

X-TENSION® / X-MAS®

NCHRP 350 TL-3 Tangent / Flared End Terminal and Median Attenuator

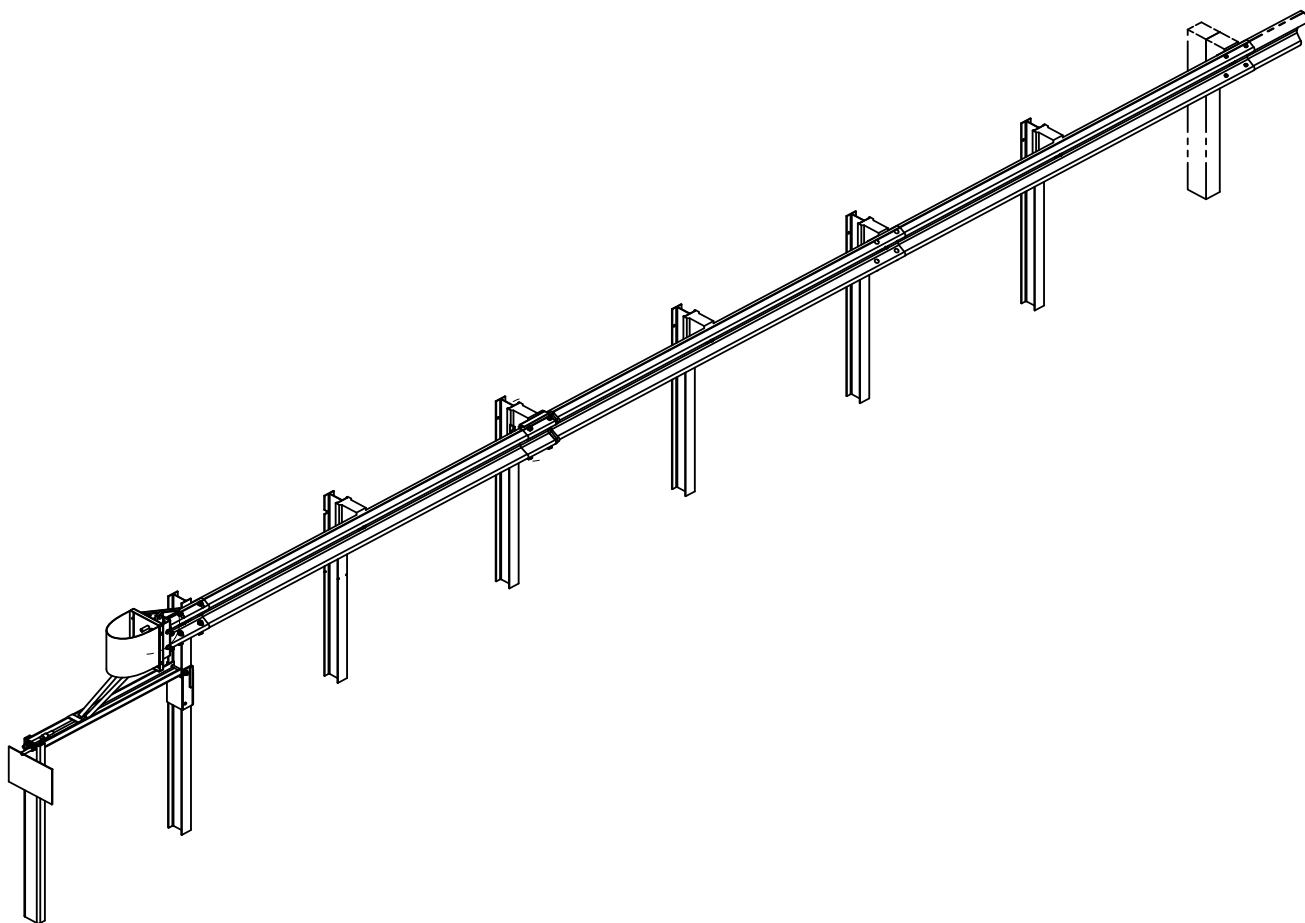


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X-Tension Introduction

Introduction

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

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

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

System Overview

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

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

Before Installation

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

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

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



STANDARD LIMITED WARRANTY

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

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.

LTS' 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 LTS, PRODUCTS OR PARTS NOT COMPLYING WITH LTS SPECIFICATIONS, OR, AT LTS' 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. LTS 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 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.

X-Tension Introduction (continued)

Limitations and Warnings

The X-Tension Guardrail End Terminal has been rigorously tested and evaluated per the recommendations in the NCHRP 350 guidelines for terminals and crash cushions. The impact conditions recommended in NCHRP 350 are intended to address typical in-service collisions.

When properly installed and maintained, the system is capable of containing and re-directing impacting vehicles in a predictable and safe manner under the NCHRP 350 impact conditions.

Vehicle impacts that vary from the NCHRP 350 impact conditions described for guardrail end terminals may result in significantly different results than those experienced in testing. Vehicle impact characteristics different than or in excess of those encountered in NCHRP 350 testing may result in system performance that may not meet the NCHRP 350 evaluation criteria.

Safety Statements

General Safety

All required traffic safety precautions should be complied with. All workers should wear required safety clothing (high visibility vests, steel capped footwear, gloves, hard hats, safety glasses etc.)

All underground services must be located before installation of any posts.

Only Authorized trained personnel should operate any machinery. Where overhead machinery is used, care must be taken to avoid any overhead hazards.

Gloves should be worn at all times. Particular care should be taken to avoid galvanizing spikes.

X-Tension Safety Statements

All installers must be well clear of post driving machinery when in use.

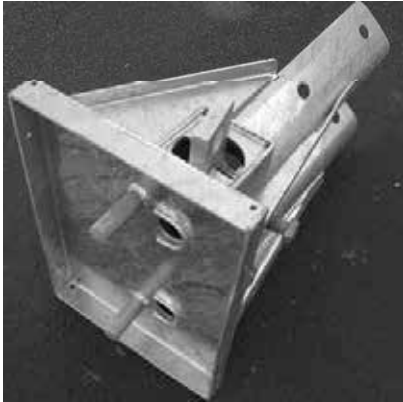
Avoid placing hands or fingers in and around moving parts when components are being lifted and manoeuvred into place. (i.e. around splice holes, etc.) permeable

The cables should be fitted by one person only. Other workers should stand clear to avoid being caught in moving cables.

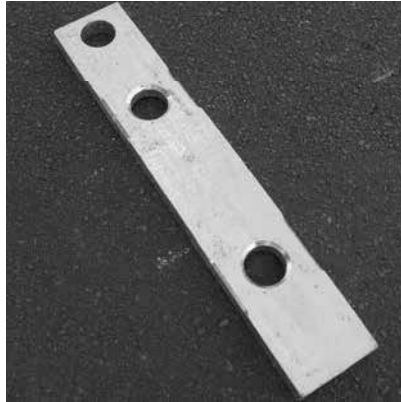
Securely fasten the impact head and rail before turning the friction plate.

The friction plate should be turned manually with a crow bar and extension handle. Do not attempt to turn it with the assistance of machinery. Ensure crow bar is securely held while the 4 locking bolts are tightened.

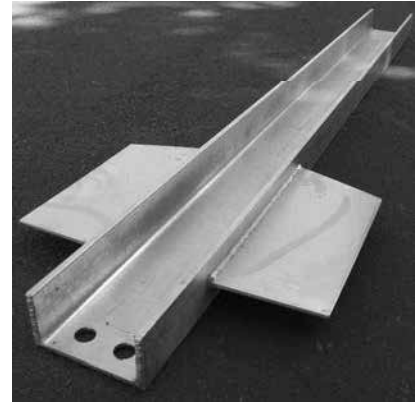
X-Tension Parts Identification



Impact Head
(1 Required)
B061072



Friction Plate
(1 Required)
B061058



Soil Anchor
(1 Required)
B061104



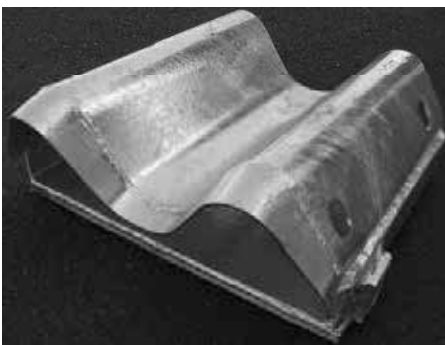
Slider Bracket + Angle Bar
(1 Required Roadside – 2 Median)
B061079



Cable Bracket
(1 Required)
B061083



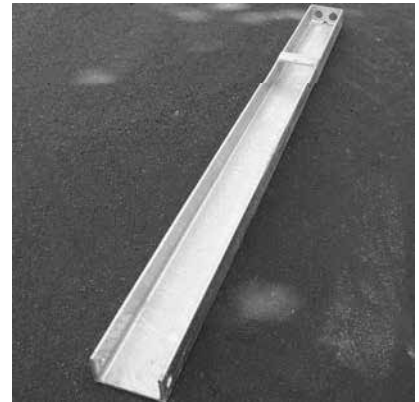
Cable Assembly
(2 Required)
B061109



Slider Panel
(1 Required Roadside – 2 Median)
B061088



Post 1 - Top
(1 Required)
B061099

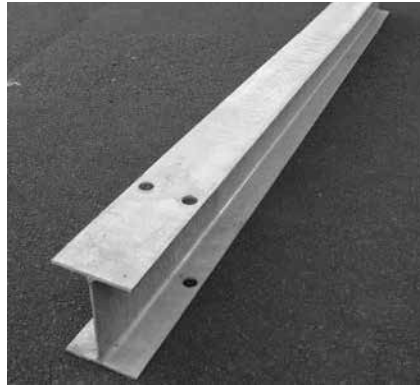


Ground Strut
(1 Required)
B061094

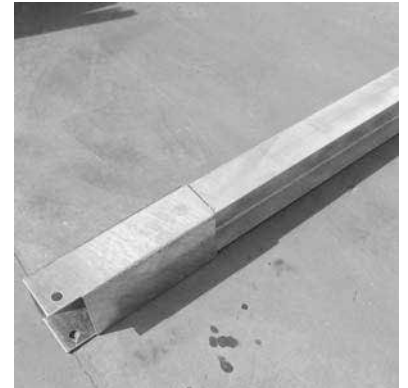
X-Tension Parts Identification



Post # 2 (1 Req.)
 Roadside can be CRT Timber
 B061100



Galv. Line Post (3-6)
 (CRT Timber Posts allowed roadside)
 BSI-1012078-00



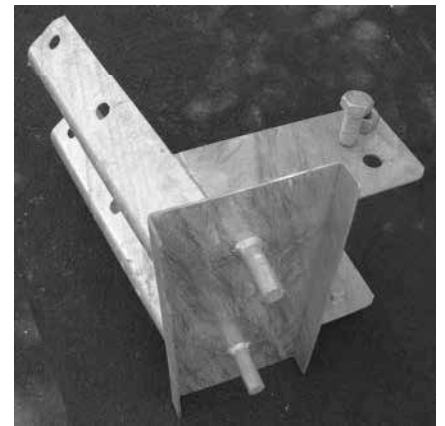
Post #1 Bottom
 (1 Required)
 B061098



W-Beam Guardrail RWM02a
 (3 Required Roadside – 5 Median)
 4000443



Median Radius Rail 1 (12'-6'')
 (1 Required – Shop Curved)
 B070233



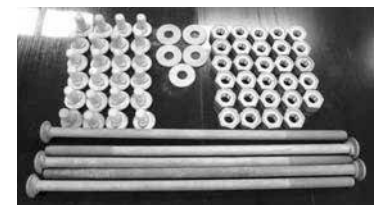
Median Secondary Head
 (1 Required)
 B070219



Shear Bolts
 8 Required Roadside - 16 Median)
 K080123



Blockout (Plastic or Timber)
 (5 Required Roadside – 10 Median)
 B090534



Hardware Set
 (Roadside)
 K070202 & K070204

X-Tension – Preparation for all Applications

Preparation

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

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

Soil Conditions

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

Tools Required

The same tools required to install standard highway guardrail will also install an X-Tension. **Specifically:** Sockets (commonly used in Guardrail), Drill, Wrenches, Large Crow Bar, String line, Level, Augers, Tampers and Post Pounders commonly used in driving posts.

Before Starting

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

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

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

Follow step by step instructions for the appropriate application.

Important Note about posts and blockouts:

Tangent & Flared Systems:

Post 1 steel – Post 2 either CRT timber or crimped steel
Post 3-6 either CRT timber or standard steel I beam posts

Median system:

Posts 1 & 2 are always crimped steel.
Posts 3 – 6 are standard steel I beam posts
Blockouts may be either composite or timber.

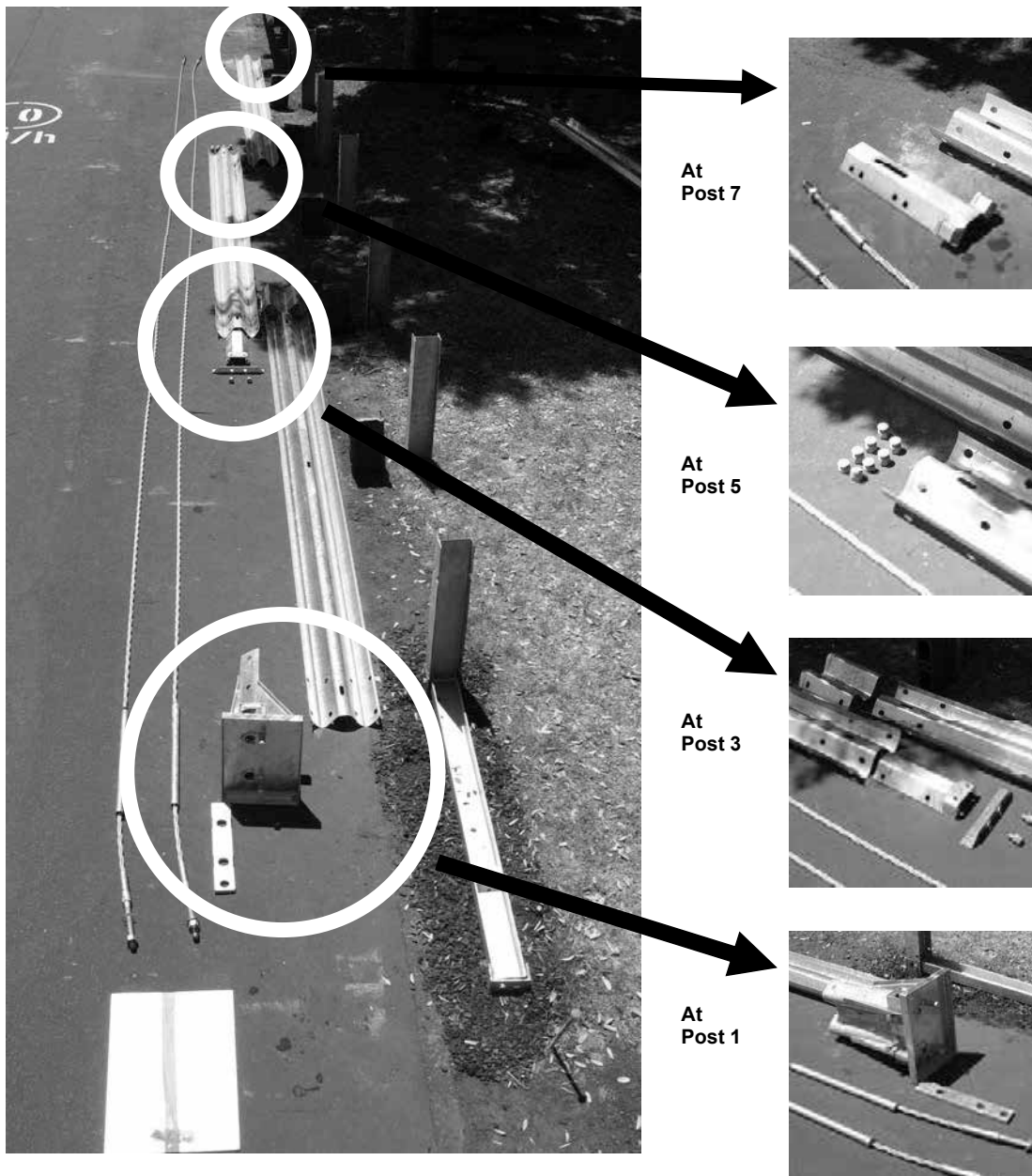
X-Tension - Tangent Installation Instructions

Step 1 - Set Out

The tangent terminal is essentially an 11.4m (38 ft) continuation of the standard guardrail run.

Pull a string line out with the desired offset (0 -450mm : 0-1.5 ft) over the length of the system, in a straight flare (Figure 1). **The system should not be installed on parabolic curve.** The string line should be set to follow the roadside edge of the posts.

All the posts except post #1 have a blockout so take care to place the roadside face of post #1 200mm (8 in) towards the roadway to compensate for the lack of blockout.



X-Tension - Tangent Installation Instructions

Step 2 – Installing Posts 6- 2

Begin installing posts 2 – 6 at standard highway post spacing, 75" (1905mm) and post height, 28 1/4" (720mm) or 31 3/4" (805mm) depending on the height of the system being installed.

Please note: Post 1 consists of two parts, Post 1 Top and Post 1 Bottom. Post 1 Top is different for 27 3/4" systems vs 31" systems . Ensure that the correct Post 1 Top is installed for the appropriate height system. Post 1 Top is not interchangeable between 27 3/4" and 31" height systems.

All posts should be the same height from ground level throughout the entire system.

Posts #6 to #3 are either standard "I" beam posts **OR** timber CRT posts. Post 2 is either the Special "I" beam post or a timber CRT (see parts identification photo).

Posts may be directly driven, or in stiff soils a 150mm (6 in) diameter hole drilled, and the post then driven into the hole. The post may also be placed in an oversized augured hole but care must be taken to ensure the backfill is properly compacted.

Hint: Offset Post 3 back from the string line 40-50mm (up to 2 in) to make it easier to push rail 1 and Slider Panel over rail 2.

When driving steel posts, ensure that a driving cap with timber or plastic insert is used to prevent damage to the galvanizing on the top of the posts.

Ensure that Post 2 has the post bolt **holes** on the side nearest the rail

Notches go to the backside as shown and are only used on the median application. (Figure 2)

Bolt the blackout to the post at post 3, prior to attaching to the rail (Figure 3).



Figure 1. Pull a string line with the desired offset.

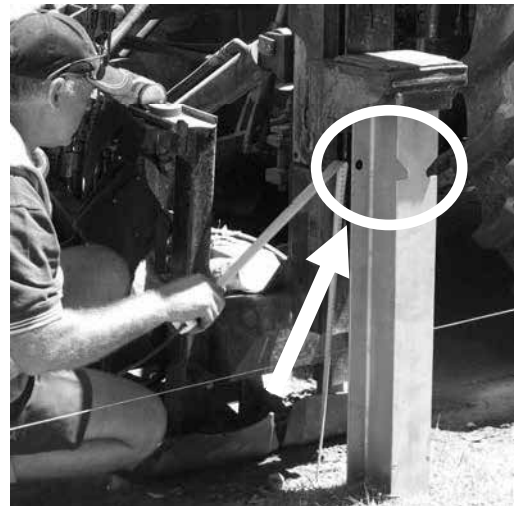


Figure 2. Holes on straight rail side, notches on the backside.



Figure 3. Bolt the blackout to post 3 prior to attaching the rail.

X-Tension - Tangent Installation Instructions

Step 3 – Post 1, Ground Strut and Soil Anchor

Place the roadside face of post 1 bottom anchor, 200mm (8 in) towards the roadway to compensate for the lack of blockout (Figure 4). Post 1 bottom, the Ground Strut and the Soil

Anchor are then placed parallel to the string line at this roadside offset position.

Drive or place the bottom of post 1 in the augured hole so that no more than 75mm (3 in) [100mm (4 in max)] protrudes above ground level (Figure 5). Use the Ground Strut as a template to place the Soil Anchor in the correct place. The Soil Anchor can then be driven into place or placed in an augured hole and backfilled. The Ground Strut should be level or lower at the anchor end than at the post 1 bottom end.

Place post 1 top in the post 1 bottom anchor ensuring that the post bolt notches are at the top and facing the Soil Anchor (Figure 6). Use M16 x 200mm (5/8 in x 8 in) hex head bolt with nut and washers. **Do not over tighten bolt.**



Figure 4. Measure 8 in. towards roadway.



Figure 5. Drive post 1 into augured hole.

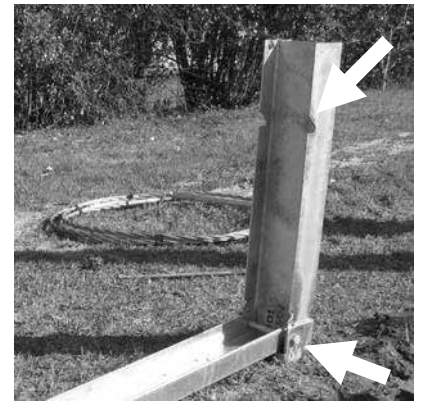


Figure 6. Post 1 top in post bottom.

Step 4 – Hang Rail 3 and Cable Anchor Bracket

Rail 3 is installed like standard guardrail with post 6 at the center of the rail and blockouts between the rail and post. Place the Cable Anchor Bracket on the back of the rail at the joint between rail 3 and rail 4 (post 7).

The two “boxes” on the cable bracket should be on the impact head side of the splice joint. Attach rails to post with post bolt and splice rail 3 to rail 4 with 8 standard splice bolts (Figure 7).



Figure 7. Splice rail 3 to rail 4 with 8 standard splice bolts.

X-Tension - Tangent Installation Instructions

Step 5 – Hang Rail 2 and Shear Bolts

Before installing rail 2, double check that the blockout is already bolted to post 3.

Bolt rail 2 to the post and blockouts at posts 4 and 5 with the appropriate post bolt (Figure 8).

DO NOT BOLT THE RAIL TO POST 3.

Splice rail 2 to rail 3 with the 8 special shear bolts (yellow) supplied (Figure 9). Put the washer and nut on inside of rail.

IMPORTANT NOTE: DO NOT USE STANDARD SPLICE BOLTS AT POST 5 SPLICE. DO NOT USE AN AIR-IMPACT WRENCH TO TIGHTEN SHEAR BOLTS. SHEAR BOLTS WILL BREAK IF OVER-TIGHTEND.



Figure 8. Bolt rail 2 to post and blockouts.



Figure 9. Splice rail 2 to rail 3 with 8 special shear bolts.

Step 6 – Attach Slider Bracket to Rail 2

Bolt the Slider Bracket to the end of rail 2 at post 3 (Figure 10). Use 4 standard splice bolts. The angle bar end should be closest to the Impact Head end.

Remove the angle bar and 2 x M20 x 25mm (3/4 in x 1 in) bolts (Figure 11).



Figure 10. Bolt Slider Bracket to end of rail 2 at post 3.



Figure 11. Remove angle bar bolts.

X-Tension - Tangent Installation Instructions

Step 7 – Assemble Slider Panel onto Rail 1

Start by sitting rail 1 on a blockout or post so that it is raised off the ground as shown (Figure 12). Slide the Slider Panel onto the downstream end of rail at post 3 location (Figure 13) and bolt into place using 4 standard splice bolts, pushing the bolt through from the inside of the slider to the outside so that the **nut is on the traffic face**.

The curved and reinforced (post breaker) end of Slider Panel sits at the rail end.

Use guardrail pin bar or crow bar to assist with lining up splice holes.



Figure 12. Sit rail 1 so it is raised off the ground.



Figure 13. Slide the Slider Panel onto downstream end.

Step 8 – Hang Rail 1

Lift rail 1 with Slider Panel attached and push the slider end over rail 2 (Figure 14). Overlap the rails as per a standard splice joint overlap.

Bolt rail 1 and blockout to post 2 using a standard post bolt that is supplied (Figure 15).

Re-attach the angle bar to the slider bracket on the backside of the rail (Figure 16).



Figure 14. Push Slider Panel over rail 2.



Figure 15. Bolt rail 1 and blockout to post 2.



Figure 16. Reattach the angle bar.

Step 9 – Attach Impact Head

Place Impact Head on upstream end of rail 1 and attach using 8 standard splice bolts with nuts on traffic face (Figure 17). **Hint:** Place bottom two bolts first then use guardrail pin bar to lever head up snug onto rail.

Bolt head and rail 1 to post 1 using the supplied M16 x 50mm (5/8 in x 2 in) guardrail post bolt. **Ensure to use a 5/8" hex nut at post 1.** Use a 50mm x 50mm (2 in x 2 in) washer under the nut on the inside of post 1 (Figure 18).



Figure 17. Attach Impact Head to rail 1.

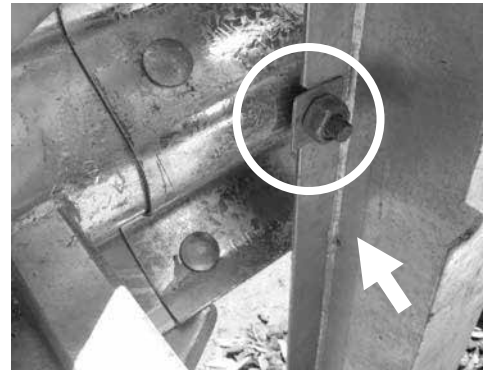


Figure 18. Bolt head and rail 1 to post 1 with washer & 5/8" hex nut.

Step 10 – Place the Cables

Push the cables under the steel strap on the Ground Strut (Figure 19) and forward through the holes at the top of the anchor. Lay the cables out parallel to the guardrail, downstream from the anchor.

Ensure that bottom cable (Cable B in Diagram 1) has half the thread protruding through the anchor, as shown. Ensure the top cable has the nut wound on a least two turns past the end of the thread (Figure 20). Cable A should always pass through the top hole on the impact head. Cable B should always pass through the bottom hole on the impact head as shown in Diagram 1.

In addition, ensure that the bottom cable passes through the ground strut hole nearest the straight (non-radius) side of the system.



Figure 19. Push cables under steel strap on Ground Strut.



Figure 20. Thread the nuts as shown.

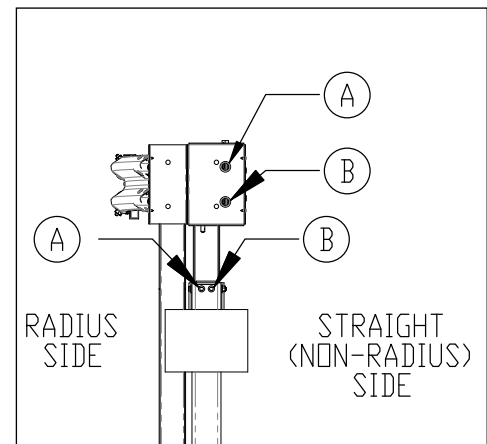


Diagram 1.

Step 11 – Installing the Cables

Install the Friction Plate in the top of the Impact Head, adjustment hole up. Take the cable closest to the road, pick up the downstream cable fitting and walk to the head, passing the cable through the bottom hole, through the Friction Plate (Figure 21) and out the backside of the Impact Head.

Now thread the cable down the backside of the rail following the bottom trough of the W-beam and attach to the bottom “box” on the Cable Bracket at post 7. Repeat this process with the other cable but push it through the top hole and thread it along the top trough of the W-beam. Place the nuts and washer on the cables at the Cable Bracket end but only run them a few turns (Figure 22).

Do not tighten cables at this stage (or the Friction Plate will not turn)



Figure 21. Pass the cable through the bottom hole.

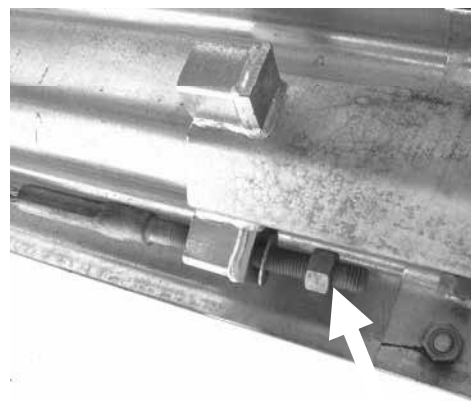


Figure 22. Do not tighten nuts at this time.

Step 12 – Turning the Friction Plate

Put a crow bar through the hole at the top of the friction plate (Figure 23) and turn it to the final position. Using a socket, tighten the 4 - M20 x 75mm (3/4 in x 3 in) bolts on the side of the impact head to lock the bar in the turned position (Figure 24).



Figure 23. Use crow bar to turn Friction Plate.



Figure 24. Use socket to lock bar in the turned position.

Step 13 – Tightening the Cables

Only tighten the cables using the nuts at the Cable Bracket end (post 7) (Figure 25). **Do not tighten the cable nuts at front of the Ground Anchor.**

Tighten the cables until they are taut, i.e. they rest in the backside of the W-beam and do not visibly sag between posts (Figure 26). There is no torque requirement for the cables.

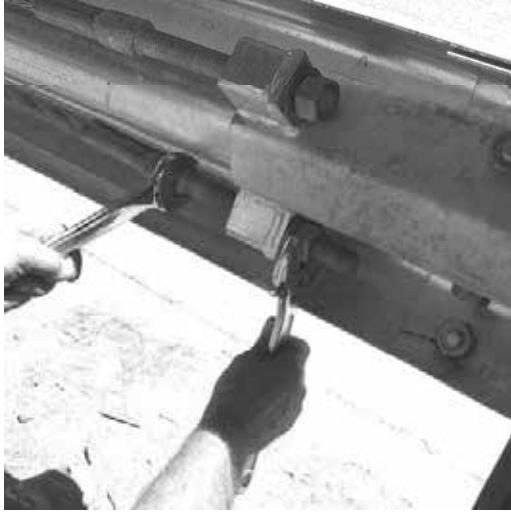


Figure 25. Tighten cables at Cable Bracket end (post 7).



Figure 26. Tighten cables until they are taut.

Step 14 – Attach Nosing

Push nosing into place on the front of the impact head. Attach using the supplied nylon push rivets (Figure 27).

Delineation to be attached to nosing, as per the Local Authorities requirements.



Figure 27. Attach nose using nylon push rivets.

X-Tension - Flared Installation Instructions

This section deals with installation of a Flared X-Tension system in a roadside guardrail terminal end application.

Apart from the initial set out, the flared X-Tension and installation procedure is identical to the Tangent system, the only difference being the amount of offset used.

Site preparation

The Flared terminal may be installed either parallel to the edge of the roadway (tangent) or with the impact head end of the rail offset by up to 1.2m (4 ft) away from the road (Figure 28) in a straight flare, over the length of the system. **The system should not be installed on parabolic curve.**

Ensure that the area where the X-Tension is to be installed is flat enough so that the anchor will not protrude more than 75 mm (3 in) [100 mm (4 in) max] above ground level, when measured with a straight line over a 1.5m (5 ft) cord. Minor site grading may be required.

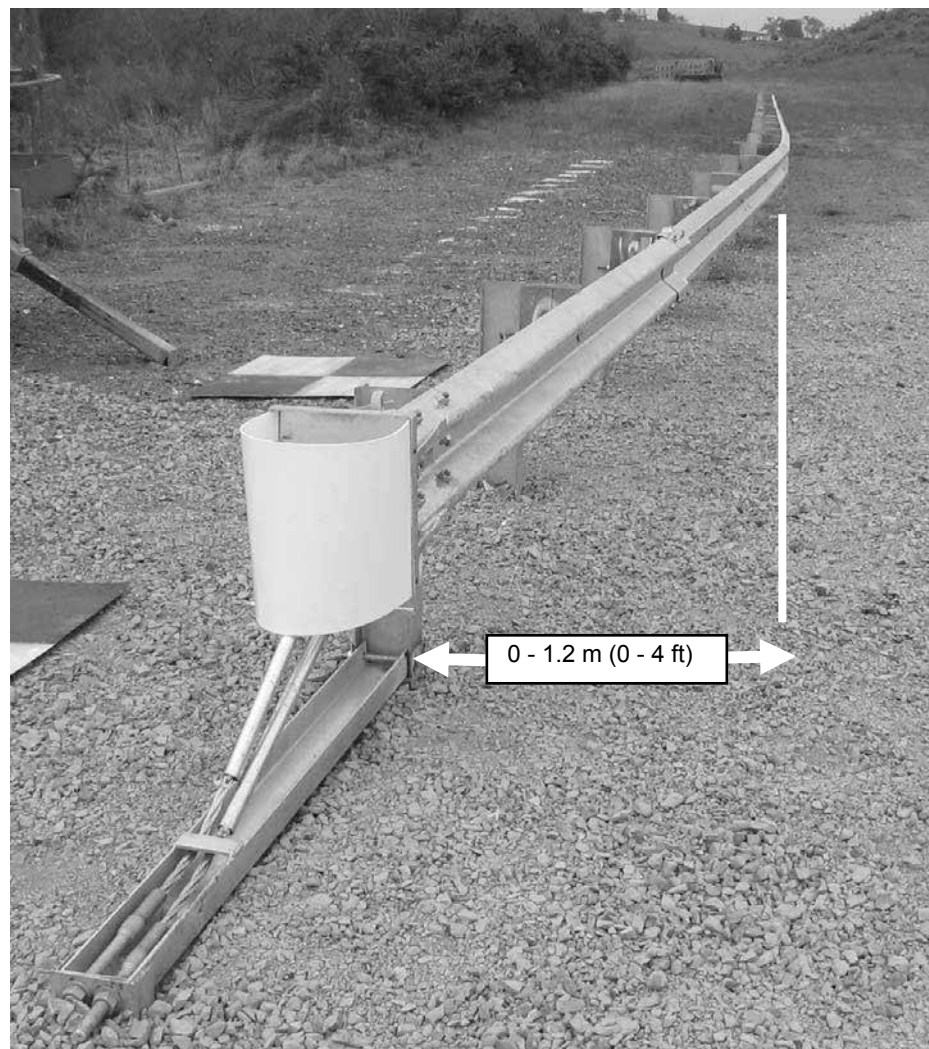


Figure 28. Maximum offset is 1.2 m (4 ft).

X-Tension - Flared Installation Instructions

Step 1 - Set Out

Pull a string line out with the desired offset (0 -1.2m; 0-4 ft)

Note that the flare is a straight flare, over the length of the system (11.4m; 38 ft)

The string line should be set to follow the roadside edge of the posts (Figure 29).

All the posts except post 1 have a blackout so take care to place the roadside face of post 1 200mm (8 in) towards the roadway (Figure 30).

Post 1 bottom, the Ground Strut and the Soil Anchor are then placed parallel to the string line on the roadside of it (Figure 31).

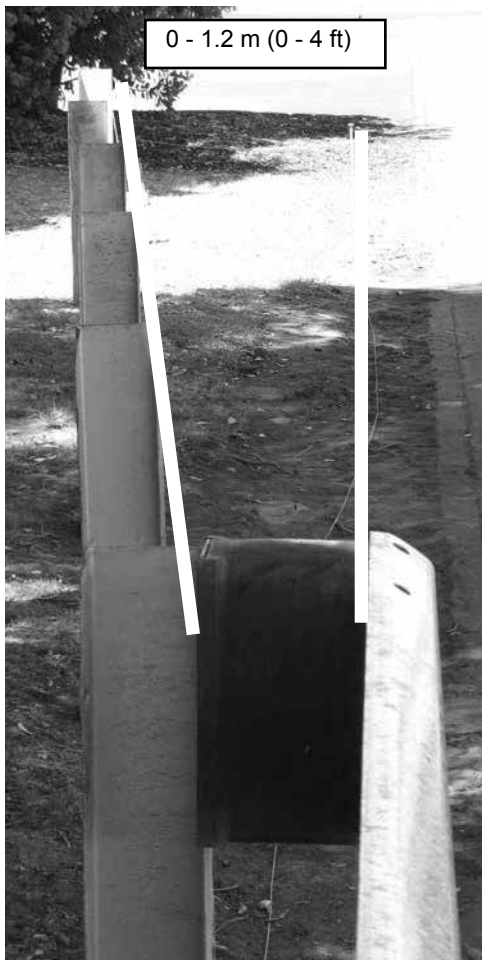


Figure 29. Pull string line to follow roadside edge of posts.



Figure 30. Place roadside face of post 1 towards roadway.



Figure 31. Place Ground Strut parallel to string line.

Now follow steps 2 – 14 in the Tangent installation instructions.

Note: The “kink” in the line of rail between rail 3 and rail 4 (at post #7) is formed by simply pushing the rails around to follow the flared line of posts. This is not factory bent.

X-MAS - Median Installation Instructions

This section deals with installation of a X-Tension Median Attenuator System (X-MAS) as a median guardrail terminal end application.

Site preparation

The X-Tension Median Attenuator System is installed parallel to the standard median barrier, therefore no offset is used (Figure 32).

Ensure that the area where the X-Tension is to be installed is flat enough so that the soil anchor will not protrude more than 100mm (4 in) [preferred 75 mm 3 in] from ground level when measured with a straight line over a 1.5m (5 ft) cord. Minor site grading may be required.

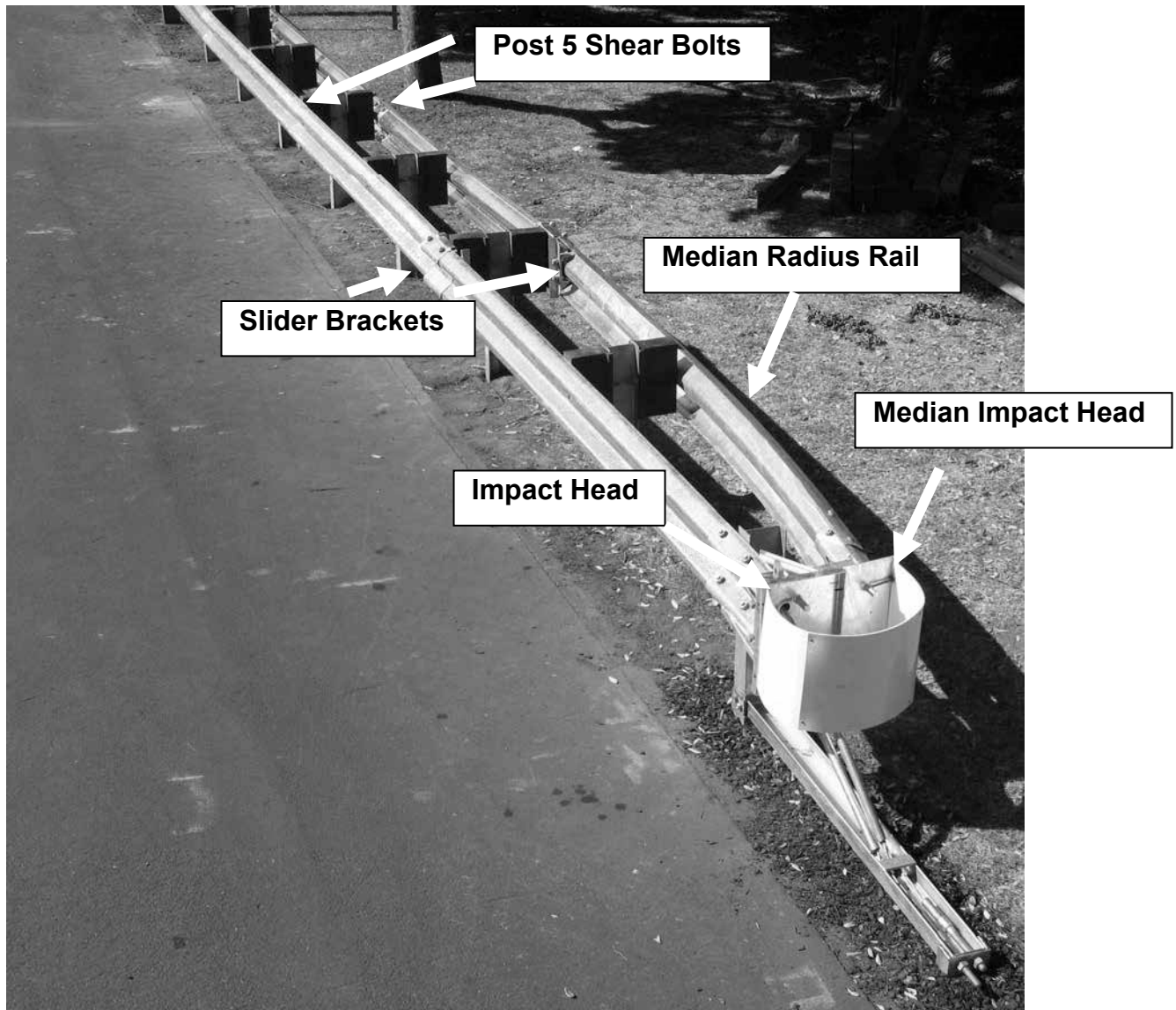


Figure 32. X-Tension median installation.

X-MAS - Median Installation Instructions

Step 1 - Set Out

The X -Tension Median Attenuator is essentially one Tangent X-Tension installed parallel to one side of the median barrier (Figure 33), with a small number of additional components and rail attached parallel with the other side of the barrier (Figure 34).

Pull a string line out the length of the system, parallel with the median barrier posts.

The string line should be set to follow the side of the posts, on the side that it is desired to install the tangent X-Tension.

The X-Tension portion (straight side) of the X-Tension Median Attenuator should always be installed on the side with approach traffic. See Diagram 2.



Figure 33. Essentially a tangent system installed parallel to median barrier.



Figure 34. Small number of additional components.

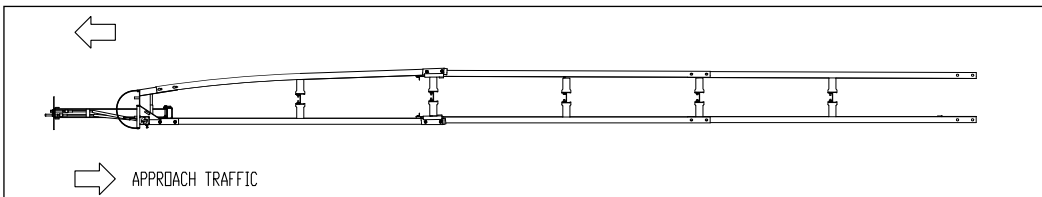


Diagram 2.

Step 2 – Installing Tangent X-Tension Portion

Follow steps 2 – 13 in the Tangent installation instructions, with the following exceptions.

(1) DO NOT set post 3 back 30-50mm (1 -2 in) as per the instructions in Step 2 of the Tangent installation instructions. For the Median application, Post 3 remains parallel with the other line posts.

(2) As noted on page #7, Post 2 must be steel crimped and Post 3-6 are always standard steel I-beam posts.

Now follow the remaining steps 3 to 8 to complete the backside of the median terminal.

X-MAS - Median Installation Instructions

Step 3 – Attach Secondary Impact Head

Fit secondary head to main head by pushing sideways onto the main head as shown below (Figure 35), until the holes in the gussets line up. Fix into place with either the 25mm (1 in) pin and pin lynch, or 2 M24 x 50mm (1 in X 2 in) bolts as shown (Figure 36).



Figure 35. Fit secondary head to main head.

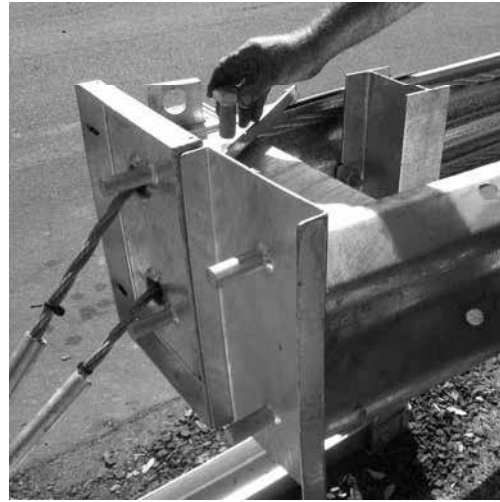


Figure 36. Fix secondary head into place.

Step 4 – Attach Backside Rail #3 and Rail #2

Rails 3 and 2 are installed like standard guardrail with blockouts between the rail and post (Figure 37). Attach rails to post 2, 4, 5 and 6 with blockouts and post bolts supplied (do not bolt the rail to post 3) and splice rail 3 to rail 4 with 8 standard splice bolts. At post 7 lap rail in the direction of traffic as per standard median barrier.

Ensure that rail 2 is spliced to rail 3 using the special shear bolts (yellow head) supplied. DO NOT use standard splice bolts at this joint (Figure 38). Be sure rail 2 is lapped outside rail 3 in both directions. DO NOT USE AN AIR-IMPACT WRENCH TO TIGHTEN SHEAR BOLTS. SHEAR BOLTS WILL BREAK IF OVER-TIGHTEND.



Figure 37. Rails installed with blockouts.



Figure 38. Splice rail 2 to rail 3 with 8 special shear bolts.

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Step 5 – Attach Slider Bracket to Backside Rail 2

Bolt the Slider Bracket to the upstream end of rail 2 (at post 3) using 4 standard splice bolts (Figure 39). The angle bar end should be closest to the Impact Head end (Figure 40).

Remove the angle bar and 2 M20 X 25mm (3/4 in x 1 in) bolts.



Figure 39. Bolt Slider Bracket to upstream end of rail 2.

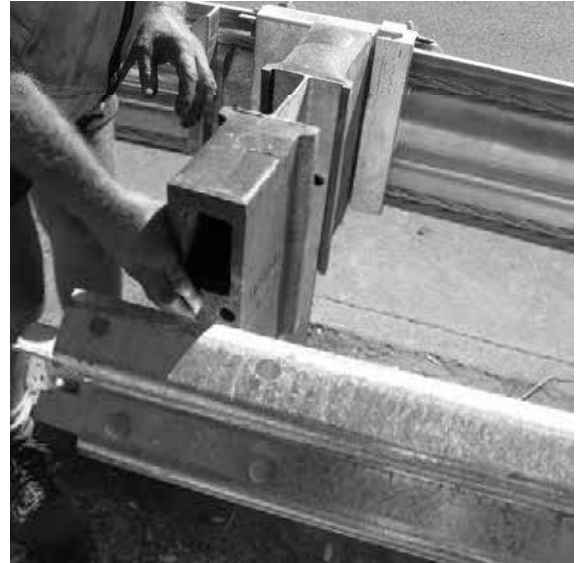


Figure 40. Angle bar end should be closest to Impact Head.

Step 6 – Assemble Slider Panel onto Backside Rail 1

Raise the straight end of the curved backside rail 1 and fit the Slider Panel onto the downstream (straight) end of rail (Figure 41) and bolt into place using 4 standard splice bolts, pushing the bolt through from the inside of the slider to the outside so the nut is on the traffic face (Figure 42).

The curved and reinforced (post breaker) end of Slider Panel sits at the rail end. Use guardrail pin bar or crow bar to assist with lining up splice holes.



Figure 41. Fit the Slider Panel onto the straight end of rail.



Figure 42. Push bolt from inside (nut on traffic face).

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Step 7 – Hang Curved Backside Rail #1

Lift rail 1 with Slider Panel attached and push the slider end over rail 2.

Bolt rail 1 and blockout to post 2 using supplied standard post bolt and 50x50mm (2 in x 2 in) washer on inside of post bolt notch on the backside of post 2 (Figure 43). The bolt should pass through the notch on the approach end of the system.

Re-attach the angle bar to the Slider Bracket (Figure 44) on the backside of the rail (at post 3).



Figure 43. Bolt rail 1 and blockout to post 2 using the square washer.

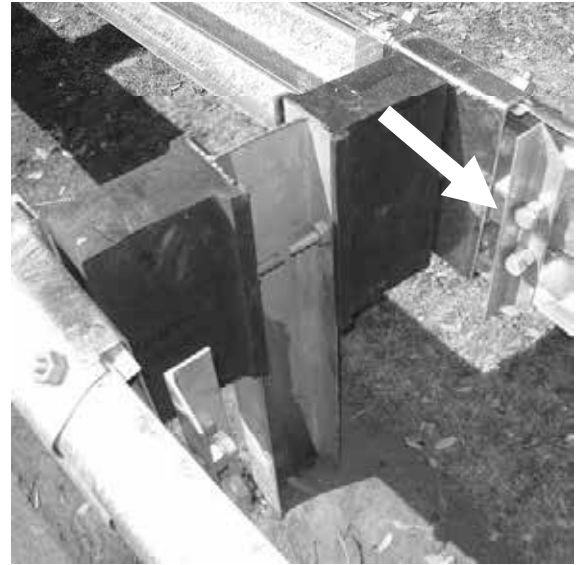


Figure 44. Re-attach the angle bar to the Slider Bracket.

Splice the rail to the secondary impact head using 8 standard splice bolts (Figure 45, 46).

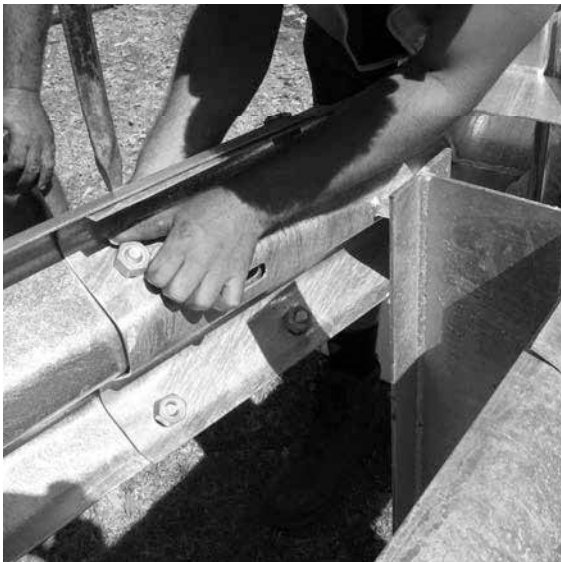


Figure 45. Splice the rail to secondary impact head.



Figure 46. Use 8 standard splice bolts.

X-MAS - Median Installation Instructions

Step 8 – Attach Nosing

Push nosing into place on the front of the impact head. Attach using the supplied nylon push rivets (Figure 47).

Delineation to be attached to nosing, as per Local Authorities requirements.



Figure 47. Attach nosing using nylon push rivets.

Optional Nose Cover – Install High Visibility Nose Cover

Attach the High Visibility Nose Cover to the Impact Head using the supplied hardware. The nose cover is attached using (4) bolts, two on each side of the Impact Head and a wire tether.

To attach the wire tether, pass the tether through the Nose Cover and the Friction Plate (Figure 48).



Figure 48. Tether Installation



Figure 49. Nose Cover Installed

INSTALLATION CHECKLIST FOR X-Tension / X-MAS Systems

Location			
Installed By		Date	
Inspected By		Date	

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

X-Tension Maintenance (Traffic Face Impacts)

Types of repair are divided into two categories:
Traffic Face Impacts and Head on Impacts

Traffic Face Impacts

Key Repair Steps:

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

Step 1: Remove Cables

Undo nuts at downstream cable bracket (post 7). Take out the bolts on the side of the impact head that hold the friction plate in place and rotate the locking bar backwards.

Pull one cable at a time from the front side of the impact head and completely remove them. Rotating the cables as you pull them will help. Undo nuts at ground anchor end and remove cables.

Step 2: Remove Rails

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

Step 3: Remove X-Tension Components

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

Step 4: Remove Posts

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

Step 5: Assess the Damage

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

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

Step 6: Reassemble

Reassemble as per system installation instructions.

X-Tension Maintenance (Head on Impacts)

Head on Impacts

Key Repair Steps:

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

Step 1: Remove Cables

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

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

Step 2: Pull Rails Back Out

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

Step 3: Remove X-Tension Components

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

Step 4: Remove Posts

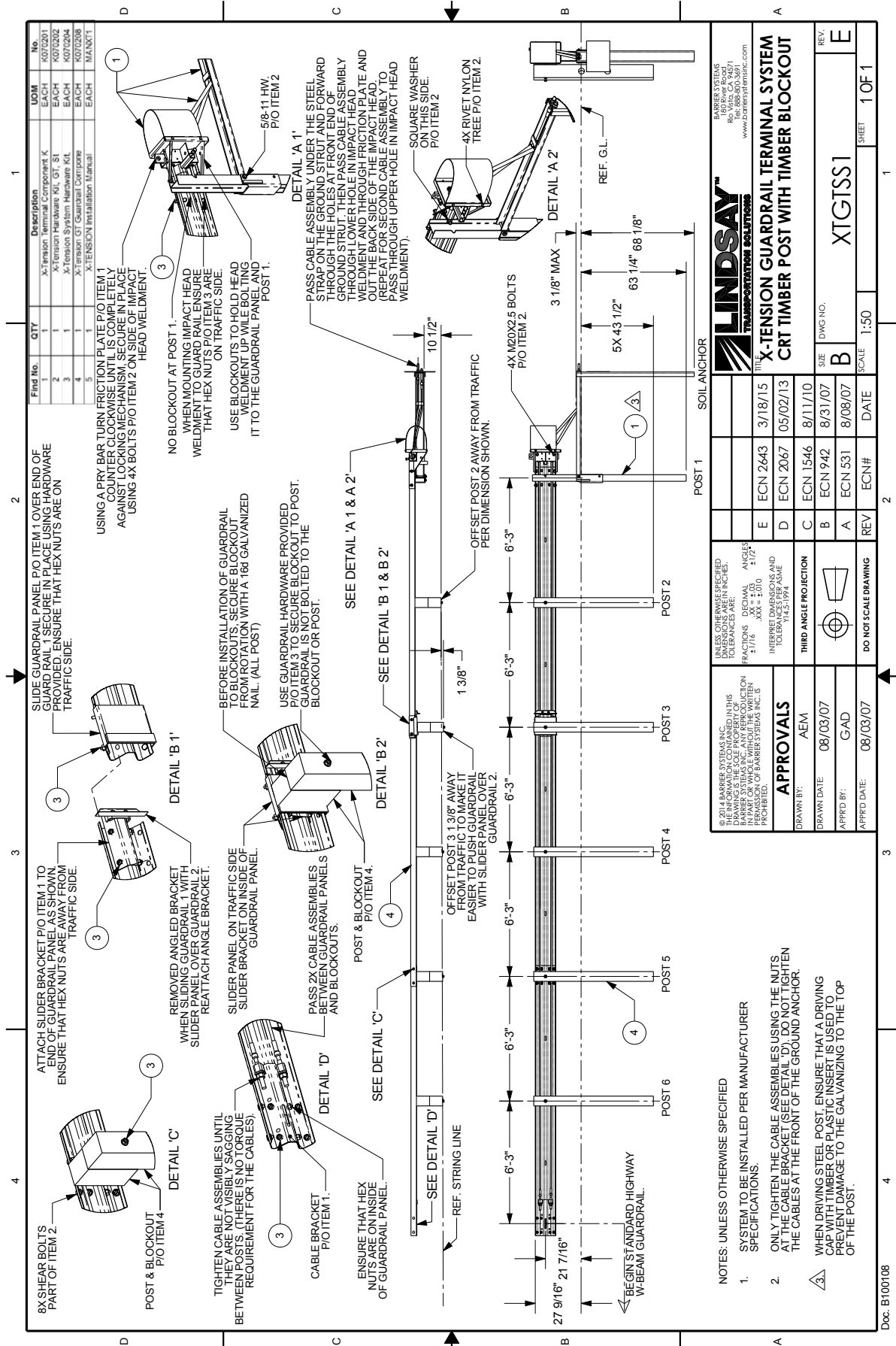
Undo the bolt at the bottom of Post 1 and pull out post. For all other damaged line posts, attach a chain to the top half of the post and pull out of the ground with either a crane truck or digger. Note it is sometimes possible to remove steel posts by hand.

Step 5: Assess The Damage

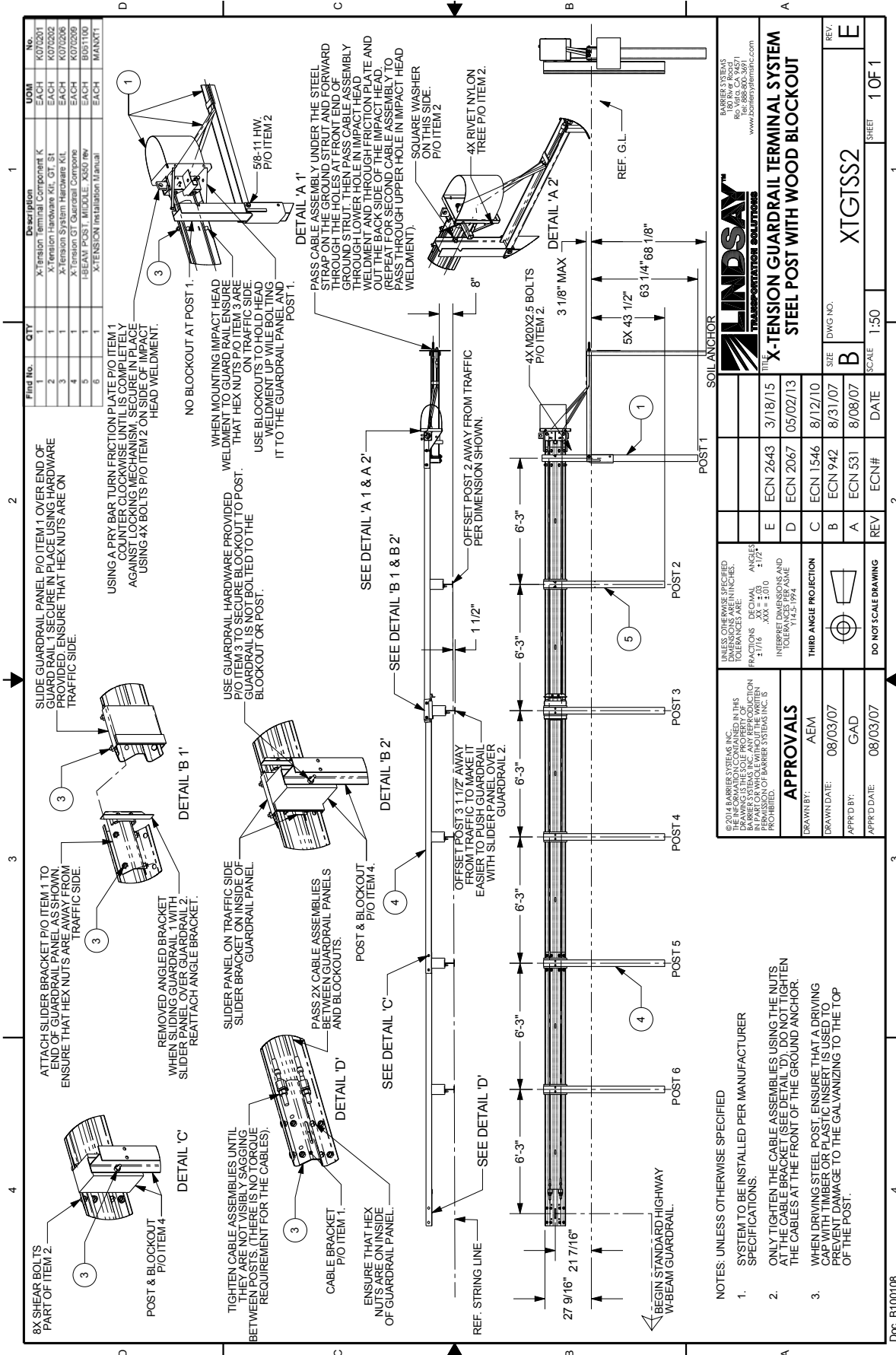
Any part that cannot be reused must be replaced with a new part. In minor impacts (rails telescoped less than 3 meters (10 feet)) the cables can be reused by turning them end for end. If additional damage has occurred, replace the cables. Generally, all the specialized components of the system such as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

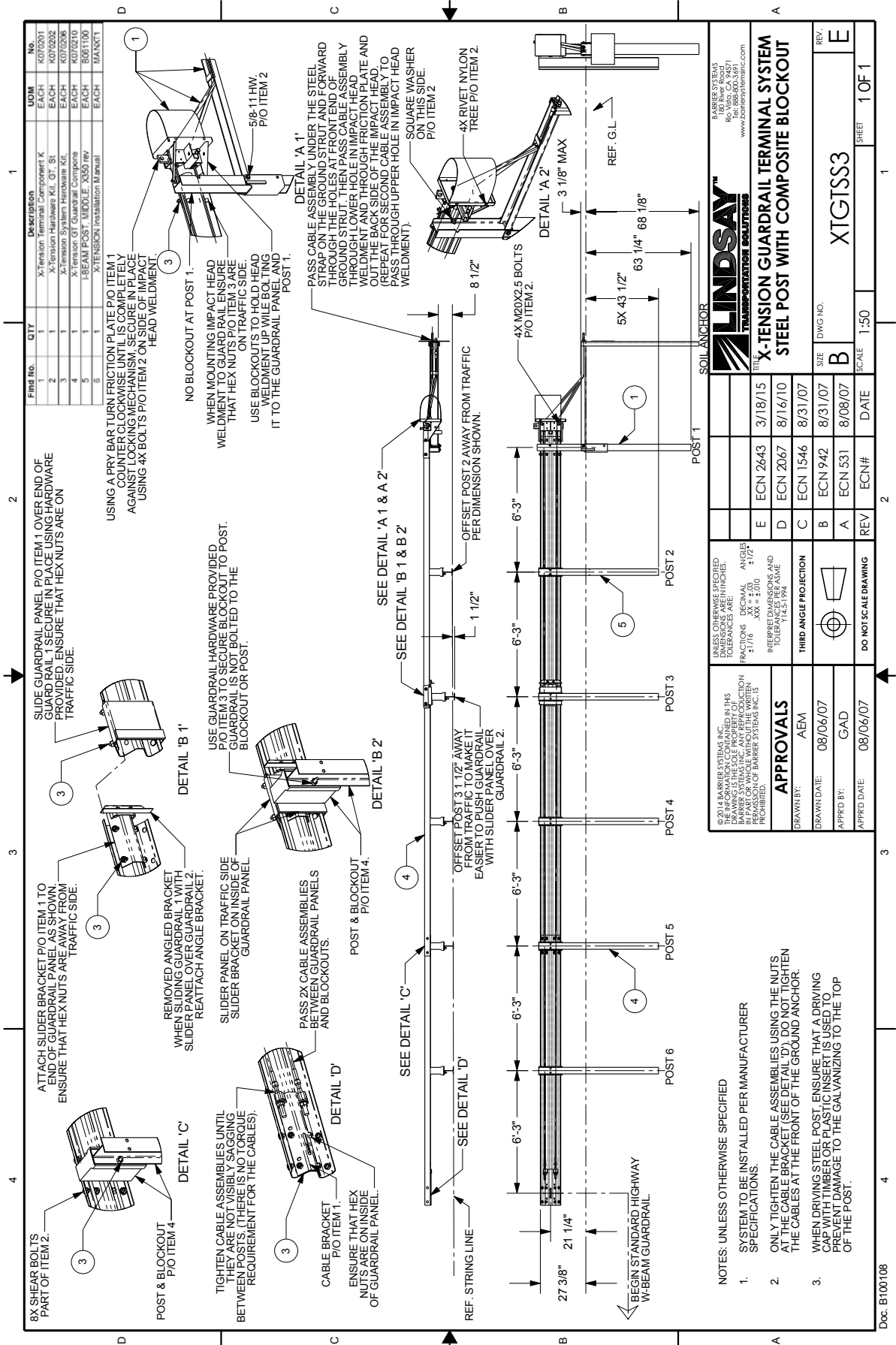
Step 6: Reassemble

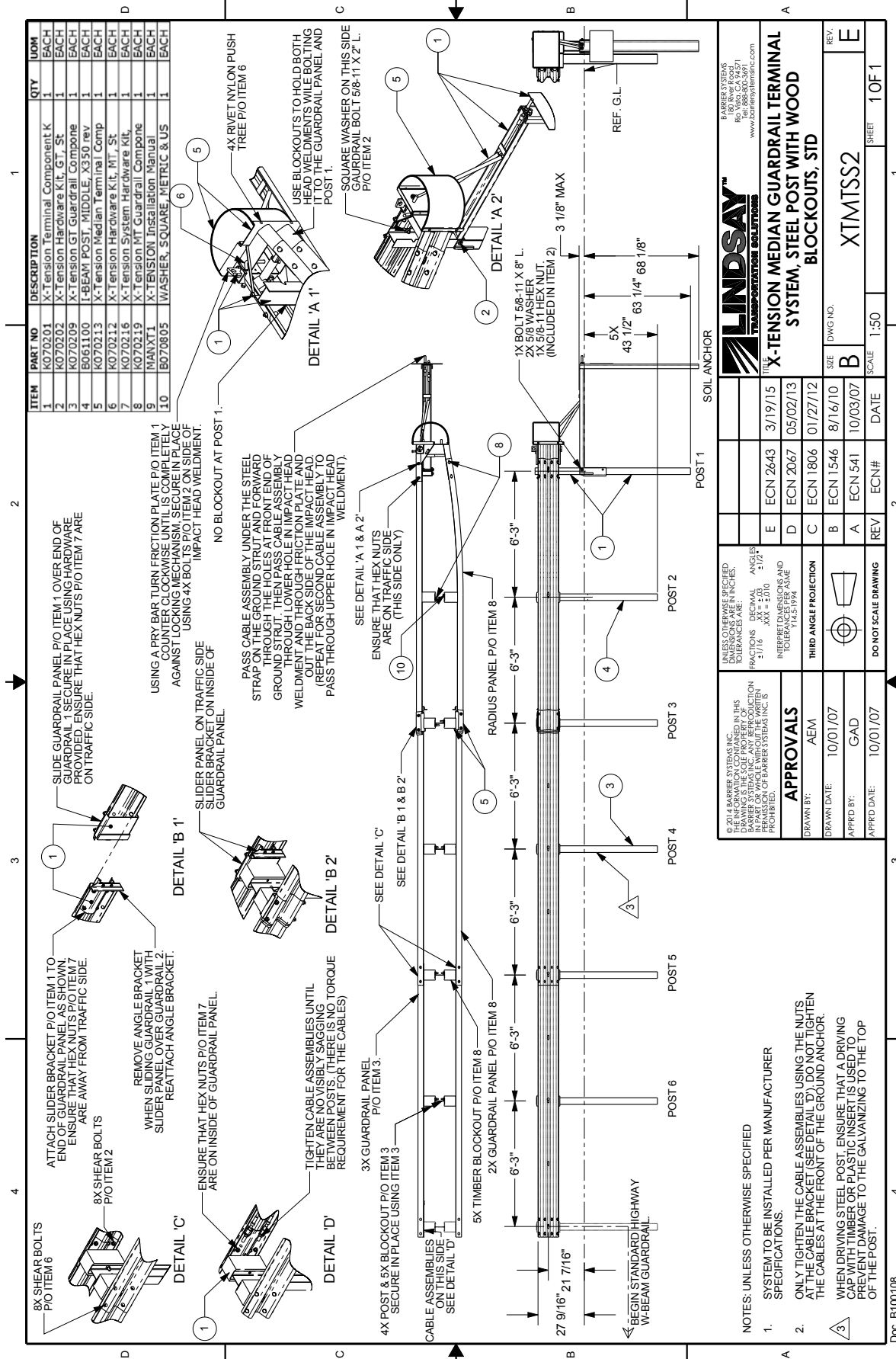
Reassemble as per system installation instructions.



		BARBER SYSTEMS 80 River Road P.O. Box 3891 Fort Worth, TX 76101 Tel: 888-800-3691 www.barbersystems.com	
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. FRACTIONS: DECIMAL: ANGLES: 1/16 .XXX = 1.010 1/2	TITLE: X-TENSION GUARDRAIL TERMINAL SYSTEM CRT TIMBER POST WITH TIMBER BLOCKOUT	DATE: 3/18/15	REV: E
APPROVALS DRAWN BY: AEM DRAWN DATE: 08/03/07 APP'D BY: GAD APP'D DATE: 08/03/07	INTERPRET DIMENSIONS AND TOLERANCES AS FOLLOWS: THIRD ANGLE PROJECTION	ECN 2643 ECN 2067 ECN 1546 ECN 942 ECN 531	DATE: 05/02/13 DATE: 8/11/10 DATE: 8/31/07 DATE: 8/08/07
NOTES: 1. SYSTEM TO BE INSTALLED PER MANUFACTURER SPECIFICATIONS. 2. ONLY TIGHTEN THE CABLE ASSEMBLIES USING THE NUTS AT THE CABLE BRACKET (SEE DETAIL 'D'). DO NOT TIGHTEN THE CABLES AT THE FRONT OF THE GROUND ANCHOR. WHEN DRIVING STEEL POST, ENSURE THAT A DRIVING CAP WITH TIMBER OR PLASTIC INSERT IS USED TO PREVENT DAMAGE TO THE GALVANIZING TO THE TOP OF THE POST.	DO NOT SCALE DRAWING	SCALE: 1:50	SHEET: 1 OF 1







ITEM	PART NO	DESCRIPTION	QTY	UOM
1	K070201	X-Tension Terminal Component K	1	EACH
2	K070202	X-Tension Hardware Kit, GT, St	1	EACH
3	K070209	X-Tension GT Guardrail Composite	1	EACH
4	B061100	L-BEAM POST, MIDDLE, X350 rev	1	EACH
5	K070213	X-Tension Median Terminal Comp	1	EACH
6	K070212	X-Tension Hardware Kit, MT, St	1	EACH
7	K070216	X-Tension System Hardware Kit	1	EACH
8	K070219	X-Tension MT Guardrail Composite	1	EACH
9	MANXT11	X-Tension Installation Manual	1	EACH
10	B070805	WASHER, SQUARE, METRIC & US	1	EACH

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ALL DIMENSIONS SPECIFIED IN THIS DRAWING ARE IN INCHES. DIMENSIONS ARE IN INCHES. TOLERANCES ARE:
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3/16 .003 3/16
.XXX ± .010
INTERPRET DIMENSIONS AND TOLERANCES AS SHOWN
Y14.5-1974

UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES. DIMENSIONS ARE IN INCHES. TOLERANCES ARE:
FRACTIONS DECIMAL ANGLE
3/16 .003 3/16
.XXX ± .010
INTERPRET DIMENSIONS AND TOLERANCES AS SHOWN
Y14.5-1974

APPROVALS
DRAWN BY: AEM
DRAWN DATE: 10/01/07
APPROVED BY: CAD
APPROVED DATE: 10/01/07

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

REV. E
DATE 10/03/07
ECN# ECN 541
SCALE 1:50
SHEET 10F1

REV	ECN#	DATE	SCALE	SHEET
A	ECN 541	10/03/07	1:50	10F1
B	ECN 1546	8/16/10		
C	ECN 1806	01/27/12		
D	ECN 2067	05/02/13		
E	ECN 2643	3/19/15		

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Installation manual details for the X-Tension System are subject to change without notice to reflect improvements and upgrades.

Additional information is available from Lindsay Transportation Solutions Sales and Service © Lindsay Transportation Solutions

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