Mr. Omar Fernandez
MTA Bridges and Tunnels – Triborough Bridge & Tunnel Authority
Bronx-Whitestone Facility Building
1 Hutchinson River Parkway
Bronx, NY 10465
USA

Dear Mr. Fernandez:

This letter is in response to your December 12, 2019 request for the Federal Highway Administration (FHWA) to review a roadside safety device, hardware, or system for eligibility for reimbursement under the Federal-aid highway program. This FHWA letter of eligibility is assigned FHWA control number B-335 and is valid until a subsequent letter is issued by FHWA that expressly references this device.

**Decision**

The following device is eligible within the length-of-need, with details provided in the form which is attached as an integral part of this letter:

- Bronx Whitestone Median Barrier Extension Bridge Rail

**Scope of this Letter**

To be found eligible for Federal-aid funding, new roadside safety devices should meet the crash test and evaluation criteria contained in the American Association of State Highway and Transportation Officials’ (AASHTO) Manual for Assessing Safety Hardware (MASH). However, the FHWA, the Department of Transportation, and the United States Government do not regulate the manufacture of roadside safety devices. Eligibility for reimbursement under the Federal-aid highway program does not establish approval, certification or endorsement of the device for any particular purpose or use.

This letter is not a determination by the FHWA, the Department of Transportation, or the United States Government that a vehicle crash involving the device will result in any particular outcome, nor is it a guarantee of the in-service performance of this device. Proper manufacturing, installation, and maintenance are required in order for this device to function as tested.

This finding of eligibility is limited to the crashworthiness of the system and does not cover other structural features, nor conformity with the Manual on Uniform Traffic Control Devices.
**Eligibility for Reimbursement**

Based solely on a review of crash test results and certifications submitted by the manufacturer, and the crash test laboratory, FHWA agrees that the device described herein meets the crash test and evaluation criteria of the AASHTO’s MASH. Therefore, the device is eligible for reimbursement under the Federal-aid highway program if installed under the range of tested conditions.

- **Name of system:** Bronx Whitestone Median Barrier Extension Bridge Rail
- **Type of system:** Longitudinal Barrier
- **Test Level:** MASH Test Level 4 (TL4)
- **Testing conducted by:** Texas A&M Transportation Institute
- **Date of request:** December 12, 2019

FHWA concurs with the recommendation of the accredited crash testing laboratory on the attached form.

In accordance with FHWA’s Memo “Federal-aid Reimbursement Eligibility Process for Safety Hardware Devices” dated November 12, 2015, FHWA will make note of any reported damage to a test vehicle’s fuel tank. AASHTO’s MASH states “Although not a specific factor in assessing test results, integrity of a test vehicle’s fuel tank is a potential concern. It is preferable that the fuel tank remains intact and not be punctured. Damage or rupture of the fuel tank, oil pan, or other feature that might serve as a surrogate of the fuel tank should be reported”. A test report included in this submittal documenting Test 4-12 (Report for test 611351-1) states that the fuel tank on the right side of the test vehicle was damaged.

**Full Description of the Eligible Device**

The device and supporting documentation, including reports of the crash tests or other testing done, videos of any crash testing, and/or drawings of the device, are described in the attached form.

**Notice**

This eligibility letter is issued for the subject device as tested. Modifications made to the device are not covered by this letter. Any modifications to this device should be submitted to the user (i.e., state DOT) as per their requirements.

You are expected to supply potential users with sufficient information on design, installation and maintenance 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 test and evaluation criteria of AASHTO’s MASH.
Issuance of this letter does not convey property rights of any sort or any exclusive privilege. This letter is based on the premise that information and reports submitted by you are accurate and correct. We reserve the right to modify or revoke this letter if: (1) there are any inaccuracies in the information submitted in support of your request for this letter, (2) the qualification testing was flawed, (3) in-service performance or other information reveals safety problems, (4) the system is significantly different from the version that was crash tested, or (5) any other information indicates that the letter was issued in error or otherwise does not reflect full and complete information about the crashworthiness of the system.

**Standard Provisions**

- To prevent misunderstanding by others, this letter of eligibility designated as FHWA control number B-335 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 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.

- This FHWA eligibility letter is not an expression of any Agency view, position, or determination of validity, scope, or ownership of any intellectual property rights to a specific device or design. Further, this letter does not impute any distribution or licensing rights to the requester. This FHWA eligibility letter determination is made based solely on the crash-testing information submitted by the requester. The FHWA reserves the right to review and revoke an earlier eligibility determination after receipt of subsequent information related to crash testing.

Sincerely,

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

Enclosures
Request for Federal Aid Reimbursement Eligibility of Highway Safety Hardware

I request the following devices be considered eligible for reimbursement under the Federal-aid highway program.

### Device & Testing Criterion

<table>
<thead>
<tr>
<th>System Type</th>
<th>Submission Type</th>
<th>Device Name / Variant</th>
<th>Testing Criterion</th>
<th>Test Level</th>
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<tbody>
<tr>
<td>&quot;B&quot;: Rigid/Semi-Rigid Barriers (Roadside, Median, Bridge Railings)</td>
<td>Physical Crash Testing</td>
<td>Bronx Whitestone Median Barrier Extension Bridge Rail</td>
<td>AASHTO MASH</td>
<td>TL4</td>
</tr>
<tr>
<td></td>
<td>Engineering Analysis</td>
<td></td>
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</table>

By submitting this request for review and evaluation by the Federal Highway Administration, I certify that the product(s) was (were) tested in conformity with the AASHTO Manual for Assessing Safety Hardware and that the evaluation results meet the appropriate evaluation criteria in the MASH.

### Individual or Organization responsible for the product:

- **Contact Name:** Omar Fernandez  
  **Company Name:** MTA Bridges & Tunnels - Triborough Bridge & Tunnel Authority  
  **Address:** Bronx-Whitestone Facility Building, 1 Hutchinson River Parkway  
  **Country:** Bronx, NY 10465, USA

Enter below all disclosures of financial interests as required by the FHWA `Federal-Aid Reimbursement Eligibility Process for Safety Hardware Devices` document.

**HNTB:** HNTB Corporation is a paid consultant for MTA-TBTA for this Bronx Whitestone Median Barrier Extension Bridge Rail project and eligibility request. HNTB has no further financial interest in the use of this barrier system.

**TTI:** Texas A&M Transportation Institute (TTI) was contracted by HNTB to perform full-scale crash testing of the Bronx Whitestone Median Barrier Extension Bridge Rail. There are no shared financial interests in the Bronx Whitestone Median Barrier Extension Bridge Rail design by TTI, or between HNTB and TTI, other than costs involved in the actual crash tests and reports for this submission to FHWA.
PRODUCT DESCRIPTION

New Hardware or Modification to
- Significant Modification  - Existing Hardware

The installation was 210 ft long, and was comprised of 14 barrier segments that were each 14 ft-9¾ inches long. Each segment was comprised of a lower steel median barrier and an upper barrier extension. Adjacent segments were connected through bolted splice connections.

The lower steel median barrier was comprised of posts fabricated from steel plates that were spaced 4 ft 11¼ inches apart. Steel tubes were attached to each side of these posts and an outer steel shell covered the tubes to provide a smooth barrier face on each side of the lower median barrier.

The upper barrier extension was comprised of vertical posts that were attached on top of the lower steel median barrier posts. Acrylic panels were installed between adjacent posts of the upper barrier extension. A rail comprised of a pair of HSS tubes was attached to each side of the upper barrier extension posts near the bottom of the upper barrier extension.

A 14 ft-7¾ inches gap in the upper barrier extension, with posts on each side, was built into the system near one end of the installation. No upper barrier extension posts or acrylic panels were present in this gap. Instead, a top rail comprised of two steel tubes spanned the gap and connected the adjacent upper barrier extension posts. Additionally, the outer HSS tubes of the typical rail extend across the gap.

The top of the lower steel median barrier was 32½ inches above grade, the centerline of the bottom rail of the upper barrier extension was 41¾ inches above grade, and the top of the railing posts was 69 inches above grade.

CRASH TESTING

By signature below, the Engineer affiliated with the testing laboratory, agrees in support of this submission that all of the critical and relevant crash tests for this device listed above were conducted to meet the MASH test criteria. The Engineer has determined that no other crash tests are necessary to determine the device meets the MASH criteria.

Engineer Name: Nauman M. Sheikh, P.E.
Engineer Signature: Nauman Sheikh
Address: TTI, TAMUS3135, College Station, TX77843-3135
Country: USA

Date: 2019.11.25 17:16:58-06'00'

A brief description of each crash test and its result: Help
<table>
<thead>
<tr>
<th>Required Test Number</th>
<th>Narrative Description</th>
<th>Evaluation Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-10 (1100C)</td>
<td>Test 4-10 involves an 1100°C vehicle impacting the test article at a target impact speed of 62 mi/h and target angle of 25°. The target CIP for the right corner of the front bumper was 3.6 ft upstream of the joint between segments 6 &amp; 7. The results of the test conducted on April 30, 2019, are found in TTI Test Report No. 611351-01. The 2008 Kia Rio test vehicle was traveling at an impact speed of 62.7 mi/h as it made contact with the Bronx Whitestone Median Barrier Extension Bridge Rail 3.7 ft upstream of the joint between segments 6 &amp; 7 and at an impact angle of 25.1°. After loss of contact with the barrier, the vehicle came to rest 235 ft downstream of the impact point and 64 ft toward the traffic lanes. The Bronx Whitestone Median Barrier Extension Bridge Rail contained and redirected the 1100°C vehicle. The vehicle did not penetrate, underride, or override the installation. No dynamic deflection or permanent deformation was observed. No detached elements, fragments, or other debris were present to penetrate or show potential for penetrating the occupant compartment, or to present hazard to others in the area. The 1100°C vehicle remained upright during and after the collision event. Maximum roll and pitch angles were 27° and 8°, respectively. Longitudinal OIV was 18.4 ft/s and lateral OIV was 33.8 ft/s. Maximum longitudinal occupant ridedown acceleration was 6.0 g, and maximum lateral occupant ridedown acceleration was 10.2 g. Occupant risk factors were within the maximum limits specified in MASH. Maximum exterior crush to the vehicle was 8.0 inches in the side plane at the right front corner at bumper height. Maximum occupant compartment deformation was 1.5 inches in the right front floor pan. The Bronx Whitestone Median Barrier Extension Bridge Rail performed acceptably for MASH test 4-10.</td>
<td>PASS</td>
</tr>
<tr>
<td>Required Test Number</td>
<td>Narrative Description</td>
<td>Evaluation Results</td>
</tr>
<tr>
<td>----------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-------------------</td>
</tr>
</tbody>
</table>
| 4-11 (2270P)         | Test 4-11 involves a 2270P vehicle impacting the test article at a target impact speed of 62 mi/h and target angle of 25°. The target CIP for the right corner of the front bumper was 4.3 ft upstream of the joint between segments 8 & 9.  

The results of the test conducted on May 2, 2019, are found in TTITestReport No. 611351-01. The 2014 RAM 1500 test vehicle was traveling at an impact speed of 62.9 mi/h as it made contact with the Bronx Whitestone Median Barrier Extension Bridge Rail 4.1 ft upstream of the joint between segments 8 & 9 and at an impact angle of 25.9°. After loss of contact with the barrier, the vehicle came to rest 215 ft downstream of the impact point and 2 ft toward the traffic lanes.  

The Bronx Whitestone Median Barrier Extension Bridge Rail contained and redirected the 2270P vehicle. The vehicle did not penetrate, underride, or override the installation. Maximum dynamic deflection was 0.7 inches, and no permanent deformation was observed. No detached elements, fragments, or other debris were present to penetrate or show potential for penetrating the occupant compartment, or to present hazard to others in the area. The 2270P vehicle remained upright during and after the collision event. Maximum roll and pitch angles were 19° and 5°, respectively.  

Longitudinal OIV was 20.3 ft/s and lateral OIV was 29.5 ft/s. Maximum longitudinal occupant ridedown acceleration was 5.3 g, and maximum lateral occupant ridedown acceleration was 9.7 g. Occupant risk factors were within the preferred limitsspecified in MASH. Maximum exterior crush to the vehicle was 11.0 inches in the side plane at the right front corner at bumper height. Maximum occupant compartment deformation was 4.5 inches in the right front firewall area.  

The Bronx Whitestone Median Barrier Extension Bridge Rail performed acceptably for MASH test 4-11. | PASS |
Test 4-12 involves a 10000S vehicle impacting the test article at a target impact speed of 56 mi/h and target angle of 15°. Two Test 4-12’s were performed on the barrier. Test No. 611351-1 was performed in the main length-of-need of the barrier. Test 611351-2 was performed to evaluate the open section of the upper barrier extension.

The Bronx Whitestone Median Barrier Extension Bridge Rail performed acceptably for both MASH test 4-12’s, summarized below:

---

TEST 611351-1:
The target CIP for the right corner of the front bumper was 5.0 ft upstream of the joint between segments 2 & 3.

The results of the test conducted on May 6, 2019, are found in TTITestReport No. 611351-01. The 2012 International 4300 SUT test vehicle was traveling at an impact speed of 57.2 mi/h as it made contact with the Bronx Whitestone Median Barrier Extension Bridge Rail 5.8 ft upstream of the joint between segments 2 & 3, and at an impact angle of 14.9°. After loss of contact with the barrier, the vehicle came to rest 352 ft downstream of the impact point and 30 ft toward the field side.

The Bronx Whitestone Median Barrier Extension Bridge Rail contained and redirected the 10000S vehicle. The vehicle did not penetrate, underride, or override the installation. Any dynamic deflection was obscured in the camera views, but no permanent deformation was observed. No detached elements, fragments, or other debris were present to penetrate or show potential for penetrating the occupant compartment, or to present hazard to others in the area. The 10000S vehicle remained upright during and after the collision event. Maximum roll and pitch angles were 25° and 4°, respectively.

Longitudinal OIV was 7.5 ft/s, and lateral OIV was 16.1 ft/s. Maximum longitudinal occupant ridedown acceleration was 2.0 g, and maximum lateral occupant ridedown acceleration was 4.5 g.

Maximum exterior crush to the vehicle was 10.0 inches at the right front corner at bumper height. Maximum occupant compartment deformation was 3.0 inches in the right floor pan area.

See Additional Test 4-12 info next page...
ADDITIONAL TEST 611351-2:
The target CIP for the left corner of the front bumper was 16.5 ft upstream of the upstream edge of top of post #4.

The results of the test conducted on May 8, 2019, are found in TTITestReport No. 611351-01. The 2013 International 4300 SUT test vehicle was traveling at an impact speed of 57.1 mi/h as it made contact with the Bronx Whitestone Median Barrier Extension Bridge Rail 16.5 ft upstream of the upstream edge of top of post #4, and at an impact angle of 15.2°. After loss of contact with the barrier, the vehicle came to rest 315 ft downstream of the impact point and 18 ft toward the field side.

The Bronx Whitestone Median Barrier Extension Bridge Rail contained and redirected the 10000S vehicle. The vehicle did not penetrate, underride, or override the installation. Maximum dynamic deflection was 1.5 inches, and no permanent deformation was observed. No detached elements, fragments, or other debris were present to penetrate or show potential for penetrating the occupant compartment, or to present hazard to others in the area. The 10000S vehicle remained upright during and after the collision event. Maximum roll and pitch angles were 23° and 7°, respectively.

Longitudinal OIV was 6.2 ft/s, and lateral OIV was 14.1 ft/s.
Maximum longitudinal occupant ridedown acceleration was 3.5 g, and maximum lateral occupant ridedown acceleration was 16.7 g.

Maximum exterior crush to the vehicle was 14.0 inches at the left front corner at bumper height. Maximum occupant compartment deformation was 5.0 inches in the left firewall area.

<table>
<thead>
<tr>
<th>Test</th>
<th>Description</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-20 &amp; 4-21</td>
<td>Device is not a transition</td>
<td>Non-Relevant Test, not conducted</td>
</tr>
<tr>
<td>4-22 (10000S)</td>
<td>Device is not a transition</td>
<td>Non-Relevant Test, not conducted</td>
</tr>
</tbody>
</table>

Full Scale Crash Testing was done in compliance with MASH by the following accredited crash test laboratory (cite the laboratory’s accreditation status as noted in the crash test reports):
Laboratory Name: Texas A&M Transportation Institute

Laboratory Signature: Digitally signed by Darrell L. Kuhn
'Date: 2019.11.25 13:51:30-06'00

Address: TTI, TAMUS MS3135, College Station, TX 77843-3135
Country: USA

Accreditation Certificate Number and Dates of current Accreditation period:
ISO 17025-2017 Laboratory A2LA Certificate Number: 2821.01
Valid To: April 30, 2021

Submitter Signature*: Gavin Daly
'Date: 2019.11.26 17:49:10-05'00

ATTACHMENTS

Attach to this form:
1) Additional disclosures of related financial interest as indicated above.
2) A copy of the full test report, video, and a Test Data Summary Sheet for each test conducted in support of this request.
3) A drawing or drawings of the device(s) that conform to the Task Force-13 Drawing Specifications [Hardware Guide Drawing Standards]. For proprietary products, a single isometric line drawing is usually acceptable to illustrate the product, with detailed specifications, intended use, and contact information provided on the reverse. Additional drawings (not in TF-13 format) showing details that are relevant to understanding the dimensions and performance of the device should also be submitted to facilitate our review.

FHWA Official Business Only:

<table>
<thead>
<tr>
<th>Eligibility Letter</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>Date</td>
<td>Key Words</td>
</tr>
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<td></td>
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</tbody>
</table>
**General Information**

- **Test Agency**: Texas A&M Transportation Institute (TTI)
- **Test Standard Test No.**: MASH Test 4-10
- **TTI Test No.**: 611351-3
- **Test Date**: 2019-04-30

**Test Article**
- **Type**: Bronx Whitestone Bridge Rail
- **Name**: Longitudinal Barrier – Bridge Rail
- **Installation Length**: 210 ft
- **Material or Key Elements**: Steel plate posts, steel parapet covering steel beams secured to posts, fabricated steel rail above the parapet, acrylic windscreen above parapet and rail supported by posts
- **Soil Type and Condition**: Reinforced concrete foundation, damp

**Test Vehicle**
- **Type/Designation**: 1100C
- **Make and Model**: 2008 Kia Rio
- **Curb**: 2430 lb
- **Test Inertial**: 2455 lb
- **Dummy**: 165 lb
- **Gross Static**: 2620 lb

**Impact Conditions**
- **Speed**: 62.7 m/h
- **Angle**: 25.1°
- **Location/Orientation**: 3.7 ft upstream of joint 6-7
- **Impact Severity**: 58 kip-ft
- **Exit Conditions**: 53.9 m/h
- **Trajectory/Heading Angle**: 3.9° / 8.1°

**Occupant Risk Values**
- **Longitudinal OIV**: 18.4 ft/s
- **Lateral OIV**: 33.8 ft/s
- **Longitudinal Ridedown**: 6.0 g
- **Lateral Ridedown**: 10.2 g
- **THIV**: 41.7 km/h
- **PHD**: 10.4 g
- **ASI**: 2.61
- **Max. 0.050-s Average**:
  - Longitudinal: -10.3 g
  - Lateral: -20.2 g
  - Vertical: -4.2 g

**Post-Impact Trajectory**
- **Stopping Distance**: 235 ft downstream
- **64 ft twd traffic lanes

**Vehicle Stability**
- **Maximum Yaw Angle**: 97°
- **Maximum Pitch Angle**: 8°
- **Maximum Roll Angle**: 27°
- **Vehicle Snagging**: No
- **Vehicle Pocketing**: No

**Test Article Deflections**
- **Dynamic**: None
- **Permanent**: None
- **Working Width**: 30.0 inches
- **Height of Working Width**: 6.0 inches

**Vehicle Damage**
- **VDS**: 01RFQ5
- **CDC**: 01FREW4
- **Max. Exterior Deformation**: 8.0 inches
- **OCDI**: RF0102100
- **Max. Occupant Compartment Deformation**: 1.5 inches

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Figure 5.6. Summary of Results for *MASH* Test 4-10 on Bronx Whitestone Bridge Rail.
Figure 6.6. Summary of Results for MASH Test 4-11 on Bronx Whitestone Bridge Rail.
Figure 7.6. Summary of Results for MASH Test 4-12 on Bronx Whitestone Bridge Rail.
### General Information

<table>
<thead>
<tr>
<th>Test Agency</th>
<th>Texas A&amp;M Transportation Institute (TTI)</th>
</tr>
</thead>
<tbody>
<tr>
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<td>MASH Test 4-12</td>
</tr>
<tr>
<td>TTI Test No.</td>
<td>611351-2</td>
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<tr>
<td>Test Date</td>
<td>2019-05-08</td>
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### Test Article

<table>
<thead>
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<th>Type</th>
<th>Longitudinal Barrier – Bridge Rail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Bronx Whitestone Bridge Rail</td>
</tr>
<tr>
<td>Installation Length</td>
<td>210 ft</td>
</tr>
<tr>
<td>Material or Key Elements</td>
<td>Steel plate posts, steel parapet covering steel beams secured to posts, fabricated steel rail above the parapet, acrylic windscreen above parapet and rail supported by posts</td>
</tr>
</tbody>
</table>

| Soil Type and Condition       | Reinforced concrete foundation, damp     |

### Test Vehicle

| Type/Designation              | 10000S                                   |
| Make and Model                | 2013 International 4300 Single-Unit Truck |
| Curb                          | 14,190 lb                                |
| Test Inertial                 | 22,270 lb                                |
| Dummy                         | No dummy                                 |
| Gross Static                  | 22,270 lb                                |

### Impact Conditions

| Speed                          | 57.1 mi/h                               |
| Angle                         | 15.2°                                    |
| Location/Orientation          | 16.5 ft upstream of upstream edge of post 4 |

### Impact Severity

167 kip-ft

### Exit Conditions

- Speed: 53.0 mi/h
- Trajectory/Heading Angle: 2.1° / 0°

### Occupant Risk Values

- Longitudinal OIV: 6.2 ft/s
- Lateral OIV: 14.1 ft/s
- Longitudinal Ridedown: 3.5 g
- Lateral Ridedown: 16.7 g
- THIV: 17.0 km/h
- PHD: 16.7 g
- ASI: 0.67

### Post-Impact Trajectory

- Stopping Distance: 315 ft downstream
- 18 ft twd field side

### Vehicle Stability

- Maximum Yaw Angle: 17°
- Maximum Pitch Angle: 7°
- Maximum Roll Angle: 23°

- Vehicle Snagging: No
- Vehicle Pocketing: No

### Test Article Deflections

- Dynamic: 1.5 inches
- Permanent: 0 inches
- Working Width: 43.8 inches
- Height of Working Width: 135.8 inches

### Vehicle Damage

- VDS: NA
- CDC: 11FREW3
- Max. Exterior Deformation: 14.0 inches
- OCDI: NA
- Max. Occupant Compartment Deformation: 5.0 inches

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Figure 8.6. Summary of Results for MASH Test 4-12 on Bronx Whitestone Bridge Rail.
TRIBOROUGH BRIDGE AND TUNNEL AUTHORITY

CONTRACT NO. PSC-16-2991

MEDIAN BARRIER EXTENSION CRASH TEST AND FABRICATION
FOR THE BRONX WHITESTONE BRIDGE
AS-BUILT DRAWINGS

PREPARED BY:

HNTB CORPORATION
EMPIRE STATE BUILDING
350 5TH AVE, 57TH FL.
NEW YORK, NY 10118

DATE: 06/05/2019
**INDEX OF DRAWINGS**

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**ABBREVIATIONS**

- A.A.S.H.T.O.: AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
- N.T.S.: NOT TO SCALE
- M.B.E.: MEDIAN BARRIER EXTENSION
- S.P.L.: SPLICE
- L.E.V.: ELEVATION
- S.T.D.: ST AND ARD
- S.Y.M.: SYMMETRICAL
- T.Y.P.: TYPICAL
- V.E.R.: VERTICAL
- V.E.R.: VERTICAL
- Q.T.Y.: QUANTITY
- O.C.: ON CENTER
- O.P.P.: OPPOSITE
- O.T.O.: OUT TO OUT
- P.P.G.W.: PARTIAL PENETRATION GROOVE WELD
- C.Y.N.: CHARPY V-NOTCH TEST
- G.F.M.: GENERAL DRAWING SHEET
- C.O.: CONTRACT DOCUMENT
- P.E.: PROFESSIONAL ENGINEER
- R.D./R.A.D.: RADIUS
- P.L.: PLATE
- N.Y.S.S.C.M.: NEW YORK STATE STEEL CONSTRUCTION MANUAL
- C.T.S.K.: COUNTERSUNK
- C.O.N.N.: CONNECTION
- C.O.N.N.: CONNECTION
- G.U.M.: GALVANIZED
- C.T.R.: CLEAR
- P.E.: PROFESSIONAL ENGINEER
- T.Y.P.: TYPICAL
- F.S.: FAR SIDE
- D.M.T.: DIA./DIAMETER
- E.L.V.: ELEVATION
- F.L.G.: FLANGE
- E.Q.: EQUAL
- E.L.V.: ELEVATION
- D.E.T.: DETAIL
- E.L.V.: ELEVATION
- N.T.: NON-TYPICAL
- N.A.: NOT APPLICABLE
- M.M.: MINIMUM
- M.A.X.: MAXIMUM
- L.O.N.G.: LONGITUDINAL
- L.O.N.G.: LONGITUDINAL
- V.S.T.: VERTICAL
- V.S.T.: VERTICAL
- E.A.R.: EFFECTIVE AREA
- S.T.L.: STEEL IN SECTION
- S.T.L.: STEEL IN SECTION
- N.T.S.: NOT TO SCALE
- U.T.: UT - ULTRASONIC TESTING
- U.O.N.: UNLESS OTHERWISE NOTED
- S.T.L.: STEEL IN SECTION
- S.T.L.: STEEL IN SECTION
- N.T.S.: NOT TO SCALE
- C.R.S.: CRASH TEST FABRICATION DRAWINGS

**SECTION AND DETAIL LEGEND**

- DRAWING WHERE SECTION OR PLAN IS SHOWN
- SECTION OR PLAN MARK
- DETAIL MARK
- DRAWING WHERE SECTION OR PLAN IS SHOWN
- DRAWING WHERE SECTION OR PLAN IS SHOWN
- DETAIL MARK
- DETAIL MARK
- DETAIL MARK
- DETAIL MARK
- DETAIL MARK

**LEGEND:**

- STEEL IN SECTION
- CONCRETE IN SECTION
- EPDM RUBBER GASKET IN SECTION
GENERAL NOTES:

1. DESIGN, DETAILING, FABRICATION, AND EXECUTION OF ALL CONSTRUCTION SHALL CONFORM TO THE REQUIREMENTS OF THE CURRENT EDITION OF THE FOLLOWING SPECIFICATIONS:
   A. AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS
   B. NEW YORK STATE DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS
   C. AASHTO LRFD BRIDGE CONSTRUCTION SPECIFICATIONS
   D. NEW YORK STATE STEEL CONSTRUCTION MANUAL
   E. NEW YORK STATE DOT STEELbrate SPECIFICATIONS
   F. NEW YORK STATE DOT MIDTOWN MANHATTAN SPECIFICATIONS
   G. NEW YORK STATE DOT MIDTOWN MANHATTAN SPECIFICATIONS
   H. NEW YORK STATE DOT MIDTOWN MANHATTAN SPECIFICATIONS
   I. NEW YORK STATE DOT MIDTOWN MANHATTAN SPECIFICATIONS
   J. NEW YORK STATE DOT MIDTOWN MANHATTAN SPECIFICATIONS
   K. NEW YORK STATE DOT MIDTOWN MANHATTAN SPECIFICATIONS

2. ALL STRUCTURAL STEEL SHALL CONFORM TO THE FOLLOWING:
   A. ASTM A500, GRADE B
   B. ASTM A500, GRADE C
   C. ASTM A500, GRADE D
   D. ASTM A325, TYPE 1
   E. ASTM A325, TYPE 2
   F. ASTM A449, TYPE 1
   G. ASTM A449, TYPE 2
   H. ASTM A449, TYPE 3
   I. ASTM A449, TYPE 4
   J. ASTM A449, TYPE 5
   K. ASTM A449, TYPE 6
   L. ASTM A449, TYPE 7
   M. ASTM A449, TYPE 8
   N. ASTM A449, TYPE 9
   O. ASTM A449, TYPE 10
   P. ASTM A449, TYPE 11
   Q. ASTM A449, TYPE 12
   R. ASTM A449, TYPE 13
   S. ASTM A449, TYPE 14
   T. ASTM A449, TYPE 15
   U. ASTM A449, TYPE 16
   V. ASTM A449, TYPE 17
   W. ASTM A449, TYPE 18
   X. ASTM A449, TYPE 19
   Y. ASTM A449, TYPE 20
   Z. ASTM A449, TYPE 21

3. ALL STRUCTURAL STEEL SHALL BE HOT-DIP GALVANIZED IN ACCORDANCE WITH SECTION 719 OF THE NYS ST AND ARD SPECIFICATIONS, UNLESS OTHERWISE NOTED.

4. ALL FASTENERS, NUTS AND WASHERS SHALL BE HOT-DIP GALVANIZED IN ACCORDANCE WITH ASTM A563.

5. REPAIRS TO DAMAGED GALVANIZING SHALL BE MADE IN ACCORDANCE WITH ASTM A780.

6. ALL HIGH STRENGTH BOLTED CONNECTIONS SHALL BE INSTALLED IN ST AND ARD SIZE.

7. HD BLIND BOLTS WHERE INDICATED TO BE COATED WITH DACRALON ZINC FINISH.

8. WASHERS, NUTS, AND BOLTS MAY BE USED IN ACCORDANCE WITH THE CONTRACT DRAWINGS. THREADS SHALL BE EXCLUDED FROM THE SHEAR PLANE.

9. ALL STRUCTURAL STEEL FOR THE MEDIAN BARRIER EXTENSION SHALL CONFORM TO THE FOLLOWING:
   A. ASTM A36
   B. ASTM A572, GRADE 50
   C. ASTM A572, GRADE 60
   D. ASTM A572, GRADE 70
   E. ASTM A572, GRADE 80
   F. ASTM A572, GRADE 90
   G. ASTM A572, GRADE 100
   H. ASTM A572, GRADE 110
   I. ASTM A572, GRADE 120
   J. ASTM A572, GRADE 130
   K. ASTM A572, GRADE 140
   L. ASTM A572, GRADE 150
   M. ASTM A572, GRADE 160
   N. ASTM A572, GRADE 170
   O. ASTM A572, GRADE 180
   P. ASTM A572, GRADE 190
   Q. ASTM A572, GRADE 200
   R. ASTM A572, GRADE 210
   S. ASTM A572, GRADE 220
   T. ASTM A572, GRADE 230
   U. ASTM A572, GRADE 240
   V. ASTM A572, GRADE 250
   W. ASTM A572, GRADE 260
   X. ASTM A572, GRADE 270
   Y. ASTM A572, GRADE 280
   Z. ASTM A572, GRADE 290

10. INSTALL MEDIAN EXTENSION PANELS, TIGHTEN BLIND BOLTS ON CONNECTION ANGLES.

SUGGESTED INSTALLATION SEQUENCE:

REQUIREMENTS IN THE CONTRACT:
1. FABRICATE MEDIAN BARRIER FOR THE EXTENTS SHOWN ON THE CONTRACT DRAWINGS.
2. FABRICATE MEDIAN BARRIER EXTENSION FOR THE EXTENTS SHOWN ON THE CONTRACT DRAWINGS.
3. SHOP ASSEMBLE MEDIAN BARRIER AND MEDIAN BARRIER EXTENSION AND VERIFY GEOMETRY AND FIELD SPLICES.
4. SHIP ASSEMBLED MEDIAN BARRIER AND MEDIAN BARRIER EXTENSION TO THE CRASH TESTING FACILITY.

REQUIREMENTS BY OTHERS:
5. INSTALL CONCRETE SLAB.
6. PLACE MEDIAN BARRIER POSTS AT SPACING INDICATED IN SHEET.
7. POST-INSTALL TEMPORARY ANCHOR BOLTS INTO THE CONCRETE SLAB.
8. INSTALL MEDIAN BARRIER SHELL / TUBE ASSEMBLY ON EACH SIDE OF THE POSTS.
9. INSTALL BOTH SIDES OF THE MEDIAN BARRIER EXTENSION WITH CONNECTION ANGLES LOOSE ON TOP OF THE MEDIAN BARRIER POST.
10. INSTALL MEDIAN EXTENSION PANELS TIGHTEN BLIND BOLTS ON CONNECTION ANGLES.

SPARE PARTS FOR CRASH TESTING:

THE FOLLOWING SPARE PARTS FOR REPLACEMENT DURING CRASH TESTING SHALL BE FABRICATED AND SHIPPED ALONG WITH THE TEST BARRIER LENGTH:
1. SIX (6) MEDIAN BARRIER EXTENSION PANELS (LENGTH 4'-9"") WITH BOLTS.
2. TWO (2) TYPICAL MEDIAN BARRIER UNITS (LENGTH 14'-9"") WITH FASTENERS.
3. TWO (2) TYPICAL MEDIAN BARRIER EXTENSION STEEL PANELS (LENGTH 14'-9"").
4. ANY ASSOCIATED CONNECTION HARDWARE.

MISCELLANEOUS DESIGN SERVICES ON AN AS-NEEDED BASIS - TASK ORDER 21 CRASH TEST FABRICATION DRAWINGS

1. DRAWN BY P. GAUNT
2. DESIGNED BY J. GAUNT
NOTES:
1. FOR TYPICAL MEDIAN BARRIER ELEVATION, SEE DWG. NO. S-001.
2. FOR TYPICAL MEDIAN BARRIER EXTENSION ELEVATION, SEE DWG. S-002.
3. WORK DETAIL A WITH DETAILS SHOWN ON DWG. NOS. S-002 TO S-005.
5. FOR MOCK DECK PLATE DETAILS, SEE DWG. NO. S-003A.
NOTES:

1. FOR MEDIAN BARRIER WORK POINT WORK LINE LOCATION DETAIL, SEE DWG. NO. G-004.

2. FOR SHELL PLATE DETAIL, SEE DWG. NO. S-005.

3. OMIT HAND HOLES AT MEDIAN BARRIER END SEGMENTS WHERE NO FIELD SPLICES ARE PRESENT.

4. MEDIAN BARRIER EXTENSION NOT SHOWN FOR CLARITY, SEE DWG. NO. S-006 FOR DETAILS.

5. MOCK DECK PLATE AND CONCRETE SLAB NOT SHOWN FOR CLARITY, SEE DWG. NOS. S-003 AND S-003A FOR DETAILS.
FOLLOWED BY HIS/HER SIGNATURE AND DATE OF ALTERATION.

APPLICABLE. THE ALTERING ENGINEER/ARCHITECT SHALL AFFIX HIS/HER SEAL AND THE NOTATION 'ALTERED BY':
NOTES:
1. FOR MEDIAN RAILING SPICE DETAIL REFER TO DWG. NO. S-012.
2. PRIOR TO GALVANIZING, GRIND ALL EDGES TO A MINIMUM RADIUS OF 1/16".
3. EXTERNAL VENT HOLES SHALL BE DRILLED IN THE RAIL TUBES AS REQUIRED TO FACILITATE GALVANIZING AND DRAINAGE.
APPLICABLE. THE ALTERING ENGINEER/ARCHITECT SHALL AFFIX HIS/HER SEAL AND THE NOTATION 'ALTERED BY' ANY WAY, UNLESS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER/ARCHITECT AS IT IS A VIOLATION OF THE PROFESSIONAL LICENSE LAW FOR ANY PERSON TO ALTER THIS DRAWING IN REV. DESCRIPTION AS-BUILT UPDATES FOR MEDIAN BARRIER POST SEALS WELD (TYP.)

SCALE:

NOTES:

1. FOR ADDITIONAL NOTES AND DETAILS SEE DWG. NOS. S-006 AND S-008.

2. UNLESS OTHERWISE NOTED, HIGH STRENGTH BOLTS SHALL CONFORM TO AASHTO M64, ASTM A325, TYPE 1. THREADS OF HIGH STRENGTH BOLTS SHALL BE EXCLUDED FROM SHEAR PLANES.

3. A 70 DUROMETER EPDM GASKET OR APPROVED EQUAL SHALL BE PROVIDED BETWEEN ACRYLITE PANEL FACE AND STEEL POST CONTACT POINTS.

4. HD BLIND BOLTS TO BE STAGGERED EITHER SIDE OF EACH POST TO AVOID CONFLICT. CONNECTION IS SLIP CRITICAL AFTER GALVANIZING HAND WIRE BRUSH SURFACE OF L3x2x1/4" U-GASKET (TYP.)

5. FILL PLATE THICKNESS TO PROVIDE CONSISTENT HEIGHT OF MEDIAN BARRIER EXTENSION FRAMING AND CLEARANCE ABOVE BOLTS OF MEDIAN BARRIER POST.

6. NO BLIND BOLTS TO BE STAGGERED OTHER SIDE OF EACH POST TO AVOID CONFLICT CONNECTION IS SLIP CRITICAL AFTER GALVANIZING HAND WIRE BRUSH SURFACE OF L3x2x1/4" U-GASKET FOR CLASS C FAYING SURFACE.

7. FILL PLATE THICKNESS TO PROVIDE CONSISTENT HEIGHT OF MEDIAN BARRIER EXTENSION FRAMING AND CLEARANCE ABOVE BOLTS OF MEDIAN BARRIER POST.

8. All POST CAP PLATE CORNERS SHALL MOVE RADIUS TO MATCH RS POSTS.

9. MEDIAN BARRIER POST TRANSVERSE SPACING WITH GASKET THICKNESS.
NOTES:

1. FOR ADDITIONAL NOTES SEE DWG. NO. S-007.
2. CONNECTION PLATE BOLT HOLES ARE OVERSIZED. BASE PLATE AND FILL PLATE HOLES ARE STANDARD SIZE.
3. EACH MBE POST TUBE HAS A SEPARATE 5" WIDE BASE PLATE TO ALLOW FOR EASE OF INSTALLATION.
4. COORDINATE CONNECTION PLATE LENGTH AND BOLT HOLE POSITIONS WITH TOP OF MEDIAN BARRIER POST, SEE DWG. NO. S-003.
5. FAYING SURFACES FOR BOLTED CONNECTIONS WITH OVERSIZED HOLES TO BE HAND WIRE BRUSHED FOR CLASS C FINISH.
Triborough Bridge and Tunnel Authority

MISCELLANEOUS DESIGN SERVICES ON AN AS-NEEDED BASIS – TASK ORDER 21
CRASH TEST FABRICATION DRAWINGS

S-009
Triborough Bridge / Tunnel Authority

HNTB

SCALE: 1" = 3'-0"
NOTES:
1. FOR ADDITIONAL NOTES, SEE DWG NOS. 5-006 AND 5-009.
2. A 0.70 DIAMETER EPDM GASKET OR APPROVED EQUAL SHALL BE PROVIDED AT ALL INTERFACES BETWEEN ACYRILITE PANEL AND STEEL POST CONTACT POINTS.
3. SEE DETAILS ON 5-001.
4. COORDINATE PANEL GASKET THICKNESS WITH POST TRANSVERSE SPACING AND STIFFENER PLATE WIDTH.
5. COORDINATE VERTICAL STIFFENER PLATE BOLTS WITH PANEL CONNECTION ANGLE BOLTS ON REAR SIDE OF POST.
NOTES:

1. FABRICATOR TO ADD SPLICES WHERE DEEMED NECESSARY FOR FIT-UP.
2. TWO WASHERS AND A HEAVY HEX NUT ON EACH BOLT, NUT TO BE FINGER TIGHT AND THE FIRST THREAD BELOW THE NUT TO BE DAMAGED A.O.B.E.
3. HIGH STRENGTH BOLTS SHALL CONFORM TO AASHTO M164, ASTM A325, TYPE 1. THREADS OF HIGH STRENGTH BOLTS SHALL BE EXCLUDED FROM SHEAR PLANES.
4. FOR ADDITIONAL NOTES, SEE DWG. NO. S-006.
5. A .78 DUROMETER EPDM GASKET OR APPROVED EQUAL SHALL BE PROVIDED BETWEEN ACRYLITE PANEL FACE AND STEEL POST CONTACT POINTS.
6. PROTRUSIONS CAUSED BY WELDING OR GALVANIZING ARE NOT PERMITTED ON THE ADJOINING SURFACES OF THE RAILINGS, SPLICE TUBES, AND FILL PLATES.

FOLLOWED BY HIS/HER SIGNATURE AND DATE OF ALTERATION.

APPLICABLE. THE ALTERING ENGINEER/ARCHITECT SHALL AFFIX HIS/HER SEAL AND THE NOTATION 'ALTERED BY' ANY WAY, UNLESS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER/ARCHITECT AS IT IS A VIOLATION OF THE PROFESSIONAL LICENSE LAW FOR ANY PERSON TO ALTER THIS DRAWING IN ANY WAY.