



U.S. Department
of Transportation
**Federal Highway
Administration**

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

September 25, 2017

In Reply Refer To:
HSST-1/B-287

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

Dear Mr. Russell Hood:

This letter is in response to your June 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-287 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™ 70

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™ 70

Type of system: Longitudinal Barrier

Test Level: MASH Test Level 2 (TL2)

Testing conducted by: Holmes Solutions

Date of request: July 6, 2017

Date initially acknowledged: July 6, 2017

FHWA concurs with the recommendation of the accredited crash testing laboratory on the length- of-need tests for Defender Barrier™ 70 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-287 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,

A handwritten signature in blue ink, appearing to read "Robert Ritter", with a stylized flourish at the end.

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:	June 15, 2017	<input checked="" type="radio"/> New <input type="radio"/> 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)	<input checked="" type="radio"/> Physical Crash Testing <input type="radio"/> Engineering Analysis	Defender Barrier™ 70	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:	Russell Hood	Same as Submitter <input checked="" type="checkbox"/>
Company Name:	Safe Barriers Pte. Ltd.	Same as Submitter <input checked="" type="checkbox"/>
Address:	PO Box 148, Novena Post Office, Singapore 913017	Same as Submitter <input checked="" type="checkbox"/>
Country:	Singapore	Same as Submitter <input checked="" type="checkbox"/>
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™ 70 is an unanchored Test Level 2 longitudinal steel temporary barrier system 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 320kg (705.6lbs). 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.

Ballast Boxes - Three ballast boxes measuring 954mm (37.55") long x 788mm (31") high x 150mm (5.9") wide. Each ballast box can hold 0.1 cubic meter of concrete, approximately 240kg (529.2lbs) in weight. There is a filling hole measuring 110mm (4.33") x 190mm (7.48") for each ballast box. Each ballast box is connected to the barrier segment with four (4) M16 G8.8 bolts.

End Treatments - The test article incorporated the ABSORB 350 crash cushion with transition adapter straps that connect to the Defender Barrier™ 70. The adapter straps which attach between the adapter tapered ABSORB and the first Defender Barrier™ 70 segment require purpose drilled 22mm holes on the first barrier segment to attach M20 8.8G threaded rod to attach the straps.

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: 2017.06.15 04:46:40 +12'00'
Address:	7 Canterbury Street Christchurch	Same as Submitter <input type="checkbox"/>
Country:	New Zealand	Same as Submitter <input type="checkbox"/>

A brief description of each crash test and its result:

Required Test Number	Narrative Description	Evaluation Results
2-10 (1100C)	<p>Holmes Crash Test No. 131393.2-10 was performed on 27th April 2017. The Defender Barrier™ 70 successfully contained and redirected the 1100c vehicle impacting the test article at 24.7 degrees and a velocity of 69.4km/h (43.1mph). Maximum dynamic deflection during the test was 0.74m (29.1").</p> <p>The test vehicle impacted the test installation 1100mm upstream of barrier joint 10B. The CIP was chosen to maximize the potential to snag a wheel on the adjoining barriers and also to increase the Occupant Impact Velocity (OIV).</p> <p>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.</p> <p>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 exit trajectory remained within acceptable limits.</p>	PASS

Required Test Number	Narrative Description	Evaluation Results
2-11 (2270P)	<p>Holmes Crash Test No. 131393.2-11 was performed on 27th April 2017. The Defender Barrier™ 70 successfully contained and redirected the 2270P vehicle impacting the test article at 24.7 degrees and a velocity of 70.2km/h (43.6mph). Maximum dynamic deflection during the test was 1.20m (47.2").</p> <p>The test vehicle impacted the test installation 600mm upstream of barrier joint 10B. The CIP was chosen to test the containment and vehicle stability, while also imparting the most amount of load on the connection joint.</p> <p>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.</p> <p>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 exit trajectory remained within acceptable limits.</p>	PASS

2-20 (1100C)	<p>Holmes Crash Test No. 131393.2-20 was performed on 11th May 2017. The Defender Barrier™ 70 successfully contained and redirected the 1100c vehicle impacting the test article at 24.8 degrees and a velocity of 71.5 km/h (44.4 mph). Maximum dynamic deflection during the test was 1.20m (47.2").</p> <p>The test vehicle impacted the test installation 0mm upstream of barrier transition assembly. The CIP was chosen to maximize the potential to snag a wheel on the adjoining barriers, verify vehicle trajectory and also to increase the Occupant Impact Velocity (OIV).</p> <p>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.</p> <p>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 exit trajectory remained within acceptable limits.</p>	PASS
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2-21 (2270P)	<p>Holmes Crash Test No. 131393.2-21 was performed on 11th May 2017. The Defender Barrier™ 70 successfully contained and redirected the 2270P vehicle impacting the test article at 25.4 degrees and a velocity of 71.6 km/h (44.5 mph). Maximum dynamic deflection during the test was 2.80m (110.2").</p> <p>The test vehicle impacted the test installation 0mm upstream of barrier transition assembly. The CIP was chosen to maximize the potential for vehicle roll over, to verify vehicle trajectory and structural capacity of the test article.</p> <p>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.</p> <p>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 exit trajectory remained within acceptable limits.</p>	PASS
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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: 2017.06.15 04:54:42 +12'00'
Address:	7 Canterbury Street Christchurch	Same as Submitter <input type="checkbox"/>
Country:	New Zealand	Same as Submitter <input type="checkbox"/>
Accreditation Certificate Number and Dates of current Accreditation period :	ISO/IEC 17025:2005 IANZ Certificate Number:1022 23 July 2009 to present Day	

Submitter Signature*: **Russell Hood** Digitally signed by Russell Hood
Date: 2017.06.15 08:59:49 +08'00'

Submit Form

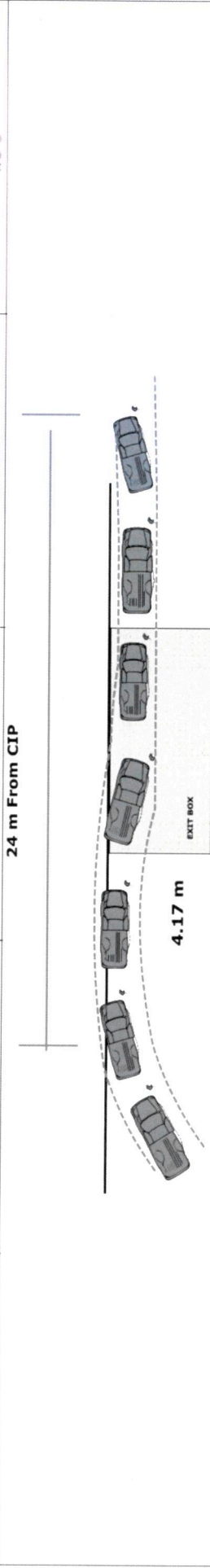
ATTACHMENTS

Attach to this form:

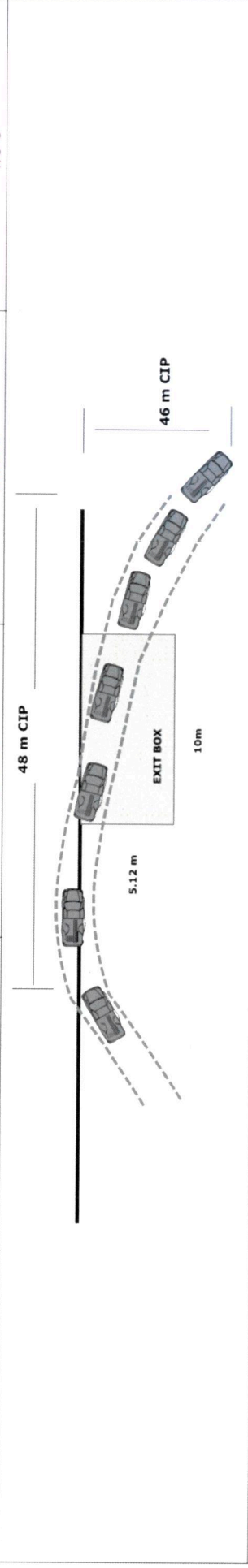
- 1) Additional disclosures of related financial interest as indicated above.
- 2) A copy of the full test report, video, and a Test Data Summary Sheet for each test conducted in support of this request.
- 3) A drawing or drawings of the device(s) that conform to the Task Force-13 Drawing Specifications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



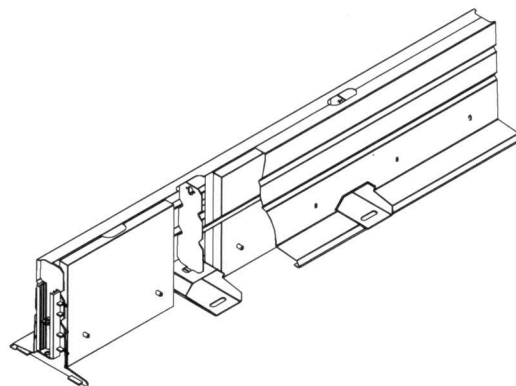
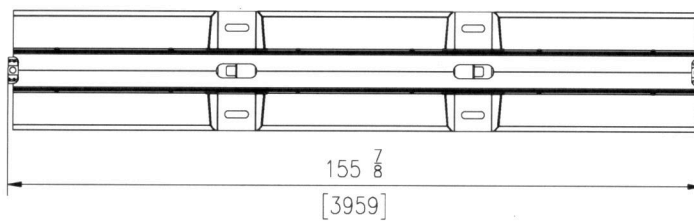
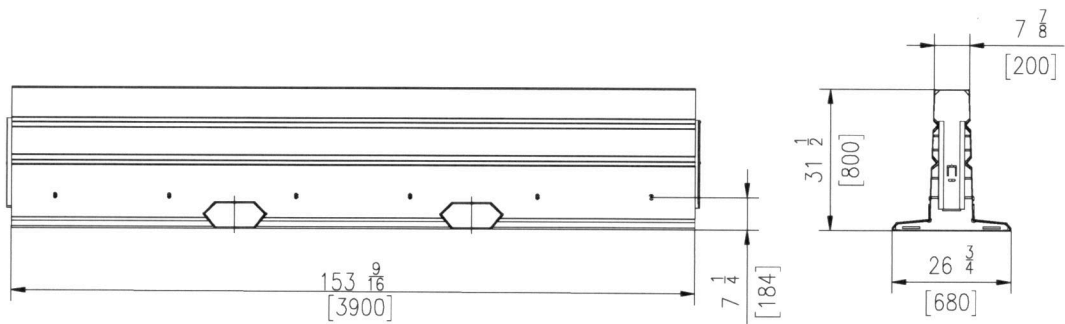
Test Article:		Safe Barriers Ballasted STBS - Defender 70		Post Impact Vehicle Behaviour	
Total Length		105.3 m		Vehicle Stability	
Key Elements - Barrier		Test 2-10		Stopping Distance	
Description		Steel Temporary Barrier System		Vehicle Snagging	
Length of Barrier Installation		105.3 m length of need		Vehicle Pocketing	
Height		0.80 m		Occupant Impact Velocity (m/s)	
Length of Barrier Segments		3.9 m		Longitudinal	
Test Vehicle				Lateral (optional)	
Designation		1100C		Occupant Ride-down Deceleration	
Make/Model		Nissan Tiida		X-direction (g)	
Dimensions (LxWxH)		4350 mm x 1695 mm x 1535 mm		Y-direction (g)	
Curb Wt		1096.0 kg		THIV (optional) (m/s)	
Test Inertial Wt		1083.0 kg		PHD (optional) (g)	
Gross Static		1158.0 kg		ASI (optional)	
Impact Conditions				Test Article Damage	
Speed		69.4 km /h		Test Article Deflections	
Angle		24.7 degrees		Dynamic	
Impact Point		1100 mm upstream of barrier joint 10B		Permanent	
Exit Conditions				Working Width	
Exit Speed:		41 km/h		Vehicle Damage Exterior	
Exit Angle:		1.0° Est		VDS	
				CDC	
				Maximum Deformation	



Test Article:		Safe Barriers Ballasted STBS – Defender 70		Post Impact Vehicle Behaviour	
Total Length		105.3 m		Vehicle Stability	
Key Elements - Barrier		Test 2-11		Stopping Distance	
Description		Steel Temporary Barrier System		Vehicle Snagging	
Length of Barrier Installation		105.3 m length of need		Vehicle Pooketing	
Height		0.80 m		Occupant Impact Velocity (m/s)	
Length of Barrier Segments		3.9 m		Longitudinal	
Test Vehicle				Lateral (optional)	
Designation		2270P		Occupant Ride-down Deceleration	
Make/Model		Dodge Ram 1500 Quad Cab		X-direction (g)	
Dimensions (LxWxH)		5785 mm x 1995 mm x 1890 mm		Y-direction (g)	
Curb Wt		2203.0 kg		THIV (optional) (m/s)	
Test Inertial Wt		2277.0 kg		PHD (optional) (g)	
Gross Static		2277.0 kg		ASI (optional)	
Impact Conditions				Test Article Damage	
Speed		70.2 km /h		Test Article Deflections	
Angle		24.7 degrees		Dynamic	
Impact Point		600 mm upstream of barrier joint 10B		Permanent	
Exit Conditions				Working Width	
Exit Speed:		48 km/h		Vehicle Damage Exterior	
Exit Angle:		12.0° Est		VDS	
				CDC	
				Maximum Deformation	

				
<p>40 m From CIP</p>  <p>4.17 m</p> <p>10 m</p>				
Test Article: Total Length Key Elements - Barrier Description Length of Barrier Installation Height Length of Barrier Segments		Safe Barriers Ballasted STBS with Absorb™ 112.3 m Test 2-20 Steel Temporary Barrier System 105.3 m length of need 0.80 m 3.9 m		
Test Vehicle Designation Make/Model Dimensions (LxWxH) Curb Wt Test Inertial Wt Gross Static		1100C Nissan Tiida 4150 mm x 1695 mm x 1520 mm 1107.5 kg 1090.5 kg 1165.5 kg		
Impact Conditions Speed Angle Impact Point		71.5 km /h 24.8 degrees 0 mm upstream of transition section		
Exit Conditions Exit Speed: Exit Angle:		37 km/h 1.0° Est		
Post Impact Vehicle Behaviour Vehicle Stability Stopping Distance Vehicle Snagging Vehicle Pooketing		Good 40.0 m None None		
Occupant Impact Velocity (m/s) Longitudinal Lateral (optional)		0.1231 seconds right side of interior -2.5 3.9		
Occupant Ride-down Deceleration X-direction (g) Y-direction (g) THIV (optional) (m/s) PHD (optional) (g) ASI (optional)		3.6 -9.3 5.2 9.5 0.56		
Test Article Damage Test Article Deflections Dynamic Permanent Working Width		Minor 1.20 m 1.20 m 1.20 m		
Vehicle Damage Exterior VDS CDC Maximum Deformation		11FL-1 11LFEE1 60 mm		

						
<div><div>0.00 s</div><div>0.25 s</div><div>0.50 s</div><div>0.75 s</div><div>1.0 s</div></div> <div><div>51 m From CIP</div><div><div>5.2 m</div><div>10 m</div></div></div>						
Test Article:		Safe Barriers Ballasted STBS with Absorb™			Post Impact Vehicle Behaviour	
Total Length		112.3 m			Vehicle Stability Good	
Key Elements - Barrier		Test 2-21			Stopping Distance 51.0 m	
Description		Steel Temporary Barrier System			Vehicle Snagging Very Minor	
Length of Barrier Installation		105.3 m length of need			Vehicle Pocketing None	
Height		0.80 m			Occupant Impact Velocity (m/s)	
Length of Barrier Segments		3.9 m			Longitudinal 0.1410 seconds right side of interior -3.1	
Test Vehicle					Lateral (optional) 3.6	
Designation		2270P			Occupant Ride-down Deceleration	
Make/Model		Dodge Ram 1500 Quad Cab			X-direction (g) 1.5 [0.6055 - 0.6155 seconds]	
Dimensions (LxWxH)		5720 mm x 1995 mm x 1885 mm			Y-direction (g) -4.2 [0.6040 - 0.6140 seconds]	
Curb Wt		2266.0 kg			THIV (optional) (m/s) 5.1	
Test Inertial Wt		2263.0 kg			PHD (optional) (g) 4.4 [0.6043 - 0.6143 seconds]	
Gross Static		2263.0 kg			ASI (optional) 0.64 [0.0359 - 0.0859 seconds]	
Impact Conditions					Test Article Damage Minor	
Speed		71.6 km /h			Test Article Deflections	
Angle		25.4 degrees			Dynamic 2.80 m	
Impact Point		0 mm upstream of transition section			Permanent 2.80 m	
Exit Conditions					Working Width 2.80 m	
Exit Speed:		56 km/h			Vehicle Damage Exterior	
Exit Angle:		1.0° Est			VDS 11FL-1	
					CDC 11LFEE1	
					Maximum Deformation 100 mm	



Steel Barrier Segment

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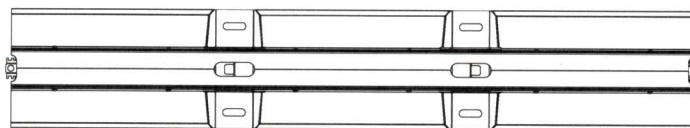
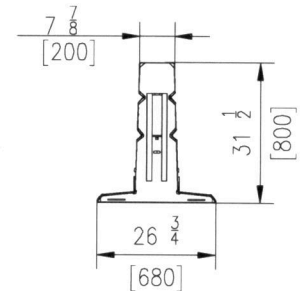
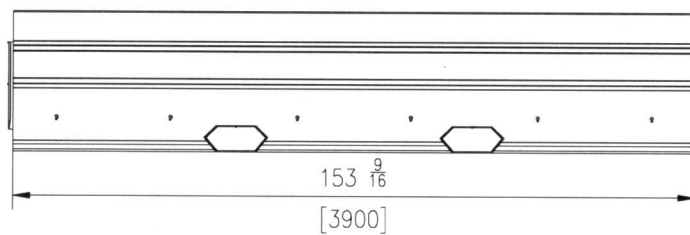
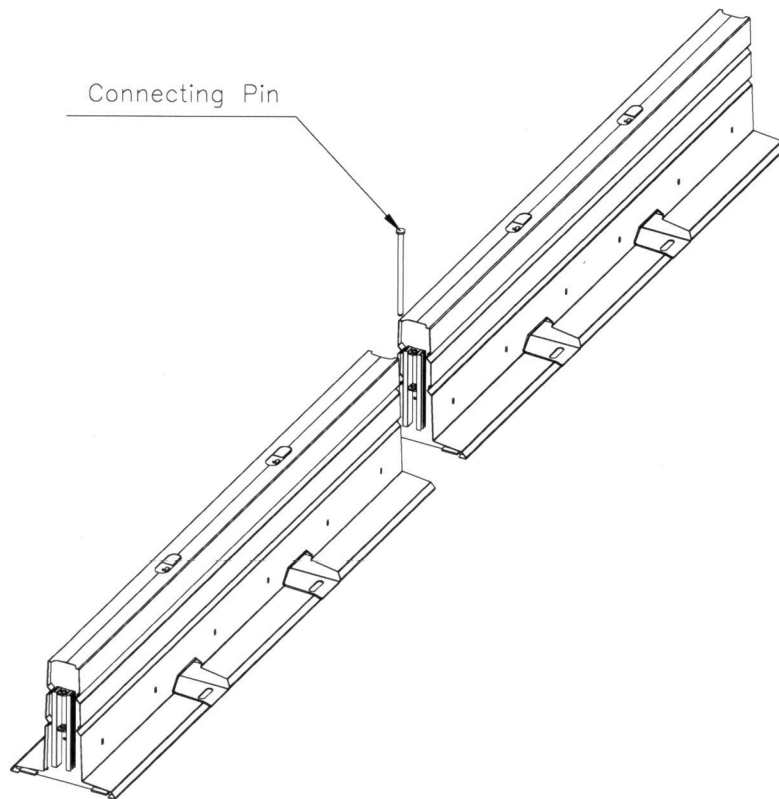
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Steel Barrier Segments Connection

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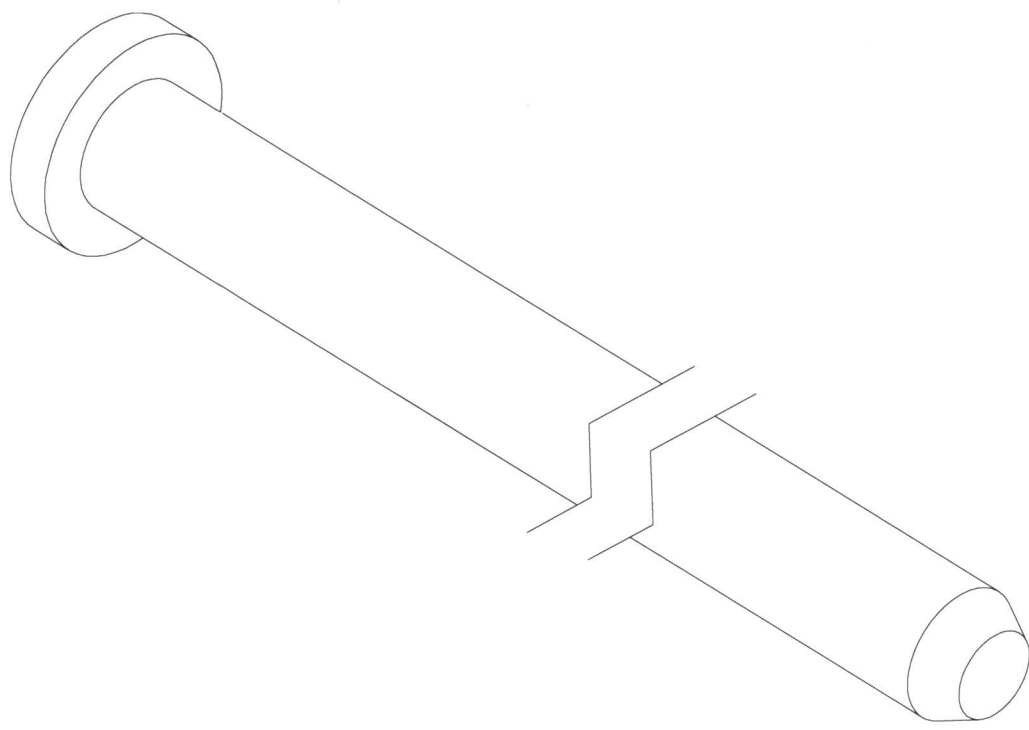
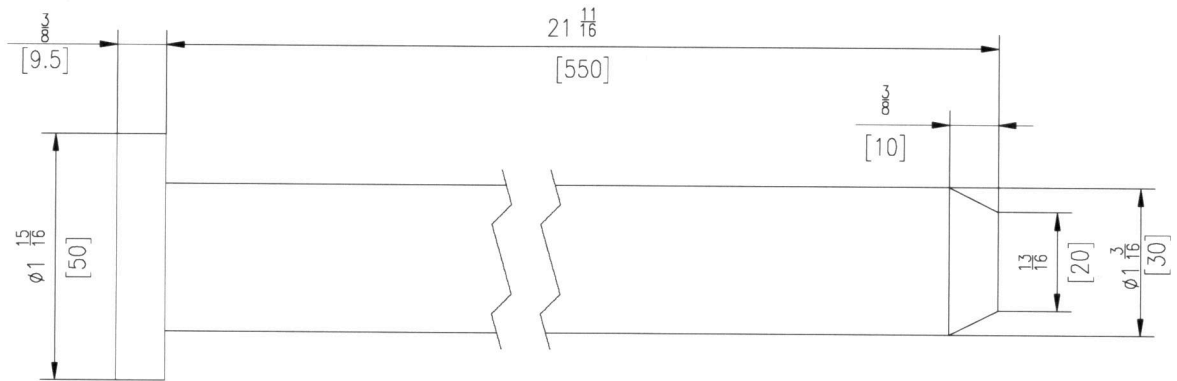
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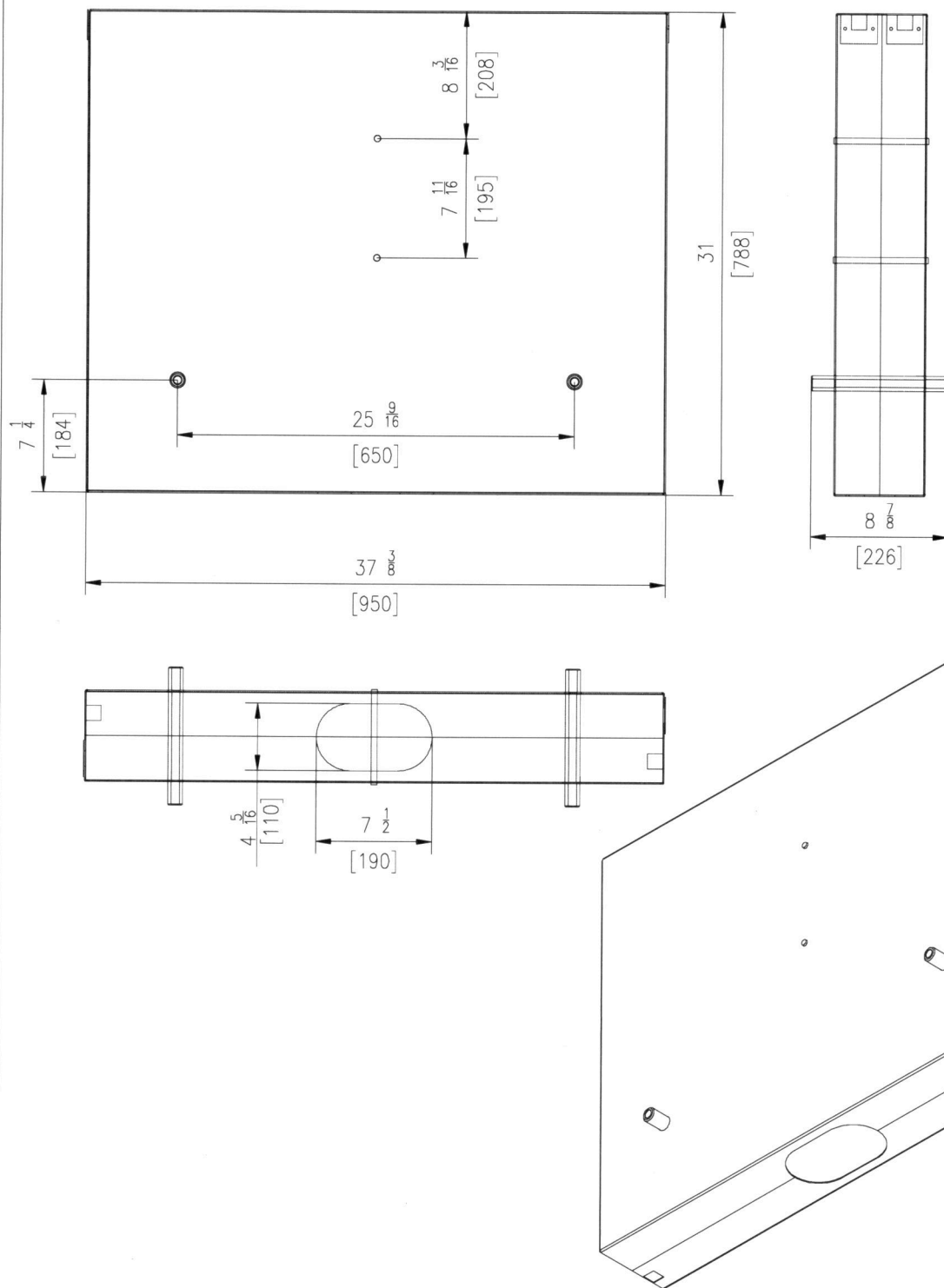
Connecting Pin

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D10

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Ballast Box

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D8

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INTENDED USE

The Defender Barrier™ 70 Test Level 2 Steel Temporary Barrier is designed to be used in work zones in Highway, Arterial, Collector and Local Roads where construction speed limits are 70km/hour (43.7mph) or less.

The Defender Barrier™ 70 is a free standing, ballasted temporary longitudinal barrier that provides positive protection for both construction workers and motorists driving through these lower speed work zone.

The Defender Barrier™ 70 is made up of 3 primary components, the main Defender Barrier™ body, three (3) ballast boxes filled with concrete and one (1) connecting pin. The Defender Barrier™ 70 is compatible with the ABSORB 350® Crash Cushion

APPROVALS

The Defender Barrier™ 70 Steel Temporary Barrier has been fully testing in conformance with MASH Test Level 2 guidelines

FHWA Acceptance Letter: TBD

CONTACT INFORMATION

Safe Barriers Pte. Ltd.
PO Box 148, Novena Post Office
Singapore 913017

www.safebarriers.com

Tel: +65 3159 1857

Email: info@safebarriers.com



Defender Barrier™ 70

D70

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2 June 2017

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SPECIFICATIONS

COMPONENTS

Effective Unit Barrier Length 153.5" (3900 mm)

Description	Material	Quantity
Defender Barrier™ Main Body		1
Ballast Box	Q235B	3
Concrete Ballast	M25 Grade Concrete	0.1m ³ per box
M16 Bolts	G8.8	12
Connecting Pin	Q235B	1

Defender Barrier™ 70

D70

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