



U.S. Department
of Transportation

**Federal Highway
Administration**

February 15, 2019

1200 New Jersey Ave., SE
Washington, D.C. 20590

In Reply Refer To:
HSST-1/B-317

Mr. Rajesh Taneja
New York State Thruway Authority
P. O. Box 189
Albany, NY, 12201-0189

Dear Mr. Taneja:

This letter is in response to your October 31, 2018 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-317 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:

- Three-Rail Steel Bridge Rail with Curb

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: Three-Rail Steel Bridge Rail with Curb
Type of system: Longitudinal Barrier
Test Level: MASH Test Level 5 (TL5)
Testing conducted by: TamTI
Date of request: January 30, 2019

FHWA concurs with the recommendation of the accredited crash testing laboratory as stated within the attached form.

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-317 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.
- If the subject device is a patented product it may be considered to be proprietary. If proprietary systems are specified by a highway agency for use on Federal-aid projects: (a) they must be supplied through competitive bidding with equally suitable unpatented items; (b) the highway agency must certify that they are essential for synchronization with the existing highway facilities or that no equally suitable alternative exists; or (c) they must be used for research or for a distinctive type of construction on relatively short sections of road for experimental purposes. Our regulations concerning proprietary products are contained in Title 23, Code of Federal Regulations, Section 635.411.

Sincerely,



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

Enclosures

Request for Federal Aid Reimbursement Eligibility of Highway Safety Hardware

Submitter	Date of Request:	10-31-2018	<input checked="" type="radio"/> New <input type="radio"/> Resubmission
	Name:	Christopher Gaunt, P.E.	
	Company:	HNTB Corporation	
	Address:	Empire State Building, 350 Fifth Avenue, 57th Floor, New York, NY, 10118	
	Country:	United States of America	
	To:	Michael S. Griffith, Director FHWA, Office of Safety Technologies	

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

Device & Testing Criterion - Enter from right to left starting with Test Level

!-!-!

System Type	Submission Type	Device Name / Variant	Testing Criterion	Test Level
'B': Rigid/Semi-Rigid Barriers (Roadside, Median, Bridge Railings)	<input checked="" type="radio"/> Physical Crash Testing <input type="radio"/> Engineering Analysis	Three-Rail Steel Bridge Rail with Curb	AASHTO MASH	TL5

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:	Rajesh Taneja	Same as Submitter <input type="checkbox"/>
Company Name:	New York State Thruway Authority	Same as Submitter <input type="checkbox"/>
Address:	P. O. Box 189, Albany, NY, 12201-0189	Same as Submitter <input type="checkbox"/>
Country:	United States of America	Same as Submitter <input type="checkbox"/>

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 New York State Thruway Authority (NYSTA) for the Governor Mario M. Cuomo (formerly Tappan Zee) Bridge Rail design 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 NYSTA Governor Mario M. Cuomo (formerly Tappan Zee) Bridge Rail design. There are no shared financial interests in the NYSTA Governor Mario M. Cuomo (formerly Tappan Zee) 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

<input checked="" type="radio"/> New Hardware or Significant Modification	<input type="radio"/> Modification to Existing Hardware	
<p>The bridge rail design tested was a three-rail steel bridge rail with a reinforced concrete curb that was constructed on a reinforced concrete grade beam and deck. The curb had a 7-inch tall face. Fabricated steel posts were mounted on the curb, spaced at 48 inches on center. There were three rows of 6-inch square HSS tubing rails bolted to the posts, with the top surface of the top rail at 38 inches above the curb, for a total rail height of 45 inches above grade. The top of the middle rail was 33 inches above grade, and the top of the bottom rail was 21 inches above grade.</p>		
<h3>CRASH TESTING</h3>		
<p>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.</p>		
Engineer Name:	Nauman M. Sheikh	
Engineer Signature:	<h2 style="margin: 0;">Nauman M. Sheikh</h2>	Digitally signed by Nauman M. Sheikh Date: 2018.10.12 17:32:31 -05'00'
Address:	TTI, TAMUS MS 3135, College Station, TX 77843-3135	Same as Submitter <input type="checkbox"/>
Country:	USA	Same as Submitter <input type="checkbox"/>

A brief description of each crash test and its result:

Required Test Number	Narrative Description	Evaluation Results
5-10 (1100C)	<p>A 2011 Kia Rio traveling at an impact speed of 61.1 mi/h contacted the bridge rail 3.6 ft upstream of the joint between posts 30 and 31 at an impact angle of 25.2°. The bridge rail contained and redirected the 1100C vehicle. The vehicle did not penetrate, underide, or override the installation. There was 0.7 inch of dynamic deflection of the bridge rail during the test. 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. Maximum occupant compartment deformation was 2.0 inches on the left side at the wheel/foot well area. The 1100C vehicle remained upright during and after the collision event. A gyroscope/accelerometer connection was severed during the test, However, based on video analysis, the vehicle did not exceed 75 degrees of roll or pitch. Longitudinal OIV was 18.7 ft/s, and lateral OIV was 30.5 ft/s. Longitudinal occupant ridedown acceleration was 2.7 g, and lateral occupant ridedown acceleration was 9.8 g.</p>	PASS

Required Test Number	Narrative Description	Evaluation Results
5-11 (2270P)	<p>A 2013 RAM 1500 traveling at an impact speed of 62.8 mi/h contacted the bridge rail 4.1 ft upstream of the joint between posts 20 and 21 at an impact angle of 25.7°. The bridge rail contained and redirected the 2270P vehicle. The vehicle did not penetrate, underride, or override the installation. There was 1.0 inch of dynamic deflection of the bridge rail during the test. 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. Maximum occupant compartment deformation was 3.0 inches on the left side at the floor pan to roof, and wheel/foot well and toe pan area. The 2270P vehicle remained upright during and after the collision event. Maximum roll and pitch angles were 13° and 5°, respectively. Longitudinal OIV was 20.3 ft/s, and lateral OIV was 28.5 ft/s. Longitudinal occupant ridedown acceleration was 7.8 g, and lateral occupant ridedown acceleration was 8.5 g.</p>	PASS
5-12 (36000V)	<p>A 2006 Freightliner with a 2002 Utility trailer was traveling at an impact speed of 50.9 mi/h when it contacted the bridge rail 1.4 ft downstream of the splice between posts 10 and 11 at an impact angle of 15.2°. The bridge rail contained and redirected the 36000V vehicle. The vehicle did not penetrate, underride, or override the installation. There was 1.5 inches of dynamic deflection of the bridge rail during the test. 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. Maximum occupant compartment deformation was 2.0 inches on the left side firewall/floor pan area. The 36000V vehicle remained upright during and after the collision.</p>	PASS
5-20 (1100C)	<p>Hardware is not a transition. This test is therefore not applicable and was not performed.</p>	Non-Relevant Test, not conducted
5-21 (2270P)	<p>Hardware is not a transition. This test is therefore not applicable and was not performed.</p>	Non-Relevant Test, not conducted
5-22 (36000V)	<p>Hardware is not a transition. This test is therefore not applicable and was not performed.</p>	Non-Relevant Test, not conducted

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:	Darrell L. Kuhn	Digitally signed by Darrell L. Kuhn Date: 2018.10.15 10:48:18 -05'00'
Address:	TTI, TAMUS MS 3135, College Station, TX 77843-3135	Same as Submitter <input type="checkbox"/>
Country:	USA	Same as Submitter <input type="checkbox"/>
Accreditation Certificate Number and Dates of current Accreditation period :	ISO 17025 Laboratory Certificate Number: 2821.01 Valid To: April 30, 2019	

Submitter Signature*: Christopher Gaunt, PE

Digitally signed by Christopher Gaunt, PE
Date: 2018.10.31 15:19:07 -04'00'

Submit Form

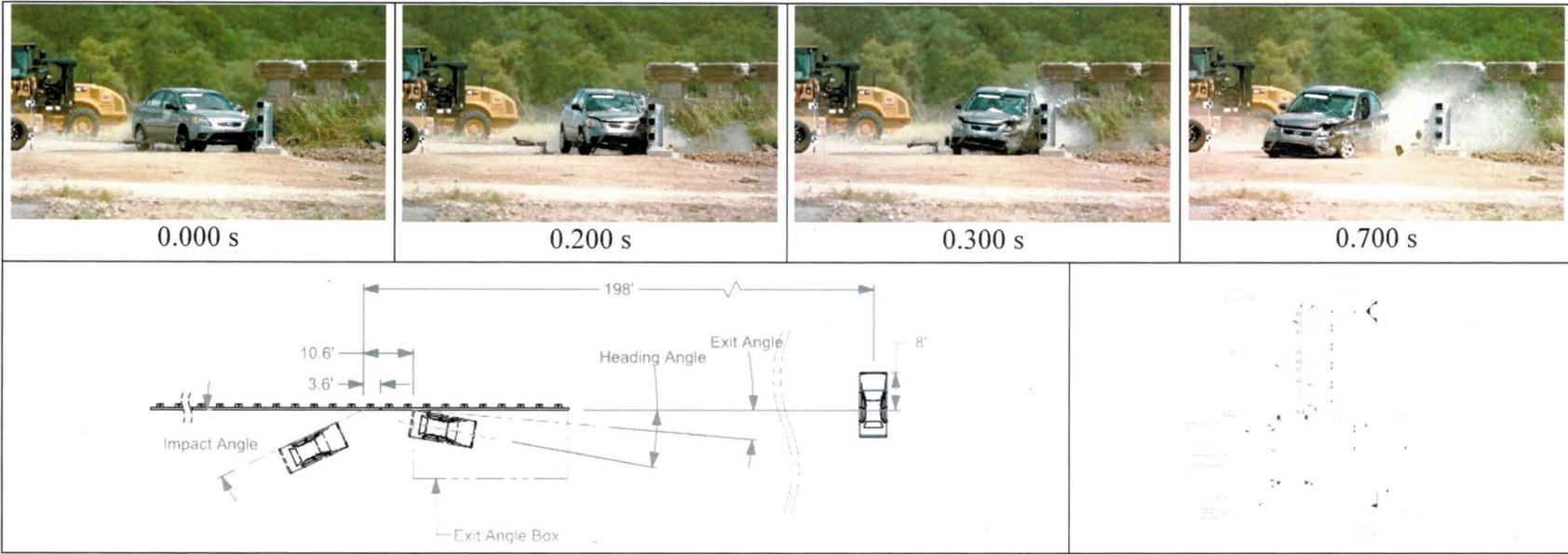
ATTACHMENTS

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:

Eligibility Letter		
Number	Date	Key Words



General Information

Test Agency..... Texas A&M Transportation Institute (TTI)
 Test Standard Test No..... MASH Test 5-10
 TTI Test No. 609891-02-1
 Test Date..... 2018-06-13

Test Article

Type Longitudinal Barrier – Bridge Rail
 Name..... TZH Crossing Bridge Rail
 Installation Length..... 151 ft
 Material or Key Elements ... 7-inch tall concrete curb, 3 rows of HSS 6x6x3/16 square tube rails for a total height of 45 inches above grade

Soil Type and Condition

..... Concrete bridge deck, damp

Test Vehicle

Type/Designation..... 1100C
 Make and Model 2011 Kia Rio
 Curb..... 2532 lb
 Test Inertial..... 2444 lb
 Dummy 165 lb
 Gross Static..... 2609 lb

Impact Conditions

Speed..... 61.1 mi/h
 Angle..... 25.2°
 Location/Orientation 3.6 ft upstream of joint between post 30&31

Impact Severity

..... 59.0 kip-ft

Exit Conditions

Speed..... 49.3 mi/h
 Exit Trajectory Angle 4.9°
 Exit Heading Angle..... 10.3°

Occupant Risk Values

Longitudinal OIV..... 18.7 ft/s
 Lateral OIV 30.5 ft/s
 Longitudinal Ridedown 2.7 g
 Lateral Ridedown..... 9.8 g
 THIV..... 39.0 km/h
 PHD 10.0 g
 ASI 2.51

Max. 0.050-s Average

Longitudinal..... -10.5 g
 Lateral 18.5 g
 Vertical..... 1.4 g

Post-Impact Trajectory

Stopping Distance 198 ft downstream
 8 ft twd field side

Vehicle Stability

Maximum Yaw Angle No Data
 Maximum Pitch Angle No Data
 Maximum Roll Angle No Data
 Vehicle Snagging..... No
 Vehicle Pocketing No

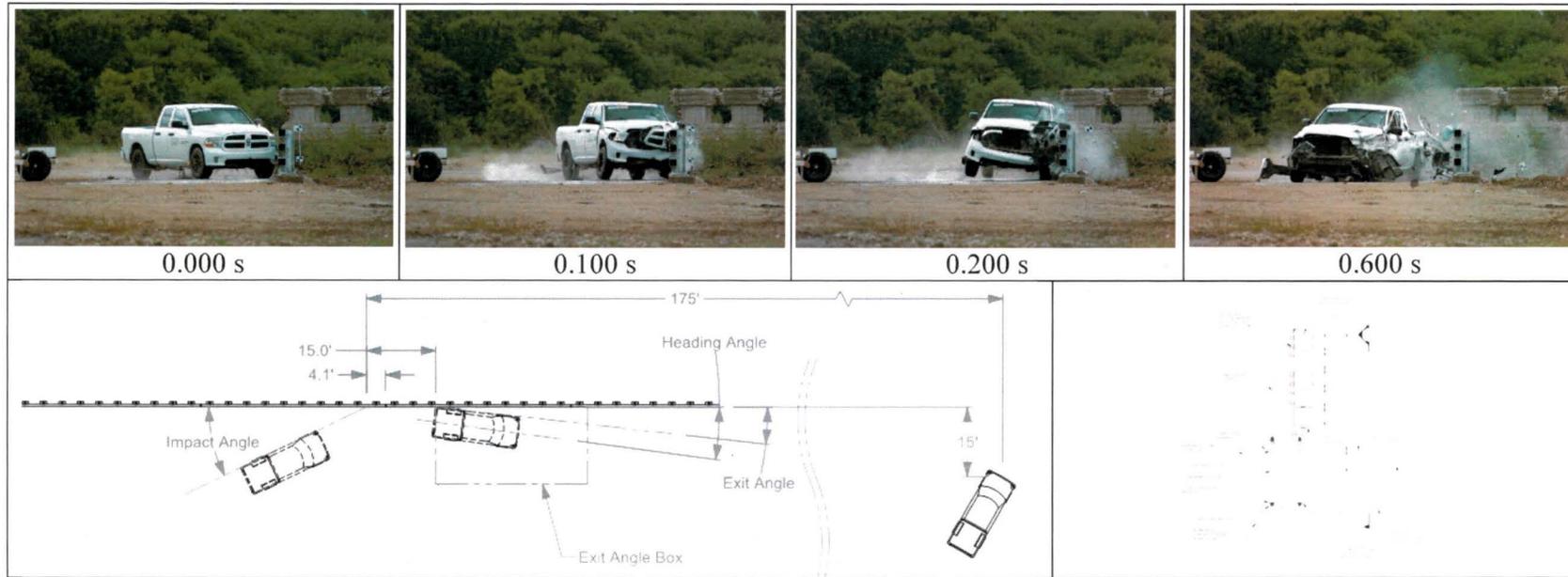
Test Article Deflections

Dynamic 0.7 inches
 Permanent..... None
 Working Width 13.6 inches
 Working Width Height 43.0 inches

Vehicle Damage

VDS..... 10-LFQ-5
 CDC 10FLEW3
 Max. Exterior Deformation 8.0 inches
 OCDI LF0011000
 Max. Occupant Compartment Deformation..... 2.0 inches

Figure 5.6. Summary of Results for MASH Test 5-10 on Tappan Zee Hudson River Crossing Bridge Rail.



General Information

Test Agency..... Texas A&M Transportation Institute (TTI)
 Test Standard Test No..... MASH Test 5-11
 TTI Test No. 609891-02-2
 Test Date 2018-06-18

Test Article

Type Longitudinal Barrier – Bridge Rail
 Name TZH Crossing Bridge Rail
 Installation Length..... 151 ft
 Material or Key Elements ... 7-inch tall concrete curb, 3 rows of HSS
 6x6x3/16 square tube rails for a total
 height of 45 inches above grade
Soil Type and Condition Concrete bridge deck, damp

Test Vehicle

Type/Designation..... 2270P
 Make and Model 2013 RAM 1500
 Curb..... 5111 lb
 Test Inertial..... 5016 lb
 Dummy 165 lb
 Gross Static 5181 lb

Impact Conditions

Speed 62.8 mi/h
 Angle 25.7°
 Location/Orientation 4.1 ft upstream of
 Joint 20-21

Impact Severity

..... 129 kip-ft

Exit Conditions

Speed 49.9 mi/h
 Exit Trajectory Angle 6.4°
 Exit Heading Angle..... 7.5°

Occupant Risk Values

Longitudinal OIV 20.3 ft/s
 Lateral OIV..... 28.5 ft/s
 Longitudinal Ridedown 7.8 g
 Lateral Ridedown 8.5 g
 THIV 35.4 ft/s
 PHD 10.7 g
 ASI..... 2.1

Max. 0.050-s Average

Longitudinal -10.6 g
 Lateral..... 15.8 g
 Vertical..... 3.1 g

Post-Impact Trajectory

Stopping Distance..... 175 ft downstream
 15 ft toward traffic

Vehicle Stability

Maximum Yaw Angle 44°
 Maximum Pitch Angle 5°
 Maximum Roll Angle 13°
 Vehicle Snagging No
 Vehicle Pocketing No

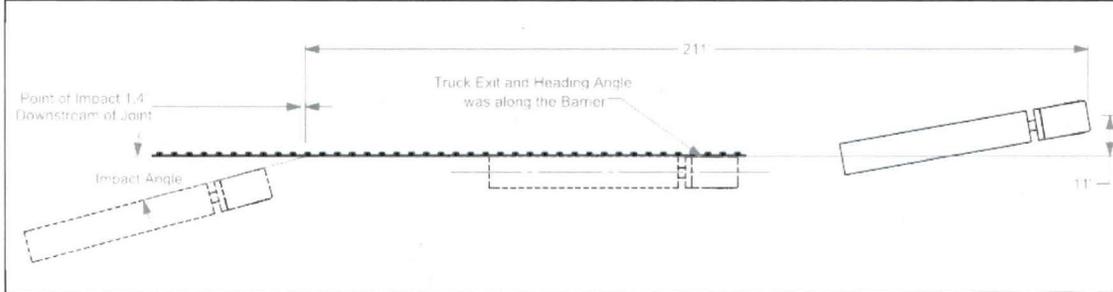
Test Article Deflections

Dynamic..... 1.0 inch
 Permanent None
 Working Width..... 13.9 inches
 Working Width Height 41.7 inches

Vehicle Damage

VDS..... 10-LFQ-5
 CDC..... 10FLEW3
 Max. Exterior Deformation..... 12.0 inches
 OCDI..... LF0021000
 Max. Occupant Compartment
 Deformation 3.0 inches

Figure 6.6. Summary of Results for MASH Test 5-11 on Tappan Zee Hudson River Crossing Bridge Rail.



General Information

Test Agency Texas A&M Transportation Institute (TTI)
 Test Standard Test No. MASH Test 5-12
 TTI Test No. 609891-02-3
 Test Date 2018-06-22

Test Article

Type Longitudinal Barrier – Bridge Rail
 Name TZH Crossing Bridge Rail
 Installation Length 151 ft
 Material or Key Elements ... 7-inch tall concrete curb, 3 rows of HSS 6x6x3/16 square tube rails for a total height of 45 inches above grade

Soil Type and Condition

Concrete bridge deck, damp

Test Vehicle

Type/Designation 36000V
 Make and Model 2006 Freightliner w/2002 Utility trailer
 Curb 29,490 lb
 Test Inertial 80,090 lb
 Dummy No dummy
 Gross Static 80,090 lb

Impact Conditions

Speed 50.9 mi/h
 Angle 15.2°
 Location/Orientation 1.4 ft downstream of field joint between posts 10 and 11

Impact Severity

477 kip-ft

Exit Conditions

Speed 45.1 mi/h
 Exit Trajectory Angle Along Barrier
 Exit Heading Angle Along Barrier

Occupant Risk Values

Longitudinal OIV 2.3 ft/s
 Lateral OIV 12.5 ft/s
 Longitudinal Ridedown 17.1 g
 Lateral Ridedown 33.1 g
 THIV 15.7 ft/s
 PHD 33.2 g
 ASI 0.8

Max. 0.050-s Average

Longitudinal -5.4 g
 Lateral 5.7 g
 Vertical 7.0 g

Post-Impact Trajectory

Stopping Distance 211 ft downstream
 11 ft twd field side

Vehicle Stability

Maximum Yaw Angle 48°
 Maximum Pitch Angle 24°
 Maximum Roll Angle 9°
 Vehicle Snagging No
 Vehicle Pocketing No

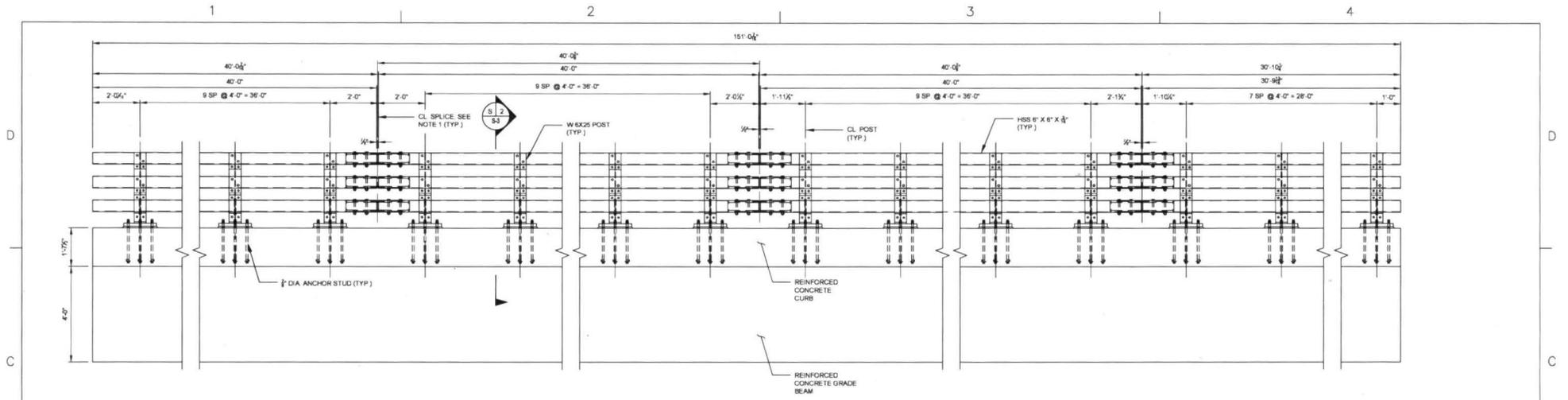
Test Article Deflections

Dynamic 1.5 inches
 Permanent 0.9 inch
 Working Width 47.4 inches
 Working Width Height 110.2 inches

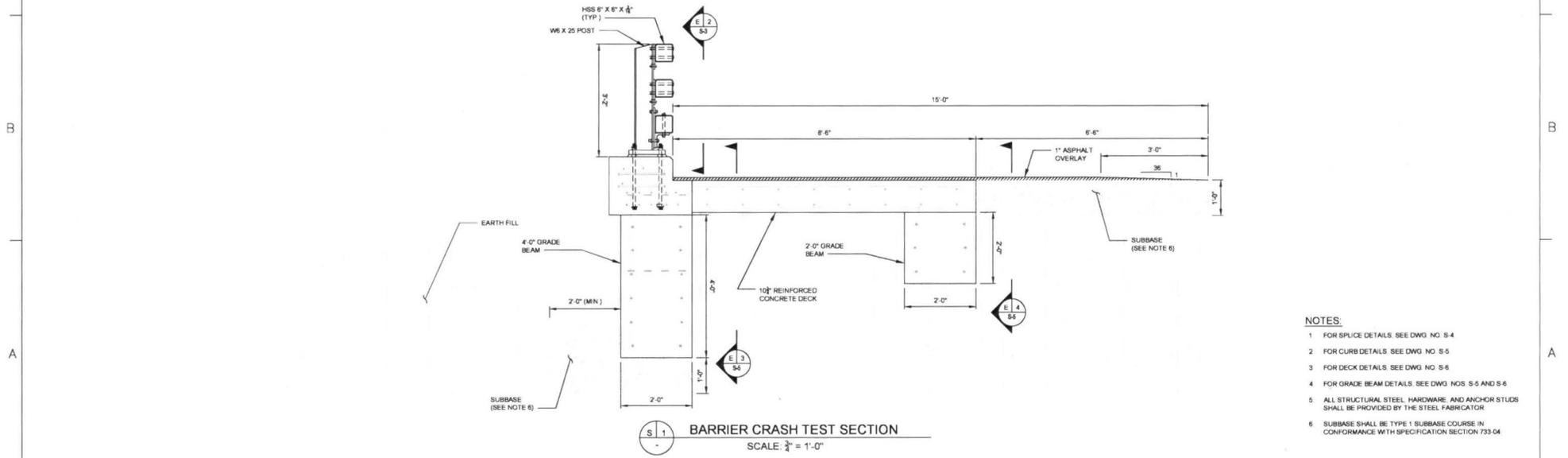
Vehicle Damage

VDS NA
 CDC NA
 Max. Exterior Deformation 19.0 inches
 OCDI NA
 Max. Occupant Compartment Deformation 2.0 inches

Figure 7.6. Summary of Results for MASH Test 5-12 on Tappan Zee Hudson River Crossing Bridge Rail.



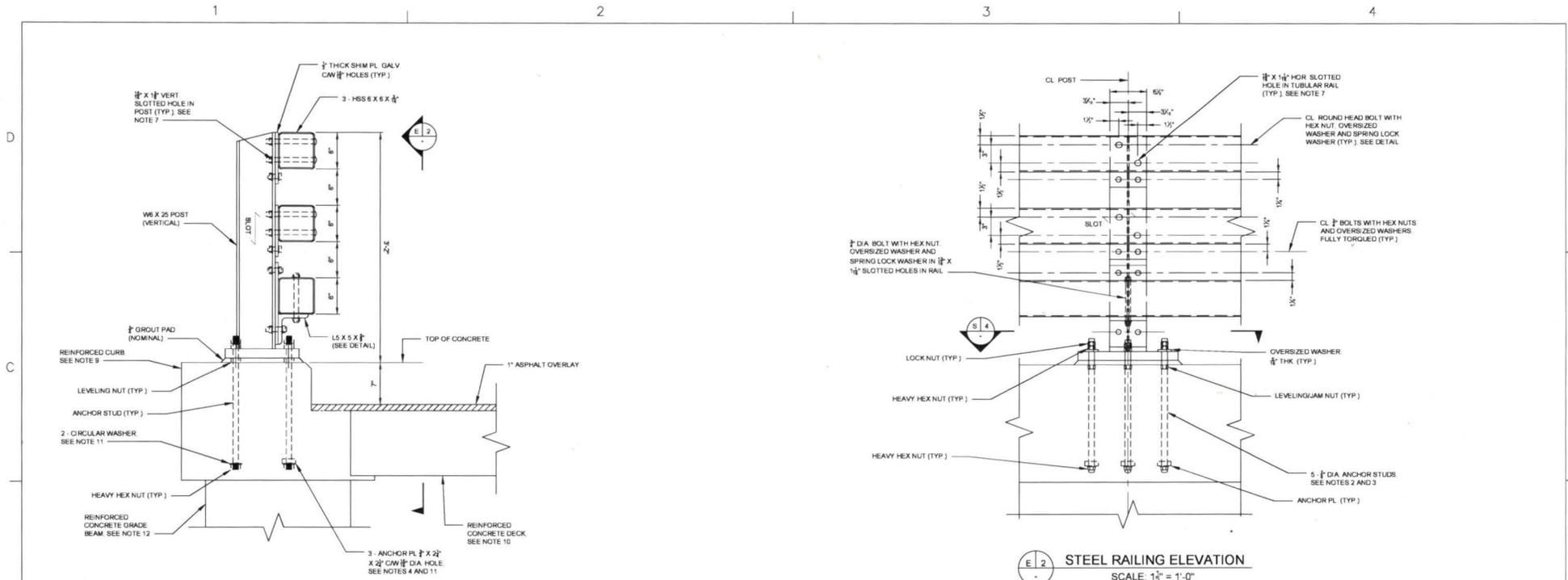
E 1 BARRIER CRASH TEST ELEVATION
SCALE: $\frac{1}{4}'' = 1'-0''$



S 1 BARRIER CRASH TEST SECTION
SCALE: $\frac{1}{4}'' = 1'-0''$

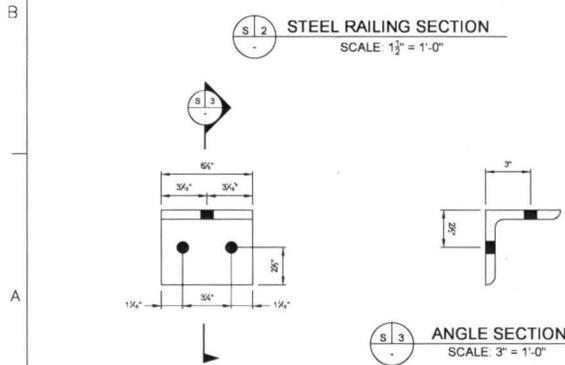
- NOTES:**
- 1 FOR SPLICE DETAILS SEE DWG NO. S-4
 - 2 FOR CURB DETAILS SEE DWG NO. S-5
 - 3 FOR DECK DETAILS SEE DWG NO. S-6
 - 4 FOR GRADE BEAM DETAILS SEE DWG NOS. S-5 AND S-6
 - 5 ALL STRUCTURAL STEEL HARDWARE AND ANCHOR STUDS SHALL BE PROVIDED BY THE STEEL FABRICATOR
 - 6 SUBBASE SHALL BE TYPE 1 SUBBASE COURSE IN CONFORMANCE WITH SPECIFICATION SECTION 733.04

DRAWN BY A. HEISER DESIGNED BY A. HEISER CHECKED BY M. ZDENEK SCALE: AS SHOWN					3 RAIL STEEL BARRIER CRASH TEST – BARRIER FOUNDATION AND INSTALLATION	DRAWING TITLE BARRIER CRASH TEST - ELEVATION AND SECTION		CONTRACT NO.
REV. DESCRIPTION DATE APP'D.			DRAWING NO. S-2 SHEET 3 OF 7			DATE MAY 26, 2017		
<small>*IT IS A VIOLATION OF THE PROFESSIONAL LICENSE LAW FOR ANY PERSON TO ALTER THIS DRAWING IN ANY WAY, UNLESS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER/ARCHITECT AS APPLICABLE. THE ALTERING ENGINEER/ARCHITECT SHALL AFFIX HIS/HER SEAL AND THE NOTATION "ALTERED BY FOLLOWED BY HIS/HER SIGNATURE AND DATE OF ALTERATION."*</small>						PROJECT NO.	REVISION NO. 0	



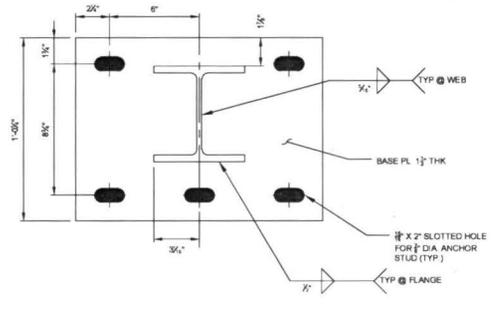
S 2 STEEL RAILING SECTION
SCALE: 1 1/2" = 1'-0"

E 2 STEEL RAILING ELEVATION
SCALE: 1 1/2" = 1'-0"

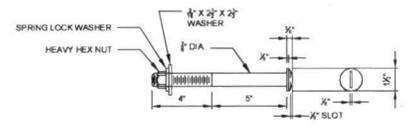
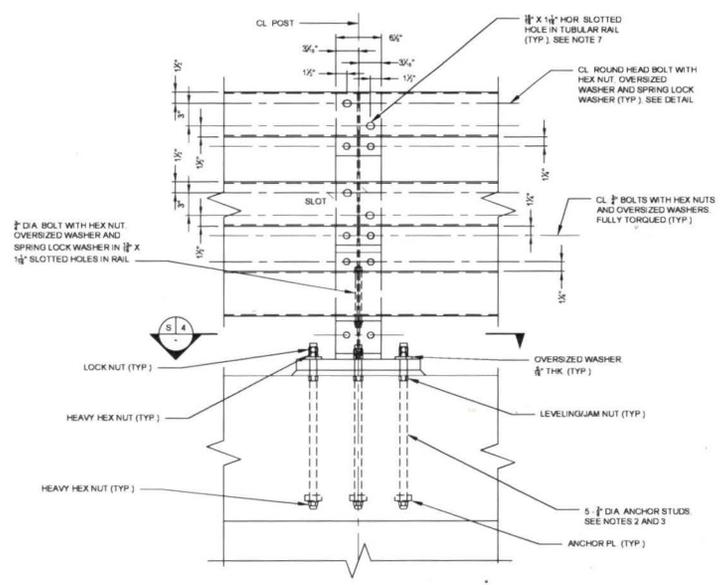


RAIL ANGLE DETAILS
SCALE: 3" = 1'-0"

S 3 ANGLE SECTION
SCALE: 3" = 1'-0"



S 4 BASE PLATE DETAILS
SCALE: 1 1/2" = 1'-0"



S 4 SLOTTED ROUND HEAD BOLT
SCALE: 3" = 1'-0"

- NOTES:**
- UNLESS NOTED OTHERWISE, ALL RAILING IS TO BE FABRICATED AND ERECTED ACCORDING TO SECTION 588 OF THE STANDARD SPECIFICATIONS. ALL STRUCTURAL STEEL HARDWARE AND ANCHOR STUDS SHALL BE PROVIDED BY THE STEEL FABRICATOR.
 - ANCHOR STUDS SHALL CONFORM TO ASTM A193 GRADE B7 AND SHALL BE GALVANIZED (MECHANICALLY CLEANED).
 - ANCHOR STUDS SHALL BE TORQUED TO SNUG TIGHT CONDITION WITH THE HEAVY HEX NUT. EXPOSED ANCHOR STUD THREADS SHALL NOT BE CUT OR DAMAGED. ANCHOR STUD SHALL NOT BE FLAME CUT.
 - ANCHOR PLATES FOR ANCHOR STUDS SHALL CONFORM TO ASTM A573 OR TO AN APPROVED EQUAL GALVANIZED.
 - PRIOR TO DOWNING THE ASSEMBLED POST, GRIND ALL EDGES TO MINIMUM RADIUS OF 1/8".
 - BOLTS IN TUBULAR RAILS SHALL BE TORQUED SNUG TIGHT (APPROXIMATELY 100 FT-LB).
 - ALL BOLT HOLES IN TUBULAR RAILS AND POSTS SHALL BE SLOTTED PARALLEL TO THE AXIS OF THE MEMBER.
 - FOR SPLICE DETAILS, SEE DWG. NO. S-4 SPLICES SHALL BE SPACED AS SHOWN ON DWG. NO. S-2.
 - FOR CURB REINFORCEMENT, SEE DWG. NO. S-5.
 - FOR DECK REINFORCEMENT, SEE DWG. NO. S-6.
 - ANCHOR PLATES AND WASHERS AT ANCHOR STUD ENDS SHALL BE SECURED IN PLACE TO PREVENT DISLODGING DURING CASTING OF CONCRETE.
 - FOR GRADE BEAM REINFORCEMENT, SEE DWG. NOS. S-5 AND S-6.

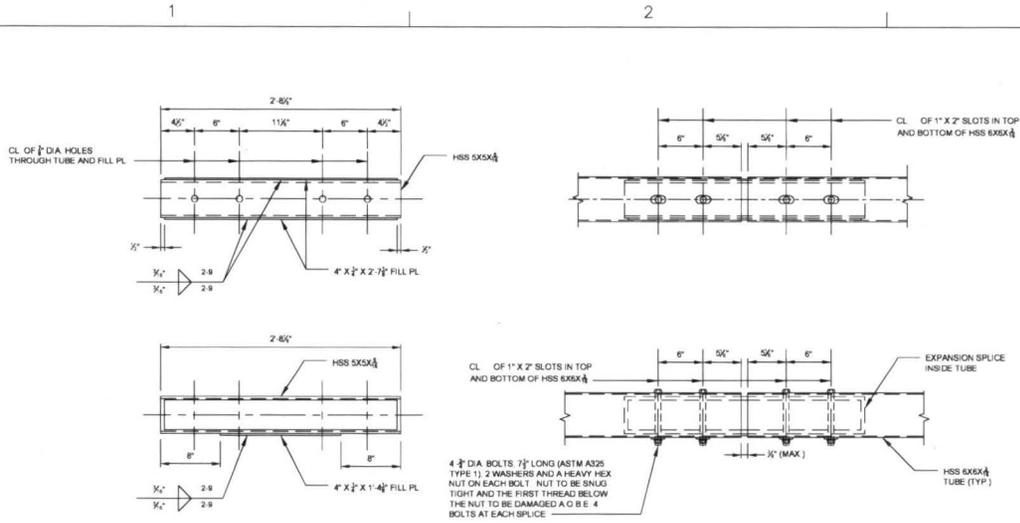
DRAWING TITLE RAILING DETAILS				CONTRACT NO. S-3	
PROJECT NO.				DRAWING NO. S-3	
DRAWING NO.				SHEET 4 OF 7	
DATE				MAY 25, 2017	
REVISION NO.				0	

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

DRAWN BY	A. REISER
DESIGNED BY	A. REISER
CHECKED BY	M. ZDENEK
SCALE:	AS SHOWN



3 RAIL STEEL BARRIER CRASH TEST -
BARRIER FOUNDATION AND
INSTALLATION



EXPANSION SPLICE INSIDE TUBE
SCALE: 1 1/2" = 1'-0"

EXPANSION SPLICE TUBE ASSEMBLY
SCALE: 1 1/2" = 1'-0"

4 3/4 DIA BOLTS 7 1/2" LONG (ASTM A325 TYPE 1) 2 WASHERS AND A HEAVY HEX NUT ON EACH BOLT. NUT TO BE SNUG TIGHT AND THE FIRST THREAD BELOW THE NUT TO BE DAMAGED AND BE 4 BOLTS AT EACH SPLICE.

NOTES

- 1 ALL STRUCTURAL STEEL HARDWARE AND ANCHOR STUDS SHALL BE PROVIDED BY THE STEEL FABRICATOR
- 2 PROTRUSIONS CAUSED BY WELDING OR GALVANIZING ARE NOT PERMITTED ON THE ADJOINING SURFACES OF THE BOX BEAM RAILS SPLICE TUBES AND FILL PLATES
- 3 FOR SPLICE LOCATIONS, SEE DWG. NO. S-2

DRAWN BY A. HESER DESIGNED BY A. HESER CHECKED BY M. ZDENEK SCALE: AS SHOWN					3 RAIL STEEL BARRIER CRASH TEST – BARRIER FOUNDATION AND INSTALLATION	DRAWING TITLE	SPLICE DETAILS		CONTRACT NO.
REV.	DESCRIPTION	DATE	APP'D.				DRAWING NO.	S-4 SHEET 5 OF 7	
<small>*IT IS A VIOLATION OF THE PROFESSIONAL LICENSE LAW FOR ANY PERSON TO ALTER THIS DRAWING IN ANY WAY, UNLESS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER/ARCHITECT AS APPLICABLE. THE ALTERING ENGINEER/ARCHITECT SHALL AFFIX HIS/HER SEAL AND THE NOTATION "ALTERED BY" FOLLOWED BY HIS/HER SIGNATURE AND DATE OF ALTERATION.*</small>						PROJECT NO.	MAY 28, 2017		0