Memorandum

Subject: **ACTION**: NYS Concrete Barrier with Box Beam Stiffener FHWA Eligibility Letter B-239

Date: November 1, 2012

From: Michael S. Griffith
Director, Office of Safety Technologies
Office of Safety

In Reply Refer To: Jonathan D. McDade
Division Administrator
Albany, New York

This memorandum is in response to your request for the Federal Highway Administration (FHWA) to review a roadside safety system for eligibility for reimbursement under the Federal-aid highway program.

Name of system: New York State Temporary Concrete Barrier with Box Beam Stiffener
Type of system: Portable Concrete Barrier with reduced deflection
Test Level: MASH Test Level 3
Testing conducted by: Mid West Roadside Safety Facility (MWRSF)

**Decision**

The following device is eligible, with details provided below and in the attachments:

- New York State Temporary Concrete Barrier (TCB) with Box Beam Stiffener. Stiffener detail may also be used with other TCB as noted.

Based on a review of crash test results certifying the device described herein meets the crash test and evaluation criteria of the National Cooperative Highway Research Program (NCHRP) Report 350, the device is eligible for reimbursement under the Federal-aid highway program. Eligibility for reimbursement under the Federal-aid highway program does not establish approval or endorsement by the FHWA for any particular purpose or use.

The FHWA, the Department of Transportation, and the United States Government do not endorse products or services and the issuance of a reimbursement eligibility letter is not an endorsement of any product or service.
Requirements
To be found eligible for Federal-aid funding, roadside safety devices should meet the crash test and evaluation criteria contained in the National Cooperative Highway Research Program (NCHRP) Report 350 or the American Association of State Highway and Transportation Officials’ Manual for Assessing Safety Hardware (MASH).

Description
Previous crash testing of the New York State Department of Transportation (NYSDOT) temporary concrete barrier (TCB) system had been conducted according to the National Cooperative Highway Research Program (NCHRP) Report 350 criteria, and documented in FHWA Letter B-94, dated January 24, 2002. In the 2001 test at the Texas Transportation Institute, the unpinned NYSDOT TCB system, a 2,076-kg (4,577-lb) pickup truck impacted the ten barrier system at a speed of 100.8 km/h (62.6 mph) and at an angle of 25.6 degrees. During the impact, the vehicle was redirected smoothly and the barrier system experienced 1,270 mm (50 in.) of deflection. The upstream end was pulled 148 mm (5.8 in.) longitudinally downstream, while the downstream end was displaced 5 mm (0.2 in.) longitudinally upstream, or toward the impact point.

Crash Testing of Stiffened Barrier
In the 2008 testing at the Midwest Roadside Safety Facility (MRSF) the 60.96-m (200-ft) long test installation consisted of box beam stiffened temporary concrete barrier sections in a free-standing configuration with both end sections anchored. The ten 6,096-mm (20-ft) long, temporary concrete barrier sections were installed with the first and last sections attached to the concrete using nine 25-mm (1-in.) diameter by 394-mm (15.5-in.) long, A36 steel rods, five anchors and four anchors on the traffic and back sides, respectively. Each anchor rod was driven into a hole drilled in the concrete to an embedment depth of 127 mm (5 in.).

The three joints between barrier nos. 4 and 7 were stiffened with a box beam section consisting of a 152-mm x 152-mm x 4.8-mm (6-in. x 6-in. x 0.1875-in.) ASTM A500 Grade C box beam, which was 3,658 mm (12 ft) long. The box beams were connected to the barriers with 19-mm (0.75-in.) diameter by 432-mm (17-in.) long, Grade 5 continuously threaded rods and nuts. An 83-mm (3.25-in.) outside diameter x 22-mm (0.875-in.) inside diameter x 9.5-mm (0.375-in.) thick Grade 5 fender washer was placed on the traffic side of the barrier between the barrier and the nut. A 203-mm x 203-mm x 6.4-mm (8-in. x 8-in. x 0.25-in.) A36 steel plate was placed on the back side of the barrier between the nut and the box beam section.

Details of the crash are in the attached Figure 29 Summary of Test Results. The maximum dynamic deflection was 700 mm (approximately 28 inches). This is 44 percent less deflection than the 1,270 mm (50 in.) recorded in the test of the un-stiffened barrier.

The analysis of the test results for test no. NYTCB-1 showed that the stiffened temporary concrete barrier system with anchored ends adequately contained and redirected the 2270P vehicle with controlled lateral displacements of the barrier system. This test was determined to meet the TL-3 safety performance criteria of test designation no. 3-11 found in MASH.
Summary and Standard Provisions

Therefore, the system described and detailed in this memorandum is eligible for reimbursement and may be installed under the range of conditions tested. We also concur that the same stiffening method may be used to reduce the deflection of other portable concrete barrier systems with the following provisions:

1) The length of the individual barrier segments are at least 20 feet long.
2) The deflection of the system to be retrofit was no greater than 50 inches under NCHRP Report 350 Test Level 3 conditions.
3) The barriers are anchored at both ends to achieve the limited deflection properties demonstrated in the crash testing. If the end sections are not anchored then the barrier line, with stiffeners, should be extended until the barrier’s desired deflection can be achieved.

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

- This finding of eligibility does not cover other structural features of the systems, nor conformity with the Manual on Uniform Traffic Control Devices.
- Any changes that may influence system conformance with NCHRP Report 350 criteria will require a new reimbursement eligibility letter.
- Should the FHWA discover that the qualification testing was flawed, that in-service performance reveals safety problems, or that the system is significantly different from the version that was crash tested, we reserve the right to modify or revoke this letter.
- You are expected to supply potential users with sufficient information on design and installation requirements to ensure proper performance.
- You are expected to certify to potential users that the hardware furnished has the same chemistry, mechanical properties, and geometry as that submitted for review, and that it will meet the crash test and evaluation criteria of the NCHRP Report 350.
- To prevent misunderstanding by others, this letter of eligibility is designated as number B-239 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 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 FHWA does not become involved in issues concerning patent law. Patent issues, if any, are to be resolved by the applicant.

Attachments
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Attachments
- **Test Agency**: MwRSF
- **Test Number**: NYTCB-1
- **Date**: 7/24/07
- **NCHRP 350 Update Test Designation**: 3-11
- **Appurtenance**: Stiffened Temporary Concrete Barriers
- **Total Length**: 60.96 m
- **Key Elements - Barrier**
  - **Description**: New York TCB with Connection Keys
  - **Length**: 6.096 mm
  - **Base Width**: 610 mm
  - **Height**: 810 mm
- **Key Elements - Anchor Ends**
  - **Size**: 25 mm diameter ASTM A36 rod
  - **Length**: 394 mm
  - **Number per Barrier**: 5 traffic-side, 4 back-side
- **Key Elements - Box Beam Stiffener**
  - **Size**: 152 mm x 152 mm x 4.8 mm
  - **Length**: 3.658 mm
  - **Connector Rod**: 19 mm diameter x 432 mm long Grade 5
  - **Plate Washer**: 203 mm x 203 mm x 6.4 mm
- **Type of Soil**: N/A
- **Test Vehicle**
  - **Type/Designation**: 2270P
  - **Make and Model**: 2002 Dodge Ram 1500 Quad Cab 4x2
  - **Curb**: 2,302 kg
  - **Test Inertial**: 2.275 kg
  - **Gross Static**: 2.275 kg
- **Impact Conditions**
  - **Speed**: 99.5 km/h
  - **Angle**: 24.6 degrees
  - **Impact Location**: 1,300 mm upstream from downstream end of barrier 4
- **Exit Conditions**
  - **Speed**: 62.9 km/h
  - **Angle**: 7 deg
  - **Exit Box Criterion**: Pass
- **Post-Impact Trajectory**
  - **Vehicle Stability**: Satisfactory
  - **Stopping Distance**: 62.3 m downwind
  - **4.6 m laterally
- **Occupant Impact Velocity**
  - **Longitudinal**: -4.67 m/s < 12
  - **Lateral**: 6.33 m/s < 12
- **Occupant Ridedown Deceleration**
  - **Longitudinal**: 4.72 g's < 20
  - **Lateral**: 8.36 g's < 20
- **THIV (not required)**: 7.45 m/s
- **PHD (not required)**: 8.71 g's
- **Test Article Damage**: Moderate
- **Test Article Deflections**
  - **Permanent Set**: 660 mm
  - **Dynamic**: 700 mm
  - **Working Width**: 1,311 mm
- **Vehicle Damage**: Moderate
  - **VDS**: 11-LFQ-3
  - **CDC**: 11-LYEN2
  - **Maximum Deformation**: 38 mm
- **Angular Displacements**
  - **Roll**: -10.5 deg
  - **Pitch**: -11.4 deg
  - **Yaw**: 28.0 deg

Figure 29. Summary of Test Results and Sequential Photographs. Test NYTCB-1