U.S. Department
of Transportation
Federal Highway Administration

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

February 14, 2018

In Reply Refer To:
HSST-1/B-298

Mr. Russell Hood
Safe Barriers Pte. Ltd.
PO Box 148 Novena Post Office
Singapore 913017

Dear Mr. Hood:

This letter is in response to your October 9, 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-298 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:

- Defender Barrier 100 LDS

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: Defender Barrier 100 LDS
Type of system: Longitudinal Barrier
Test Level: MASH Test Level 3 (TL3)
Testing conducted by: Holmes Solutions
Date of request: October 8, 2017
Date initially acknowledged: October 15, 2017

FHWA concurs with the recommendation of the accredited crash testing laboratory on the attached form. Though the laboratory conducted Test 3-21 Transition test for an attachment between test article and an attenuator and included this test in this submission, this eligibility letter is for barrier length of need only.

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-298 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,

Michael S. Griffith

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:	October 4, 2017	◉ New ○ Resubmission
	Name:	Russell Hood	
	Company:	Safe Barriers Pte. Ltd.	
	Address:	PO Box 148, Novena Post Office, Singapore 913017	
	Country:	Singapore	
	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	Defender Barrier 100LDS	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:	Russell Hood	Same as Submitter ☒
Company Name:	Safe Barriers Pte. Ltd.	Same as Submitter ☒
Address:	PO Box 148, Novena Post Office, Singapore 913017	Same as Submitter ☒
Country:	Singapore	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.

Holmes Solutions performs crash testing activities for Safe Barriers Pte. Ltd. For the completion of these services, Holmes Solutions receive payment in the form of professional fees. In no circumstance are these fees received linked to the performance of the product not the outcome of the tests. In accordance with the requirements of Holmes Solutions ISO 17025 accreditation, all testing activities are completed free from undue commercial influence.
Holmes Solutions does not have, nor ever had, any financial interest in Safe Barriers or any of the products that they sell. Holmes Solutions does not receive and research funding or other forms of payment from Safe Barriers. Holmes Solutions have no business ownership or investment interest in Safe Barriers. No licensing agreements exist between Holmes Solutions and Safe Barriers.

PRODUCT DESCRIPTION

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

The Defender Barrier™ 100 LDS (Low Deflection System) is an anchored Test Level 3 longitudinal steel temporary barrier system with an integrated Test Level 3 transition consisting of :

Steel Barrier Segments - Barrier segments are manufactured from Q235B grade steel with a nominal 3.0mm wall thickness. Each barrier measures 3960mm (155.9") long x 800mm (31.4") high x 680mm (26.7") wide and have a dry weight of 303kg (668.1lbs). Each of the steel barriers connect together via interlocking flanges and a steel galvanized connecting pin at each end. The installed length of each barrier segment is 3900mm (153.5"). The two lifting points for the barrier are approximately 1350mm (53.15") apart.

Connecting Pins - Galvanized connecting pins connecting the barrier segments are manufactured from Q235B steel and measure 30mm (1.18") diameter x 550mm (21.6") long. The top of the pin has a 50mm (2") wide x 9.5mm (0.37") thick plate welded 5mm down from the top end of the bar. Pins are fitted vertically down through interlocking lugs of the barrier segment forming a hinge type joint.

Ground Anchor Pins - The ground anchor pins that anchor the barrier segments are manufactured from Q235B steel and measure 30mm (1.18") diameter x 500mm (19.68"). The top of the pin has a 60mm (2.36") wide x 20mm (0.78") thick plate welded 5mm down from the top end of the bar. Pins are fitted vertically down through purpose made holes for the ground anchor pins, which also function as drain holes. The ground anchor pins are not galvanized. The Defender Barrier™ 100 LDS is anchored every 9.15m with 2 ground anchor pins, 1 ground anchor pin on each side of the 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:	Emerson Ryder	
Engineer Signature:	Emerson Ryder Digitally signed by Emerson Ryder Date: 2018.02.09 15:49:32 +13'00'	
Address:	level 2, 254 Montreal Street, Christchurch	Same as Submitter ☐
Country:	New Zealand	Same as Submitter ☐

A brief description of each crash test and its result:

Required Test Number	Narrative Description	Evaluation Results
3-10 (1100C)	Holmes Crash Test No. 131393.3-10LDS was performed on 19 July 2017. The Defender Barrier™ 100 LDS successfully contained and redirected the 1100c test vehicle impacting the test article at 24.9 degrees and a velocity of 99.3 km/h (61.7 mph). Maximum dynamic deflection was 0.56m (22"). The test vehicle impacted the test installation 1.4m downstream from ground anchor pin 9 at barrier 8, and 7.7m upstream from ground anchor pin 11 at barrier 10. The CIP was chosen to maximize the OIV and vehicle damage. The test article was anchored with 2 ground anchor pins (1 each side) at barrier 8 and barrier 10, with a distance of 9.15m between anchors. The test article was anchored to 150mm (6") asphalt over 150mm (6") compacted sub-base. No debris or detached elements penetrated or showed potential to penetrate the occupant compartment. No fragments were distributed outside of the vehicle trajectory. The trajectory of the vehicle was such that it did not present any undue hazard to other traffic, pedestrians or work zone personnel. The vehicle remained upright during and after the impact and vehicle stability was considered satisfactory. Occupant risk factors satisfied the test criteria and the vehicle trajectory remained within acceptable limits.	PASS

Required Test Number	Narrative Description	Evaluation Results
3-11 (2270P)	Holmes Crash Test No. 131393.3-11LDS was performed on 28 February 2017. The Defender Barrier™ 100 LDS successfully contained and redirected the 2270P test vehicle impacting the test article at 24.9 degrees and a velocity of 101.3 km/h (62.9 mph). Maximum dynamic deflection was 0.88m (34.6"). The test vehicle impacted the test installation 2.3m downstream from ground anchor pin 9 at barrier 8, and 6.8m upstream from ground anchor pin 11 at barrier 10. The CIP was chosen to test the containment and vehicle stability while also imparting the most amount of load on the connection detail. The test article was anchored with 2 ground anchor pins (1 each side) at barrier 8 and barrier 10, with a distance of 9.15m between anchors. The test article was anchored to 150mm (6") asphalt over 150mm (6") compacted sub-base. No debris or detached elements penetrated or showed potential to penetrate the occupant compartment. No fragments were distributed outside of the vehicle trajectory. The trajectory of the vehicle was such that it did not present any undue hazard to other traffic, pedestrians or work zone personnel. The vehicle remained upright during and after the impact and vehicle stability was considered satisfactory. Occupant risk factors satisfied the test criteria and the vehicle trajectory remained within acceptable limits.	PASS
3-20 (1100C)		Non-Relevant Test, not conducted
3-21 (2270P)		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:	Holmes Solutions	
Laboratory Signature:	Emerson Ryder — Digitally signed by Emerson Ryder Date: 2018.02.09 15:50:22 +13'00'	
Address:	level 2, 254 Montreal Street, Christchurch	Same as Submitter ☐
Country:	New Zealand	Same as Submitter ☐
Accreditation Certificate Number and Dates of current Accreditation period :	7559 1022 23 July 2009 to present day NZS ISO/IEC 17025:2005	

Submitter Signature*: Russell Hood Digitally signed by Russell Hood Date: 2018.02.09 11:06:11 +08'00'

Submit Form

ATTACHMENTS

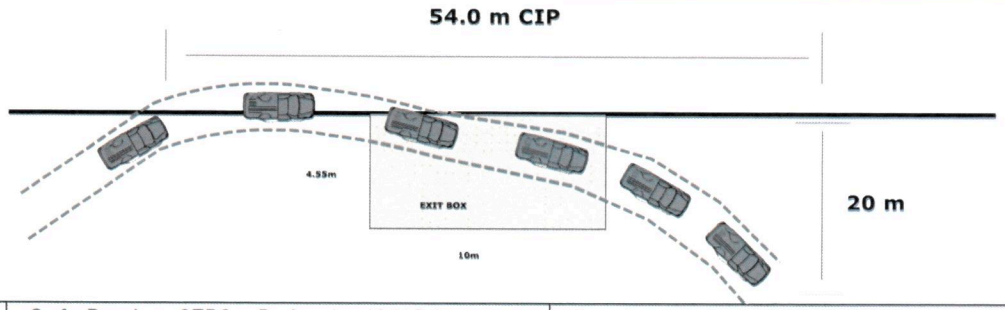
Attach to this form:

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

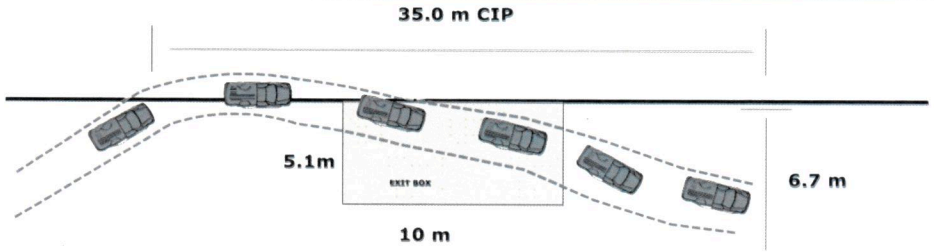
0.00 s	0.125 s	0.250 s	0.375 s	0.500 s



Test Article:	Safe Barriers STBS – Defender 100LDS
Total Length	78.0 m
Key Elements - Barrier	Test 3-10
Description	Ground anchored every second barrier STBS
Length of Barrier Installation	78.0 m length of need
Height	0.80 m
Length of Barrier Segments	3.9 m
Test Vehicle	
Designation	1100C
Make/Model	Nissan Tiida
Dimensions (LxWxH)	4320 mm x 1695 mm x 1520 mm
Curb Wt	1050 kg
Test Inertial Wt	1075 kg
Gross Static	1150 kg
Impact Conditions	
Speed	99.3 km /h
Angle	24.9 degrees
Impact Point	1040 mm upstream of barrier joint 8B
Exit Conditions	
Exit Speed:	86.4 km/h
Exit Angle:	12° Est
Test Number	131393.3-10LDS
Test Date	19 July 2017

Post Impact Vehicle Behaviour		
Vehicle Stability	Good	
Stopping Distance	54.0 m	
Vehicle Snagging	None	
Vehicle Pocketing	None	
Occupant Impact Velocity (m/s)	0.1100 seconds right side of interior	
Longitudinal	4.5	
Lateral (optional)	-6.6	
Occupant Ride-down Deceleration		
X-direction (g)	-6.8	(2.4405 - 2.4505 seconds)
Y-direction (g)	11.4	(0.1530 - 0.1630 seconds)
THIV (optional) (m/s)	7.8	
PHD (optional) (g)	12.4	(0.1529 - 0.1629 seconds)
ASI (optional)	1.11	(0.0249 - 0.0749 seconds)
Test Article Damage	Minor	
Test Article Deflections		
Dynamic	0.56 m	
Permanent	0.29 m	
Working Width	0.56 m	
Vehicle Damage Exterior		
VDS	11FL-2	
CDC	11LFEE2	
Maximum Deformation	110 mm	

0.00 s	0.18 s	0.35 s	0.56 s	0.75 s



Test Article:	Safe Barriers STBS – Defender 100LDS
Total Length	78.0 m
Key Elements - Barrier	Test 3-11
Description	Ground anchored every second barrier STBS
Length of Barrier Installation	78.0 m length of need
Height	0.80 m
Length of Barrier Segments	3.9 m
Test Vehicle	
Designation	2270P
Make/Model	Dodge Ram 1500 Quad Cab
Dimensions (LxWxH)	5710 mm x 2010 mm x 1890 mm
Curb Wt	2212.0 kg
Test Inertial Wt	2275.0 kg
Gross Static	2275.0 kg
Impact Conditions	
Speed	101.3 km /h
Angle	24.9 degrees
Impact Point	320 mm upstream of barrier joint 8B
Exit Conditions	
Exit Speed:	61 km/h
Exit Angle:	5.0°
Test Number	131393.3-11LDS
Test Date	28 February 2017

Post Impact Vehicle Behaviour		
Vehicle Stability	Good	
Stopping Distance	35.0 m	
Vehicle Snagging	None	
Vehicle Pocketing	None	
Occupant Impact Velocity (m/s)	0.1453 seconds on front of interior	
Longitudinal	4.3	
Lateral (optional)	4.3	
Occupant Ride-down Deceleration		
X-direction (g)	-16.8	(0.1977 - 0.2077 seconds)
Y-direction (g)	-10.0	(0.1466 - 0.1566 seconds)
THIV (optional) (m/s)	6.1	
PHD (optional) (g)	16.9	(0.1975 - 0.2075 seconds)
ASI (optional)	0.81	(0.1251 - 0.1751 seconds)
Test Article Damage	Moderate	
Test Article Deflections		
Dynamic	0.88 m	
Permanent	0.57 m	
Working Width	0.88 m	
Vehicle Damage Exterior		
VDS	11FL-3	
CDC	11LFEE3	
Maximum Deformation	215 mm	