



**NCHRP REPORT 350 TEST 3-11 OF THE NUCOR
STEEL MARION CABLE BARRIER WITH POSTS IN
SOCKETS SPACED AT 6.1 M**

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| 16. Abstract <p>The objective of the test reported herein was to evaluate the length-of-need portion of the Nucor Steel Marion cable barrier system with posts placed in sockets spaced at 6.1 m. This report presents the details of the installation, description of the full-scale crash test, and the results and evaluation of that crash test.</p> <p>The Nucor Steel Marion cable barrier with posts in sockets spaced at 6.1 m performed acceptably according to the specifications for <i>NCHRP Report 350</i> test 3-11.</p> | | | |
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SUMMARY AND CONCLUSIONS

ASSESSMENT OF TEST RESULTS

An assessment of the test based on the following applicable *NCHRP Report 350* safety evaluation criteria.

Structural Adequacy

- A. *Test article should contain and redirect the vehicle; the vehicle should not penetrate, underride, or override the installation although controlled lateral deflection of the test article is acceptable.*

Results: The Nucor Steel Marion cable barrier contained and redirected the pickup truck. The vehicle did not penetrate, underride, or override the installation. Maximum dynamic deflection during the test was 2.99 m. (PASS)

Occupant Risk

- D. *Detached elements, fragments, or other debris from the test article should not penetrate or show potential for penetrating the occupant compartment, or present an undue hazard to other traffic, pedestrians, or personnel in a work zone. Deformation of, or intrusions into, the occupant compartment that could cause serious injuries should not be permitted.*

Results: A few of the posts pulled out of the sockets and separated from the cable. However, none of these penetrated, nor showed potential for penetrating the occupant compartment, nor to present undue hazard to others in the area. No occupant compartment deformation occurred. (PASS)

- F. *The vehicle should remain upright during and after collision although moderate roll, pitching, and yawing are acceptable.*

Results: The pickup truck remained upright during and after the collision event. (PASS)

Vehicle Trajectory

- K. *After collision, it is preferable that the vehicle's trajectory not intrude into adjacent traffic lanes.*

Result: The vehicle came to rest 7.6 m downstream of the end of the barrier with the front of the vehicle aligned with the traffic face of the barrier and the rear behind the barrier. (PASS)

L. *The occupant impact velocity in the longitudinal direction should not exceed 12 m/s and the occupant ridedown acceleration in the longitudinal direction should not exceed 20 g's.*

Result: Longitudinal occupant impact velocity was 2.0 m/s, and longitudinal ridedown acceleration was 8.3 g's. (PASS)

M. *The exit angle from the test article preferably should be less than 60 percent of the test impact angle, measured at time of vehicle loss of contact with the test device.*

Result: The vehicle exited the view of the overhead camera prior to loss of contact. However, exit angle was estimated at 4.8 degrees, which is 18 percent of the impact angle. (PASS)

The following supplemental evaluation factors and terminology, as presented in the FHWA memo entitled "Action: Identifying Acceptable Highway Safety Features," were used for visual assessment of test results: ⁽¹²⁾

Passenger Compartment Intrusion

1. *Windshield Intrusion*

a. *No windshield contact*

b. *Windshield contact, no damage*

c. *Windshield contact, no intrusion*

d. *Device embedded in windshield, no significant intrusion*

e. *Complete intrusion into passenger compartment*

f. *Partial intrusion into passenger compartment*

2. *Body Panel Intrusion*

yes or no

Loss of Vehicle Control

1. *Physical loss of control*

2. *Loss of windshield visibility*

3. *Perceived threat to other vehicles*

4. *Debris on pavement*

Physical Threat to Workers or Other Vehicles

1. *Harmful debris that could injure workers or others in the area*

2. *Harmful debris that could injure occupants in other vehicles*

A few of the posts pulled out of the sockets and separated from the cable.

However, none caused a hazard.

Vehicle and Device Condition

1. *Vehicle Damage*

a. *None*

b. *Minor scrapes, scratches or dents*

c. *Significant cosmetic dents*

d. *Major dents to grill and body panels*

e. *Major structural damage*

2. *Windshield Damage*

- a. *None*
- b. *Minor chip or crack*
- c. *Broken, no interference with visibility*
- d. *Broken or shattered, visibility restricted but remained intact*

- e. *Shattered, remained intact but partially dislodged*
- f. *Large portion removed*
- g. *Completely removed*

3. *Device Damage*

- a. *None*
- b. *Superficial*
- c. *Substantial, but can be straightened*

- d. *Substantial, replacement parts needed for repair*
- e. *Cannot be repaired*

CONCLUSIONS

The Nucor Steel Marion cable barrier with posts in sockets spaced at 6.1 m performed acceptably according to the specifications for *NCHRP Report 350* test 3-11, as shown in table 1.

DRAFT

Table 1. Performance evaluation summary for *NCHRP Report 350* test 3-11 on the Nucor Steel Marion cable barrier with posts at 6.1 m.

Test Agency: Texas Transportation Institute

Test No.: 400001-NSM4

Test Date: 02-14-2006

| <i>NCHRP Report 350</i> Evaluation Criteria | Test Results | Assessment |
|---|--|-------------------|
| <p>Structural Adequacy</p> <p>A. <i>Test article should contain and redirect the vehicle; the vehicle should not penetrate, underride, or override the installation although controlled lateral deflection of the test article is acceptable</i></p> | <p>The Nucor Steel Marion cable barrier contained and redirected the pickup truck. The vehicle did not penetrate, underride, or override the installation. Maximum dynamic deflection during the test was 2.99 m.</p> | <p>Pass</p> |
| <p>Occupant Risk</p> <p>D. <i>Detached elements, fragments, or other debris from the test article should not penetrate or show potential for penetrating the occupant compartment, or present an undue hazard to other traffic, pedestrians, or personnel in a work zone. Deformations of, or intrusions into, the occupant compartment that could cause serious injuries should not be permitted.</i></p> | <p>A few of the posts pulled out of the sockets and separated from the cable. However, none of these penetrated, nor showed potential for penetrating the occupant compartment, nor to present undue hazard to others in the area. No occupant compartment deformation occurred.</p> | <p>Pass</p> |
| <p>F. <i>The vehicle should remain upright during and after collision although moderate roll, pitching, and yawing are acceptable.</i></p> | <p>The pickup truck remained upright during and after the collision event.</p> | <p>Pass</p> |
| <p>Vehicle Trajectory</p> <p>K. <i>After collision, it is preferable that the vehicle's trajectory not intrude into adjacent traffic lanes.</i></p> | <p>The vehicle came to rest 7.6 m downstream of the end of the barrier with the front of the vehicle aligned with the traffic face of the barrier and the rear behind the barrier.</p> | <p>Pass*</p> |
| <p>L. <i>The occupant impact velocity in the longitudinal direction should not exceed 12 m/s and the occupant ridedown acceleration in the longitudinal direction should not exceed 20 g's.</i></p> | <p>Longitudinal occupant impact velocity was 2.0 m/s, and longitudinal ridedown acceleration was 8.3 g's.</p> | <p>Pass</p> |
| <p>M. <i>The exit angle from the test article preferably should be less than 60 percent of test impact angle, measured at time of vehicle loss of contact with test device.</i></p> | <p>Exit angle was estimated at 4.8 degrees, which is 18 percent of the impact angle.</p> | <p>Pass*</p> |

*Criterion K and M are preferable, not required.