September 10, 2020

U.S. Department of Transportation
Federal Highway Administration

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

In Reply Refer To:
HSST-1/B-348

Mr. Robby Ramirez
TrafFix Devices, Inc.
160 Avenida La Pata
San Clemente, CA 92673
USA

Dear Mr. Ramirez:

This letter is in response to your January 03, 2020 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-348 and is valid until a subsequent letter is issued by FHWA that expressly references this device.

Decision

The following device is eligible within the length-of-need, with details provided in the form which is attached as an integral part of this letter:

- Lo-Ro 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 AASHTO's 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: Lo-Ro Water Cable Barrier
Type of system: Longitudinal Barrier
Test Level: MASH Test Level 2 (TL2)
Testing conducted by: Applus IDIADA KARCO Engineering, LLC.
Date of request: January 3, 2020

FHWA concurs with the recommendation of the accredited crash testing laboratory on 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. Any modifications to this device should be submitted to the user (i.e., state DOT) as per their requirements.

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-348 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.

- This FHWA eligibility letter is not an expression of any Agency view, position, or determination of validity, scope, or ownership of any intellectual property rights to a specific device or design. Further, this letter does not impute any distribution or licensing rights to the requester. This FHWA eligibility letter determination is made based solely on the crash-testing information submitted by the requester. The FHWA reserves the right to review and revoke an earlier eligibility determination after receipt of subsequent information related to crash testing.

Sincerely,

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

Enclosures

Request for Federal Aid Reimbursement Eligibility of Highway Safety Hardware

Submitter	Date of Request:	January 03, 2020	◉ New ○ Resubmission
	Name:	Robby Ramirez	
	Company:	TrafFix Devices, Inc.	
	Address:	160 Avenida La PataSan Clemente, CA 92673	
	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 L ! - ! - !

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	Lo-Ro Water Cable Barrier	AASHTO MASH	TL2

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:	Robby Ramirez	Same asSubmitter☒
Company Name:	TrafFix Devices, Inc.	Same asSubmitter☒
Address:	160 Avenida La PataSan Clemente, CA 92673	Same asSubmitter☒
Country:	United States	Same asSubmitter☒
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 Applus IDIADA KARCOEngineering LLCshare no financial interests between the two organizations. This includes no shared financial interest but not limited to: i. Compensation including 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

Help

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

The Low Rotation (Lo-Ro) Water Cable Barrier is a longitudinal barrier designed to contain, redirect and shield vehicles from roadside obstacles. The Lo-Ro Water Cable Barrier provides positive protection and separation between the traveling public and personnel in the work zone. The Lo-Ro Water Cable Barrier is free standing and 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 and a minimum length-of-need (LON) of 15 connected modules. The Lo-Ro is designed and tested for TL-2 (44 mph/70 km/h) applications and can also be used in TL-1 (31 mph/50 km/h) applications.

The individual modules are 75.75 in. (1,924 mm) long (measured from pin to pin) by 22.5 in. (572 mm) wide by 36.0 in. (914 mm) tall. The modules are manufactured from white or orange colored plastic polyethylene that is UV stabilized to minimize degradation. Orange and white barrier modules were the as-tested colors, the product may be produced in other colors. Molded within the modules are a series of three (3) corrosion resistant wire rope cables. The cables are permanently molded into the modules during the manufacturing process. The empty module weights approximately 159.0 lbs (72.2 kg) and the water filled module weights approximately 1,633.0 lbs (740.8 kg). Each module is designed to utilize an optional drive by float lid for visual water level inspection.

The modules were designed with a four (4) knuckle end on one side and a five (5) knuckle end on the opposite side. Each knuckle contains a series of vertically aligned concentric holes and a steel drop t-pin is inserted into these holes to connect adjacent modules. When adjacent modules are pinned together there are a total of nine (9) knuckles aligned with the steel drop t-pin inserted. This provides a positive connection between adjacent modules and a continuous internal cable barrier within the connected modules. Upon impact the plastic modules rupture and the impacting vehicle engages and tightens the internal molded cables.

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:	Steven Matsusaka	
Engineer Signature:	Steven Matsusaka DN: cn=Steven Matsusaka, email=steven.matsusaka@idiada.com, c=US Digitally signed by Steven Matsusaka Date: 2020.01.24 17:44:38 -08'00'	
Address:	9270 Holly Road, Adelanto, CA 92301	Same as Submitter ☐
Country:	United States of America	Same as Submitter ☐

~~A brief description of each crash test and its result:~~

Help

Required Test Number	Narrative Description	Evaluation Results
2-10 (1100C)	Test report number P39098-01 conducted on 03/22/19. Test 2-10 involves an 1100C test vehicle impacting the Low Rotation Water Cable Barrier at 25° and 44 mph (70 km/h). The angled 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 isacceptable. The test vehicle, a 2013 Hyundai Accent with a test inertial weight of 2,415.1 lbs (1,095.5 kg), wasset to impact the barrier at the CIPas recommended in MASH. The vehicle impacted the barrier at aspeed and angle of 44.40 mph (71.45 km/h) and 25.2°, respectively. The barrier contained and redirected the vehicle. The vehicle did not penetrate, underride, or override the installation. The vehicle exited within the bounds of the exit box before coming to a controlled stop. The final resting point of the vehicle was 92.4 ft. (28.2 m) downstream from its initial point of contact with the barrier. The barrier had a maximum dynamic deflection of 6.9 ft. (2.1 m). The Lo-Ro modules remained tethered together via the steel t-pin between module knuckles which connects directly to the internal molded in steel cables. There were no detached elements that showed potential to penetrate the vehicle or present undue hazards to personnel in a work zone. The Occupant Impact Velocities (OIV) and Ridedown accelerations were within the specified limits of MASH. The roll and pitch angles did not exceed 75° and there was minimal occupant compartment deformation. The Lo-Ro met all the requirements for MASH Test 2-10.	PASS

Required Test Number	Narrative Description	Evaluation Results
2-11 (2270P)	Test report number P38127-01 conducted on 10/02/18. Test 2-11 involves an 2270P test vehicle impacting the Low Rotation Water Cable Barrier at 25° and 44 mph (70 km/h). The angled 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 isacceptable. The test vehicle, a 2013 RAM 1500 with a test inertial weight of 4,948.2 lbs (2,244.5 kg), wasset to impact the barrier at the CIPas recommended in MASH. The vehicle impacted the barrier at aspeed and angle of 44.53 mph (71.67 km/h) and 25.1°, respectively. The barrier brought the vehicle to a controlled stop. The vehicle did not penetrate, underride, or override the installation. The vehicle rotated about its yaw axis before coming to a controlled stop. The final resting point of the vehicle was 28.5 ft. (8.7 m) downstream from its initial point of contact with the barrier. The barrier had a maximum dynamic deflection of 11.8 ft. (3.6 m). The Lo-Ro modules remained tethered together via the steel t-pin between module knuckles which connects directly to the internal molded in steel cables. There were no detached elements that showed potential to penetrate the vehicle or present undue hazards to personnel in a work zone. The Occupant Impact Velocities (OIV) and Ridedown accelerations were within the specified limits of MASH. The roll and pitch angles did not exceed 75° and there was no occupant compartment deformation. The Lo-Ro Water Cable Barrier met all the requirements for MASH Test 2-11.	PASS
2-20 (1100C)	Test for transition is not applicable for the Lo-Ro Water Cable Barrier.	Non-Relevant Test, not conducted
2-21 (2270P)	Test for transition is not applicable for the Lo-Ro 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:	Applus IDIADA KARCOEngineering, LLC	
Laboratory Signature:	Steven Matsusaka DN: cn=Steven Matsusaka, email=steven.matsusaka@idiada.com, c=US Digitally signed by Steven Matsusaka Date: 2020.01.24 17:49:02 -08'00'	
Address:	9270 Holly Road, Adelanto, CA 92301	Same as Submitter ☐
Country:	United States of America	Same as Submitter ☐
Accreditation Certificate Number and Dates of current Accreditation period :	TL-371: July 2019 - July 2022	

Submitter Signature*: Robert Ramirez Digitally signed by Robert Ramirez Date: 2020.01.27 10:45:02 -08'00'

Submit Form

ATTACHMENTS

Attach to this form:

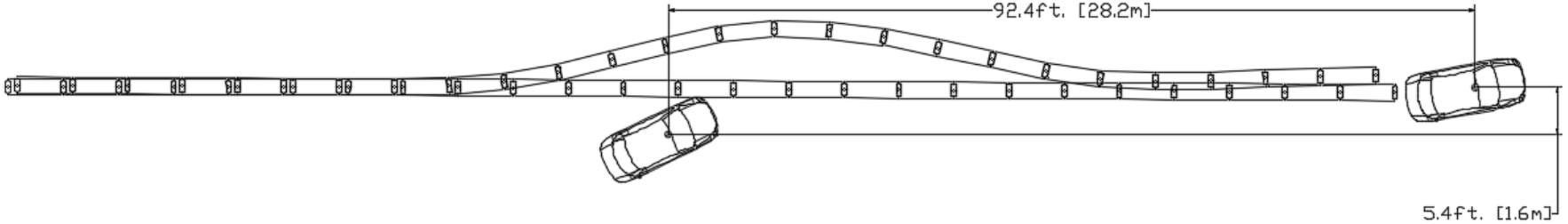
1) Additional disclosures of related financial interest as indicated above.
2) A copy of the full test report, video, and a Test Data Summary Sheet for each test conducted in support of this request.
3) A drawing or drawings of the device(s) that conform to the Task Force-13 Drawing Specifications [Hardware 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

MASH Test 2-10 Summary

0.000 s | 0.200 s | 0.500 s | 0.950 s | 1.400 s



General Information

Test Agency	Applus IDIADA KARCO
Test No.	P39098-01
Test Designation	2-10
Test Date	03/22/19

Test Article

Name / Model	Low Rotation Water Cable Barrier
Type	Free Standing
Installation Length	158.8 ft. (48.4 m)
Key Elements	Standing water filled barrels
Road Surface	Concrete

Test Vehicle

Type / Designation	1100C
Year, Make, and Model	2013 Hyundai Accent
Curb Mass	2,469.1 lbs (1,120.0 kg)
Test Inertial Mass	2,415.1 lbs (1,095.5 kg)
Gross Static Mass	2,588.2 lbs (1,174.0 kg)

Impact Conditions

Impact Velocity	44.40 mph (71.45 km/h)
Impact Angle	25.2°
Location / Orientation	3.3 ft. Upstream from Pin
Impact Severity	28.9 kip-ft (39.1 kJ)

Exit Conditions

Exit Velocity	19.55 mph (31.46 km/h)
Exit Angle	30.8° (after initial redirect)
Final Vehicle Position	92.4 ft. (28.2 m) Downstream 5.4 ft. (1.6 m) Left
Exit Box Criteria Met	N/A
Vehicle Snagging	Satisfactory
Vehicle Pocketing	Satisfactory
Vehicle Stability	Satisfactory
Maximum Roll Angle	1.7 °
Maximum Pitch Angle	2.2 °
Maximum Yaw Angle	-33.9 °

Occupant Risk

Longitudinal OIV	18.7 ft/s (5.7 m/s)
Lateral OIV	11.8 ft/s (3.6 m/s)
Longitudinal RA	-6.0 g
Lateral RA	3.0 g
THIV	24.0 ft/s (7.3 m/s)
PHD	5.4 g
ASI	0.68

Test Article Deflections

Static	6.9 ft. (2.1 m)
Dynamic	6.9 ft. (2.1 m)
Working Width	8.2 ft (2.5 m)
Debris Field	None

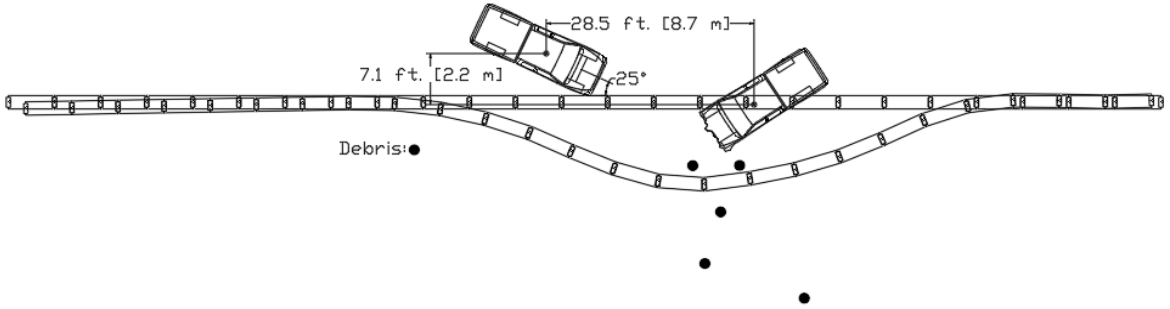
Vehicle Damage

Vehicle Damage Scale	11-LFQ-4
CDC	11FLEW4
Maximum Intrusion	None

Figure 2 Summary of Test 2-10

MASH Test 2- 11 Summary

0.000 s 0.250 s 0.900 s 1.550 s 2.400 s



General Information

Test Agency	IDIADA KARCO
Test No.	P38127-01
Test Designation	2-11
Test Date	10/02/18

Test Article

Name / Model	Low Rotation Water Wall
Type	Longitudinal Barrier
Article Length	6.3 ft. (1.9 m)
Installation Length	157.8 ft. (48.1 m)
Road Surface	Concrete and Soil

Test Vehicle

Type / Designation	2270P
Year, Make, and Model	2013 RAM 1500
Curb Mass	4,772.9 lbs (2,165.0 kg)
Test Inertial Mass	4,948.2 lbs (2,244.5 kg)
Gross Static Mass	4,948.2 lbs (2,244.5 kg)

Impact Conditions

Impact Velocity	44.53 mph (71.67 km/h)
Impact Angle	25.1°
Location / Orientation	2.7 ft. (0.82 m) upstream from pin
Impact Severity	58.6 kip-ft (79.4 kJ)

Exit Conditions

Exit Velocity	N/A
Exit Angle	N/A
Final Vehicle Position	28.5 ft. (8.7 m) Downstream 7.1 ft. (2.2 m) Right
Vehicle Snagging	Minor
Vehicle Pocketing	Satisfactory
Vehicle Stability	Satisfactory
Maximum Roll Angle	-24.6°
Maximum Pitch Angle	-38.3°
Maximum Yaw Angle	-47.7°

Occupant Risk

Longitudinal OIV	23.6 ft/s (7.2 m/s)
Lateral OIV	2.6 ft/s (0.8 m/s)
Longitudinal RA	-4.3 g
Lateral RA	2.3 g
THIV	23.6 ft/s (7.2 m/s)
PHD	4.5 g
ASI	0.48

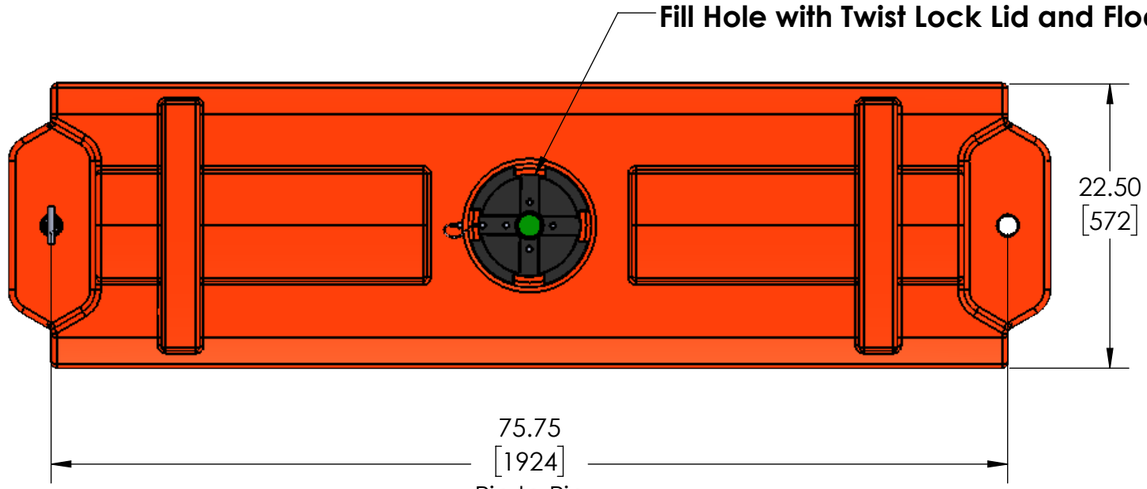
Test Article Deflections

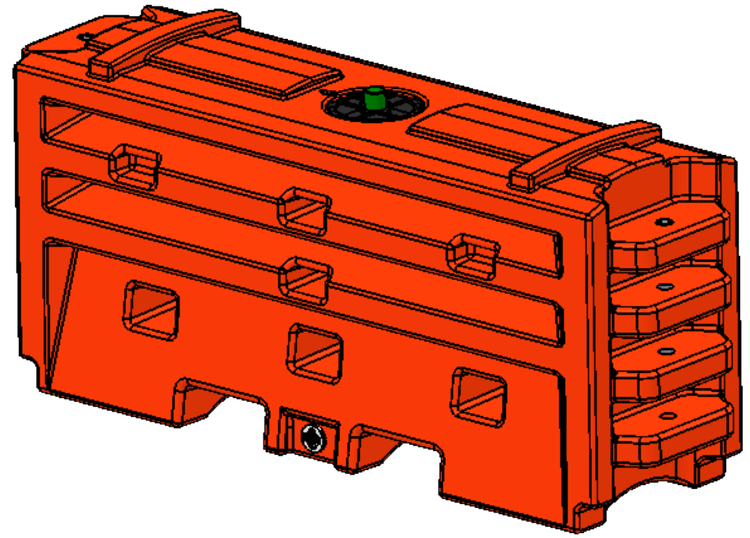
Static	11.5 ft. (3.5 m)
Dynamic	11.8 ft. (3.6 m)
Working Width	13.3 ft. (4.1 m)
Article Debris Field	29.5 ft (9.0 m) Downstream 28.3 ft. (8.6 m) Right

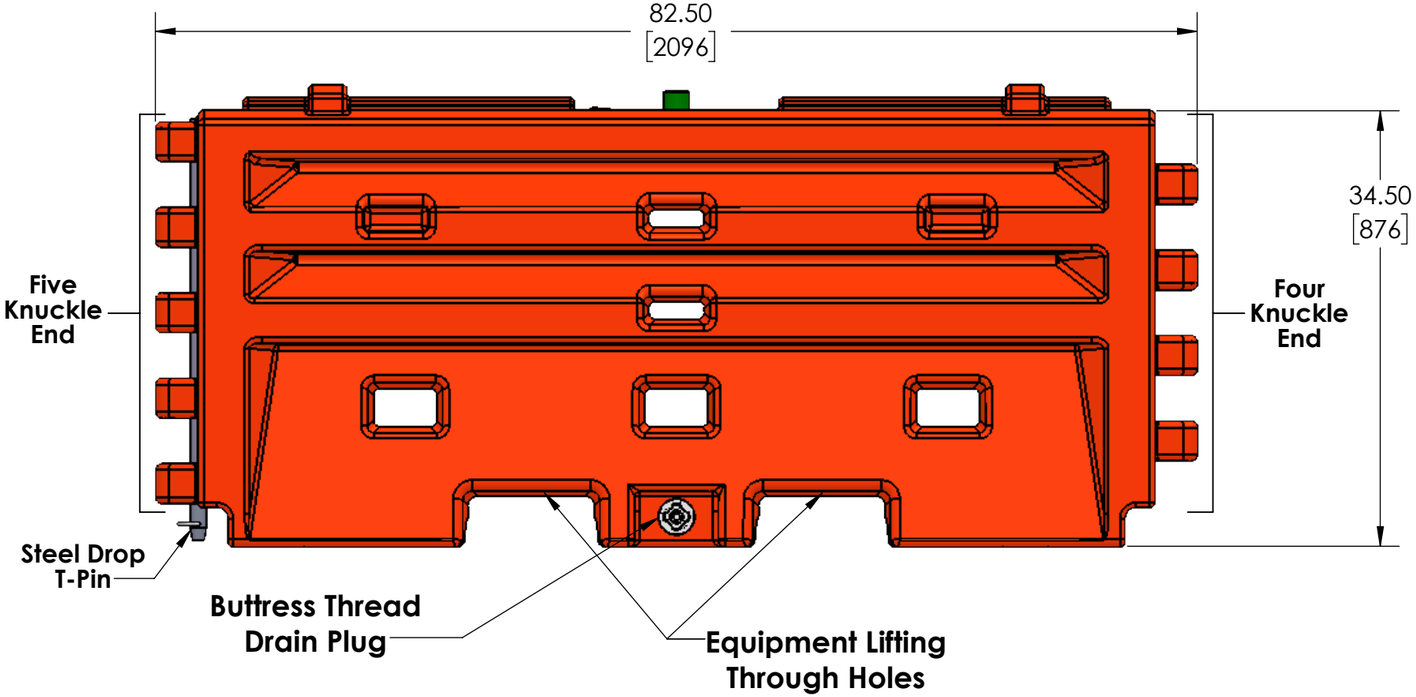
Vehicle Damage

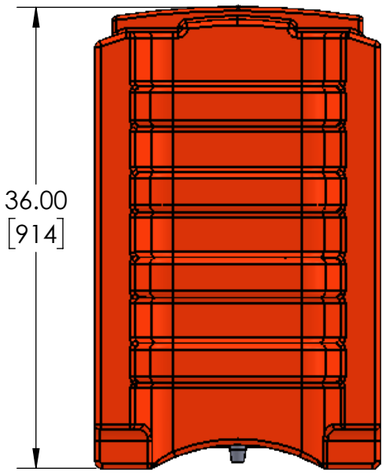
Vehicle Damage Scale	1-RFQ-4
CDC	01FREW4
Maximum Intrusion	None

Figure 2 Summary of Test 2-11









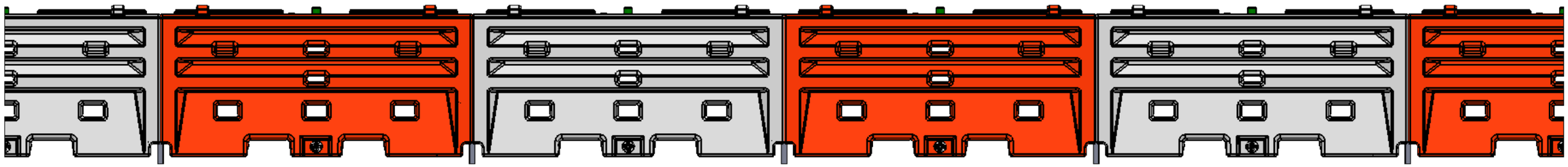
Low Rotation (LR) Water Cable Barrier
5. Color: Orange and White
4. Empty Weight: 159 lbs. [72.2 kg]
3. Filled Weight: Approx. 1633 lbs. [740.8 kg]
2. Material: Plastic Polyethylene
1. Units: Inches [mm]
NOTES: UNLESS OTHERWISE SPECIFIED

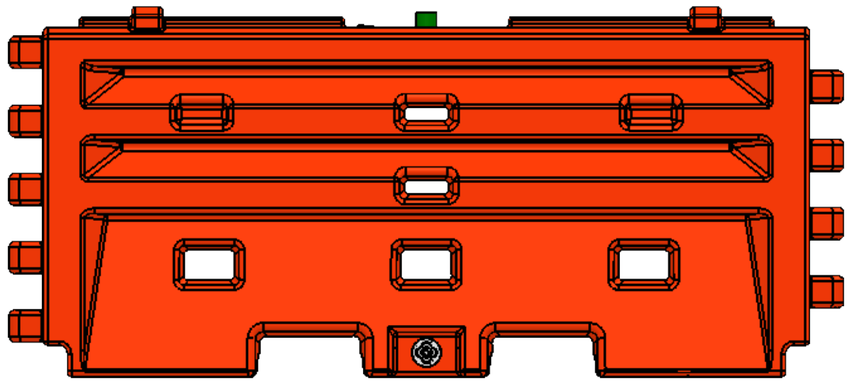
UNLESS OTHERWISE SPECIFIED:
ALL DIMENSIONS ARE IN mm.

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

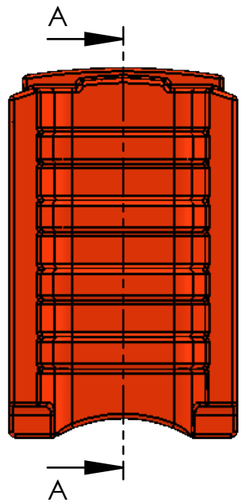
TITLE:
Low Rotation (LR) Water Cable Barrier Module

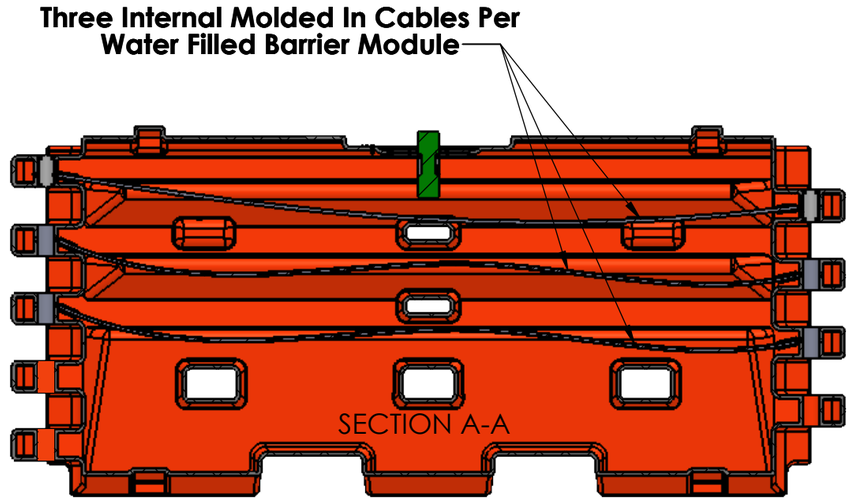
DRAWN BY: Christopher Jaime	DATE: 11/9/17	SIZE **B**	DWG. NO. 300-280
CHECKED BY: FA	DATE: 11/9/17		REV **B**
APPROVED BY: FA	DATE: 11/9/17		SHEET 1 OF 1





Sentry LR Water Cable Barrier with Molded Internal Cables





Module Section View Displaying Internal Molded In Cables

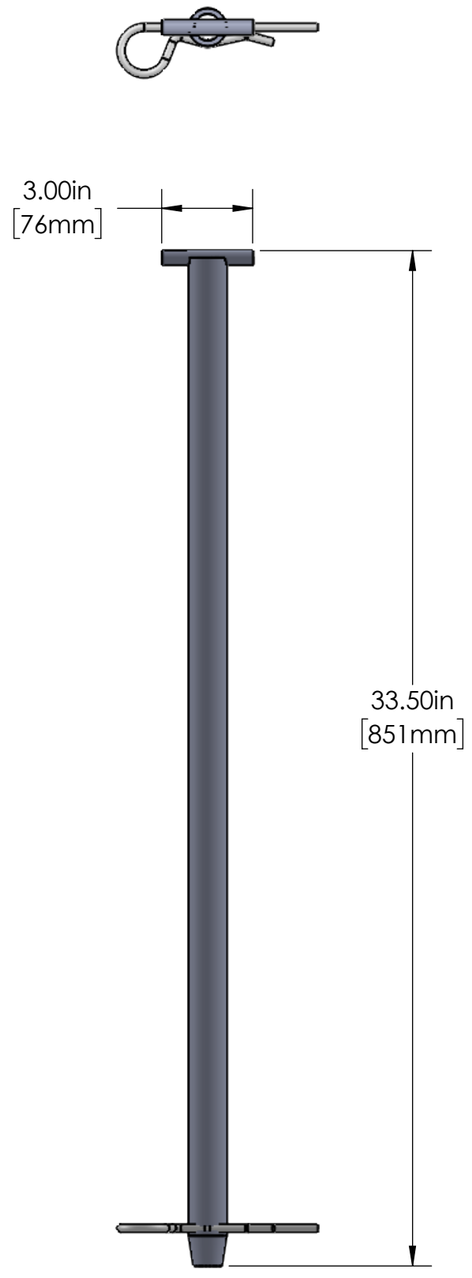
NOTES: UNLESS OTHERWISE SPECIFIED

UNLESS OTHERWISE SPECIFIED:
ALL DIMENSIONS ARE IN mm.

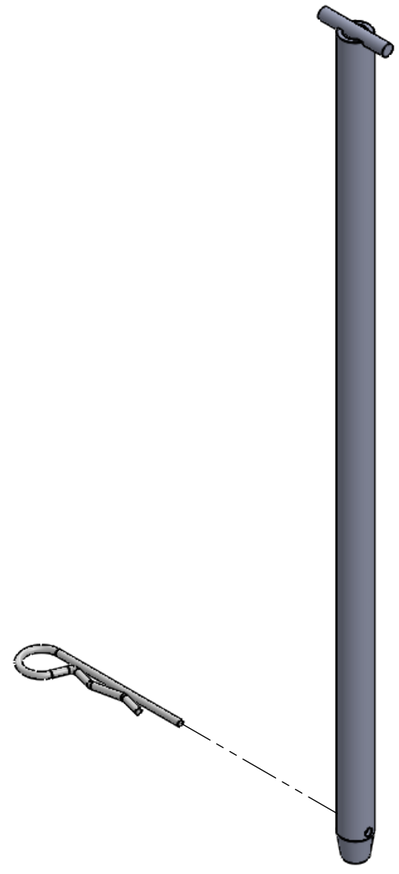
TrafFix Devices Inc.
160 Avenida La Pata
San Clemente, CA 92673
(949) 361-5663
FAX (949) 361-9205
www.traffixdevices.com

TITLE:
Low Rotation (LR)
Water Cable Barrier Array with
Internal Molded In Cables

DRAWN BY: Christopher Jaime	DATE: 6/8/17	SIZE B	DWG. NO. 300-268
CHECKED BY: FA	DATE: 6/8/17		REV B
APPROVED BY: FA	DATE: 6/8/17		SHEET 1 OF 1



T-PIN w/ KEEPER PIN



1. Units: Inches [mm]

NOTES: UNLESS OTHERWISE SPECIFIED

UNLESS OTHERWISE SPECIFIED:
ALL DIMENSIONS ARE IN INCHES[mm].
TOLERANCES:
FRACTIONAL: X/X ± 1/16" [1.6mm]
DECIMAL: X.X ± .0625"
X.XX ± .032"
X.XXX ± .015"
DEGREES: ± 0.5°

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

TITLE:

Low Rotation (LR) Barrier Hardware

DRAWN BY: Christopher Jaime	DATE: 2/23/18	
CHECKED BY: FA	DATE: 2/23/18	
APPROVED BY: FA	DATE: 2/23/18	

SIZE	DWG. NO.	REV
B	300-298	A

SHEET 1 OF 1