

# **INFORMATION HANDOUT**

## **AGREEMENTS**

1602 AGREEMENT MAINTENANCE NOTIFICATION  
VERIFICATION REQUEST FORM

## **MANUFACTOR DRAWINGS AND SPECIFICATIONS**

TERMINAL SYSTEM (TYPE X-TENSION)

CRASH CUSHION (TYPE QUADGUARD II)

CRASH CUSHION (TYPE SMART)

CRASH CUSHION (TYPE TAU II)



**DISTRICT 6 ENVIRONMENTAL**  
1602 AGREEMENT  
MAINTENANCE NOTIFICATION  
VERIFICATION REQUEST FORM (VRF)

|   |
|---|
| <input checked="" type="checkbox"/> ORIGINAL REQUEST<br><br><input type="checkbox"/> REVISION NO. _____ |
| <b>Date of Request</b><br>June 21, 2012   |

|  |  |
|--|--|
| <b>Name of Requestor:</b> Primavera Parker<br><b>Cost Center:</b> EA 06-0H100<br><b>Maintenance Region:</b> Fresno District 06 | <b>Phone Number:</b> (559) 445-5502<br><b>Cell Number/ Pager:</b> (____) _____ - _____<br><b>E-Mail:</b> Primavera_Parker@dot.ca.gov |
| <b>Project Start Date:</b> October 2012  | <b>Project End Date:</b> February 2013   |

|  |
|--|
| <b>Location of Work (County/Route/Postmile):</b> 2 Locations FRESNO-168 PM 26.35 and PM 31.36                            |
| <b>Name of Stream:</b> Dry Creek and Big Sandy Creek   |
| <b>Nearest landmark, crossroad or other identifier:</b> On State Route 168 in Fresno County near Prather, CA             |
| <b>Latitude/Longitude (in Degrees and Minutes):</b> Dry Creek -119.528 and 36.991<br>Big Sandy Creek -119.501 and 37.042 |

| <b>Maintenance Activities</b>  |  |
|--|--|
| <p style="text-align: center;"><b><u>Type of Work</u></b></p> <input type="checkbox"/> Sediment Removal (Amount of material to remove below obvious flow line <input type="text"/> (cubic yards))<br><input type="checkbox"/> Sediment will be removed with Vactor<br><input type="checkbox"/> Equipment can work off bank<br><input type="checkbox"/> Equipment must work from within stream channel<br><input checked="" type="checkbox"/> Hand removal of vegetation<br><input type="checkbox"/> Tree Thinning<br><input type="checkbox"/> Tree Removal<br><input type="checkbox"/> Vegetation removal will include removal of roots<br><input type="checkbox"/> Herbicide to stump<br><input type="checkbox"/> Minor Bridge work (cleaning, painting etc.)<br><input type="checkbox"/> Repair of damaged RSP<br><input type="checkbox"/> Work will occur in live channel<br><input type="checkbox"/> Other: Culvert Cleaning and Rehab | <p style="text-align: center;"><b><u>Routine Work Requiring Variance</u></b></p> <input type="checkbox"/> Work will occur outside RMA Dates<br><input type="checkbox"/> Access to be created down to waterway<br><input type="checkbox"/> Other:<br><br><p style="text-align: center;"><b><u>Equipment</u></b></p> <input type="checkbox"/> Chainsaw/Clippers<br><input type="checkbox"/> Backhoe/ grade-all<br><input type="checkbox"/> Excavator<br><input type="checkbox"/> Vactor<br><input type="checkbox"/> Other: |

|  |
|--|
| <p><b>Description of Proposed Maintenance Work</b></p> <p>Caltrans proposes to overlay the existing pavement with Hot Mix Asphalt on State Route 168 (PM 25.5/32.9), in Fresno County near the town of Prather from Oak Creek Road to Lodge Road. The proposed project also includes upgrading nonstandard metal beam guardrails. There will also be vegetation removal, drainage work (culvert inlet repair work), upgrading existing dikes, over-side drains and down-drains to maintain existing drainage patterns, work off the paved roadway, and grading for 3' shoulder backing. No trees or shrubs will be removed. There will be some tree branches cut back by hand.</p> |
|--|

### Section 2: Biological Information

Area Biologist: **Primavera Parker**  
 Phone: **(559) 445-5502**  
 E-Mail: **Primavera\_Parker@dot.ca.gov**

Field Review Conducted By: Caltrans biologist Primavera Parker

Date of Biological Field Review: July 8, 2011 and August 18, 2011

Need CESA/FESA Consultation/ Species:

Known Sensitive Resources: **1 elderberry shrub located at PM 28.55 will have a 20 ft ESA from the drip line of the shrub.**

Restrictions on Work: No work will be done in the channel. Fiber roll will be placed at the two locations to keep any debris from entering the creeks.

Habitat Classification: perennial waterway/riparian

Comments:

Routine Work 10 days Notice

Urgent – minimum 2 day notice (describe urgency below)

Emergency – work to begin immediately (describe emergency below)

Comments:

### Section 3: DFG Approval

*In accordance with Section II of the Agreement between the California Department of Fish and Game (DFG) and the California Department of Transportation (Caltrans) for Routine Maintenance in waterways within/adjacent to State Right of Way for the purposes of protecting and maintaining the state highway system. Caltrans hereby notifies DFG of its intent to perform routine maintenance work within a waterway covered in the Agreement.*

#### DFG Contact Information

Name: **Laura Peterson-Diaz**

Phone Number: **(559) 243-4015 x 225**

E-Mail: **LPDIAZ@dfg.ca.gov**

Date Submitted to DFG by Caltrans:

Date DFG Responded to Caltrans:

Notice of Concurrence

Work can begin as scheduled

Work can begin immediately

Notice of concurrence with conditions (See DFG comments below)

Notice of non-concurrence with comments (See DFG Comments below)

Laura Peterson-Diaz  
 Environmental Scientist  
 Caltrans Liaison  
 DFG/Central Region  
 1234 East Shaw Avenue  
 Fresno, CA 93710

Comments: For all locations which fall under DFG's jurisdiction the work done must follow the provisions of the SAA Maintenance Agreement. A copy of which should be on site at all times.

**BARRIER SYSTEMS**



A LINDSAY TRANSPORTATION SOLUTIONS COMPANY

# X-Tension™

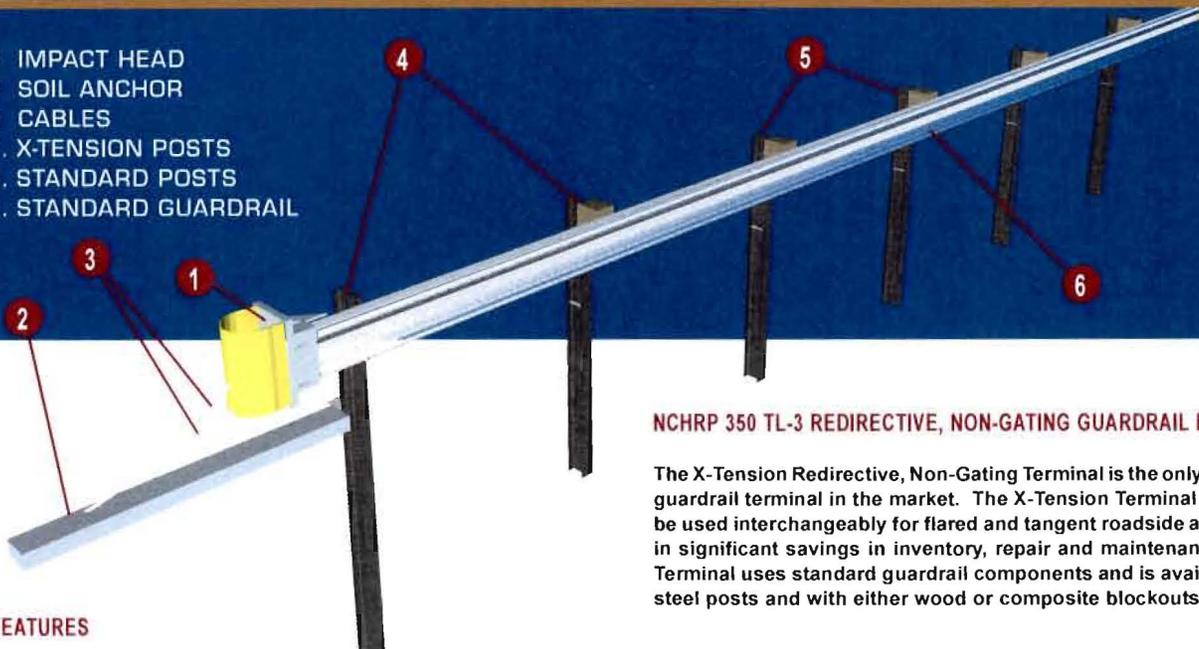
Redirective,  
Non-Gating Guardrail  
End Terminal

- Contractor Friendly
- Simple Installation
- Meets NCHRP 350 TL-3



# X-Tension™ Redirective, Non-Gating Terminal

- 1 IMPACT HEAD
- 2 SOIL ANCHOR
- 3 CABLES
- 4 X-TENSION POSTS
- 5 STANDARD POSTS
- 6 STANDARD GUARDRAIL



## NCHRP 350 TL-3 REDIRECTIVE, NON-GATING GUARDRAIL END TERMINAL

The X-Tension Redirective, Non-Gating Terminal is the only Redirective, Non-Gating guardrail terminal in the market. The X-Tension Terminal has been engineered to be used interchangeably for flared and tangent roadside applications. This results in significant savings in inventory, repair and maintenance costs. The X-Tension Terminal uses standard guardrail components and is available with either wood or steel posts and with either wood or composite blockouts.

### FEATURES

- Only NCHRP 350 tested Redirective Non-Gating Guardrail Terminal available
- Available in 727 or 787mm [28.5 or 31"] heights
- Uses same components for tangent or flared applications
- Easy to install
- Utilizes many standard guardrail components

### WHERE TO USE

Side of road where limited clear zone or excessive slope restricts the use of Redirective Gating terminals.



The X-Tension Terminal can be installed either flared or tangent.

General details for the X-Tension Terminal are subject to change without notice to reflect improvements and upgrades. Additional information is available from Barrier Systems, Inc.

### PHYSICAL SPECIFICATIONS

|            |                        |
|------------|------------------------|
| Length     | 12 m [40']             |
| Width      | 572 mm [22.5"]         |
| Height     | 727 / 787mm [28.5/31"] |
| Weight     | 534 kg [1179 lb]       |
| Test Level | NCHRP 350 TL-3         |



### FREQUENTLY ASKED QUESTIONS

#### WHAT MAKES THE X-TENSION TERMINAL DIFFERENT FROM THE OTHER END TERMINALS ON THE MARKET?

The X-Tension Terminal is tested to NCHRP 350 as a Redirective Non-Gating System. All other terminals are tested as Redirective Gating Systems, meaning they will only start to redirect at the third post.

#### CAN THE X-TENSION TERMINAL BE ATTACHED TO CONCRETE BARRIER?

The X-Tension Terminal can be attached to concrete barrier with the addition of standard transitions.

#### IS A TRANSITION NEEDED TO ATTACH TO STANDARD GUARDRAIL?

The X-Tension Terminal is designed to attach directly to guardrail with no transition required.

#### CAN THE X-TENSION TERMINAL BE INSTALLED USING COMPOSITE BLOCKOUTS?

The X-Tension Terminal can be ordered with either wood or composite blockouts.

DISTRIBUTED BY:

**BARRIER SYSTEMS**

A LINDSAY TRANSPORTATION SOLUTIONS COMPANY



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3333 VACAVALLEY PKWY, VACAVILLE, CA 95688

TEL. +1 707.374.6800 U.S. TOLL FREE 888.800.3691

WWW.BARRIERSYSTEMSINC.COM

## **X-Tension Guardrail Terminal End General Specifications**

### **I. Description**

The X-Tension guardrail terminal end is designed, manufacture and supplied by Barrier Systems Sales and Service LLC.

The X-Tension is a Tangent, Flared, Median, fully redirective, non-gating terminal end which is energy absorbing. The X-Tension substantially consists of an impact head with a brake bar inside, a slider assembly and slider bracket, a cable anchor bracket, a foundation anchor assembly, ground strut, steel breakaway posts and three standard 12 gauge highway W-beam rails.

The total length of the system is 11.4 meters and may be flared at the head end over the 11.4 meters, 0 - 1219mm / 0 - 4' to the face of the rail.

### **II. Performance**

- A. The X-Tension is capable of redirecting vehicles of 820 to 2000Kg's impacting the side of the system at an angle of up to 20 degrees and 100 KPH when impacting from the length of need. The length of need starts at post #1.
- B. When impacted end on with the 820 to 2000Kg vehicle at speeds of up to 100 KPH, the system is brought to a controlled stop or allowed to penetrate to the back side, depending on the impact conditions.
- C. In all end on impacts, varying amounts of energy are dissipated depending on the length of time the vehicle remains in contact with the impact head.
- D. During end on impacts the head, rail one and the slider, telescope over rail two until rail two comes to rest in the back of the impact head. At this point, the V notch bolts joining rail one and two are sheared allowing the entire rail one, head, slider and rail two assembly to slide over rail three.
- E. As the head is pushed down the two cables, the cables are pulled through the brake bar in a torturous path, which dissipates energy.

### **III. Materials**

#### **A. Impact Head**

The impact head shall be fabricated from hot rolled steel that is galvanized after fabrication in accordance with AS/NZS 4680.

The hot rolled steel specification – ASM A36 , AS 3678-250, JISG3101 – SS400, BS4360 -43A.

The impact head shall be attached to the end of rail one with 8 standard splice bolts reversed so that the nut is on the traffic face. The head contains the brake bar through which the cables are threaded before tightening the brake bar.

#### B. Steel Line Posts

These posts are fabricated from W6 x 13.5 standard I beam section. Standard specification for this section is AASHTO M270M (ASTM A 709M) grade 250steel. Posts #1 and #2 are crimped. Posts 3 – 6 are standard guardrail posts as per AASHTO PWE01, Wide Flange Post.

#### C. Timber Block Outs

Standard routed block outs H4 treated, Number one rough sawn pine. 5 block outs are required; Post #1 does not have a block out.

#### D. Slider and Slider Bracket

Shall be constructed from standard, 350 grade, guardrail and hot rolled steel of the same specification as the impact head. The slider is bolted to the downstream end of rail one with 4 standard splice bolts reversed so that the nuts are on the outside. The slider bracket is bolted with 4 splice bolts to the end of rail two in the usual manner. Once rail one is slid over rail two into its final position, the locking angle is bolted to the slider bracket. The combination of these two devices allows the rails to telescope when impacted end on and yet still maintain full ribbon strength in the rail during a redirect impact. Both components are to be hot dipped galvanized after fabrication.

#### E. Cable Anchor Bracket

The cable bracket is fabricated from hot rolled mild steel, 5mm thick, and attached to the back of the rail at the junction between rails 3 and 4. (Post 7). The bracket is attached using four centre splice bolts that are joining the rails. Bracket is also hot dip galvanized after fabrication.

#### F. Cables

Two cables are constructed using 19mm 3x7 strand galvanised cable complete with an M24 threaded rod swaged onto each end. The cables are attached to the ground anchor point, threaded through the impact head and brake bar, down the back of the W beam in the “hollows” and attached to the cable anchor bracket at the downstream end. The brake bar is then turned and locked into place before the cables are tightened. Cable specification, DSR Galvanized 320 / ASTM A-603

#### G. Foundation Anchor

Foundation anchor consists of one C section anchor fabricated from mild steel channel and one I section anchor fabricated from the same section and specification as the Line Posts.

The C section anchor shall be constructed from mild steel conforming to the following specifications ASM A36, AS 3678-300, JISG3101 – SS400, BS4360 - 43A.

#### H. Ground Strut

Ground strut is fabricated from C section mild steel made to the same standard as the foundation anchor specifications. The ground strut shall join the C section anchor point and the, I section, anchor point which is also the bottom half of post one.

#### I. Post One and Two

Fabricated from the same section and specification as the line posts. Post #1 is a short post and bolts into the top of the, I section, anchor point. Both Post #1 and #2 are crimped near the ground level. The impact head is bolted to post one with a standard 50mm long splice bolt.

#### J. Bull nose

Fabricated from a, 3mm thick, polyethylene plastic sheeting. This bull nose is “bent” into position on site.

#### K. Rail Elements

Standard 12 gauge, 2.7mm BMT, 350 grade galvanised W beam. As per AASHTO M180 Class A rail. Three standard sections are required.

#### L. Fasteners

All fasteners shall be Class 4.6 (Grade2) or greater and galvanized in accordance with ASTM 153. Washers shall be hardened and galvanized.

### **IV. Construction**

Design, selection and placement of the X-Tension terminal end shall be in accordance with the AASHTO Roadside Design Guide and the details shown in the construction drawings. Installation shall be in accordance with the installation instructions supplied by Barrier Systems.

Damaged systems shall be repaired or replaced immediately at the expense of the owner of the installed system.

### **V. Performance Specification**

All leading Guardrail Terminal Ends must be fully re-directive and non-gating, capable of redirecting an errant vehicle from post one in side on impacts. (up to 2000P at 20 Degrees and 100 kph). The terminal end must be telescoping and energy absorbing in end on impacts with the impacting force held in tension rather than compression. No debris shall be expelled from the system.



A TRINITY INDUSTRIES INC. COMPANY

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Product Sheet  
Product Specifications  
FHWA Acceptance

## QuadGuard®II CRASH CUSHION SYSTEM



### QUADGUARD®II CRASH CUSHION

QUADGUARD®II CRASH CUSHION family has evolved again! Using the existing framework of the QuadGuard, the QuadGuard II provides TL-2 and TL-3 protection using less length.

The TL-2 QuadGuard II is 25% shorter than the original QuadGuard measuring less than 3m (10'). The TL-3 model is also nearly a meter, 3 feet, shorter than its predecessor.

The only modifications are the addition of the revolutionary Steel Nose, and the monorail Guide Stabilizers. The remaining components are identical to the existing NCHRP 350 systems that have been installed globally since the mid 1990's.

The QuadGuard II will telescope rearward on head-on impacts by both the light car and the high center-of-gravity pickup truck at speeds up to 100 km/h (62 mph) and safely redirect errant vehicles on impact up to 20 angles into the side of the unit without gating.

#### FEATURES AND BENEFITS

- LESS is MORE!
- QuadGuard II has up to 25% less footprint reducing installation cost
- Steel Nose provides excellent visibility
- Majority of system is identical to QuadGuard reduced inventory requirements
- Shorter Systems are less likely to be impacted
- Offers hazard protection from 40 km/h (25mph) to 115 km/h to (70mph)



### **Post Impact Debris**

The design of the QuadGuard II does an excellent job of minimizing debris affecting other vehicles in the roadway.

### **European Standard EN-1317-3**

The QuadGuard® Family also includes systems to meet Europe's EN-1317-3 Criteria  
- QuadGuard CEN Crash Cushion Family

### **Head-On Impacts**

During head-on impacts, the QuadGuard® System telescopes rearward and crushes the cartridges to absorb the energy of impact.

### **Redirective Capability**

When impacted from the side, the QuadGuard® System redirects the errant vehicle back toward its original travel path without allowing gating.

### **Quad-Beam™ Panels**

Quad-Beam panels provide 30% higher beam strength than three beam panels.

### **Monorail Base**

Monorail base eliminates the need for chains and cables providing excellent redirective capability.

Self-Supporting Nosee

Self-supporting nose means no legs to complicate installation and maintenance. Optional Flex-Belt Nose available.

### **Easy Refurbishment of Crash Cushions**

Self-supporting nose means no legs to complicate installation and maintenance. Optional Flex-Belt Nose available.

### **Replaceable Cartridge**

Replaceable cartridge contains impact debris, avoiding loose parts that may cause secondary accidents.

Energy Absorption Systems, Inc.

# QUADGUARD® II

The New  
Standard  
in Crash  
Cushions

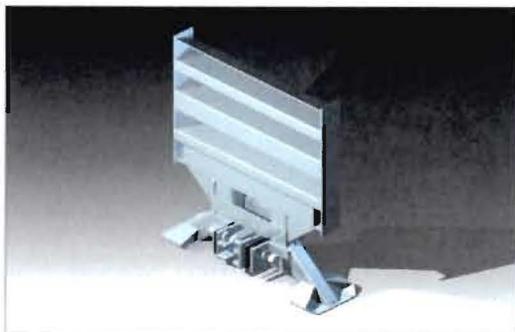
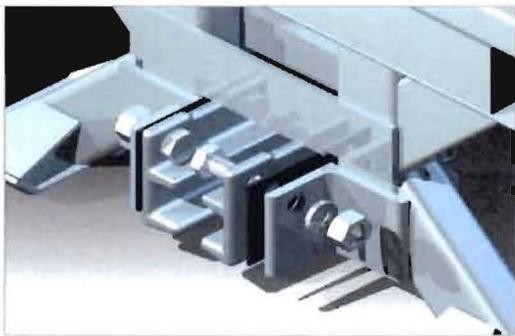


## OVERVIEW

The QuadGuard family has evolved again! Using the existing framework of the QuadGuard, the QuadGuard II provides TL-2 and TL-3 protection using less length. The TL-2 QuadGuard II is 25% shorter than the original QuadGuard measuring less than 3m (10'). The TL-3 model is also nearly a meter, 3 feet, shorter than its predecessor.

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## POST IMPACT DEBRIS

The design of the QuadGuard II does an excellent job of minimizing debris affecting other vehicles in the roadway.

## FEATURES AND BENEFITS

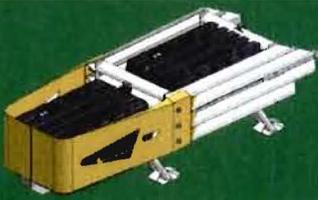
- More is LESS!
- QuadGuard II has up to 25% less footprint reducing installation cost
- Steel Nose provides excellent visibility
- Majority of system is identical to QuadGuard- reduced inventory requirements
- Shorter Systems are less likely to be impacted
- Offers hazard protection from 40 km/h (25mph) to 115 km/h to (70mph)



**ENERGY ABSORPTION  
SYSTEMS, INC.**

SAVING LIVES BY DESIGN™

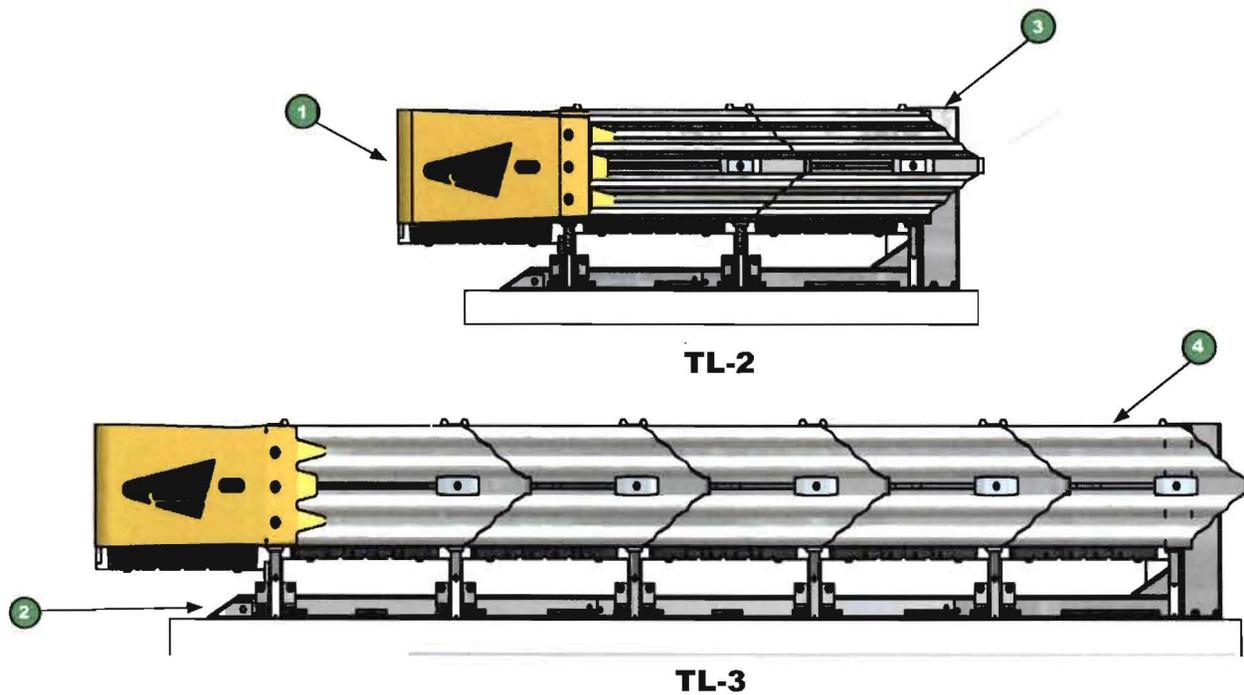
[www.energyabsorption.com](http://www.energyabsorption.com)



## SPECIFICATIONS

|                         |        |        |
|-------------------------|--------|--------|
| Minimum Width at Backup | 610 mm | (2')   |
| Maximum Width at Backup | 2.3 m  | (8')   |
| TL-2 Effective Length   | 2.6 m  | (8'8") |
| TL-3 Effective Length   | 5.4 m  | (8'8") |

- 1 ENGINEERED STEEL NOSE
- 2 MONORAIL
- 3 STEEL BACKUP
- 4 FENDER PANEL



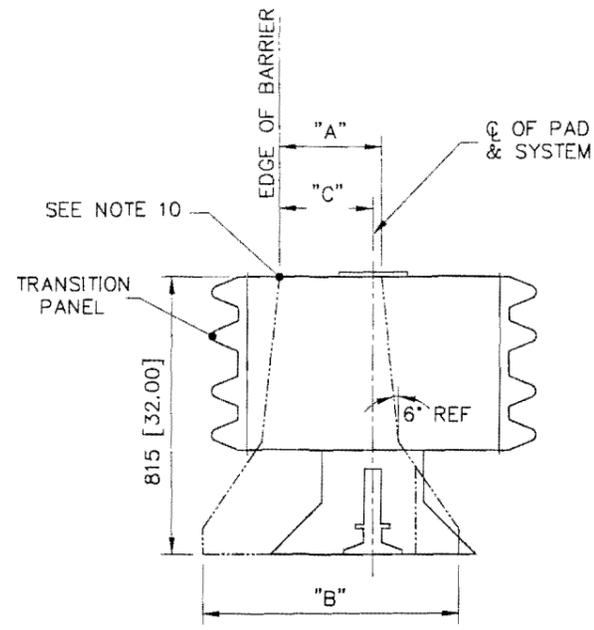
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VIEW A-A  
SCALE: 1=20

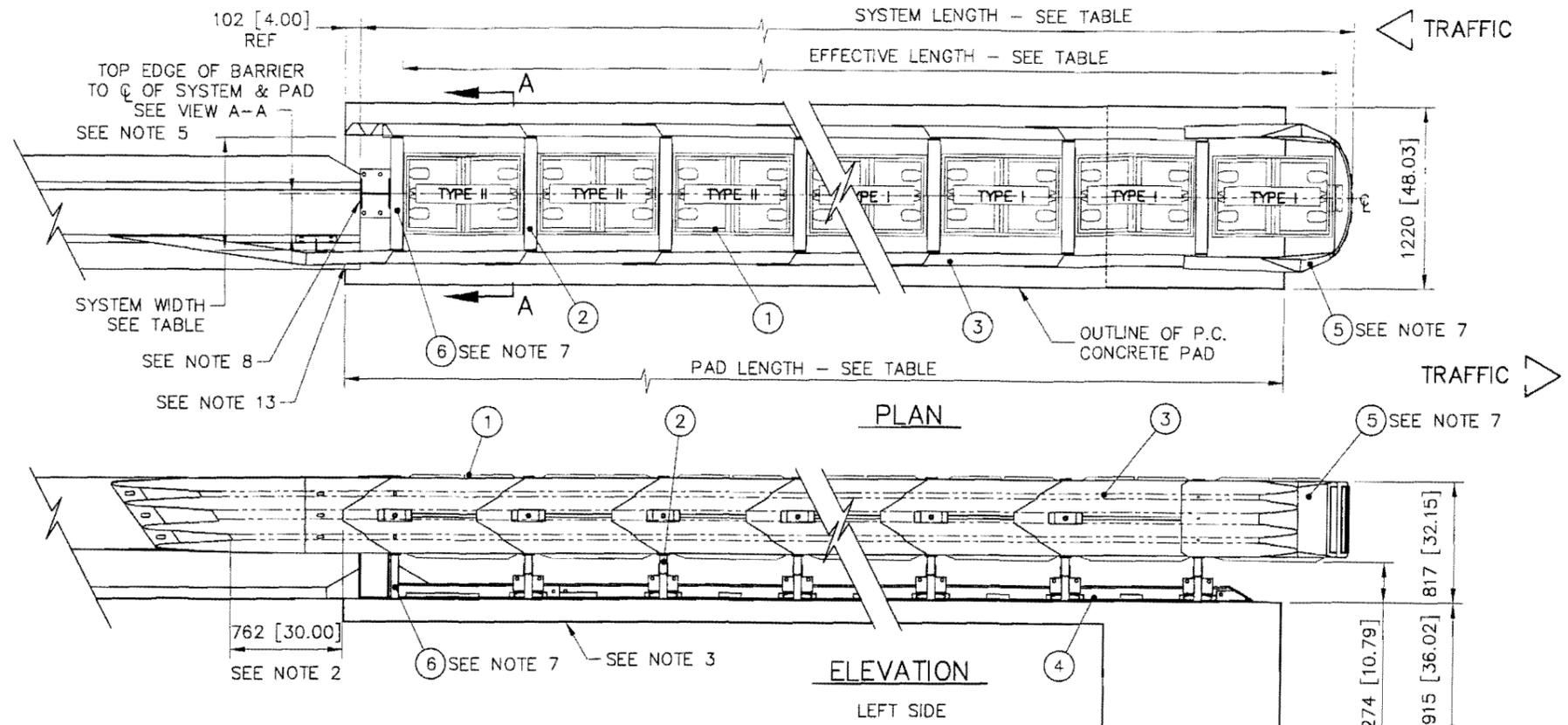
TABLE "A"

| SYSTEM WIDTH | TYPICAL BARRIER APPLICATION |                        |             |
|--------------|-----------------------------|------------------------|-------------|
|              | "A" TOP OF BARRIER          | "B" BARRIER WIDTH      | SEE DIM "C" |
| 610 [24.00]  | 152-406 [6.00-16.00]        | 610-864 [24.00-34.00]  | 203 [8.00]  |
| 760 [30.00]  | 305-559 [12.00-22.00]       | 760-1016 [30.00-40.00] | 279 [11.00] |
| 914 [36.00]  | 457-711 [18.00-28.00]       | 914-1168 [36.00-46.00] | 356 [14.00] |

\* PANEL OFFSET MEASURED AT 815 [32.00] ABOVE GRADE.

\* G = GREY or Y = YELLOW

| BAYS | WIDTH     |           |           | SYSTEM LENGTH  | EFFECTIVE LENGTH | PAD LENGTH     | MAX DESIGN SPEED | # OF CARTRIDGES |         |
|------|-----------|-----------|-----------|----------------|------------------|----------------|------------------|-----------------|---------|
|      | 610 [24"] | 762 [30"] | 914 [36"] |                |                  |                |                  | TYPE I          | TYPE II |
| 1    | QS2401*   | QS3001*   | QS3601*   | 2.16 [7'-1"]   | 1.73 [5'-8"]     | 2.74 [9'-0"]   | 40 [25]          | 2               | 0       |
| 2    | QS2402*   | QS3002*   | QS3602*   | 3.08 [10'-1"]  | 2.64 [8'-8"]     | 2.74 [9'-0"]   | 60 [37]          | 2               | 1       |
| 3    | QS2403*   | QS3003*   | QS3603*   | 4.00 [13'-1"]  | 3.56 [11'-8"]    | 3.66 [12'-0"]  | 70 [44]          | 3               | 1       |
| 4    | QS2404*   | QS3004*   | QS3604*   | 4.91 [16'-1"]  | 4.47 [14'-8"]    | 4.57 [15'-0"]  | 80 [50]          | 3               | 2       |
| 5    | QS2405*   | QS3005*   | QS3605*   | 5.83 [19'-1"]  | 5.38 [17'-8"]    | 5.49 [18'-0"]  | 90 [56]          | 4               | 2       |
| 6    | QS2406*   | QS3006*   | QS3606*   | 6.74 [22'-1"]  | 6.30 [20'-8"]    | 6.40 [21'-0"]  | Δ100 [62]        | 4               | 3       |
| 7    | QS2407*   | QS3007*   | QS3607*   | 7.65 [25'-1"]  | 7.21 [23'-8"]    | 7.32 [24'-0"]  | Δ105 [65]        | 4               | 4       |
| 8    | QS2408*   | QS3008*   | QS3608*   | 8.57 [28'-1"]  | 8.13 [26'-8"]    | 8.23 [27'-0"]  | Δ110 [68]        | 4               | 5       |
| 9    | QS2409*   | QS3009*   | QS3609*   | 9.49 [31'-1"]  | 9.04 [29'-8"]    | 9.14 [30'-0"]  | Δ115 [71]        | 4               | 6       |
| 10   | QS2410*   | QS3010*   | QS3610*   | 10.40 [34'-1"] | 9.96 [32'-8"]    | 10.06 [33'-0"] | Δ120 [75]        | 5               | 6       |
| 11   | QS2411*   | QS3011*   | QS3611*   | 11.32 [37'-1"] | 10.87 [35'-8"]   | 10.97 [36'-0"] | Δ120 [75]        | 5               | 7       |
| 12   | QS2412*   | QS3012*   | QS3612*   | 12.23 [40'-1"] | 11.79 [38'-8"]   | 11.89 [39'-0"] | Δ120 [75]        | 5               | 8       |



NOTES:

- IN COMPLIANCE WITH THE AASHTO 2002 ROADSIDE DESIGN GUIDE, MANUFACTURER RECOMMENDS REMOVAL OF ALL CURBS AND ISLANDS TO ENSURE PROPER IMPACT PERFORMANCE.
- PROVISION SHALL BE MADE FOR REAR FENDER PANELS TO SLIDE REARWARD UPON IMPACT 762 [30.00] MIN.
- 150 [6.00] MIN. REINFORCED 28 MPa [4000 PSI] P.C. CONCRETE PAD OR 200 [8.00] MIN. NON-REINFORCED 28 MPa [4000 PSI] P.C. CONCRETE ROADWAY, MEASURING AT LEAST 3.66 m [12'-0"] WIDE BY 15.24 m [50'-0"] LONG.
- SEE THE "QUADGUARD SYSTEM PRODUCT MANUAL", FOR A DESCRIPTION OF ITS IMPACT PERFORMANCE CHARACTERISTICS AND DESIGN LIMITATIONS BEFORE PLACING A SYSTEM AT A GIVEN SITE. INFORMATION AND COPIES OF ABOVE MANUAL ARE AVAILABLE BY CALLING CUSTOMER SERVICE DEPARTMENT AT (888) 323-6374.
- WHERE NECESSARY, THE CUSTOMER SHALL SUPPLY AN ADEQUATE TRANSITION FROM THE QUADGUARD SYSTEM TO THE OBJECT BEING SHIELDED.
- UNITS OF MEASUREMENT ARE MILLIMETERS [INCHES], UNLESS OTHERWISE NOTED.
- BACKUP, TRANSITION AND NOSE ASSEMBLIES NOT INCLUDED IN MODEL NUMBER. ORDER SEPARATELY. TRANSITION ASSEMBLY IS AN ACCESSORY ITEM.
- CAUTION:  $\phi$  OF QUADGUARD SYSTEM SHALL BE PARALLEL WITH  $\phi$  OF BARRIER  $\pm 1^\circ$ .
- CAUTION: MAX. 180 [7.00] CLEARANCE BETWEEN BACKUP AND BARRIER WALL. ZERO CLEARANCE RECOMMENDED.
- LOCATE EDGE OF BARRIER @ 815 [32.00] ABOVE GRADE & USE DIMENSIONS PROVIDED IN TABLE "A" TO LOCATE QUADGUARD SYSTEM & PAD WITH RESPECT TO SAFETY SHAPE BARRIER.
- THE NUMBER OF BAYS INDICATED IN THE TABLE IS BASED ON CALCULATED VALUES TO ENSURE ADEQUATE SYSTEM CAPACITY TO DISSIPATE THE LONGITUDINAL IMPACT ENERGY OF A 2000 kg VEHICLE TRAVELING AT THE SPEED INDICATED.
- THE SIX BAY SYSTEM HAS BEEN FULLY TESTED AT 100 km/h UNDER THE FULL 8 TEST MATRIX OF NCHRP 350 TL-3. SYSTEMS LONGER THAN SIX BAYS SHALL ALSO BE CAPABLE OF MEETING THE OCCUPANT RISK CRITERIA AS RECOMMENDED IN NCHRP 350 FOR VEHICLES WEIGHING 2000 kg IMPACTING HEAD ON AT THE SPEED INDICATED IN THE TABLE.
- TRANSITION PANEL SHALL BE ANGLED SUCH THAT MAXIMUM GAP FROM FENDER PANEL OVERLAP DOES NOT EXCEED 20 [.78].

BIDIRECTIONAL

| Revisions                        | Date     | Rev. | By  | Ckd. | App. |
|----------------------------------|----------|------|-----|------|------|
| AASHTO WAS 1996                  | 12/03/03 | H    | SDC | STT  | ACF  |
| CHANGED NOTES 4, 5 & 7           | 12/15/04 | I    | RGC | STT  | ACF  |
| REVISED "C" IN TABLE A & DIM "C" | 11/06/08 | J    | RGC | STT  | ACF  |

| REFERENCES      |                           |
|-----------------|---------------------------|
| SERIAL#         | DIAPHRAGM ASSY. 607113    |
| SALES ORDER#    | NOSE ASSY. 35-40-05       |
| EH PROJECT#     | FENDER PANEL ASSY. 608236 |
| DESIGN SPEED    | BACKUP ASSY. 35-40-03     |
| NOSE COLOR      | MONORAIL ASSY. 35-40-06   |
| NUMBER OF UNITS | CONCRETE PAD 35-40-11     |
|                 | TRANSITION ASSY. 35-40-18 |
|                 | WHEEL DEFLECTOR ASSY. N/A |

|             |                |      |         |
|-------------|----------------|------|---------|
| DRAWN BY    | T. BUSSE       | DATE | 9/16/96 |
| DESIGNED BY | JVM/MHO        | DATE | 3/01/96 |
| CHECKED BY  | SML            | DATE | 9/27/96 |
| APPROVED BY | J. MACHADO     | DATE | 9/27/96 |
| CAD FILE:   | QSTSCVR-T4.dwg |      |         |

**ENERGY ABSORPTION SYSTEMS**  
ENGINEERING AND RESEARCH DEPARTMENT

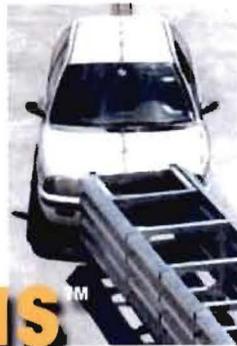
**QUADGUARD® SYSTEM**  
W/TENSION STRUT BACKUP AND LEFT SIDE 4" NJ OFFSET PANEL

SCALE: 1=40      DWG: QSTSCVR-T4      SHEET: 1 of 1      REV: J



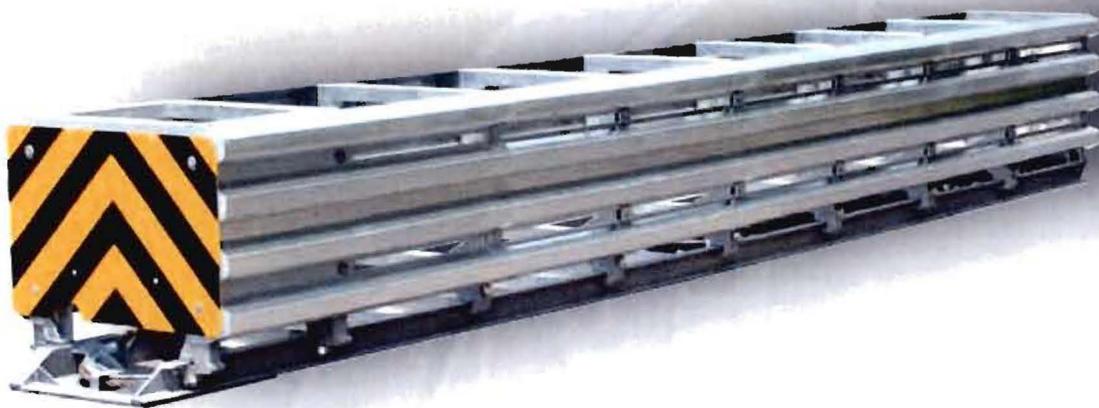
**SCI Products Inc.**

**The World's Only  
Speed-Dependent  
Crash Attenuators.**



**SMART CUSHION INNOVATIONS™**

NCHRP 350 Approved



*Marketed and Distributed by*

**W o r k A r e a P r o t e c t i o n**

# SMART CUSHION INNOVATIONS™

The World's Only Speed-Dependent Crash Attenuators



The Smart Cushion Innovations (SCI) crash attenuator is a revolutionary, speed-dependent product that varies stopping resistance during an impact. The Smart Cushion Innovations (SCI) crash attenuator allows lighter and slower-moving vehicles to have longer ridedown distances and lower ridedown G forces.

Unlike fixed-resistance attenuators, the Smart Cushion Innovations (SCI) attenuator does not reach maximum stopping resistance unless a vehicle is traveling at the maximum design speed. This fully redirective, non-gating, bi-directional, impact attenuator was designed for maximum safety and reusability, as well as outstanding durability before, during and after an impact.

The SCI is the only attenuator with a reverse-tapered design to eliminate side panel stress during a collapse. It also has an extremely low angle of exit on side impacts ( $<1^\circ$ ) to keep vehicles from rebounding back into traffic and causing secondary accidents. This is the lowest angle of exit for any redirective attenuator on the market.



## How It Works

The hydraulic porting of the attenuator ensures that the proper resistance is used to stop the vehicle before it reaches the end of the cushion's usable length.

The SCI was specifically designed for durability and resetability to enable resets to be performed in less than one hour. After a frontal impact, an experienced crew can perform the two-stage reset in less than 45 minutes. Side impacts within NCHRP 350 specifications should not damage the attenuator.

After an impact, the cushion requires a dual-stage pull-out with the replacement of two 1/4" shear bolts. The crash attenuator requires a minimal inventory of spare parts because of the new side panels' durability and the normal requirement of only two shear bolts on the frontal impact reset. Minimal damage means quick resetting and reduced worker exposure to traffic, as well as lower costs for traffic control, replacement parts and labor.



## Ready To Install

SCI attenuators come fully assembled for a pick-and-set install. A typical installation can be performed in less than 1-1/2 hours. The units require no backstops for permanent or temporary construction applications.

## NCHRP 350 Test Results

All NCHRP 350 tests were performed on the same unit in four consecutive days. All tests showed outstanding results for ridedown G forces and low angle of exit. There were no replacement parts required prior to the next test except for shear bolts.

*"It's a very easy installation. We set the SCI impact attenuator with a truck-mounted crane, drove into the concrete surfacing and then did some epoxy work. The installation went real well and took about an hour. It would normally take longer for a different type of system. SCI manufactures a quality product and I'm sure they save many lives."*

— Tyler Chicoine, Garcia-Chicoine Enterprises Inc., Lincoln, Nebraska

### Repair Costs

Based on NCHRP 350 Test results, the **SCI100GM** required the following parts and labor:

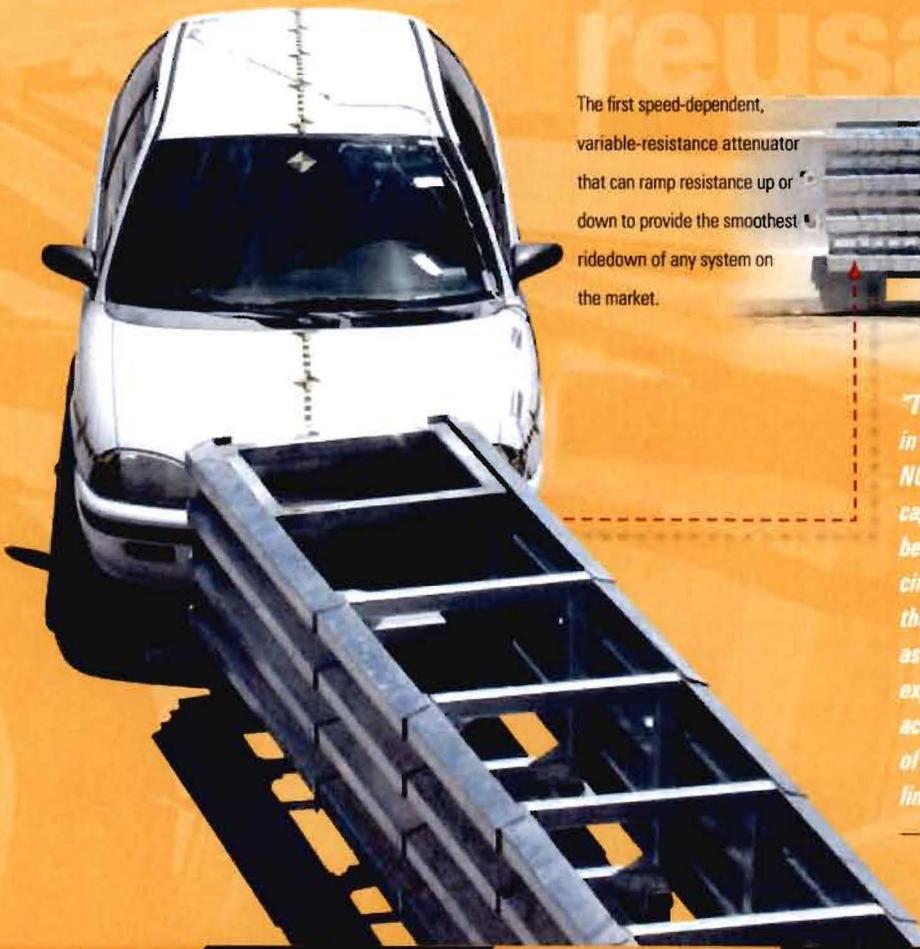
| NCHRP 350 TEST LEVEL III REPAIR RESULTS                     | Part Names      | Cost | Repair Hrs. | Cost | Total Cost |
|---|-----------------|------|-------------|------|------------|
| #3-31 2000 kg vehicle 0 degree frontal impact at 102 km/h   | 2 – Shear Bolts | \$1  | 2 man hours | \$80 | \$81       |
| #3-32 820 kg vehicle 15 degree frontal impact at 101 km/h   | 2 - Shear Bolts | \$1  | 2 man hours | \$80 | \$81       |
| #3-33 2000 kg vehicle 15 degree frontal impact at 101 km/h  | 2 - Shear Bolts | \$1  | 2 man hours | \$80 | \$81       |
| #3-37 2000 kg vehicle 20 degree side impact at 99 km/h      | 0               | \$0  | 0           | \$0  | \$0        |
| #3-39 2000 kg vehicle 20 degree rev. side impact at 99 km/h | 0               | \$0  | 0           | \$0  | \$0        |

### Test Levels Available

The **SCI70GM** is our Test Level 2 (45 MPH) attenuator and the **SCI100GM** is our Test Level 3 (62 MPH) attenuator. Both attenuators can protect a wide range of hazards including bridges, median barriers and highway signs.

reusability.

The first speed-dependent, variable-resistance attenuator that can ramp resistance up or down to provide the smoothest ridedown of any system on the market.



*"The **SCI100GM** unit has experienced three hits in a very short period. The first was well above the NCHRP 350 criteria. The crash used every bit of the capacity the unit has and I believe the driver survived because of the performance of the unit in extreme circumstances. The next two hits were within the NCHRP 350 criteria and the unit functioned as designed with very little repair cost. As we gain experience in resetting units, the job can be accomplished in less than 30 minutes for a majority of hits. Damage to the unit for the last two hits was limited to the shear pins and the chevron plate."*

— Ron Jones, Trafficade Services Inc., Phoenix, Arizona

## Features



### Support Gussets.

Gussets located behind the panels reduce gap formation and deformation to prevent snagging on reverse side impacts.



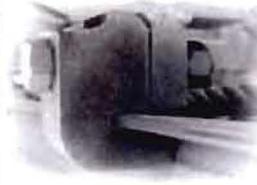
### Stronger Side Panel.

Our panels are over 90% stronger than curved profiles. The profile allows the edges to be beveled, reducing the potential for snagging and damage on reverse-direction impacts. The panel also smoothly redirects vehicles on side impacts. The side panel is fabricated from 10-gauge, 60-ksi, minimum-yield steel with a G90 galvanized coating.



### Cable & Cylinder System.

This system allows longer ridedown distances for smaller vehicles, as well as smoother ridedown with lower G forces for all vehicles. The cylinder's hydraulic porting assures a controlled ridedown by applying the necessary resistance required based on the speed of the vehicle.



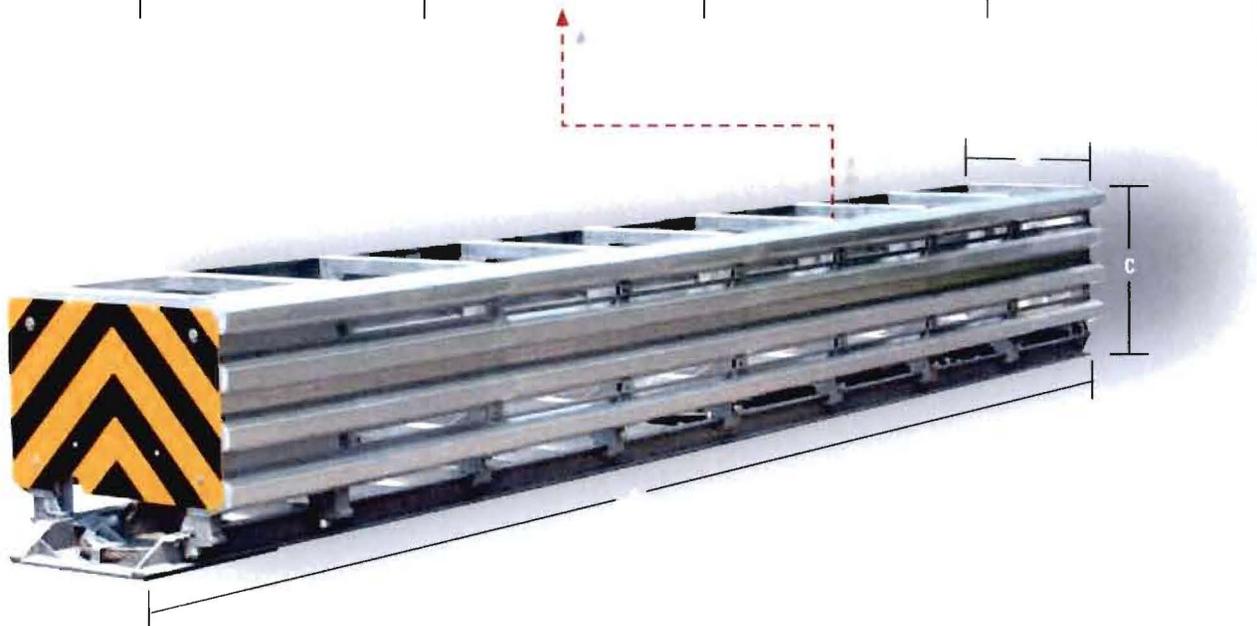
### Side Guide Design.

This new design withstands side impacts with no damage. It also allows individual replacement of the support frames.



### Front Rollers.

The roller guide design on the front sled produces a smooth, aligned collapse by reducing friction and binding.



| SCI Dimensions | Test Level 2 | Test Level 3 |
|----------------|--------------|--------------|
| A              | 13' 6"       | 21' 6"       |
| B              | 24"          | 24"          |
| C              | 34"          | 34"          |
| Weight         | 2470 lbs.    | 3450 lbs.    |

Weights are for attenuators only



# SMART CUSHION INNOVATIONS™

## Highlights

### Safety Benefits

- ▶ Variable force (speed-dependent), not fixed force, provides consistent deceleration during ridedown.
- ▶ Longer ridedown distances and lower sustained G forces for lighter or slower-moving vehicles.
- ▶ Low angle of exit on side impacts (<1°) to keep vehicle from deflecting back into traffic.
- ▶ Quick and easy resetting for reduced worker exposure to traffic.
- ▶ Reduced out-of-service time to maximize highway safety.

02 06-23-03 PLAY 000079  
FWD30 0000 1560sec



1/5000 CENTER 500FPS

### Cost Benefits

- ▶ Minimal replacement parts requirement reduces spare parts inventory and parts costs.
- ▶ Quick, easy resetting reduces labor and traffic control costs.
- ▶ The new, reverse-tapered design eliminates side panel stress on frontal impacts to reduce damage and system fatigue from multiple impacts.
- ▶ Low life cycle cost benefits increase dramatically as impacts occur.

01 06-23-03 PLAY 000  
FWD30 0000 1320



1/5000 CENTER 500FPS

## About Work Area Protection Corporation

Work Area Protection Corporation is the international leader in traffic control devices and work zone safety products. Since 1969, we have been meeting customer needs and exceeding quality standards with a wide range of highway and construction safety products. We back those products with knowledgeable, personalized customer service and strong distributor support.

| Part No.           | Description  | Weight   |
|--------------------|--|--|
| <b>Attenuators</b> |  |  |
| 9400               | SCI100GM Attenuator 24" wide w/Concrete Anchors Test Level 3                         | 3500 lbs.  |
| 9450               | SCI100GM Attenuator 24" wide w/Asphalt Anchors Test Level 3                          | 3575 lbs.  |
| 9451               | SCI70GM Attenuator 24" wide w/Concrete Anchors Test Level 2                          | 2500 lbs.  |
| 9452               | SCI70GM Attenuator 24" wide w/Asphalt Anchors Test Level 2                           | 2550 lbs.  |
| <b>Anchor Kits</b> |  |  |
| 9401               | Concrete Anchor Kit for SCI100GM   |  |
| 9402               | Asphalt Anchor Kit for SCI100GM  |  |
| 9453               | Concrete Anchor Kit for SCI70GM  |  |
| 9454               | Asphalt Anchor Kit for SCI70GM   |  |
| <b>Accessories</b> |  |  |
| 9406               | Shear Bolt   |  |
| 9424               | Delineator Panel Yellow Test Level 3   |  |
| 9456               | Delineator Panel Yellow Test Level 2   |  |
| 9439               | Epoxy 22 oz. Cartridge Required for Attenuator Part No. 9400=4/9450=12/9451=3/9452=9 |  |
| 9440               | Nozzle Epoxy Mixing – 1 nozzle required per cartridge                                |  |
| 9444               | Spare Parts Kit Test Level 3   |  |
| 9458               | Spare Parts Kit Test Level 2   |  |
| <b>Transitions</b> |  |  |
| 9431               | Transition 24" Jersey Barrier - Right (viewed from front)                            |  |
| 9432               | Transition 24" Jersey Barrier - Left (viewed from front)                             |  |
| 9433               | Transition 24" Concrete - Left & Right   |  |

Call for other transition design availability

### Disclaimer

This product is only intended for use as a redirective impact attenuator. Installations must be performed according to manufacturer's specification. Improper installations, modifications or unintended use creates a hazardous condition that can cause personal injury, property damage or death. Any modification or unintended use of this product shall immediately void all manufacturers' warranties. SCI Products Inc. disclaims all liability for injuries to persons or property resulting from any modifications to, unintended use of or unspecified installation of this product.

Designs are subject to change without notice.  
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 PATENT PENDING.



**SCI Products Inc.**

Permanent Message Boards • Attenuators • Speed Awareness Products • LED Signals • Advanced Warners



### Work Area Protection Corp.

P.O. Box 4087 • 2500 Production Drive • St. Charles, IL 60174-9081  
 Phone: 630.377.9100 • Orders: 800.327.4417 • Fax: 630.377.9270  
 Web: www.workareaprotection.com

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# SMART CUSHION INNOVATIONS

## SCI100GM

### General Specifications

#### **DESCRIPTION:**

The SCI100GM is a redirective, non-gating crash attenuator that consists of a base, supporting frames, a sled, side panels, a wire rope cable, sheaves and a shock arresting cylinder. The base is anchored to the mounting surface and provides support for the frames that are mounted on it. The support frames hold the side panels that provide an outer flat redirective surface for side impacts. The sled provides redirective support for side impacts and deceleration force for frontal impacts. It is designed for 24" applications. The SCI100GM telescopes rearward upon frontal impact and can be reset with minimal repair parts. It is NCHRP 350 Test Level 3 approved.

#### **MATERIALS:**

SCI100GM Impact Attenuator component parts shall meet the following requirements:

- A. Shock Arresting Cylinder.** The cylinder shall be specially designed for different Test Levels and filled with an environmentally friendly, fire-resistant hydraulic fluid that will perform to a minimum saturated pour point temperature of -37 degrees C. (-35 degrees F.). The Shock Arresting Cylinder shall be a metered hydraulic cylinder that has internal ports engineered to reduce the speed of the vehicle to a predefined rate that is dependent on a combination of speed and mass. It translates its resistance (force) to the cable that is attached to the sled.
- B. Cable.** The wire rope cable shall be a 28.6mm (1.125") 6 x 3 IWRC galvanized wire rope cable with a breaking strength of 58.96 metric tons (65 tons). It shall be attached to the sled with an Open Spelter Socket that has a 100% efficiency rating. It shall be reaved around the Shock Arresting Cylinder and terminated to the base with 4 wire rope clips.
- C. Base.** The base shall be manufactured from 20.5kg/m (13.8lb/ft) steel channel. It shall include all cross bracing necessary to sustain its design criteria impacts without damage.
- D. Side Panels.** The side panels shall be manufactured from ASTM A1011 Grade 60 Steel with an ASTM653 galvanized coating. The outer surface shall have four flat flutes to provide a substantial redirective bearing surface for side impacts. The outer trailing edge overlaps shall be formed to create a bend toward the inner panel to reduce snag potential on reverse side impacts. The angle of the outer flat surface to the flat side return wall shall be 19 – 22 degrees which provides an optimized angle for maximum rigidity to minimize damage and snag potential on side impacts. The outside trailing edge shall be longitudinally shorter than the inside trailing edge to produce a minimum of a 23 degree taper giving the attachment bolts more surface to hold the panels on the support frames with no overlap past the rear edge of the support frames to reduce snagging on reverse impacts.

- E. Support Frames.** The support frames shall be fabricated out of 63.5mm x 63.5mm x 4.7mm (2.5" x 2.5" x .187") tubular steel. The support frames provide a structure to mount and support the side panels. They will include outboard gussets to support the top and bottom panel flange to eliminate panel fold over at both locations caused by side impacts. They shall be attached to the base by the side guides using a 1" diameter Grade 8 bolt which allows the frames to slide longitudinally upon frontal impacts. The frames shall be designed to be individually replaced without removing other frames.
- F. Front Sled.** The front sled shall be fabricated out of 63.5mm x 63.5mm x 4.7mm (2.5" x 2.5" x .187") tubular steel. It shall have diagonal bracing to minimize distortion on angled hits, support impact of different vehicle heights, and transfer stopping force to the Spelter Socket attachment. The sled shall have four guide rollers to eliminate wedging on angled front impacts.
- G. Transition Panels.** The transition panels shall be manufactured from ASTM A1011 Grade 60 Steel with an ASTM123 galvanized coating. Three standard transition panels shall be available. These shall be: SCI100GM to Jersey Barrier, SCI100GM to Thrie Beam, and SCI100GM Concrete Transition (for vertical surfaces). Drawings are available for the Thrie Beam transition to be used with Thrie and W Beam Guardrail.
- H. Delineator Plate and Reflectorization.** The front delineator plate shall be supplied in the color specified by the state or, if no color is specified, it shall be yellow. Reflectorization shall be in accordance with state requirements.
- I. Metal Work.** All metal work, except side and transition panels, shall be fabricated from ASTM A36 steel. After fabrication, all metal work shall be hot dip galvanized in accordance with ASTM A123. Welding shall be performed by welders certified per AWS3G.
- J. Fasteners.** All bolts shall be American-made Standard Regular Bolts, unless indicated otherwise in the specification. Anchor bolts shall be anchored using an epoxy with an ultimate pullout load rating of 14,695kg (32,397 lbs) and ultimate shear load rating of 10,644 kg (23,467 lbs).

#### **CONSTRUCTION DETAILS:**

The SCI100GM shall be built either on existing concrete pad minimum 150 mm (6") deep or existing 150 mm (6") minimum asphalt (type 6 or 7) over 150 mm (6") minimum compacted subbase (minimum 95% of maximum theoretical density) or existing 150 mm (6") minimum asphalt (type 6 or 7) over 76 mm (3") minimum concrete. If new installation is necessary, then the preferred foundation would be a 150 mm (6") reinforced concrete pad per manufacturer's instructions.

Anchors shall be set into holes drilled with rotary impact drills, approved by the Engineer, of the sizes recommended by the manufacturer of the attenuator.

The SCI100GM shall be bolted in place in accordance with the attenuator manufacturer's instructions, but no sooner than seven days after placement of fresh concrete, without accelerators, and no sooner than three days after placement of concrete which has been batched with an approved accelerator.

If a transition is required, the appropriate manufacturer's standard transition shall be used.

Traffic protection devices, such as cones, drums, lights, signs, barricades, or other articles directed by the Engineer, shall be provided and maintained under their respective items. Those devices shall not be removed until the SCI100GM Impact Attenuator is fully operational and, in lighted areas or areas to be lighted, these articles shall also be maintained until the lighting system is operational.

**QUALITY CONTROL:**

1. All steel shall be fabricated from the specified material that is called out on the fabrication drawings.
2. All welding shall be performed by welders certified per AWS3G.
3. Material certifications shall be required from all vendors.
4. All attenuators shall be fabricated from the drawings of the NCHRP 350 tested unit.

**TESTING AND CERTIFICATION:**

The SCI100GM has passed all required tests and is certified for NCHRP 350 Test Level III. The letter of approval from the Federal Highway Administration is dated September 12, 2003 and has a designation of HSA-10/CC-85.

**PERFORMANCE:**

1. The SCI100GM is designed to meet the Test Level 3 performance criteria of the NCHRP 350 for redirective, non-gating crash cushions including, but not limited to, Occupant Risk Criteria and Redirective Criteria.
2. After impacts that are within the design parameters of vehicle mass and speed, the SCI100GM should not require the replacement of parts except for the Nose Plate and Mobile Sheave Shear Bolts. Side impacts may only require an inspection with no repair parts necessary.
3. Upon side impacts, vehicle exit angles should be <1 degree.

**DIMENSIONS:**

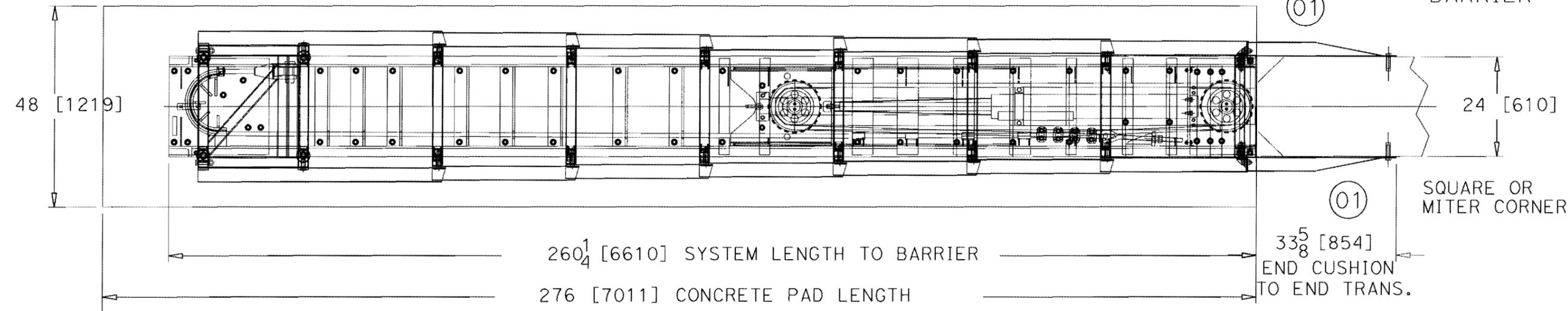
|                         |                  |
|-------------------------|------------------|
| Width (Effective) ----- | 24" (610mm)      |
| Length -----            | 21.5' (6.55m)    |
| Height -----            | 33" (838mm)      |
| Weight -----            | 3450 lb (1565kg) |

Parts List:  
 01 - Transition 24" Concrete Block Right & Left

SMART CUSHION - TEST LEVEL III  
 CONCRETE FOUNDATION SCI100GM

CONCRETE BLOCK, 24 INCH TRANSITION  
 ET-06-04  
 ONE OR BOTH SIDES AS REQUIRED

24" BLOCK  
 CONCRETE  
 BARRIER

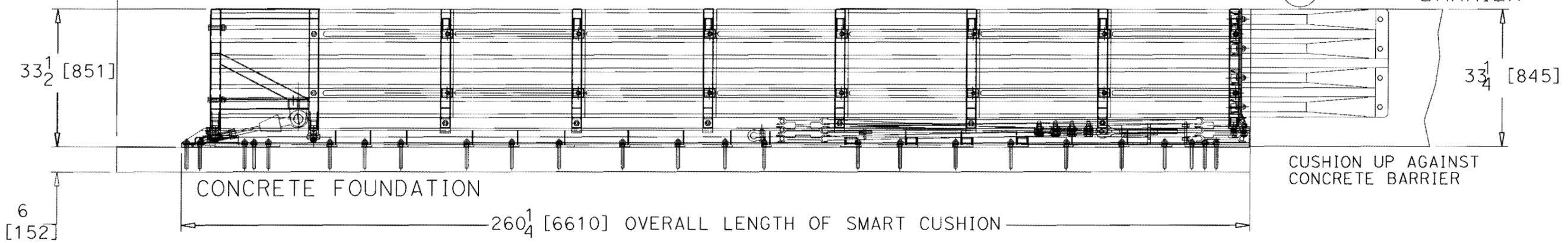


LEVEL III PLAN VIEW

SMART CUSHION - TEST LEVEL III  
 SCI100GM

CONCRETE BLOCK, 24 INCH TRANSITION  
 ET-06-04  
 ONE OR BOTH SIDES AS REQUIRED

24" BLOCK  
 CONCRETE  
 BARRIER



LEVEL III ELEVATION

|                           |         |
|---------------------------|---------|
| DRAWING NO.               | #94     |
| FILE:                     | 33      |
| DRAWN BY                  | 33      |
| CHECKED BY                |         |
| SHEET                     | 1       |
| OF                        | 1       |
| SCALE                     | 24 INCH |
| NEXT ASSEMBLY DRAWING NO. |         |

|                        |                                 |
|------------------------|---------------------------------|
| PROJECT                | END TREATMENT w/COMPLETE SYSTEM |
| LEVEL III SYSTEM COM   |                                 |
| CONCRETE BLOCK TRANSIT |                                 |
| CLIENT                 |                                 |

|  |            |
|--|------------|
| COMMERCIAL TOLERANCES APPLY TO STOCK SIZES | TOLERANCES |
| .X   | ± .03      |
| .XX  | ± .01      |
| .XXX                                       | ± .006     |
| FRACTIONS                                  | ± 1/16     |
| ANGLES                                     | ± 1/2°     |

ALL DIMENSIONS ARE INCHES UNLESS OTHERWISE NOTED

| REV. LETTER | DESCRIPTION | DATE | BY |
|-------------|-------------|------|----|
|             |             |      |    |
|             |             |      |    |
|             |             |      |    |

SCI PRODUCTS, INC. A Division of Stabler Companies

635 LUCKNOW ROAD, HARRISBURG, PA 17110-1635  
 PHONE 717-234-3106 FAX 717-234-8518  
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 MAY BE USED FOR ANY PURPOSES WITHOUT THE INTEREST OF SCI PRODUCTS, INC. UNLESS OTHERWISE NOTED.

# TAU-II<sup>®</sup>

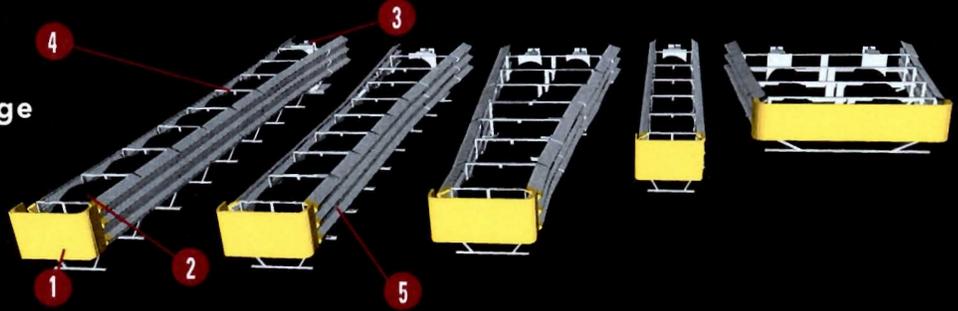
## Redirective Non-Gating Crash Cushions

- Shields Multiple Width Hazards
- Partially Reusable Design
- Quick and Easy to Install
- NCHRP 350 Accepted



# TAU-II® REDIRECTIVE, NON-GATING CRASH CUSHIONS

- 1 Nose Cover
- 2 Energy Absorbing Cartridge
- 3 Backstop
- 4 Diaphragm
- 5 Thrie-Beam Slider Panel



## FEATURES

- Minimum number of anchors needed to secure system
- Can be installed over expansion joints
- Low profile foundation ideal for deployment on bridge decks
- Numerous transition options
- Low priced replacement components
- Reusable nose standard
- Uses standard, non-proprietary transitions

## DESIGNED TO SHIELD MULTIPLE WIDTH HAZARDS

The Redirective, Non-Gating, (R-NG) TAU-II Crash Cushion Family consists of a full line of Systems designed to meet the requirements of NCHRP Report 350, TL-2 & TL-3. The system is available in lengths and capacities for both low and high speed applications (50-113 km/h, 30-70 mph). The TAU-II System can shield hazards with widths up to 2.6 m (102"). The TAU-II System is ideally suited for roadway hazards such as the ends of rigid concrete barriers, steel barrier, bridge piers, signs, etc. Ease of installation, low profile foundation, numerous transition options, and low priced replacement components after an impact make the TAU-II System ideal to shield most roadside hazards.

## PHYSICAL SPECIFICATIONS

|                       |                    |             |
|-----------------------|--------------------|-------------|
| <b>Classification</b> | R-NG               |             |
| <b>TL-3 Length</b>    | 7 m                | (23' 1")    |
| <b>Width</b>          | 0.7 - 3 m          | (27 - 102") |
| <b>Height</b>         | 800 mm             | (31 1/2")   |
| <b>TL-3 Weight</b>    | 1129 kg            | (2489 lb.)  |
| <b>Test Level</b>     | NCHRP 350 TL 2 / 3 |             |



### What needs to be replaced after a design impact?

Typically only the damaged cartridges will need to be replaced. The Nose and slider panels are designed to withstand multiple design impacts.

### What type of foundation is needed for the Universal TAU-II System?

A 152 mm (6") reinforced concrete pad is required. The TAU System can also be ordered to be installed on asphalt.

### What transitions are available?

Since TAU-II transitions are non-proprietary, any approved thrie beam barrier transition will fit.

### Can the TAU-II System be used for low and high speeds?

The TAU-II System is designed for speeds from 50 to 113 km/h (31 to 70 mph)



The TAU-II System uses disposable, inexpensive cartridges and telescoping panels making the System easy to reset after a design impact.

### Distributed By:



Barrier Systems Sales & Service • 3333 Vaca Valley Pkwy. • Vacaville, CA 95688 • +1 707.374.6800, U.S. Toll free 888.800.3691 • www.barriersystemsinc.com

General details for the TAU-II System are subject to change without notice to reflect improvements and upgrades.

Additional information is available from Barrier Systems, Inc. © Lindsay Transportation Solutions

PT # TAU04-100111

TECHNICAL  
BRIEF

180 River Road • Rio Vista, CA 94571 • Tel 707-374-6800 • Fax 707-374-6801  
Email: info@barriersystemsinc.com • Website: barriersystemsinc.com

Product Specification

Universal TAU-II®  
Redirective, Non-Gating, Crash Cushion

**I. General**

The Universal TAU-II® system is a Redirective, Non-Gating Crash Cushion in accordance with the definitions in the National Cooperative Highway Research Program Report 350 (NCHRP 350). The system configurations that have been evaluated for various impact velocities and hazard widths are shown in the Universal TAU-II System Configuration Chart (Figure 1).

**II. Performance**

The Universal TAU-II® system is designed to absorb the impact energy of an errant vehicle in accordance with NCHRP 350 guidelines for Redirective, Non-Gating Crash Cushions. The system is designed for locations where both head-on and angled impacts are likely to occur and where it is desirable to have the majority of post impact trajectories on the impact side of the system. The design provides for a high degree of flexibility in applying the system to a wide range of hazard widths (up to 2.6 meters (8.5 feet)) in 150mm (6 inch) increments and a large variety of non-proprietary transitions to other highway barriers. The systems also provide a very low life-cycle cost by demonstrating an average repair cost of less than 20% for the whole NCHRP 350, Test Level 3 test matrix. When installed in accordance with the manufacturer's instructions, any of the configurations shown in the Configuration Chart (Figure 1) under the 100 km/h (62.1 mph) column is capable of safely redirecting or stopping a 2000 kg (4400 lb) pick-up truck and an 820 kg (1800 lb) car impacting the system at 100 km/hr (62.1 mph).

- A. When properly installed according to the manufacturer's recommendations, the systems shall be able to meet the recommended structural adequacy, occupant risk, and vehicle trajectory criteria set forth in the in NCHRP 350 for Test Level 3 (100 km/hr) Redirective, Non-Gating Crash Cushions with an average material cost for refurbishment of less than 20% of the installed cost. The NCHRP 350, Test Level 3 Test Matrix includes the following conditions:

1. A 2000 kg vehicle at -20 degrees (reverse direction) impact to the midpoint of the system (Test 3-39).

2. A 2000 kg vehicle at 20 degrees impacting at the Critical Impact Point of the system. The critical impact point was determined to be the front of the backstop along the centerline of the system (Test 3-38).
  3. A 2000 kg vehicle at 20 degrees impacting the side, near the front of the system (Test 3-37).
  4. An 820 kg vehicle at 20 degrees impacting the side, near the front of the system (Test 3-36).
  5. A 2000 kg vehicle at 15 degrees impacting the front of the system (Test 3-33).
  6. An 820 kg vehicle at 15 degrees impacting the front of the system (Test 3-32).
  7. A 2000 kg vehicle at 0 degrees and centered on the front of the system (Test 3-31).
  8. An 820 kg vehicle at 0 degrees and an offset of  $\frac{1}{4}$  the width of the vehicle from the centerline of the system (Test 3-30).
- B. The impact velocity of a hypothetical front seat passenger against the vehicle interior as calculated from the longitudinal vehicle acceleration and 600 mm [23 5/8 in] forward displacement, and the lateral vehicle acceleration and 300 mm [12 in] lateral vehicle displacement, shall be less than 12 m/s (39.3 ft/s). The highest 10 ms average vehicle acceleration in the longitudinal and lateral directions subsequent to the instant of hypothetical occupant impact shall be less than 20 g's in the NCHRP 350 testing matrix of the Universal TAU-II system.

Detached debris shall not show potential for penetrating the vehicle occupant compartment or present a hazard to other traffic, pedestrians, or workers in a work zone. The vehicle shall remain upright during and after the collision, although moderate roll, pitch, and yaw may occur. Vehicle deformations shall not cause intrusion into the occupant compartment in excess of 150 mm (6 inches).

### III. Description of System

- A. The Universal TAU-II crash cushion is made up of independent collapsible bays that are guided and supported by high strength galvanized steel cables. The system's energy capacity is provided by an array of Energy Absorbing Cartridges. The Universal TAU-II systems are available in various length and width configurations and with capacities as shown in the Universal TAU-II System Configuration Chart (Figure 1). All of these configurations can be assembled from the basic parts as shown in the Universal TAU-II Parts List (Figure 2). The systems shall be made up of the following components and shall be fabricated from materials conforming to the following specifications:

1. The foundation system for the Universal TAU-II consists of two cables, a Back Support and Front Cable Anchors as shown in Figure 2 or Figure 3. The Front Cable Anchor weighs approximately 35 kg (75 lb). The types of Cable Anchors and Back Supports can be selected from those shown in Figures 2 and 3 based on the requirements of the specific site.
  - a. All steel structural components of these assemblies shall be fabricated from mild steel in conformance with ASTM A-36 specifications. These components are hot dipped galvanized per ASTM A-123.
  - b. Fasteners shall be Class 5.8 (Grade 2) or greater and galvanized in accordance with ASTM 153. Washers shall be hardened and galvanized.
  - c. The steel cables shall be at least 25 mm (1 in) diameter and galvanized in accordance with ASTM A-603.
2. Front and Middle Supports and the various sizes of Bulkheads (XL, XXL and XXXL) (Figure 2) separate each independent collapsible bay. Cable Guides bolt to the Middle Supports and Bulkheads, capturing the cables and connecting the bays to the foundation system.
  - a. All Front and Middle Supports, Bulkheads and cable guides shall be fabricated from mild steel in conformance with ASTM A-36 specifications. These components are hot dipped galvanized per ASTM A-123.
  - b. All fasteners shall be Class 5.8 (Grade 2) or greater and galvanized in accordance with ASTM 153. Washers shall be hardened and galvanized.
3. Each Bay is enclosed on the sides with Sliding Panels. Sliding Bolts fasten the panels to the Front and Middle Supports and Bulkheads. End Panels are attached to the Back Support and the last bays's Sliding Panels through Pipe Panel Mounts and provide transition mounting points. The Pipe Panel Mounts are bolted to the back support.
  - a. Steel panels are to be fabricated from steel that conforms to the requirements of AASHTO M180 Class B.
  - b. Sliding Bolts are to be cast from ASTM 1045 HT steel and galvanized per ASTM A-123.

- c. Steel Pipe Panel Mounts shall be fabricated from mild steel in conformance to ASTM A513, Type 5 specifications.
  - d. Fasteners shall be Class 5.8 (Grade 2) or greater and galvanized in accordance with ASTM 153. Washers shall be hardened and galvanized.
4. Flexible Front Support Legs and a Nose Piece mount to the Front Support. The Front Support Legs and Nose Piece are bolted in place. The Nose Piece provides a location to attach suitable delineation in conformance with local specifications (to be supplied by others).
- a. The front support legs shall be fabricated from either synthetic or natural rubber or polyurethane.
  - b. The Nose Piece shall be fabricated from polyurethane.
  - c. All fasteners shall be Class 5.8 (Grade 2) or greater and galvanized in accordance with ASTM 153. Washers shall be hardened and galvanized.
5. Two types of Energy Absorbing Cartridges (Figures 4 and 5) provide the primary energy absorbing capacity for the system. The cartridges appear as cylindrical plastic containers measuring approximately 775 mm (30 ½ in) in length and approximately 635 mm (25 in) in diameter. Each cartridge weighs approximately 16 kg (35 lb).
- a. All plastic parts shall be molded from specially formulated High Density Cross-linked Polyethylene.
- B. The Universal TAU-II systems are available in various capacities, each requiring a specific configuration of Energy Absorbing Cartridges (Types A and B). The capacities and configurations are shown in the Universal TAU-II System Configuration Chart (Figure 1).
- C. The Universal TAU-II system shall require attachment to a foundation. Anchoring of the system will require attachment in accordance with the manufacturer's drawings and instructions. Anchor capacity will require 12000 kg (25000 lb) pull out and 8500 kg (19000 lb) shear strength.
- D. The TAU-II system shall be assembled, installed, and refurbished in accordance with the manufacturer's instructions.

#### **IV. Application of Safety Appurtenances**

Highway safety appurtenances should be applied to hazardous sites in accordance with the guidelines and recommendations in the American Association of State Highway

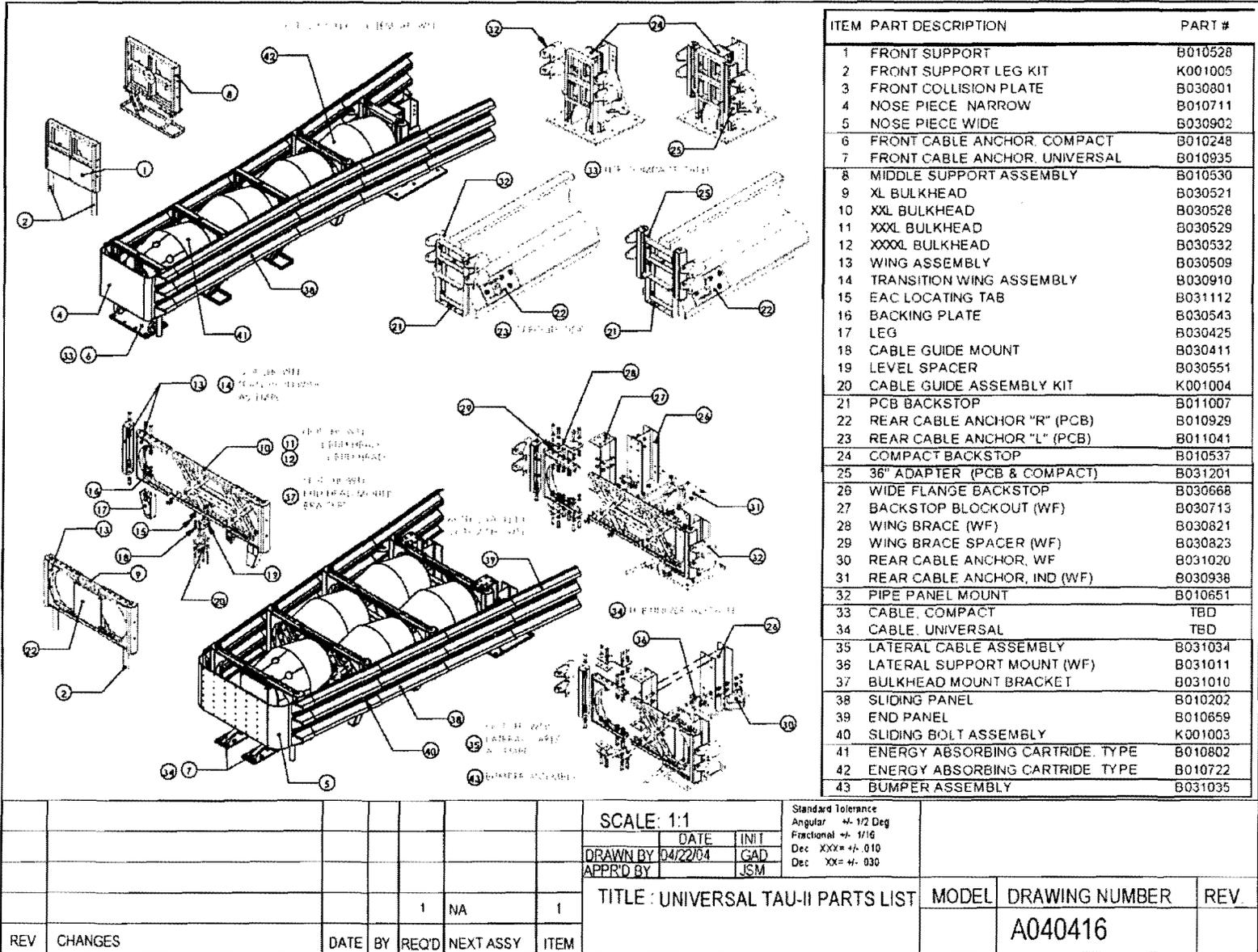
Transportation Officials (AASHTO), "Roadside Design Guide", and other Federal Highway Administration and State Department of Transportation requirements. Placement of the TAU-II system must comply with these specifications and guidelines as well as those of the manufacturer.

Figure 1

| BACKSTOP WIDTH     | SYSTEM CAPACITY |        |        |        |        |         |         |
|--------------------|-----------------|--------|--------|--------|--------|---------|---------|
|                    | 50 KPH          | 60 KPH | 70 KPH | 80 KPH | 90 KPH | 100 KPH | 110 KPH |
| PARALLEL UP TO 30° |                 |        |        |        |        |         |         |
| 36° BACKSTOP       |                 |        |        |        |        |         |         |
| 42° BACKSTOP       |                 |        |        |        |        |         |         |
| 46° BACKSTOP       |                 |        |        |        |        |         |         |
| 54° BACKSTOP       |                 |        |        |        |        |         |         |
| 60° BACKSTOP       |                 |        |        |        |        |         |         |
| 66° BACKSTOP       |                 |        |        |        |        |         |         |
| 72° BACKSTOP       |                 |        |        |        |        |         |         |
| 78° BACKSTOP       |                 |        |        |        |        |         |         |
| 84° BACKSTOP       |                 |        |        |        |        |         |         |
| 90° BACKSTOP       |                 |        |        |        |        |         |         |
| 96° BACKSTOP       |                 |        |        |        |        |         |         |
| 102° BACKSTOP      |                 |        |        |        |        |         |         |

|                             |  |                     |  |                         |  |
|-----------------------------|--|---------------------|--|-------------------------|--|
| © 2008 Bunker Systems, Inc. |  | SCALE: 1=50         |  | DATE: 1/15/11           |  |
| BY: A20 36° BACKSTOP        |  | PROJECT: 1101       |  | DRAWING NUMBER: 0031101 |  |
| A 50 KPH BACKSTOP           |  | TITLE: (N) - STORED |  | REV: A                  |  |
| DATE: 1/15/11               |  | CONFOURION MARKS    |  |                         |  |

Figure 2



| ITEM | PART DESCRIPTION                 | PART #  |
|------|----------------------------------|---------|
| 1    | FRONT SUPPORT                    | B010528 |
| 2    | FRONT SUPPORT LEG KIT            | K001005 |
| 3    | FRONT COLLISION PLATE            | B030801 |
| 4    | NOSE PIECE NARROW                | B010711 |
| 5    | NOSE PIECE WIDE                  | B030902 |
| 6    | FRONT CABLE ANCHOR, COMPACT      | B010248 |
| 7    | FRONT CABLE ANCHOR, UNIVERSAL    | B010935 |
| 8    | MIDDLE SUPPORT ASSEMBLY          | B010530 |
| 9    | XL BULKHEAD                      | B030521 |
| 10   | XXL BULKHEAD                     | B030528 |
| 11   | XXXL BULKHEAD                    | B030529 |
| 12   | XXXXL BULKHEAD                   | B030532 |
| 13   | WING ASSEMBLY                    | B030509 |
| 14   | TRANSITION WING ASSEMBLY         | B030910 |
| 15   | EAC LOCATING TAB                 | B031112 |
| 16   | BACKING PLATE                    | B030543 |
| 17   | LEG                              | B030425 |
| 18   | CABLE GUIDE MOUNT                | B030411 |
| 19   | LEVEL SPACER                     | B030551 |
| 20   | CABLE GUIDE ASSEMBLY KIT         | K001004 |
| 21   | PCB BACKSTOP                     | B011007 |
| 22   | REAR CABLE ANCHOR "R" (PCB)      | B010929 |
| 23   | REAR CABLE ANCHOR "L" (PCB)      | B011041 |
| 24   | COMPACT BACKSTOP                 | B010537 |
| 25   | 36" ADAPTER (PCB & COMPACT)      | B031201 |
| 26   | WIDE FLANGE BACKSTOP             | B030668 |
| 27   | BACKSTOP BLOCKOUT (WF)           | B030713 |
| 28   | WING BRACE (WF)                  | B030821 |
| 29   | WING BRACE SPACER (WF)           | B030823 |
| 30   | REAR CABLE ANCHOR, WF            | B031020 |
| 31   | REAR CABLE ANCHOR, IND (WF)      | B030938 |
| 32   | PIPE PANEL MOUNT                 | B010651 |
| 33   | CABLE, COMPACT                   | TBD     |
| 34   | CABLE, UNIVERSAL                 | TBD     |
| 35   | LATERAL CABLE ASSEMBLY           | B031034 |
| 36   | LATERAL SUPPORT MOUNT (WF)       | B031011 |
| 37   | BULKHEAD MOUNT BRACKET           | B031010 |
| 38   | SLIDING PANEL                    | B010202 |
| 39   | END PANEL                        | B010859 |
| 40   | SLIDING BOLT ASSEMBLY            | K001003 |
| 41   | ENERGY ABSORBING CARTRIDGE, TYPE | B010802 |
| 42   | ENERGY ABSORBING CARTRIDGE, TYPE | B010722 |
| 43   | BUMPER ASSEMBLY                  | B031035 |

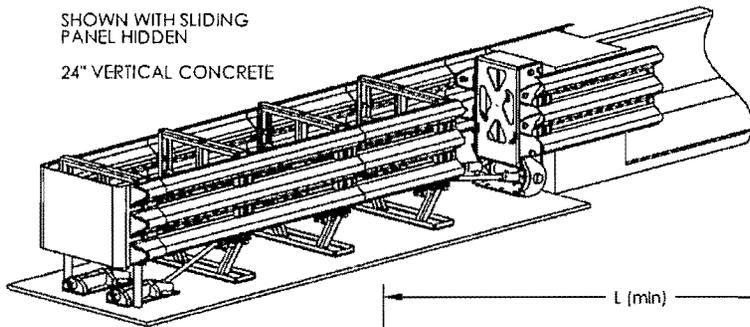
SCALE: 1:1  
 DATE: 04/22/04  
 INIT: GAD  
 DRAWN BY: GAD  
 APPROV BY: JSM

Standard Tolerance  
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 Fractional +/- 1/16  
 Dec: XXX+/- 0.10  
 Dec: XX- +/- 0.30

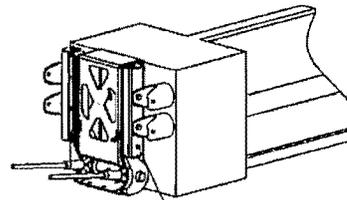
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|-----|---------|------|----|-------|-----------|------|
| 1   | NA      |      |    |       |           | 1    |

|                                    |       |                |      |
|------------------------------------|-------|----------------|------|
| TITLE: UNIVERSAL TAU-II PARTS LIST | MODEL | DRAWING NUMBER | REV. |
|                                    |       | A040416        |      |

SHOWN WITH SLIDING  
PANEL HIDDEN  
24" VERTICAL CONCRETE



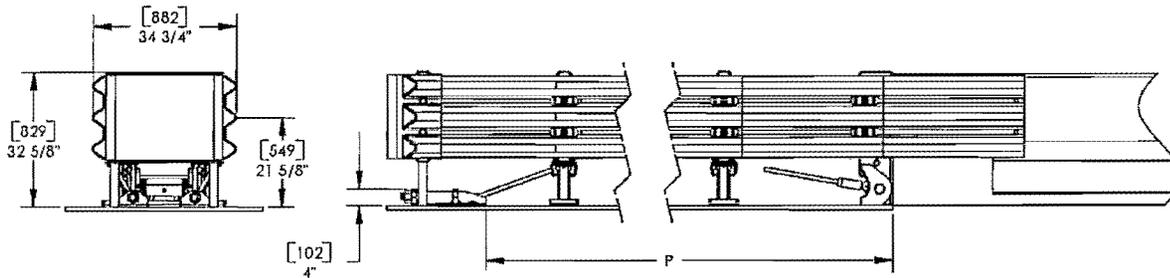
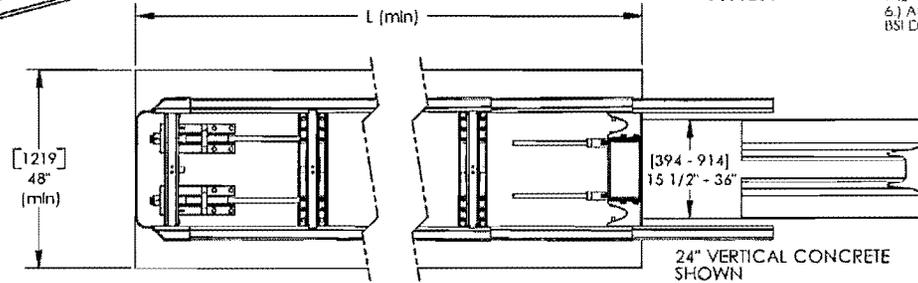
36" VERTICAL CONCRETE



36" ADAPTER  
BSI PART No.  
B031201

NOTES:

- 1.) FLUSH MOUNT BACKSTOP SYSTEMS ARE INTENDED FOR APPLICATIONS WHERE THE HAZARD WIDTH EXCEEDS THE LIMITATIONS OF THE PCB BACKSTOP. FLUSH MOUNT SYSTEMS ARE ALSO APPLICABLE IN LOCATIONS WITH LIMITED FOUNDATION SIZE.
- 2.) THE FLUSH MOUNT BACKSTOP MAY BE ATTACHED TO REINFORCED SAFETY SHAPE OR VERTICAL CONCRETE STRUCTURES UP TO 36" (914) WIDE. STRUCTURES OVER 24" (610) WIDE REQUIRE 36" ADAPTER B031201. EDGES OF VERTICAL CONCRETE MAY REQUIRE CHAMFER ACCORDING TO LOCAL STANDARDS.
- 3.) VERTICAL SLOTS ON THE BACKSTOP ALLOW REMOVAL / REPLACEMENT OF THE BACKSTOP. ANCHORS MUST BE PLACED AT THE TOP OF SAID SLOTS TO BE EFFECTIVE.
- 4.) FLUSH MOUNT BACKSTOP SYSTEMS USE THE SAME CABLE USED IN ALL PARALLEL SYSTEMS. THE CABLE IS INSTALLED WITH THE THREADED TENSIONING END FORWARD. THE LOOPED END IS PINNED IN PLACE AT THE BACKSTOP.
- 5.) THE FRONT CABLE ANCHOR USES AN INSERTED KEY TO KEEP THE THREADED STUD FROM ROTATING DURING TENSIONING.
- 6.) ANCHOR ACCORDING TO BSI SPECIFICATIONS. REFERENCE BSI DRAWING A40113.



| FOUNDATION PAD LENGTH<br>DIMENSION "L" (MINIMUM) |                |              |        |
|--|----------------|--------------|--------|
| BAY No.  | CAPACITY (kph) | L (ft-in)    | L (mm) |
| 2  | 50             | 6' - 11 1/2" | 2121   |
| 3  | 60             | 9' - 9 1/2"  | 2885   |
| 4  | 70             | 12' - 7 1/2" | 3848   |
| 5  | 80             | 15' - 5 1/2" | 4712   |
| 6  | 85             | 19' - 4"     | 5588   |
| 7  | 90             | 21' - 2"     | 6452   |
| 8  | 100            | 24' - 0"     | 7315   |
| 9  | 105            | 26' - 10"    | 8179   |
| 10   | 110            | 29' - 8 1/2" | 9055   |
| 11   | 115            | 32' - 6 1/2" | 9919   |
| 12   | 120            | 35' - 4 1/2" | 10782  |

| FRONT ANCHOR PLACEMENT<br>DIMENSION "P" |                |              |        |
|---|----------------|--------------|--------|
| BAY No.                                 | CAPACITY (kpt) | P (ft-in)    | P (mm) |
| 2                                       | 50             | 4' - 11 1/2" | 1511   |
| 3                                       | 60             | 7' - 9 1/2"  | 2375   |
| 4                                       | 70             | 10' - 7 1/2" | 3239   |
| 5                                       | 80             | 13' - 5 1/2" | 4102   |
| 6                                       | 85             | 16' - 4"     | 4970   |
| 7                                       | 90             | 19' - 2"     | 5842   |
| 8                                       | 100            | 22' - 0"     | 6706   |
| 9                                       | 105            | 24' - 10"    | 7569   |
| 10                                      | 110            | 27' - 8 1/2" | 8446   |
| 11                                      | 115            | 30' - 6 1/2" | 9309   |
| 12                                      | 120            | 33' - 4 1/2" | 10173  |

NOTE:  
THICKNESS OF WELD TO BE EQUAL  
TO THE THINNER OF 2 PIECES  
BEING JOINED. WELD TO BE ALL  
AROUND UNLESS OTHERWISE SPECIFIED.

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|-----|---------|------|----|------|-----------|------|
| 1   | TBD     |      |    |      |           |      |

SCALE: 1:24  
DATE: 01/21/14  
DRAWN BY: GJZ/ALH  
TITL: APPLICATION, FLUSH  
MOUNT BACKSTOP

| MODEL | DRAWING NUMBER | REV |
|-------|----------------|-----|
|       | B040239        |     |

| ITEM | QTY / DWG | PART DESCRIPTION      | SPECIFICATION                 | DWG # |
|------|-----------|-----------------------|-------------------------------|-------|
| 1    | 1         | COMPOSITE MOLDED PART | BLACK CROSS LINK POLYETHYLENE | NA    |

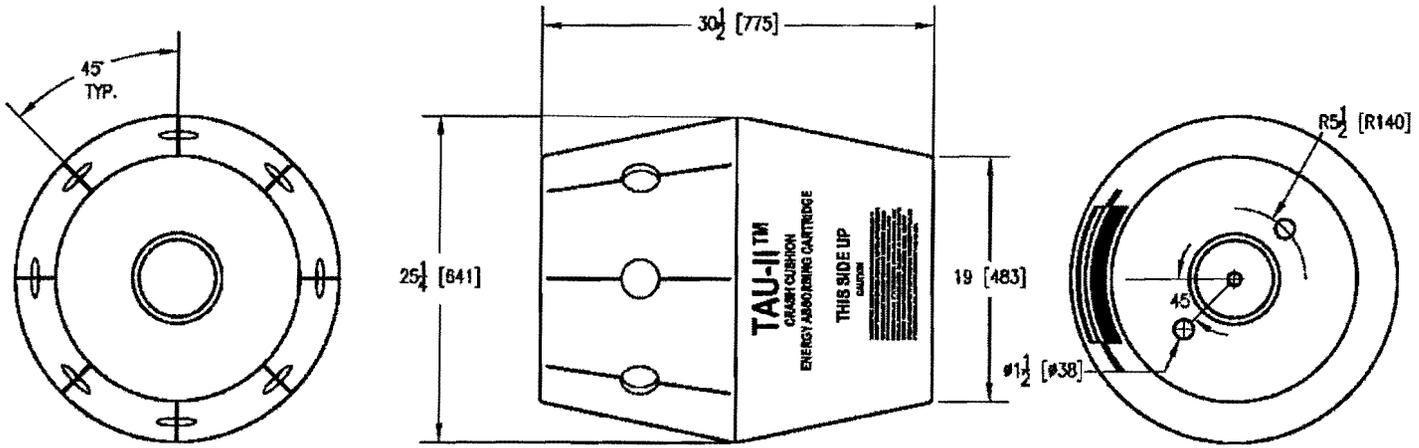


Figure 4

NOTE:  
THICKNESS OF WELD TO BE EQUAL  
TO THE THINNER OF 2 PIECES  
BEING JOINED. WELD TO BE ALL  
AROUND UNLESS OTHERWISE NOTED.

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|------|---------|------|----|-------|------------|------|
|      |         |      |    |       |            |      |
|      |         |      |    |       |            |      |
|      |         |      |    |       |            |      |

SCALE: EIGHTH  
Standard Tolerance  
Angular ± 1/2°  
Positional ± 1/16"  
Dwg. 3000-2-4110  
Dwg. 300-2-330

TITLE: ENERGY ABSORBING  
CARTRIDGE, TYPE A

| MODEL | DRAWING NUMBER | REV. |
|-------|----------------|------|
|       | B010802-PD     |      |

| ITEM | QTY / DWGS | PART DESCRIPTION      | SPECIFICATION                 | DWG # |
|------|------------|-----------------------|-------------------------------|-------|
| 1    | 1          | COMPOSITE MOLDED PART | BLACK CROSS LINK POLYETHYLENE | NA    |

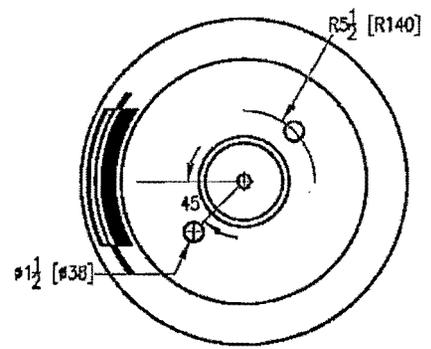
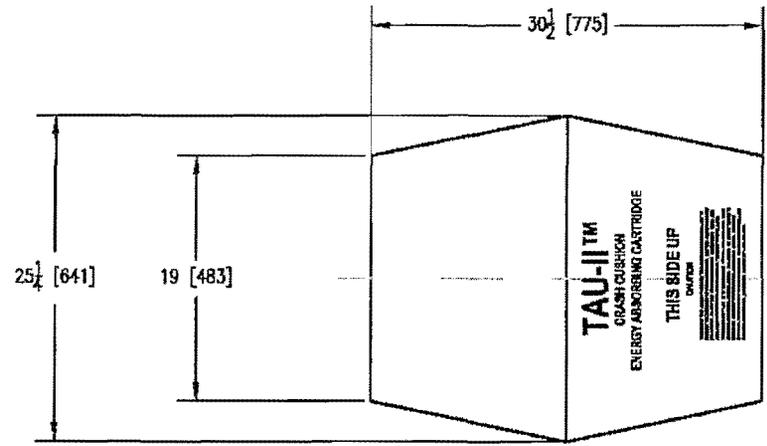


Figure 5

NOTE:  
THICKNESS OF WELD TO BE EQUAL TO THE THINNER OF 2 PIECES BEING JOINED. WELD TO BE ALL AROUND UNLESS OTHERWISE NOTED.

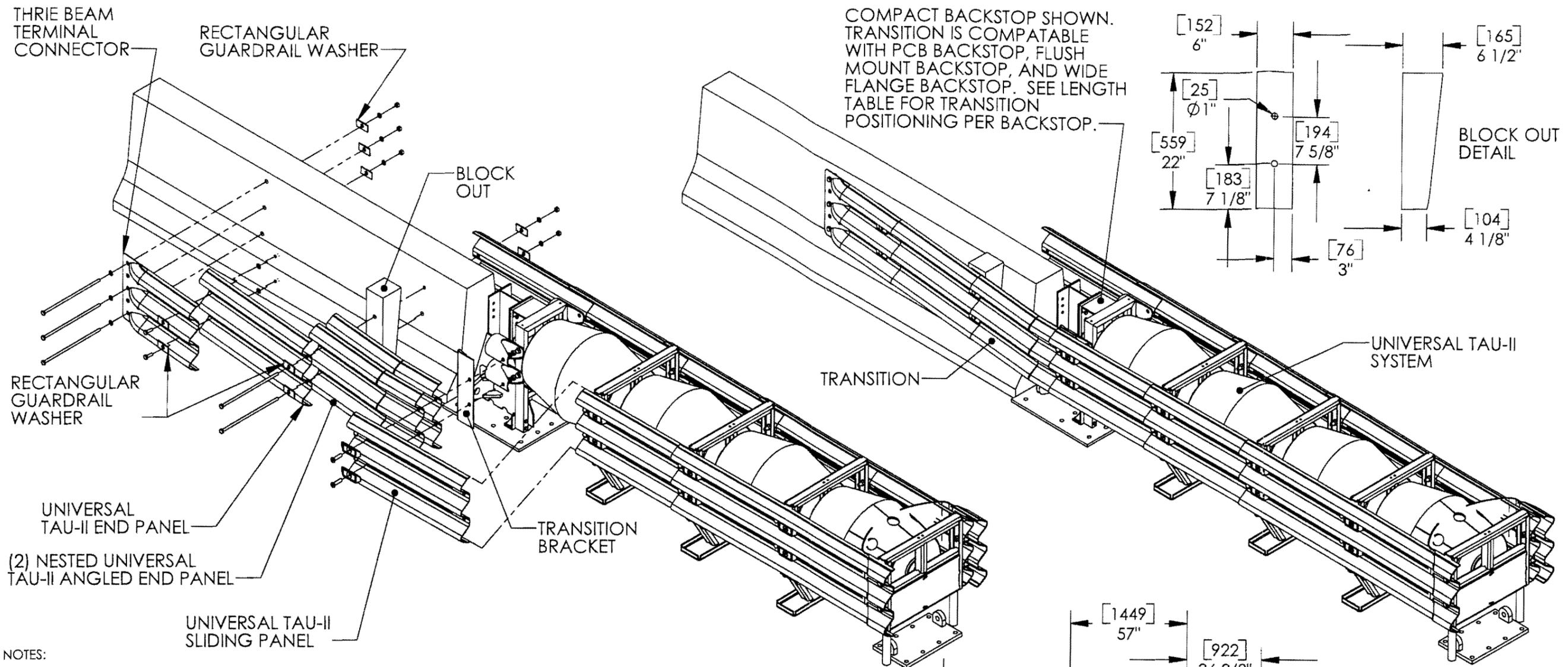
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|------|---------|------|----|-------|------------|------|
|      |         |      |    |       |            |      |

SCALE: EIGHTH  
 DATE: 07/21/00  
 DRAWN BY: CMO  
 CHECKED BY: CMO  
 TITLE: ENERGY ABSORBING CARTRIDGE, TYPE B

| MODEL | DRAWING NUMBER | REV. |
|-------|----------------|------|
|       | B010722-PD     |      |

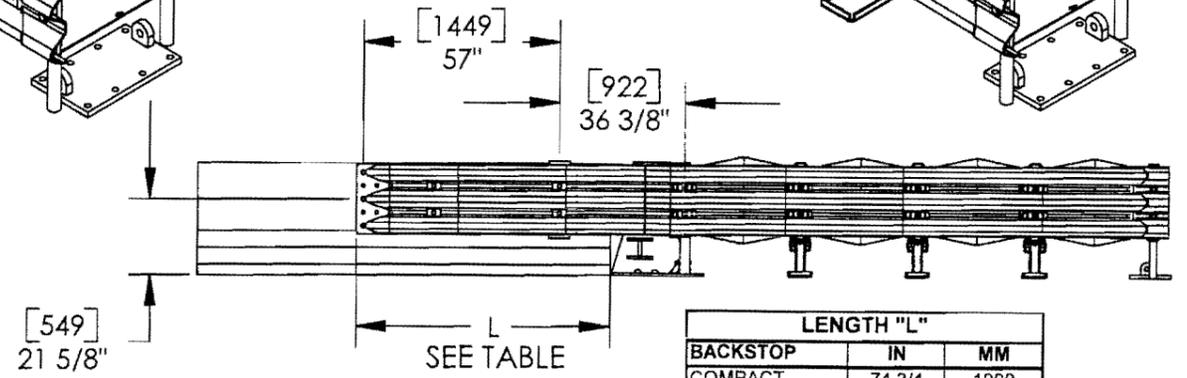
Standard Tolerance  
 Angles ± 1/2°  
 Finishes ± 1/16"  
 Dia. .0005 ± .010  
 Dia. .315 ± .030



NOTES:

- 1.) UNIVERSAL TAU-II SYSTEM TO BE INSTALLED PER MANUFACTURERS INSTRUCTIONS.
- 2.) TRANSITION SHOWN IS COMPATIBLE WITH COMPACT BACKSTOP (SHOWN), FLUSH MOUNT BACKSTOP, PCB BACKSTOP, AND WIDE FLANGE BACKSTOP. IT IS APPLICABLE WITH ASPHALT ANCHORING PACKAGES FOR PCB BACKSTOP AND PCB BRACE KIT FOR COMPACT BACKSTOP.
- 3.) THRIE BEAM TERMINAL CONNECTOR PER AASHTO HARDWARE SPECIFICATION RTE01.
- 4.) STANDARD TIMBER OR PLASTIC OFFSET BLOCKS FIELD TRIMMED FOR USE. BLOCK OUT DETAIL SHOWS DIMENSIONS FOR F-SHAPE SAFETY SHAPED BARRIER. ACTUAL DIMENSIONS SHOULD REFLECT SHAPE OF BARRIER TRANSITIONED TO.
- 5.) PANELS AND BLOCKOUT ATTACHED TO BARRIER WALL WITH 5/8" [16mm] BOLTS WITH BEAM WASHER AND NUT WITH WASHER AND BEAM WASHER. 20" [500mm] BOLTS MAY BE FIELD TRIMMED. LENGTH MAY VARY WITH DIFFERENT BARRIER SHAPES. HOLES DRILLED THROUGH MEDIAN BARRIER ARE 3/4" [20mm]. MECHANICAL OR CHEMICALLY BONDED ANCHORS MAY BE USED THAT MEET OREXCEED 15,000 LBF SHEAR AND PULL OUT STRENGTH.
- 6.) ATTACH THRIE BEAM TERMINAL CONNECTOR TO MEDIAN BARRIER WITH (3) 5/8" [16mm] BOLTS WITH WASHERS AND NUT WITH WASHERS AND BEAM WASHERS. REFERENCE NOTE 5 FOR DETAILS.

- 7.) ATTACH THRIE BEAM TERMINAL CONNECTOR TO UNIVERSAL TAU-II END PANEL WITH 5/8" [16mm] X 2" [50mm] BOLTS WITH BEAM WASHER AND NUT WITH WASHER.
- 8.) TRANSITION BRACKET TO BE INSTALLED OVER PIPE PANEL MOUNTS UNDER THE (2) NESTED ANGLED END PANELS AND THE SLIDING PANEL. BEND IN TRANSITION BRACKET FACES REARWARD AND FITS AROUND PIPE PANEL MOUNTS. JOINT IS SECURED WITH SLIDING BOLTS. SLIDING BOLTS TO BE TORQUED PER MANUFACTURERS SPECIFICATIONS.



| LENGTH "L"  |         |      |
|-------------|---------|------|
| BACKSTOP    | IN      | MM   |
| COMPACT     | 74 3/4  | 1900 |
| PCB         | 94 3/4  | 2400 |
| FLUSH MOUNT | 89 3/8  | 2270 |
| WIDE FLANGE | 128 1/2 | 3260 |

|  |         |      |    |       |  |       |   |       |                |     |
|--|---------|------|----|-------|--|-------|---|-------|----------------|-----|
| © 2005 Barrier Sytems Inc.   |         |      |    |       | SCALE: 1:25  |       | Standard Tolerance<br>Angular +/- 1/2 Deg<br>Fractional +/- 1/16<br>Dec. XXX= +/- .010<br>Dec. XX= +/- .030 |       |                |     |
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|  |         |      |    |       | DRAWN BY   | GAD   |   |       |                |     |
|  |         |      |    |       | DATE   | GAD   |   |       |                |     |
|  |         |      |    |       | TITLE: UNIVERSAL TAU-II TRANSITION TO MEDIAN BARRIER |       |   | MODEL | DRAWING NUMBER | REV |
|  |         |      |    |       |  |       |   |       | B050606        |     |
| REV.   | CHANGES | DATE | BY | REQ'D | NEXT ASSY.   | ITEM  |   |       |                |     |
|  |         |      |    | 1     | NA   | 1     |   |       |                |     |