U.S. Department
of Transportation
Federal Highway
Administration

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

November 1, 2017

In Reply Refer To:
HSST-1/B-252A

Mr. John Wheatland
Midwest Traffic Controllers Pty Ltd
KSI Global Australia Pty Ltd
61 Foskew Way
Narngulu WA 6532
Australia

Dear Mr. Wheatland:

This letter is in response to your September 25, 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-252A 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:

- Safety Roller Barrier TL3 Transition to W-Beam

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: Safety Roller Barrier TL3 Transition to W-Beam
Type of system: Longitudinal Barrier
Test Level: MASH Test Level 3 (TL3)
Testing conducted by: Holmes Solutions
Date of request: September 26, 2017
Date initially acknowledged: September 27, 2017

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 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-252A 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:	March 14, 2017	(•) New ( ) Resubmission
	Name:	Ben Poulter	
	Company:	Holmes Solutions LP	
	Address:	7 Canterbury St, Hornby, Christchurch, 8042	
	Country:	New Zealand	
	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	Safety Roller Barrier TL3 Transition to W-Beam	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:	John Wheatland	Same as Submitter ☐
Company Name:	Midwest Traffic Controllers Pty Ltd trading as KSI Global Australia Pty. Ltd.	Same as Submitter ☐
Address:	61 Foskew Way, Narngulu WA 6532	Same as Submitter ☐
Country:	Australia	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.		
See attached letter titled 102350 25LT0815 100 (v1.0).		

PRODUCT DESCRIPTION

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

Safety Roller Barrier TL3 Transition to W-Beam

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: 2017.09.26 12:54:26 +13'00'	
Address:	7 Canterbury St, Hornby, Christchurch 8042	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)	Already Approved for Eligibility B-252	Non-Relevant Test, not conducted
3-11 (2270P)	Already Approved for Eligibility B-252	Non-Relevant Test, not conducted

Required Test Number	Narrative Description	Evaluation Results
3-20 (1100C)	Test 20 for a transition section is an optional test to evaluate the occupant risk and post-impact trajectory criteria for all test levels. It should be conducted if there is reasonable uncertainty regarding the impact performance of the system for impacts with small passenger vehicles. The primary concerns with respect to the small vehicle testing is the increased occupant hazard associated with high ride down accelerations, vehicle underride and/or vehicle snagging. With respect to vehicle underride and/or vehicle snagging, it was determined that the likely worst case location for this to occur, is the location of the first stiffness change, namely the interface of the W-beam and the Transition section. This is also the largest distance between the road surface and lower rail height. The interface at this location is the same as the previously evaluated and FHWA approved transition, and as such, when determining whether to run test 3-20, this transition was reviewed. Specifically: STG01 W-Beam To Thrie-Beam Transition Furthermore; standard transitions with Asymmetrical transition sections with three posts across the transition section, were considered the same or worse with respect to vehicle underride and potential snagging, when compared to a symmetric transition STG01 and as such were also reviewed. Specifically: STG02 MGS W-Beam to Thrie-Beam Transition – (MASH TESTED, FHWA ref B187 and STG03 a-b MGS W-Beam to Thrie-Beam Transition with Standard Posts (MASH TESTED, FHWA ref B-231 (REVISED)) The result of these reviews determined that the impact performance, with respect to potential for vehicle underride and/or vehicle snagging, had been adequately determined and so it was considered unnecessary to run Test 3-20. With respect to the occupant ride downs, the Safety Roller Barrier LON was considered to be the stiffer of the two systems, (namely the "Transition" and the "Safety Roller Barrier LON.") As such, the testing undertaking on the Safety Roller LON with the small vehicle, namely test 4-10 was considered worst case with respect for occupant ride downs and so it was considered unnecessary to undertake further evaluation with the small vehicle to evaluate the potential for occupant ride downs.	Non-Critical, not conducted

3-21 (2270P)	The Transition zone between a W-beam guardrail system or W-Beam terminal end and the KSI Global Australia Pty Ltd Safety Roller Longitudinal barrier system when installed in AASHTO Standard Soil successfully contained and redirected a 2270P test vehicle impacting the test article at 25.0 degrees with a velocity of 102.3km/ hr. No debris or detached elements penetrated or showed potential to penetrate the occupant compartment. No fragments were distributed outside of the vehicle trajectory and therefore 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 exit trajectory remained within acceptable limits.	PASS

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: 2017.09.26 12:54:47 +13'00'	
Address:	7 Canterbury St, Hornby, Christchurch 8042	Same as Submitter ☐
Country:	New Zealand	Same as Submitter ☐
Accreditation Certificate Number and Dates of current Accreditation period :	ISO/IEC 17025:2005; IANZ Certificate Number: 1022 (23/07 /2009 thru Present)	

Submitter Signature*: Digitally signed by Ben Poulter Date: 2017.09.26 12:58:34 +13'00'

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

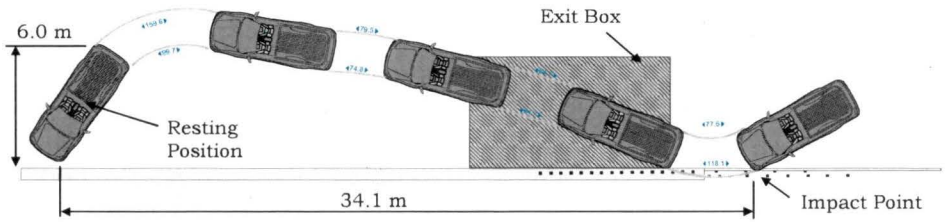

0.1 sec

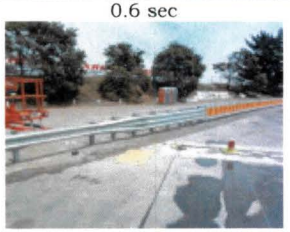

0.2 sec

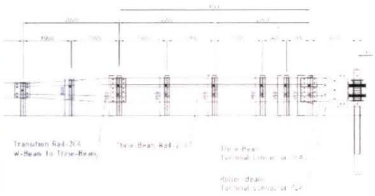

0.4 sec


0.6 sec

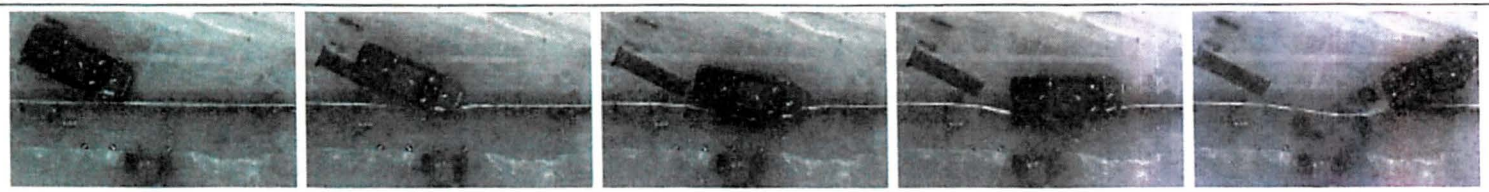

0.8 sec







- **Test Article** — Transition for Safety Roller Barrier System
- **Total Length** — 65 m
- **Key Elements – Barrier**
  - Description — W-beam to Safety Roller Barrier Transition zone
  - Length — 4.0 metre transition zone
  - Rail Height — 830 mm
  - Post Spacing — variable
- **Test Vehicle**
  - Designation — 2270P
  - Make/Model — 2005 Dodge Ram 1500 Quad Cab
  - Dimensions (lwh) — 5720 x 2050 x 1930 mm
  - Curb Weight — 2226 kg
  - Test Inertial weight — 2260 kg
  - Gross Static weight — 2260 kg
- **Impact Conditions**
  - Speed — 102.3 kph
  - Angle — 25°
  - Impact Point — 0.5 m upstream of 4th Transition post
- **Exit Conditions**
  - Exit Speed — est. 45.3 km/hr
  - Exit Angle — 14.0°
- **Post Impact Vehicle Behaviour**
  - Vehicle Stability — Moderate
  - Vehicle Stopping Distance — 34.1 metres
- **Vehicle Snagging** — minor
- **Vehicle Pocketing** — None
- **Occupant Impact Velocity**
  - Longitudinal — 0.3 m/s at 0.1129 sec
  - Lateral (optional) — 6.9 m/s at 0.1129 sec
- **Occupant Ridedown Deceleration**
  - x-direction — 0.6 g (0.1369 – 0.1469 s)
  - y-direction — 7.8 g (0.1811 - 0.1911 s)
  - THIV (optional) — 5.8 m/s at 0.1079 sec
  - PHD (optional) — 7.8 g (0.1811 – 0.1911 s)
- **Test Article Damage** — moderate
- **Test Article Deflections**
  - Dynamic — 0.609 m
  - Permanent — 0.260 m
  - Working Width — 0.609 m
- **Vehicle Damage - Exterior**
  - VDS — 11-LFQ-4
  - CDC — 11FLEE3
  - Max. Deformation — 145 mm



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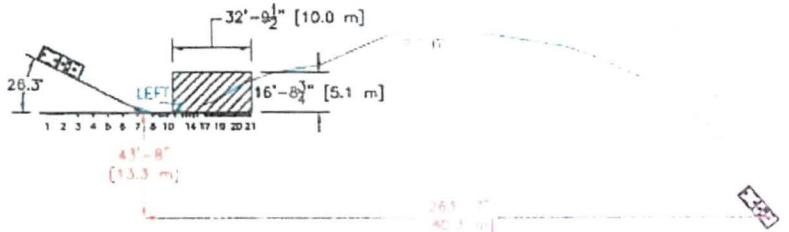
- Test Agency ..... MwRSF
- Test Number MWTSP-2
- Date 7/7/08
- MASH Test Designation 3-21
- Test Article ..... Stiffness Transition between MGS and Thrie Beam Transition
- Total Length ..... 87 ft – 6 in. (26.7 m)
- Height to Top of Rail ..... 31 in. (787 mm)
- Key Components – Steel W-Beam Guardrail
  - Thickness ..... 12 gauge (2.66 mm)
- Key Components – Steel W-Beam to Thrie Beam Transition
  - Thickness ..... 10 gauge (3.42 mm)
  - Segment Length ..... 75 in. (1,905 mm)
- Key Components – Steel Thrie Beam
  - Thickness ..... 12 gauge (2.66 mm)
- Key Components – Steel Posts
  - Post Nos. 3 - 15 ..... 72 in. (1,829 mm) long, W6x9 (W152x13.4)
  - Post Nos. 16 - 18 ..... 84 in. (2,134 mm) long, W6x15 (W152x22.3)
  - Post Nos. 19 - 21 ..... 29 ½ in. (752 mm) long, W6x20 (W152x29.8)
- Post Spacing
  - Post Nos. 1 - 8, 19 - 21 ..... 75 in. (1,905 mm)
  - Post Nos. 8 - 12, 16 - 19 ..... 37½ in. (953 mm)
  - Post Nos. 12 - 16 ..... 18¾ in. (476 mm)
- Type of Soil ..... Grading B – AASHTO M 147-65
- Vehicle
  - Make and Model ..... 2002 Dodge Ram 1500 Quad Cab
  - Curb ..... 5,138 lb (2,331 kg)
  - Test Inertial ..... 4,993 lb (2,265 kg)
  - Gross Static ..... 5,158 lb (2,340 kg)
- Impact Conditions
  - Speed ..... 61.2 mph (98.5 km/h)
  - Angle ..... 26.3 deg
  - Impact Location ..... 75 in. (1,905 mm) US of Post No. 9
- Exit Conditions
  - Speed ..... 37.3 mph (60.0 km/h)
  - Angle ..... 22.0 deg
- Vehicle Stability ..... Satisfactory
- Exit Box Criteria ..... Passed
- Vehicle Damage ..... Moderate
  - VDS[24] 1-RFQ-5
  - CDC[24] 01-RFEW2



- Vehicle Stopping Distance ..... 263 ft (80.2 m) DS of Impact
  43.7 ft (13.3 m) Laterally Behind the System
- Test Article Damage ..... Moderate
- Test Article Deflections
  - Permanent Set ..... 25.4 in. (654 mm)
  - Dynamic ..... 32.8 in. (833 mm)
  - Working Width ..... 51.6 in. (1,310 mm)
- Maximum Angular Displacements
  - Roll ..... 13° 75°
  - Pitch ..... 10° 75°
  - Yaw ..... 51°
- Impact Severity ..... 126.8 kip-ft (171.9 kJ) 106 kip-ft (144 kJ)
- Transducer Data

Evaluation Criteria		Transducer EDR-3	Transducer EDR-4	Transducer DTS	MASH Limit
OIV ft/s (m/s)	Longitudinal	-21.21 (-6.46)	NA	NA	±40 (12.2)
	Lateral	-16.91 (-5.15)	NA	NA	±40 (12.2)
ORA g's	Longitudinal	-12.03	NA	NA	±20.49
	Lateral	-9.87	NA	NA	±20.49
THIV – ft/s (m/s)		-	NA	NA	not required
PHD – g's		-	NA	NA	not required
ASI		0.91	NA	NA	not required

Figure 64. Summary of Test Results and Sequential Photographs, Test No. MWTSP-2

Holmes Solutions

Level 2, 254 Montreal Street
Christchurch Central 8013
PO Box 6718
Upper Riccarton, Christchurch 8442
holmessolutions.com

CORRESPONDENCE

To:	John Weatland	Project No.:	102350.25
Company:	KSI Global Australia Pty Ltd	Pages:	2
From:	Emerson Ryder		
Date:	26/09/2017		
Subject:	RE: Clarification of KSI Safety Roller Transition Test Matrix		

Dear John

Thank you for sending us your request for additional information from the transition testing we completed on the Safety Roller TL3 Transition system. We understand that this request was initiated by Will Longstreet at the Office of Safety Technology, Federal Highways Administration. In particular, additional information is sought relating to Safety Roller TL3 transition and the associated test matrix used to evaluate this safety feature.

The following information relates to the testing Holmes Solutions undertook for KSI Globalon the Safety Roller TL3 transition in December 2012. Details of this testing can be found in Holmes Test Report 102350.25-2-1A (v1.2)

The final test matrix for this system was developed in accordance with MASH 09. Specifically the tests utilised to evaluate transitions to Test level 3, can be found in TABLE 2-2A - Recommended Test Matrices for Longitudinal Barriers. These are.

- Test 3-21 : 2270P Pickup truck impacting the barrier at 25 degrees @ 70 km/hr
- Test 3-20 (Optional): 1100C Small Passenger vehicle impacting the barrier at 25 degrees @ 70 km/hr

Test 20 for a transition section is an optional test to evaluate the occupant risk and post-impact trajectory criteria for all test levels. It should be conducted if there is reasonable uncertainty regarding the impact performance of the system for impacts with small passenger vehicles. The primary concerns with respect to the small vehicle testing is the increased occupant hazard associated with high ride down accelerations, vehicle underride and/or vehicle snagging.

Furthermore, MASH (2.2.1.1 General) states that "*when two adjacent barriers have drastically different stiffness, the transition design often incorporates two significant stiffness changes, one from the more flexible barrier to the transition section and the other from the transition section to the more rigid barrier, both of which can produce vehicle rollover, pocketing, or rail rupture (109). In this situation, the user should conduct transition testing at both locations*"

When considering the transition section between the Safety Roller Barrier and the W-beam, the two locations with significant stiffness changes are as follows:

- Location 1: From the Standard W-Beam guardrail (flexible barrier) to the Transition section and;
- Location 2: From the Nested Thrie-Beam section to the Safety Roller Barrier (rigid barrier).

With respect to vehicle underride and/or vehicle snagging, it was determined that the likely worst case location for this to occur is the location of the first stiffness change, namely the interface of the W-beam and the Transition section (Location 1). This is also the largest distance between the road surface and lower rail height. The interface at this location is the same as the previously evaluated and FHWA approved

transition, and as such when determining whether to run test 3-20, this transition was reviewed. Specifically:

- STG01 W-Beam to Thrie-Beam

Furthermore; standard transitions with Asymmetrical transition sections with three posts across the transition section, were considered the same or worse with respect to vehicle underride and potential snagging, when compared to a symmetric transition STG01 and as such were also reviewed. Specifically:

- STG02 MGS W-Beam to Thrie-Beam Transition - (MASH TESTED, FHWA ref B187_
- STG03 a-b MGS W-Beam to Thrie-Beam Transition with Standard Posts (MASH TESTED, FHWA ref B-231 (REVISED))

The result of these reviews determined that the impact performance, with respect to potential for vehicle underride and/or vehicle snagging, had been adequately determined and so it was considered unnecessary to run Test 3-20.

With respect to the occupant ride downs, the Safety Roller Barrier LON was considered to be the stiffer of the two systems, (namely the "Transition" and the "Safety Roller Barrier LON.") As such, the testing undertaking on the Safety Roller LON with the small vehicle, namely test 4-10 was considered worst case with respect for occupant ride downs and so it was considered unnecessary to undertake further evaluation with the small vehicle to evaluate the potential for occupant ride downs.

When evaluating the second stiffness change (Location 2), namely the interface between the Nested Thrie-beam and the Safety Roller Barrier (Location 2), it is noted that this transition section has been specially designed to accommodate the Safety Roller Barrier. As such, the performance at this location was unknown. In this regard, MASH guideline, with respect to the evaluation of transitions, were utilised. Specifically Test 3-21 was selected as this represented the highest energy and most likely to produce vehicle rollover, pocketing, or rail rupture.

All test results for the Transition were evaluated in accordance with MASH and where found to successfully meet with the evaluation criteria set out in the Standard.

I trust this letter provides you with the information you require, however please feel free to contact me directly should you need any additional information or wish to seek clarification on the information contained above.

Regards,

Emerson Ryder
SENIOR ENGINEER

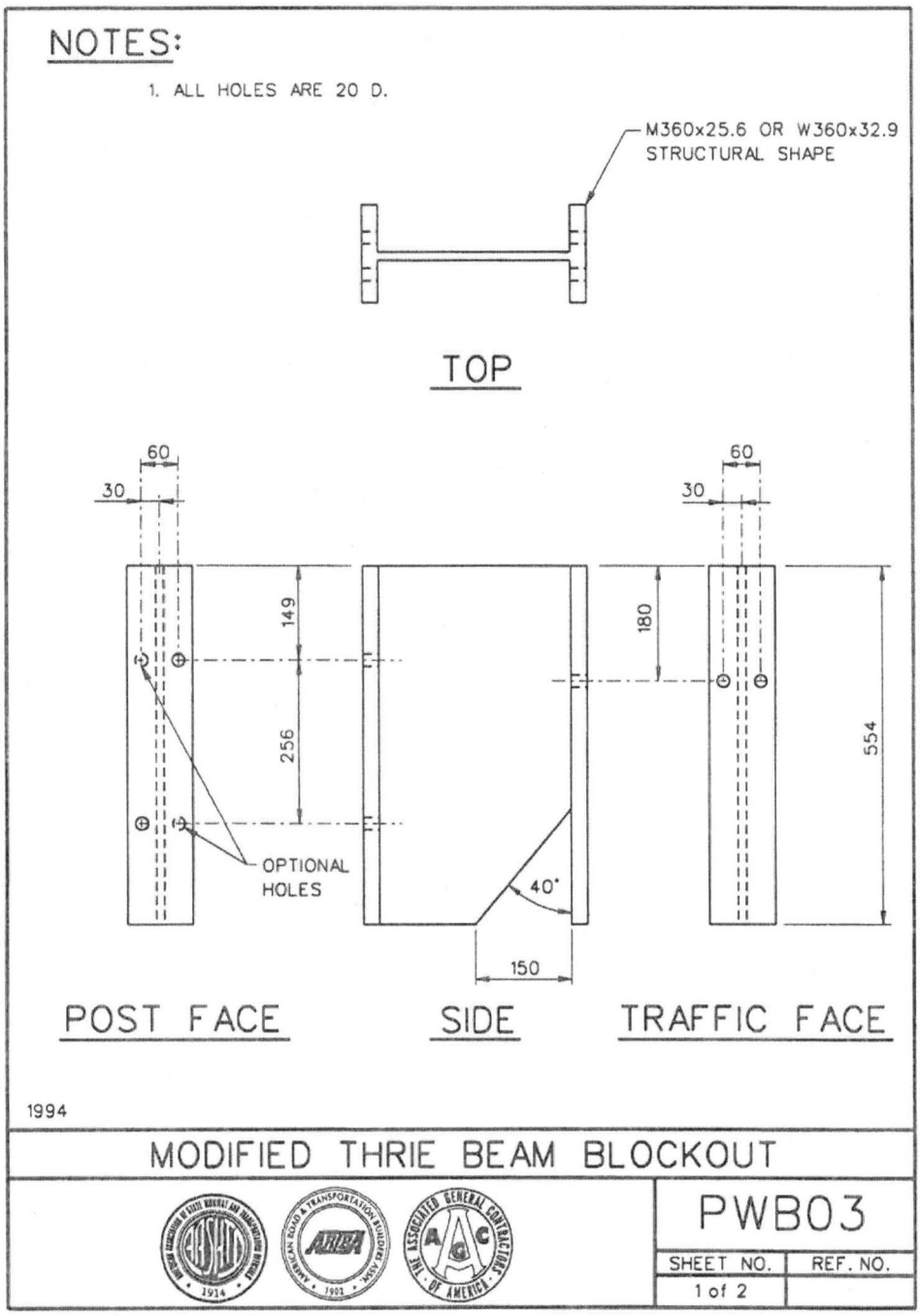


Figure 0-3: Modified Thrie-beam blockout

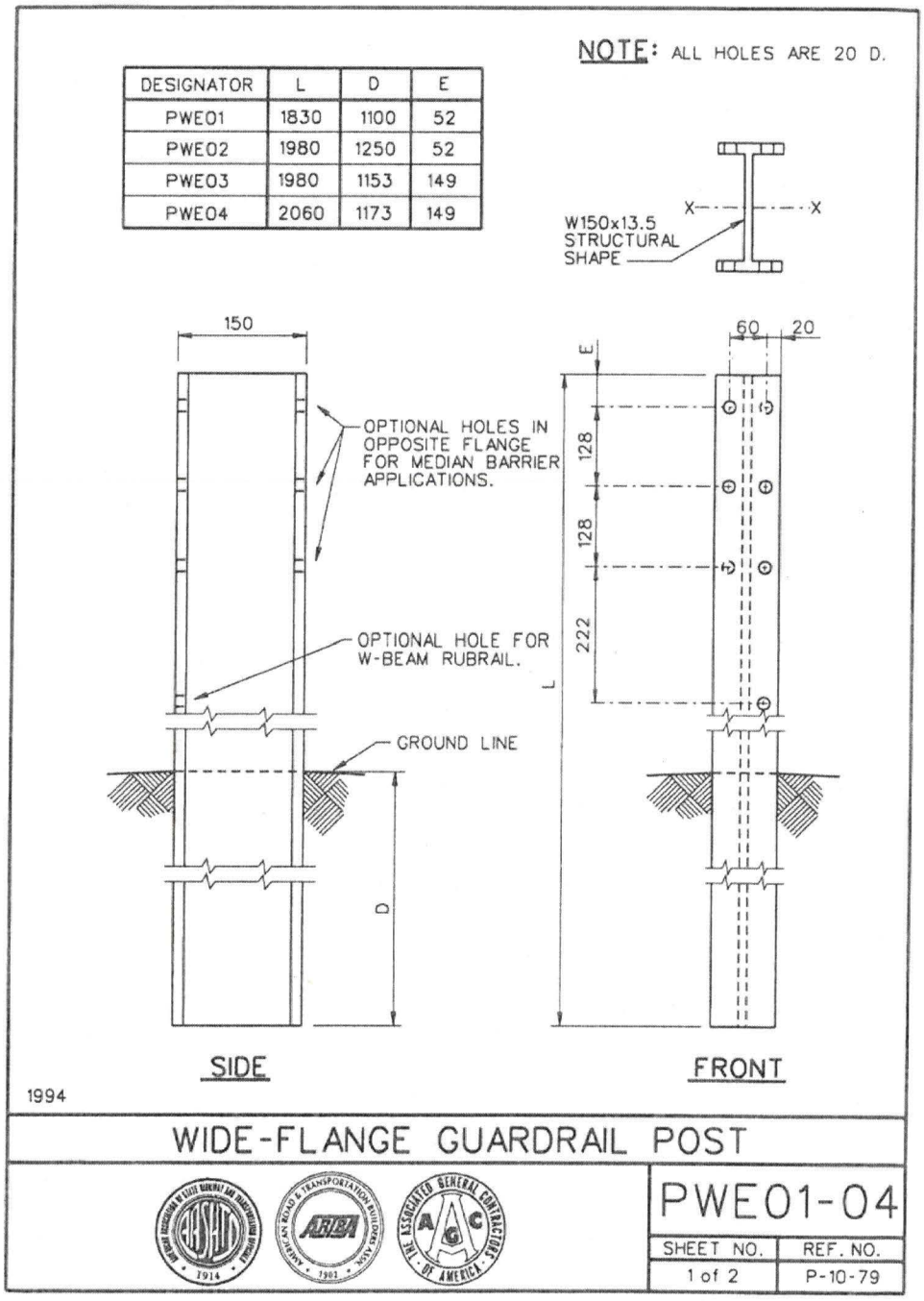


Figure 0-4: Transition Post

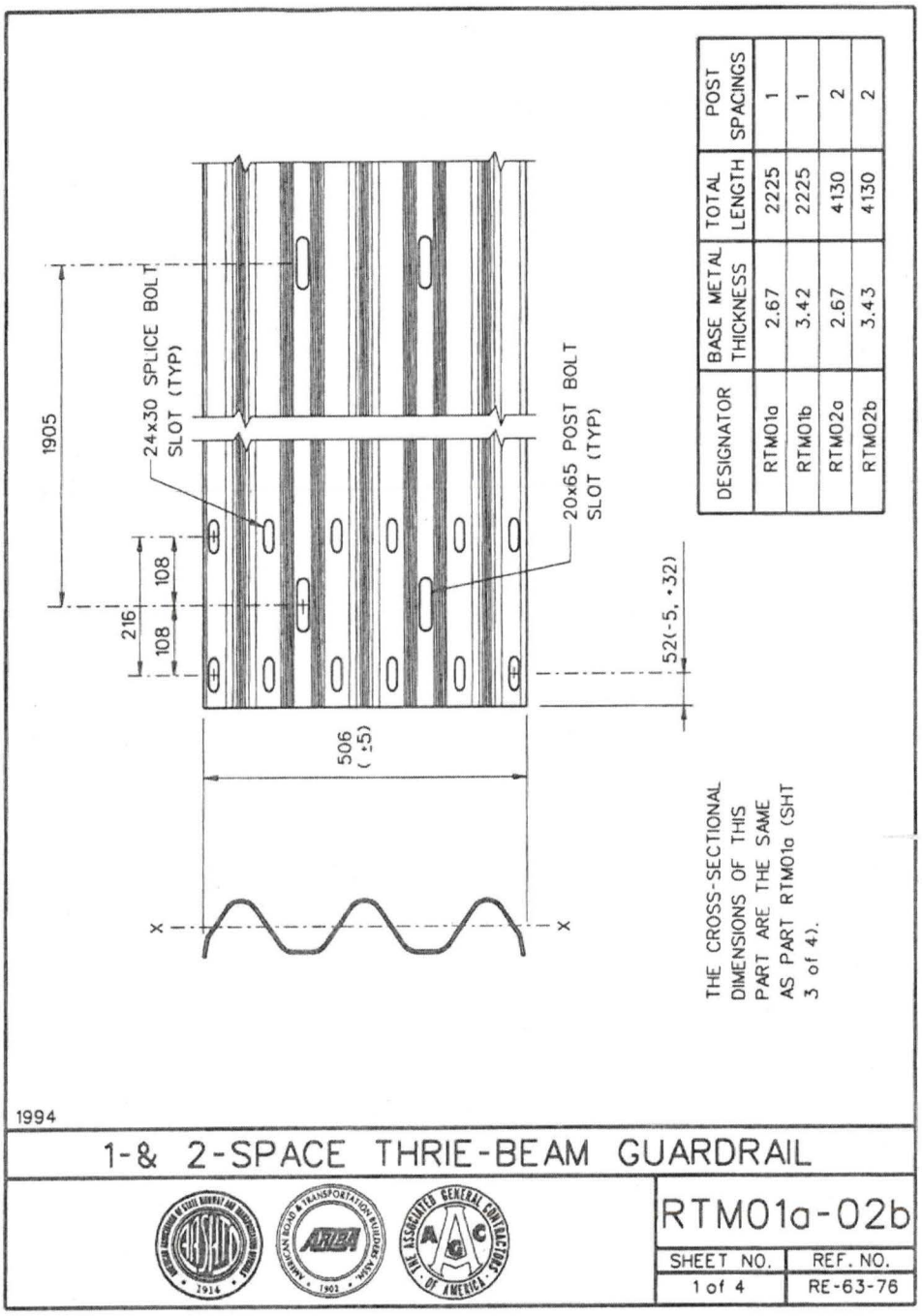


Figure 0-5: Thrie-beam

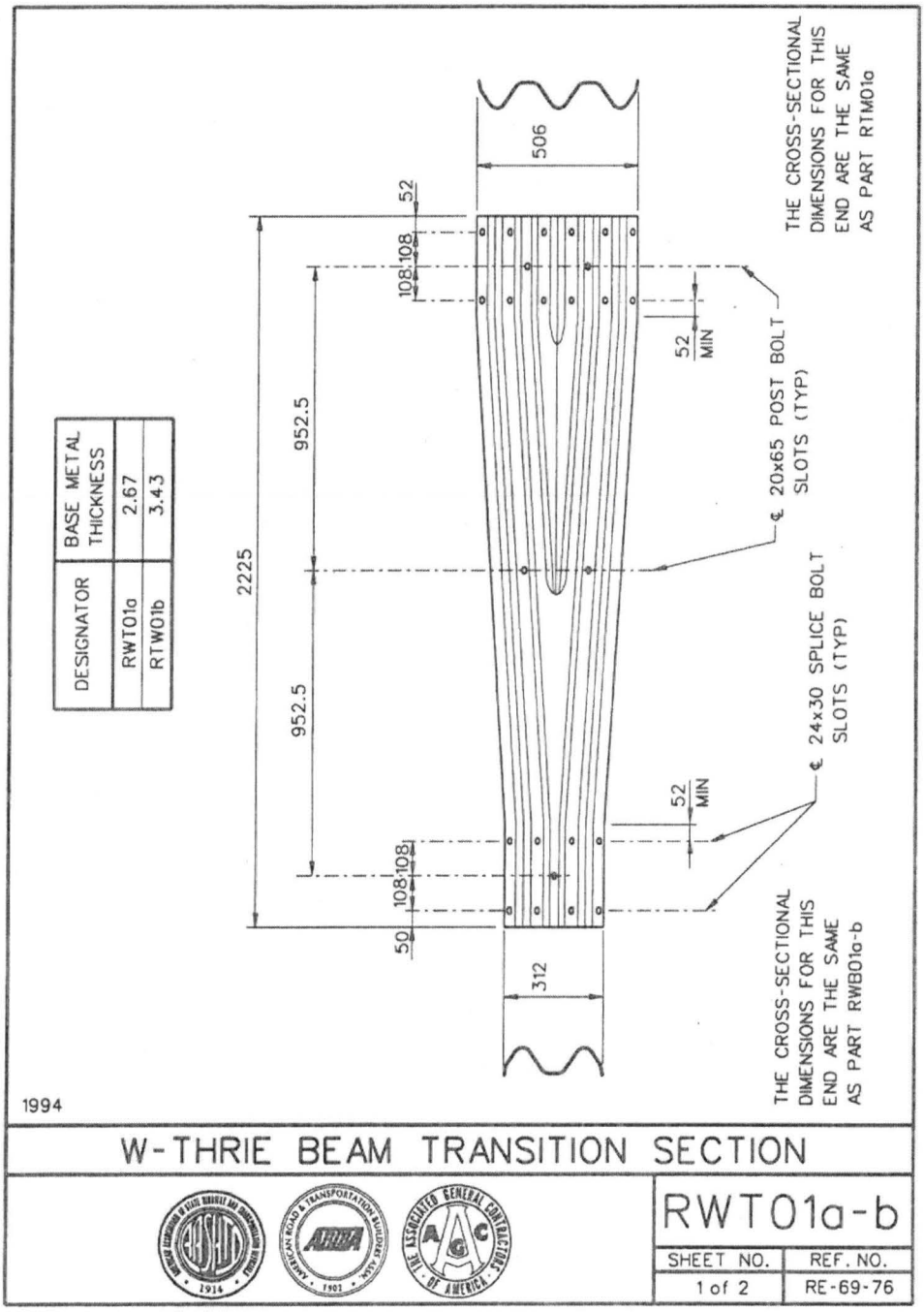


Figure 0-6: W-Thrie-beam transition section

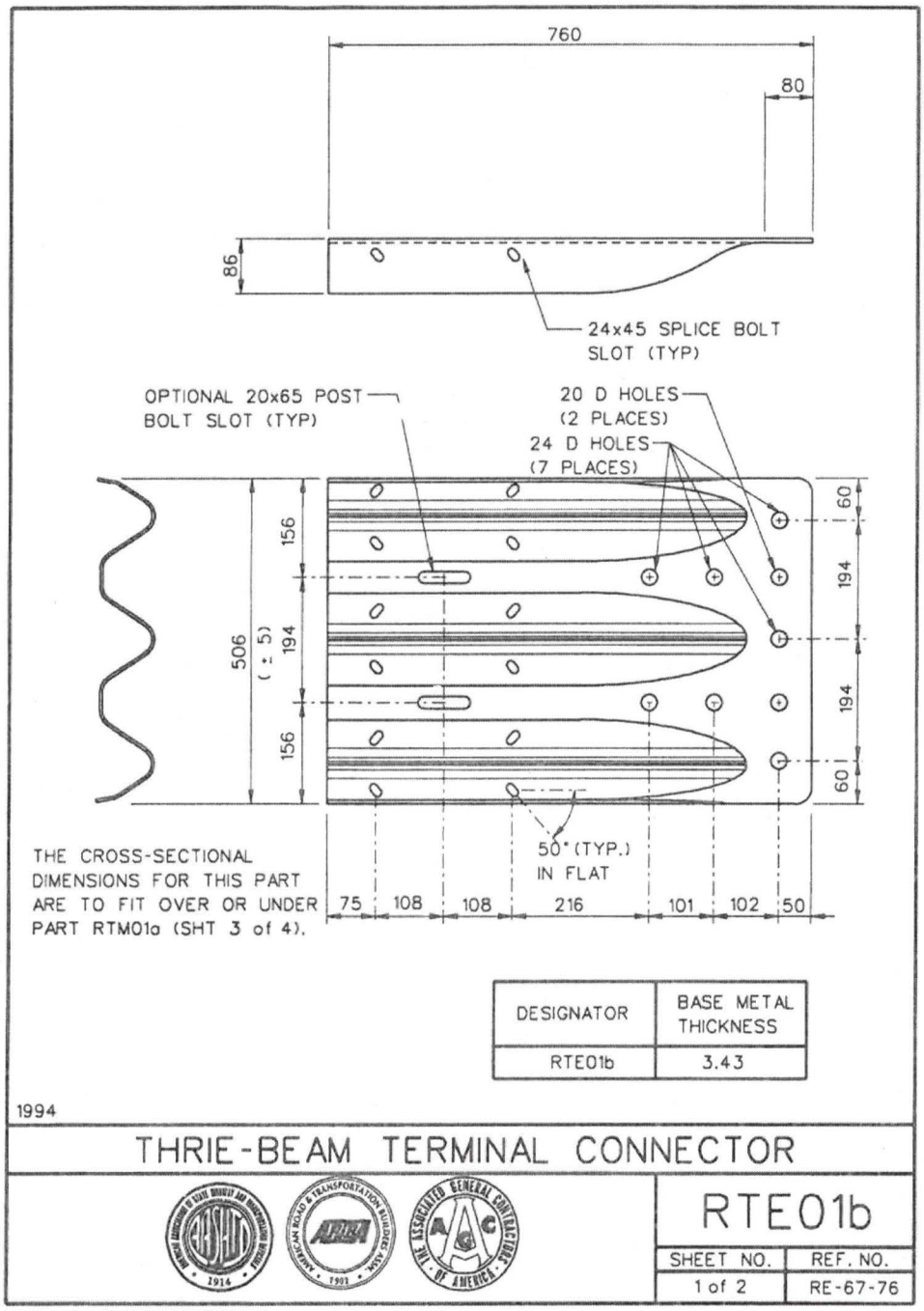


Figure 0-7: Thrie-beam connector plate

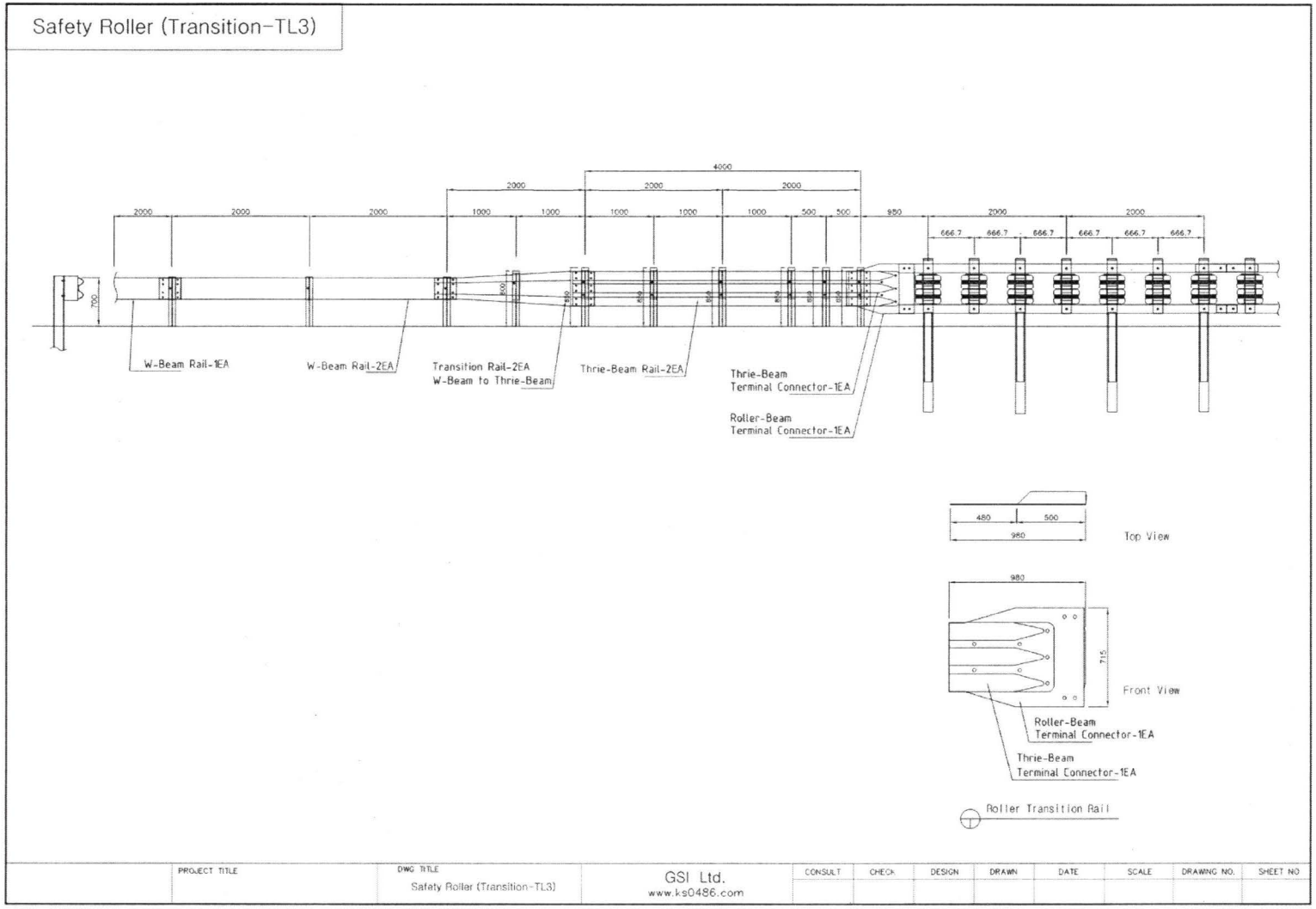


Figure 0-8: Test Article Technical Details

Holmes Solutions

Level 2, 254 Montreal Street
Christchurch Central 8013
PO Box 6718
Upper Riccarton, Christchurch 8442
holmessolutions.com

CORRESPONDENCE

To:	John Wheatland	Project No.:	102350.25
Company:	KSI Global Australia Pty Ltd	Pages:	6
From:	Emerson Ryder		
Date:	16/10/2017		
Subject:	RE: Test Vehicle utilised in KSI Safety Roller Transition 3-21 Test		

Dear John

Thank you for sending us your request for additional information from the transition testing we completed on the Safety Roller Barrier TL3 Transition system. We understand that this request was initiated by Will Longstreet at the Office of Safety Technology, Federal Highways Administration. In particular, additional information is sought relating to age of the vehicles utilised in the Safety Roller TL3 transition testing.

The following information relates to the testing Holmes Solutions undertook for KSI Global on the Safety Roller TL3 transition in December 2012. Details of this testing can be found in Holmes Test Report 102350.25-2-1A (v1.2)

By way of background, this project was initiated in 2012 (Proposal 102350FE.25.100 (v1.0) dated July 2012) and all testing for the project was conducted in accordance with MASH 2009 standard. Accordingly, the following information is provided on the basis that it was the industry-accepted interpretation of the Standard at the time of this project's initiation and a recognised practice employed in accredited laboratories around the world. Due to revision of the Standard since this time, the USA's recent adoption of MASH, and the subsequent clarifications by the FHWA on the guidelines within the Standard, this may no longer be reflective of the current interpretation of the Standard or current practice at the time of writing this correspondence. The recent legal matters affecting the industry have caused significant tensions and are ultimately resulting in a less consolatory working environment, particular with the FHWA in the USA.

The information provided in this letter includes a comparative assessment between the vehicles used and their more modern variants. The vehicle requirements in MASH 2009 states;

"It is recognized that some research projects can experience extensive delays. To eliminate the potential for these delays to require replacement of test vehicles purchased in anticipation of testing, it is acceptable to utilize test vehicles that are within 6 model years of the date when the original research project was initiated."

To clarify, the accepted definition of a model year at the time of the project is the last year of production for a vehicle model before it undergoes a significant change to the structural characteristics. Accordingly, the model year and the actual calendar year of a production vehicle rarely coincide. Simply put, a vehicle that is considerably older than 6 calendar years can still be less than 6 model years old.

At the time of any project's initiation, we ensure that all vehicles to be used in the project are industry acceptable standards and comply with the requirements of MASH and the accepted variations. If the vehicles fall outside of the recommended age range, we ensure that they comply with the more stringent dimensional and weight limitations. It is common practice for testing laboratories to use vehicles outside of this age range and the FHWA have continued to support this practice, whereby it is shown that the use of an older vehicle will not influence the results of the testing that is completed. The primary reason for using older vehicles is to reduce the cost of the testing for clients and thereby encourage the completion of full testing matrices. The practice of using older vehicles had become sufficiently common that the FHWA had

stopped asking for any supporting information; however, we understand that due to recent changes in the FHWA process that they are revising their stance in this area.

For every project undertaken at Holmes Solutions, we undertake a detailed assessment of the vehicles we use to ensure its compliance. This is a requirement of our internal quality assurance procedures and is mandated in our ISO 17025 accreditation policy. In accordance with this policy, a review was completed on the vehicles used in the testing of the Safety Roller Barrier TL3 Transition and we were satisfied that all vehicles were suitable for use.

The internal review process adopted by Holmes Solutions LP includes a full analysis of the vehicle specifications to ensure that it remains compliant with the key criteria in MASH. Furthermore, we also complete an inspection of the structural integrity of the various vehicles models to investigate if any changes would influence the performance of the system during an impact. Key aspects of the review process includes:

a) The key vehicle specifications remain in accordance within the parameters outlined in the Table 4.1 MASH.

b) The vehicle model remains in accordance with MASH Appendix H and is recommended on Table H-2.

c) The vehicles physical parameters falls within the guidelines outlined in Section MASH 4.2 Test Vehicle Description.

d) The vehicles physical and dimensional parameters do not significantly differ from an identical model from the same manufacturer which is no more than 6 model years old on the day of project initiation. Where any difference does exists a more detailed review is undertaken to ensure this would have a negligible influence on the outcome of any testing.

e) Variations in the structural integrity of the vehicle that would be likely to influence the outcome of the test to be completed. Specific attention is paid to the type of test being completed.

It is our testing laboratories preference to utilise a consistent vehicle fleet for the majority of our testing, as is the common practice across all testing laboratories. Before settling on this fleet we completed an extensive review of the recommended vehicle models in MASH conforming to Section 4.2.1 and Appendix H. Consultation was also held with other accredited testing facilities at the Task Force 13 meetings regarding their preferred vehicles. From this review we settled on the use of the following vehicles as our preferred vehicle stock at the time of the Safety Roller TL3 Transition testing;

2270P - Dodge Ram 1500 Quadcab (2002-2005/2006)

The vehicles used in the testing completed on the Safety Roller Barrier TL3 Transition System complied with these requirements. A more detailed description of the vehicle used is provided below.

Test 3-21 - 2270P – Model selected Dodge Ram Quad cab 2005:

Our preferred 2270P vehicle is the Dodge Ram 1500 Quad Cab. This model is recommended in MASH 09 (Table H-2) and has been widely adopted as the vehicle of choice by the majority of accredited testing laboratories. The Dodge Ram 1500 Quad cab has undergone a number of face-lifts since inception. We have completed a regular assessment of the models when updates occur, spanning the previous 10 years. These assessments include a comparison of the critical vehicle dimensions, weights, and centre of mass. In addition, a review of the structural integrity of the vehicles is completed for each model upgrade. As noted in the previous section, the requirement for vehicle age in MASH is related to the model year of the vehicle.

We have completed a detailed review of the dimensional and weight requirements from various Dodge Ram 1500 Quad cabs models, as shown in Table 3. The actual vehicle used in the testing for the Safety Roller Barrier TL3 Transition System is shown in the table as the 2005 production model (highlighted in blue). As shown in Table 3, there is no significant difference in physical vehicle parameters between the difference model years. The mass, centre of mass location, and general dimensions for the models surveyed are all within the allowable tolerance of MASH (with exception to the vehicle width and track width - A and M). Similarly, no significant differences were found in the structural integrity of the vehicles that would affect the performance of the system in a transition test.

Table 3 Comparison of suitable 2270P vehicles.

Critical Measurements	MASH Requirements	Dodge Ram 1500 Quad Cab Production year			
		2002	2005 (model used)	2006	2011
Weight	2270 ± 50	2248.5 kg	2260 kg	2215 kg	2210.5 kg
A (mm)	1950 ± 50	2025	2050	2070	2030
B (mm)	n/a	1890	1930	1910	1180
C (mm)	6020 ± 325	5725	5720	5780	5720
D (mm)	n/a	1195	1180	1180	1190
E (mm)	3760 ± 300	3550	3570	3570	3580
F (mm)	1000 ± 75	980	970	1030	950
G (mm)	710 min	720	760	739	735
H (mm)	1575 ± 100	1455	1430	1510	1495
I (mm)	n/a	380	290	380	280
J (mm)	n/a	690	680	690	660
M (mm)	1700 ± 38	1700	1740	1740	1715
N (mm)	1700 ± 38	1720	1740	1720	1715
O (mm)	1100 ± 75	1100	1110	1090	1120
P (mm)	n/a	50	80	70	110
Q (mm)	n/a	815	840	820	780
R (mm)	n/a	470	545	475	475

Table 4 presents a direct comparison between the Recommended Properties of the 2270P vehicle in MASH (detailed in Table 4-1 of MASH) and the actual properties of the vehicle used in the testing. As noted, the Dodge Ram 1500 Quadcab model used complies with all recommendations of MASH with the exception of "vehicle width" that has 25 mm of excess body width on each side and the "track width" that has 1 mm of excess width on each side. The extra vehicle width is a known variance and is accepted by industry. Furthermore the small variation in track width for the test vehicle utilised, was considered so small it was not likely to effect on the outcome of any testing. As such this variance was also considered acceptable for this project.

Table 4 Comparison of MASH Requirements and actual 2270P vehicle parameters

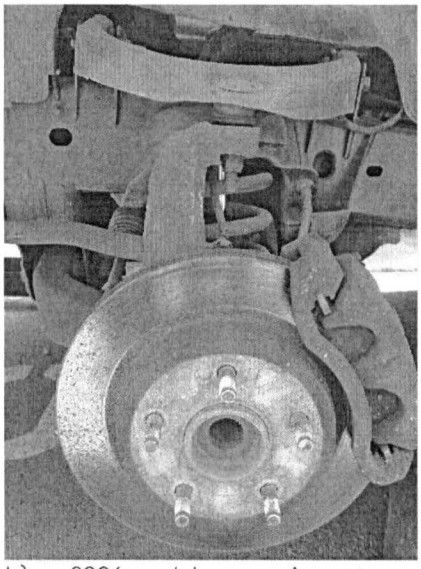
PROPERTY	MASH 2270P REQUIREMENT	DODGE RAM USED in SAFETY ROLLER TRANSITION	COMPLIANT (Y/N)
MASS			
Test Inertia (kg)	2270±50	2260	YES
Dummy (kg)	Optional	-	YES
Max. Ballast (kg)	200	33	YES
Gross Static (kg)	2270±50	2260	YES
DIMENSIONS			
Wheelbase (mm)	3760±300	3570	YES
Front Overhang (mm)	1000±75	970	YES
Overall Length (mm)	6020±325	5720	YES
Overall Width (mm)	1950±50	2050	NO
Hood Height (mm)	1100±75	1110	YES
Track Width (mm)	1700±38	1740	NO
LOCATION OF ENGINE	Front	Front	YES
LOCATION OF DRIVE AXLE	Rear	Rear	YES
TYPE OF TRANSMISSION	Manual/Auto	Auto	YES

A detailed inspection was also completed on the handling characteristics and suspension setup of the various models. It was noted that the suspension configuration had minor alterations in the 2006 model, however all subsequent models used an identical set up until 2009. Key dimensions of the critical elements used in the set up are noted in Table 5 below. Photographs of the suspension set ups for the 2005 model (vehicle used in testing) and 2006 model are also shown in Figure 1.

Table 5 Suspension measurements for Dodge Ram models

Critical Measurements	Production year			
	2002	2005 (model used)	2006	2011
Springs				
Outside diameter (mm)	140	140	140	140
Coil diameter (mm)	19.5	19	19	19
Overall spring length (mm)	370	350	350	350
Set-up				
Roll Bar outside diameter (mm)	34	33	33	33
Upper A arm Pivot-Pivot (mm)	240	240	240	240
Upper A arm Pivot-Pivot (mm)	440	440	440	440

a) 2002 model suspension set up



b) 2006 model suspension set up

Figure 1 2270P suspension set up

Based on the investigations completed on the vehicle dimensions, handling characteristics, and suspension set up it was confirmed that the minor changes to the components would have negligible effect on performance of the vehicle during a transitions testing undertaken. As such, it was considered acceptable to use a 2005 model Dodge Ram 1500 Quad Cab in the evaluation of the Safety Roller Barrier TI3 Transition.

I trust this letter provides you with the information you require, however please feel free to contact me directly should you need any additional information or wish to seek clarification on the information contained above.

Regards,

Emerson Ryder (approved signatory)
SENIOR ENGINEER

Laboratory Accreditation Programmes

Schedule to

CERTIFICATE OF ACCREDITATION

Laboratory	Holmes Solutions LP Vehicle Crash Testing Facility
Address	PO Box 6718, Upper Riccarton, Christchurch, 8442 Level 2, 254 Montreal Street, Christchurch Central, Christchurch, 8013
Telephone	03 363-2180
Fax	03 379-2169
URL	www.holmessolutions.com
Authorised Representative	Ms Irina Sestakova Quality Manager
Client No.	7559
Programme	Mechanical Testing Laboratory
Accreditation Number	1022
Initial Accreditation Date	23 July 2009
Conformance Standard	NZS ISO/IEC 17025:2005 General requirements for the competence of testing and calibration laboratories
Testing Services Summary	4.30 Safety Equipment 4.31 Motor Vehicle Safety Tests 4.76 Metals and Metal Products
Signatories	Dr Chris Allington 4.30, 4.31, 4.76 Mr Aaron Carson 4.30, 4.76 Mr Chris Diehl 4.76 Mr Emerson Ryder 4.31

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www.ianz.govt.nz

Schedule to

CERTIFICATE OF ACCREDITATION

Holmes Solutions LP
Mechanical Testing Laboratory
SCOPE OF ACCREDITATION

Accreditation No 1022

4.30 Safety Equipment

(f) Other safety products

ANSI/ASSE Z359.4:2007	Safety requirements for Assisted Rescue and Self Rescue systems, subsystems and components (part of the fall protection code)
4.3.5	Descent devices qualification testing
BS EN 341:1993	Personal protective equipment against falls from a height – Descender devices
BS EN 364:1993	Personal protective equipment against falls from a height – Test methods
CSA Z259.2.3:1999	Descent control devices

The following tests in accordance with AS 1891.1:2007- Industrial Fall-Arrest systems and Devices

Part 1 Harnesses and ancillary equipment

Appendix B	Static breaking strength of load-bearing webbing
Appendix C	Static loading test attachment points of harness
Appendix D	Dynamic loading test attachment points of harnesses
Appendix E	Dynamic loading test harness and pole-strap
Appendix F	Static strength test harness with a pole-strap
Appendix G	Static loading tests for Lanyard
Appendix H	Dynamic test for Lanyards

The following tests in accordance with AS 1891.3:1997- Industrial Fall-Arrest systems and Devices

Part 3 Fall-arrest devices

Appendix A	Endurance Test
Appendix B	Locking performance after conditioning of anchorage lines in oil
Appendix C	Dynamic Performance Test
Appendix D	Strength Test
Appendix E	Lanyard Dynamic Test

4.31 Motor Vehicle Safety Tests

(s) Other tests

ASTM F2656-07 Standard Test Method for Vehicle Crash Testing of Perimeter Barriers
PAS:68 (2010) – Impact Test Specifications for Vehicle Security Barriers

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(t) Highway Safety Products

NCHRP Report 350

Recommended procedures for the Safety Performance Evaluation of Highway Features (excluding Appendix G)

Manual for Assessing Safety Hardware (MASH 09)
Manual for Assessing Safety Hardware (MASH 16)

Recommended procedure for the Safety Performance Evaluation of Highway Features (excluding Appendix H)

BS EN 1317-1:2010	Road Restraint Systems – Terminology and general criteria for test methods
BS EN 1317-2:2010	Road Restraint Systems - Performance classes, impact test acceptance and test methods for safety barriers including vehicle parapets
BS EN 1317-3:2010	Road Restraint Systems – Performance classes, impact test acceptance criteria and test methods for crash cushions
BS EN 1317-4:2010	Road Restraint Systems – Performance classes impact test acceptance criteria and test methods for transitions and removable barrier sections
BS EN 1317-7:2010	Road Restraint Systems – Performance classes impact test acceptance criteria and test methods for terminals of safety barriers

4.76 Metals and Metal Products

Testing methods as defined by the following standards and, with AS/NZS 4671, as modified by Verification Method B1/VM1 Clause 14.

(a) Tension tests in accordance with the following methods in the load range 5 kN to 600 kN

AS 1391:2007
ASTM A370:2012
ASTM E8/E8M-11
ISO 6892-1:2009
ISO 15630-1:2010 Clause 5
ISO 15630-2:2010 Clause 5
ISO 15630-3:2010 Clause 5

(h) Other tests in accordance with the following standards

ISO 15630-2:2010 Clause 7 (Weld shear test)
AS/NZS 4671 Appendix C3.3 Mass per unit length of reinforcing steels

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Federal Highways Administration
Office of Safety
1200 New Jersey Avenue, SE
Washington, D.C
20590
United States of America

holmessolutions

21 August 2015

Attention: Nick Artimovich

Testing activities completed for KSI Global Australia

I am writing to you regarding the financial interest disclosures requested by the Federal Highways Administration.

Holmes Solutions completes testing activities for the KSI Global Australia. For the completion of this service we receive payment in the form of Professional Fees. In no circumstances are the fees we received linked to the performance of the product nor the outcome of the tests. In accordance with the requirements of our ISO 17025 accreditation, I can confirm that all of our testing activities are completed free from undue commercial influence.

Holmes Solutions does not have, nor ever had, any financial interest in KSI Global Australia or any of the products that they develop and sell. Holmes Solutions does not receive any research funding (or other forms of research support) from KSI Global Australia. We have no patents, copyrights or other intellectual property rights on any of the KSI products. We have no business ownership or investment interest in KSI Global Australia. No licencing agreements exist between Holmes Solutions and KSI Global Australia.

The corporate structure of Holmes Solutions is part of the wider Holmes Group of entities, the parent company being Holmes Group Limited. Holmes Group Limited currently has, and has previously held, ownership in a series of ventures, all of which are operated as separate legal entities. Holmes Solutions has no financial interest in any of the other Holmes Group entities or any of the products that they develop and sell. Holmes Solutions does not receive any research funding or other forms of research support from the other Holmes Group entities. We have no patents, copyrights, or other intellectual property rights on any of the products sold or distributed by any of the Holmes Group entities.

I trust this letter provides you with the information you require, however please feel free to contact me directly should you need any additional information or wish to seek clarification on the information contained above.

Yours Sincerely,

Dr Chris Allington, B.E (Hons), PhD (Civil)
CEO
Holmes Solutions LP

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