



U.S. Department
of Transportation

**Federal Highway
Administration**

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

March 27, 2014

In Reply Refer To:
HSST/B-230A

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

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

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,

A handwritten signature in blue ink that reads "Michael S. Griffith". The signature is written in a cursive style with a large initial "M".

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:	December 18, 2013	<input checked="" type="radio"/> New <input type="radio"/> Resubmission
	Name:	Karla Lechtenberg	Signature: <i>Karla Lechtenberg</i>
	Company:	Midwest Roadside Safety Facility (MwRSF)	
	Address:	130 Whittier Research Center, 2200 Vine Street, Lincoln, NE 68583-0853	
	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.

System Type	Submission Type	Device Name / Variant	Testing Criterion	Test Level
'B': Barriers (Roadside, Median, Bridge Railings)	<input checked="" type="radio"/> Physical Crash Testing <input type="radio"/> FEA & V&V Analysis	Midwest Guardrail System (MGS) with Southern Yellow Pine Posts	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 <input checked="" type="checkbox"/>
Company Name:	Midwest Roadside Safety Facility (MwRSF)	Same as Submitter <input checked="" type="checkbox"/>
Address:	130 Whittier Research Center, 2200 Vine Street, Lincoln, NE 68583-	Same as Submitter <input checked="" type="checkbox"/>
Country:	USA	Same as Submitter <input checked="" type="checkbox"/>

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 breakout (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

Submitter	Date of Request:	December 18, 2013	<input checked="" type="radio"/> New <input type="radio"/> Resubmission
	Name:	Karla Lechtenberg	Signature:
	Company:	Midwest Roadside Safety Facility (MwRSF)	
	Address:	130 Whittier Research Center, 2200 Vine Street, Lincoln, NE 68583-0853	
	Country:	USA	
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System Type	Submission Type	Device Name / Variant	Testing Criterion	Test Level
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Company Name:	Midwest Roadside Safety Facility (MwRSF)	Same as Submitter <input checked="" type="checkbox"/>
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PRODUCT DESCRIPTION

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CRASH TESTING

A brief description of each crash test and its result:

Required Test Number	Narrative Description	Evaluation Results
3-10 (1100C)	<p>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.</p> <p>Exterior vehicle damage was moderate, and the interior occupant compartment deformations were minimal, with a maximum deformation of 1¼ 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.</p>	PASS
3-11 (2270P)	<p>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.</p> <p>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.</p>	PASS
3-20 (1100C)	Not applicable	WAIVER REQUESTED
3-21 (2270P)	Not applicable	WAIVER REQUESTED

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	Same as Submitter <input checked="" type="checkbox"/>
Address:	130 Whittier Research Center, 2200 Vine Street, Lincoln, NE 68583-0853	Same as Submitter <input checked="" type="checkbox"/>
Country:	USA	Same as Submitter <input checked="" type="checkbox"/>
Accreditation Certificate Number and Date:	A2LA Certificate Number: 2937.01, Valid to December 31, 2013	

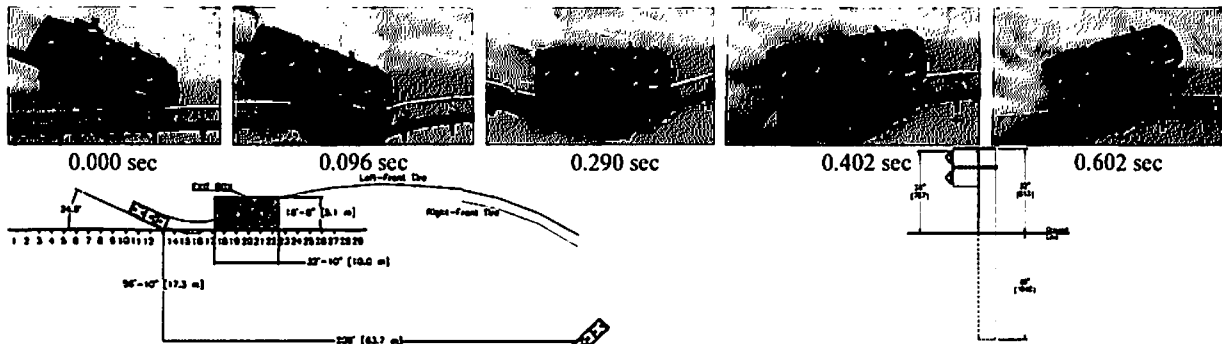
ATTACHMENTS

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.

FHWA Official Business Only:

Eligibility Letter		AASHTO TF13	
Number	Date	Designator	Key Words
B230A	March 14, 2014	SGR20a-c	31-inch MGS, Southern Yellow Pine (SYP) wood posts.

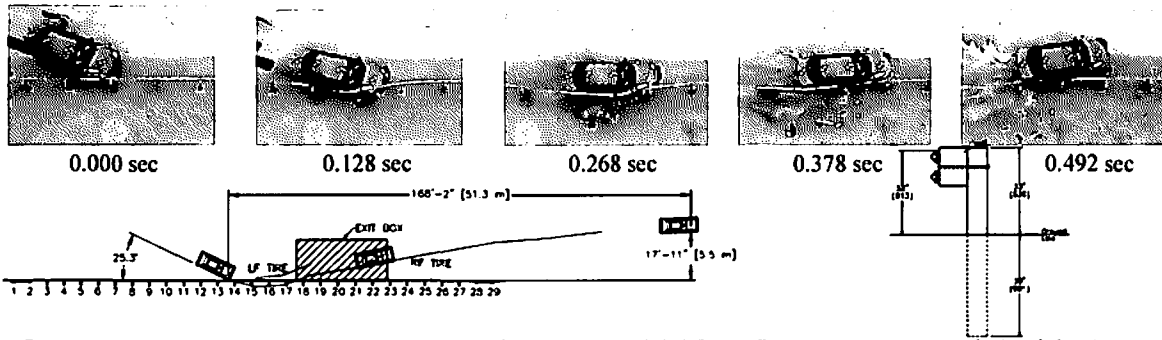


- Test Agency MwRSF
- Test Number MGSSYP-1
- Date 8/3/2011
- MASH Test Designation No 3-11
- Test Article MGS with SYP Posts
- Total Length 181 ft - 3 in (55.2 m)
- Key Component - Steel W-Beam Guardrail
 - Thickness 12 gauge (2.66 mm)
 - Top Mounting Height 31 in (787 mm)
- Key Component - Southern Yellow Pine Posts
 - Dimension 6 x 8 x 72 in (152 x 203 x 1,829 mm)
 - Post Spacing 75 in (1,905 mm)
 - Embedment Depth 40 in (1,016 mm)
- Key Component - Wood Blockout
 - Post Nos. 3-27 6 x 12 x 14 1/4 in (152 x 305 x 362 mm)
- Vehicle Make /Model 2004 Dodge Ram 1500 Quad Cab
 - Curb 5,130 lb (2,327 kg)
 - Test Inertial 5,029 lb (2,281 kg)
 - Gross Static 5,199 lb (2,358 kg)
- Impact Conditions
 - Speed 62.2 mph (100.2 km/h)
 - Angle (Trajectory) 24.9 deg
 - Impact Location 12 ft - 6 in (3.8 m) Upstream of Post No. 15
- Impact Severity 115.5 kip-ft (156.6 kJ) > 106 kip-ft (144 kJ)
- Exit Conditions
 - Speed 37.8 mph (60.8 km/h)
 - Angle (Trajectory) 15.7 deg
 - Angle (Orientation) 16.1 deg
- Exit Box Criterion Pass
- Vehicle Stability Satisfactory
- Vehicle Stopping Distance 209 ft (63.7 m) downstream
56 ft - 10 in (17.3 m) laterally behind

- Vehicle Damage Minimal
 - VDS⁽¹¹⁾ 01-RFQ-4
 - CDC⁽¹²⁾ 01-RYEW-3
 - Maximum Interior Deformation 1 in (25 mm)
- Test Article Damage Moderate
- Maximum Test Article Deflections
 - Permanent Set 30 1/4 in (768 mm)
 - Dynamic 40.0 in (1,016 mm)
 - Working Width 53.8 in (1,367 mm)
- Maximum Angular Displacements
 - Roll 5.6° < 75°
 - Pitch 4.4° < 75°
 - Yaw -44.1°
- Transducer Data

Evaluation Criteria	Transducer		MASH Limit	
	EDR-3	DTS		
OIV ft/s (m/s)	Longitudinal	-14.20 (-4.33)	-13.25 (-4.04)	≤ 40 (12.2)
	Lateral	-14.77 (-4.50)	-14.74 (-4.50)	≤ 40 (12.2)
ORA g's	Longitudinal	8.39	-8.14	≤ 20.49
	Lateral	-7.65	-8.51	≤ 20.49
THIV - ft/s (m/s)	NA	19.82 (6.04)	not required	
PHD - g's	NA	11.36	not required	
ASI	0.70	0.70	not required	

Figure 32. Summary of Test Results and Sequential Photographs, Test No. MGSSYP-1

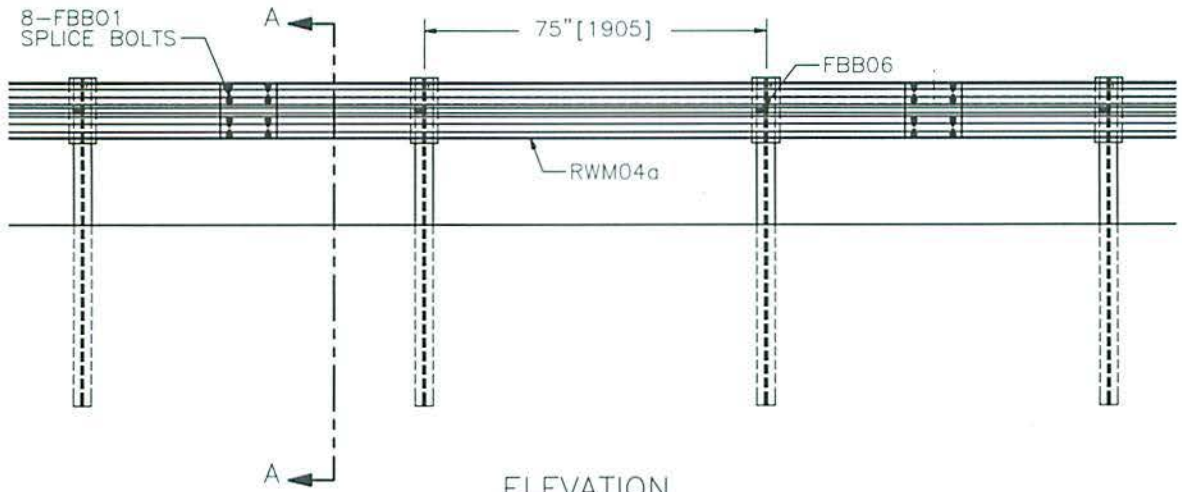


- Test Agency MWRSF
- Test Number MGSSYP-2
- Date 9/13/2011
- MASH Test Designation No. 3-10
- Test Article MGS with SYP Posts
- Total Length 181 ft - 3 in (55.3 m)
- Key Component - Steel W-Beam Guardrail
 - Thickness 12 gauge (2.66 mm)
 - Top Mounting Height 32 in. (813 mm)
- Key Component - Southern Yellow Pine Posts
 - Dimension 6 x 8 x 72 in. (152 x 203 x 1,829 mm)
 - Post Spacing 75 in. (1,905 mm)
 - Embedment Depth 39 in. (991 mm)
- Key Component - Wood Blockout
 - Post Nos. 3-27 6 x 12 x 14 1/4 in. (152 x 305 x 362 mm)
- Vehicle Make /Model 2004 Kia Rio
 - Curb 2,402 lb (1,090 kg)
 - Test Inertial 2,442 lb (1,108 kg)
 - Gross Static 2,612 lb (1,185 kg)
- Impact Conditions
 - Speed 61.5 mph (98.9 km/h)
 - Angle (Trajectory) 25.3 deg
 - Angle (Orientation) 24.9 deg
 - Impact Location 8 ft - 4 in (2.5 m) Upstream of Post No. 15
- Impact Severity (IS) 56.4 kip-ft (76.4 kJ) > 51 kip-ft (69.7 kJ)
- Exit Conditions
 - Speed 35.7 mph (57.4 km/h)
 - Angle (Trajectory) 13.6 deg
 - Angle (Orientation) 9.0 deg
- Exit Box Criterion Pass
- Vehicle Stability Satisfactory

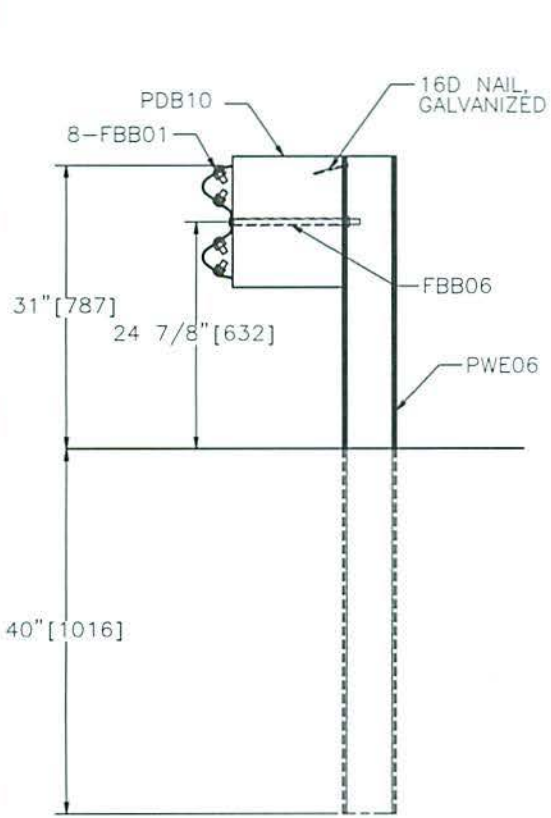
- Vehicle Stopping Distance 168 ft - 2 in (51.3 m) downstream
17 ft - 11 in (5.5 m) laterally in front
- Vehicle Damage Moderate
 - VDS⁽¹⁾⁽¹⁾ 01-RFO-6
 - CDC⁽¹⁾⁽²⁾ 01-RYEW-5
 - Maximum Interior Deformation 1 1/4 in (31.8 mm)
- Test Article Damage Moderate
- Maximum Test Article Deflections
 - Permanent Set 16 1/4 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°
- Transducer Data

Evaluation Criteria		Transducer		MASH Limit
		EDR-3	DTS	
OIV ft/s (m/s)	Longitudinal	-17.13 (-5.22)	-15.72 (-4.79)	≤ 40 (12.2)
	Lateral	-19.52 (-5.95)	-20.93 (-6.38)	≤ 40 (12.2)
ORA g's	Longitudinal	-13.05	-13.04	≤ 20.49
	Lateral	-7.42	-9.30	≤ 20.49
THIV - ft/s (m/s)		NA	27.92 (8.51)	not required
PHD - g's		NA	14.38	not required
ASI		0.91	0.99	not required

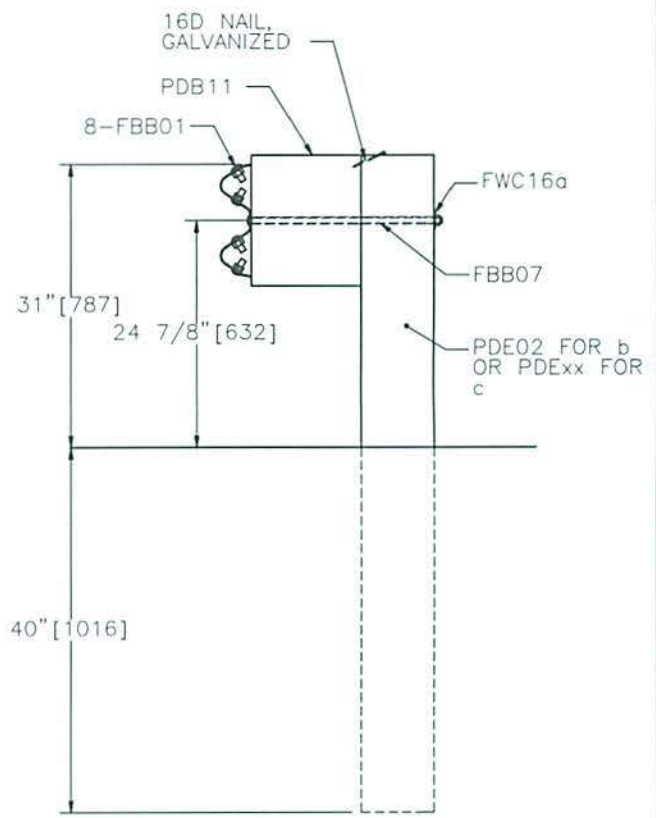
Figure 49. Summary of Test Results and Sequential Photographs, Test No. MGSSYP-2



ELEVATION



SGR20d
SECTION A-A



SGR20b-c

MIDWEST GUARDRAIL SYSTEM WITH STANDARD POST SPACING



SGR20a-c

SHEET NO.	DATE:
1 of 4	8/1/2011

INTENDED USE

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

COMPONENTS

Unit Length = 150" [3810]

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

ACCEPTANCE

FHWA Acceptance Letter B-133, March 1, 2005.

FHWA Acceptance Letter B-212, June, 2011.

REFERENCES

Polivka, K.A., Faller, R.K., Sicking, D.L., Reid, J.D., Rohde, J.R., Holloway, J.C., Bielenberg, R.W., and Kuipers, 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: RPPF-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. 1890, Transportation Research Board, National Research Council Washington, D.C., January 2004, pp. 19-33.

Sicking, D.L., Reid, J.D. and Rohde, J.R., *Development of the Guardrail System*, Transportation Research Record No. 1797, Transportation Research Board, National Research Council, Washington, D.C., November 2002, pp. 44-52.

Polivka, K.A., Faller, R.K., Sicking, D.L., Rohde, J.R., Bielenberg, R.W., and Reid, J.D., *Performance Evaluation of the Midwest Guardrail System - Update to NCHRP 350 Test No. 3-11 (2214MG-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.

Stolle, C.J., Lechtenberg, K.A., Faller, R.K., Rosenbaugh, S.K., Sicking, D.L., and Reid, J.D., *Evaluation of the 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.

MIDWEST GUARDRAIL SYSTEM WITH STANDARD POST SPACING

SGR20a-c

SHEET NO.

DATE:

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8/1/2011



REFERENCES

Polivka, K.A., Faller, R.K., Sicking, D.L., Rohde, J.R., Bielenberg, R.W., and Reid, J.D., *Performance Evaluation of the Midwest Guardrail System – Update to NCHRP 350 Test No. 3-11 With 28" CG Height (2214MG-2)*, Final Report to the National Cooperative Highway Research Program (NCHRP), MwRSF Research Report No. TRP-03-171-06, Midwest Roadside Safety Facility, Lincoln, Nebraska, October 11, 2006.

Polivka, K.A., Faller, R.K., Sicking, D.L., Rohde, J.R., Bielenberg, R.W., and Reid, J.D., *Performance Evaluation of the Midwest Guardrail System – Update to NCHRP 350 Test No. 3-10 (2214MG-3)*, Final Report to the National Cooperative Highway Research Program (NCHRP), MwRSF Research Report No. TRP-03-172-06, Midwest Roadside Safety Facility, Lincoln, Nebraska, October 11, 2006.

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: mwrsf@unl.edu
Website: <http://mwrsf.unl.edu/>

MIDWEST GUARDRAIL SYSTEM WITH STANDARD POST SPACING



SGR20a-c

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MIDWEST GUARDRAIL SYSTEM WITH STANDARD POST SPACING

SGR20a-c

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