U.S. Department of Transportation
Federal Highway Administration

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

September 9, 2009

In Reply Refer To:
HSSD/B-196

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

Dear Mr. Maus:

This letter is in response to your request for the Federal Highway Administration (FHWA) acceptance of a roadside safety system for use on the National Highway System (NHS).

Name of system: TrafFix Devices, Inc., Sentry Water-Cable Barrier
Type of system: Water filled barrier
Test Level: NCHRP Report 350 TL-1, TL-2 and TL-3
Testing conducted by: Karco Engineering, LLC
Date of request: January 21, 2009
Date of completed package: July 27, 2009
Request initially acknowledged: January 26, 2009

You requested that we find this system acceptable for use on NHS under the provisions of the National Cooperative Highway Research Program (NCHRP) Report 350 "Recommended Procedures for the Safety Performance Evaluation of Highway Features."

Requirements
Roadside safety systems should meet the guidelines contained in the NCHRP Report 350. The FHWA Memorandum "ACTION: Identifying Acceptable Highway Safety Features" of July 25, 1997, provides further guidance on crash testing requirements of longitudinal barriers.

Description
The TrafFix Devices, Inc., Sentry Water-Cable Barrier was designed without the need for an external attached structure to meet Test Level 2 (TL-2) and TL-3 barrier performance. A second design objective was to produce a product with minimal lateral deflection of the barrier. Each section is a freestanding longitudinal wall unit with an approximate width, height, and length of 25 inches by 46 inches by 84 inches (635 mm x 1092 mm x 2032 mm) respectively.

Each section has 11 connecting lugs, 5 on one end, and 6 on the opposite end. The four upper lugs on each barrier section contain one each independent corrosion resistant steel wire rope molded into the Sentry Water-Cable Barrier. The four wire rope pieces in each section act similarly to a cable barrier when impacted. A 1.25-inch (31.8-mm) diameter steel T-pin drops through the 1.5-inch (38.1-mm) diameter holes in the lugs, linking the sections together. The shell of each section is made up of high density polyethylene (HDPE).

Water-Cable Barrier wall sections are set in position, connected by the T-pin and T-pin clip, and filled with water. The empty weight of each Water-Cable Barrier section is approximately 165 pounds (75 kg). The weight of each Water-Cable Barrier section when filled with water is approximately 2,150 pounds (975 kg). The TrafFix Devices, Inc., Sentry Water-Cable Barrier does not use an external structure to achieve TL-2 or TL3 barrier performance, reducing the chance of improper assembly of the barrier.

Crash Testing

Three full scale crash tests were performed on a series of 25 linked Water Wall sections. The Water Wall sections were filled with water; no sections were anchored to the ground. The impact point was the center of the thirteenth barrier section from the beginning of the series. The 25 linked Sentry Water-Cable Barrier sections provided a tested length of approximately 158 feet (48 m). The Water-Cable Barrier system length and impact point were chosen to replicate previous tests performed on products of this category. The impact point at the center of the Water-Cable Barrier was also deemed to be “worst case”, as it is the mid point between the supported ends. The test data summary sheets for the three tests, NCHRP Report 350 Test 2-11, 3-10, and 3-11 are enclosed for reference. In each case the vehicle was captured by the barrier system with the vehicle experiencing substantial pitching and yawing. However, the vehicle remained upright in contact with the barrier and did not rebound into adjacent lanes. All occupant risk values were within allowable limits. The design deflection distance, as recorded in Test 3-11, was 9 feet (2.74 m).

Findings

You requested the following FHWA Acceptance conditions for the Sentry Water-Cable Barrier:

Request #1: Longitudinal Barrier at Test Levels TL-3, TL-2, and TL-1

Request #2: Longitudinal Channelizing Device at Test Levels TL-3, TL-2 and TL-1.

We concur that the system described above and detailed in the enclosed drawings is acceptable for use on the NHS above as a barrier and a longitudinal channelizing device under the range of conditions tested and as expanded in Requests #1 and #2, when such use is acceptable to a highway agency. TL-1 performance is assumed based on the successful TL-2 and TL-3 testing.

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

- 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.

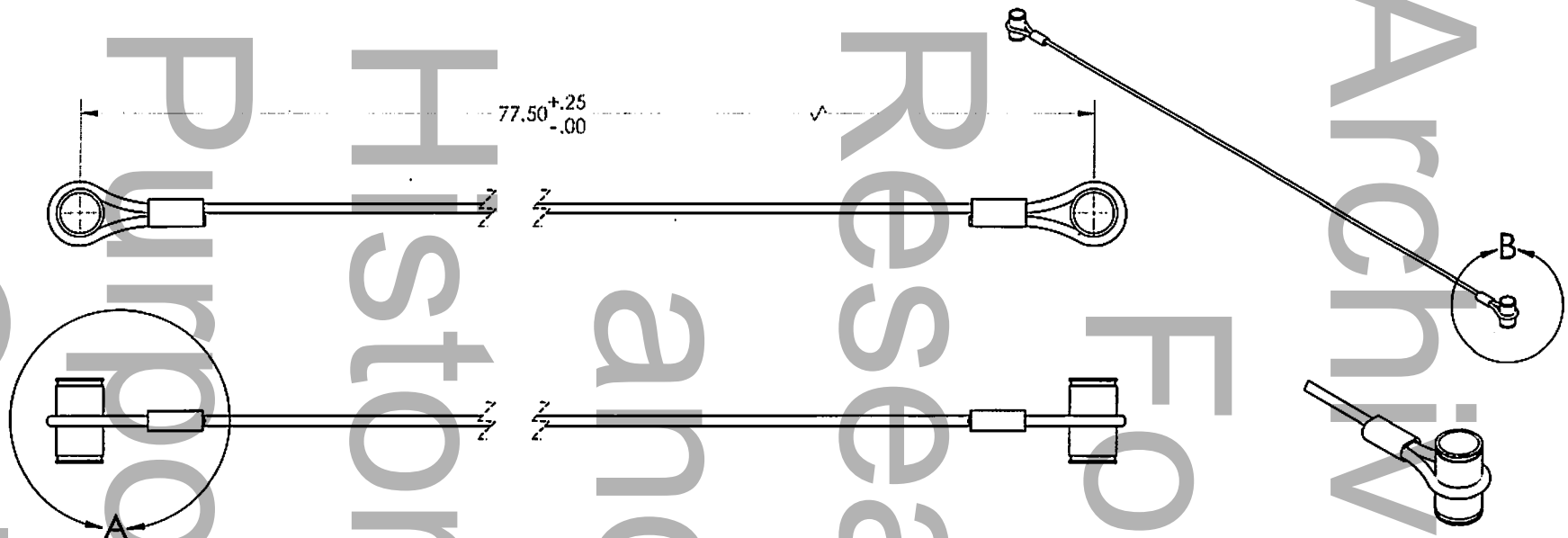
- Any changes that may adversely influence the crashworthiness of the system will require a new acceptance letter.
- Should FHWA discover that the qualification testing was flawed, that in-service performance reveals unacceptable safety problems, or that the system being marketed is significantly different 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 FHWA and NCHRP Report 350.
- To prevent misunderstanding by others, this letter of acceptance is designated as number B-196 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.
- Because some water ballasted barriers and channelizers are similar in appearance, FHWA recommends labeling each unit or module to indicate limitations on use. When used as a barrier all hardware, both internal and external that was used in the crash testing, shall be installed per the manufacturer's instructions. Recommended guidance for such labels may be found on the Web site of the AASHTO/AGC/ARTBA Task Force 13 at http://www.aashtotf13.org.
- The TrafFix Devices, Inc., Sentry Water-Cable Barrier is a patented product and considered proprietary. If proprietary systems 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 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 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.

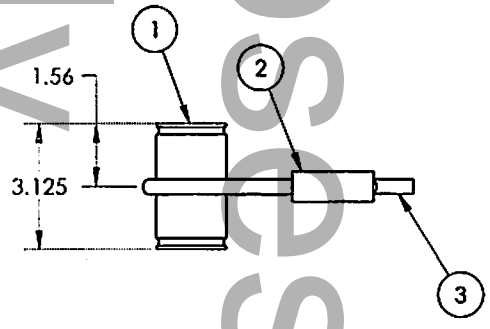
Sincerely yours,

David A. Nicol, P.E.
Director, Office of Safety Design
Office of Safety

Enclosures

CABLE SPEC
3/8" DIA WIRE ROPE
CORROSION RESISTANT





ITEM NO.	DESCRIPTION	QTY
1	BUSHING	2
2	SWAGE	2
3	CABLE	1

UNLESS OTHERWISE SPECIFIED:
ALL DIMENSIONS ARE IN INCHES[mm].
TOLERANCES:
DECIMAL: .000 ± .0425

DRAWN BY: DATE: 12-29-09
CHECKED BY: DATE:
APPROVED BY: DATE:

TrafFix Devices Inc.
160 Avenida La Pata
San Clemente, CA 92673
(949) 361-5663
FAX (949) 361-9205
www.traffixdevices.com

TITLE: WATER WALL WIRE ROPE

SIZE B | DWG. NO. 323 | REV -

SHEET 1 OF 1

DATA SHEET 4

SUMMARY OF RESULTS

Test Article: TrafFix Devices Inc. Water Wall
Project No.: P28185-01
Test Program: NCHRP 350 2-11
Test Date: 01/05/09
Test Vehicle: 2000 Chevrolet 2500

GENERAL INFORMATION		OCCUPANT RISK VALUES	
TEST AGENCY	KARCO Engineering, LLC	FLAIL SPACE VELOCITY (m/sec)	
TEST NO.	2-11	X DIRECTION	8.6
DATE	1/5/2009	Y DIRECTION	0.7
TEST ARTICLE		THIV (Optional)	N/A
TYPE	Longitudinal Barrier	RIDEDOWN ACCELERATION (g's)	
INSTALLATION LENGTH	48.3 m	X DIRECTION	-8.1
SIZE AND/OR DIMENSION OF KEY ELEMENTS	975.2 kg (2150 lbs)	Y DIRECTION	-4.1
SOIL TYPE AND CONDITION	Concrete/Dirt	PHD (Optional)	N/A
TEST VEHICLE		ASI (Optional)	N/A
TYPE	Production Model	TEST ARTICLE DEFLECTIONS (m)	
DESIGNATION	2000P	DYNAMIC	1.8 m
MODEL	2000 Chevrolet 2500	PERMANENT	1.8 m
MASS (CURB)	2150.5 kg (4741 lbs)	VEHICLE DAMAGE	
MASS (TEST INERTIAL)	2026.0 kg (4467 lbs)	EXTERIOR	
DUMMY MASS	0 kg (0 lbs)	VDS	1-FR-4
MASS (GROSS STATIC)	2026.0 kg (4467 lbs)	CDC	01FRMW2
IMPACT CONDITIONS		INTERIOR	
VELOCITY (km/h)	69.0 (42.9 mph)	OCDI	FS0000000
ANGLE (°)	24.4		
IMPACT SEVERITY (kJ)	372.1	POST-IMPACT VEHICULAR BEHAVIOR	
EXIT CONDITIONS		MAXIMUM ROLL ANGLE (°)	-22.4
VELOCITY (km/h)		MAXIMUM PITCH ANGLE (°)	-28.4
ANGLE (°)		MAXIMUM YAW ANGLE (°)	-83.6

DATA SHEET 4

SUMMARY OF RESULTS

Test Article: TrafFix Devices Inc. Water Wall

Test Program: NCHRP 350 3-10

Test Vehicle: 1995 Geo Metro

Project No.: P28187-01

Test Date: 01/08/09

GENERAL INFORMATION	
TEST AGENCY	KARCO Engineering, LLC
TEST NO.	3-10
DATE	1/8/2009
TEST ARTICLE	
TYPE	Longitudinal Barrier
INSTALLATION LENGTH	48.3 m
SIZE AND/OR DIMENSION OF KEY ELEMENTS	975.2 kg (2150 lbs)
SOIL TYPE AND CONDITION	Concrete/Dirt
TEST VEHICLE	
TYPE	Production Model
DESIGNATION	820C
MODEL	Geo Metro
MASS (CURB)	773.0 kg (1704 lbs)
MASS (TEST INERTIAL)	816.5 kg (1800 lbs)
DUMMY MASS	78 kg (171 lbs)
MASS (GROSS STATIC)	894.5 kg (1972 lbs)
IMPACT CONDITIONS	
VELOCITY (km/h)	99.4 (61.8 mph)
ANGLE (°)	20.0
IMPACT SEVERITY (kJ)	341.1
EXIT CONDITIONS	
VELOCITY (km/h)	
ANGLE (°)	

OCCUPANT RISK VALUES	
FLAIL SPACE VELOCITY (m/sec)	
X DIRECTION	12.0
Y DIRECTION	4.1
THIV (Optional)	N/A
RIDEDOWN ACCELERATION (g's)	
X DIRECTION	-13.1
Y DIRECTION	-3.4
PHD (Optional)	N/A
ASI (Optional)	N/A
TEST ARTICLE DEFLECTIONS (m)	
DYNAMIC	1.63 m
PERMANENT	1.63 m
VEHICLE DAMAGE	
EXTERIOR	
VDS	1-FR-7
CDC	01FRMW5
INTERIOR	
OCDI	FS0101001
POST-IMPACT VEHICULAR BEHAVIOR	
MAXIMUM ROLL ANGLE (°)	13.8
MAXIMUM PITCH ANGLE (°)	-11.3
MAXIMUM YAW ANGLE (°)	-127.9

DATA SHEET 4

SUMMARY OF RESULTS

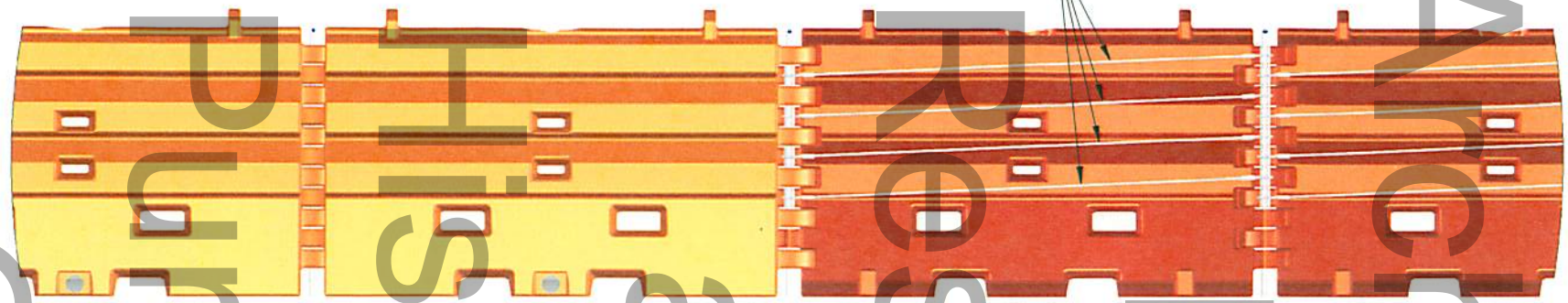
Test Article: TrafFix Devices Inc. Water Wall
Project No.: P28186-01
Test Program: NCHRP 350 3-11
Test Date: 01/08/09
Test Vehicle: 2000 Chevrolet 2500

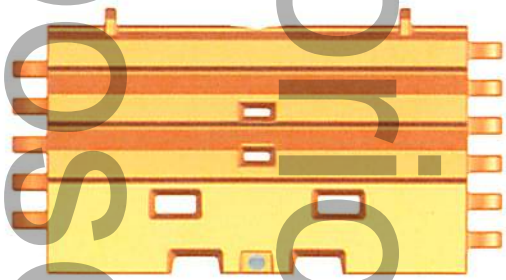
GENERAL INFORMATION	
TEST AGENCY	KARCO Engineering, LLC
TEST NO.	3-11
DATE	1/8/2009
TEST ARTICLE	
TYPE	Longitudinal Barrier
INSTALLATION LENGTH	48.3 m
SIZE AND/OR DIMENSION OF KEY ELEMENTS	975.2 kg (2150 lbs)
SOIL TYPE AND CONDITION	Concrete/Dirt
TEST VEHICLE	
TYPE	Production Model
DESIGNATION	2000P
MODEL	2000 Chevrolet 2500
MASS (CURB)	2152.5 kg (4745 lbs)
MASS (TEST INERTIAL)	2041.0 kg (4500 lbs)
DUMMY MASS	0 kg (0 lbs)
MASS (GROSS STATIC)	2041.0 kg (4500 lbs)
IMPACT CONDITIONS	
VELOCITY (km/h)	104.7 (65.0 mph)
ANGLE (°)	*
IMPACT SEVERITY (kJ)	862.4
EXIT CONDITIONS	
VELOCITY (km/h)	
ANGLE (°)	

OCCUPANT RISK VALUES		
FLAIL SPACE VELOCITY (m/sec)		
	X DIRECTION	11.9
	Y DIRECTION	2.3
	THIV (Optional)	N/A
RIDEDOWN ACCELERATION (g's)		
	X DIRECTION	-10.9
	Y DIRECTION	-2.5
	PHD (Optional)	N/A
	ASI (Optional)	N/A
TEST ARTICLE DEFLECTIONS (m)		
DYNAMIC		2.74 m
PERMANENT		2.74 m
VEHICLE DAMAGE		
EXTERIOR		
VDS		1-FR-7
CDC		01FRMW3
INTERIOR		
OCDI		FS0000000
POST-IMPACT VEHICULAR BEHAVIOR		
MAXIMUM ROLL ANGLE (°)		-58.5 1
MAXIMUM PITCH ANGLE (°)		-63.7 1
MAXIMUM YAW ANGLE (°)		-47.5 1

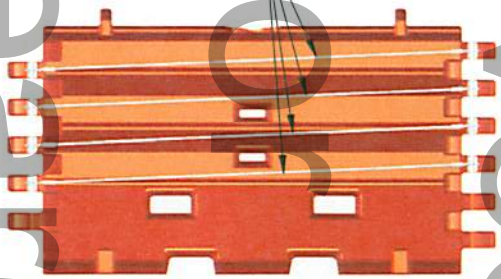
* - Unavailable due to camera loss.

1 – Maximum angle measurements are recorded during first 1000 ms.





WATER WALL SHOWN WITH MOLDED
INTERNAL BARRIER CABLES



CUT AWAY VIEW DISPLAYING INTERNAL
MOLDED IN BARRIER CABLES

UNLESS OTHERWISE SPECIFIED:
ALL DIMENSIONS ARE IN INCHES.

TrafFix Devices Inc.
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TITLE:
WALL DISPLAY

DRAWN BY:	DATE: 12/29/08	SIZE: B	DWG. NO.: 302
CHECKED BY:	DATE:		REV: -
APPROVED BY:	DATE:		SHEET 1 OF 1