U.S. Department
of Transportation
Federal Highway Administration

August 11, 2006

400 Seventh St., S.W.
Washington, D.C. 20590

In Reply Refer To:
HSA-10/B-96B

Mr. Rick Mauer
Outside National Sales Representative
Nucor Steel Marion Inc.
912 Chaney Avenue
Marion, Ohio 43302

Dear Mr. Mauer:

The Federal Highway Administration formally accepted your high-tension 3-strand cable median barrier in Ms. Carol H. Jacoby's August 30, 2002 letter to you. Your original design, with cable heights 545 mm, 650 mm, and 750 mm, used standard 1664-mm long 6 kg/m U-channel line posts installed on 2-meter centers with trapezoidal soil plates just below the ground line. Your September 9, 2005 letter to Mr. Richard Powers of my staff requested acceptance of two variations on the original design. The first change was the use of your standard 6 kg/m U-channel line posts, 1219-mm long, set in 100-mm diameter 12-gauge steel pipe sockets in lieu of direct-driven posts with soil plates. Each socket was set in the center of a 300-mm diameter by 760-mm deep reinforced concrete footing. The second change was the post spacing. Whereas the original design used line posts on 2-m centers, you tested installations with post spacings of 3.8 m and 5.1 m. Both changes were formally accepted as being crashworthy in Mr. John Baxter's October 12, 2005 acceptance letter, B-96A.

In your July 25, 2006 letter, you requested formal acceptance of the cable barrier described above, but supported by heavier 7.44 kg/m posts set on 6.1-m centers. These posts were again set in steel pipe sockets that were embedded in 300-mm diameter by 760-mm deep concrete footings. When impacted by the standard pickup truck at a nominal speed and angle of 100 km/h and 25 degrees respectively, the dynamic deflection was reported to be 1.7 m, as shown in the enclosed test summary sheet. Full details of the test are contained in the Texas Transportation Institute's July 2006 report entitled "NCHRP Report 3-11 of the Nucor Steel Marion Cable Barrier in Sockets Spaced at 20 ft with 5 lb/ft U-channel Posts".

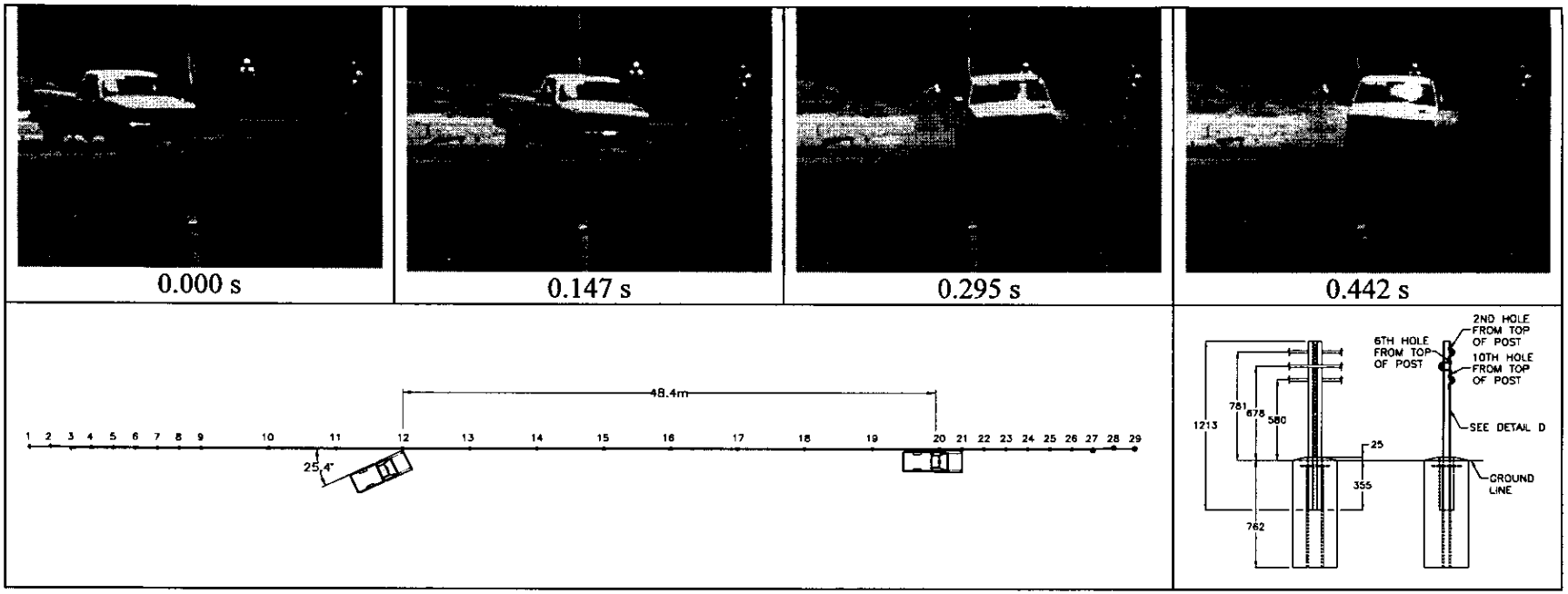
Based on our review of the test report, the 3-strand cable barrier described above is acceptable for use on the National Highway System as a National Cooperative Highway Research Program Report 350 test level 3 barrier. Since both the anchor used in the test installation and

the locking hook bolts at each line post are considered proprietary, the provisions of Title 23 CFR, Section 635.411 apply to the use of this system on federally funded projects.

Sincerely yours,

John R. Baxter, P.E.
Director, Office of Safety Design
Office of Safety

Enclosure



General Information		**Impact Conditions**		**Test Article Deflections (m)**	
Test Agency	Texas Transportation Institute	Speed (km/h)	100.4	Dynamic	1.7
Test No.	400001-NSM6	Angle (deg)	25.2	Permanent	1.7
Date	06-12-2006	**Exit Conditions**		Working Width	2.0
Test Article		Speed (km/h)	73.4	**Vehicle Damage**	
Type	Cable Barrier	Angle (deg)	~5	Exterior	
Name	Nucor Steel Marion Cable Barrier	**Occupant Risk Values**		VDS	11LD3
Installation Length (m)	101.5	Impact Velocity (m/s)		CDC	11LDEW3
Material or Key Elements	3-Cable Barrier System with 5 lb/ft U-Channel Posts Spaced at 20 ft	Longitudinal	3.0	Max. Exterior Vehicle Crush (mm)	400
Soil Type and Condition	Concrete Footings, Dry	Lateral	4.5	Interior	
Test Vehicle		THIV (km/h)	17.9	OCDI	LS0000000
Type	Production	Ridedown Accelerations (g's)		Max. Occupant Compartment Deformation (mm)	17
Designation	2000P	Longitudinal	-8.1	**Post-Impact Behavior**	
Model	1998 Chevrolet C2500 Pickup Truck	Lateral	-10.3	(during 1.0 sec after impact)	
Mass (kg)		PHD (g's)	12.5	Max. Yaw Angle (deg)	29
Curb	2220	ASI	0.62	Max. Pitch Angle (deg)	-3
Test Inertial	2106	Max. 0.050-s Average (g's)		Max. Roll Angle (deg)	5
Dummy	No Dummy	Longitudinal	-3.2		
Gross Static	2106	Lateral	5.4		
		Vertical	1.8		

Figure 12. Summary of results for *NCHRP Report 350* test 3-11 on the Nucor Steel Marion cable barrier.

August 30, 2002

HSA-10/B96

Mr. Rick Mauer
National sales Manager
Marion Steel Company
Post Office Box 837
Greenland, New Hampshire 03840-0837

Dear Mr. Mauer:

Your January 8 letter to Mr. Lawrence A. Staron, former Chief of the Federal Highway Administration's Federal-Aid and Design Division, was forwarded to me for a response. Because you requested acceptance of a modified cable barrier design that used a new anchoring system, you subsequently asked Mr. Richard Powers of my staff to withhold action on the barrier proper until the new terminal design was accepted. An interim review of the test report also revealed some discrepancies between the report text and figures. A revised report, dated February 2002 and entitled "NCHRP Report 350 Test 3-11 of the Wire Rope Barrier with Marion Steel 6 Kg/M U-Channel Posts" was sent to Mr. Powers by Dr. Dean Alberson, Texas Transportation Institute Research Engineer on March 4. The proprietary cable anchor was finally accepted on August 29, following additional tests and significant design modifications. However, the terminal changes would have no effect on the performance of the length of need section of barrier that you tested.

Your tested installation was a 3-strand cable guardrail installed as a median barrier with the upper and lower cables on the field side of the posts and the middle cable on the impact side. The cables were 19-mm diameter 3 x 7 wire rope and their heights above the ground were approximately 520 mm, 650 mm, and 775 mm. The length-of-need posts were standard 1664-mm long 6 kg/m U-channel posts installed on 2-meter centers with trapezoidal soil plates just below the ground line. The cables were attached to the line posts with proprietary 6.4-mm diameter locking hook bolts. The test installation was anchored at both ends with TTI's proprietary Cable Guardrail Terminal and each cable was tensioned to 25 kN (5600 lbs.) for the ambient temperature of 21 degrees C. Design details can be seen in Enclosure 1, but note that changes have been made to the terminal itself and its final design is somewhat different from that shown on Enclosure 1A.

NCHRP Report 350 Test No. 3-11 was run on the 101.4 meter test installation, with the pickup truck impacting approximately 20 m from the upstream anchor at 25.3 degrees and 100.7 km/h. The dynamic deflection of the cable barrier was 1.99 m with the 2.0 m post spacing. By comparison, the dynamic deflection of the standard 3-cable median barrier in test 3-11 was 3.4 m. The reduced deflection seen in your test can be attributed to the combination of higher cable tension, the reduced post

spacing, and the use of locking hook bolts to develop the full strength of each post before the cables disengage. Summary test results are shown in Enclosure 2.

Test 3-10, an 820-kg car impacting at 20 degrees, was not run. However, based on earlier tests of Washington State's cable median barrier that has cables at the same heights (but with significantly less tension) and posts on 5.0 m centers, I am willing to waive test 3-10.

The 3-strand cable barrier described above is acceptable for use on the National Highway System as an NCHRP Report 350 test level 3 (TL-3) barrier. Although tested as a median barrier, this design may be used as a roadside barrier with all three cables on the traffic side of the posts at heights of approximately 610 mm, 685 mm, and 760 mm above the ground. Your posts and locking hook bolts may also be used with the current NCHRP Report 350 concrete anchor block terminal and the standard 3-strand cable rail with its reduced cable tension, 5.0-m post spacing, and a dynamic deflection of 3.5 m. Use of the patented locking hook bolts is likely to reduce the barrier dynamic deflection to some extent.

Since both the TTI anchor and the locking hook bolts at each line post are considered proprietary, the provisions of Title 23 CFR, Section 635.411 apply to the use of this system on federally funded projects.

Sincerely yours,

(original signed by Janet A. Coleman)
for
Carol H. Jacoby, P.E.
Director, Office of safety Design

2 Enclosures