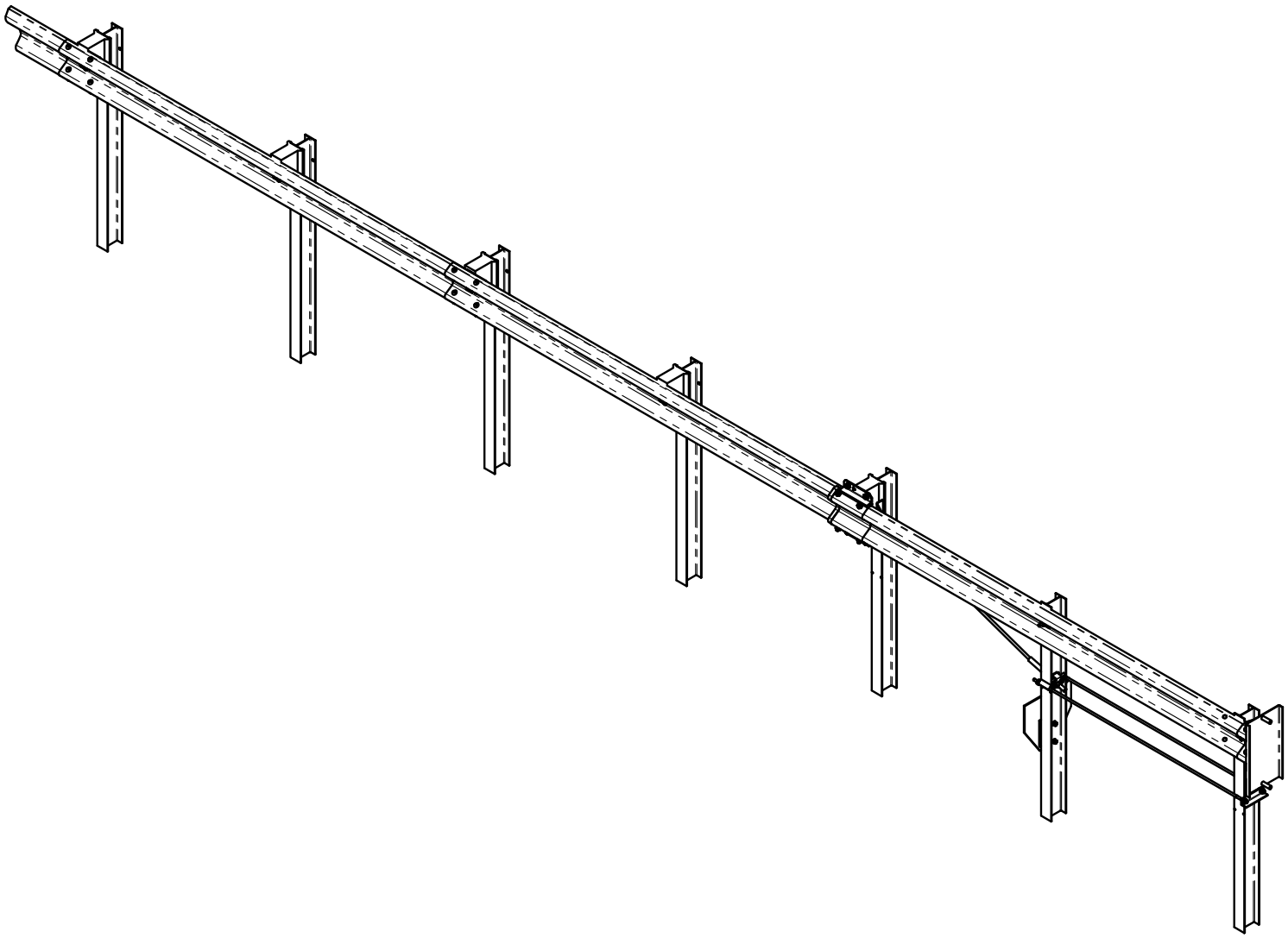
X-LITE® TANGENT

NCHRP 350 TL-3 Redirective, Gating, End Terminal



BARRIER SYSTEMS®
BY LINDSAY

Installation Manual

X-LITE TANGENT END TERMINAL

APPENDICES

Preface

The X-Lite Guardrail End Terminal Tangent 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 re-directive, 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 re-directing 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, re-directive 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 on site 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 or stiff soil is encountered, the posts may be installed by augering and backfilling the hole. Extra care must be taken to prevent settlement or lateral displacement of the post. Backfill material shall be compacted to optimum compaction.

Before Starting
For all applications, begin the installation from the trailing / back 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 Axe
- 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 LIMITED WARRANTY

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LTS warrants that any product or component part manufactured by LTS will be free from defects in material or workmanship. LTS will replace free of cost any Product or component part manufactured by LTS 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.

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Any claim by the Buyer with reference to Products sold hereunder for any cause shall be deemed waived by the Buyer unless LTS 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 LTS' plant for inspection in accordance with return shipping instructions that LTS shall furnish to the Buyer forthwith upon receipt of the Buyer's notice of claim. If the claim is established, LTS 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.

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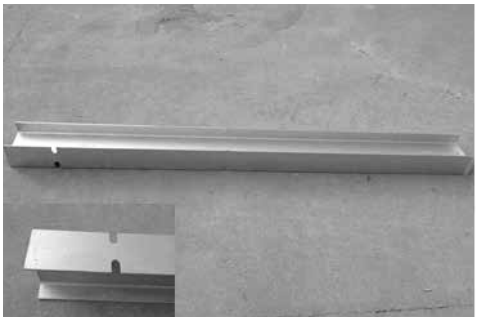
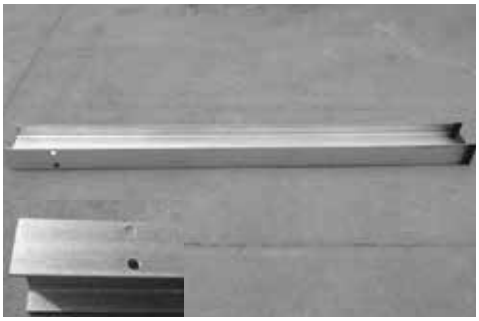
180 River Road • Rio Vista, CA 94571 • Tel. +1 (707) 374-6800 • Fax. +1 (707) 374-6801

Parts Identification

A Complete Bill of Materials for Systems and Kits Can be Found in Appendix A

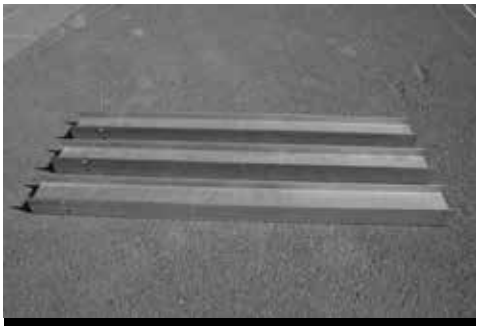


Crimp Post #1 (QTY. 1)
BSI-1310024-00



Crimp Post # 3 (QTY. 1)
BSI-1310027-00

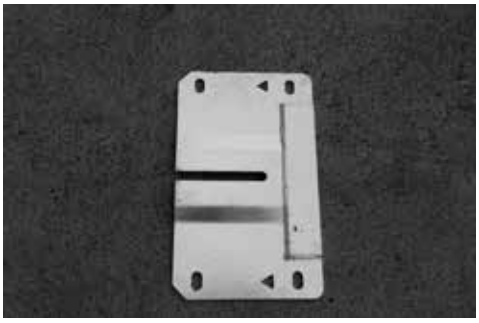
Post II
BSI-1012086-00



Line Post (QTY. 3)*
BSI-1012078-00

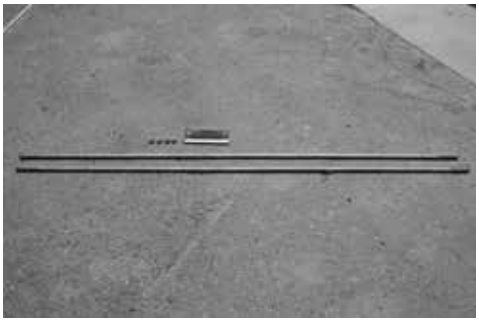
Impact Head
BSI-1012103-00

Slider Panel (Front)
BSI-1012093-00



Slider Panel (Back)
BSI-1012096-00

Slider Bracket
BSI-1012090-00



Ground Strut BSI-1012097-00 (QTY. 2), Nut 4001116 (QTY. 4), Angle BSI-1012098-00 (QTY. 1)

Cable Anchor Assembly
BSI-1012104-00

Shear Bolt Kits (8 Yellow Bolts per Kit)
K080123

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

*** Denotes Shipped With Full System Only**

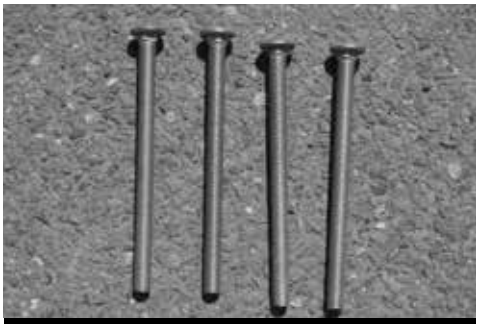
Parts Identification

A Complete Bill of Materials for Systems and Kits Can be Found in Appendix A

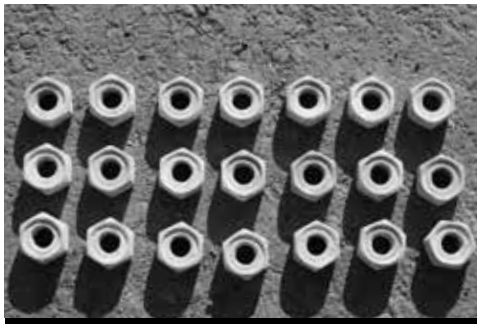
Blockouts (QTY. 4)*
B090534

Guardrail Bolts (QTY. 16)*
4001115

5/8" x 2" Guardrail Bolt (For Post 1 & 2)
(QTY. 2)* 2001758



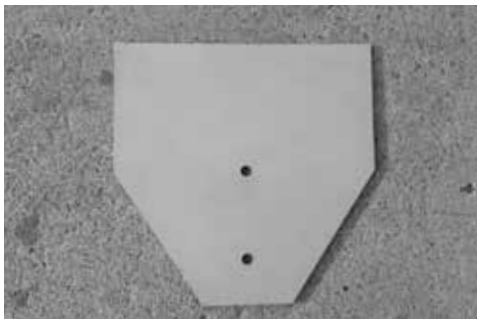
5/8" x 10" Guardrail Bolt (QTY. 4)*
2001840



Guardrail Nut (QTY. 22)*
4001116

1" Washer (For Slider Panel-Back &
Cable Assy.)* (QTY. 2) 2001580

W-Beam Guardrail (QTY. 3)*
4000443

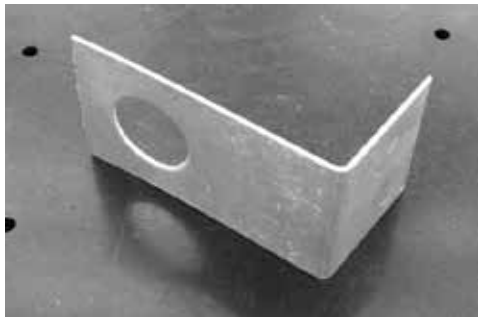


Soil Plate
BSI-1312100-00

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

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

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



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

*** Denotes Shipped With Full System Only**

Step 1 – Assembling Components

Components required:
- (1) Post II – BSI-1012086-00
- (1) Soil Plate – BSI-1312100-00
- (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
- (2) 5/8” Nut - 2000312
- (8) 5/8” Guardrail Nut - 4001116

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

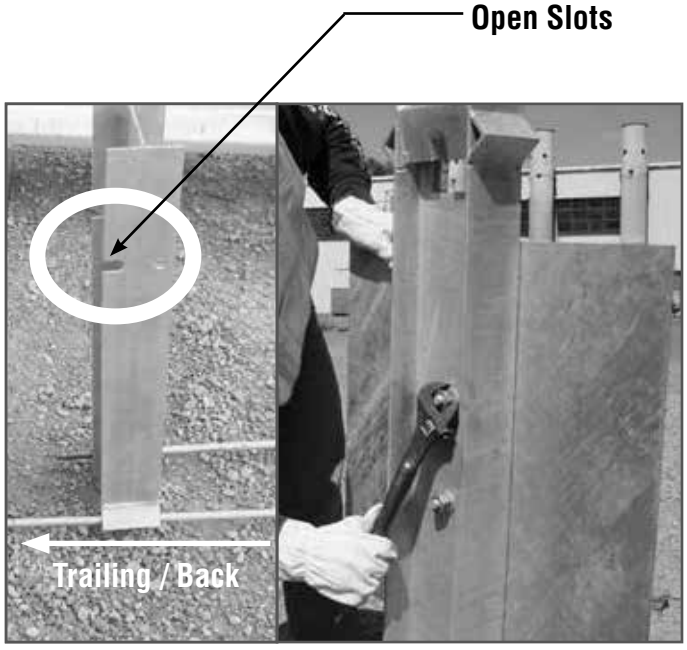
Notes:

Post II Assembly:

1. Attach the soil plate to the trailing / back side of Post II using two (2) 5/8” x 3 ½” bolts, washers (4), and nuts (2). The trailing / back 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.



Attach Soil Plate to Post II

Slider Bracket and Panel Assembly:

2. Attach the slider bracket to the inside of the approach / front 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 stick out of the rail.**

Attach Slider Bracket to Rail 2.

3. Attach the Slider Panel (Front) to the outside of the trailing / back 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 trailing / back of the system when assembled in step 18.

Attach Slider Panel (Front) to Rail 1.

Angled Portion Extends Beyond the End of the Rail.

Step 2 – Post and Blockout Installation

Components required:
- (1) Crimp Post w/ Slots (Post 1) - BSI-1310024-00
- (1) Crimp Post w/ Holes (Post 3) - BSI-1310027-00
- (1) Post II Assembly with Soil Plate
- (3) Line Post – BSI-1012078-00
- (4) Blockout – B090534
- (1) Slider Panel (Back) – BSI-1012096-00

Hardware Required:
- (2) 5/8” x 10” Guardrail Bolt - 2001840
- (2) 5/8” Guardrail Nut - 4001116
- (1) 1” Washer - 2001580

Always start the installation at the existing w – beam barrier and assemble the system toward the impact head.

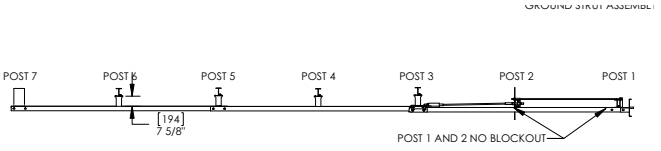
When driving the posts into stiff/rocky soil, place close attention not to bend the posts. If rock or stiff soil is encountered, the posts may be installed by augering and backfilling the holes. Extra care must be taken to prevent settlement or lateral displacement of the post. Backfill material shall be compacted to optimum compaction.

4. Begin by running a string line from the existing posts in a tangent position.

Note: The X-LITE can be installed with an offset of 0 - 24” (0 - 600 mm) over the length of the system.

Note: **The front of posts 3-6 will be 7 5/8” (195mm) from the backside of rails 2 and 3 as blockouts are used. Posts 1 and 2 do not require blockouts and will align with the backside of rail 1. Post 3 requires up to an additional 2” (50mm) offset away from the rail to allow space for the slider assembly. (See Step 5.)**

Notes:



Post Identification

Existing Trailing / Back Guardrail

Post Layout

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

Post 4-6: Line Posts

Note: if you are installing a 50 FT. system, the systems will have an additional 2 posts and an additional section of guardrail. Please reference Appendix A for detail of a 50 FT. system.

Post 3: Crimped Post

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

Post 3 is identified by the post having a crimp and holes on one side of the post only. These holes are used to mount the blockout and slider panel (back) on a later step. In addition, Post 3 can be easily identified by having black paint near the bottom.

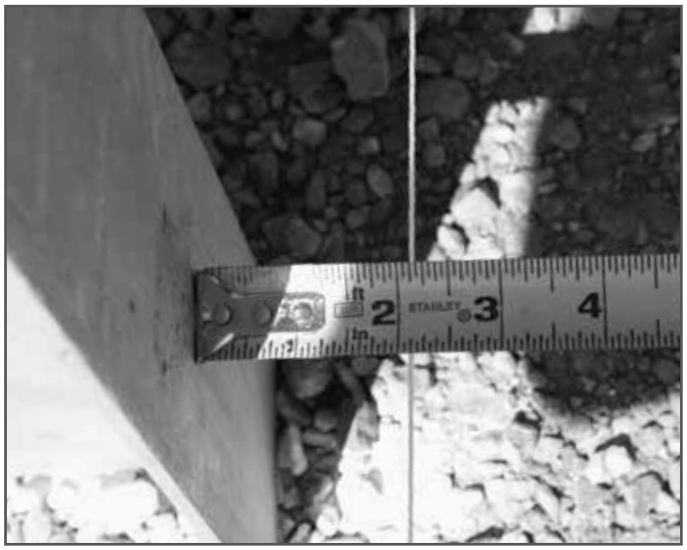
Post 2: Post II Assembly with Soil Plate

Soil Plate should be on the trailing / back side of the system.

Post 2 does not require a blockout, therefore, align the post with the backside of the rail. Position the outside edge of the post roughly 8” (200mm) from the string line on the rail side of the string.

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.



Post 3 Offset

Drive Post 2

Post 1: Crimped Post

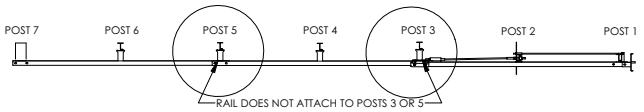
Post 1 does not require a blockout, therefore, align the post with the backside of the rail. Position post roughly 2" (50mm) from the string line on the rail side of the string.

Post 1 is identified by the post having a crimp and slots instead of holes. These slots are used to bolt the guardrail on a later step. In addition, Post 1 can be easily identified by having yellow paint near the bottom.

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

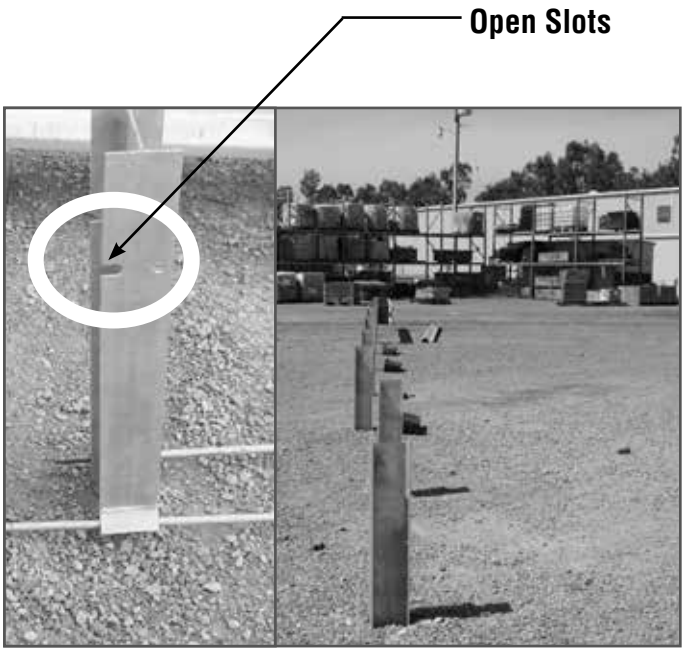
7. At post 5, attach the blockout using the 5/8" x 10" bolt. Secure blockout using the approach / front hole on the post. The rail does not attach at post 5.

   See diagram below for post identification.



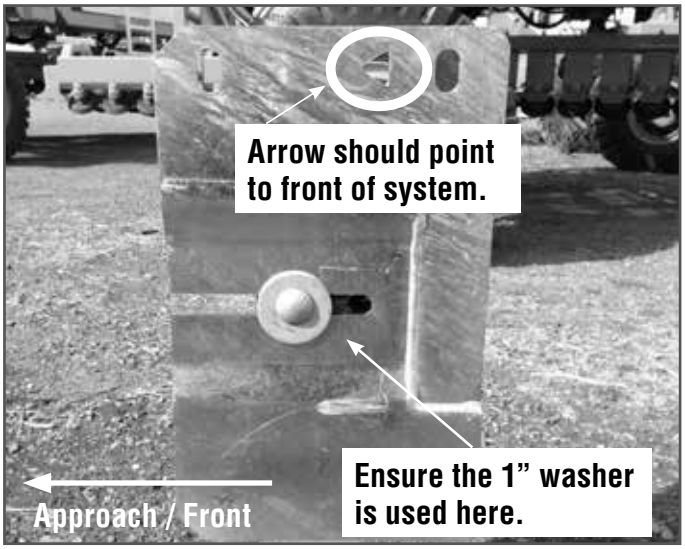
8. At post 3, attach blockout and slider panel (back) using the 5/8" x 10" bolt and 1" washer. The slot on the slider panel should point toward the front of the system. Secure blockout using the approach / front hole on the post.

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



Installed Posts

Install Blockout at Post 5



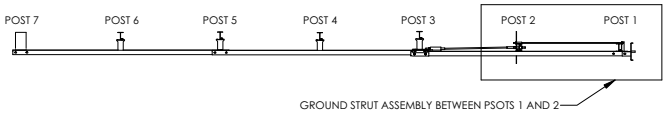
Slider Panel (Back) and Blockout on Post 3

Step 3 – Install Ground Strut Assembly

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

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

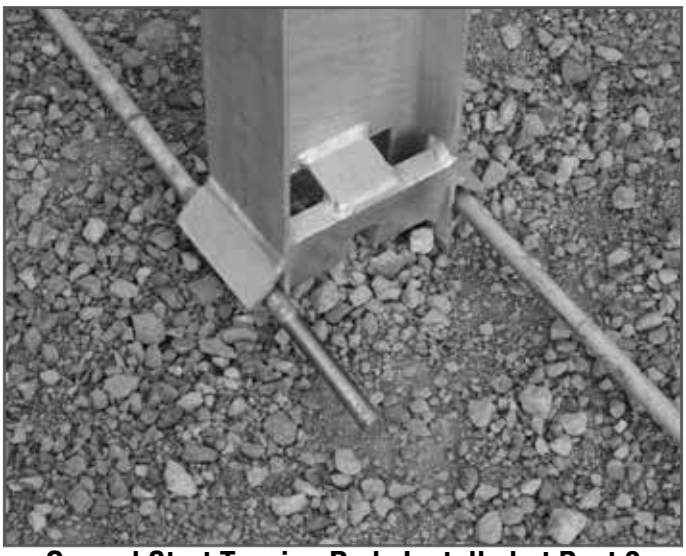
9. Install ground strut tension rods between posts 1 and 2 by sliding the rods through the openings on the bottom of post 2.



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.

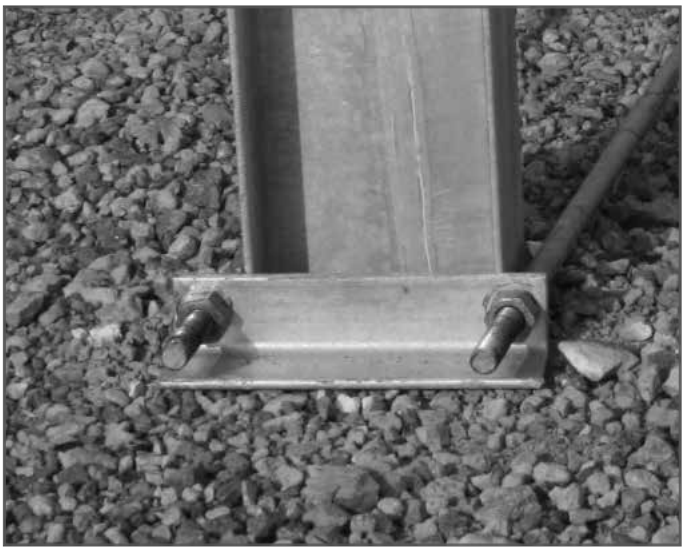
    The small piece of angle will sit flush with the ground on 28” systems only. On 31” height systems, the small piece of angle will sit approximately 3” (75mm) off the ground.

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



Ground Strut Tension Rods Installed at Post 2

Ground Strut Tension Rods Attached at Post 1



Nuts Tightened on Ground Strut Tension Rods

Step 4 – Hang Rails

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

Hardware Required:
- (2) 5/8” x 10” Guardrail Bolt -2001840
- (4) 5/8” x 1 ¼” Guardrail Bolt - 4001115
- (2) 5/8” x 2” Guardrail Bolt - 2001758
- (16) Shear Bolts – K080123 (Kit of 8; 2 Required)
- (5) 5/8” Guardrail Nut - 4001116
- (1) 5/8” Nut - 2000468
- (1) Square Washer – BSI-1102027-00

*If installing **a 50 ft system**, the system uses 4 sections of rail in stead of 3.*

*If you are attaching to **an MGS rail system**, a transition guardrail panel is necessary.*

*Please reference **Appendix A for 50 ft. or MGS system** details.*

***Note:* For the system to telescope properly, the forward most guardrail panel should always be on the outside.**

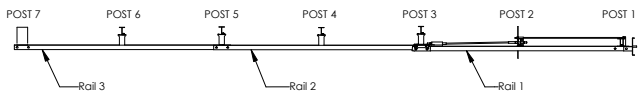
12. Before installing rail 3 ensure that the blockout at post 5 has already been bolted on. Attach rail 3 using the 5/8” x 10” bolt at post 6, pass bolt through the approach / front hole of post.

***Note:* Rail 3 is not attached to Post 5**

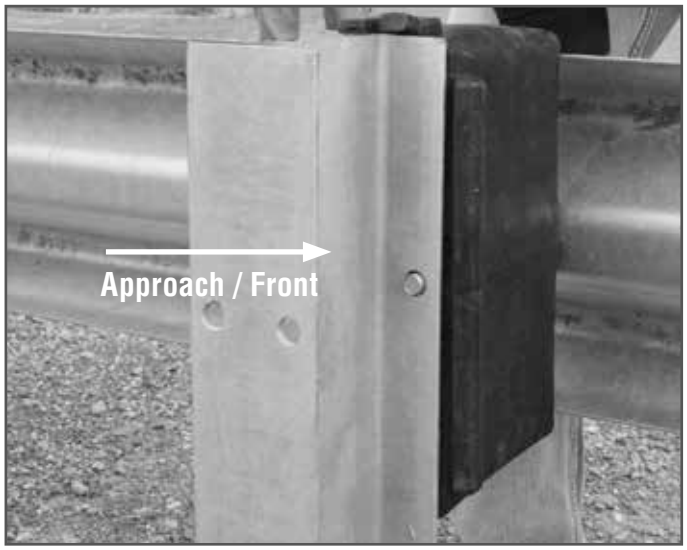
13. Splice rail 3 with the existing rail using the special yellow shear bolts. **DO NOT USE AN AIR IMPACT WRENCH TO TIGHTEN SHEAR BOLTS.**

    Ensure that the 10” bolt used secure the rail and blockout passes through both sections of guardrail, blockout and post.

Notes:



Post Identification



Attach Rails to Posts

Shear 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 10" bolt at post 4, pass bolt through the approach / front 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 Connection

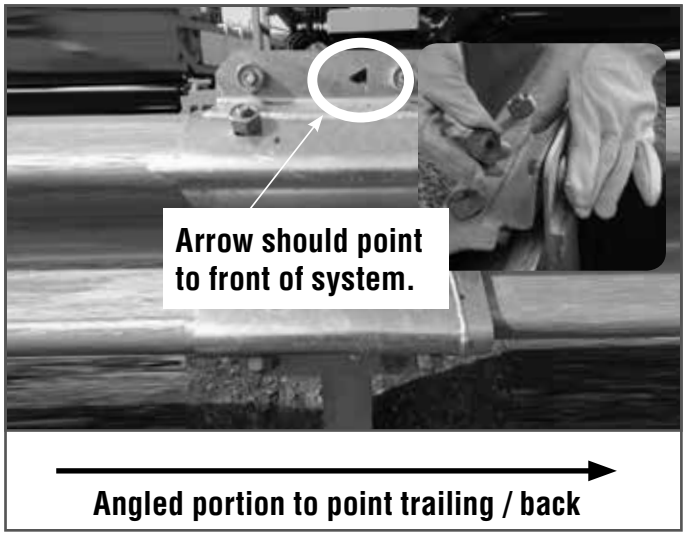
16. Attach rail 1 using the 5/8" x 2" guardrail bolt at post 2, pass bolt through the trailing / back slot of post.

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 trailing / back end of the system.

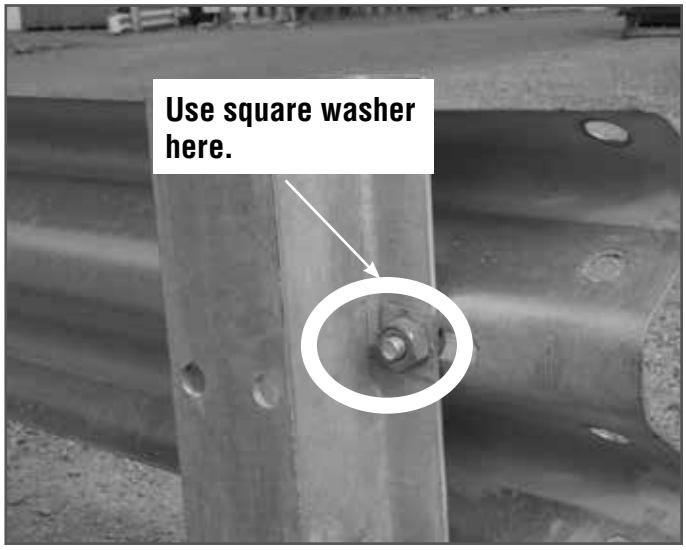
Connect Rails 1 and 2 at Slider Assembly

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 2” bolt and square washer, pass bolt through the approach / front slot of post.



Attach Rail 1 at Post 1

All Rails Installed

Step 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 approach / front 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

Step 6 – Install Cable

Components required:
- (1) Cable – BSI-1012104-00
- (1) 1” Washer - 2001580
- (1) L-Bracket - BSI-1301005-00

The cable is attached to the bottom of post 2 and at the slider bracket at post 3.

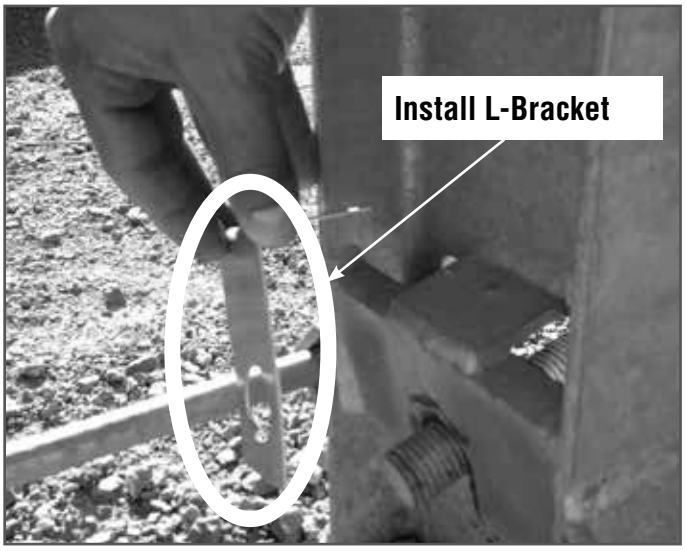
22. Begin to install the cable by passing the threaded end through the slot at the bottom of post 2.

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.

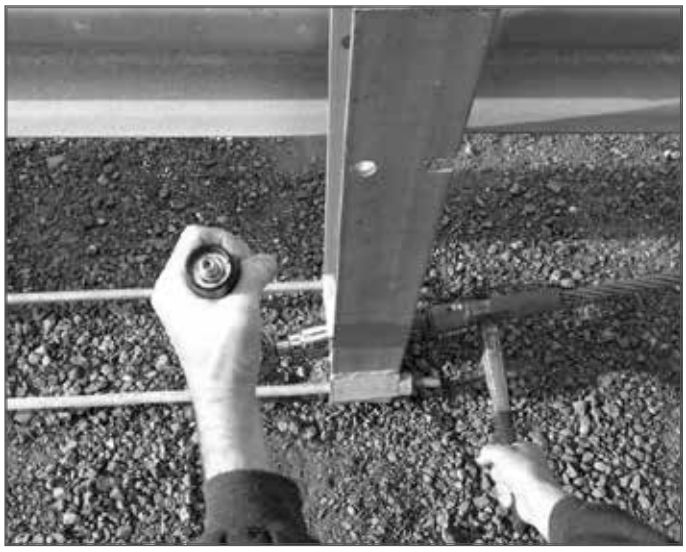
    Install the nut. Tightening of the cable should be done at the bottom of Post 2 in the following step.

Install Trailing / Back End of Cable Through Bracket at Post 3

25. Tighten the cable nut at Post 2. It 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 approximately 60 FT-Lb torque. Continue to tighten the cable nut until the cable is tight and the approximate torque is achieved.

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



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

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

If a torque wrench is not available, use the following method to ensure cable is adequately tensioned:

Tighten cable nut until a maximum 1/2" cable deflection is measured at the midpoint when pressure is applied by hand.

Cable Installed

Final Inspection Checklist

Inspection Date	Inspection By:	Item
		Post 1 uses slotted holes
		Post 3, uses standard post holes
		Rail bolted at posts 1, 2, 4 and 6 only (7, 8 for 50 ft. system)
		Rails not bolted to posts at Posts 3 and 5
		Square washer used at Post 1
		Post 2, rail bolted using trailing / back slot on post
		Posts 1, 4, 6, rails bolted using approach / front hole on posts
		Rails 3 and 4 spliced using special yellow shear bolts
		Rails 2 and 3 spliced using special yellow shear bolts
		At Post 7, 10" bolt passes through both guardrail sections, block-out and post.
		Slider assembly properly assembled with bolts from back to front with nuts on the outside
		Angled position of Slider panel points toward the trailing / back end of the system.
		Arrows on slider should point toward the front of the system
		Cable bracket and washer installed on cable at Post 2
		Approximately 60 ft.-lb. torque applied to cable nut at Post 2
		No blockout on Post 1 or Post 2
		Tangent installation or with allowable offset from 0 - 24” (0 - 600mm) over length of the system

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.

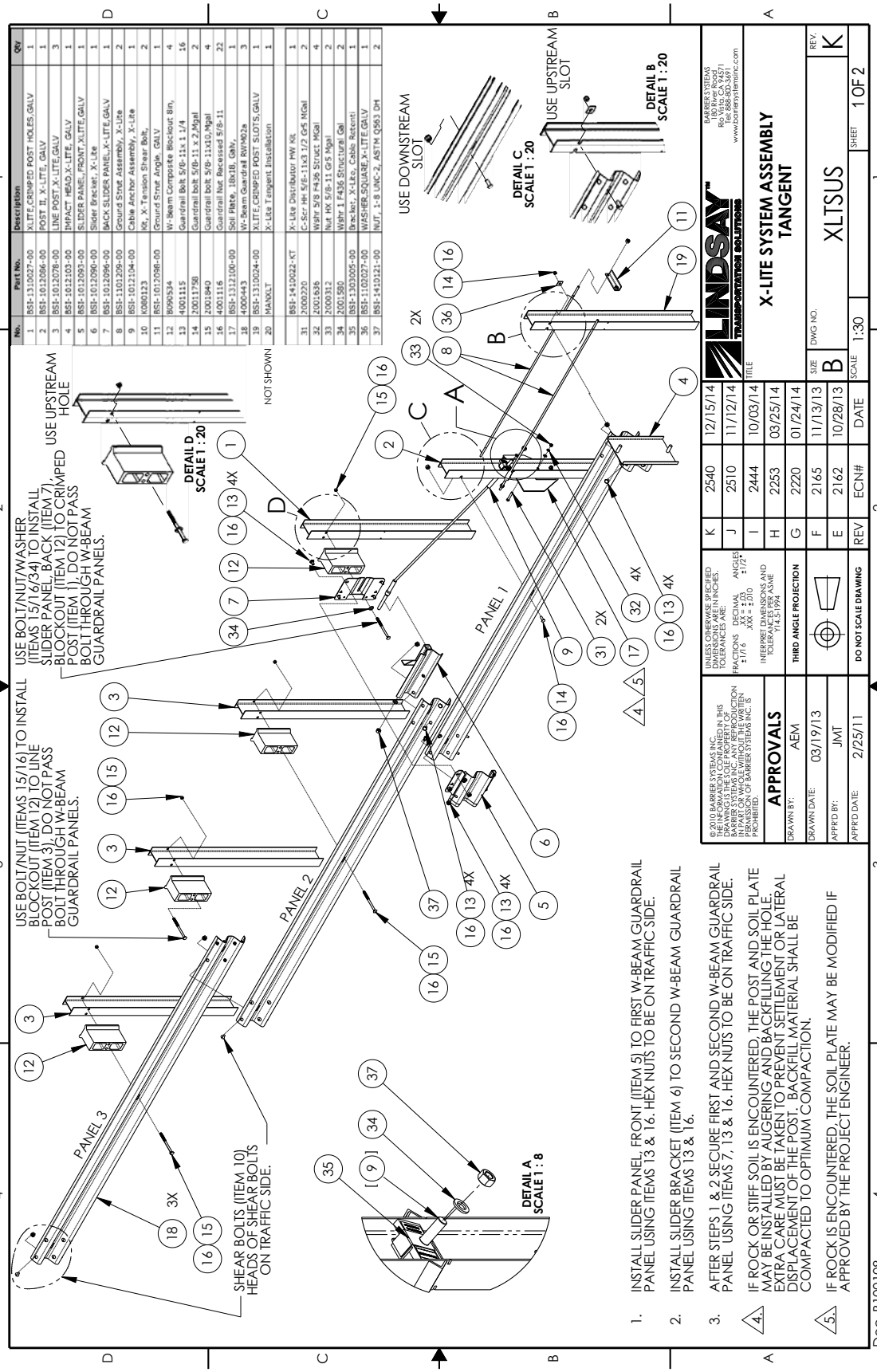
The X-Lite system is a gating, re-directive guardrail end terminal designed to attach to the ends of guardrail systems.

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

Appendix A - System Configuration, 37’ 6”

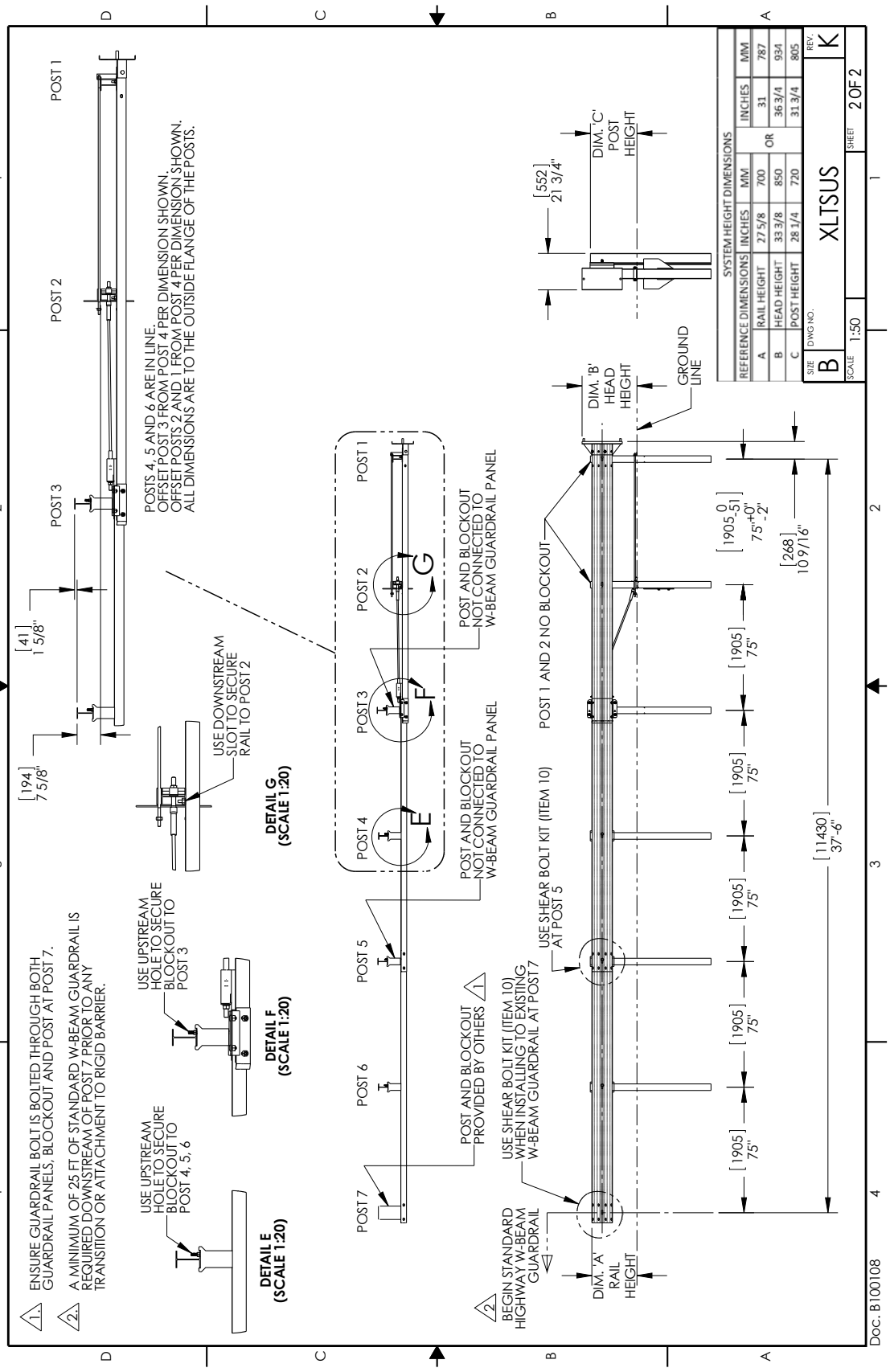


No.	Part No.	Description	QTY
1	BSI-1310027-00	X,LITE,CRIMPED POST HOLES,GALV	1
2	BSI-1012086-00	POST II, X-LITE, GALV	1
3	BSI-1012078-00	LINE POST X-LITE,GALV	3
4	BSI-1012103-00	IMPACT HEAD,X-LITE, GALV	1
5	BSI-1012093-00	SLIDER PANEL, FRONT,XLITE,GALV	1
6	BSI-1012090-00	Slider Bracket, X-Lite	1
7	BSI-1012096-00	BACK SLIDER PANEL,X-LITE,GALV	1
8	BSI-1101299-00	Ground Strut Assembly, X-Lite	2
9	BSI-1012104-00	Cable Anchor Assembly, X-Lite	1
10	K080123	Kit, X-Tension Shear Bolt,	2
11	BSI-1012098-00	Ground Strut Angle, GALV	1
12	BK99534	W-Beam Composite Blockout Bin,	4
13	4001115	Guardrail Bolt 5/8-11x 1 1/4	16
14	20011780	Guardrail bolt 5/8-11 x 2,Mgal	2
15	2001040	Guardrail bolt 5/8-11x10,Mgal	4
16	4001116	Guardrail Nut Recessed 5/8-11	22
17	BSI-1312100-00	Soil Plate, 18x18, Galv,	1
18	4000443	W-Beam Guardrail RWM02a	3
19	BSI-1310024-00	X,LITE,CRIMPED POST SLOTS,GALV	1
20	MANXLT	X-Lite Tangent Installation	1
31	BSI-1410022-KT	X-Lite Distributor MW Kit	1
32	2000220	C-Scr HH 5/8-11x3 1/2 Gr5 MGal	2
33	2001535	WSHR 5/8 F436 Struct MGal	4
34	2000312	Nut HH 5/8-11 Gr5 Mgal	2
35	2001380	WSHR F436 Structural Gal	2
36	BSI-1303005-00	Bracket, X-Lite, Cable Retent	1
37	BSI-1102027-00	WASHER,SQUARE,X-LITE,GALV	1
38	BSI-1410121-00	NUT, 1-8 UNC-2, ASTM G563 DH	2

REV	ECN#	DATE
K	2540	12/15/14
J	2510	11/12/14
I	2444	10/03/14
H	2253	03/25/14
G	2220	01/24/14
F	2165	11/13/13
E	2162	10/28/13

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:
FRACTIONS ±1/16 DECIMAL XX = ±.010 XXX = ±.005 ANGLES ±1/2°
INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5.1994

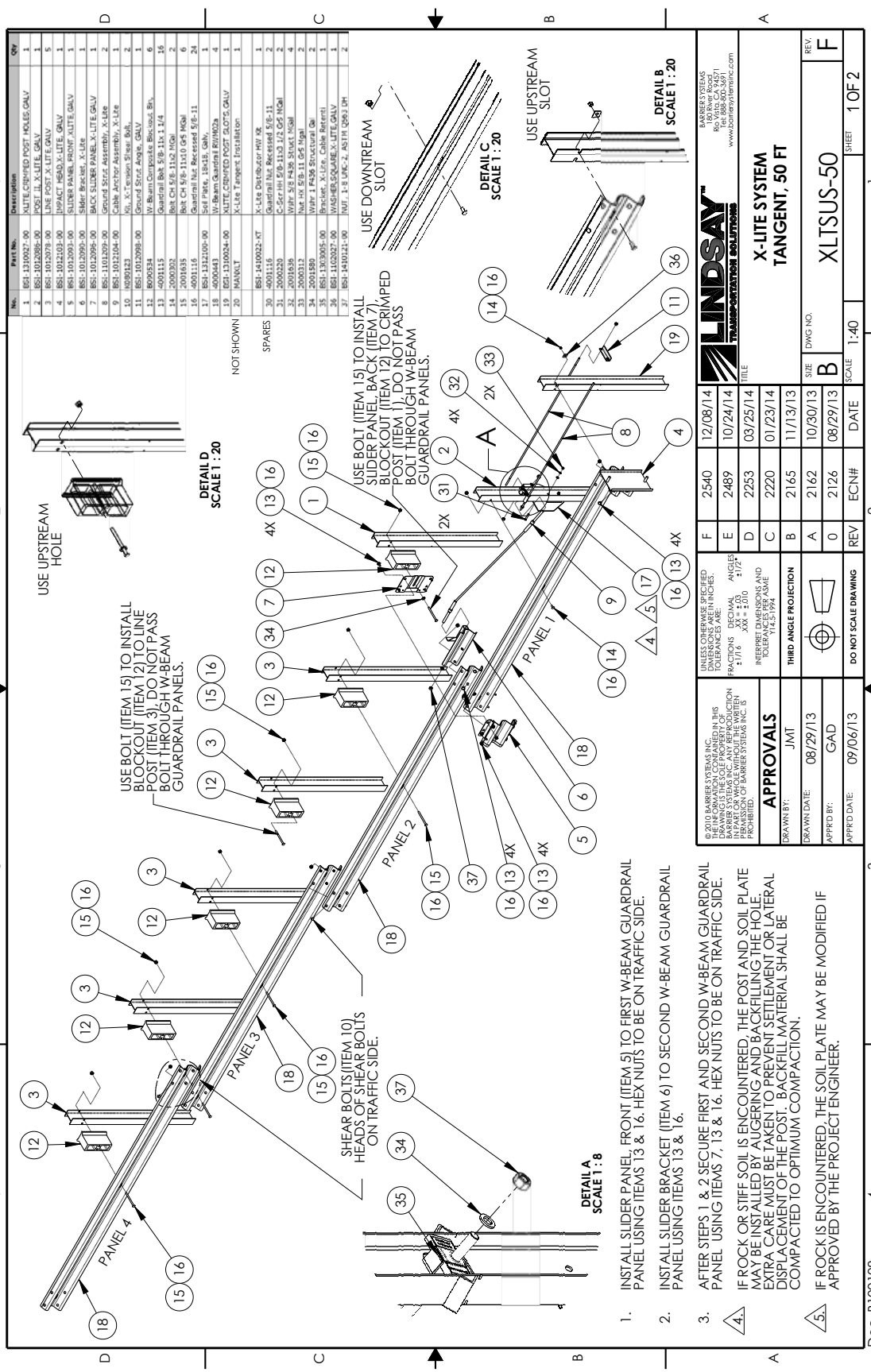
Appendix A - System Configuration, 37’ 6”



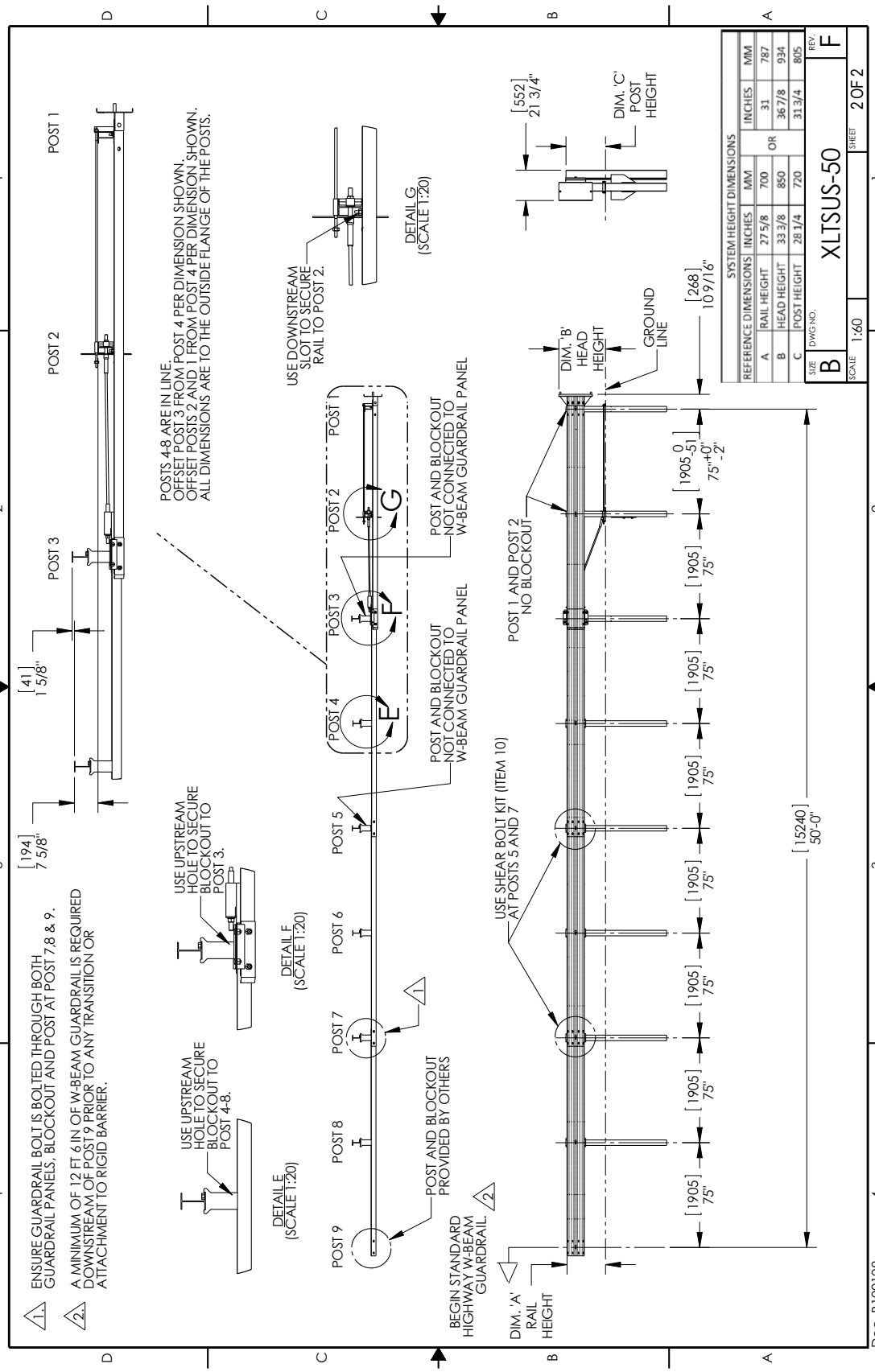
Appendix A -Bill of Materials - X-Lite Tangent, 37’ 6”

Item	Description	Full System	Kit Only
BSI-1310024-00	XLITE,CRIMPED POST SLOTS,GALV	1.00	1.00
BSI-1310027-00	XLITE,CRIMPED POST HOLES,GALV	1.00	1.00
BSI-1012086-00	POST II, X-LITE, GALV	1.00	1.00
BSI-1012078-00	LINE POST,X-LITE,GALV	3.00	-
BSI-1012103-00	IMPACT HEAD,X-LITE, GALV	1.00	1.00
BSI-1012093-00	SLIDER PANEL,FRONT,XLITE,GALV	1.00	1.00
BSI-1012090-00	Slider Bracket, X-Lite	1.00	1.00
BSI-1012096-00	BACK SLIDER PANEL,X-LITE,GALV	1.00	1.00
BSI-1012097-00	Ground Strut, X-Lite	2.00	2.00
BSI-1012098-00	Ground Strut Angle	1.00	1.00
BSI-1012104-00	Cable Anchor Assembly, X-Lite	1.00	1.00
K080123	Kit, X-Tension Shear Bolt,	2.00	2.00
BSI-1102027-00	WASHER,SQUARE,X-LITE,GALV	1.00	1.00
B090534	W-Beam Composite Blockout 8in,	4.00	-
4001115	Guardrail Bolt 5/8-11x 1 1/4	16.00	-
2001758	Guardrail Bolt 5/8-11 x 2”	2.00	-
2001840	Guardrail Bolt 5/8-11 x 10”	4.00	-
4001116	Guardrail Nut Recessed 5/8-11	24.00	2.00
2001580	Wshr 1" F436 Structural	2.00	2.00
4000443	W-Beam Guardrail RWM02a	3.00	-
BSI-1312100-00	Soil Plate	1.00	1.00
2000220	C-Scr HH 5/8-11x3 1/2	2.00	2.00
2001636	Wshr 5/8 F436	4.00	4.00
2000312	Nut HX 5/8-11	2.00	2.00
BSI-1303005-00	Bracket, X-Lite, Cable Retenti	1.00	1.00

Appendix A - System Configuration, 50’



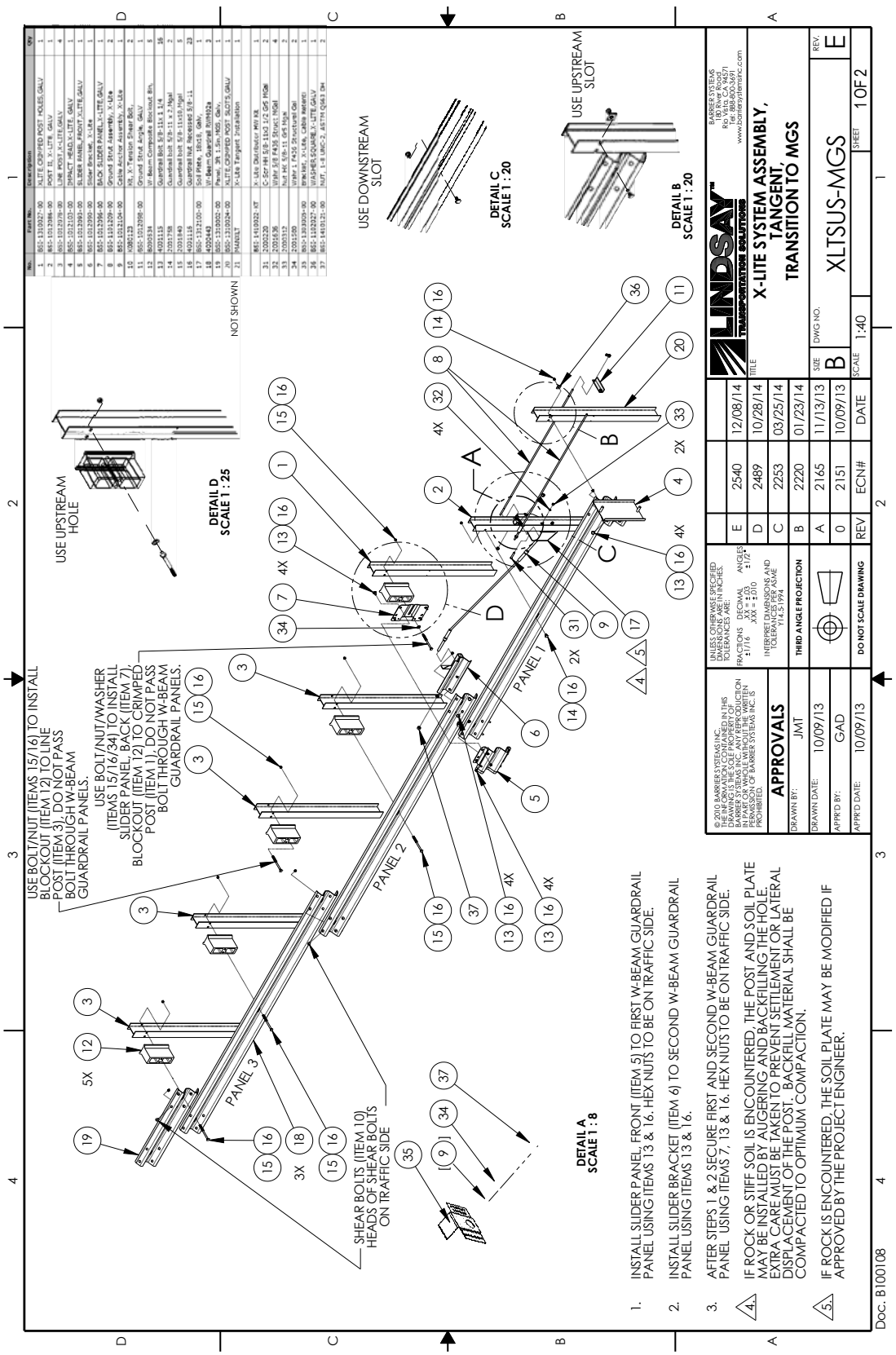
Appendix A - System Configuration, 50’



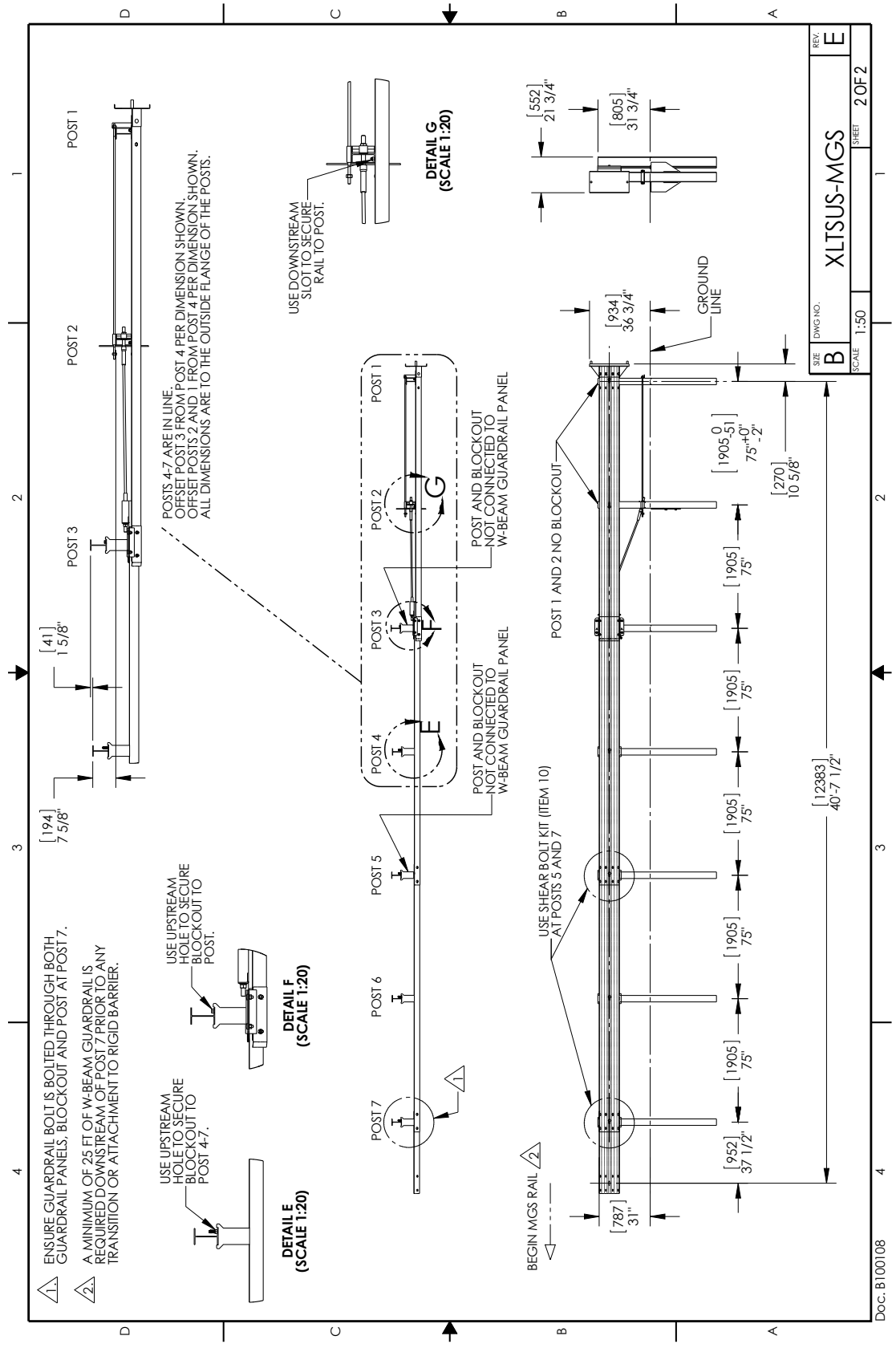
Appendix A -Bill of Materials - X-Lite Tangent, 50’

Item	Description	Full System	Kit Only
BSI-1310024-00	XLITE,CRIMPED POST SLOTS,GALV	1.00	1.00
BSI-1310027-00	XLITE,CRIMPED POST HOLES,GALV	1.00	1.00
BSI-1012086-00	POST II, X-LITE, GALV	1.00	1.00
BSI-1012078-00	LINE POST,X-LITE,GALV	5.00	-
BSI-1012103-00	IMPACT HEAD,X-LITE, GALV	1.00	1.00
BSI-1012093-00	SLIDER PANEL,FRONT,XLITE,GALV	1.00	1.00
BSI-1012090-00	Slider Bracket, X-Lite	1.00	1.00
BSI-1012096-00	BACK SLIDER PANEL,X-LITE,GALV	1.00	1.00
BSI-1012097-00	Ground Strut, X-Lite	2.00	2.00
BSI-1012098-00	Ground Strut Angle	1.00	1.00
BSI-1012104-00	Cable Anchor Assembly, X-Lite	1.00	1.00
K080123	Kit, X-Tension Shear Bolt,	2.00	2.00
BSI-1102027-00	WASHER,SQUARE,X-LITE,GALV	1.00	1.00
B090534	W-Beam Composite Blockout 8in,	6.00	-
4001115	Guardrail Bolt 5/8-11x 1 1/4	16.00	-
2001758	Guardrail Bolt 5/8-11 x 2”	2.00	-
2001840	Guardrail Bolt 5/8-11 x 10”	6.00	-
4001116	Guardrail Nut Recessed 5/8-11	26.00	2.00
2001580	Wshr 1" F436 Structural	2.00	2.00
4000443	W-Beam Guardrail RWM02a	4.00	-
BSI-1312100-00	Soil Plate	1.00	1.00
2000220	C-Scr HH 5/8-11x3 1/2 Gr5 MGal	2.00	2.00
2001636	Wshr 5/8 F436 Struct MGal	4.00	4.00
2000312	Nut HX 5/8-11 Gr5 Mgal	2.00	2.00
BSI-1303005-00	Bracket, X-Lite, Cable Retenti	1.00	1.00

Appendix A - System Configuration, 37’ 6” MGS

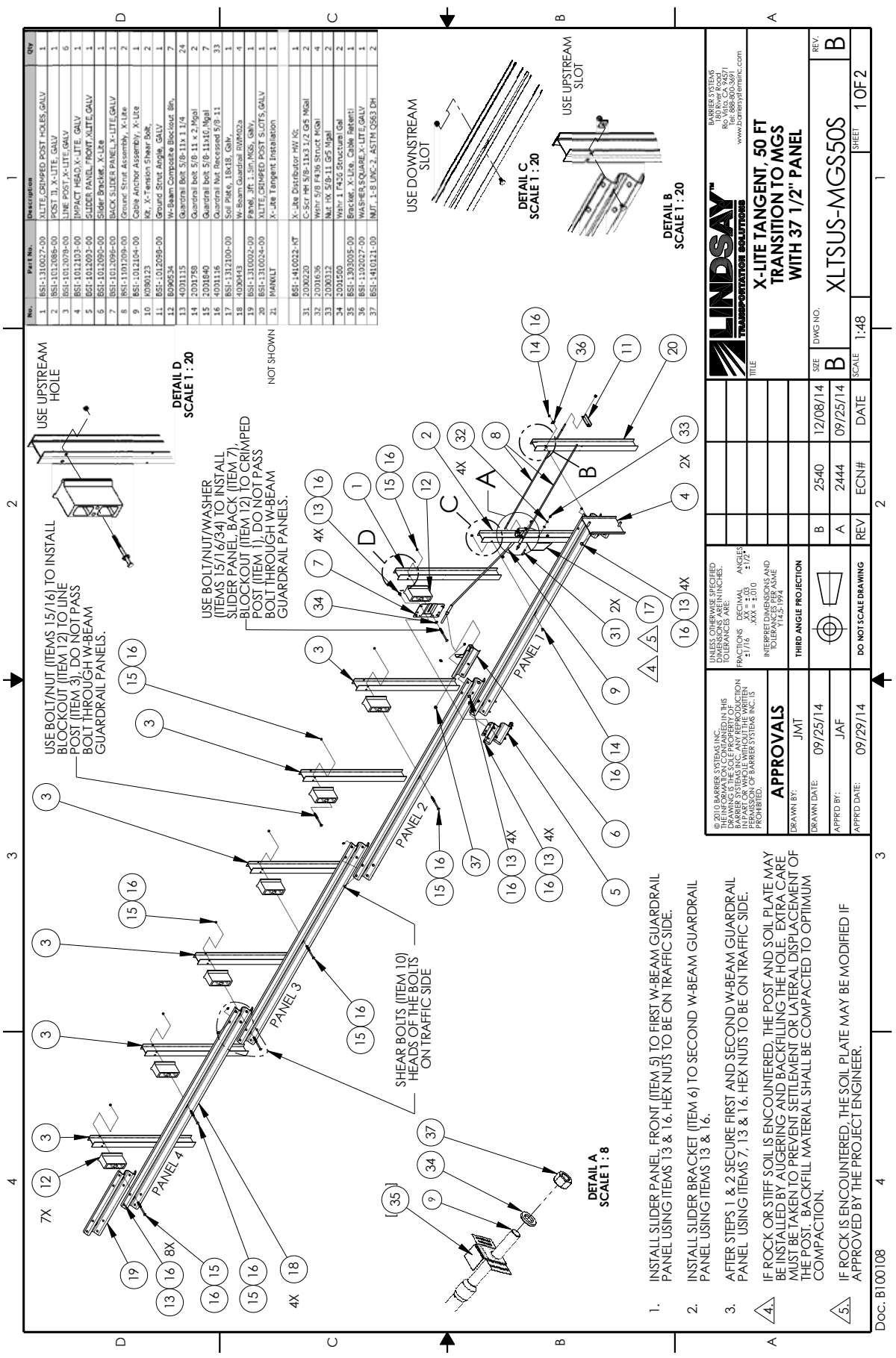


Appendix A - System Configuration, 37’ 6” MGS



Appendix A -Bill of Materials - X-Lite Tangent, MGS 37’ 6”

Item	Description	Full System	Kit Only
BSI-1310024-00	XLITE,CRIMPED POST SLOTS,GALV	1.00	1.00
BSI-1310027-00	XLITE,CRIMPED POST HOLES,GALV	1.00	1.00
BSI-1012086-00	POST II, X-LITE, GALV	1.00	1.00
BSI-1012078-00	LINE POST,X-LITE,GALV	3.00	-
BSI-1012103-00	IMPACT HEAD,X-LITE, GALV	1.00	1.00
BSI-1012093-00	SLIDER PANEL,FRONT,XLITE,GALV	1.00	1.00
BSI-1012090-00	Slider Bracket, X-Lite	1.00	1.00
BSI-1012096-00	BACK SLIDER PANEL,X-LITE,GALV	1.00	1.00
BSI-1012097-00	Ground Strut, X-Lite	2.00	2.00
BSI-1012098-00	Ground Strut Angle	1.00	1.00
BSI-1012104-00	Cable Anchor Assembly, X-Lite	1.00	1.00
K080123	Kit, X-Tension Shear Bolt,	2.00	2.00
BSI-1102027-00	WASHER,SQUARE,X-LITE,GALV	1.00	1.00
B090534	W-Beam Composite Blockout 8in,	5.00	-
4001115	Guardrail Bolt 5/8-11x 1 1/4	16.00	-
2001758	Guardrail Bolt 5/8-11 x 2”	2.00	-
2001840	Guardrail Bolt 5/8-11 x 10”	5.00	-
4001116	Guardrail Nut Recessed 5/8-11	25.00	2.00
2001580	Wshr 1" F436 Structural	2.00	2.00
4000443	W-Beam Guardrail RWM02a	3.00	-
BSI-1312100-00	Soil Plate	1.00	1.00
2000220	C-Scr HH 5/8-11x3 1/2	2.00	2.00
2001636	Wshr 5/8 F436 Struct	4.00	4.00
2000312	Nut HX 5/8-11	2.00	1.00
BSI-1303005-00	Bracket, X-Lite, Cable Retenti	1.00	1.00
BSI-1310016-KT	Transition Kit, MGS, X-Lite	1.00	1.00



No.	Part No.	Description	Qty
1	BSI-1310027-00	XLITE_CRIMPED POST HOLES,GALV	1
2	BSI-1012086-00	POST 31, X-LITE, GALV	1
3	BSI-1012079-00	LINE POST,X-LITE,GALV	6
4	BSI-1012103-00	IMPACT HEAD,X-LITE, GALV	1
5	BSI-1012093-00	SLIDER PANEL,FRONT,XLITE,GALV	1
6	BSI-1012092-00	Slider Bracket, X-Lite	1
7	BSI-1012096-00	BACK SLIDER PANEL,X-LITE,GALV	1
8	BSI-1101209-00	Ground Strut Assembly, X-Lite	2
9	BSI-1012104-00	Cable Anchor Assembly, X-Lite	1
10	KD80123	Kit, X-Tension Shear Bolt	2
11	BSI-1012098-00	Ground Strut Angle, GALV	1
12	BOW0534	W-Beam Composite Blockout 8in,	7
13	4001115	Guardrail Bolt 5/8-11x 1 1/4	24
14	2001758	Guardrail bolt 5/8 11 x 2,Mgal	2
15	2001840	Guardrail bolt 5/8-11x10,Mgal	7
16	4001116	Guardrail Nut Recessed 5/8-11	33
17	BSI-1312100-00	Soil Plate, 18x18, Galv.	1
18	4000443	W-Beam Guardrail RWM02a	4
19	BSI-1310002-00	Panel, 3ft 1.5in,MGS, Galv,	1
20	BSI-1310024-00	XLITE_CRIMPED POST SLOTS,GALV	1
21	MANUAL	X-Lite Tangent Installation	1
	BSI-1410022-HT	X-Lite Distributor HW Kit	1
31	2000220	C-Scr HH 5/8-11x3 1/2 G5 MGal	2
32	2001636	Wshr 5/8 F436 Struct MGal	4
33	2000312	Nut HX 5/8-11 G5 Mgal	2
34	2001500	Washr 1 F436 Structural Gal	2
35	BSI-1303005-00	Bracket, X-Lite, Cable Retent	1
36	BSI-1102027-00	WASHER,SQUARE,X-LITE,GALV	1
37	BSI-1410121-00	NUT, 1-8 UNC-2, ASTM G563 DH	2

1. INSTALL SLIDER PANEL, FRONT (ITEM 5) TO FIRST W-BEAM GUARDRAIL PANEL USING ITEMS 13 & 16. HEX NUTS TO BE ON TRAFFIC SIDE.
2. INSTALL SLIDER BRACKET (ITEM 6) TO SECOND W-BEAM GUARDRAIL PANEL USING ITEMS 13 & 16.
3. AFTER STEPS 1 & 2 SECURE FIRST AND SECOND W-BEAM GUARDRAIL PANEL USING ITEMS 7, 13 & 16. HEX NUTS TO BE ON TRAFFIC SIDE.
4. IF ROCK OR STIFF SOIL IS ENCOUNTERED, THE POST AND SOIL PLATE MAY BE INSTALLED BY AUGERING AND BACKFILLING THE HOLE. EXTRA CARE MUST BE TAKEN TO PREVENT SETTLEMENT OR LATERAL DISPLACEMENT OF THE POST. BACKFILL MATERIAL SHALL BE COMPACTED TO OPTIMUM COMPACTION.
5. IF ROCK IS ENCOUNTERED, THE SOIL PLATE MAY BE MODIFIED IF APPROVED BY THE PROJECT ENGINEER.

APPROVALS	
DRAWN BY:	JMT
DRAWN DATE:	09/25/14
APPRD BY:	JAF
APPRD DATE:	09/29/14

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE:
FRACTIONS ±1/16 DECIMAL .XX = ±.03 .XXX = ±.010 ANGLES ±1/2°
INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5-1994
THIRD ANGLE PROJECTION
DO NOT SCALE DRAWING

REV	ECN#	DATE
B	2540	12/08/14
A	2444	09/25/14

LINDSAY™ TRANSPORTATION SOLUTIONS

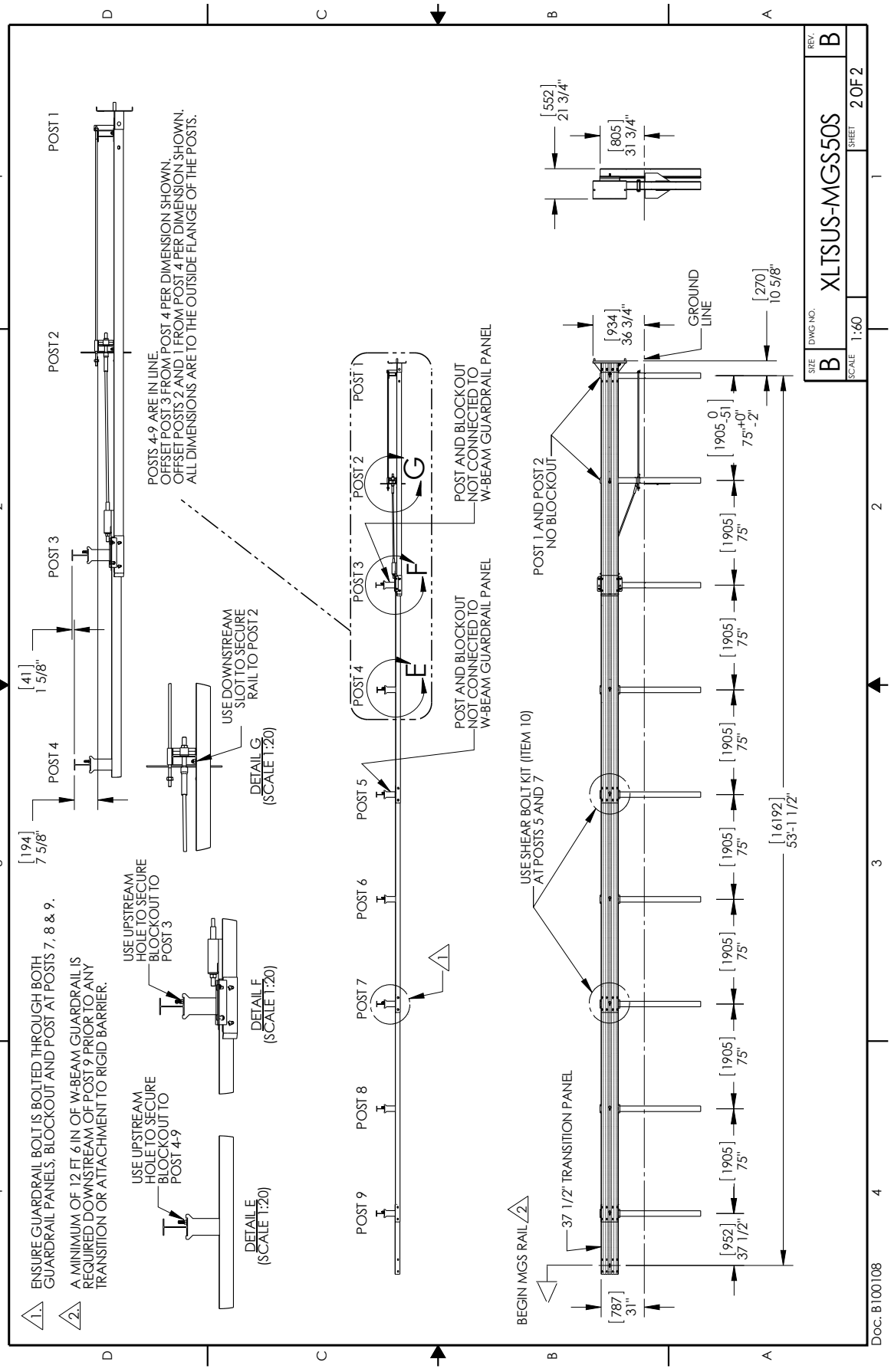
BARRIER SYSTEMS
180 River Road
Red Bluff, CA 96071
tel: 888-800-3691
www.barriersystemsinc.com

TITLE: X-LITE TANGENT, 50 FT TRANSITION TO MGS WITH 37 1/2" PANEL

SIZE: B | DWG NO.: XLTSUS-MGS50S | REV.: B

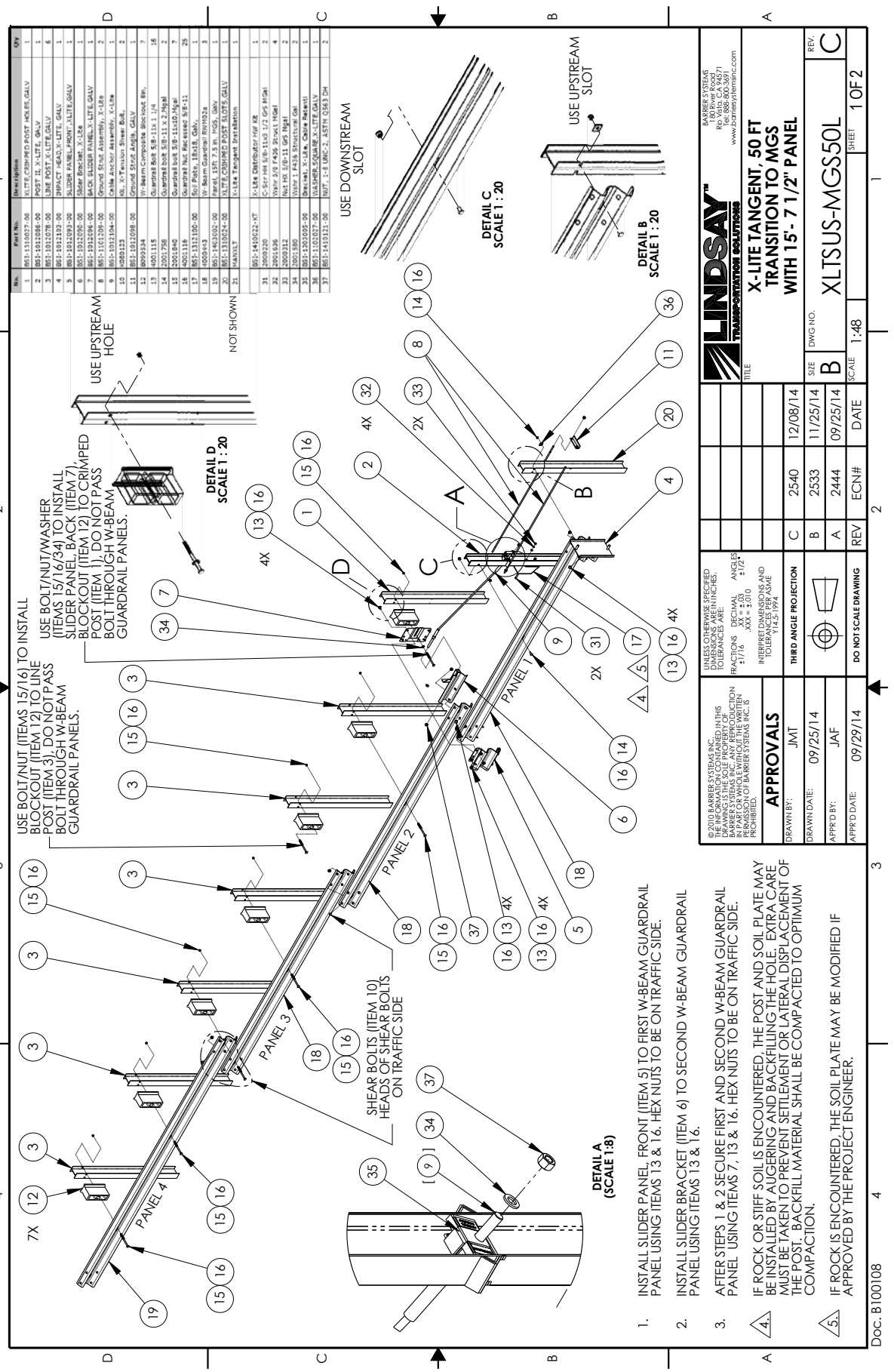
SCALE: 1:48 | SHEET: 1 OF 2

Doc. B100108

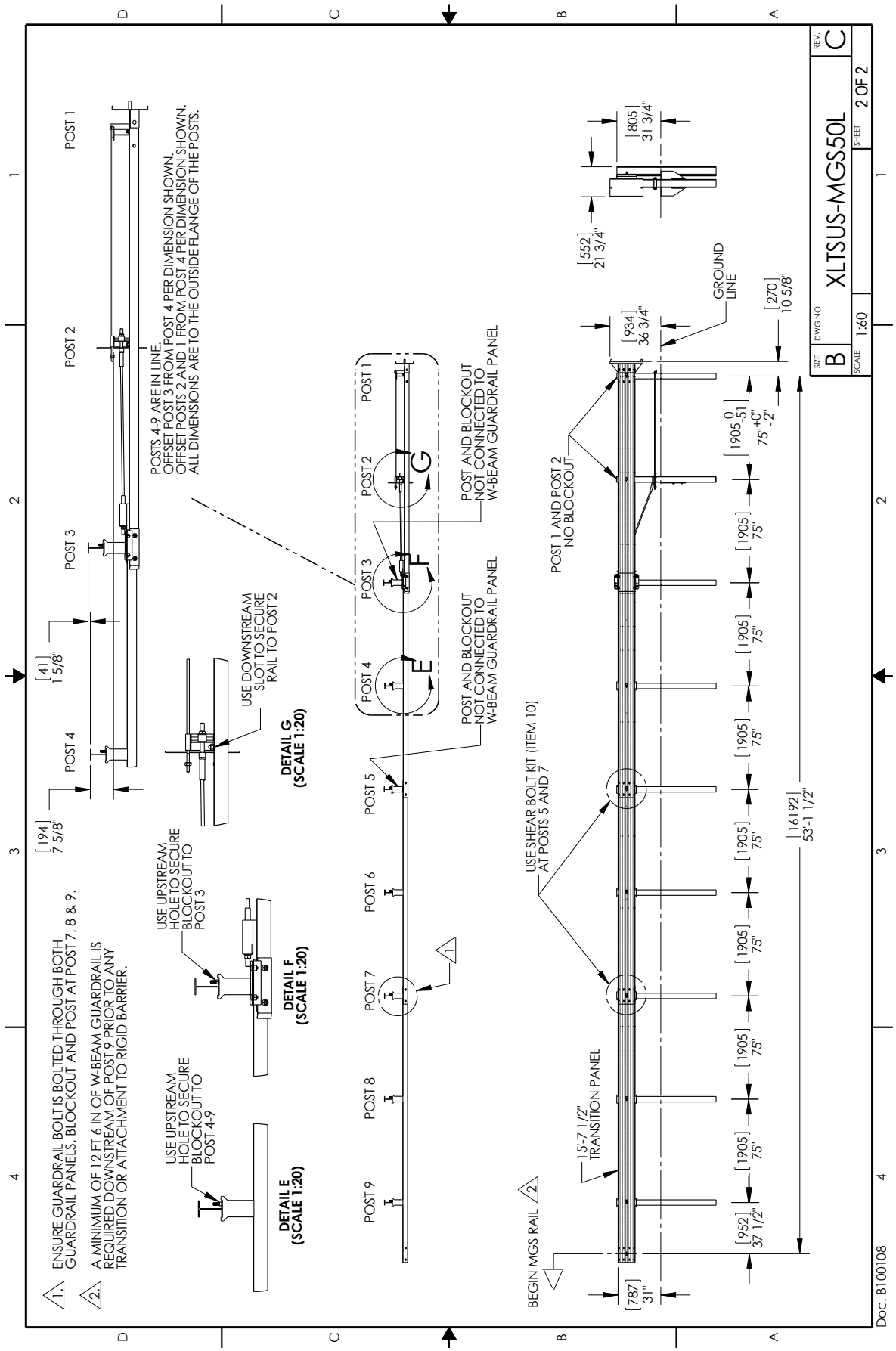

1. ENSURE GUARDRAIL BOLT IS BOLTED THROUGH BOTH GUARDRAIL PANELS, BLOCKOUT AND POST AT POSTS 7, 8 & 9.
2. A MINIMUM OF 12 FT 6 IN OF W-BEAM GUARDRAIL IS REQUIRED DOWNSTREAM OF POST 9 PRIOR TO ANY TRANSITION OR ATTACHMENT TO RIGID BARRIER.
POSTS 4-9 ARE IN LINE.
OFFSET POST 3 FROM POST 4 PER DIMENSION SHOWN.
OFFSET POSTS 2 AND 1 FROM POST 4 PER DIMENSION SHOWN.
ALL DIMENSIONS ARE TO THE OUTSIDE FLANGE OF THE POSTS.
POST 1
POST 2
POST 3
POST 4
POST 5
POST 6
POST 7
POST 8
POST 9
[41] 1 5/8"
[194] 7 5/8"
USE DOWNSTREAM SLOT TO SECURE RAIL TO POST 2
DETAIL G (SCALE 1:20)
USE UPSTREAM HOLE TO SECURE BLOCKOUT TO POST 3
DETAIL F (SCALE 1:20)
USE UPSTREAM HOLE TO SECURE BLOCKOUT TO POST 4-9
DETAIL E (SCALE 1:20)
POST AND BLOCKOUT NOT CONNECTED TO W-BEAM GUARDRAIL PANEL
POST AND BLOCKOUT NOT CONNECTED TO W-BEAM GUARDRAIL PANEL
POST 1 AND POST 2 NO BLOCKOUT
USE SHEAR BOLT KIT (ITEM 10) AT POSTS 5 AND 7
37 1/2" TRANSITION PANEL
BEGIN MGS RAIL
[552] 21 3/4"
[805] 31 3/4"
[934] 36 3/4"
GROUND LINE
[270] 10 5/8"
[1905 0 -51] 75" +0" -2"
[1905] 75"
[952] 37 1/2"
[787] 31"
[16192] 53'-1 1/2"
SIZE B
DWG NO. XLTSUS-MGS50S
REV. B
SCALE 1:60
SHEET 2 OF 2
Doc. B100108

Appendix A -Bill of Materials - X-Lite Tangent, 50’ MGS Short Panel

Item	Description	Full System	Kit Only
BSI-1310027-00	XLITE,CRIMPED POST HOLES,GALV	1.00	1.00
BSI-1310024-00	XLITE,CRIMPED POST SLOTS,GALV	1.00	1.00
BSI-1012086-00	POST II, X-LITE, GALV	1.00	1.00
BSI-1012078-00	LINE POST,X-LITE,GALV	6.00	-
BSI-1012103-00	IMPACT HEAD,X-LITE, GALV	1.00	1.00
BSI-1012093-00	SLIDER PANEL,FRONT,XLITE,GALV	1.00	1.00
BSI-1012090-00	Slider Bracket, X-Lite	1.00	1.00
BSI-1012096-00	BACK SLIDER PANEL,X-LITE,GALV	1.00	1.00
BSI-1101209-00	Ground Strut Assembly, X-Lite	2.00	1.00
BSI-1012098-00	Ground Strut Angle, GALV	1.00	1.00
BSI-1012104-00	Cable Anchor Assembly, X-Lite	1.00	1.00
K080123	Kit, X-Tension Shear Bolt,	2.00	1.00
BSI-1102027-00	WASHER,SQUARE,X-LITE,GALV	1.00	1.00
B090534	W-Beam Composite Blockout 8in,	7.00	-
4001115	Guardrail Bolt 5/8-11x 1 1/4	24.00	-
2001758	Guardrail Bolt 5/8-11 x 2”	2.00	-
2001840	Guardrail Bolt 5/8-11 x 10”	7.00	-
4001116	Guardrail Nut Recessed 5/8-11	35.00	2.00
2001580	Wshr 1 F436 Structural Gal	2.00	2.00
4000443	W-Beam Guardrail RWM02a	4.00	-
BSI-1310002-00	Panel, 3ft 1.5in,MGS, Galv,	1.00	-
BSI-1312100-00	Soil Plate, 18x18, Galv,	1.00	1.00
2000220	C-Scr HH 5/8-11x3 1/2	2.00	1.00
2001636	Wshr 5/8 F436	4.00	1.00
2000312	Nut HX 5/8-11	2.00	1.00
BSI-1303005-00	Bracket, X-Lite, Cable Retenti	1.00	1.00



No.	Part No.	Description	QTY
1	861-1311077-00	X-LITE, CRIMPED POST HOLES, GALV	1
2	861-1911096-00	POST 11, X-LITE, GALV	1
3	861-1911078-00	LINE POST, X-LITE, GALV	6
4	861-1911193-00	IMPACT HEAD, X-LITE, GALV	1
5	861-1911093-00	SLIDER PANEL, FRONT, X-LITE, GALV	1
6	861-1911096-00	Slider Bracket, X-Lite	1
7	861-1911094-00	BACK SLIDER PANEL, X-LITE, GALV	1
8	861-1161109-00	Ground Strut Assembly, X-Lite	2
9	861-1911104-00	Cable Anchor Assembly, X-Lite	1
10	4000123	HX, X-Tension Shear Bolt	2
11	861-1911098-00	Ground Strut Angle, GALV	1
12	9999334	11" Beam Composite Blockout Rn.	1
13	4001155	Guardrail Bolt 5/8-11x 1 1/4	16
14	2001298	Guardrail Bolt 5/8-11 x 2 Hgal	2
15	2001646	Guardrail Bolt 5/8-11x10 Hgal	2
16	4000148	Washer Flat 5/8 Std Hgal	25
17	861-1311100-00	Soil Plate, 18x18, Galv, 5/8-11	1
18	4000143	W-Beam Guardrail RWM02a	3
19	861-1403002-00	Panel, 150, 7.5 in. HSS, Galv	1
20	861-1310024-00	11"LTE,CRIMPED POST SLOTS,GALV	1
21	MANUAL	X-Lite Tangent Installation	1
	861-1410022-KT	X-Lite Distributor HW Kit	1
31	2000220	C-Str HH 5/8-11x3 1/2 Grd M3al	2
32	2001636	Wshr 5/8 F436 Struct M3al	4
33	2000312	Nut HX 5/8-11 Grd M3al	2
34	2001580	Washer 1 F436 Structural Gal	2
35	861-1303005-00	Bracket, X-Lite, Cable Retent	1
36	861-1103027-00	WASHER,SQUARE,X-LITE,GALV	1
37	861-1411911-00	NUT, 1-8 UNC-2, ASTM G563 DH	2


1. ENSURE GUARDRAIL BOLT IS BOLTED THROUGH BOTH GUARDRAIL PANELS, BLOCKOUT AND POST AT POST 7, 8 & 9.
2. A MINIMUM OF 12 FT 6 IN OF W-BEAM GUARDRAIL IS REQUIRED DOWNSTREAM OF POST 9 PRIOR TO ANY TRANSITION OR ATTACHMENT TO RIGID BARRIER.
POSTS 4-9 ARE IN LINE.
OFFSET POST 3 FROM POST 4 PER DIMENSION SHOWN.
OFFSET POSTS 2 AND 1 FROM POST 4 PER DIMENSION SHOWN.
ALL DIMENSIONS ARE TO THE OUTSIDE FLANGE OF THE POSTS.
[194] 7 5/8"
[41] 1 5/8"
POST 1
POST 2
POST 3
POST 4
USE DOWNSTREAM SLOT TO SECURE RAIL TO POST 2
DETAIL G (SCALE 1:20)
USE UPSTREAM HOLE TO SECURE BLOCKOUT TO POST 3
DETAIL F (SCALE 1:20)
USE UPSTREAM HOLE TO SECURE BLOCKOUT TO POST 4-9
DETAIL E (SCALE 1:20)
POST 5
POST 6
POST 7
POST 8
POST 9
POST AND BLOCKOUT NOT CONNECTED TO W-BEAM GUARDRAIL PANEL
POST AND BLOCKOUT NOT CONNECTED TO W-BEAM GUARDRAIL PANEL
USE SHEAR BOLT KIT (ITEM 10) AT POSTS 5 AND 7
POST 1 AND POST 2 NO BLOCKOUT
15'-7 1/2" TRANSITION PANEL
BEGIN MGS RAIL
[787] 31"
[952] 37 1/2"
[1905] 75"
[16192] 53'-1 1/2"
[552] 21 3/4"
[805] 31 3/4"
[934] 36 3/4"
GROUND LINE
[270] 10 5/8"
1905 0 -51 75" +0" -2"
SIZE B
DWG NO. XLTSUS-MGS50L
REV. C
SCALE 1:60
SHEET 2 OF 2
Doc. B100108

Appendix A -Bill of Materials - X-Lite Tangent, 50’ MGS Long Panel

Item	Description	Full System	Kit Only
BSI-1310027-00	XLITE,CRIMPED POST HOLES,GALV	1.00	1.00
BSI-1310024-00	XLITE,CRIMPED POST SLOTS,GALV	1.00	1.00
BSI-1012086-00	POST II, X-LITE, GALV	1.00	1.00
BSI-1012078-00	LINE POST,X-LITE,GALV	6.00	-
BSI-1012103-00	IMPACT HEAD,X-LITE, GALV	1.00	1.00
BSI-1012093-00	SLIDER PANEL,FRONT,XLITE,GALV	1.00	1.00
BSI-1012090-00	Slider Bracket, X-Lite	1.00	1.00
BSI-1012096-00	BACK SLIDER PANEL,X-LITE,GALV	1.00	1.00
BSI-1101209-00	Ground Strut Assembly, X-Lite	2.00	1.00
BSI-1012098-00	Ground Strut Angle, GALV	1.00	1.00
4001116	Guardrail Nut Recessed 5/8-11	2.00	1.00
BSI-1012104-00	Cable Anchor Assembly, X-Lite	1.00	1.00
K080123	Kit, X-Tension Shear Bolt,	2.00	1.00
BSI-1102027-00	WASHER,SQUARE,X-LITE,GALV	1.00	1.00
B090534	W-Beam Composite Blockout 8in,	7.00	-
4001115	Guardrail Bolt 5/8-11x 1 1/4	16.00	-
2001758	Guardrail Bolt 5/8-11 x 2”	2.00	-
2001840	Guardrail Bolt 5/8-11 x 10”	7.00	-
4001116	Guardrail Nut Recessed 5/8-11	27.00	2.00
2001580	Wshr 1 F436 Structural Gal	2.00	2.00
4000443	W-Beam Guardrail RWM02a	3.00	-
BSI-1403002-00	Panel, 15ft 7.5 in, MGS, Galv	1.00	-
BSI-1312100-00	Soil Plate, 18x18, Galv,	1.00	1.00
2000220	C-Scr HH 5/8-11x3 1/2	2.00	1.00
2001636	Wshr 5/8 F436	4.00	1.00
2000312	Nut HX 5/8-11	2.00	1.00
BSI-1303005-00	Bracket, X-Lite, Cable Retenti	1.00	1.00

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Lindsay Transportation Solutions Sales and Services, Inc.
180 River Road • Rio Vista, CA 94571 • +1 707.374.6800 U.S. Toll Free: 888.800.3691 • www.barrriersystemsinc.com