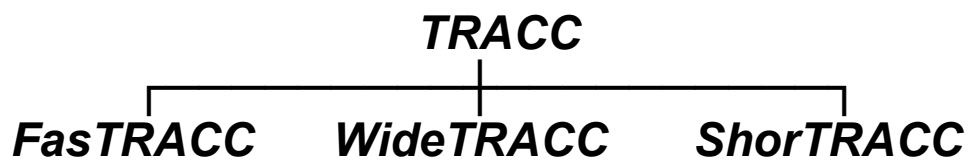


TRinity Attenuating Crash Cushion

# TRACC-Family System Manual

- 2005 Model -



A Family of NCHRP Report 350 Crash Cushions



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## **New for 2005!**

### **Some Things Changed:**

- New base assembly structural arrangement makes rip plates easily accessible.
- New rip plate attachment system makes removal and replacement of rip plates much simpler.
- New sled / shredder design makes disassembly a snap.
- New side panel design results in less damage during impact and easier disassembly afterward.
- **FIELD REPAIR** JUST GOT A WHOLE LOT EASIER!

### **Some Things Stayed the Same:**

- Fully assembled at the factory.
- Can be lifted and placed as a complete unit.
- Galvanized all-steel construction.
- Simple delineation options make installation flexible.
- Outstanding Customer Support

# **CUSTOMER SERVICE**

Trinity Industries, Incorporated is committed to the highest level of customer service. Comments regarding the quality and workmanship of our products, their installation procedures, supporting documentation, and roadside performance are welcome. Our goal is to enhance highway safety through continuous improvement and innovation. More information can be obtained in the following ways:

## **Corporate Contacts:**

Telephone:	800-644-7976 (U.S. Calls) 214-589-8140 (International Calls)
Fax:	214-589-8423
E-mail:	TRACC.service@trin.net TRACC.info@trin.net
Internet:	www.highwayguardrail.com www.trin.net

## **Regional Telephone Contacts:**

Centerville, Utah	800-772-7976
Dallas, Texas	800-527-6050
East Hartford, Connecticut	800-634-7245
Elizabethtown, Kentucky	800-282-7668
Girard, Ohio	800-321-2755
Orangeburg, South Carolina	800-835-9307

# **TRACC FAMILY DESIGN** **INFORMATION**

## **General Information**

### **Product Overview**

The 2005 TRACC (Trinity Attenuating Crash Cushion) family of products from Trinity Industries, Inc., includes TRACC, a narrow Test Level 3 cushion; SHORTRACC, a narrow Test Level 2 cushion; FASTERACC, a narrow Test Level 3 cushion with additional capacity for head-on impacts up to 70 mph; and WideTRACC, a wide Test Level 3 cushion for any large gore area.

TRACC crash cushions are fully redirective, non-gating, bidirectional, energy absorbing crash cushions designed to protect motorists from impacting the end of concrete barriers and bridge parapet rail, bridge piers and other hazards in both permanent and temporary work zone locations. All TRACC family products are accepted by the U.S. Federal Highway Administration for use on the National Highway System regardless of design or posted speed.

WideTRACC is an innovative system that allows the designer to tailor the cushion to the specific location. One or both sides of the system can be flared to practically any width using standard, repeating components. The flexibility of the system to flare down its left side, its right side, or both sides means that the unit can be oriented parallel with mainline roads while flaring to additional width along exit ramps or other similar roadway features.

No matter what the situation, a member of the TRACC Family of Crash Cushion products is available to meet the requirements in the most convenient, user-friendly and economical way.

### **Maintenance Overview**

The entire TRACC family of products is designed to be a very low maintenance roadside safety feature. Except for repairs due to impact, there is virtually no maintenance required for the system. It is recommended that an annual drive-by inspection be performed to ensure that no minor impacts went undetected and that debris has not accumulated around the system.

## **Crash Performance**

All TRACC products meet National Cooperative Highway Research Program (NCHRP) Report 350 requirements at Test Level 2 or Test Level 3. The systems will redirect vehicles that impact along their sides at angles up to 20° with the axis of the system. They will also stop vehicles that impact the ends of the systems at angles up to 15°. Testing was performed at speeds up to 100 km/hr (62.1 mph) making the TRACC Family of Crash Cushions an appropriate choice for **ALL** design speeds or posted speed limits on the National Highway System. If additional protection is desired beyond the mandated Test Level 3, the FASTRACC system is available in narrow and flared (wide) configurations and has been tested end-on at speeds up to 70 mph (113 km/hr.) For locations with design-speeds at or below 45 mph (72 km/hr), the ShorTRACC can provide full NCHRP Report 350 Test Level 2 protection.

A copy of NCHRP Report 350 can be obtained at the following address:

Transportation Research Board  
National Research Council  
2101 Constitution Avenue, N.W.  
Washington, D.C. 20418  
(202) 334-2933

## **Repair Options**

TRACC systems are designed for field repair or rapid replacement of the entire unit. Please see the TRACC Family Repair After Impact section of this manual for more information.

## Configuration Options

The TRACC Family of NCHRP Report 350 qualified crash cushions are available in several configurations as shown in Table 1.

	Test Level	Width	Length
TRACC	3	24", 30"	21'
ShorTRACC	2	24", 30"	14'
FasTRACC	3+ *	24", 30"	25' – 8"
WideTRACC – L	3, 3+	41" **	21' **
WideTRACC – R	3, 3+	41" **	21' **
WideTRACC – B	3, 3+ *	58" **	21' ***

Table 1

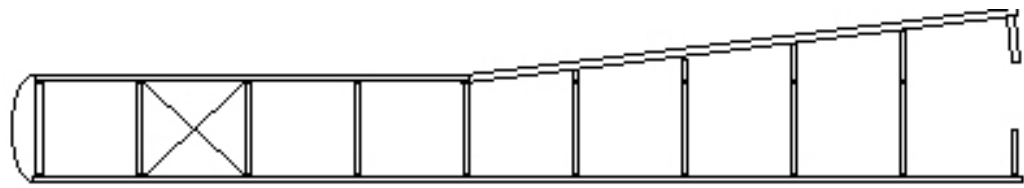
\* - Test Level 3+ refers to the fact that some units have been tested or are accepted for test conditions that exceed normal Test Level 3. Additional testing included a 2000 kg vehicle impacting at zero degrees at 70 MPH.

\*\* - The width of the WideTRACC-L and –R can be increased by adding approved wing extensions on one side. The extensions will add 28 inches of length and 3-7/16 inches of width for each section.

\*\*\* - The width of the WideTRACC-B can be increased by adding approved wing extensions on both sides. The extensions will add 28 inches of length and 6-7/8 inches of width for each section.

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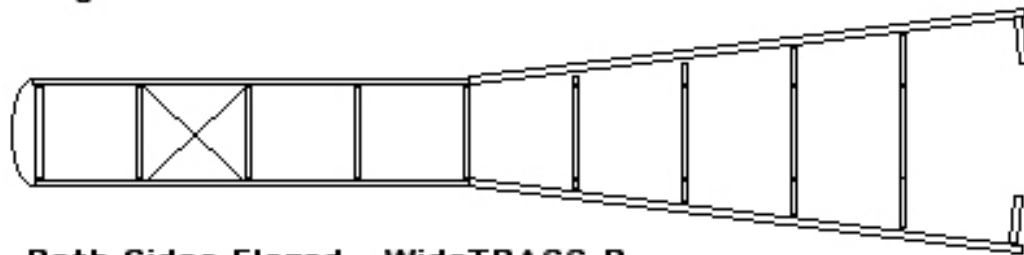
WideTRACC offers designers options in protecting wide barriers and gores. The WideTRACC can be flared down its left side only, its right side only, or both sides simultaneously. Figure 1 shows the basic options available. The extension attached to the rear of the WideTRACC consists of a pair of guardrail panels continuing the height and flare angle of the WideTRACC side panels. The panels are supported by specially designed braced, base-plated posts. The lower panel is further supported by a channel that is installed between the post and the guardrail.



**Left Side Flared - WideTRACC-L**



**Right Side Flared - WideTRACC-R**



**Both Sides Flared - WideTRACC-B**

Figure 1. Basic WideTRACC configurations.



# Location Requirements

## Unidirectional Application

Installation of a TRACC System and its transitions depends on the traffic pattern and the backup structure at the particular location. Unidirectional traffic (one side or both) requires no transition. See Figures 2 and 3. The backup frame can be attached to any solid structure including a square cast-in-place concrete pillar, a vertical concrete wall, or the end of a New Jersey style barrier. The backup frame provides a hole pattern that may require adaptation to the backup structure. Trinity Industries can provide an adaptor to allow direct attachment of the backup frame to a variety of concrete barrier profiles. Call Technical Service at 800-644-7976 with questions regarding this and other types of installation.

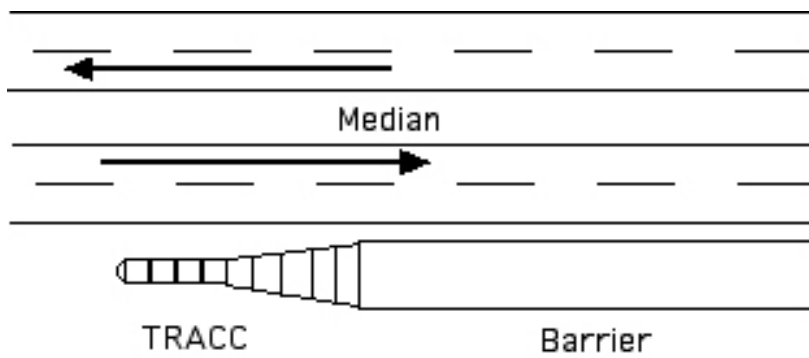


Figure 2. Unidirectional Traffic Flow - One Side - Requires No Transition.

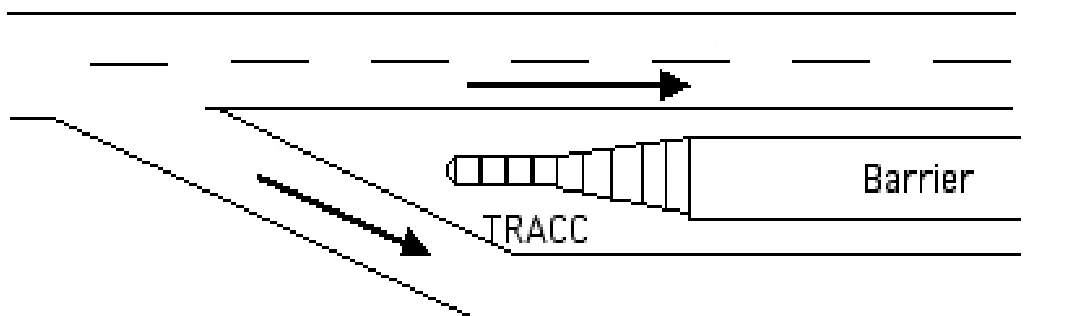


Figure 3. Unidirectional Traffic Flow - Both Sides - Requires No Transition.

## Bidirectional Application

For bidirectional installations that face oncoming traffic or reverse direction traffic (see figure 4), the appropriate transition(s) should be installed on the reverse traffic side of the backup structure.

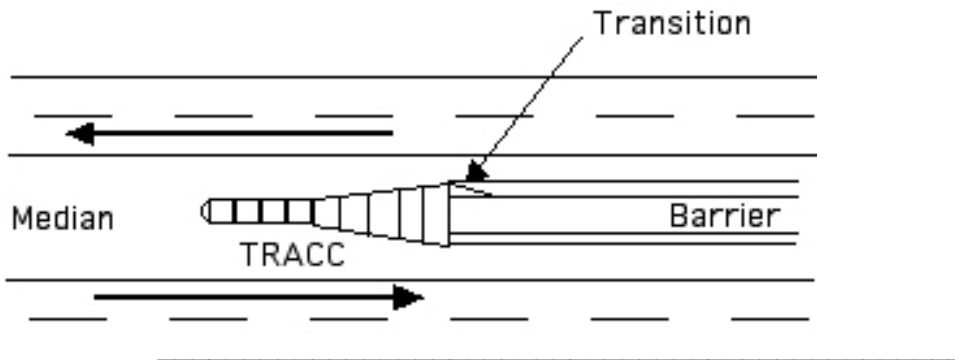


Figure 4. Bidirectional Traffic Flow - Requires Transition on One Side.

## Approach Zone and Clear Zone

The TRACC System should not be placed directly behind a raised curb. The approach area in front of the system should slope at a different rate no greater than 10:1 in the direction of traffic flow. The cross slope should differ by no more than 12:1. The clear zone behind the TRACC should be consistent with the area behind the downstream Length-of-Need of the barrier. The entire length of the TRACC can be used in Length-of-Need calculations as it is fully redirecting.

## Downstream Zone

The TRACC should be installed so that a 60" clear space will exist on both sides of the backup structure for the side panels to retract during an end-on impact (see figure 5).



Figure 5. Clear Space for Panel Retraction

# Installation Options

## Foundations

During an impact, the stopping force provided by a TRACC System is **NOT** transferred to the backup structure beyond the cushion. All the stopping loads pass to the foundation **BELOW** the system through the anchor bolts that attach the system to the foundation.

TRACC Systems can be anchored to combinations of asphalt, concrete, and compacted subbase as shown in Table 2 below.

- 6" Reinforced Concrete
- 8" Unreinforced Concrete
- 3" Minimum Asphalt over 3" Minimum Concrete
- 6" Asphalt over 6" Compact Subbase
- 8" Minimum Asphalt

Table 2. Foundation Options

## TRACC Foundation Drawings

SS1010	TRACC TL-3 Crash Cushion Attenuating Terminal 22' Concrete Foundation Plan
SS1011	FasTRACC TL-3 Crash Cushion Attenuating Terminal 26' 8" Concrete Foundation Plan
SS1013	ShorTRACC TL-2 Crash Cushion Attenuating Terminal 14' Concrete Foundation Plan

## Backup Support and Transition Options

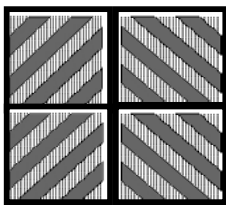
The TRACC with its sliding side panels can be attached or transitioned to any backup structure capable of supporting the last frame. If the system has been extended to greater widths as described previously for the WideTRACC, the flared guardrail panels used to create the extra width can be attached to any downstream barrier or structure just as a standard guardrail would be attached.

The following drawings are located in the Appendix of this manual. They provide the necessary detail for attachment and transition to their subject structures.

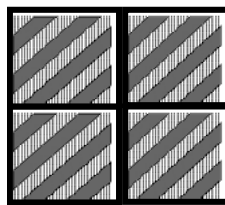
- SS453, "TRACC Transition to W-Beam Median Barrier Soil Post Option"
- SS454, "TRACC Transition to Thrie Beam Median Barrier Soil Post Option"
- SS455, "TRACC Transition to W-beam Median Barrier Plan, Elevation & Sections"
- SS456, "TRACC Transition to Vertical Wall"
- SS461, "TRACC Transition to Concrete Safety Shape Barrier Plan, Elevation & Sections"
- SS462, "TRACC Transition to Concrete Barrier Single Slope Plan, Elevation & Sections"
- SS463, "TRACC Transition to Thrie Beam Median Barrier Plan, Elevation & Sections"
- SS464, "TRACC Transition to Thrie Beam Median Barrier All Wood Post"
- SS497, "WideTRACC - Optional Wing Extensions"

## Nose Delineation Options

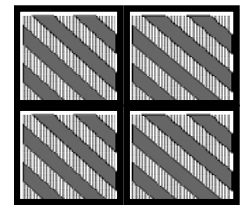
The TRACC is intended for use on either shoulder or in the median in both unidirectional and bidirectional traffic situations. To provide the greatest level of safety, the delineation of the plastic nose section can be customized for any particular location. Four pieces of reflective tape are provided with the TRACC and can be used to delineate left shoulder, right shoulder, and gore applications. All four identical pieces of reflective tape can be used to create the three designs as shown below. The plastic nose should be attached to the front of the TRACC system using the side panel attachment hardware already located on the system.



Gore Area



Right Shoulder



Left Shoulder

Figure 6. Nose Delineation Options.

**Note:** Consult local transportation authorities for delineation requirements.

# **TRACC FAMILY INSTALLATION** **GUIDELINES**

## **Drawings and Bills of Material**

Drawings and bills of material for the most popular TRACC System options are shown in the Appendix to this manual. If parts are missing from a TRACC System shipment or if you have questions regarding installation options, please contact Trinity Industries, Inc., Highway Safety Products Division Technical Service at 800-644-7976.

## **Recommended Tools and Equipment**

1. Forklift or Crane (4000 pound capacity)
2. Lifting Slings or Chains
3. Air hammer/drill 35/50# and appropriate power source
4. Rock drill bit 11/16" x 16" with 30" extender
5. Socket and Ratchet Set or Flat Wrenches - 3/8" to 1-1/4"
6. Traffic control equipment
7. Gloves, safety goggles, and back protection for lifting
8. Dispensing Gun and Mixing Tubes for Hilti HY-150 Adhesive

### **NOTE:**

HILTI anchors supplied with TRACC systems require 11/16" holes for installation. Dispensing gun and mixing tubes for HY-150 adhesive are available from Trinity Industries or directly from Hilti, Inc., at 800-879-8000 in the United States or 800-363-4458 in Canada.

## **Safety Instructions**

Always use appropriate safety precautions when operating power equipment, mixing chemicals, and moving heavy equipment. Gloves, safety goggles and back protection should be used.

Safety measures incorporating appropriate traffic control devices should also be used to protect personnel while at the installation site. Trinity Industries Inc. offers an economical and effective truck mounted attenuator, the MPS-350, for the protection of workers in work zones. For more information on the MPS-350 call 800-644-7976, or visit the Trinity Industries Highway Safety Products website at [www.highwayguardrail.com](http://www.highwayguardrail.com).

## Installation of System

To facilitate accurate communication regarding the parts of the TRACC and WideTRACC, Figure 7 shows the two systems with side panels removed and major parts labeled.

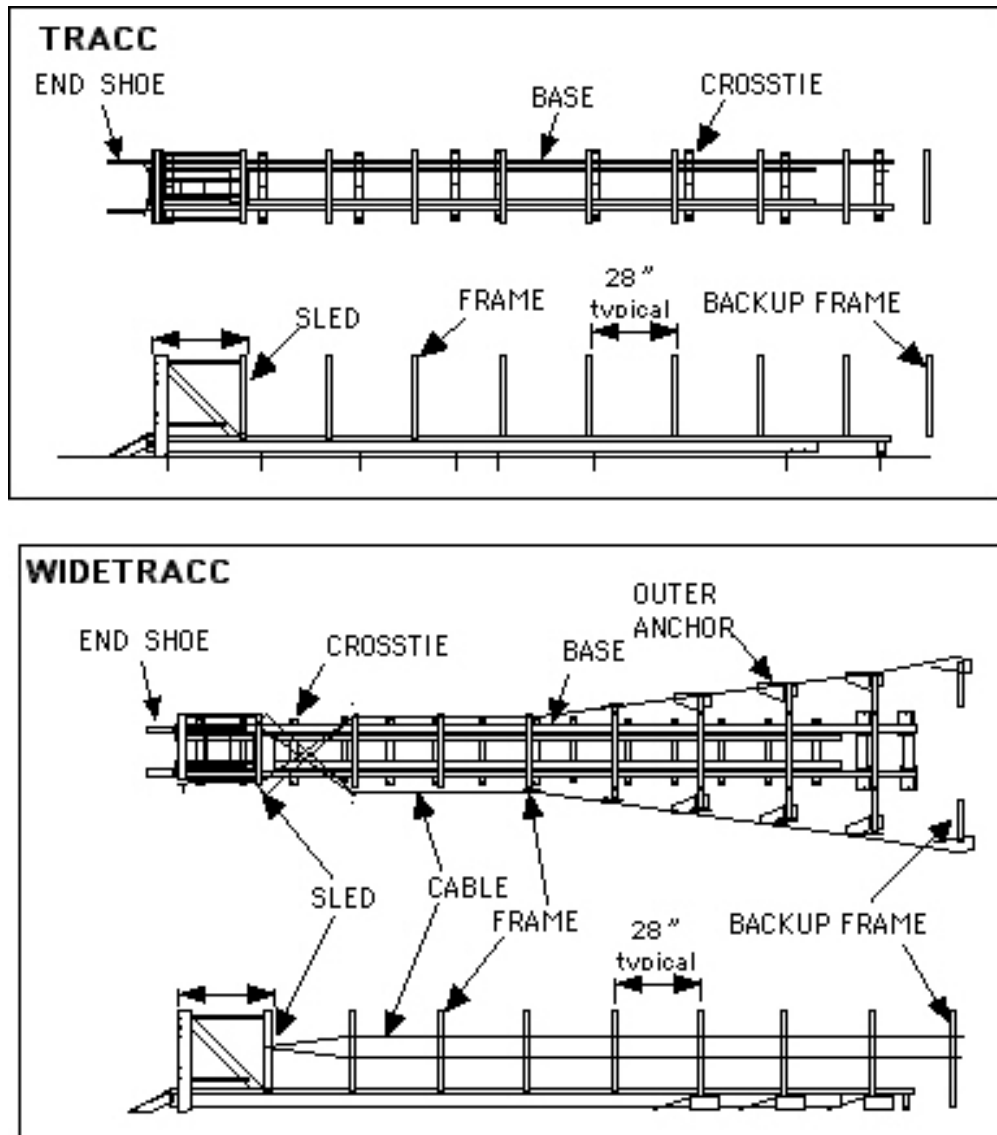


Figure 7. Major Components of the TRACC and WideTRACC. (The side panels have been removed from the outside of the systems for clarity.)

## Lifting the System

TRACC Systems can be lifted as complete units by threading lifting chains or slings directly through the tops of the frames. Someone should maintain control of the system by guiding the end as it is lifted and moved. Care should be taken to ensure that the system can be handled safely prior to moving.

## Anchoring the System

TRACC Systems can be installed on combinations of asphalt and concrete. Table 3 shows the types of foundations that can be used and the anchoring studs that are required. In general, concrete installation can be performed using 7-1/8 inch anchor studs while asphalt installation requires 18-inch anchor studs. Holes should be drilled 1.5 inches less than the overall length of the anchor stud to ensure proper embedment.

TRACC Systems can be placed directly onto the foundation as a complete unit. The system should be aligned within 1° of the downstream barrier according to the approach and downstream zone requirements set forth in the section entitled, "Location Requirements." Holes for the anchor studs can be drilled into the foundation using the system as a template. Because of the open design of all the TRACC systems including the WideTRACC, it is not necessary to disassemble any portion of the system in order to drill the anchoring holes. Note that the flared portion of the WideTRACC requires additional outboard anchors that have been shipped loose and must also be anchored to the foundation. Special attention should be paid to drawing SS496, "WideTRACC Double Flare - Plan Elevations and Sections," for the location of those outboard anchors.

After the holes are drilled, the adhesive system can be dispensed into the hole and then the anchor stud should be suspended by its nut and washer through the crosstie. Figure 8 shows how the anchor stud should pass through the crosstie suspended by its nut and washer. The stud should hang in the uncured adhesive with no threads showing above the nut. Final tightening of the anchor nuts should be done after the adhesive has set. (See adhesive manufacturer's instructions for set times under various environmental conditions.)

Table 3. Anchor Stud Selection Table

Foundation	Anchor Stud Size
6" Reinforced Concrete	5/8" d x 7 – 1/8" long
8" Unreinforced Concrete	5/8" d x 7 – 1/8" long
3" Minimum Asphalt over 3" Min. Concrete	5/8" d x 18" long
6" Asphalt over 6" Compact Subbase	5/8" d x 18" long
8" Minimum Asphalt	5/8" d x 18" long

**NOTE:** If asphalt is located over a minimum of 6-inches of concrete, the 18-inch anchor studs can be cut off to a total length equal to the asphalt thickness plus 7.5 inches.



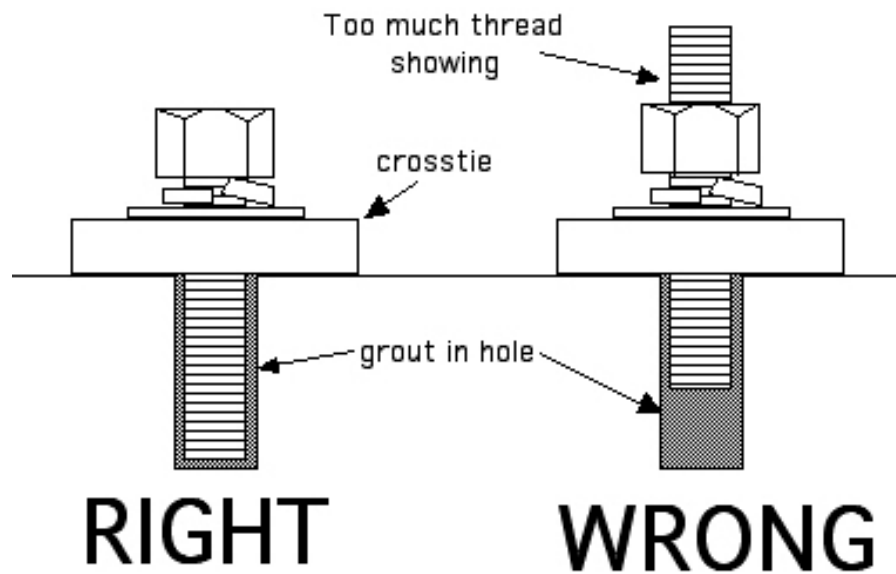


Figure 8. Suspending the Anchor Studs in the Uncured Adhesive.

### Attaching Backups and Transitions

The last support frame on a TRACC System must be attached to something in order to support the side panels and any required transition panels. While no direct stopping forces are transmitted into the backup support structure, its presence is important for possible redirecting impacts. Drawings in the Appendix show the TRACC systems attached to and shielding a variety of downstream barriers and structures. For more information about specific installation options not shown in the Appendix drawings, contact Technical Service at 800-644-7976.

**NOTE:** The width of the WideTRACC can be adjusted through the addition of wing extension sections as shown in drawing SS497, "WIDETRACC Double Flare Wing Extension Structures," located in the Appendix.

# **TRACC FAMILY REPAIR AFTER** **IMPACT**

## **Repair Options**

TRACC systems are designed for field repair or rapid replacement of the entire unit.

The energy absorbing portions of the base assembly of the TRACC system can be replaced in stages depending on the extent of the impact. Because TRACC systems are delivered fully assembled, it is extremely practical to replace the entire damaged system on the roadside and then perform the necessary repairs safely and accurately in the maintenance shop away from traffic dangers. Many of a TRACC system's components remain undamaged after most impacts making refurbishment simple and economical.

### **NOTE:**

TRACC PRODUCTS ARE **NOT** DISPOSABLE. COMPLETE REPLACEMENT ON THE ROADSIDE AFTER AN IMPACT IS A CONVENIENT - BUT NOT REQUIRED - WAY TO PROTECT WORKERS BY LIMITING EXPOSURE TO TRAFFIC. UP TO 98% OF A TRACC SYSTEM IS REUSABLE AFTER DESIGN IMPACTS REGARDLESS OF WHETHER THE REPAIR IS PERFORMED IN THE FIELD OR IN THE SAFETY OF THE MAINTENANCE YARD.

## **Types of Damage**

TRACC Systems are designed to withstand end-on impacts and redirecting side impacts. Side impacts, depending on the severity, may only cause cosmetic damage to the system. Any system that has been impacted along its side should

be examined to make sure that the damage is only cosmetic and that any damage that might hinder subsequent function of the system is repaired.

During some severe high-speed redirecting impacts with heavy vehicles, a TRACC System may become permanently twisted. If the deformation of the base causes a portion of one side of the system to be raised more than one and one half inches when compared to the other side of the system, then the damaged portion of the base assembly should be replaced.

## **Field Repair**

The 2005 TRACC Family of Crash Cushions is specifically designed for rapid field repair. Removal and replacement of the system remains a valid option for those who prefer to work on the system away from the roadside.

### **NOTE:**

**Minor impacts that stroke the system less than 53 inches will require pulling the sled out to its original position and checking the system for damage. If there is no damage then the system is ready for service. If damaged components are found, they should be replaced.**

TRACC Systems can be repaired in the field by replacing the parts that have been damaged. The first step for repair will be to disconnect the sled and its attached side panels from the remainder of the system and pull them back to their original upstream location. To facilitate this it may be necessary to release the shredder plates from the sled and to partially remove the straps that brace the lower part of the sled. Don't forget to replace the shredder plates and reattach the straps once the sled is relocated to its original position.

The energy absorbing rip plates attached to the top of the base assembly can be replaced in stages. The rip plates are held in place with doubler plates. Each doubler plate is secured with three (3) bolts. The doubler bolts are accessed directly from above the base assembly. Special care should be taken to ensure that new rip plates are installed in the proper location on the base assembly. Please refer to the applicable assembly drawing in the appendix for details about rip plate location and attachment.

The side panels and frames can now be redistributed along the length of the system. It may be necessary to loosen some of the panel attachment hardware in order to facilitate respacing. The reassembled sled and its side panels can be attached to the remainder of the system and all the hardware tightened to complete the repair job. Several innovative features have been incorporated into the 2005 TRACC system to make this process simple.

In the case of redirecting impacts along the side of the system, it may be necessary to replace only side panels and other upper structural pieces so long as the base assembly under the system is not damaged.

## **Removal / Replacement of System**

The TRACC can be removed from its foundation by releasing the anchor nuts that hold the crossties down. Flat wrenches may be required to access the anchor studs under the displaced frames and sled. Once released, the system can be lifted as a unit and transported back to a maintenance facility for repair. A new or reconditioned TRACC can be positioned on the existing anchor studs and firmly attached using the appropriate nuts and washers.

In some impacts, a small number of anchor studs may become bent or fractured. In these cases it will be necessary to remove the old anchor, drill out the adhesive in the old hole, and replace the removed anchor with a new anchor and adhesive.

## **Repair at Maintenance Facility**

In general, the procedure for repairing a TRACC at a Maintenance Facility will be the same as a field repair. Should you encounter technical difficulties, help is available by calling Trinity Industries Highway Safety Products Technical Service at 800-644-7976.

The first step for repair will be to disconnect the sled and its attached side panels from the remainder of the system and pull them back to their original upstream location. To facilitate this it may be necessary to release the shredder plates from the sled and to partially remove the straps that brace the lower part of the sled. Don't forget to replace the shredder plates and reattach the straps once the sled is relocated to its original upstream position.

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The TRACC system is now ready to save another life.

# APPENDIX

SS453	TRACC Transition to W-Beam Median Barrier Soil Post Option”
SS454	TRACC Transition to Thrie Beam Median Barrier Soil Post Option
SS455	TRACC Transition to W-beam Median Barrier Plan, Elevation & Sections
SS456	TRACC Transition to Vertical Wall
SS461	TRACC Transition to Concrete Safety Shape Barrier Plan, Elevation & Sections
SS462	TRACC Transition to Concrete Barrier Single Slope Plan, Elevation & Sections
SS463	TRACC Transition to Thrie Beam Median Barrier Plan, Elevation & Sections
SS464	TRACC Transition to Thrie Beam Median Barrier All Wood Post
SS497	WideTRACC - Optional Wing Extensions
SS1000	Crash Cushion Attenuating Terminal - Plan, Elevations, and Sections, Assembled Unit, Base, and Rip Plate Schematic
SS1001	Crash Cushion Attenuating Terminal – Assembled Base Unit
SS1002	Crash Cushion Attenuating Terminal - Plan, Elevations, and Sections, Shop Assembly Details, Pages 1, 2
SS1003	Crash Cushion Attenuating Terminal - Plan, Elevations, and Sections, Unidirectional, Direct Attachment
SS1004	ShorTRACC Crash Cushion Attenuating Terminal – Assembled Base Unit
SS1005	ShorTRACC Crash Cushion Attenuating Terminal – Shop Assembly Details, Pages 1, 2
SS1006	ShorTRACC Crash Cushion Attenuating Terminal – Plan, Elevation, and Sections, Unidirectional, Direct Attachment
SS1007	FasTRACC Crash Cushion Attenuating Terminal – Assembled Base Unit
SS1008	FasTRACC Crash Cushion Attenuating Terminal – Plan Elevation, and Section, Shop Assembly Details, Pages 1, 2
SS1009	FasTRACC Crash Cushion Attenuating Terminal – Plan, Elevation, and Sections, Unidirectional, Direct Attachment
SS1010	TRACC Crash Cushion Attenuating Terminal, 22’ Concrete Foundation Plan
SS1013	TRACC Crash Cushion Attenuating Terminal, 15’ Concrete Foundation Plan
SS1018	58” WideTRACC Double Flare Crash Cushion Attenuating Terminal – Plan, Elevation, and Sections – Shop Assembly Details, Pages 1, 2, 3
SS1019	58” WideTRACC Double Flare Crash Cushion Attenuating Terminal – Plan, Elevation, and Sections – Unidirectional, Direct Attachment