



June 25, 2008

In Reply Refer To: HSSD/B-175

Ronald K. Faller, Ph.D., P.E.
Research Assistant Professor
University of Nebraska Lincoln
527 Nebraska Hall
P.O. Box 880529
Lincoln, NE 68588-0529

Dear Dr. Faller:

This letter is in response to your request for Federal Highway Administration (FHWA) acceptance of a roadside safety system for use on the National Highway System (NHS).

Name of system: Midwest Guardrail System (MGS) with round posts:
Douglas Fir, Ponderosa Pine, Southern Yellow Pine
Type of system: 31-inch high W-Beam guardrail system
Test Level: NCHRP Report 350 Test Level 3
Testing conducted by: Midwest Roadside Safety Facility
Date of request: September 26, 2007

You requested that we find this system acceptable for use on the NHS under the provisions of National Cooperative Highway Research Program (NCHRP) Report 350 "Recommended Procedures for the Safety Performance Evaluation of Highway Features."

Requirements

Roadside safety systems should meet the guidelines contained in the NCHRP Report 350, "Recommended Procedures for the Safety Performance Evaluation of Highway Features". FHWA Memorandum "**ACTION**: Identifying Acceptable Highway Safety Features" of July 25, 1997 provides further guidance on crash testing requirements of longitudinal barriers.

Description

The MGS was first recognized in the FHWA Acceptance Letter B-133 dated March 1, 2005. In that letter it was described as follows:

The MGS barrier consists of standard 12-gauge W-beam sections installed with the top of the rail set at a nominal height of 787 mm (31 inches). It is mounted on standard W152 x 13.4 steel posts that are 1829-mm (6-feet) long and set on 1905-mm (75-inch) centers. To obtain the additional rail height, each post is raised approximately 100 mm (4 inches), resulting in slightly

less embedment than the posts in a standard W-beam installation. The rail is offset from these posts with 152-mm wide x 305-mm deep x 356-mm long (6-inch x 12-inch x 14-inch) wood offset blocks. Finally, the rail splices are located at mid-span between adjacent posts rather than at each post as in a traditional W-beam installation.

Your **present request** is to allow the use of round wood posts of Douglas Fir (DF), Ponderosa Pine (PP), and Southern Yellow Pine (SYP) based on research conducted by the Forest Products Laboratory (FPL) and full-scale crash testing you conducted. The FPL research developed the following grading specifications for the three varieties of wood posts.

Species	DF	PP	SYP
Maximum Knot Diameter	2 in	4 in	2.5 in
Minimum Ring Density	6 rings/in	6 rings/in	4 rings/in
Nominal Post Diameter*	7.25 in	8.00 in	7.50 in
Post Diameter Range*	7.00 to 8.00 in	7.75 to 8.75 in	7.25 to 8.25 in

*Post diameter at the ground line.

Crash Testing

The MGS barrier was subjected to two NCHRP Report 350 3-11 crash tests, MGSDF-1 using Douglas Fir posts, and MGSP-1 using Ponderosa Pine posts. Because of prior testing of the MGS using SYP posts, tests on other w-beam barrier systems using round SYP posts, and the initial MGS test using the 820C vehicle (reported in B-133 noted above) only the two 3-11 tests were deemed necessary. Test Data Summary Sheets for the two tests are enclosed for reference. The occupant risk criteria were met for both impacts as was the post-impact trajectory, with no potential noted for spearing or deformation of the passenger compartment.

For the test on the Douglas Fir system (test no. MGSDF-1), the W-beam rail located upstream of the impact region had fallen to the ground after the test. For the test on the Ponderosa Pine system (test no. MGSP-1), a smaller portion of the W-beam rail located upstream of the impact region had fallen to the ground after the test. The maximum dynamic deflection in test MGSDF-1 was 60 inches, and in test MGSP-1 was 38 inches. For comparison, the maximum dynamic deflection in test NPG-4 using steel posts, reported in B-133, was 43 inches.

Findings

The MGS system described above using DF, PP, and SYP posts and detailed in the enclosed drawings is acceptable for use on the NHS under the range of conditions tested, when such use is acceptable to the highway agency.

Please note the following standard provisions that apply to the FHWA letters of acceptance:

- This acceptance is limited to the crashworthiness characteristics of the systems and does not cover their structural features, nor conformity with the Manual on Uniform Traffic Control Devices.
- Any changes that may adversely influence the crashworthiness of the system will require a new acceptance letter.

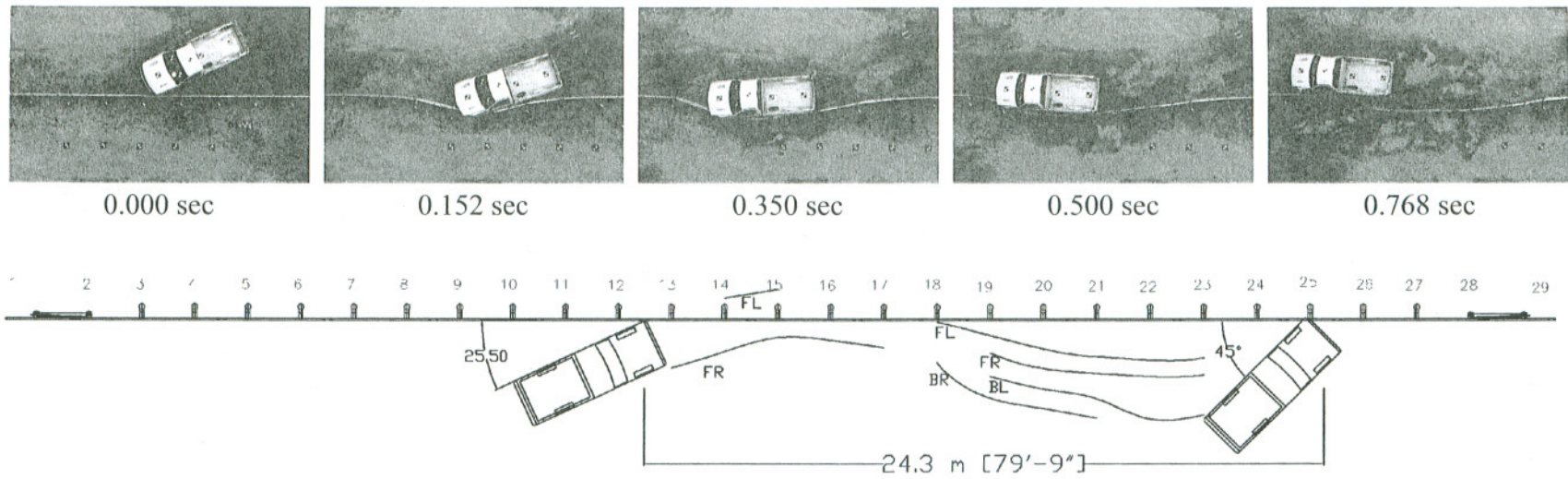
- Should the FHWA discover that the qualification testing was flawed, that in-service performance reveals unacceptable safety problems, or that the system being marketed is significantly different from the version that was crash tested, we reserve the right to modify or revoke our acceptance.
- You will be expected to supply potential users with sufficient information on design and installation requirements to ensure proper performance.
- You will be expected to certify to potential users that the hardware furnished has essentially the same chemistry, mechanical properties, and geometry as that submitted for acceptance, and that it will meet the crashworthiness requirements of the FHWA and the NCHRP Report 350.
- To prevent misunderstanding by others, this letter of acceptance is designated as number B-175 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 acceptance 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 acceptance letter is limited to the crashworthiness characteristics of the candidate system, and the FHWA is neither prepared nor required to become involved in issues concerning patent law. Patent issues, if any, are to be resolved by the applicant.

Sincerely yours,



David A. Nicol, P.E.
Director, Office of Safety Design
Office of Safety

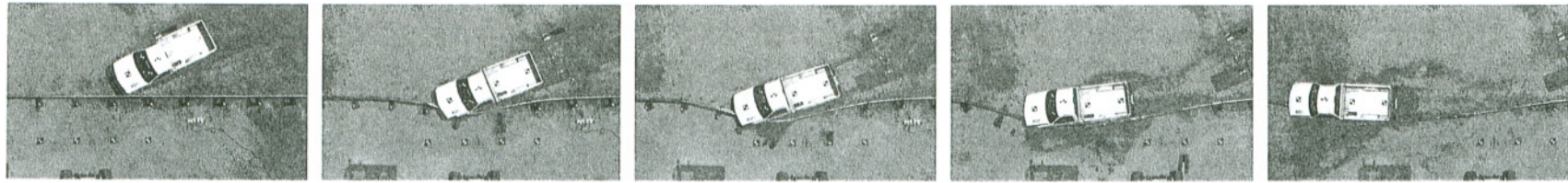
Enclosures



- Test Number..... MGSP-1 (3-11)
- Date 6/1/06
- Test Article..... Midwest Guardrail System
 - Key Elements..... Round Ponderosa Pine Posts
 - Impact Location..... 953 mm Downstream of Post 12
- Soil Type..... Grading B AASHTO M147-65 (1990)
- Vehicle Model..... 2000 GMC C2500
 - Curb 1,959 kg
 - Test Inertial..... 2,025 kg
 - Gross Static..... 2,025 kg
- Vehicle Speed
 - Impact 100.2 km/h
 - Exit 37.4 km/h
- Vehicle Angle
 - Impact (trajectory) 25.5 deg
 - Exit (trajectory)..... 19.9 deg
- Vehicle Stability..... Satisfactory
- Vehicle Snagging Minor
- Occupant Ridedown Deceleration (10 msec avg.)
 - Longitudinal 5.90 g's < 20 g's
 - Lateral 4.09 g's < 20 g's
- Occupant Impact Velocity
 - Longitudinal 6.85 m/s < 12 m/s
 - Lateral 7.18 m/s < 12 m/s
- THIV..... 6.12 m/s < 12 m/s (not req.)
- PHD 8.47 g's < 20 g's (not req.)
- Vehicle Damage..... Moderate
 - TAD 11-LFQ-4
 - SAE 10LFEW5
 - OCDI..... LF000000000
- Vehicle Stopping Distance..... 24.3 m downstream of impact
- Test Article Damage Moderate
- Maximum Deflection
 - Permanent Set..... 705 mm
 - Dynamic 956 mm
- Working Width 1,234 mm

Figure 117. Summary of Test Results and Sequential Photographs, Test MGSP-1





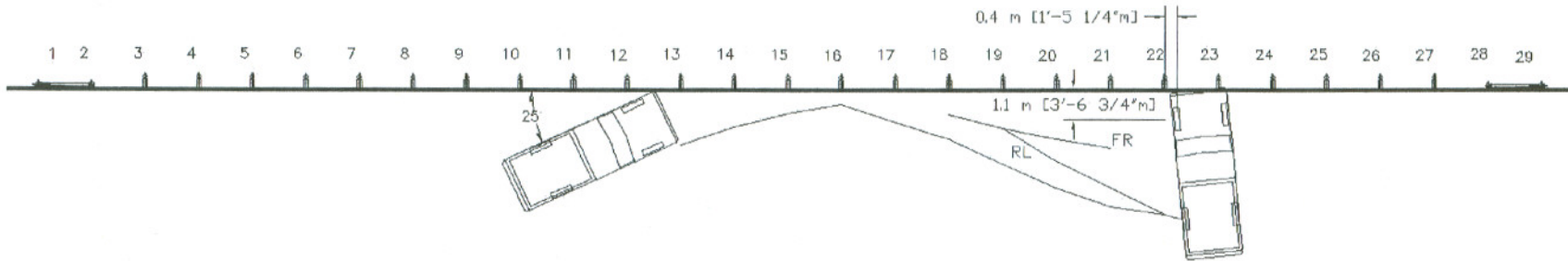
0.000 sec

0.134 sec

0.204 sec

0.372 sec

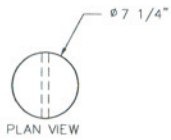
0.596 sec



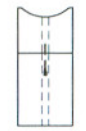
- Test Number MGSDf-1 (3-11)
- Date 6/16/06*
- Test Article Midwest Guardrail System
 - Key Elements Round Douglas Fir Posts
 - Impact Location 953 mm Downstream of Post 12
- Soil Type Grading B AASHTO M147-65 (1990)
- Vehicle Model 2000 GMC C2500
 - Curb 2,078 kg
 - Test Inertial 2,018 kg
 - Gross Static 2,018 kg
- Vehicle Speed
 - Impact 100.0 km/h
 - Exit NA
- Vehicle Angle
 - Impact (trajectory) 25.5 deg
 - Exit (trajectory) NA
- Vehicle Stability Satisfactory
- Vehicle Snagging Minor

- Occupant Ridedown Deceleration (10 msec avg.)
 - Longitudinal 8.76 g's < 20 g's
 - Lateral 5.69 g's < 20 g's
- Occupant Impact Velocity
 - Longitudinal 4.03 m/s < 12 m/s
 - Lateral 4.03 m/s < 12 m/s
- THIV 6.84 m/s < 12 m/s (not req.)
- PHD 8.87 g's < 20 g's (not req.)
- Vehicle Damage Moderate
 - TAD 11-LFQ-4
 - SAE 10LFEW5
 - OCDI LF000000000
- Vehicle Stopping Distance 19.2 m downstream of impact
- Test Article Damage Moderate
- Maximum Deflection
 - Permanent Set 902 mm
 - Dynamic 1,529 mm
- Working Width 1,531 mm

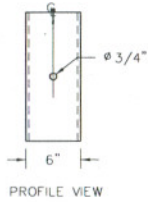
Figure 102. Summary of Test Results and Sequential Photographs, Test MGSDf-1



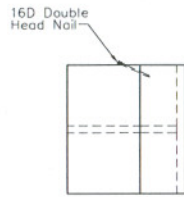
Douglas Fir Round Post
Part a1



PLAN VIEW

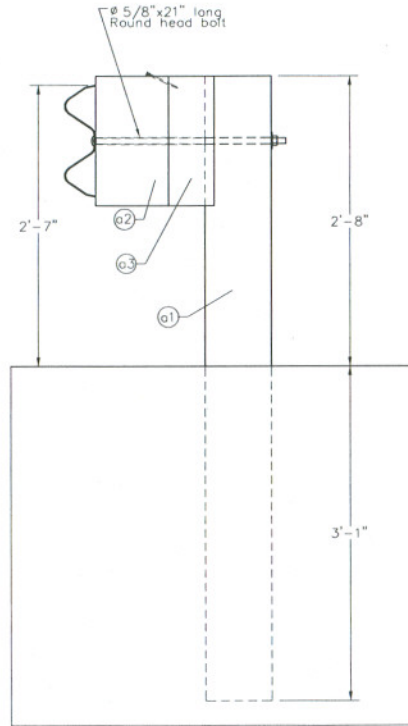


PROFILE VIEW



SIDE VIEW

Douglas Fir Segmented Blockout
Part ??



SECTION A-A



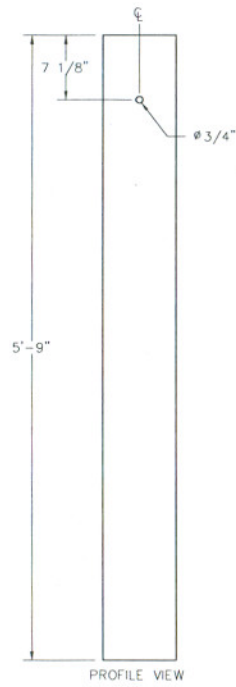
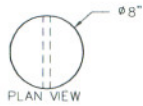
Midwest Roadside
Safety Facility

Round-Post MGS
Post 3-27 Detail

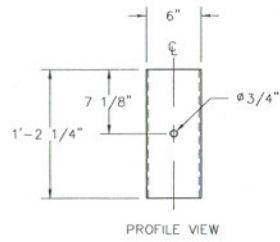
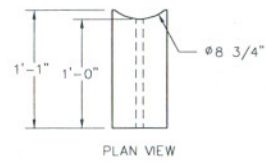
DWG. NAME:
FPL_MGS_DF_R3

SCALE: None
UNITS: inches

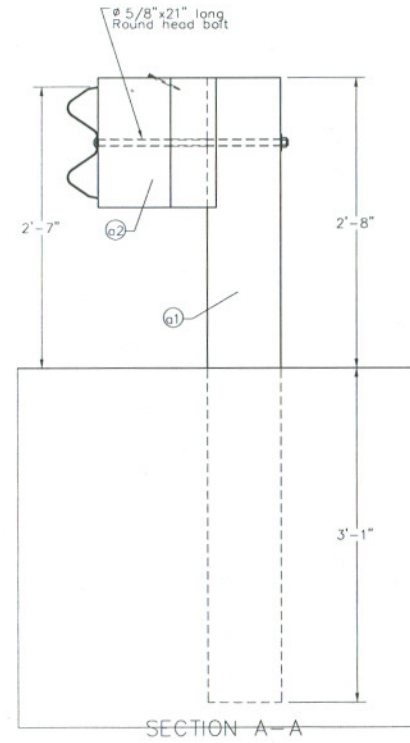
SHEET:
3 of 9
DATE:
06/08/2006
DRAWN BY:
GEP
REV. BY:
CME




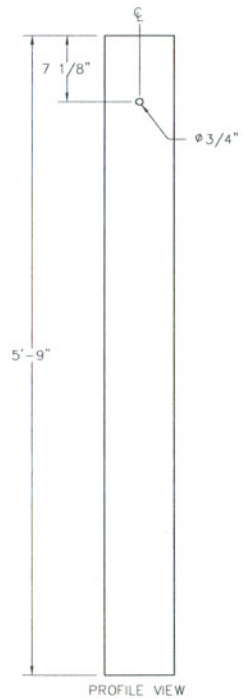
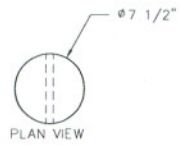
Ponderosa Pine Round Post
Part a1



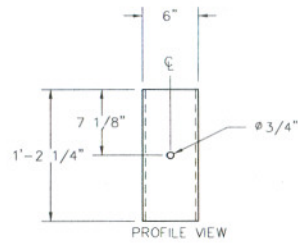
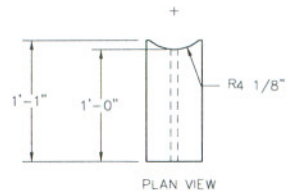
Ponderosa Pine Blockout
Part a2



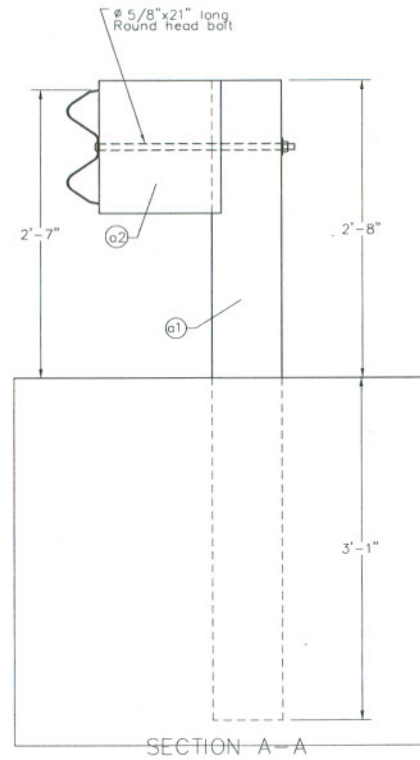
 Midwest Roadside Safety Facility	Round-Post MGS Post 3-27 Detail	SHEET: 3 of 9
	DWG. NAME: FPL_MGS_PP_R4	DATE: 06/06/2006
SCALE: None UNITS: Inches	DRAWN BY: GEP	REV. BY: CME



Southern Round Post
Part a1



Southern Blockout
Part a2



Midwest Roadside
Safety Facility

Round-Post MGS
Post 3-27 Detail

DWG. NAME
FPL_MGS_SP_R0

SCALE: None
UNITS: Inches

SHEET:
3 of 9
DATE:
05/02/2006
DRAWN BY:
GEP
REV. BY:
KAP/RKF