March 27, 2014

Ms. Karla Lechtenberg
Midwest Roadside Safety Facility (MwRSF)
130 Whittier Research Center
2200 Vine Street
Lincoln, NE 68583

Dear Ms. Lechtenberg:

This letter is in response to your request for the Federal Highway Administration (FHWA) to review a roadside safety system for eligibility for reimbursement under the Federal-aid highway program.

Name of system: 31-inch Midwest Guardrail System (MGS) with Southern Yellow Pine Posts
Type of system: Longitudinal Barrier
Test Level: AASHTO MASH TL3
Testing conducted by: Midwest Roadside Safety Facility (MwRSF)
Task Force 13 Designator: SGR20a-c
Date of request: December 18, 2013

Decision:
The following device is eligible, with details provided in the form which is attached as an integral part of this letter:

- 31-inch Midwest Guardrail System (MGS) with Southern Yellow Pine Posts

Based on a review of crash test results you submitted certifying 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), the device is eligible for reimbursement under the Federal-aid highway program. Eligibility for reimbursement under the Federal-aid highway program does not establish approval or endorsement by the FHWA for any particular purpose or use.

The FHWA, the Department of Transportation, and the United States Government do not endorse products or services and the issuance of a reimbursement eligibility letter is not an endorsement of any product or service.
Requirements
To be found eligible for Federal-aid funding, 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).

Description
The device and supporting documentation are described in the attached form.

Summary and Standard Provisions
Therefore, the system described and detailed in the attached form is eligible for reimbursement and may be installed under the range of conditions tested. Please note the following standard provisions that apply to FHWA eligibility letters:

- This letter provides a AASHTO/ARTBA/AGC Task Force 13 designator that should be used for the purpose of the creation of a new and/or the update of existing Task Force 13 drawing for posting on the on-line 'Guide to Standardized Highway Barrier Hardware' currently referenced in AASHTO Roadside Design Guide.
- This finding of eligibility does not cover other structural features of the systems, nor conformity with the Manual on Uniform Traffic Control Devices.
- Any changes that may influence system conformance with MASH will require a new reimbursement eligibility letter.
- Should the FHWA discover that the qualification testing was flawed, that in-service performance reveals safety problems, or that the system is significantly different from the version that was crash tested, we reserve the right to modify or revoke this letter.
- You are expected to supply potential users with sufficient information on design and installation 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.
- To prevent misunderstanding by others, this letter of eligibility is designated as number B-230A and 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 at our office 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. The FHWA does not become involved in issues concerning patent law. Patent issues, if any, are to be resolved by the applicant.

Sincerely yours,

Michael S. Griffith
Director, Office of Safety Technologies
Office of Safety

Enclosures
Request for Federal Aid Reimbursement Eligibility
Of Highway Safety Hardware

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

<table>
<thead>
<tr>
<th>System Type</th>
<th>Submission Type</th>
<th>Device Name / Variant</th>
<th>Testing Criterion</th>
<th>Test Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>'B': Barriers (Roadside, Median, Bridge Railings)</td>
<td>( ) Physical Crash Testing  ( ) FEA &amp; V&amp;V Analysis</td>
<td>Midwest Guardrail System (MGS) with Southern Yellow Pine Posts</td>
<td>AASHTO MASH</td>
<td>TL3</td>
</tr>
</tbody>
</table>

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:

<table>
<thead>
<tr>
<th>Contact Name:</th>
<th>Karla Lechtenberg</th>
<th>Same as Submitter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company Name:</td>
<td>Midwest Roadside Safety Facility (MwRSF)</td>
<td>Same as Submitter</td>
</tr>
<tr>
<td>Address:</td>
<td>130 Whittier Research Center, 2200 Vine Street, Lincoln, NE 68583-0853</td>
<td>Same as Submitter</td>
</tr>
<tr>
<td>Country:</td>
<td>USA</td>
<td>Same as Submitter</td>
</tr>
</tbody>
</table>

PRODUCT DESCRIPTION

Modification to Existing Hardware Non-Significant - Effect is positive or Inconsequential

The Midwest Guardrail System (MGS) with Southern Yellow Pine (SYP) wood posts (SGR20a-c) consists of standard 12-gauge W-beam sections (RMW04a) installed with the top of the rail set at a nominal height of 31 inches. The rail is mounted on standard 6-in. x 8-in. SYP wood posts that are 6-ft long (PDE02) and set at 75-in. centers. The posts are embedded 40 inches in the ground. A 6-in. x 8-in. x 12-in. wood blockout (PDB11a-b) is used to block the rail away from the front face of the SYP wood post. The rail splices are located at mid-spans between adjacent posts. Standard guardrail bolts or ASTM A307 5/8-in. diameter x 21-in. long guardrail bolts and nuts (FBB07) are used to attach the rail to the posts.

CRASH TESTING

A brief description of each crash test and its result:
Request for Federal Aid Reimbursement Eligibility
Of Highway Safety Hardware

<table>
<thead>
<tr>
<th>Submitter</th>
<th>Date of Request: December 18, 2013</th>
<th>Name: Karla Lechtenberg</th>
<th>Signature:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company:</td>
<td>Midwest Roadside Safety Facility (MwRSF)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Address:</td>
<td>130 Whittier Research Center, 2200 Vine Street, Lincoln, NE 68583-0853</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Country:</td>
<td>USA</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>System Type</th>
<th>Submission Type</th>
<th>Device Name / Variant</th>
<th>Testing Criterion</th>
<th>Test Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>'B': Barriers (Roadside, Median, Bridge Railings)</td>
<td>☑ Physical Crash Testing</td>
<td>Midwest Guardrail System (MGS) with Southern Yellow Pine Posts</td>
<td>AASHTO MASH</td>
<td>TL3</td>
</tr>
<tr>
<td>☑ FEA &amp; V&amp;V Analysis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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:

<table>
<thead>
<tr>
<th>Contact Name:</th>
<th>Karla Lechtenberg</th>
<th>Same as Submitter ✗</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company Name:</td>
<td>Midwest Roadside Safety Facility (MwRSF)</td>
<td>Same as Submitter ✗</td>
</tr>
<tr>
<td>Address:</td>
<td>130 Whittier Research Center, 2200 Vine Street, Lincoln, NE 68583-0853</td>
<td>Same as Submitter ✗</td>
</tr>
<tr>
<td>Country:</td>
<td>USA</td>
<td>Same as Submitter ✗</td>
</tr>
</tbody>
</table>

PRODUCT DESCRIPTION

Modification to Existing Hardware Non-Significant - Effect is positive or inconsequential

The Midwest Guardrail System (MGS) with Southern Yellow Pine (SYP) wood posts (SGR20a-c) consists of standard 12-gauge W-beam sections (RWM04a) installed with the top of the rail set at a nominal height of 31 inches. The rail is mounted on standard 6-in. x 8-in. SYP wood posts that are 6-ft long (PDE02) and set at 75-in. centers. The posts are embedded 40 inches in the ground. A 6-in. x 8-in. x 12-in. wood blockout (PDB11a-b) is used to block the rail away from the front face of the SYP wood post. The rail splices are located at mid-spans between adjacent posts. Standard guardrail bolts or ASTM A307 5/8-in. diameter x 21-in. long guardrail bolts and nuts (FBB07) are used to attach the rail to the posts.

CRASH TESTING

A brief description of each crash test and its result:
<table>
<thead>
<tr>
<th>Required Test Number</th>
<th>Narrative Description</th>
<th>Evaluation Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-10 (1100C)</td>
<td>The results of test no. MGSSYP-2 conducted on September 13, 2011 are found in MwRSF report no. TRP-03-272-13. A 2,612-lb small car with a simulated occupant seated in the right-front seat, impacted the MGS with SYP posts, with its rail height set to the maximum tolerance of 32 inches, at a speed of 61.5 mph and at an angle of 25.3 degrees. After impact, the vehicle began to redirect, including a counter-clockwise yaw rotation. At 0.260 sec after impact, the vehicle became parallel to the guardrail with a speed of 41.2 mph. At 0.484 sec, the vehicle exited the guardrail at an angle of 13.6 degrees and at a speed of 35.7 mph. The vehicle was smoothly redirected. Exterior vehicle damage was moderate, and the interior occupant compartment deformations were minimal, with a maximum deformation of 1 1/4 in. (32 mm), consequently not violating the limits established in MASH. Damage to the barrier was moderate, consisting mostly of deformed W-beam rail and fractured wood guardrail posts as well as contact marks on guardrail and posts. The maximum lateral dynamic rail deflection was 22.2 inches. The working width of the system was 39.7 inches. All occupant risk measures were well below recommended values, and the test vehicle showed no tendency to roll over.</td>
<td>PASS</td>
</tr>
<tr>
<td>3-11 (2270P)</td>
<td>The results of test no. MGSSYP-1 conducted on August 3, 2011 are found in MwRSF report no. TRP-03-272-13. A 5,199-lb pickup truck with a simulated occupant seated in the right-front seat, impacted the MGS with SYP posts, with its rail height set to the nominal height of 31 inches, at a speed of 62.2 mph and at an angle of 24.9 degrees. At 0.290 sec after impact, the vehicle became parallel to the guardrail with a speed of 46.8 mph. At 0.652 sec, the vehicle exited the guardrail at an angle of 15.7 degrees and at a speed of 37.8 mph. The vehicle was smoothly redirected even though the right-front tire snagged on a post and was disengaged from the vehicle. Exterior vehicle damage was minimal, 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 mostly of deformed W-beam and fractured guardrail posts as well as contact marks on guardrail. The maximum lateral dynamic rail deflection was 40.0 inches. The working width of the system was 53.8 inches. All occupant risk measures were well below recommended values, and the test vehicle showed no tendency to roll over.</td>
<td>PASS</td>
</tr>
<tr>
<td>3-20 (1100C)</td>
<td>Not applicable</td>
<td>WAIVER REQUESTED</td>
</tr>
<tr>
<td>3-21 (2270P)</td>
<td>Not applicable</td>
<td>WAIVER REQUESTED</td>
</tr>
</tbody>
</table>

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 Contact: Karla Lechtenberg
Address: 130 Whittier Research Center, 2200 Vine Street, Lincoln, NE 68583-0853
Country: USA
Accreditation Certificate Number and Date: A2LA Certificate Number: 2937.01, Valid to December 31, 2013

### ATTACHMENTS

Attach to this form:

1) A copy of the full test report, video, and a Test Data Summary Sheet for each test conducted in support of this request.

2) 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 key to understanding the performance of the device should also be submitted to facilitate our review.

<table>
<thead>
<tr>
<th>Eligibility Letter</th>
<th>AASHTO TF13</th>
<th>Designator</th>
<th>Key Words</th>
</tr>
</thead>
<tbody>
<tr>
<td>B230A</td>
<td>March 14, 2014</td>
<td>SGR20a-c</td>
<td>31-inch MGS, Southern Yellow Pine (SYP) wood posts.</td>
</tr>
</tbody>
</table>
Figure 32. Summary of Test Results and Sequential Photographs, Test No. MGSSYP-1
- **Test Agency**: MoRFS
- **Test Number**: MGSSYP-2
- **Date**: 9/13/2011
- **MASH Test Designation No**: 3-10
- **Test Article**: MGS with SYP Posts
- **Test Length**: 181 ft - 3 in (55.3 m)
- **Key Component - Steel W-Beam Guardrail**: Thickness 12 gauge (2.66 mm), Top Mounting Height 32 in (813 mm)
- **Key Component - Southern Yellow Pine Posts**: Dimensions 6 x 8 x 72 in (152 x 203 x 1829 mm), Post Spacing 75 in (1.905 mm), Embedment Depth 39 in (991 mm)
- **Test Vehicle**: 2004 Kia Rio, Weight 2,402 lb (1,090 kg)
- **Test Conditions**: Speed 61.5 mph (99.9 km/h), Angle (Trajectory) 25 deg, Angle (Direction) 24.9 deg, Impact Location 8 ft - 4 in (2.5 m) Upstream of Post No. 15
- **Impact Severity (IS)**: 50.4 kip-ft (70.4 kJ) > 51 kip-ft (69.7 kJ)
- **Exit Conditions**: Speed 35.7 mph (57.4 km/h), Angle (Trajectory) 13.6 deg, Angle (Orientation) 90 deg
- **Exit Box Criterion**: Pass
- **Vehicle Stopping Distance**: 160 ft - 2 in (51.3 m) downstream, 17 ft - 11 in (5.5 m) laterally in front
- **Vehicle Damage**: MASH Postion 01-ROQ-6, Maximum Temporal Deformation 1/16.1 in (31.8 mm)
- **Test Article Damage**: Moderate
- **Maximum Test Article Deflections**: Permanent Set 10/8 in (413 mm)
- **Dynamic**: 22.2 in (564 mm)
- **Working Width**: 39.7 in (1,008 mm)
- **Maximum Angular Displacements**: Roll -10.7° < 75°, Pitch -6.7° < 75°, Yaw -32.9°

---

**Figure 49. Summary of Test Results and Sequential Photographs, Test No. MGSSYP-2**

<table>
<thead>
<tr>
<th>Evaluation Criteria</th>
<th>EDR-3</th>
<th>DTS</th>
<th>MASH Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>OIV (ft/s) (m/s)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>60</td>
</tr>
<tr>
<td>Longitudinal</td>
<td>-17.13 (-5.22)</td>
<td>-15.72 (-4.79)</td>
<td>≤ 40 (12.2)</td>
</tr>
<tr>
<td>Lateral</td>
<td>-19.52 (-5.95)</td>
<td>-20.93 (-6.38)</td>
<td>≤ 40 (12.2)</td>
</tr>
<tr>
<td>ORA (ft/s) (m/s)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Longitudinal</td>
<td>-13.05</td>
<td>-13.04</td>
<td>≤ 20.49</td>
</tr>
<tr>
<td>Lateral</td>
<td>-7.42</td>
<td>-9.30</td>
<td>≤ 20.49</td>
</tr>
<tr>
<td>THV - ft/s (m/s)</td>
<td>NA</td>
<td>27.92 (8.51)</td>
<td>not required</td>
</tr>
<tr>
<td>PIDD - g's</td>
<td>NA</td>
<td>14.38</td>
<td>not required</td>
</tr>
<tr>
<td>ASI</td>
<td>0.91</td>
<td>0.99</td>
<td>not required</td>
</tr>
</tbody>
</table>

---

MoRFS Report No.: TR-02.272-13
September 5, 2013
MIDWEST GUARDRAIL SYSTEM WITH STANDARD POST SPACING

SGR20a-c

SECTION A-A

ELEVATION

SGR20b-c

16D NAIL
GALVANIZED

8-FBB01
8-FBB01

8-FBB01
8-FBB01

31" [787]
24 7/8" [632]

31" [787]
24 7/8" [632]

40" [1016]

40" [1016]
INTENDED USE
Midwest Guardrail System (MGS) with standard post spacing should be used in locations where a maximum
dynamic deflection of 43 1/16 in. (1094 mm) or less is acceptable and where a working width of 49" (1245 mm) is provided.
MGS should be anchored and terminated using a suitable guardrail end treatment that is approved with a 31" (787 mm)
top mounting height. MGS can be used with wide-flange steel posts (PWE06) or timber posts (PDE02). Guardrail
sections measuring 300" (7620 mm) long can be used in lieu of the 150" (3810 mm) long sections. This system is TL-3
NCHRP 350 accepted and acceptable according to the update to NCHRP 350.

COMPONENTS
Unit Length = 150" (3810 mm)

<table>
<thead>
<tr>
<th>DESIGNATOR</th>
<th>COMPONENT</th>
<th>SYSTEM</th>
<th>NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>FBB01</td>
<td>Guardrail splice bolts and nuts</td>
<td>a-c</td>
<td>8</td>
</tr>
<tr>
<td>FBB06</td>
<td>Guardrail post bolts and nuts</td>
<td>a</td>
<td>2</td>
</tr>
<tr>
<td>FBB07</td>
<td>Guardrail post bolts and nuts</td>
<td>b-c</td>
<td>2</td>
</tr>
<tr>
<td>FWC16a</td>
<td>Round washer</td>
<td>b-c</td>
<td>2</td>
</tr>
<tr>
<td>PDB10</td>
<td>MGS timber blockout</td>
<td>a</td>
<td>2</td>
</tr>
<tr>
<td>PDB11</td>
<td>MGS timber blockout</td>
<td>b-c</td>
<td>2</td>
</tr>
<tr>
<td>PDE02</td>
<td>Timber guardrail post</td>
<td>b</td>
<td>2</td>
</tr>
<tr>
<td>PWE06</td>
<td>Wide-flange guardrail post</td>
<td>a</td>
<td>2</td>
</tr>
<tr>
<td>RWM04a</td>
<td>W-beam Rail</td>
<td>a-c</td>
<td>1</td>
</tr>
<tr>
<td>16D</td>
<td>16D nail, galvanized</td>
<td>a-c</td>
<td>2</td>
</tr>
<tr>
<td>PDExx</td>
<td>White Pine guardrail post</td>
<td>c</td>
<td>2</td>
</tr>
</tbody>
</table>

ACCEPTANCE

REFERENCES
B.D., Development of the Midwest Guardrail System (MGS) for Standard and Reduced Post Spacing and in
Combination with Curbs, Final Report to the Midwest State's Regional Pooled Fund Program, Transportation
Research Report No. TRP-03-139-04, Project No. SPR-3(017)-Years 10, and 12-13, Project Code: RPFP-00-02, 02-01,
and 03-05, Midwest Roadside Safety Facility, University of Nebraska-Lincoln, September 1, 2004.

Faller, R.K., Polivka, K.A., Kuipers, B.D., Bielenberg, B.W., Reid, J.D., Rohde, J.R., and Sicking, D.L., Midwest
Guardrail System for Standard and Special Applications, Paper No. 04-4778, Transportation Research Record No.

Sicking, D.L., Reid, J.D. and Rohde, J.R., Development of the Guardrail System, Transportation Research Record

of the Midwest Guardrail System – Update to NCHRP 350 Test No. 3-11 (221-MG-1), Final Report to the National
Cooperative Highway Research Program (NCHRP), MwRSF Research Report No. TRP-03-170-06, Midwest
Roadside Safety Facility, Lincoln, Nebraska, October 10, 2006.

Midwest Guardrail System (MGS) with White Pine Wood Posts, Final Report to Wisconsin Department of
Transportation, MwRSF Research Report No. TRP-03-241-11, Project No. TPF-5(193) Supplement #12, Midwest
Roadside Safety Facility, University of Nebraska-Lincoln, March 28, 2011.
REFERENCES


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

MIDWEST GUARDRAIL SYSTEM WITH STANDARD POST SPACING

SGR20a-c

<table>
<thead>
<tr>
<th>SHEET NO.</th>
<th>DATE:</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 of 4</td>
<td>8/1/2011</td>
</tr>
</tbody>
</table>