



U.S. Department
of Transportation

Federal Highway
Administration

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:
HSST

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.

FHWA: HSST: NArtimovicht: sf: x61331:10/26/12: **sf.Updated 11/1/12**
File: s://directory folder/HSST/Artimovich/B239_NYS Box Beam
TCB.docx
cc: HSST (NArtimovich)

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.

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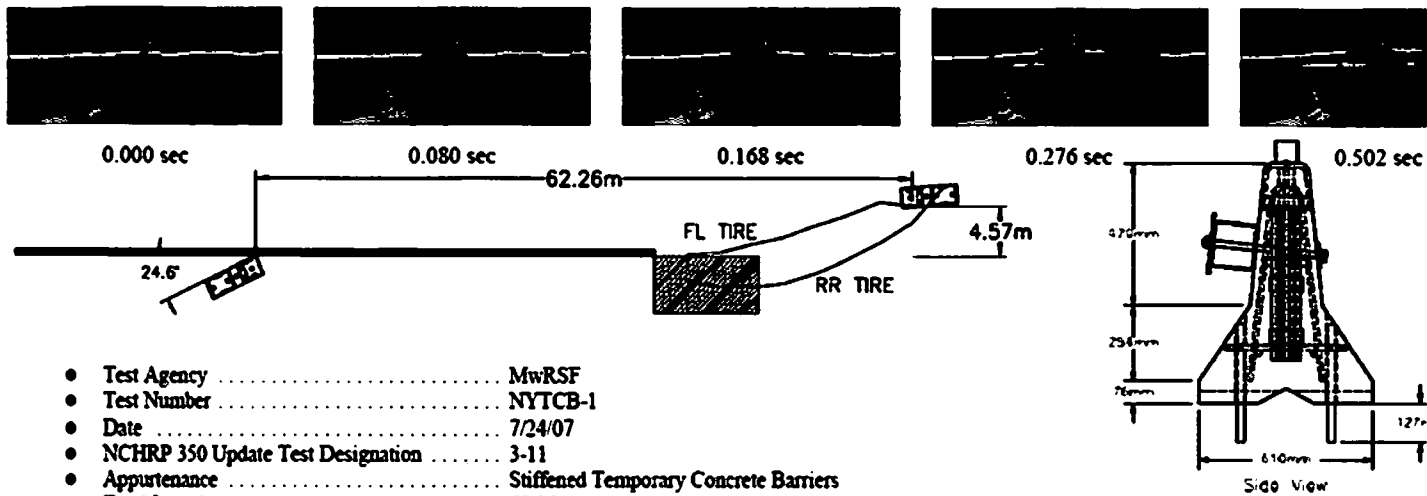
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Attachments



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- 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 downs
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
 - VDS¹¹ 11-LFQ-3
 - CDC¹⁴ 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

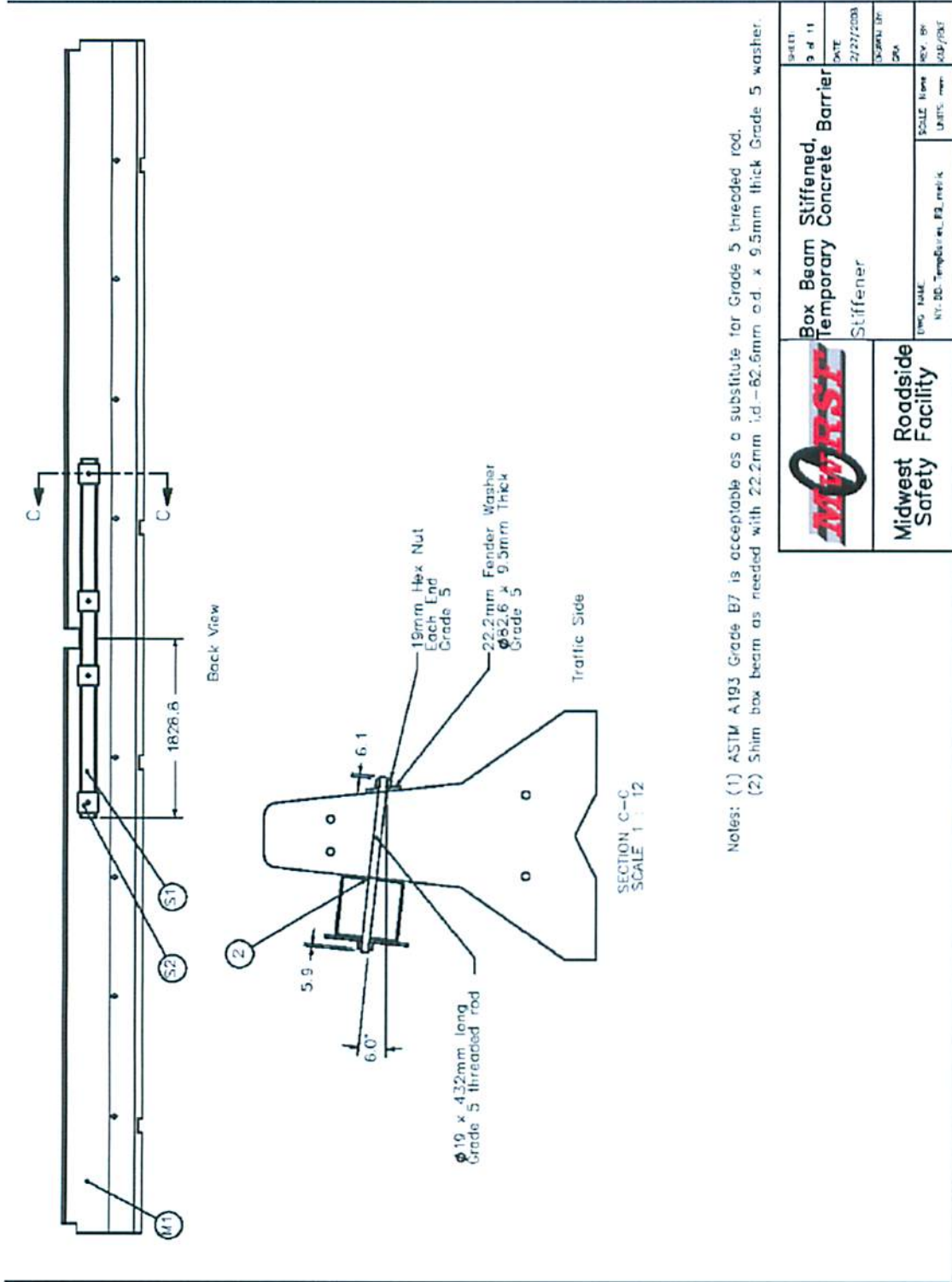


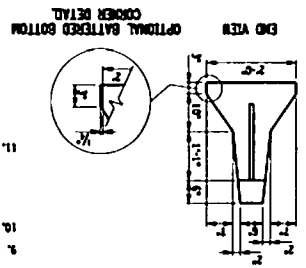
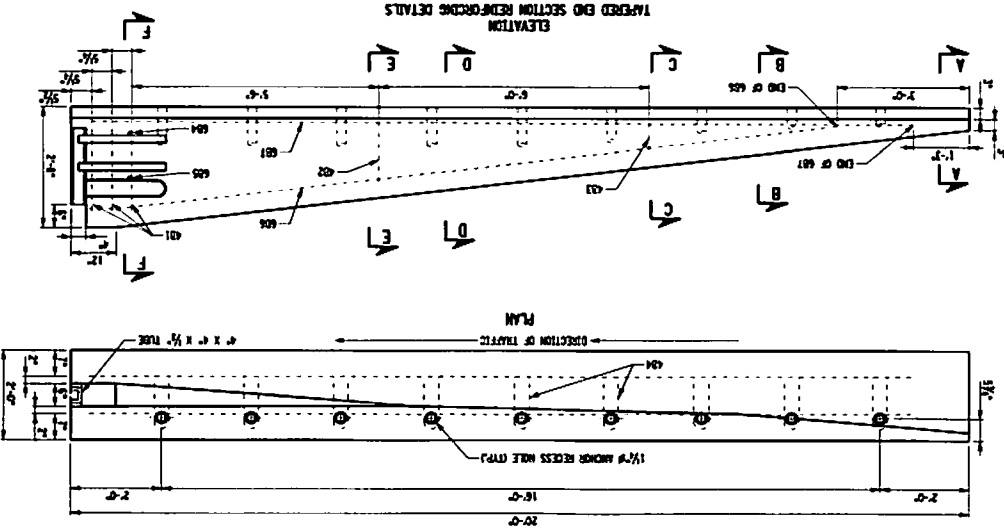
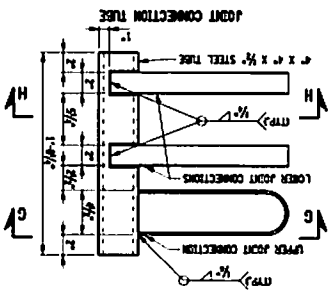
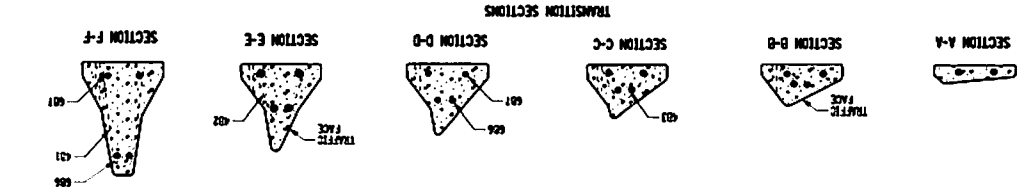
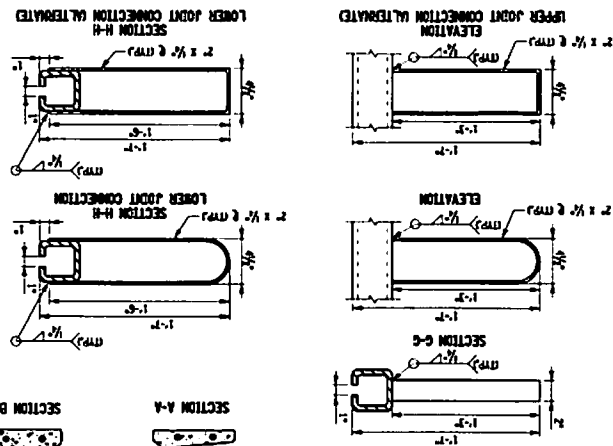
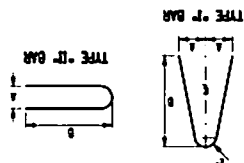
Figure 21. Box Beam Stiffener Details, Test NYTCB-1

STATE OF NEW YORK
 DEPARTMENT OF TRANSPORTATION
 U.S. CUSTOMARY STANDARD SHEET
 TEMPORARY CONCRETE BARRIER
 (SHEET 2 OF 3)
 APPROVED SEPTEMBER 30, 2009 ISSUED UNDER E.D. 09-025
 W.F. F. THOMAS, P.E.
 COUNTY OFF ENGINEER
 619-01

EFFECTIVE DATE: 01/07/10

TAPERED END SECTION BAR LIST

| MARK | SIZE | SECTION | LENGTH | TYPE | A | B | C | LOCATION |
|------|------|-----------|--------|------|---|----|---|-------------------|
| Q01 | 3 | SECTION 1 | 4'-11" | 1 | 5 | 28 | 1 | STAIRS |
| Q02 | 13 | 1 | 2'-2" | 1 | 5 | 18 | 1 | STAIRS |
| Q03 | 13 | 1 | 1'-4" | 1 | 5 | 8 | 1 | STAIRS |
| Q04 | 13 | 9 | 2'-1" | 2 | 4 | 15 | 1 | STAIRS |
| Q05 | 13 | 1 | 1'-2" | 1 | 5 | 8 | 1 | STAIRS |
| Q06 | 13 | 1 | 15'-2" | 1 | 5 | 18 | 1 | TRANSVERSE TOP |
| Q07 | 13 | 2 | 18'-2" | 2 | 5 | 18 | 2 | TRANSVERSE BOTTOM |

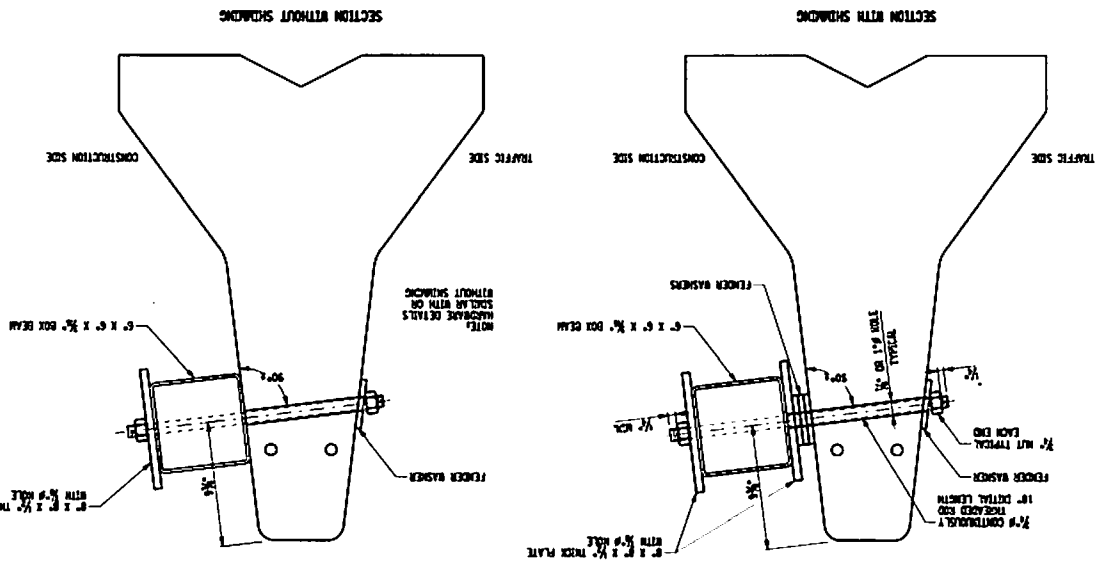


- NOTES:
- TEMPORARY CONCRETE BARRIER SHALL BE PRECAST IN ACCORDANCE WITH THE REQUIREMENTS OF SP-08, PRECAST CONCRETE BARRIER.
 - STEEL PLATE SHALL BE ASTM A36, ASTM GRADE 50, TYPE STEEL SHALL BE ASTM GRADE B OR C, AND REINFORCING BARS SHALL BE ASTM GRADE 60.
 - ALL REINFORCING SHALL BE PERFORMED IN ACCORDANCE WITH THE REQUIREMENTS OF THE NY STATE CONSTRUCTION MANUAL.
 - SPACES TO BE REINFORCED SHALL BE FREE OF SLAC, DIRT, MOISTURE, OILS OR ANY OTHER MATERIAL THAT WILL PREVENT PROPER BONDING OR PRODUCE COLLECTIBLE FLAKES.
 - REINFORCING SHALL BE SPLICED WITH LAP REINFORCING COMPARED TO THE REQUIREMENTS OF SECTION 7 OF THE NY STATE CONSTRUCTION MANUAL.
 - CONCRETE CLEAN COVER FOR REINFORCING BARS SHALL BE 1 1/2" UNLESS OTHERWISE SPECIFIED.
 - A MINIMUM OF (2) TWO RECESSES (LAPPED DEVICES, WITH THE CAPACITY TO LIFT A MASS OF 6 TONS EACH) SHALL BE INSTALLED ON EACH SECTION.
 - 1 1/2" ASTM A36 ANCHOR PINS SHALL BE PLACED IN FOUR RECESSES OF EACH SECTION TO BE POWERED.
 - CONNECTION KEY COVER PLATE SHALL BE INSTALLED FLUSH WITH THE GASOLINE TOP.
 - THE DETAILS SHOWN FROM THIS SECTION ON THIS SHEET ARE FOR APPROXIMATE ENDS WHICH ARE TO BE LOCATED TO THE LEFT OF THE TRAFFIC FLOW ON THE END WALL. APPROXIMATE ENDS ARE TO BE LOCATED TO THE RIGHT OF THE TRAFFIC FLOW ON THE END WALL.
 - SECTION SHALL BE CONSTRUCTED SO THAT IT IS PROPERLY BOND REINFORCED IN ALL COMPARABLE AREAS WITH LOCATIONS AND REINFORCEMENT.
 - ALL CORNERS OF THE SECTION SHALL BE ROUNDED TO A 1" RADIUS. THE SECTION SHALL HAVE A SMOOTH FINISH TO A 1/4" SECTION HEIGHT. ALL END SECTIONS SHALL BE FINISHED UNLESS OTHERWISE NOTED.

| | |
|---|--|
| STATE OF NEW YORK DEPARTMENT OF TRANSPORTATION | |
| U.S. CUSTOMARY STANDARD SHEET | |
| TEMPORARY CONCRETE BARRIER (SHEET 3 OF 3) | |
| 619-01 | APPROVED SEPTEMBER 1, 2010 ISSUED UNDER E3 10-024 DEPUTY CHIEF ENGINEER JULY 27, 2004, P.E. |

EFFECTIVE DATE 01/06/11

BOX BEAM STIFFENING OF TEMPORARY CONCRETE BARRIER



- NOTES:
1. TEMPORARY CONCRETE BARRIER SHALL BE PLACED IN ACCORDANCE WITH THE REQUIREMENTS OF §10-04 AND PRECAST CONCRETE BARRIER AND STANDARD SHEET TITLED "TEMPORARY CONCRETE BARRIER - SHEET 1 OF 3" AND "TEMPORARY CONCRETE BARRIER - SHEET 2 OF 3".
 2. BOX BEAM SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF §110-21, BOX BEAM BARRIERS AND MEDIUM BARRIER, BARS.
 - a. HOWEVER, THE BOX BEAM NEED NOT BE NEW.
 - b. THE GALVANIZING REMAINING ON THE OLD PIECES SHALL BE SUFFICIENT TO ENSURE THE STEEL IS STRUCTURALLY EFFECTIVE.
 3. TOP RIB BOX BEAM STIFFENERS SHALL BE AT LEAST 50'-0" BEYOND THE AREA INCLUDING LIMITED DEFLECTIONS, UNDER SPACE LIMITS THROUGH AND EXTEND AT LEAST 50'-0" BEYOND THE AREA INCLUDING LIMITED DEFLECTIONS, UNDER SPACE LIMITS THROUGH AND EXTEND.
 4. TEMPORARY CONCRETE BARRIER WITH BOX BEAM STIFFENERS MAY ONLY BE USED WITH TOP SEGMENTS 14'-0" OR LONGER.
 5. TEMPORARY CONCRETE BARRIER MAY ONLY BE INSTALLED TO THE FOLLOWING MAXIMUM RADIUS: 14'-0" SEGMENT - 250'-0" RADIUS, 16'-0" RADIUS, 18'-0" RADIUS, 18'-0" SEGMENT - 201'-0" RADIUS, AND 20'-0" SEGMENT - 237'-0" RADIUS.
 6. WHEN TEMPORARY CONCRETE BARRIERS ARE PLACED ON A RADIUS, THE RESULTING GAPS BETWEEN THE BOX BEAM AND CONCRETE BARRIER SHALL BE SHIMMED.
 7. THE SHIMMING SHALL CONSIST OF 6" x 6" x 1/2" SQUARE PLATE, AND FINGER WASHERS AS NEEDED TO SHIM THE BOX BEAM STIFFENER TO THE TOP.
 8. FINGER WASHERS SHALL BE 3" MINIMUM DIA.
 9. HARDWARE OTHER THAN THE BOX BEAM NEED NOT BE GALVANIZED.
 10. THE PRESENCE OF NORMAL HOLES DRILLED FOR THIS SHEET WILL NOT AFFECT THE RESPONSIBILITY OF THE CONCRETE SEGMENTS.

