U.S. Department of Transportation
Federal Highway Administration

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

August 17, 2011

In Reply Refer To:
HSST/CC-95C

Mr. Felipe Almanza
Chief Design Engineer
TrafFix Devices, Inc.
160 Avenida La Pata
San Clemente, CA 92673

Dear Mr. Almanza:

This letter is in response to your request for the Federal Highway Administration (FHWA) acceptance of an alternative anchoring system for your Compressor Crash Cushion for use on the National Highway System (NHS).

Name of system: Compressor Crash Cushion
Type of system: Non-Gating Self-Restoring Narrow Crash Cushion/Impact Attenuator
Test Level: NCHRP Report 350 Test Level 3 (TL-3)
Testing conducted by: KARCO Engineering, LLC
Date of request: December 21, 2010
Date initially acknowledged: December 28, 2010
Task Force 13 Designator: SCI28

You requested that we find an alternative anchoring system acceptable for use on the NHS under the provisions of the National Cooperative Highway Research Program (NCHRP) Report 350.

Requirements
Roadside safety devices should meet the guidelines contained in NCHRP Report 350. The FHWA memorandum "ACTION: Identifying Acceptable Highway Safety Features" of July 24, 1997, provides further guidance on crash testing requirements of longitudinal barriers and crash cushions.

Decision
The following device was found acceptable, with details provided below:

- Compressor Crash Cushion anchored to an asphalt pad with a 30-point anchor rod system

FHWA: HSST: WLongstreet: ms: x60087:6/24/11
File: h://directory folder/HSST/WPL_052011_Compressor#2.docx
cc: HSST Will Longstreet

Description

The Compressor Crash Cushion was originally accepted for use on the NHS for one-way traffic applications in FHWA Product Acceptance Letter CC-95 on February 26, 2007 and for two-way traffic applications in Acceptance Letter CC-95A, dated December 23, 2009. In both cases, the Compressor was mounted on a reinforced concrete pad using fourteen (14) anchor bolts for each of the crash tests conducted. For the present request, the Compressor itself remained unchanged from the previously accepted design. In short, the TrafFix Devices Inc. Compressor is a re-directive, non-gating and self-restoring narrow crash cushion with a total length of 6.5 meters (255.25 inches). Its effective length is 4.98 meters (196 inches). The Compressor measures 1.24 meters (48.66 inches) wide, and is 1.36 meters (53.5 inches) in height. Its main components include: a steel mounting base, six plastic energy absorbing modules, and twelve steel fender panels. The front and rear anchor plates remain unchanged from the previously accepted design, but eight (8) anchor clips have been added to each side of the base plate to accommodate the additional anchors needed to secure the Compressor to an asphalt pad. Thirty (30) 7/8-inch-9TPI threaded anchor rods with an overall length of 406 millimeters (16 inches) were used. These rods were set into 2.54 millimeters (1-inch) diameter holes drilled 355.6 millimeters (14 inches) deep through a 6-inch thick asphalt pad and into compacted sub base. All bolts were secured with an epoxy adhesive. The front and rear anchor rods are positioned in the same fourteen (14) locations as were the concrete anchor bolts used for Acceptance Letter CC-95 and CC-95A testing. Design details for anchoring the Compressor to an asphalt pad are provided as enclosure to this correspondence.

Crash Testing

Since the basic design of the Compressor was unchanged from the previously accepted version, required testing for the new anchoring system is to determine the adverse affects of the crash performance of the unit. After an initial consultation with FHWA, it was agreed that NCHRP Report 350 tests 3-33 and 3-38 were likely to place the greatest loadings on the new anchor design and that the remaining tests for a redirective crash cushion need not be rerun.

Test 3-33 required a 100 km/h impact by a 2000-kg pickup truck at 15 degrees on the nose of the crash cushion. As reported in Karco Test Report Number TR-P30145-01-A, dated December 4, 2010, a 2042 kg (4502 lb) pickup truck impacted the Compressor at 101.4 km/h (63 mph) and at 14.8 degrees. Occupant Impact Velocity was 10.7 m/sec and the Ridedown Acceleration was 14.6 g's. Vehicular roll, pitch, and yaw were recorded as 43.9, 30.5, and 177.3 degrees, respectively. The truck came to rest 3.9 meters (12.8 feet) rearward and 8.4 meters (27.5 feet) to the left of the crash cushion. The Karco report indicated that some repairs would need to be made to the Compressor to return it to its fully functional condition.

Test 3-38 also required a 100 km/h 2000-kg pickup truck test, but into the side of the Compressor at a 20-degree angle. Karco Test Report Number TR-P30144-01-A, dated December 3, 2010, reported a 2029.5-kg (4473-lb) truck struck the crash cushion at 100.2 km/h (62.3 km/h) and 20.1 degrees. Occupant Impact Velocity was 7.0 m/sec (lateral) and the Ridedown Acceleration was 12 g's. Vehicular roll, pitch and yaw were recorded as 15.7, 18.4, and 26.7 degrees, respectively. The truck came to rest 61.5 m (201.8 ft) downstream and 21.3 m (69.9 ft) to the left of the Compressor. After this test, the Compressor appeared to remain functional without requiring repairs.

Crash Test summaries are provided as enclosure to this correspondence.

Findings
The Compressor as described above and in Acceptance Letters CC-95 and CC-95A is acceptable for use on the NHS as a Self Restoring/Low Maintenance, Narrow Crash Cushion as a permanent or temporary attenuator when such use is acceptable to a highway agency. It can be mounted on a concrete pad with fourteen (14) anchor bolts or on an asphalt pad using thirty (30) steel rod anchors. The Compressor can be used in bi-directional traffic flow applications when used with Karco's tested transition design.

Therefore, the system described in the requests above and detailed in the enclosed drawings is acceptable for use on the NHS under the range of conditions tested, when such use is acceptable to a highway agency.

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

- This acceptance 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 acceptance 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 (when applicable).
- Any changes that may adversely influence the crashworthiness of the system will require a new acceptance 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 our acceptance.
- 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 acceptance, and that it will meet the crashworthiness requirements of the FHWA and NCHRP Report 350.
- To prevent misunderstanding by others, this letter of acceptance is designated as number CC-95C 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.
- The Compressor Crash Cushion is a patented product and considered proprietary. If proprietary devices are specified by a highway agency for use on Federal-aid projects, except exempt, non-NHS projects, (a) they must be supplied through competitive bidding with equally suitable unpatented items; (b) the highway agency must certify that they are essential for synchronization with the existing highway facilities or that no equally suitable alternative exists; or (c) they must be used for research or for a distinctive type of construction on relatively short sections of road for experimental purposes. Our regulations concerning proprietary products are contained in Title 23, Code of Federal Regulations, Section 635.411.
- This acceptance 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 acceptance letter 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,

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

Enclosures

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Sincerely,

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

Enclosures

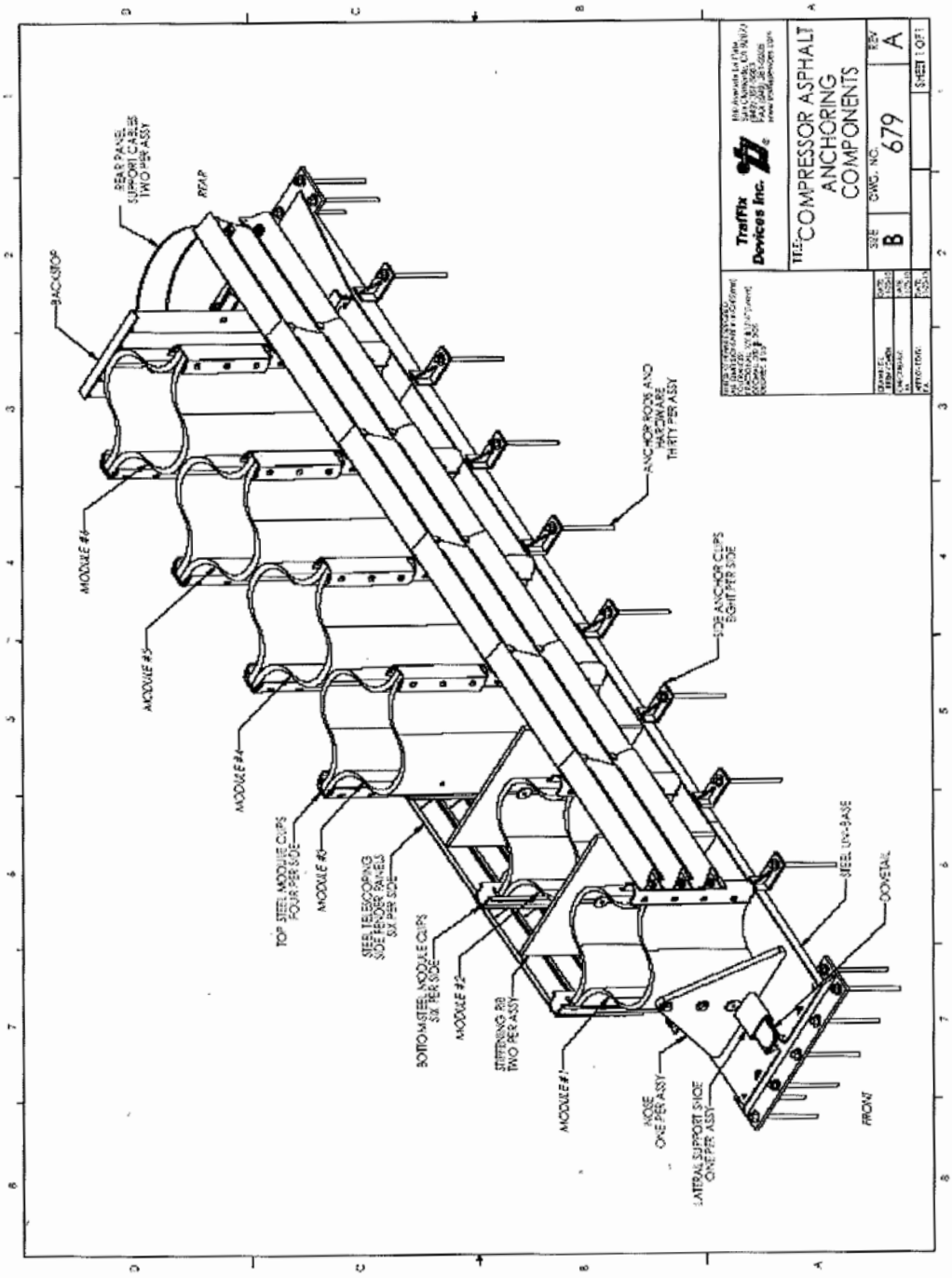


Figure 49: Manufacturer's Drawing

DATA SHEET 4

SUMMARY OF RESULTS

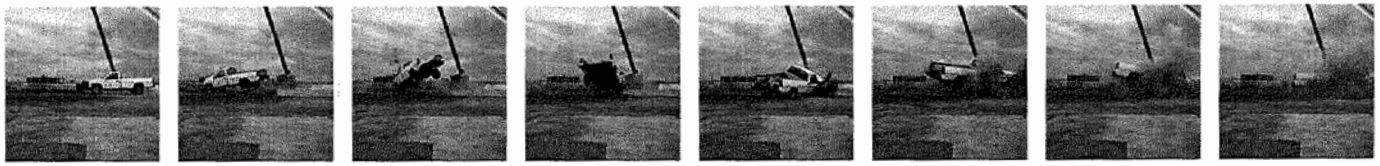
Test Article: TrafFix Devices Compressor

Project No.: P30145-01

Test Program: NCHRP 350 3-33

Test Date: 12/04/10

Test Vehicle: 1995 Chevrolet 2500



GENERAL INFORMATION	
TEST AGENCY	KARCO Engineering, LLC
TEST NO.	3-33
DATE	12/4/2010
TEST ARTICLE	
TYPE	Crash Cushion
INSTALLATION LENGTH	6.5 m
SIZE AND/OR DIMENSION OF KEY ELEMENTS	
SOIL TYPE AND CONDITION	Asphalt
TEST VEHICLE	
TYPE	Production Model
DESIGNATION	2000P
MODEL	1995 Chevrolet 2500
MASS (CURB)	2152.0 (4745 lbs)
MASS (TEST INERTIAL)	2042.0 (4502 lbs)
DUMMY MASS	0 kg (0 lbs)
MASS (GROSS STATIC)	2042.0 (4502 lbs)
IMPACT CONDITIONS	
VELOCITY (km/h)	101.4 (63.0 mph)
ANGLE (°)	14.8
IMPACT SEVERITY (kJ)	757.2
EXIT CONDITIONS	
VELOCITY (km/h)	
ANGLE (°)	

OCCUPANT RISK VALUES	
FLAIL SPACE VELOCITY (m/sec)	
X DIRECTION	10.7
Y DIRECTION	1.5
THIV (Optional)	
RIDEDOWN ACCELERATION (g's)	
X DIRECTION	-14.6
Y DIRECTION	-6.8
PHD (Optional)	
ASI (Optional)	
TEST ARTICLE DEFLECTIONS (m)	
DYNAMIC	3.4
PERMANENT	0.74
VEHICLE DAMAGE	
EXTERIOR	
VDS	12-FC-3
CDC	12FZEN1
INTERIOR	
OCDI	FS000000
POST-IMPACT VEHICULAR BEHAVIOR	
MAXIMUM ROLL ANGLE (°)	43.9
MAXIMUM PITCH ANGLE (°)	-30.5
MAXIMUM YAW ANGLE (°)	177.3

DATA SHEET 4

SUMMARY OF RESULTS

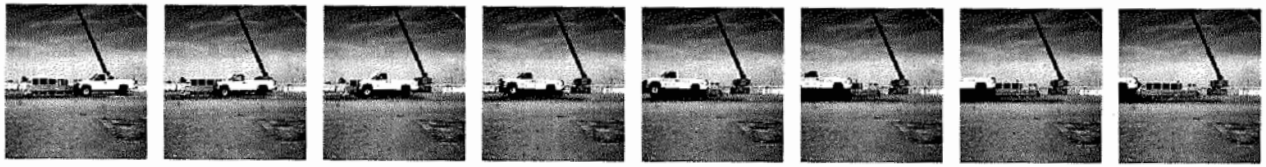
Test Article: TrafFix Devices Compressor

Project No.: P30144-01

Test Program: NCHRP 350 3-38

Test Date: 12/03/10

Test Vehicle: 1991 GMC Sierra 2500



GENERAL INFORMATION	
TEST AGENCY	KARCO Engineering, LLC
TEST NO.	3-38
DATE	12/3/2010
TEST ARTICLE	
TYPE	Crash Cushion
INSTALLATION LENGTH	6.5 m
SIZE AND/OR DIMENSION OF KEY ELEMENTS	
SOIL TYPE AND CONDITION	Asphalt
TEST VEHICLE	
TYPE	Production Model
DESIGNATION	2000P
MODEL	1991 GMC Sierra 2500
MASS (CURB)	2029.5 (4473 lbs)
MASS (TEST INERTIAL)	1978.5 (4362 lbs)
DUMMY MASS	0 kg (0 lbs)
MASS (GROSS STATIC)	1978.5 (4362 lbs)
IMPACT CONDITIONS	
VELOCITY (km/h)	100.2 (62.3 mph)
ANGLE (°)	20.1
IMPACT SEVERITY (kJ)	675.9
EXIT CONDITIONS	
VELOCITY (km/h)	86.9 (54.4 mph)
ANGLE (°)	7.0

OCCUPANT RISK VALUES	
FLAIL SPACE VELOCITY (m/sec)	
X DIRECTION	5.0
Y DIRECTION	7.1
THIV (Optional)	
RIDEDOWN ACCELERATION (g's)	
X DIRECTION	-12
Y DIRECTION	-8.2
PHD (Optional)	
ASI (Optional)	
TEST ARTICLE DEFLECTIONS (m)	
DYNAMIC	
PERMANENT	
VEHICLE DAMAGE	
EXTERIOR	
VDS	1-FR-4
CDC	1FREN1
INTERIOR	
OCDI	FS010000
POST-IMPACT VEHICULAR BEHAVIOR	
MAXIMUM ROLL ANGLE (°)	-15.7
MAXIMUM PITCH ANGLE (°)	18.4
MAXIMUM YAW ANGLE (°)	-26.7