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

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

In Reply Refer To:
HSST-1/B-263

SEP 2 1 2016

Ms. Karla Lechtenberg
Midwest Roadside Safety Facility
130 Whittier Research Center
2200 Vine Street
Lincoln, NE 68583-0853

Dear Ms. Lechtenberg:

This letter is in response to your November 3, 2015 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-263 and is valid until a subsequent letter is issued by FHWA that expressly references this device.

## Decision

The following devices are eligible, with details provided in the form which is attached as an integral part of this letter:
• MGS to Thrie Beam Stiffness Transition with 4-in. Tall Sloped Curb

## 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' 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 American Association of State Highway and Transportation Officials' Manual for Assessing Safety Hardware (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: MGS to Thrie Beam Stiffness Transition with 4-in. Tall Sloped Curb
Type of system: Longitudinal Barrier
Test Level: MASH Test Level 3 (TL3)
Testing conducted by: Midwest Roadside Safety Facility
Date of request: November 3, 2015
Date initially acknowledged: November 15, 2015
Date of completed package: April 11, 2016

'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**

If a manufacturer makes any modification to any of their roadside safety hardware that has an existing eligibility letter from FHWA, the manufacturer must notify FHWA of such modification with a request for continued eligibility for reimbursement. The notice of all modifications to a device must be accompanied by:

- Significant modifications – For these modifications, crash test results must be submitted with accompanying documentation and videos.
- Non-signification modifications – For these modifications, a statement from the crash test laboratory on the potential effect of the modification on the ability of the device to meet the relevant crash test criteria.

FHWA's determination of continued eligibility for the modified hardware will be based on whether the modified hardware will continue to meet the relevant crash test criteria.

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 the 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-263 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 yours,

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: | April 11, 2016 | ○ New ◉ Resubmission |
| | Name: | Karla Lechtenberg | |
| | Company: | Midwest Roadside Safety Facility | |
| | Address: | 130 Whittier Research Center, 2200 Vine Street, Lincoln, NE 68583-0853 | |
| | Country: | USA | |
| | To: | Michael S. Griffith, Director<br>FHWA, Office of Safety Technologies | |

I request the following devices be considered eligible for reimbursement under the Federal-aid highway program.

! - ! - !

| System Type | Submission Type | Device Name / Variant | Testing Criterion | Test Level |
|---|---|---|---|---|
| 'B': Barriers (Roadside, Median, Bridge Railings) | ◉ Physical Crash Testing<br>○ Engineering Analysis | MGS to Thrie Beam Stiffness Transition with or without 4-in. Tall Curb | 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.

Identification of the individual or organization responsible for the product:

| | | |
|---|---|---|
| Contact Name: | Karla Lechtenberg | Same as Submitter ☒ |
| Company Name: | Midwest Roadside Safety Facility | Same as Submitter ☒ |
| Address: | 130 Whittier Research Center, 2200 Vine Street, Lincoln, NE 68583- | Same as Submitter ☒ |
| Country: | USA | 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.

The Midwest Roadside Safety Facility (MwRSF) and its employees are requesting a letter of eligibility on behalf of the state departments of transportation participating in the Midwest States Regional Pooled Fund Program.

MwRSF's financial interests are as follows:
(i) No compensation, including wages, salaries, commissions, professional fees, or fees for business referrals;
(ii) Consulting relationships consist of answering design and implementation questions;
(iii) Research funding or other forms of research support include continuing to fund research projects with MwRSF;
(iv) No patents, copyrights, or other intellectual property interests for this system;
(v) No licenses or contractual relationships for this system; and
(vi) No business ownership and investment interests for this system.

# PRODUCT DESCRIPTION

| ◉ New Hardware or Significant Modification ○ Modification to Existing Hardware | |
|---|---|

The Nested MGS W-beam to Thrie Beam Stiffness Transition with or without Curb (STG04a-b) is an adaptation of the MGS W-beam to Thrie Beam Stiffness Transition with Standard Posts (STG03a-b) that allows the stiffness transition to be used with or without a curb. It utilizes a 4-in. tall curb placed such that the toe of the curb is flush with the back face of the guardrail. An additional 12-ft 6-in. long, 12-gauge W-beam segment (RWM04a) was incorporated into the system, such that 12 ft - 6 in. of nested W-beam guardrail precedes the 10-gauge W-to-thrie Transition segment (RWT02a). The Nested MGS W-beam to Thrie Beam Stiffness Transition with Curb (STG04a-b) may be used with or without soil backfill installed behind the curb.

If using a curb, the 4-in. tall curb should be placed through the entire length of the Nested MGS W-beam to Thrie Beam Stiffness Transition. In other words, the curb should extend from the bridge through the nested W-beam section before being terminated or transitioned to another curb type. It is recommended to utilize a minimum length of 3 ft for any curb shape transitions or terminations, such as transition from 4-in. curb to no curb. A minimum of 2 ft of level or gently-sloped fill should be placed behind the posts, unless special design provisions have been made to account for decreased post-soil resistance.

Although the reference point has been changed to the upstream end of the nested rail segment, these recommendations result in the same system lengths upstream of the W-to-thrie Transition segment (RWT02a) that were recommended for the MGS W-beam to Thrie Beam Stiffness Transition with Standard Posts (STG03a-b). The recommendations for utilizing the Nested MGS W-beam to Thrie Beam Stiffness Transition with or without Curb (STG04a-b) include:
(1) The total system length of an acceptable TL-3 guardrail end terminal should be the minimum length of W-beam guardrail installed upstream of the nested W-beam section. The guardrail terminal's interior end (identified by stroke length) should not intrude into the nested W-beam section of the Nested MGS W-beam to Thrie Beam Stiffness Transition with or without Curb (STG04a-b).
(2) A minimum barrier length of 34 ft – 4½ in. is recommended to be installed beyond the upstream end of the nested W-beam section, which includes standard MGS, a crashworthy guardrail end terminal, and an acceptable anchorage system.
(3) For flared guardrail applications, a minimum length of 12 ft - 6 in. is recommended between the upstream end of the nested W-beam section and the start of the flared section (i.e. bend between flare and tangent sections).
(4) For non-blocked MGS applications, a minimum length of 12 ft - 6 in. of standard MGS with spacer blocks (SGR20a-c) is to be placed adjacent to the upstream end of the nested W-beam section prior to transitioning to a non-blocked, 31-in. tall W-beam guardrail system.

For further information on implementation recommendations, see Chapter 9 of MwRSF report no. TRP-03-291-14.

# CRASH TESTING

A brief description of each crash test and its result:

| Required Test Number | Narrative Description | Evaluation Results |
|---|---|---|
| 3-10 (1100C) | Test no. 3-10 is for barrier Length of Need. LON testing for MGS was conducted and covered in FHWA letter B-212 of 6/10/2011. | Non-Relevant Test, not conducted. |
| 3-11 (2270P) | Test no. 3-11 is for barrier Length of Need. LON testing for MGS was conducted and covered in FHWA letter B-212 of 6/10/2011. | Non-Relevant Test, not conducted. |

| Required Test Number | Narrative Description | Evaluation Results |
|---|---|---|
| 3-20 (1100C) | The results of test no. MWTC-2 conducted on November 30, 2012 are found in MwRSF report no. TRP-03-291-14. A 2,410-lb small car with a simulated occupant in the left-front seat, impacted the MGS to thrie beam stiffness transition system with a 4-in. curb at a speed of 61.3 mph and at an angle of 25.6 degrees. At 0.312 sec, the vehicle exited the system at a speed of 19.6 mph and at an angle of 11.0 degrees.<br><br>Exterior vehicle damage was moderate, and the interior occupant compartment deformations were minimal with a maximum of 1 in., consequently not violating the limits established in MASH. Damage to the barrier was also moderate, consisting of contact marks on and deformation to the W-beam rail and the guardrail posts and fractured wood spacer blocks. The maximum lateral dynamic rail and post deflections were 14.4 in. and 16.4 in., respectively. The working width of the system was 32.5 in. All occupant risk measures were within the recommended limits, and the test vehicle showed no tendency for rollover. | PASS |
| 3-21 (2270P) | The results of test no. MWTC-3 conducted on May 16, 2013 are found in MwRSF report no. TRP-03-291-14. A 4,969-lb pickup truck with a simulated occupant seated in the left-front seat, impacted the MGS to thrie beam stiffness transition system with a 4-in. curb at a speed of 61.0 mph and at an angle of 24.4 degrees. At 0.218 sec after impact, the vehicle became parallel with the system. At 0.326 sec, the vehicle exited the system at a speed of 38.3 mph and at an angle of 11.7 degrees.<br><br>Exterior vehicle damage was moderate, and the interior occupant compartment deformations were minimal with a maximum of 2 1/2 in., consequently not violating the limits established in MASH. Damage to the barrier was also moderate, consisting of contact marks on and deformation to the W-beam rail and the guardrail posts and fractured wood spacer blocks. The maximum lateral dynamic rail and post deflections were 23.9 in. and 22.0 in., respectively. The working width of the system was 40.8 in. All occupant risk measures were within recommended limits, and the test vehicle showed no tendency for rollover. | 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: | Midwest Roadside Safety Facility | |
| Laboratory Signature: | Karla Lechtenberg Digitally signed by Karla Lechtenberg DN: cn=Karla Lechtenberg, o=Midwest Roadside Safety Facility (MwRSF), ou, email=kpolivka2@unl.edu, c=US Date: 2016.04.11 14:56:01 -05'00' | |
| Address: | 130 Whittier Research Center, 2200 Vine Street, Lincoln, NE 68583-0853 | Same as Submitter ☒ |
| Country: | USA | Same as Submitter ☒ |
| Accreditation Certificate Number and Dates of current Accreditation period : | A2LA Certificate Number: 2937.01, Valid to November 30, 2017 | |

Submitter Signature*: Karla Lechtenberg Digitally signed by Karla Lechtenberg DN: cn=Karla Lechtenberg, o=Midwest Roadside Safety Facility (MwRSF), ou, email=kpolivka2@unl.edu, c=US Date: 2016.04.11 14:56:24 -05'00'

Submit Form

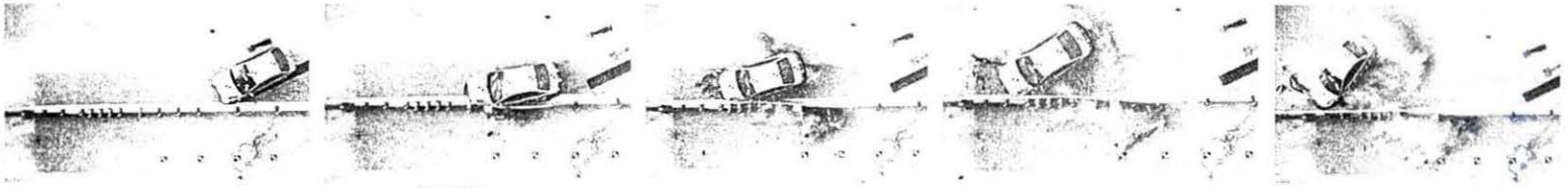
## ATTACHMENTS

Attach to this form:

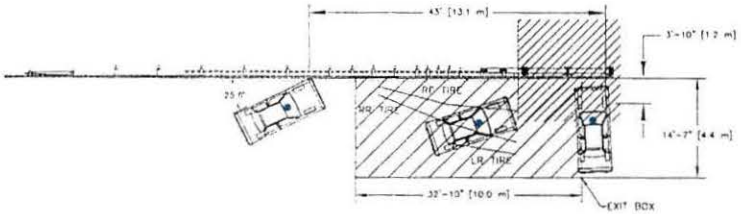
1) Additional disclosures of related financial interest as indicated above.
2) A copy of the full test report, video, and a Test Data Summary Sheet for each test conducted in support of this request.
3) A drawing or drawings of the device(s) that conform to the Task Force-13 Drawing Specifications [Hardware 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 | | AASHTO TF13 | |
|---|---|---|---|
| Number | Date | Designator | Key Words |
| | | | |



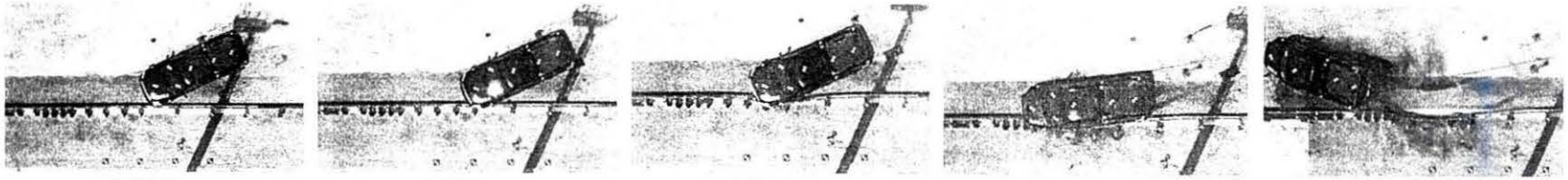

- Test Agency ..... MwRSF
- Test Number ..... MWTC-2
- Date ..... 11/30/12
- MASH Test Designation ..... 3-20
- Test Article ..... Stiffness Transition between MGS and Thrie Beam Transition with Curb
- Total Length ..... 87.5 ft (26.7 m)
- Height to Top of Rail ..... 31 in. (787 mm)
- Steel 12 gauge (2.66 mm) W-Beam Guardrail
  - Segment Location - Single ..... Post no. 1 to Splice 6/7
  - Segment Location - Nested ..... Splice 6/7 to Post no. 9
- Steel 10 gauge (3.42 mm) W-Beam to Thrie Beam Transition
  - Segment Location ..... Post nos. 9 to 11
- Steel 12 gauge (2.66 mm) Thrie Beam Guardrail
  - Segment Location - Single ..... Post nos. 11 to 14 and 19 to 21
  - Segment Location - Nested ..... Post nos. 14 to 19
- Guardrail Posts
  - Post Nos. 1-2 ..... 46 in. (1,168 mm) long, BCT timber posts
  - Post Nos. 3-15 ..... 72 in. (1,829 mm) long, W6x8.5 (W152x12.6)
  - Post Nos. 16-18 ..... 84 in. (2,134 mm) long, W6x15 (W152x22.3)
  - Post Nos. 19-21 ..... 29¾ 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)
- Soil Type ..... AASHTO Grade B
- Vehicle
  - Make and Model ..... 2007 Kia Rio
  - Test Inertial ..... 2,410 lb (1,093 kg)
  - Gross Static ..... 2,575 lb (1,168 kg)
  - Curb ..... 2,390 lb (1,084 kg)
- Impact Conditions
  - Speed ..... 61.3 mph (98.7 km/h)
  - Angle ..... 25.6 deg
  - Impact Severity (IS) ..... 56.5 kip-ft (76.6 kJ) > 51.0 kip-ft (69.1 kJ)
  - Impact Location ..... 11¼ in. (286 mm) downstream of post no. 7
- Exit Conditions
  - Speed ..... 19.6 mph (31.5 km/h)
  - Angle ..... 11.0 deg
- Exit Box Criterion ..... Passed
- Vehicle Stability ..... Satisfactory



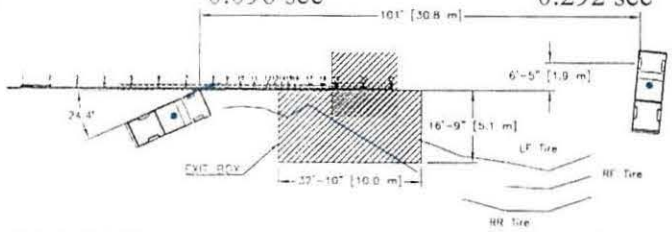

- Vehicle Stopping Distance ..... 43.0 ft (13.1 m) downstream of impact
  ..... 3.8 ft (1.2 m) laterally in front of system
- Vehicle Damage ..... Moderate
  VDS[7] ..... 11-LFQ5
  CDC[8] ..... 11-LFEW2
  Maximum Interior Deformation ..... 1 in. (25 mm)
- Test Article Damage ..... Moderate
- Maximum Test Article Deflections
  - Permanent Set ..... 16.1 in. (409 mm)
  - Dynamic ..... 16.4 in. (417 mm)
  - Working Width ..... 32.5 in. (826 mm)
- Maximum Angular Displacements
  - Roll ..... -13.7° < 75°
  - Pitch ..... -8.6° < 75°
  - Yaw ..... -70.7°
- Transducer Data

| Evaluation Criteria | | Transducer | | | MASH Limit |
|---|---|---|---|---|---|
| | | DTS | DTS SLICE | EDR-3 | |
| OIV ft/s (m/s) | Longitudinal | -22.23 (6.78) | -23.04 (-7.02) | -24.21 (-7.38) | ≤ 40 (12.2) |
| | Lateral | 22.53 (6.87) | 24.14 (7.36) | 21.19 (6.46) | ≤ 40 (12.2) |
| ORA g's | Longitudinal | -15.65 | -16.58 | -11.72 | ≤ 20.49 |
| | Lateral | 13.45 | 12.45 | 10.88 | ≤ 20.49 |
| THIV – ft/s (m/s) | | 31.66 (9.65) | 31.79 (9.69) | NA | not required |
| PHD – g's | | 15.69 | 18.84 | NA | not required |
| ASI | | 1.32 | 1.40 | 1.27 | not required |

Figure 84. Summary of Test Results and Sequential Photographs, Test No. MWTC-2



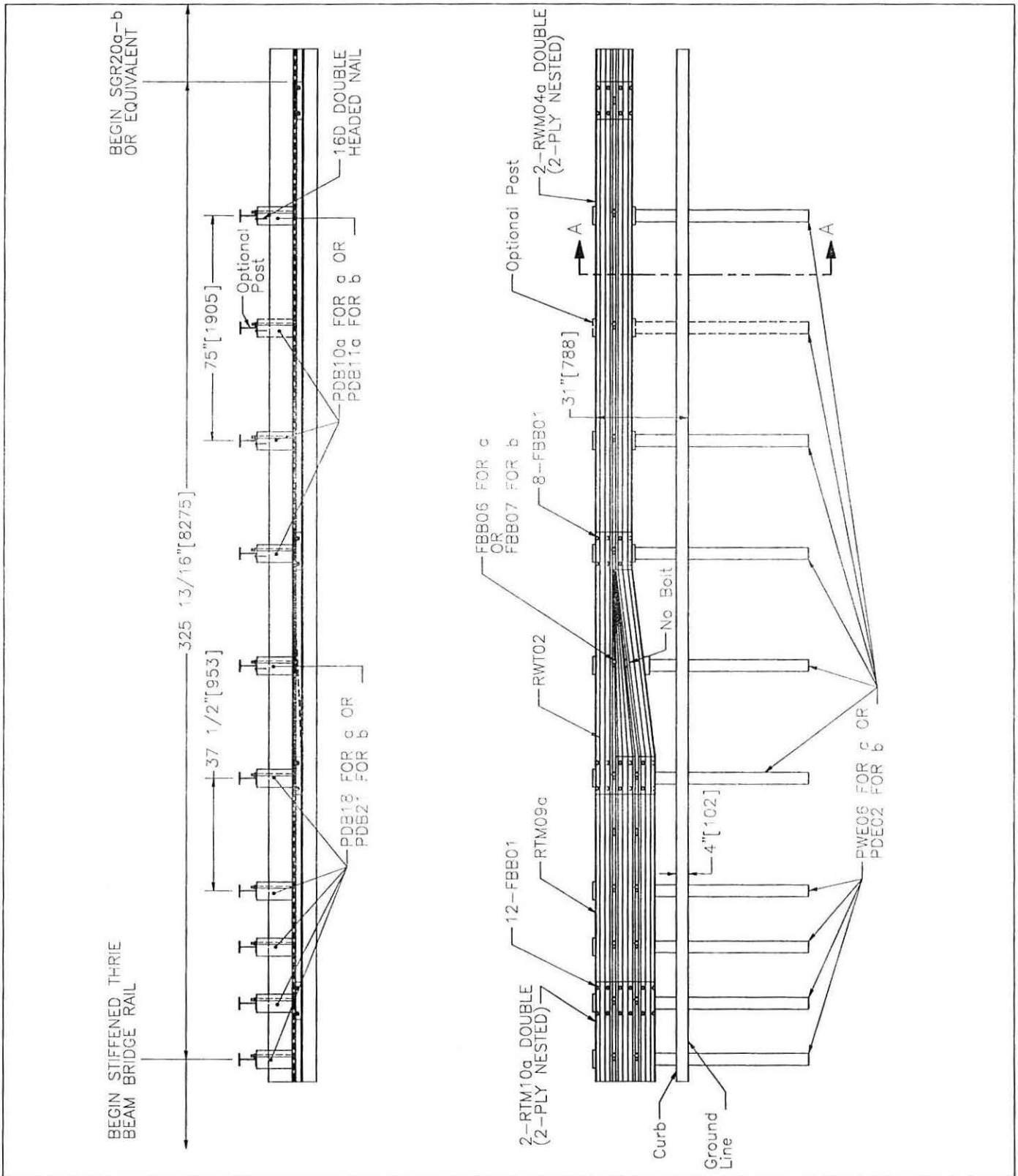

- Test Agency ..... MwRSF
- Test Number ..... MWTC-3
- Date ..... 5/16/13
- MASH Test Designation ..... 3-21
- Test Article ..... Stiffness Transition between MGS and Thrie Beam Transition with Curb
- Total Length ..... 87.5 ft (26.7 m)
- Height to Top of Rail ..... 31 in. (787 mm)
- Steel 12 gauge (2.66 mm) W-Beam Guardrail
  - Segment Location - Single ..... Post no. 1 to Splice 6/7
  - Segment Location - Nested ..... Splice 6/7 to Post no. 9
- Steel 10 gauge (3.42 mm) W-Beam to Thrie Beam Transition
  - Segment Location ..... Post nos. 9 to 11
- Steel 12 gauge (2.66 mm) Thrie Beam Guardrail
  - Segment Location - Single ..... Post nos. 11 to 14 and 19 to 21
  - Segment Location - Nested ..... Post nos. 14 to 19
- Guardrail Posts
  - Post Nos. 1-2 ..... 46 in. (1,168 mm) long, BCT timber 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 ..... 29¾ 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)
- Soil Type ..... AASHTO Grade B
- Vehicle
  - Make and Model ..... 2006 Dodge Ram 1500 Quad Cab
  - Test Inertial ..... 4,969 lb (2,254 kg)
  - Gross Static ..... 5,135 lb (2,329 kg)
  - Curb ..... 5,134 lb (2,329 kg)
- Impact Conditions
  - Speed ..... 61.0 mph (98.1 km/h)
  - Angle ..... 24.4 deg
  - Impact Severity ..... 105.8 kip-ft (143.4 kJ) > 105.6 kip-ft (143.2 kJ)
  - Impact Location ..... 75 in. (1,905 mm) Upstream of Post No. 9
- Exit Conditions
  - Speed ..... 38.3 mph (61.7 km/h)
  - Angle ..... 11.7 deg
- Exit Box Criterion ..... Passed




- Vehicle Stability ..... Satisfactory
- Vehicle Stopping Distance ..... 101 ft (30.8 m) downstream of impact
  ..... 6.4 ft (2.0 m) laterally behind system
- Vehicle Damage ..... Moderate
  VDS[7] ..... 11-LFQ4
  CDC[8] ..... 11-LFEW2
  Maximum Interior Deformation ..... 2½ in. (64 mm)
- Test Article Damage ..... Moderate
- Maximum Test Article Deflections
  - Permanent Set ..... 17.8 in. (452 mm)
  - Dynamic ..... 23.9 in. (607 mm)
  - Working Width ..... 40.8 in. (1,036 mm)
- Maximum Angular Displacements
  - Roll ..... -21.8° < 75°
  - Pitch ..... -10.8° < 75°
  - Yaw ..... 55.4°
- Transducer Data

| Evaluation Criteria | | Transducer | | | MASH Limit |
|---|---|---|---|---|---|
| | | DTS | DTS SLICE | DTS | |
| OIV ft/s (m/s) | Longitudinal | -17.62 (-5.37) | -17.46 (-5.32) | -18.77 (-5.72) | ≤ 40 (12.2) |
| | Lateral | 16.31 (4.97) | 17.79 (5.42) | 17.11 (5.22) | ≤ 40 (12.2) |
| ORA g's | Longitudinal | -12.52 | -12.29 | -13.07 | ≤ 20.49 |
| | Lateral | 10.94 | 9.18 | 10.12 | ≤ 20.49 |
| THIV – ft/s (m/s) | | 23.02 (7.02) | 23.75 (7.24) | NA | not required |
| PHD – g's | | 15.21 | 14.83 | NA | not required |
| ASI | | 0.88 | 0.93 | 0.92 | not required |

Figure 93. Summary of Test Results and Sequential Photographs, Test No. MWTC-3




# NESTED MGS W-BEAM TO THRIE BEAM TRANSITION WITH CURB

MwRSF

| STG04a-b | |
|---|---|
| SHEET NO. | DATE: |
| 1 of 4 | 1/8/2015 |

## INTENDED USE

Nested Midwest Guardrail System (MGS) W-beam to Thrie Beam Transition with Curb is intended to be used when the MGS is placed adjacent to a stiffened thrie beam approach guardrail transition to a stiff bridge rail with a 4" [102] curb. The Nested MGS W-beam to Thrie Beam Transition with Curb without the optional post upstream of the Asymmetrical W-beam to Thrie Beam Transition (RWT02) should be used in locations where a maximum dynamic deflection of 32.5" [826] or less is acceptable and where a working width of 40.8" [1,306] is provided. Nested MGS W-beam to Thrie Beam Transition with Curb with the optional post upstream of the Asymmetrical W-beam to Thrie Beam Transition (RWT02) may be used in locations where safety benefits of reduced vehicle pocketing and snag and system dynamic deflections of 27" [686] or less is desired. The Nested MGS W-beam to Thrie Beam Transition with Curb may be used with or without soil backfill and should be installed with a minimum of 24" [610] of level or gently-sloped fill placed behind the posts.

The Nested MGS W-beam to Thrie Beam Transition with Curb should be used with the following guidelines:

1. A minimum barrier length installed upstream of the nested W-beam (RWM04a) should be the total system length of an acceptable Test Level (TL-3) guardrail end terminal. The guardrail end terminal's interior end (stroke length) should not intrude into the nested W-beam (RWM04a).
2. A minimum barrier length of 412.5" [10,478] should be installed beyond the upstream end of the nested W-beam (RWM04a), which includes standard MGS, a crashworthy guardrail end terminal, and an acceptable anchorage system.
3. For flared guardrail applications, a minimum barrier length of 150" [3810] should be used between the upstream end of the nested W-beam (RWM04a) and the start of the flared section (i.e., bend between flare and tangent sections).

The Nested MGS W-beam to Thrie Beam Transition with Curb has been crash tested under TL-3 conditions of the Manual for Assessing Safety Hardware (MASH) and deemed acceptable according to the MASH safety performance criteria.

## COMPONENTS

Unit Length=325 13/16" [8275]

| DESIGNATOR | COMPONENT | QUANTITY | SYSTEM |
|---|---|---|---|
| ----- | Stiffened Thrie Beam Bridge Rail System | 1 | a-b |
| RWM04a | 4-Space W-Beam Guardrail | 2 | a-b |
| PDB18 | 6x12x19" [152x305x483] SYP Blockout | 6 | a |
| RTM10a | 12'-6" [3810] Thrie Beam, Quarter Post Spacing | 2 | a-b |
| RTM09a | 6'-3" [1905] Thrie Beam, Quarter Post Spacing | 1 | a-b |
| PWE06 | W6x8.5 72" [1829] Posts | 9 | a |
| PDB10a | 6x12x14.25" [152x305x362] SYP Blockout | 3 | a |
| RWT02 | Asymmetrical W to Thrie Beam Transition | 1 | a-b |
| FBB06 | 14" [356] Guardrail Bolt and Recessed Nut | 14 | a |
| FBB07 | 21" [356] Guardrail Bolt and Recessed Nut | 14 | b |
| ----- | 16D Double Headed Nail | 4 | a-b |
| FBB01 | 1.5" [38] Guardrail Bolt and Recessed Nut | 40 | a-b |
| PDB11 | 6x12x14.5" [152x305x368] SYP Blockout | 3 | b |
| PDB21 | 6x12x19" [152x305x483] SYP Blockout | 6 | b |
| PDE02 | 6x8" [152x203] 72" [1829] Wood Post | 9 | b |

## ELIGIBILITY

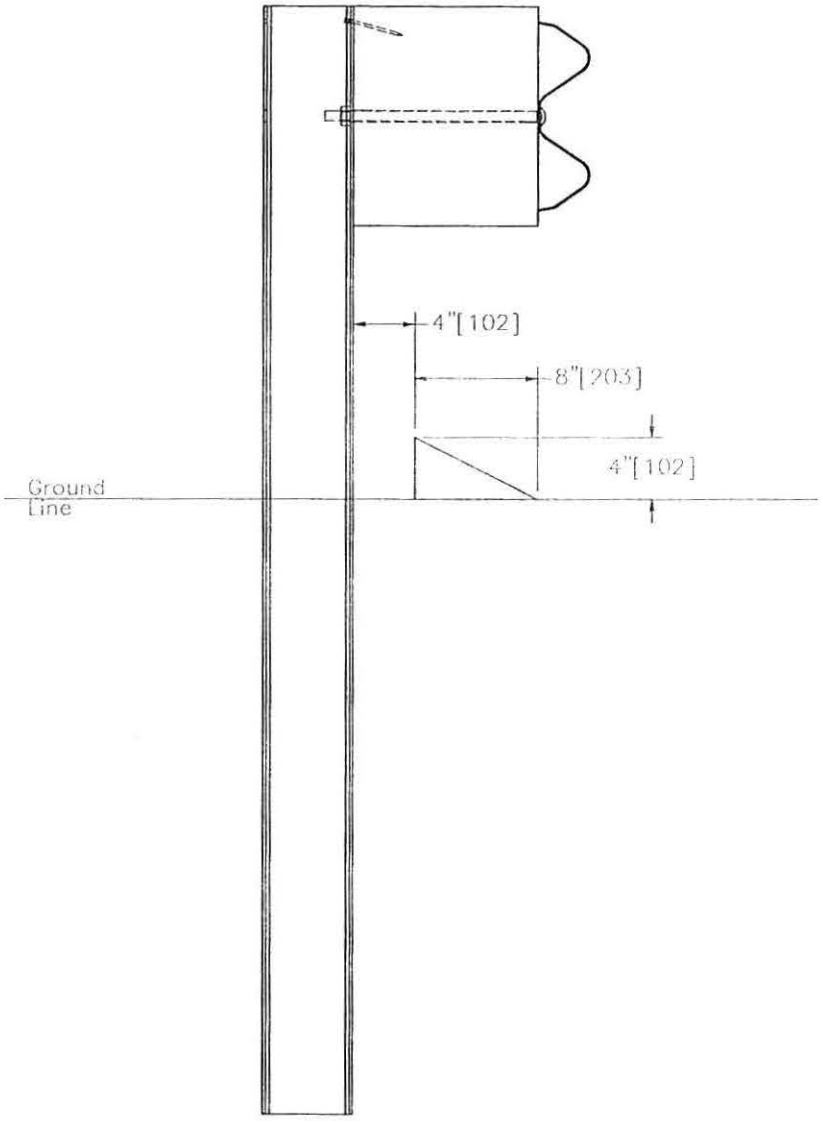
FHWA eligibility will be pursued.

# NESTED MGS W-BEAM TO THRIE BEAM TRANSITION WITH CURB

MwRSF

STG04a-b

| SHEET NO. | DATE: |
|---|---|
| 2 of 4 | 1/8/2015 |




SECTION A–A

# NESTED MGS W-BEAM TO THRIE BEAM TRANSITION WITH CURB

MwRSF

STG04a-b

| SHEET NO. | DATE: |
|---|---|
| 3 of 4 | 1/8/2015 |

## REFERENCES

Winkelbauer, B.J., Putjenter, J.G., Rosenbaugh, S.K., Lechtenberg, K.A., Bielenberg, R.W., Faller, R.K., and Reid, J.D., *Dynamic Evaluation of MGS Stiffness Transition with Curb,* Final Report to Midwest States Pooled Fund, Transportation Research Report No. TRP-03-291-14, Project No. TPF-5(193) Supplement #58 and 63, Midwest Roadside Safety Facility, University of Nebraska-Lincoln, Lincoln, NE, June 30, 2014.

## CONTACT INFORMATION

Midwest Roadside Safety Facility
Nebraska Transportation Center
University of Nebraska-Lincoln
130 Whittier Research Center
2200 Vine Street
Lincoln, NE 68583-0853
(402) 472-0965
Email: mwrsf@unl.edu
Website: http://mwrsf.unl.edu/

NESTED MGS W-BEAM TO THRIE BEAM TRANSITION WITH CURB

MwRSF

STG04a-b