U.S. Department of Transportation
Federal Highway Administration

1200 New Jersey Ave., SE
Washington, D.C. 20590

December 23, 2011

In Reply Refer To:
HSST/ CC-54I

Mr. Barry D. Stephens, P.E.
Sr. Vice President Engineering
Energy Absorption Systems, Inc.
3617 Cincinnati Avenue
Rocklin, CA 95678

Dear Mr. Stephens:

This letter is in response to your request for the Federal Highway Administration (FHWA) to review a roadside safety system for eligibility for reimbursement under the Federal-aid highway program.

Name of device:	TRACC to VULCAN Bi-directional Transition
Type of device:	Attenuator to barrier Transition
Test Level:	NCHRP Report 350 TL-2 and TL-3
Testing conducted by:	N/A; By comparison to successfully crash tested QuadGuard to Vulcan Transition testing as previously conducted by E-Tech Testing Services Inc.
Date of request:	December 18, 2010
Date initially acknowledged:	December 20, 2010
Date of final package:	October 17, 2011
Task Force 13 Designator:	SWM 18

Based on a review of the analysis submitted by the manufacturer certifying the device described herein meets the crashworthiness criteria of the National Cooperative Highway Research Program (NCHRP) Report 350, the device is eligible for reimbursement under the Federal-aid highway program. Eligibility for reimbursement under the Federal-aid highway program does not establish approval or endorsement by the FHWA for any particular purpose or use.

The FHWA, the Department of Transportation, and the United States Government do not endorse products or services and the issuance of a reimbursement eligibility letter is not an endorsement of any product or service.

Decision
The following device is eligible, with details provided below:

• TRACC to VULCAN Bidirectional Transition

FHWA: HSSI: WLongstreet: ms: x60087:7/12/11
UPDATED: 11/8/11 by MS Revised 12/20/11 by SF
File: h: //directory folder/HSST/ CC-54ITRACC to Vulcan Transition.docx
cc: HSST Will Longstreet

Requirements
Roadside safety devices should meet the guidelines contained in the National Cooperative Highway Research Program Report 350 or the AASHTO Manual for Assessing Safety Hardware. The FHWA Memorandum "ACTION: Identifying Acceptable Highway Safety Features" of July 24, 1997, provides further guidance on crash testing requirements of longitudinal barriers.

Description
The TRACC to Vulcan Bi-directional Transition (BT) is designed to connect between an anchored TRACC system and downstream steel Vulcan Barrier. This transition is necessary to prevent pocketing and/or snagging of vehicles impacting the Vulcan Barrier immediately downstream from the rigid connection point. The fabricated galvanized steel transition measures 2.03 meters (6.6 feet) long x 0.8-meter (31.5 inches) high. One end of the BT matches the profile of the Vulcan Barrier while the other transitions smoothly to the shape of the TRACC backup. As with the previously tested QuadGuard to Vulcan transition, there are no vehicle snag points. The interface to the TRACC is designed to provide support to the TRACC during head-on and angled impacts. The proposed BT has the same structural integrity as the QuadGuard to Vulcan Transition that was previously tested successfully.

Crash Testing
The TL-3 QuadGuard to Vulcan transition was successfully crash tested as per NCHRP Report 350 and accepted by the FHWA on November 17, 2005 (ref. HSA-10/B-134A). The following table provides a comparison commentary on results of this test and the submitted report of proposed TRACC to VULCAN Bidirectional Transition.

System Component No.▲	Proposed TRACC to VULCAN (Components)	Successfully Crash Tested QUADGUARD to VULCAN (Components)	Justification
1	Backup Diaphragm	Backup Diaphragm	See component comparison commentary below
2	Backup Support Post	Backup Support Post	
3	X-Brace Support	X-Brace Support	
4	Stiffener Plate	Stiffener Plate	
5	Attenuator Anchor	Attenuator Anchor	
6	Base Plate	Base Plate	
7	Transition Anchors	Transition Anchors	
8	Support Diaphragm	Support Diaphragm	

▲ System drawing comparison of both proposed TRACC to VULCAN and existing QUADGUARD to VULCAN is included in this correspondence as enclosure 'B'.

Component comparison commentary as follows:

Component 1:
The last diaphragm for the QuadGuard is integrated into the QuadGuard backup. The last diaphragm for the TRACC is integrated into the new Transition. This keeps the last Fender Panels on both systems from moving laterally during side impacts. It should be noted that the TRACC system previously passed NCHRP Report 350 Test 3-39, a wrong-way impact test at 20 degrees from a 2000 kg pickup truck. The new TRACC to Vulcan Transition has no

exposed vehicle snag points other then the attachment of the last TRACC Fender Panels. Since the attachment of this last Panel is identical to what was previously successfully tested, the transition can be expected to perform in a similar manner to the crash-tested version under the wrong-way redirect impact conditions.

The crash test summary sheet of NCHRP Report 350 Test 3-39 is included in this correspondence as an enclosure.

Component 2:

The QuadGuard Backup consists of a large support post which provides structural support for head-on and angled impacts. The original TRACC design did not incorporate a similar structural support post, therefore to duplicate the same rigidity characteristics as the QuadGuard, one was added into the proposed TRACC transition.

Components 3&4:

The previously tested QuadGuard to Vulcan Transition mid-section incorporates a short Quad-beam panel that requires backside reinforcement to resist collapse during impacts. Reinforcement is achieved via lower x-brace supports and an upper stiffener plate. A finite element analysis was conducted after testing to calculate the total deformation. Based on the crash test data and the analysis of crash video of the Test 3-21 a resultant force of 400,000N was placed on the front half of the transition. A deformation structural analysis was performed and the deformation values ranged from 8.14 millimeters (0.32 inches) to 9.86 millimeters (0.388 inches).

The proposed TRACC Transition mid-section incorporates w-beam panels that also must be reinforced to resist impact loads. Reinforcement is achieved via lower x-bracing on both the upper and lower halves. A finite element analysis was conducted to calculate the total deformation. Based on the Test 3-21 crash test data of the Quadguard to Vulcan transition, an analysis of this crash using the same resultant force of 400,000N was placed on the front half of the transition. A deformation structural analysis was performed and the deformation values ranged from 4.43millimeters (0.174 inches) to 6.56 millimeters (0.258 inches).

Components 5, 6 &7:

The QuadGuard and TRACC Transitions both require anchoring to a rigid surface using the same anchoring-bolt system. The number of anchors (12) and moment arm (distance) from the unit's centerline is the same. The only difference is that the TRACC base plate was extended to allow enough space to integrate the structural support post and the last diaphragm. Thus, the TRACC Transition can be expected to perform the same as the tested and accepted QuadGuard Transition.

Component 8:

The QuadGuard and the TRACC transitions are both designed with an internal support diaphragm that supports mid transition impacts. In summary, the structural integrity and anchoring of the new TRACC to Vulcan Transition is equal-to or better-than the tested and accepted QuadGuard Transition.

The system drawing of proposed TRACC to VULCAN Bidirectional Transition is included in this correspondence as enclosure ‘A’.

Findings

Based on the successfully crash tested TL-3 QuadGuard to Vulcan transition and provided component comparison and commentary, the proposed TRACC to VULCAN Bidirectional Transition as described in this request and detailed in the enclosed drawings is eligible for reimbursement under the federal-aid highway program under the range of conditions as previously successfully crash tested TL-3 QuadGuard to Vulcan transition, when such use is acceptable to a highway agency.

Please note the following standard provisions that apply to FHWA eligibility letters:

- This letter provides a AASHTO/ARTBA/AGC Task Force 13 designator that should be used for the purpose of the creation of a new and/or the update of existing Task Force 13 drawing for posting on the on-line 'Guide to Standardized Highway Barrier Hardware' currently referenced in AASHTO Roadside Design Guide.
- This finding of eligibility is limited to the crashworthiness characteristics of the systems and does not cover their structural features, nor conformity with the Manual on Uniform Traffic Control Devices.
- Any changes that may adversely influence the crashworthiness of the system will require a new letter.
- Should the FHWA discover that the qualification testing was flawed, that in-service performance reveals unacceptable safety problems, or that the system being marketed is significantly different from the version that was crash tested, we reserve the right to modify or revoke this letter.
- You will be expected to supply potential users with sufficient information on design and installation requirements to ensure proper performance.
- You will be expected to certify to potential users that the hardware furnished has essentially the same chemistry, mechanical properties, and geometry as that submitted for review, and that it will meet the crashworthiness requirements of the FHWA and the NCHRP Report 350.
- To prevent misunderstanding by others, this letter of eligibility is designated as number CC-54I and shall not be reproduced except in full. This letter and the test documentation upon which it is based are public information. All such letters and documentation may be reviewed at our office upon request.
- This letter shall not be construed as authorization or consent by the FHWA to use, manufacture, or sell any patented system for which the applicant is not the patent holder. The finding of eligibility is limited to the crashworthiness characteristics of the candidate system, and the FHWA is neither prepared nor required to become involved in issues concerning patent law. Patent issues, if any, are to be resolved by the applicant.

Sincerely yours,

Michael S. Griffith
Director, Office of Safety Technologies
Office of Safety

U.S. Department
of Transportation
Federal Highway Administration

December 23, 2011

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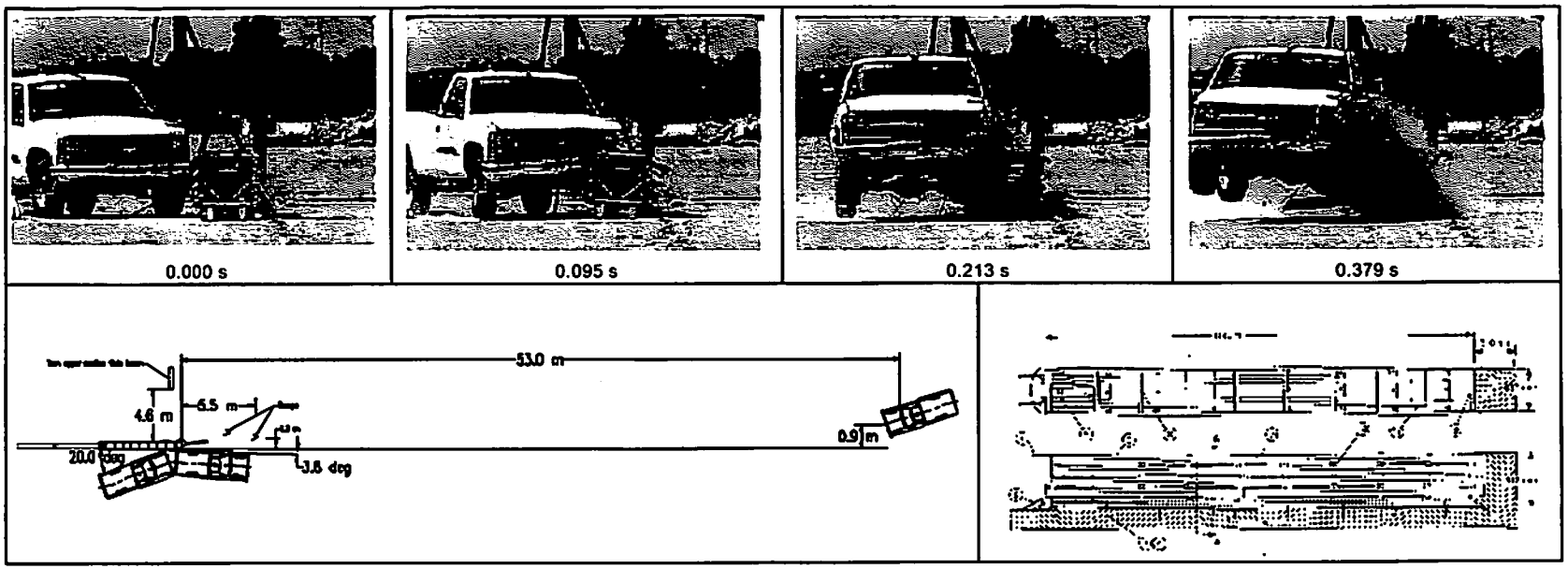
Sincerely yours,

Michael S. Griffith

Michael S. Griffith
Director, Office of Safety Technologies
Office of Safety



General Information
- Test Agency ..... Texas Transportation Institute
- Test No. 404091-18
- Date 07/01/98

Test Article
- Type ..... Crash Cushion
- Name or Manufacturer ..... Syro/Trinity Crash Cushion
- Installation Length (m) 6.40
- Material or Key Elements ... Guidance Track, Impact Sled, Intermediate Frames, Fender Panels
- **Soil Type and Condition** ..... Concrete Pavement, Dry

Test Vehicle
- Type ..... Production
- Designation 2000P
- Model ..... 1994 Chevrolet 2500 pickup truck
- Mass (kg)
  - Curb 2091
  - Test Inertial 2000
  - Dummy ..... No dummy
  - Gross Static 2000

Impact Conditions
- Speed (km/h) 100.9
- Angle (deg) 20.0

Exit Conditions
- Speed (km/h) 72.2
- Angle (deg) 3.8

Occupant Risk Values
- Impact Velocity (m/s)
  - x-direction 7.1
  - y-direction 6.4
- THIV (km/h) 28.0
- Ridedown Accelerations (g's)
  - x-direction ..... -16.4
  - y-direction 11.1
- PHD (g's) 23.2
- ASI 1.14
- Max. 0.050-s Average (g's)
  - x-direction ..... -7.6
  - y-direction 8.9
  - z-direction ..... -4.6

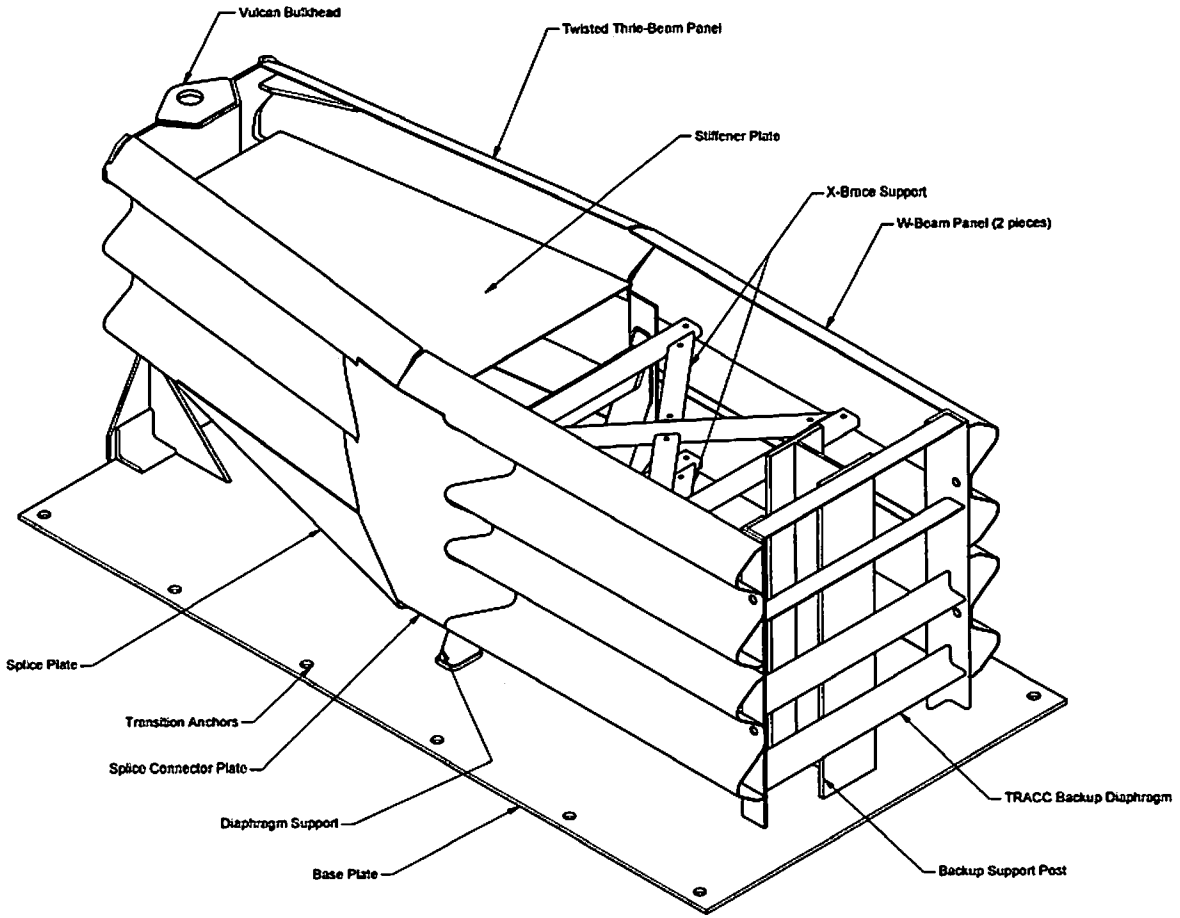
Test Article Deflections (m)
- Dynamic 0.28
- Permanent 0.24

Vehicle Damage
- Exterior
  - VDS 11LFQ3
  - CDC 11FLEK3
- Maximum Exterior & 11LYEW3
  - Vehicle Crush (mm) 340
- Interior
  - OCDI LF0001000
- Max. Occ. Compart. Deformation (mm) 40

Post-Impact Behavior (during 1.0 s after impact)
- Max. Yaw Angle (deg) 24
- Max. Pitch Angle (deg) ..... -9
- Max. Roll Angle (deg) ..... -6

Figure 58. Summary of results for test 404091-18, *NCHRP Report 350* test 3-39.

VULCAN TO TRACC BIDIRECTIONAL TRANSITION

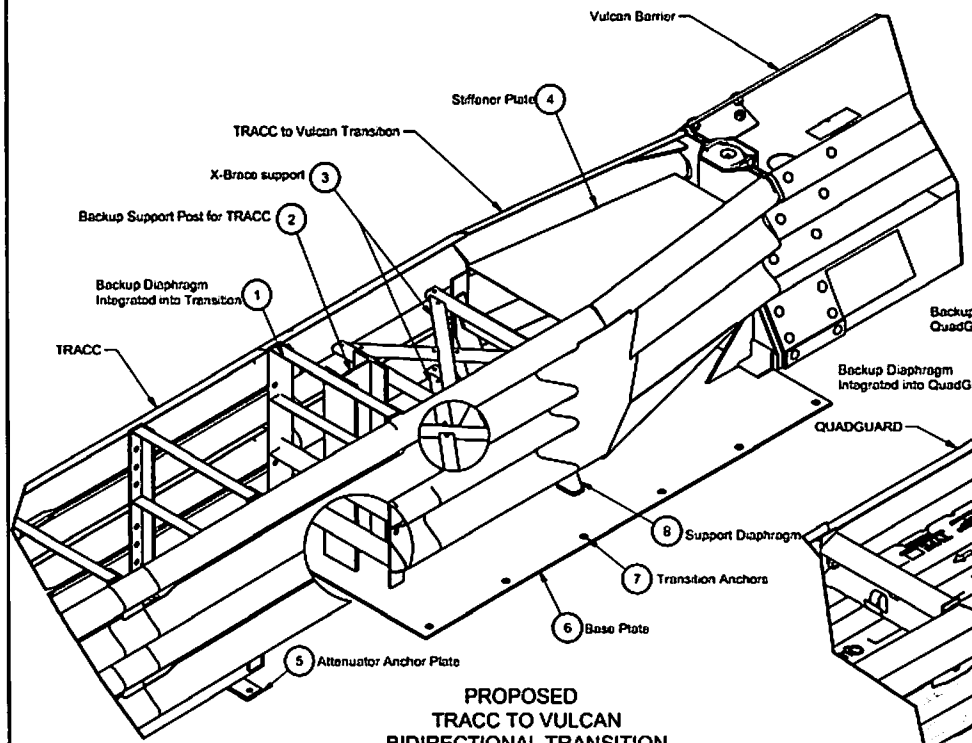


	A.Van Brocklin	12/2/2010	A
	A.Van Brocklin		
	Iso Drawing TRACC transition.idw		

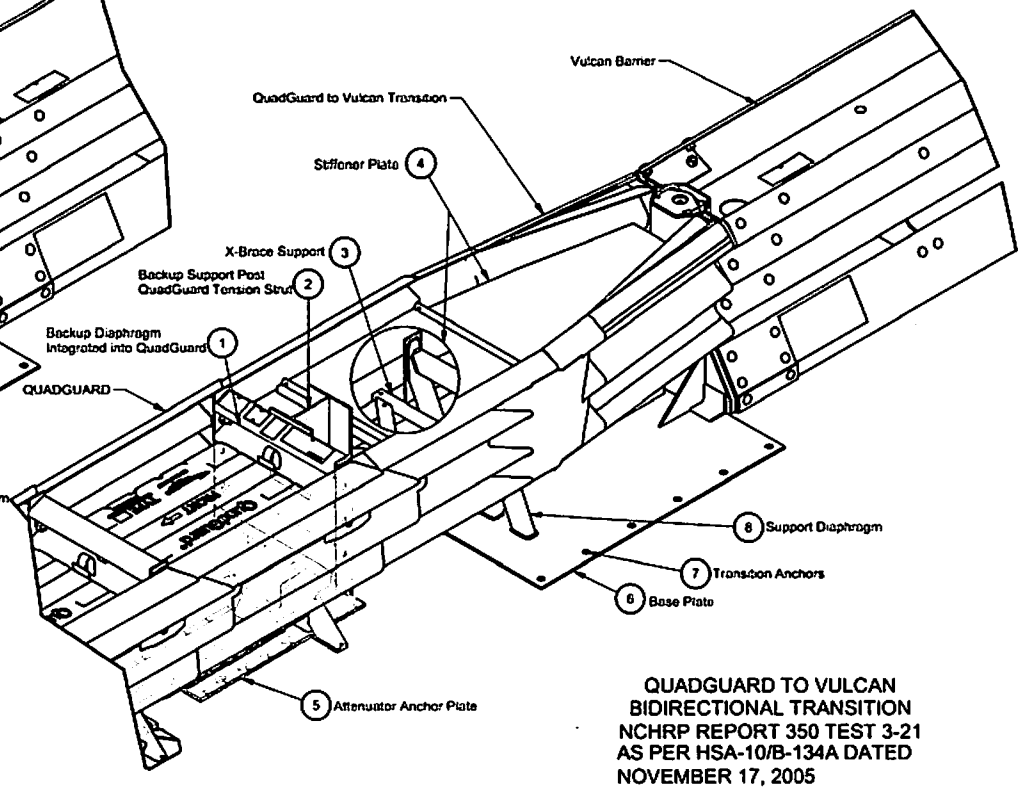
ENERGY ABSORPTION SYSTEMS INC
ENGINEERING AND RESEARCH DEPARTMENT

TRACC to Vulcan Bidirectional Transition

	Iso Drawing TRACC transition	1 of 1	



PROPOSED
TRACC TO VULCAN
BIDIRECTIONAL TRANSITION



QUADGUARD TO VULCAN
BIDIRECTIONAL TRANSITION
NCHRP REPORT 350 TEST 3-21
AS PER HSA-10/B-134A DATED
NOVEMBER 17, 2005

DRAWN	A.Van Brocklin	DATE	12/6/2010
DESIGNED	A.Van Brocklin	DATE	
CHECKED		DATE	
APPROVED		DATE	
FILE	COMPARISON1.idw		

B

ENERGY ABSORPTION SYSTEMS, INC
ENGINEERING AND RESEARCH DEPARTMENT

TRACC TO VULCAN
VS
QUADGUARD TO VULCAN

SCALE	DRAWING	SHEET	REV
	COMPARISON1	1 of 1	