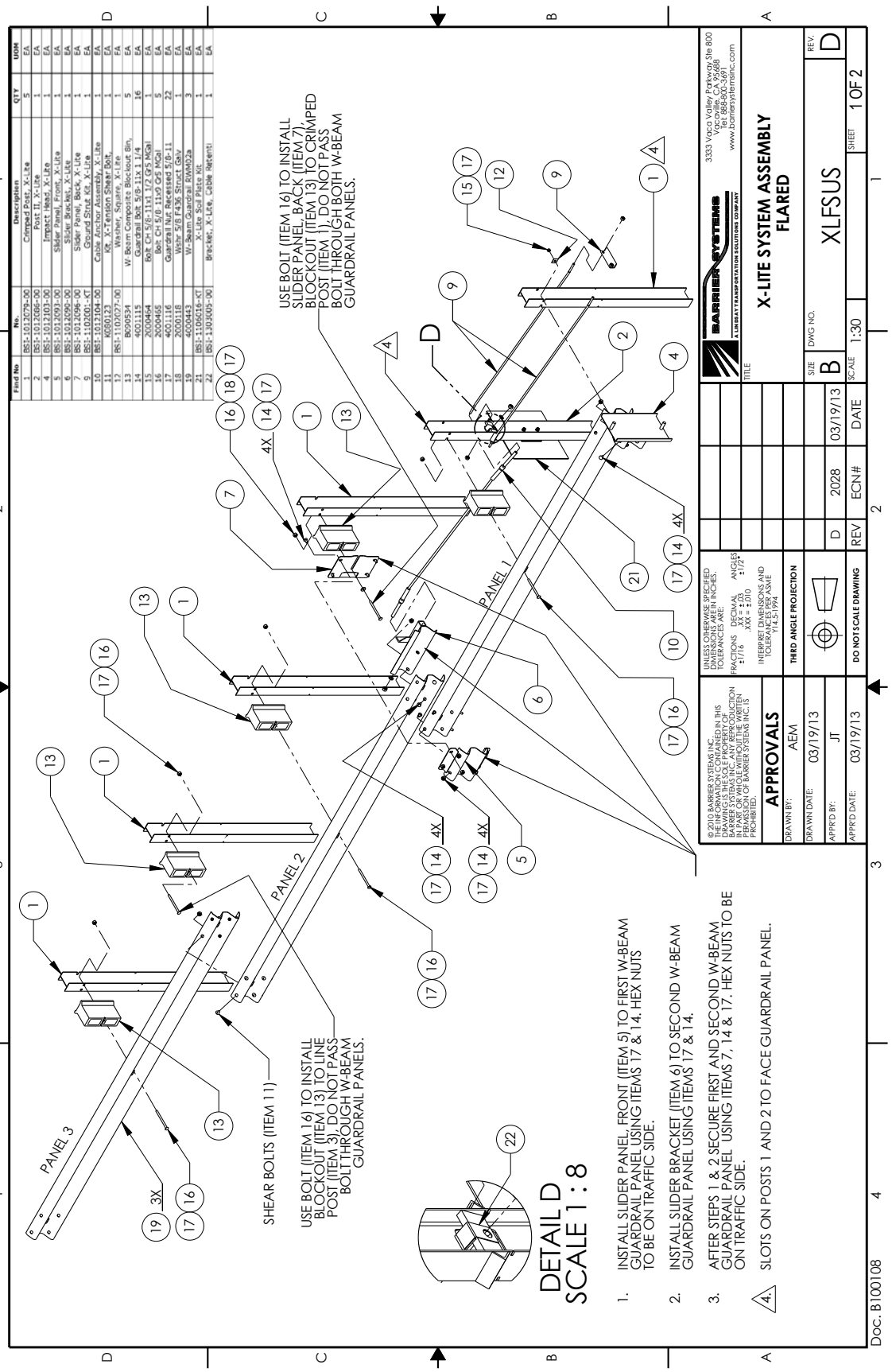
System drawings and bill of materials can be found on the following pages.

DRAWINGS

X-Lite System, Flared
DWG# XLFSUS 22

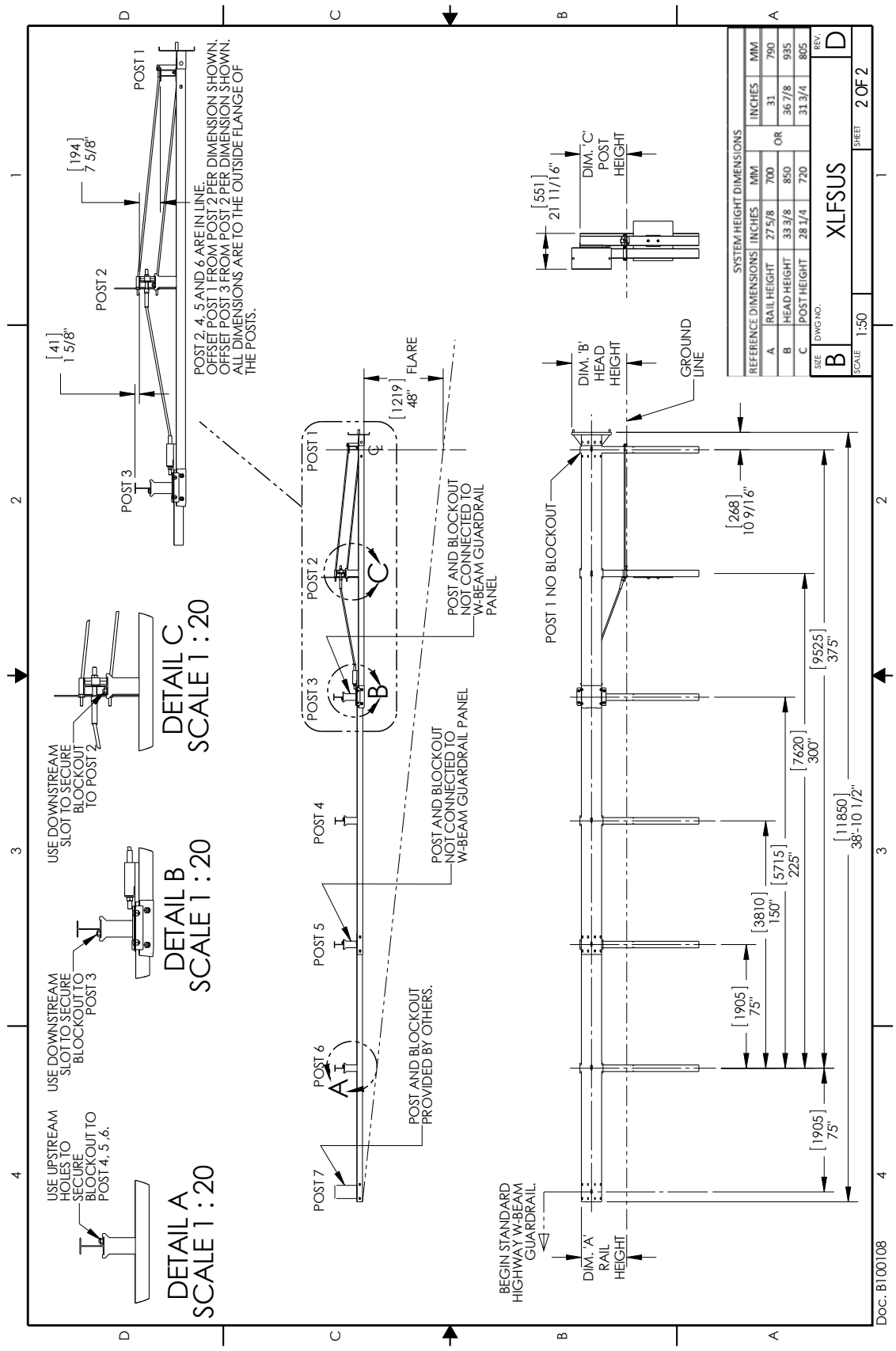
Bill of Materials 24

Appendix A - System Configuration



Find No	No.	Description	QTY	UOM
1	BSI-1012079-00	Crimped Post, X-Lite	5	EA
2	BSI-1012086-00	Post Tip, X-Lite	1	EA
4	BSI-1012103-00	Impact Head, X-Lite	1	EA
5	BSI-1012093-00	Slider Panel, Front, X-Lite	1	EA
6	BSI-1012090-00	Slider Bracket, X-Lite	1	EA
7	BSI-1012096-00	Slider Panel, Back, X-Lite	1	EA
9	BSI-1102001-KT	Ground Strut Kit, X-Lite	1	EA
10	BSI-1012104-00	Cable Anchor Assembly, X-Lite	1	EA
11	K060123	Kit, X-Tension Shear Bolt,	1	EA
12	BSI-1102077-00	Washer, Square, X-Lite	1	EA
13	B000534	W-Beam Composite Blockout 8in,	5	EA
14	4000445	Hex Nut, 5/8-11 G5 Mgal	16	EA
15	4000444	Bolt, Gr5 5/8-11 x 1.5 Mgal	5	EA
16	2K00465	Bolt CH 5/8 11x9 Gr5 MGal	5	EA
17	4001116	Guardrail Nut Recessed 5/8-11	22	EA
18	2K00116	Washr 5/8 F436 Struct Galv	1	EA
19	4000443	W-Beam Guardrail RWM02a	3	EA
21	BSI-1106016-KT	X-Lite Soil Plate Kit	1	EA
22	BSI-1003005-00	Bracket, X-Lite, Cable Retenti	1	EA

Appendix A - System Configuration



Appendix A -Bill of Materials - X-Lite Flared

No.	Description	Quantity
BSI-1012079-00	Crimped Post, X-Lite	5.00
BSI-1012086-00	Post II, X-Lite	1.00
BSI-1012103-00	Impact Head, X-Lite	1.00
BSI-1012093-00	Slider Panel, Front, X-Lite	1.00
BSI-1012090-00	Slider Bracket, X-Lite	1.00
BSI-1012096-00	Slider Panel, Back, X-Lite	1.00
BSI-1012104-00	Cable Anchor Assembly, X-Lite	1.00
K080123	Kit, X-Tension Shear Bolt,	1.00
BSI-1102027-00	Washer, Square, X-Lite	1.00
B090534	W-Beam Composite Blockout 8in,	5.00
4001115	Guardrail Bolt 5/8-11x 1 1/4	16.00
2000464	Bolt CH 5/8-11x1 1/2 Gr5 MGal	1.00
2000465	Bolt CH 5/8-11x9 Gr5 MGal	5.00
4001116	Guardrail Nut Recessed 5/8-11	26.00
2001380	Wshr 3/4 F436 Flat Rd Struct	1.00
4000443	W-Beam Guardrail RWM02a	3.00
BSI-1012097-00	Ground Strut, X-Lite	2.00
BSI-1012098-00	Ground Strut Angle	1.00
BSI-1012082-00	Soil Plate, Large	1.00
2000220	C-Scr HH 5/8-11x3 1/2 Gr5 MGal	2.00
2001636	Wshr 5/8 F436 Struct MGal	4.00
2000312	Nut HX 5/8-11 Gr5 Mgal	2.00
BSI-1303005-00	Bracket, X-Lite, Cable Retenti	1.00

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Installation manual details for the X-LITE Flared System are subject to change without notice to reflect improvements and upgrades.
Additional information is available from Lindsay Transportation Solutions Sales and Services, Inc. © Lindsay Transportation Solutions, Inc.