



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

February 15, 2019

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

In Reply Refer To:
HSST-1/B-318

Mr. Thomas Macioce
Pennsylvania Department of Transportation
400 North Street, Keystone Bldg., 7th Floor
Harrisburg, PA. 17106-7100

Dear Mr. Macioce:

This letter is in response to your October 11, 2018 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-318 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:

- PennDOT PA Bridge 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: PennDOT PA Bridge Barrier

Type of system: Longitudinal Barrier

Test Level: MASH Test Level 5 (TL5)

Testing conducted by: TamTI

Date of request: January 11, 2019

Date of final package: January 17, 2019

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

Full Description of the Eligible Device

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

Notice

This eligibility letter is issued for the subject device as tested. Modifications made to the device are not covered by this letter. 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-318 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.
- 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
Director, Office of Safety Technologies
Office of Safety

Enclosures

Request for Federal Aid Reimbursement Eligibility of Highway Safety Hardware

| | | | |
|------------------|------------------|---|---|
| Submitter | Date of Request: | October 11, 2018 | <input checked="" type="radio"/> New <input type="radio"/> Resubmission |
| | Name: | Tom Macioce, P.E. | |
| | Company: | Pennsylvania Department of Transportation | |
| | Address: | Keystone Building, 7th Floor, 400 North St., Harrisburg, Pennsylvania 17106-7100 | |
| | Country: | USA | |
| | 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 | PennDOT PA Bridge Barrier | AASHTO MASH | TL5 |

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: | Tom Macioce, P.E. | Same as Submitter <input checked="" type="checkbox"/> |
| Company Name: | Pennsylvania Department of Transportation | Same as Submitter <input checked="" type="checkbox"/> |
| Address: | Keystone Building, 7th Floor, 400 North St., Harrisburg, Pennsylvania 17106-7100 | Same as Submitter <input checked="" type="checkbox"/> |
| Country: | USA | 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.

Texas A&M Transportation Institute (TTI) was contracted by Gannett Fleming Inc. to perform full-scale crash testing of the Penn DOT PA Bridge Barrier. There are no shared financial interests in the Penn DOT PA Bridge Barrier by TTI, or between Penn DOT, Gannett Flemming, and TTI other than the costs involved in the actual crash tests and reports for this submission to FHWA.

PRODUCT DESCRIPTION

- New Hardware or Significant Modification

 Modification to Existing Hardware

The test installation for the Penn DOT PA Bridge Barrier was comprised of a steel reinforced cantilevered concrete bridge deck, 11 inches thick, supporting a 24-inch tall × 18-inch thick steel reinforced concrete barrier. The test installation was constructed with three ½-inch wide joints, two extended through the barrier wall only, and the third through the wall and deck.

There were 20 posts attached to the top of the barrier using cast in place anchor bolts. The posts were spaced on 90-inch centers, beginning 44-inches from each end of the concrete deck and barrier, for a total installation length of 149 ft-10 inches. Two rectangular HSS 5×4×¾ rails were attached to each post, with the tops of the rails located 37 inches and 50 inches above grade, respectively.

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: | D. Lance Bullard, Jr. P.E. | |
| Engineer Signature: | D. Lance Bullard, Jr. Digitally signed by D. Lance Bullard, Jr. Date: 2018.10.12 09:59:42 -05'00' | |
| Address: | TTI, TAMU 3135, College Station, TX 77843-3135 | Same as Submitter <input type="checkbox"/> |
| Country: | USA | Same as Submitter <input type="checkbox"/> |

A brief description of each crash test and its result:

| Required Test Number | Narrative Description | Evaluation Results |
|----------------------|---|--------------------|
| 5-10 (1100C) | <p>TTI Crash Test Report No. 609591-03 contains the results of this 5-10 test that was conducted on June 26, 2018. The target CIP for MASH Test 5-10 was 3.6 ft ±1 ft upstream of post 13 edge with lower rail splice.</p> <p>The PennDOT PA Bridge Barrier system contained and redirected the 1100C vehicle. The vehicle did not penetrate, underride, or override the installation. There was no observable dynamic deflection or residual permanent deformation of the bridge rail.</p> <p>No detached elements, fragments, or other debris were present to penetrate or show potential for penetrating the occupant compartment, or to present hazard to others in the area.</p> <p>Maximum occupant compartment deformation was 3.0 inches in the passenger side foot well area.</p> <p>The 1100C vehicle remained upright during and after the collision event. Maximum roll and pitch angles were 8° and 12°, respectively.</p> <p>Occupant risk factors were within the allowable limits of MASH. Longitudinal OIV was 22.3 ft/s, and lateral OIV was 34.1 ft/s. Longitudinal occupant ridedown acceleration was 7.9 g, and lateral occupant ridedown acceleration was 9.7 g</p> | PASS |

| Required Test Number | Narrative Description | Evaluation Results |
|----------------------|--|--------------------|
| 5-11 (2270P) | <p>TTI Crash Test Report No. 609591-03 contains the results of this 5-11 test that was conducted on June 28, 2018. The target CIP for MASH Test 5-11 was 4.3 ft ± 1 ft upstream of post 9 edge with lower rail splice.</p> <p>The PennDOT PA Bridge Barrier contained and redirected the 2270P vehicle. The vehicle did not penetrate, underride, or override the installation. The dynamic deflection of the bridge rail during the test was 0.7 inches.</p> <p>No detached elements, fragments, or other debris were present to penetrate or show potential for penetrating the occupant compartment, or to present hazard to others in the area.</p> <p>Maximum occupant compartment deformation was 3.0 inches on the passenger side at the floor pan to roof, and wheel/foot well and toe pan area measurements.</p> <p>The 2270P vehicle remained upright during and after the collision event. Maximum roll and pitch angles were 4° and 4°, respectively.</p> <p>Occupant risk factors were within the preferred limits of MASH. Longitudinal OIV was 19.4 ft/s, and lateral OIV was 28.2 ft/s. Longitudinal occupant ridedown acceleration was 3.2 g, and lateral occupant ridedown acceleration was 6.7 g.</p> | PASS |

| | | |
|---------------|---|----------------------------------|
| 5-12 (36000V) | <p>TTI Crash Test Report No. 609591-03 contains the results of this 5-12 test that was conducted on July 3 2018. The target CIP for MASH Test 5-12 was 1 ft ±1 ft, downstream of post 5 edge with lower rail splice.</p> <p>The PennDOT PA Bridge Barrier contained and redirected the 36000V vehicle. The vehicle did not penetrate, underride, or override the installation. The dynamic deflection of the bridge rail during the test was 7.0 inches.</p> <p>No detached elements, fragments, or other debris were present to penetrate or show potential for penetrating the occupant compartment, or to present hazard to others in the area.</p> <p>Maximum occupant compartment deformation was 2.5 inches.</p> <p>The 36000V vehicle remained upright during and after the collision.</p> | PASS |
| 5-20 (1100C) | <p>This Optional Test was not performed. This request is for a stand alone bridge rail system only, and not for a transition between two different barrier systems. Therefore, Test 5-20 is not relevant.</p> | Non-Relevant Test, not conducted |
| 5-21 (2270P) | <p>This Test was not performed. This request is for a stand alone bridge rail system only, and not for a transition between two different barrier systems. Therefore, Test 5-21 is not relevant.</p> | Non-Relevant Test, not conducted |
| 5-22 (36000V) | <p>This Test was not performed. This request is for a stand alone bridge rail system only, and not for a transition between two different barrier systems. Therefore, Test 5-22 is not relevant.</p> | 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: | Texas A&M Transportation Institute | |
| Laboratory Signature: | Darrell L. Kuhn | Digitally signed by Darrell L. Kuhn Date: 2018.10.11 12:55:39 -05'00' |
| Address: | TTI, TAMU 3135, College Station, TX 77843-3135 | Same as Submitter <input type="checkbox"/> |
| Country: | USA | Same as Submitter <input type="checkbox"/> |
| Accreditation Certificate Number and Dates of current Accreditation period : | ISO 17025 Laboratory Certificate Number: 2821.01 Valid To: April 30, 2019 | |

Submitter Signature*:

Thomas P. Moore 1/17/19

| |
|-------------|
| Submit Form |
|-------------|

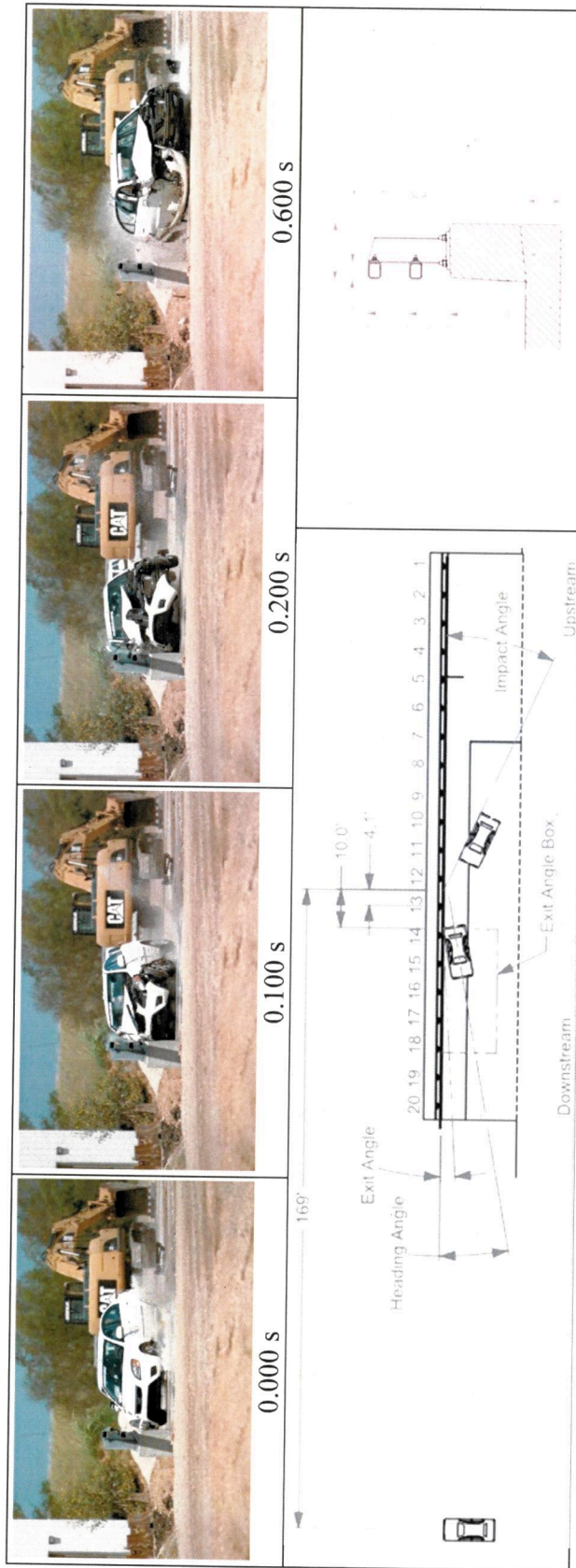
ATTACHMENTS

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.

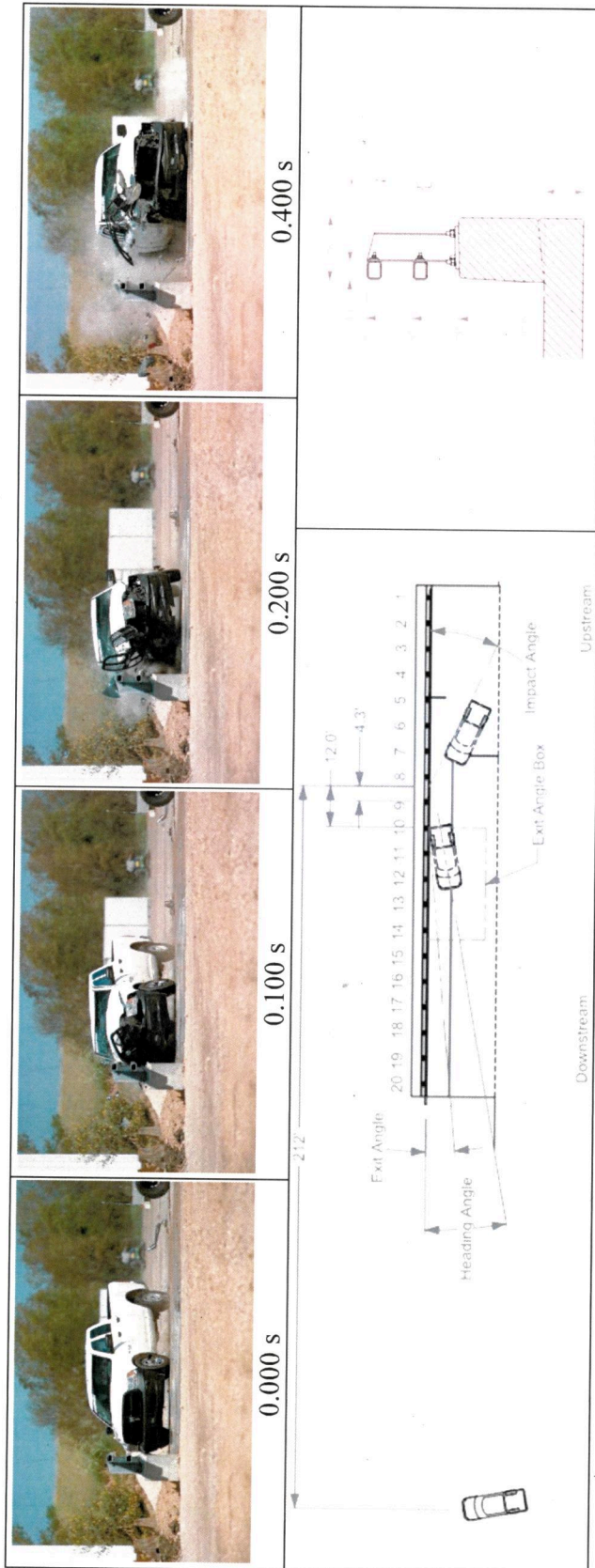
FHWA Official Business Only:

| Eligibility Letter | | |
|--------------------|------|-----------|
| Number | Date | Key Words |
| | | |



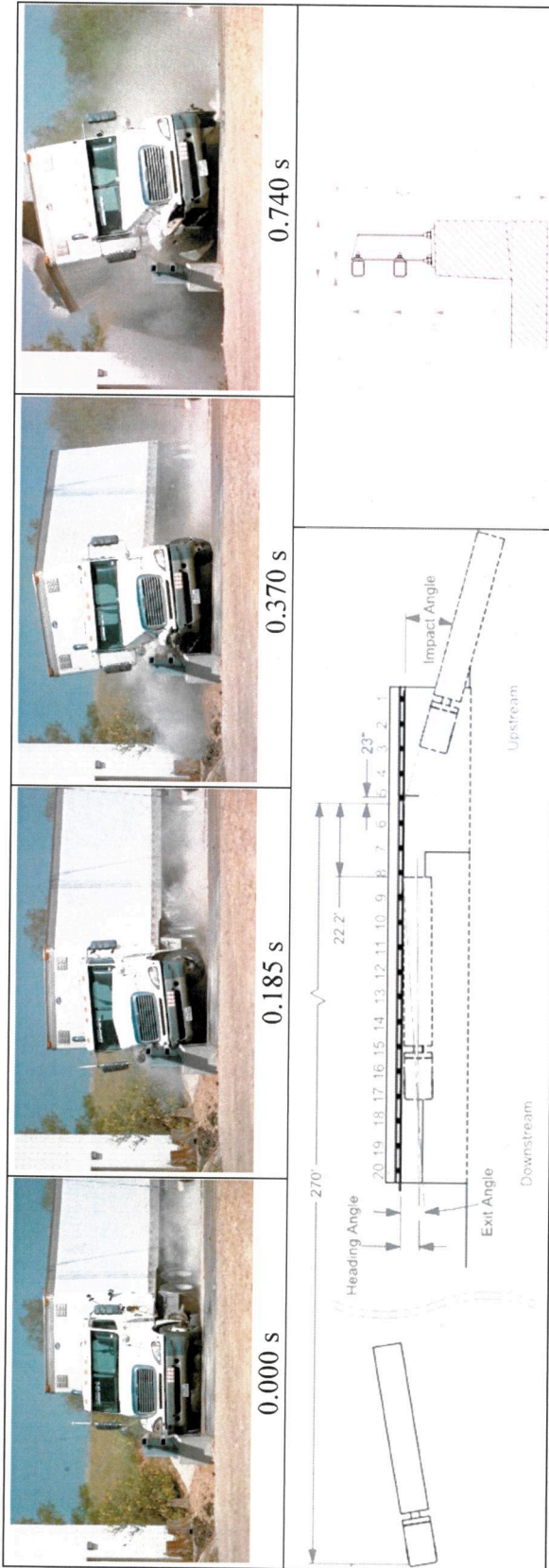
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|---------------------------------------|--|
| General Information | |
| Test Agency | Texas A&M Transportation Institute (TTI) |
| Test Standard | MASH Test 5-10 |
| TTI Test No. | 609591-03-2 |
| Test Date | 2018-06-26 |
| Test Article | |
| Type | Longitudinal Barrier - Bridge Rail |
| Name | PennDOT Bridge Deck |
| Installation Length | 149 ft-10 inches |
| Material or Key Elements | 24-inch tall x 18-inch thick reinforced concrete wall with two HSS 5x4x $\frac{3}{8}$ rails at 37 inches and 50 inches |
| Soil Type and Condition | |
| Type | Concrete bridge deck, damp |
| Type/Designation | 1100C |
| Make and Model | 2011 KIA RIO |
| Curb | 2457 lb |
| Test Inertial | 2427 lb |
| Dummy | 165 lb |
| Gross Static | 2592 lb |
| Impact Conditions | |
| Speed | 61.7 mi/hr |
| Angle | 25.3° |
| Location/Orientation | 49.2 inches upstream of Post 13 |
| Impact Severity | |
| Exit Conditions | 60 kip-ft |
| Speed | 46.3 mi/h |
| Exit Traj./Heading Angle | 3.4°/10.3° |
| Occupant Risk Values | |
| Longitudinal OIV | 22.3 ft/s |
| Lateral OIV | 34.1 ft/s |
| Longitudinal Ridedown | 7.9 g |
| Lateral Ridedown | 9.7 g |
| THIV | 40.7 ft/s |
| PHD | 10.2g |
| ASI | 2.9 |
| Max. 0.050-s Average | |
| Longitudinal | -12.6 g |
| Lateral | -20.9 g |
| Vertical | 6.7 g |
| Post-Impact Trajectory | |
| Stopping Distance | 169 ft downstream |
| | 2 ft toward traffic |
| Vehicle Stability | |
| Maximum Yaw Angle | 33° |
| Maximum Pitch Angle | 12° |
| Maximum Roll Angle | 8° |
| Vehicle Snagging | No |
| Vehicle Pocketing | No |
| Test Article Deflections | |
| Dynamic | None |
| Permanent | None |
| Working Width | 18 inches |
| Working Width Height | 24 inches |
| Vehicle Damage | |
| VDS | 10-RFQ-5 |
| CDC | 10FREW3 |
| Max. Exterior Deformation | 6.0 inches |
| OCDI | RF0114100 |
| Max. Occupant Compartment Deformation | 3.0 inches |

Figure 6.6. Summary of Results for MASH Test 5-10 on PennDOT PA Bridge Barrier.



| | | | | | |
|--------------------------------------|--|--------------------------------|---------------------------|---|----------------------|
| General Information | | Impact Conditions | | Post-Impact Trajectory | |
| Test Agency | Texas A&M Transportation Institute (TTI) | Speed | 63.2 mi/h | Stopping Distance | 212 ft downstream |
| Test Standard Test No. | MASH Test 5-11 | Angle | 24.8° | Location/Orientation | 12 ft toward traffic |
| TTI Test No. | 609591-03-1 | Exit Traj./Heading Angle | 4.3 ft upstream of post g | Vehicle Stability | |
| Test Date | 2018-06-28 | Speed | 121 kip-ft | Maximum Yaw Angle | 34° |
| Test Article | | Exit Traj./Heading Angle | 50.7 mi/h | Maximum Pitch Angle | 4° |
| Type | Longitudinal Barrier - Bridge Rail | Occupant Risk Values | | Vehicle Snagging | No |
| Name | PennDOT PA Bridge Barrier | Longitudinal OIV | 19.4 ft/s | Vehicle Pocketing | No |
| Installation Length | 149 ft-10 inches | Lateral OIV | 28.2 ft/s | Test Article Deflections | |
| Material or Key Elements | 24-inch tall x 18-inch thick reinforced concrete parapet with two HSS 5x4x¾ rails at 37 inches and 50 inches | Longitudinal Ridedown | 3.2 g | Dynamic | 0.7 inches |
| Soil Type and Condition | Concrete bridge deck, damp | Lateral Ridedown | 6.7 g | Permanent | None |
| Test Vehicle | | THIV | 34.8 ft/s | Working Width | 18.0 inches |
| Type/Designation | 2270P | PHD | 7.1 g | Working Width Height | 24.0 inches |
| Make and Model | 2013 RAM 1500 Pickup | ASI | 2.06 | Vehicle Damage | |
| Curb | 4952 lb | Max. 0.050-s Average | | VDS | 10-RFQ-5 |
| Test Inertial | 5004 lb | Longitudinal | -9.4 g | CDC | 10FREW3 |
| Dummy | 165 lb | Lateral | 15.9 g | Max. Exterior Deformation | 11.0 inches |
| Gross Static | 5169 lb | Vertical | -2.3 g | OCDI | RF0122110 |
| | | | | Max. Occupant Compartment Deformation | 3.0 inches |

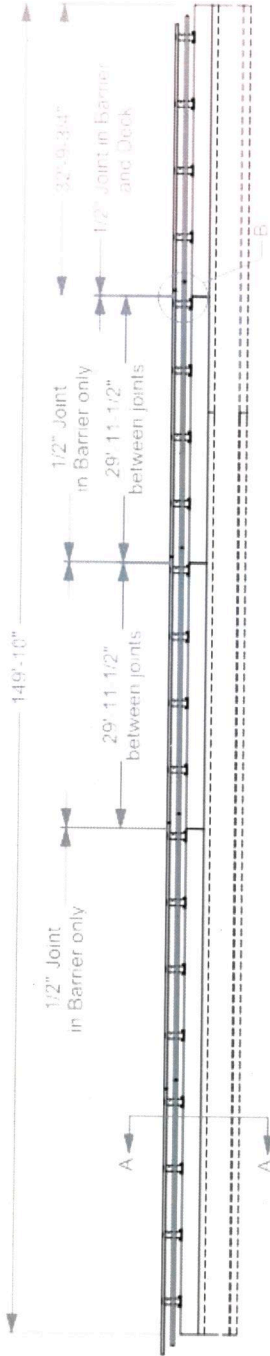
Figure 5.6. Summary of Results for MASH Test 5-11 on PennDOT PA Bridge Barrier.



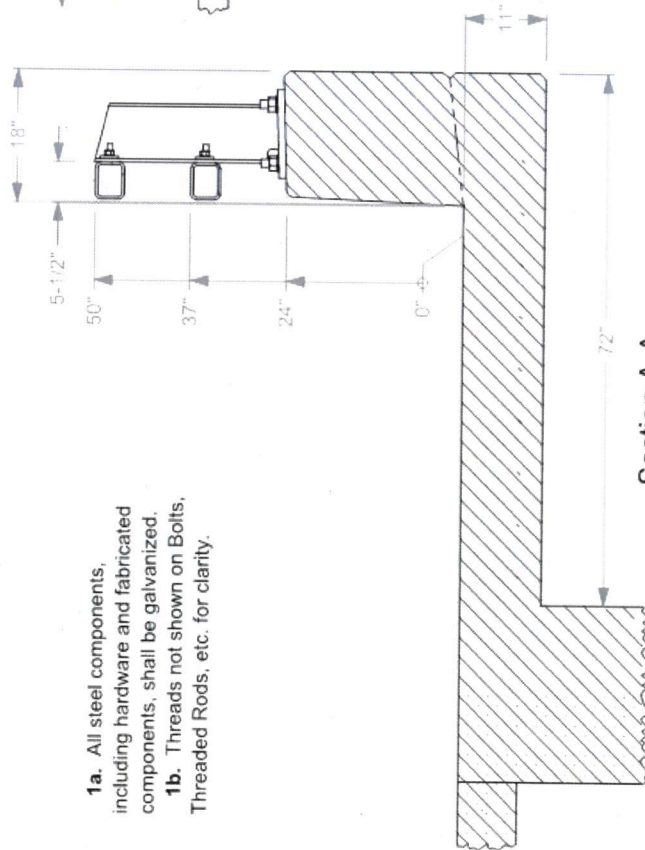
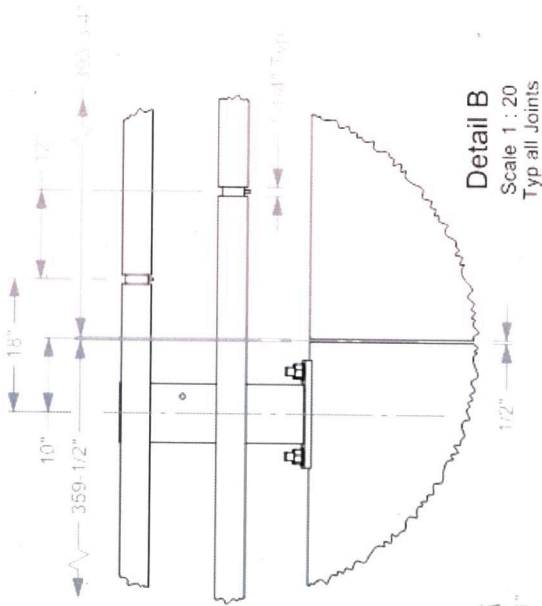
| | |
|---|--|
| General Information | |
| Test Agency | Texas A&M Transportation Institute (TTI) |
| Test Standard Test No. | MASH Test 5-12 |
| TTI Test No. | 609591-03-3 |
| Test Date | 2018-07-03 |
| Test Article | |
| Type | Longitudinal Barrier - Bridge Rail |
| Name | PennDOT PA Bridge Barrier |
| Installation Length | 149 ft-10 inches |
| Material or Key Elements | 24-inch tall x 18-inch thick reinforced concrete wall with two HSS 5x4x $\frac{3}{8}$ rails at 37 inches and 50 inches |
| Soil Type and Condition | Concrete bridge deck, damp |
| Test Vehicle | |
| Type/Designation | 36000V |
| Make and Model | 2008 Freightliner CL120 & 2002 Utility 53ft |
| Curb | 28,750 lb |
| Test Inertial | 79,280 lb |
| Dummy | None |
| Gross Static | 79,280 lb |
| Impact Conditions | |
| Speed | 49.9 mi/h |
| Angle | 14.8° |
| Location/Orientation | 23 inches downstrm of post 5 |
| Impact Severity | |
| Exit Conditions | |
| Speed | 44.0 mi/h |
| Exit Traj./Heading Angle | 4.2°/0.8° |
| Occupant Risk Values | |
| Longitudinal OIV | 3.0 ft/s |
| Lateral OIV | 13.5 ft/s |
| Longitudinal Ridedown | 8.9 g |
| Lateral Ridedown | 20.5 g |
| THIV | 13.8 ft/s |
| PHD | 21.2 g |
| ASI | 1.4 |
| Max. 0.050-s Average | |
| Longitudinal | -2.4 g |
| Lateral | -6.9 g |
| Vertical | 12.8 g |
| Post-Impact Trajectory | |
| Stopping Distance | 270 ft downstream |
| | 8 ft toward traffic |
| Vehicle Stability | |
| Maximum Yaw Angle | 25° |
| Maximum Pitch Angle | 35° |
| Maximum Roll Angle | 22° |
| Vehicle Snagging | No |
| Vehicle Pocketing | No |
| Test Article Deflections | |
| Dynamic (View Partially Obscured) | 20 inches |
| Permanent | 7.0 inches |
| Working Width | 51.9 inches |
| Working Width Height | 130.8 inches |
| Vehicle Damage | |
| VDS | NA |
| GDC | NA |
| Max. Exterior Deformation | 18 inches |
| OCDI | NA |
| Max. Occupant Compartment Deformation | 2.5 inches |

Figure 7.6. Summary of Results for MASH Test 5-12 on PennDOT PA Bridge Barrier.

Elevation View



- 1a.** All steel components, including hardware and fabricated components, shall be galvanized.
- 1b.** Threads not shown on Bolts, Threaded Rods, etc. for clarity.



See following sheets for details not shown here.

Texas A&M Transportation Institute
 Roadside Safety and Physical Security Division - Proving Ground
 Project 609591 PennDOT PA Bridge Barrier 2018-05-17
 Drawn By GES Scale: 1:200 Sheet 1 of 9 Elevation View

Figure 2.1. Details of the PennDOT PA Bridge Barrier.