U.S. Department
of Transportation
Federal Highway Administration

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

June 15, 2017

In Reply Refer To:
HSST-1/ B-279

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

Dear Mr. Almanza:

This letter is in response to your February 15, 2017 request for the Federal Highway Administration (FHWA) to review a roadside safety device, hardware, or system for eligibility for reimbursement under the Federal-aid highway program. This FHWA letter of eligibility is assigned FHWA control number B-279 and is valid until a subsequent letter is issued by FHWA that expressly references this device.

Decision

The following devices are eligible, with details provided in the form which is attached as an integral part of this letter:

- Sentry II Water Cable Barrier

Scope of this Letter

To be found eligible for Federal-aid funding, new roadside safety devices should meet the crash test and evaluation criteria contained in the American Association of State Highway and Transportation Officials'(AASHTO) Manual for Assessing Safety Hardware (MASH). However, the FHWA, the Department of Transportation, and the United States Government do not regulate the manufacture of roadside safety devices. Eligibility for reimbursement under the Federal-aid highway program does not establish approval, certification or endorsement of the device for any particular purpose or use.

This letter is not a determination by the FHWA, the Department of Transportation, or the United States Government that a vehicle crash involving the device will result in any particular outcome, nor is it a guarantee of the in-service performance of this device. Proper manufacturing, installation, and maintenance are required in order for this device to function as tested.

This finding of eligibility is limited to the crashworthiness of the system and does not cover other structural features, nor conformity with the Manual on Uniform Traffic Control Devices.

Eligibility for Reimbursement

Based solely on a review of crash test results and certifications submitted by the manufacturer, and the crash test laboratory, FHWA agrees that the device described herein meets the crash test and evaluation criteria of the American Association of State Highway and Transportation Officials' Manual for Assessing Safety Hardware (MASH). Therefore, the device is eligible for reimbursement under the Federal-aid highway program if installed under the range of tested conditions.

Name of system: Sentry II Water Cable Barrier
Type of system: Longitudinal Barrier
Test Level: MASH Test Level 3 (TL3)
Testing conducted by: KARCO
Date of request: February 15, 2017

'FHWA concurs with the recommendation of the accredited crash testing laboratory as stated within the attached form.'

Full Description of the Eligible Device

The device and supporting documentation, including reports of the crash tests or other testing done, videos of any crash testing, and/or drawings of the device, are described in the attached form.

Notice

This eligibility letter is issued for the subject device as tested. Modifications made to the device are not covered by this letter and will need to be tested in accordance with all recommended tests in AASHTO's MASH as part of a new and separate submittal.

You are expected to supply potential users with sufficient information on design, installation and maintenance requirements to ensure proper performance.

You are expected to certify to potential users that the hardware furnished has the same chemistry, mechanical properties, and geometry as that submitted for review, and that it will meet the test and evaluation criteria of AASHTO's MASH.

Issuance of this letter does not convey property rights of any sort or any exclusive privilege. This letter is based on the premise that information and reports submitted by you are accurate and correct. We reserve the right to modify or revoke this letter if: (1) there are any inaccuracies in the information submitted in support of your request for this letter, (2) the qualification testing was flawed, (3) in-service performance or other information reveals safety problems, (4) the system is significantly different from the version that was crash tested, or (5) any other information indicates that the letter was issued in error or otherwise does not reflect full and complete information about the crashworthiness of the system.

Standard Provisions

- To prevent misunderstanding by others, this letter of eligibility designated as FHWA control number B-279 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 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.

- If the subject device is a patented product it may be considered to be proprietary. If proprietary systems are specified by a highway agency for use on Federal-aid 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.

Sincerely,

Robert Ritter
Acting Director, Office of Safety
Technologies
Office of Safety

Enclosures

Request for Federal Aid Reimbursement Eligibility of Highway Safety Hardware

Submitter	Date of Request:	February 15, 2017	◉ New ○ Resubmission
	Name:	Felipe Almanza	
	Company:	TrafFix Devices Inc.	
	Address:	160 Avenida La Pata San Clemente California 92672	
	Country:	United States	
	To:	Michael S. Griffith, Director FHWA, Office of Safety Technologies	

I request the following devices be considered eligible for reimbursement under the Federal-aid highway program.

Device & Testing Criterion - Enter from right to left starting with Test Level

!-!-!

System Type	Submission Type	Device Name / Variant	Testing Criterion	Test Level
'B': Rigid/Semi-Rigid Barriers (Roadside, Median, Bridge Railings)	◉ Physical Crash Testing ○ Engineering Analysis	Sentry II Water Cable Barrier	AASHTO MASH	TL3

By submitting this request for review and evaluation by the Federal Highway Administration, I certify that the product(s) was (were) tested in conformity with the AASHTO Manual for Assessing Safety Hardware and that the evaluation results meet the appropriate evaluation criteria in the MASH.

Individual or Organization responsible for the product:

Contact Name:	Felipe Almanza	Same as Submitter ☒
Company Name:	TrafFix Devices Inc.	Same as Submitter ☒
Address:	160 Avenida La Pata San Clemente California 92672	Same as Submitter ☒
Country:	United States	Same as Submitter ☒
Enter below all disclosures of financial interests as required by the FHWA `Federal-Aid Reimbursement Eligibility Process for Safety Hardware Devices' document.		
TrafFix Devices Inc. and Karco Engineering LLC share no financial interests between the two organizations. This includes no shared financial interest but not limited to: i. Compensation included wages, salaries, commissions, professional fees, or fees for business referrals iii. Research funding or other forms of research support; iv. Patents, copyrights, licenses, and other intellectual property interests; vi. Business ownership and investment interests;		

PRODUCT DESCRIPTION

(•) New Hardware or Significant Modification ( ) Modification to Existing Hardware

The Sentry II Water Cable Barrier is a longitudinal barrier designed to contain, redirect, and shield vehicles from roadside obstacles while providing positive protection and separation between the traveling public and the personnel in the work zone. The Sentry II was designed for TL-3 (62.1 mph/100 km/hr) application. The barrier is also designed for TL-2 (43.5 mph/70 km/hr) and TL-1 (31.1 mph/50 km/hr) applications. The Sentry II is a free-standing system that does not require anchoring to the road surface and can be used on concrete, asphalt, gravel, and dirt surfaces. The surfaces used for testing were concrete and dirt. The system consists of individual water filled plastic modules that are connected to adjacent modules creating a continuous barrier wall of unlimited maximum length with minimum Length Of Need (LON) of 15 connected modules. An empty module weighs approx. 215 lbs. (97.5 kg) and 2,150 lbs. (975.2 kg) when filled with water. Each module is designed to utilize an optional drive by float lid for visual water level inspection. The modules are manufactured from polyethylene that is UV stabilized. Orange and white barrier modules were the as tested colors, and the product may be produced in other colors as needed. Adjoining modules can rotate up to 15 degrees at the connection point, allowing the barrier wall to contour to varying road curvature. Individual modules have overall dimensions of 75.6 in (1.9 m) long, pin to pin X 22.5 in (0.57 m) wide X 45.8 in (1.2 m) tall. Each module is designed with 11 connecting knuckles, 5 on one end, and 6 on the opposite end. Within the top four knuckles on each end is series of four permanently molded in corrosion resistant steel cables. The cables run longitudinally along each module and create an internal cable barrier. When the modules are installed together, the knuckles concentric vertical through holes align with adjacent modules knuckles concentric vertical through holes. This hole alignment allows for a steel pin to be inserted through all eleven knuckles creating a positive connection between modules, and a continuous internal cable barrier within the connected modules. Upon impact the plastic modules rupture, dispersing the contained water, simultaneously the impacting vehicle engages and tightens the internal molded-in cable barrier.

CRASH TESTING

By signature below, the Engineer affiliated with the testing laboratory, agrees in support of this submission that all of the critical and relevant crash tests for this device listed above were conducted to meet the MASH test criteria. The Engineer has determined that no other crash tests are necessary to determine the device meets the MASH criteria.

Engineer Name:	Balbino A. Beltran	
Engineer Signature:	Alex Beltran — Digitally signed by Alex Beltran DN: cn=Alex Beltran, o=KARCO Engineering, ou, email=abeltran@karco.com, c=US Date: 2017.02.10 12:31:07 -08'00'	
Address:	9270 Holly Rd. Adelanto, CA 92301	Same as Submitter ☐
Country:	United States	Same as Submitter ☐

A brief description of each crash test and its result:

Required Test Number	Narrative Description	Evaluation Results
3-10 (1100C)	The Sentry II Water Cable Barrier was angled 25° from the direction of the impacting vehicle. The side angle impact examines the barrier's ability to contain, re-direct, or bring the vehicle to a controlled stop. The vehicle should not penetrate the installation while controlled lateral deflection of the test article is acceptable. The test was conducted using a commercially available 2013 Kia Rio 4-door sedan with a test inertial mass of 2,461.4 lbs. (1,116.5 kg). The vehicle was in good condition, was free of major body damage, and was not missing any structural components. The bumpers were standard equipment and were not modified for this test. Based on CarFax reporting there was no recorded history of major accidents, was not a salvaged titled vehicle, not involved in flooding, or fire. The test vehicle impacted the barrier at a velocity of 62.37 mph (100.37 km/hr) and at an impact angle of 25.1°. The as tested barrier consisted of 25 water filled modules pinned together measuring 157.8 ft. (48.1 m) long, pin to pin. Upon initial contact with the first module the vehicle moved forward, impacted the adjacent module causing the module to rupture, dispersing the contained water, simultaneously engaging and tightening the internal molded-in cable barrier. The vehicle was contained on the traffic side of the barrier and was brought to a controlled stop 30.5 ft. (9.3 m) longitudinally (downstream) and 1.3 ft. (0.4 m) lateral (toward non-traffic side) from the initial point of contact. The barrier had a maximum working width of 8.9 ft. (2.7 m) and a maximum dynamic deflection of 7.2 ft. (2.2 m). The vehicle remained upright throughout the impact event. The test vehicle's occupant compartment was not penetrated, there was no measurable in cab deformation, the vehicle did not penetrate, underride, or override the barrier. The maximum roll and pitch angle did not exceed 75° and occupant risk values were within limits per MASH specifications for Occupant Impact Velocity (OIV) and Ridedown Acceleration (RA).	PASS

Required Test Number	Narrative Description	Evaluation Results
3-11 (2270P)	The Sentry Water Cable Barrier was angled 25° from the direction of the impacting vehicle. The side angle impact examines the barrier's ability to contain, re-direct, or bring the vehicle to a controlled stop. The vehicle should not penetrate the installation while controlled lateral deflection of the test article is acceptable. The test was conducted using a commercially available 2011 RAM 1500 4-door pickup truck with a test inertial mass of 5,017.6 lbs. (2,276.0 kg). The vehicle was in good condition, was free of major body damage, and was not missing any structural components. The bumpers were standard equipment and were not modified for this test. Based on CarFax reporting there was no recorded history of major accidents, was not a salvaged titled vehicle, not involved in flooding, or fire. The test vehicle impacted the barrier at a velocity of 65.57 mph (105.53 km/hr) and at an impact angle of 25.2°. The as tested MASH Sentry Water Cable Barrier consisted of 25 water filled modules pinned together measuring 157.5 ft. (48.0 m) long, pin to pin. Upon initial contact with the first module the vehicle moved forward, impacted the adjacent module causing the module to rupture, dispersing the contained water, simultaneously engaging and tightening the internal molded-in cable barrier. The vehicle was contained on the traffic side of the barrier and was brought to a controlled stop 42.3 ft. (12.9 m) longitudinally (downstream) and 6.6 ft. (2.0 m) lateral (toward non-traffic side) from the initial point of contact. The barrier had a maximum working width of 11.5 ft. (3.5 m) and a maximum dynamic deflection of 9.5 ft. (2.9 m). The test vehicle's occupant compartment was not penetrated and there was no measurable in cab deformation nor did the vehicle penetrate, underride, or override the barrier. The vehicle remained upright throughout the impact event. The test vehicle's occupant compartment was not penetrated, there was no measurable in cab deformation, the vehicle did not penetrate, underride, or override the barrier. The maximum roll and pitch angle did not exceed 75° and occupant risk values were within limits per MASH specifications for Occupant Impact Velocity (OIV) and Ridedown Acceleration (RA).	PASS

3-20 (1100C)	Test for transition is not applicable for the Sentry II Water Cable Barrier.	Non-Relevant Test, not conducted
3-21 (2270P)	Test for transition is not applicable for the Sentry II Water Cable Barrier.	Non-Relevant Test, not conducted

Full Scale Crash Testing was done in compliance with MASH by the following accredited crash test laboratory (cite the laboratory's accreditation status as noted in the crash test reports.):

Laboratory Name:	KARCO Engineering, INC	
Laboratory Signature:	Alex Beltran — Digitally signed by Alex Beltran DN: cn=Alex Beltran, o=KARCO Engineering, ou, email=abeltran@karco.com, c=US Date: 2017.02.10 12:31:23 -08'00'	
Address:	9270 Holly Road Adelanto, CA. 92301	Same as Submitter ☐
Country:	United States	Same as Submitter ☐
Accreditation Certificate Number and Dates of current Accreditation period :	TL-371; December 18, 2015 through December 18, 2017	

Submitter Signature*: Felipe Almanza — Digitally signed by Felipe Almanza DN: cn=Felipe Almanza, o=TrafFix Devices Inc., ou, email=falmanza@traffixdevices.com, c=US Date: 2017.02.08 09:26:13 -08'00'

Submit Form

ATTACHMENTS

Attach to this form:

1) Additional disclosures of related financial interest as indicated above.
2) A copy of the full test report, video, and a Test Data Summary Sheet for each test conducted in support of this request.
3) A drawing or drawings of the device(s) that conform to the Task Force-13 Drawing Specifications [Hardware Guide Drawing Standards]. For proprietary products, a single isometric line drawing is usually acceptable to illustrate the product, with detailed specifications, intended use, and contact information provided on the reverse. Additional drawings (not in TF-13 format) showing details that are relevant to understanding the dimensions and performance of the device should also be submitted to facilitate our review.

FHWA Official Business Only:

Eligibility Letter		
Number	Date	Key Words

SECTION 4

MASH TEST 3-10 SUMMARY

Test Article:	TrafFix Devices Sentry II Water Cable Barrier	Project No.	P36208-01
Test Program:	MASH 3-10	Test Date:	08/24/16

SEQUENTIAL PHOTOGRAPHS

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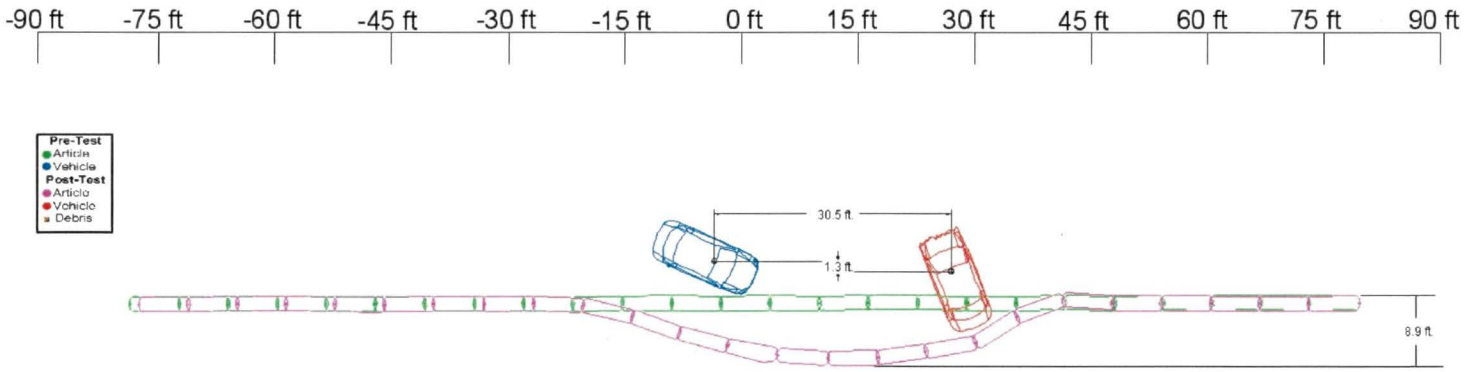
PLAN VIEW



SECTION 4 ... (CONTINUED)

MASH TEST 3-10 SUMMARY

Test Article: TrafFix Devices Sentry II Water Cable Barrier Project No. P36208-01

Test Program: MASH 3-10 Test Date: 08/24/16

GENERAL INFORMATION	
TEST AGENCY	KARCO Engineering, LLC.
TEST NUMBER	P36208-01
TEST DESIGNATION	3-10
TEST DATE	8/24/16
TEST ARTICLE	
NAME / MODEL	Sentry II Water Cable Barrier
TYPE	Longitudinal Barrier
KEY ELEMENTS	Water Barrier, Internal Cables, Drop T-Pins
MODULE LENGTH	75.8 in. (1,925 mm)
TOTAL INSTALLATION LENGTH	157.8 ft. (48.1 m)
HEIGHT	45.8 in. (1,163 mm)
MAXIMUM WIDTH	22.5 in. (572 mm)
ROAD SURFACE	Concrete
TEST VEHICLE	
TYPE / DESIGNATION	1100C
YEAR, MAKE AND MODEL	2013 Kia Rio
CURB MASS	2,450.4 lbs (1,111.5 kg)
TEST INERTIAL MASS	2,461.4 lbs (1,116.5 kg)
GROSS STATIC MASS	2,630.1 lbs (1,193.0 kg)
IMPACT CONDITIONS	
IMPACT VELOCITY	62.37 mph (100.37 km/h)
IMPACT ANGLE	25.1°
IMPACT LOCATION / ORIENTATION	3.6 ft. (1.1 m) upstream from the joint connecting modules 13 and 14

EXIT CONDITIONS		
EXIT VELOCITY		N/A
EXIT ANGLE		N/A
VEHICLE STABILITY		Satisfactory
FINAL VEHICLE POSITION		30.5 ft. (9.3 m) downstream and 1.3 ft. (0.4 m) right from its initial point of impact.
VEHICLE SNAGGING		None
VEHICLE POCKETING		None
MAXIMUM ROLL ANGLE		16.5°
MAXIMUM PITCH ANGLE		33.1°
MAXIMUM YAW ANGLE		220.5°
IMPACT SEVERITY		57.6 kip-ft (78.1 kJ)
OCCUPANT RISK VALUES		
OCCUPANT IMPACT VELOCITY	Longitudinal	28.5 ft/s (8.7 m/s)
	Lateral	25.6 ft/s (7.8 m/s)
RIDEDOWN ACCELERATION	Longitudinal	-16.4 g
	Lateral	5.0 g
THIV		38.4 ft/s (13.9m/s)
PHD		13.9 g
ASI		2.06
TEST ARTICLE DEFLECTIONS		
WORKING WIDTH		8.9 ft. (2.7 m)
DYNAMIC DEFLECTION		7.2 ft. (2.2 m)
ARTICLE DAMAGE		Module 13 through 18 damaged
VEHICLE DAMAGE		
VEHICLE DAMAGE SCALE		01-FR-6
COLLISION DAMAGE CLASSIFICATION		01FDEW2

SECTION 4

MASH TEST 3-11 SUMMARY

Test Article:	TrafFix Devices Sentry II Water Cable Barrier	Project No.	P36227-01
Test Program:	MASH 3-11	Test Date:	09/23/16

SEQUENTIAL PHOTOGRAPHS

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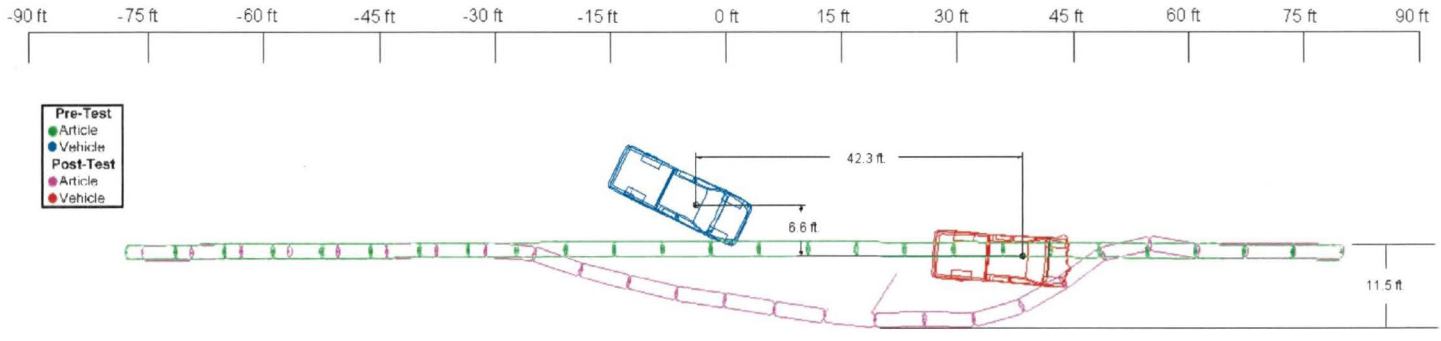
PLAN VIEW



SECTION 4 ... (CONTINUED)

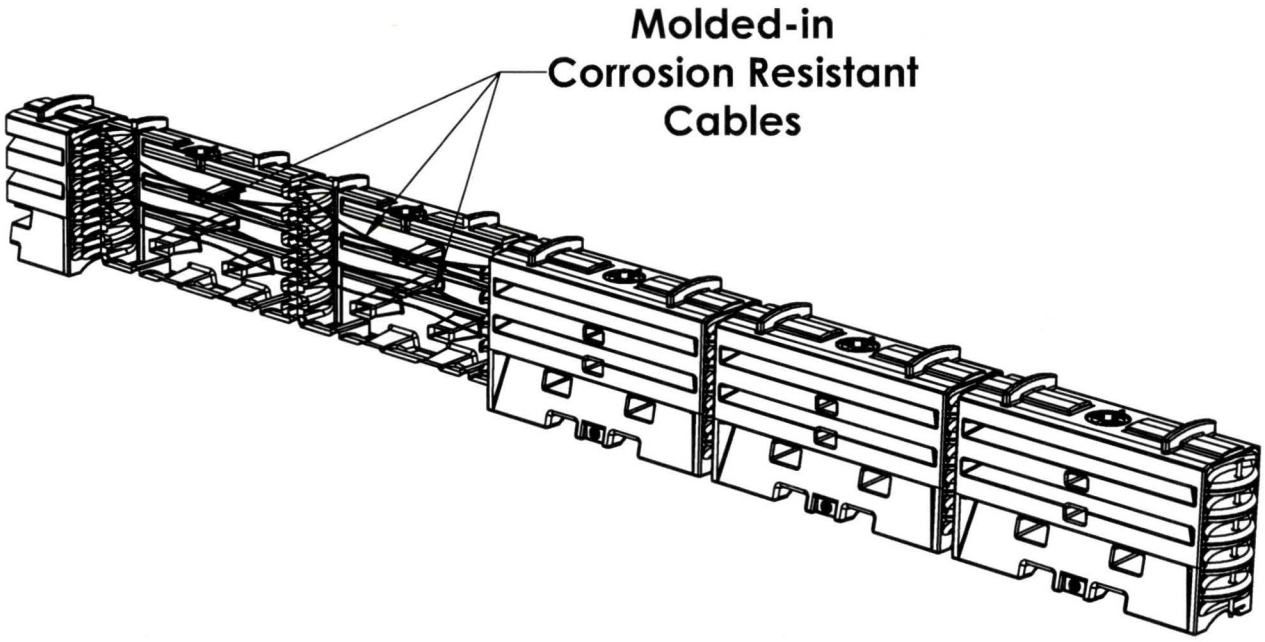
MASH TEST 3-11 SUMMARY

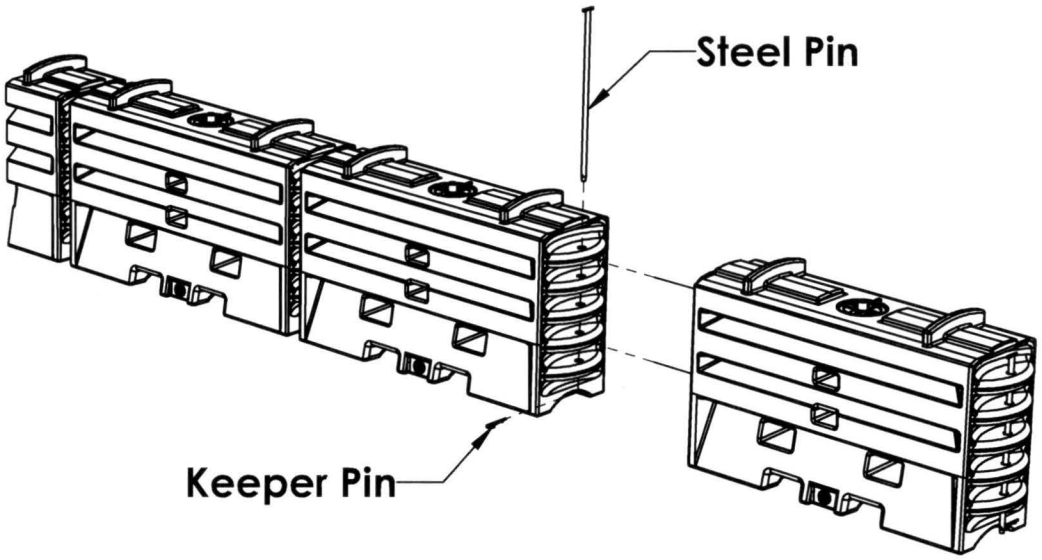
Test Article: TrafFix Devices Sentry II Water Cable Barrier — Project No. P36227-01

Test Program: MASH 3-11 — Test Date: 09/23/16

GENERAL INFORMATION	
TEST AGENCY	KARCO Engineering, LLC.
TEST NUMBER	P36227-01
TEST DESIGNATION	3-11
TEST DATE	9/23/16
TEST ARTICLE	
NAME / MODEL	Sentry II Water Cable Barrier
TYPE	Longitudinal Barrier
KEY ELEMENTS	Water Barrier, Internal Cables, Drop T-Pins
MODULE LENGTH	75.7 in. (1,924 mm)
TOTAL INSTALLATION LENGTH	157.5 ft. (48.0 m)
HEIGHT	45.8 in. (1,163 mm)
MAXIMUM WIDTH	22.5 in. (572 mm)
ROAD SURFACE	Concrete
TEST VEHICLE	
TYPE / DESIGNATION	2270P
YEAR, MAKE AND MODEL	2011 RAM 1500
CURB MASS	5,035.3 lbs (2,284.0 kg)
TEST INERTIAL MASS	5,017.6 lbs (2,276.0 kg)
GROSS STATIC MASS	5,017.6 lbs (2,276.0 kg)
IMPACT CONDITIONS	
IMPACT VELOCITY	65.57 mph (105.53 km/h)
IMPACT ANGLE	25.2°
IMPACT LOCATION / ORIENTATION	4.3 ft. (1.3 m) upstream from the joint connecting modules 13 and 14

EXIT CONDITIONS		
EXIT VELOCITY		N/A
EXIT ANGLE		N/A
VEHICLE STABILITY		Satisfactory
FINAL VEHICLE POSITION		42.3 ft. (12.9 m) downstream and 6.6 ft. (2.0 m) right from its initial point of impact.
VEHICLE SNAGGING		Right Front Wheel
VEHICLE POCKETING		None
MAXIMUM ROLL ANGLE		8.4°
MAXIMUM PITCH ANGLE		4.3°
MAXIMUM YAW ANGLE		-31.4°
IMPACT SEVERITY		128.8 kip-ft (174.6 kJ)
OCCUPANT RISK VALUES		
OCCUPANT IMPACT VELOCITY	Longitudinal	34.1 ft/s (10.4 m/s)
	Lateral	13.1 ft/s (4.0 m/s)
RIDEDOWN ACCELERATION	Longitudinal	-13.4 g
	Lateral	-4.2 g
THIV		33.5 ft/s (10.2 m/s)
PHD		14.3 g
ASI		0.98
TEST ARTICLE DEFLECTIONS		
WORKING WIDTH		11.5 ft. (3.5 m)
DYNAMIC DEFLECTION		9.5 ft. (2.9 m)
ARTICLE DAMAGE		Module 13 through 20 damaged
VEHICLE DAMAGE		
VEHICLE DAMAGE SCALE		01-FR-6
COLLISION DAMAGE CLASSIFICATION		01FDEW3





Sentry II Water Cable Barrier

TrafFix Devices Inc.

SHEET NO.	DATE:
1 OF 2	2/10/2017

INTENDED USE

The Sentry II Water Cable Barrier is a longitudinal barrier designed to contain, redirect, and shield vehicles from roadside obstacles while providing positive protection and separation between the traveling public and the personnel in the work zone. The Sentry II was designed for TL-3 (62.1 mph/100 km/hr) application. The barrier is also designed for TL-2 (43.5 mph/70 km/hr) and TL-1 (31.1 mph/50 km/hr) applications. The Sentry II is a free-standing system that does not require anchoring to the road surface and can be used on concrete, asphalt, gravel, and dirt surfaces. The surfaces used for testing were concrete and dirt. The system consists of individual water filled plastic modules that are connected to adjacent modules creating a continuous barrier wall of unlimited maximum length with minimum Length Of Need (LON) of 15 connected modules. An empty module weighs approx. 215 lbs. (97.5 kg) and 2,150 lbs. (975.2 kg) when filled with water. Each module is designed to utilize an optional drive by float lid for visual water level inspection. The modules are manufactured from polyethylene that is UV stabilized. Orange and white barrier modules were the as tested colors, and the product may be produced in other colors as needed. Adjoining modules can rotate up to 15 degrees at the connection point, allowing the barrier wall to contour to varying road curvature. Individual modules have overall dimensions of 75.6 in (1.9 m) long, pin to pin X 22.5 in (0.57 m) wide X 45.8 in (1.2 m) tall. Each module is designed with 11 connecting knuckles, 5 on one end, and 6 on the opposite end. Within the top four knuckles on each end is series of four permanently molded in corrosion resistant steel cables. The cables run longitudinally along each module and create an internal cable barrier. When the modules are installed together, the knuckles concentric vertical through holes align with adjacent modules knuckles concentric vertical through holes. This hole alignment allows for a steel pin to be inserted through all eleven knuckles creating a positive connection between modules, and a continuous internal cable barrier within the connected modules. Upon impact the plastic modules rupture, dispersing the contained water, simultaneously the impacting vehicle engages and tightens the internal molded-in cable barrier.

CONTACT INFORMATION

TrafFix Devices, Inc.
Corporate Headquarters
160 Avenida La Pata
San Clemente, CA 92673
www.traffixdevices.com

Phone: +1(949)-361-5663
Fax: +1(949)-361-9205
Email: info@traffixdevices.com

Sentry II Water Cable Barrier

SHEET NO.	DATE:
2 OF 2	2/10/2017

TrafFix Devices Inc.