U.S. Department of Transportation
Federal Highway Administration

1200 New Jersey Avenue, SE.
Washington, DC 20590

November 14, 2008

In Reply Refer To: HSSD/B-141C **(REVISED)**

Mr. Brian Smith
Trinity Highway Products, LLC
P.O. Box 568887
Dallas, TX 75356-8887

Dear Mr. Smith:

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: CASS cable barrier system on a 4:1 slope
Type of system: Three cable median barrier
Test Level: National Cooperative Highway Research Program (NCHRP) Report 350
Testing conducted by: Texas Transportation Institute (TTI)
Dates of request: November 28, 2007 and February 5, 2008,
Date of completed package: June 22, 2008
Letter revised: October, 2008

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

Introduction
The FHWA guidance on crash testing of roadside safety hardware is contained in a memorandum dated July 25, 1997, titled "INFORMATION: Identifying Acceptable Highway Safety Features."

1. The CASS 4:1 is a tensioned, three-cable barrier system that was tested with standard (non-prestretched) cables. The middle and top cables are positioned within a wave-shaped slot in the web of S100 x 11.5 (S4 x 7.7#) structural I-beam posts. The bottom cable is supported on the median-side flange of the I-beam post by an 8 mm (5/16 inch) hook bolt with the open end down. The proprietary S100 x 11.5 (S4 x 7.7#) posts have weakening holes at the ground line and were installed in steel tube sleeves set in 305 mm (12 inch) diameter x 762 mm (30 inch) deep concrete footings. Post spacing was 6.1 m (20 feet) for the first three tests and 2.03 m (6 feet 8 inches) for the fourth test. The cables within the wave-shaped slot are separated by plastic spacers. A stainless steel strap is mounted on the outside of the post above the top cable.

The 19 mm (3/4-inch) diameter standard cables were set at heights of 445 mm, 745 mm, and 1060 mm (17.5, 29.3, and 41.7 inches) above the ground surface, measured to the center of each cable. Tension of the cables was set at 24.9 kN (5600 pounds force) for the tests.

Testing

Three tests were conducted on the CASS 4:1 system with 6.1m (20 feet 0 inch) post spacing installed in a 9.1 m (30 foot) wide depressed median with 1V:4H side slopes. A fourth test was conducted on the CASS 4:1 system with 2.03 m (6 feet 8 inch) post spacing. The barrier installations and tests intended to show that the system would perform properly when located 1.22 m (4 feet) from the hinge point and 3.5 m (11 feet) from the ditch invert. The test data summary sheets are attached, and the tests are briefly described as follows:

1. The NCHRP Report 350 Test 3-11 (modified) – 2270P (MASH-08 pickup truck) at 100 km/hr with a 25 degree impact angle. The barrier was installed 1.22 m (4 feet) from the break point.

2. The NCHRP Report 350 Test 3-10 – 820C at 100 km/hr with a 20 degree impact angle with the barrier installed 1.22 m (4 feet) from the break point.

3. The NCHRP Report 350 Test 3-10 – 820C at 100 km/hr with a 20 degree impact angle with the barrier installed on the median backslope 3.35 m (11 feet) from the median bottom. The test vehicle traveled across the median bottom and traveled up the backslope before impacting the barrier.

4. The NCHRP Report 350 Test 3-11 (modified) – 2270P (MASH-08 pickup truck) at 100 km/hr with a 25 degree impact angle. The barrier was installed 1.22 m (4 feet) from the break point. Post spacing was 2.03 m (6 foot 8 inch) post spacing.

Each 100.6 m (330 foot long) test installation was anchored by TTI Breakaway Cable Anchor Terminals. Dynamic deflection in Test 3-11 (modified) with 6.1 m (20 foot) spacing was 2.85 m (9.35 feet.) Dynamic deflection in Test 3-11 (modified) with 2.03 m (6 foot 8 inch) spacing was 2.19 m (7.19 feet.)

You initially requested the FHWA Acceptance under the MASH-08 as you used the appropriate quad-cab pickup truck. Subsequently you agreed with the FHWA that the 300-foot length of the test article was inadequate under the MASH-08 guidelines, but that the 2270P vehicle would be considered acceptable for judging performance under the NCHRP Report 350 in this matrix.

Findings

The occupant risk values and vehicle trajectories in all four tests met the appropriate evaluation criteria. None of the tests showed potential for vehicle override, penetration, or rollover. Therefore, the system placed on a 1V:4H or flatter median slope described above and detailed in the enclosed drawings is acceptable for use on the NHS under the range of conditions tested, when the barrier's use is approved by a highway agency under both the NCHRP Report 350. Although testing was conducted on standard cables, we concur with your additional request that the system be found acceptable with pre-stretched cables.

Although the barrier performed well under ideal test impact conditions when originally crash tested, the likelihood of passenger car underrides of **any cable system** may increase as the post spacing increases, particularly when the barrier is installed on non-level or slightly irregular terrain and the cables are not restrained from lifting at each post. Consequently, some transportation agencies have limited post spacing to approximately 6 m (20 feet) for cable barriers. The dynamic deflection of the barrier is likely to increase when it is installed along the convex sides of horizontal curves, and when distances between anchorages exceed the 350 foot test length.

Sincerely yours,

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

Enclosures

FHWA:HSSD:NArtimovich:tb:x61331:2/25/08
REVISED 11/14/08
File: s://directory folder/nartimovich/B141Ccass4to1 Draft BS 080220.doc
cc: HSSD (Reader, HSA; Chron File, HSSD; N.Artimovich, HSSD;
MBloschock, HSSD; M.McDonough, HSSD)