U.S.Department
of Transportation
Federal Highway
Administration

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

August 3, 2009

In Reply Refer To:
HSSD/B-186

Mr. Rick Mauer
Outside National Sales Representative
Nucor Steel Marion Inc.
P.O. Box 837
Greenland, NH 03840

Dear Mr. Mauer:

This letter is in response to your request for the Federal Highway Administration's (FHWA) acceptance of a modification to a Nucor Steel Marion W-beam barrier for use on the National Highway System (NHS).

Name of system:	Nu-Guard 27 Barrier System posts mixed with Standard "Strong Post" guardrail
Type of system:	W-beam guardrail
Test Level:	NCHRP Report 350 Test Level-3 (TL-3)
Testing conducted by:	Holmes Solutions of New Zealand
Date of request:	June 29, 2009

You requested that we find this modified 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. FHWA Memorandum "ACTION: Identifying Acceptable Highway Safety Features" of July 25, 1997, provides further guidance on crash testing requirements of longitudinal barriers.

Description
The TL-3 Nu-Guard barrier system consists of Nucor Strong Posts which are hot rolled, high tensile steel fabricated into a U cross section of approximately 2 in deep and 3 1/2 in wide. The weight of each post is 5 pounds per foot. A slot, ¾-in wide is located 1 in down from the top of the posts in the middle of the cross section. The slot has a total length of 7 in. All posts are 78 in long and are hot dip galvanized. When Nucor posts are used with 27-in high non-proprietary W-beam guardrail systems, they are used with the original plastic blockouts

measuring 14 in x 3/8 in which are used to space the guardrail 8 in from the face of the U posts. The plastic blockouts are manufactured from a 50 percent blend of new and recycled high density polyethylene (HDPE).

This system was originally found acceptable in the following FHWA Acceptance Letter:

B-162 September 11, 2007 TL-3 U-channel post, W-beam rail at 27 in w/blockout

Your present request is for the TL-3 Nu-Guard 27 w-beam barrier system with blockouts to be accepted for use when maintaining standard strong-post w-beam guardrail. The dynamic deflection during the Nu-Guard 27 Test 3-11 was approximately 3 ft, 6 in., which is slightly greater than the 3 foot deflection normally seen with strong post W-beam systems. This indicated that barrier using the Nu-Guard posts performs in a similar manner to conventional strong-post W-beam. It was determined that a developmental test would be conducted to validate this assumption when replacing standard posts with Nu-Guard posts.

Crash Testing

To confirm that Nu-Guard posts could be substituted for W6 x 9 steel posts in conventional "strong post" W-beam guardrail a single developmental test was conducted. A 175-foot long section of W-beam guardrail was constructed with standard W6 x 9 posts spaced at 6 feet, 3 inches. Three posts at the impact site were replaced with Nucor Marion Steel Nu-Guard posts.

The vehicle used as a surrogate for the Chevy 2500 was a Mazda Proceed which was readily available in New Zealand and has comparable weight and measurements. Although this vehicle was not a pickup truck, it had similar measurements in terms of fender height and center of gravity but with a narrower and shorter wheel base. This in effect makes the vehicle less stable than the Chevy 2500 but still results in a test that is a good representation of what one would expect should the impacting vehicle be a Chevy 2500. The vehicle had a curb weight of 1845 kg and was ballasted to 2000 kg.

The vehicle impacted the barrier at a nominal speed of 100 km/hr and at an angle of 25 degrees. Initial contact was made mid-span between posts 8 and 9, 9 being the first Nu-Guard post and splice joint. Redirection, or the point at which the vehicle was parallel with the rail, was reached at approximately the point at which the front left wheel of the vehicle reached post 11 (the third and last Nu Guard post). The vehicle then began exiting the system, fully engaging post 12 (the first I beam post downstream) and post 13 upon exit. The left front wheel was dislodged from the vehicle by post 13 and the vehicle then exited the system, coming to rest approximately 30 meters downstream from the impact point and within one vehicle width of the barrier.

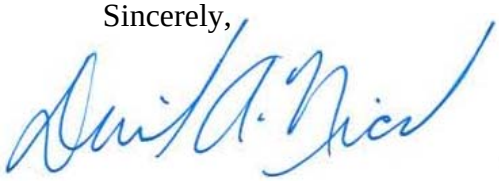
The test data summary sheet and a drawing of the test installation are enclosed for reference.

We concur that a test with the 820C vehicle is not necessary as barrier deflection with the small car would be less than with the Mazda Proceed. Also, the 820C vehicle would not tend to snag on the blocked-out Nu-Guard posts any more than standard W6 x 9 posts. Therefore, Nucor-Marion Steel Nu-Guard U-channel posts may be used in lieu of W6 x 9 posts when maintaining W-beam guardrails. Because 6-in by 8-in wood guardrail posts are generally considered interchangeable with W6 x 9 steel posts under NCHRP Report 350 conditions, the Nu-Guard U-channel posts may also be used when repairing wood post systems of comparable heights.

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

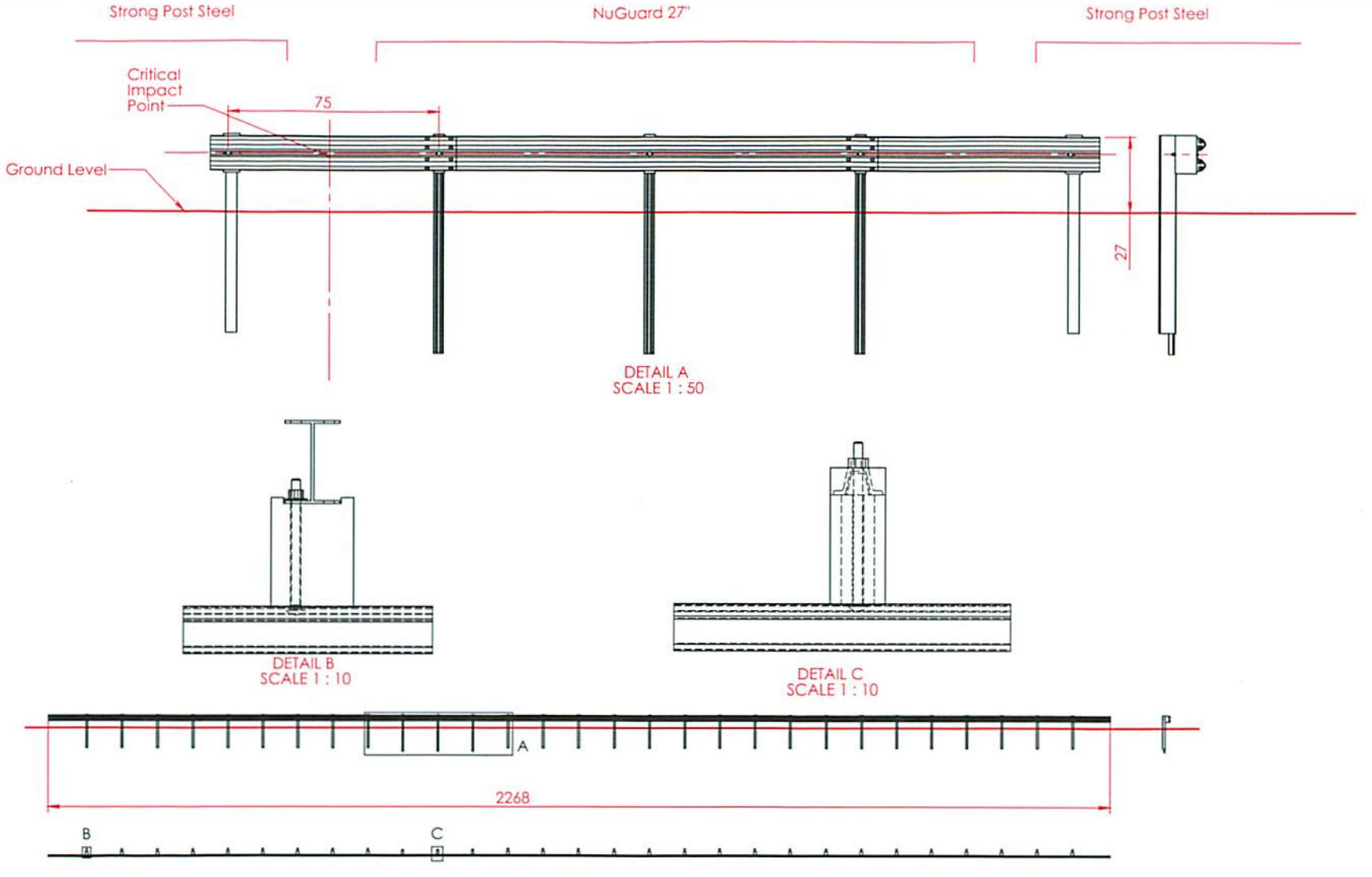
- This acceptance is limited to the crashworthiness characteristics of the system and does not cover its structural features, nor conformity with the Manual on Uniform Traffic Control Devices.
- Any changes that may adversely influence the crashworthiness of the system will require a new acceptance letter.
- 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-186 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.
- The Nu-Guard barrier systems are patented products and considered proprietary. If proprietary systems are specified by a highway agency for use on Federal-aid projects, except exempt, non-NHS 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.
- 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,



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

Enclosures



REV.	CHANGES	DATE

SCALE: 1:300

Standard Tolerance

	DATE	INIT.
DRAWN BY		AD
APPR'D BY		DJ

NuGuard 27 mixed with Standard Strong Steel Post Guardrail

ARMORFLEX New Zealand
8 Paul Matthews Rd.
Albany,Auckland,NZ
tel. 64 9 415 2991
fax. 64 9 415 2993
info@armorflex.co.nz

SHEET	DRAWING NUMBER	REV.
1 OF 1		

Test Summary

Holmes Solutions Limited, New Zealand

Test No. 0000-0-0-00-1 // 4 APR 08

0.00 sec	0.24 sec	0.41 sec	0.62 sec

•Test Article

Nucor NuGuard 31 median barrier

Test Designation ..	NCHRP 350 test 3-11
Length.....	72 m
Rail Height.....	790 mm
Post Centres.....	1905 mm
Soil Type.....	AASHTO 'standard soil' M147-64

•Test Vehicle

Designation.....	2000P Pick-up
Make/Model.....	Mazda Marvie
Dimensions (lwh)....	4090 x 1570 x 1760 mm
Test Weight.....	2000 kg

•CIP

•Impact Conditions

Impact Speed	101 km/h
Impact Angle	25
Exit Speed	56 km/h
Exit Angle	9.2

•Test Article Deflections (metres)

Test Article Damage...	moderate
Dynamic.....	1.44 m
Permanent.....	0.98 m
Working Width.....	1.65 m

•Vehicle Damage - Exterior

VDS.....	10FL-5
CDC.....	10FLLY5
Max Deformation	200 mm

•Vehicle Damage - Interior

OCDI.....	AS00000000
Max. Deformation	none

•Post Impact Behaviour

Vehicle Stability.....	Moderate
Stopping Distance...	45 m
Max. Roll angle.....	16.0
Max. Pitch angle.....	10.3
Max. Yaw angle.....	23.8

•Occupant Risk Values

Impact Velocity (m/s - front of interior)

x-direction.....
y-direction.....
THIV .....

Ridedown Decelerations (g)

x-direction.....
y-direction.....
PHD .....
ASI .....

Max. 0.050 Second Average (g)

x-direction.....
y-direction.....
z-direction.....

Test Summary

Holmes Solutions Limited, New Zealand

Test No. 0000-0-0-00-1 // 4 APR 08

HOLMESSOLUTIONSTESTING