U.S. Department of Transportation
Federal Highway Administration

October 1, 2020

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

In Reply Refer To:
HSST-1/B-350

Mr. Jeff Jeffers
State of Alaska Department of Transportation and Public Facilities
3132 Channel Drive
Juneau, AK 99811-2500
USA

Dear Mr. Jeffers:

This letter is in response to your April 17, 2020 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-350 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:

- 2019 MASH 2-Tube Bridge Rail Transition

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: 2019 MASH 2-Tube Bridge Rail Transition
Type of system: Longitudinal Barrier Transition
Test Level: Test Level 3 (TL3)
Testing conducted by: Texas A&M Transportation Institute (TTI)
Date of request: April 17, 2020

FHWA concurs with the recommendation of the accredited crash testing laboratory on 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-350 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

Submitter	Date of Request:	April 17, 2020	◉ New ○ Resubmission
	Name:	Jeff Jeffers	
	Company:	State of Alaska Department of Transportation and Public Facilities	
	Address:	3132 Channel Drive, Juneau, AK 99811-2500	
	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 L ! - ! - ! ! - ! - !

System Type	Submission Type	Device Name / Variant	Testing Criterion	Test Level
'B':Rigid/Semi-Rigid Barriers (Roadside, Median, Bridge Railings)	◉ Physical Crash Testing ○ Engineering Analysis	2019 MASH 2-Tube Bridge Rail Transition	AASHTO MASH	TL3

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:	Jeff Jeffers	Same as Submitter ☒
Company Name:	State of Alaska Department of Transportation and Public Facilities	Same as Submitter ☒
Address:	3132 Channel Drive, Juneau, AK 99811-2500	Same as Submitter ☒
Country:	United States of America	Same as Submitter ☒

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

Texas A&M Transportation Institute (TTI) was contracted by the State of Alaska Department of Transportation and Public Facilities and the North Dakota Department of Transportation to perform full-scale crash testing of the 2019 MASH 2-Tube Bridge Rail Transition. There are no shared financial interests in the 2019 MASH 2-Tube Bridge Rail Transition by TTI, or between the State of Alaska Department of Transportation and Public Facilities and/or the North Dakota Department of Transportation, and TTI, other than costs involved in the actual crash tests and reports for this submission to FHWA.

608331-4, 5, 6

PRODUCT DESCRIPTION

Help

(•) New Hardware or Significant Modification ( ) Modification to Existing Hardware

The 2019 MASH 2-Tube Bridge Rail Transition test installation was comprised of a 154-ft long section of reinforced concrete bridge deck that incorporated two steel rails, a 12½-ft long (nominal) section of two nested thrie beams (RTM08a) attached to the bridge rails with a thrie beam terminal connector (RTE01b) and unique guardrail connector, a standard symmetrical 75 inch long (nominal) thrie-beam-to-W-beam transition rail section (RWT01b), 25 ft of W beam guardrail (in length of need), and a standard 9 ft-4½ inch long TxDOT DAT terminal (posts 1 and 2) at the end.

The total length of the installation was approximately 207 ft-3½ inches (53 ft-3½ inches transition + 154 ft bridge deck). The top edges of the DAT rail and W-beam were located 31 inches above grade. The top edge of the nested thrie beam was 34¾ inches above grade, and the tops of the bridge rails were located 24 inches and 38 inches above the bridge deck.

Transition section Posts 3 through 6 were 72 inches long (embedded 40 inches), posts 7 and 8 were 72 inches long, and posts 9 through 15 were 78 inches long. Posts 1 through 6 were spaced at 75 inches; posts 7 through 10 were at 37½ inches; and posts 10 through 15 were at 18¾ inches. Timber blockouts, 8-inches deep, were installed on posts 2 through 6. Posts 7 and 8 were fitted with 12-inch deep, short (14 inches) steel hollow structural section (HSS) tubing blockouts, and posts 9 through 15 were fitted with 12-inch deep, long (21 ⅛ inches) steel HSS blockouts,

The bridge deck's curb was 10 inches tall, with a 4-inch thick lift of grout, yielding a 6-inch tall traffic side face. The curb was 18 inches wide at the base, and 17 inches wide at the top, with the traffic side face sloping 1-inch toward the field side.

Sixteen fabricated steel posts were longitudinally spaced on 10 ft centers, beginning at 24 inches from each end of the concrete curb. Two steel rectangular HSS rail elements spanned the posts and extended past them at each end of the installation.

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:	William F. Williams	
Engineer Signature:	William Williams Digitally signed by William Williams Date: 2020.09.28 16:15:43 -05'00'	
Address:	TTI, TAMU 3135 College Station, TX 77843-3135	Same as Submitter ☐
Country:	United States of America	Same as Submitter ☒

A brief description of each crash test and its result:

Help

Required Test Number	Narrative Description	Evaluation Results
3-20 (1100C)	Test 3-20 involves an 1100C vehicle impacting the test article at a target impact speed of 62 mi/h and target angle of 25°. The target CIP for the left corner of the front bumper was 5.1 ft upstream of the end of the concrete curb/deck. The results of the test conducted on September 2, 2019, are found in TTI Test Report No. 608331-4-6 as Test #4. The test vehicle was traveling at a speed of 60.9 mi/h as it made contact with the 2019 MASH 2-Tube Bridge Rail Transition 6.06 ft upstream of the end of the concrete curb/deck at impact angle of 26.5°. After loss of contact with the transition, the vehicle came to rest 145 ft downstream of the impact point and 137 ft toward the traffic side. The 2019 MASH 2-Tube Bridge Rail Transition contained and redirected the 1100C vehicle. The vehicle did not penetrate, underride, or override the installation. The vehicle exited within the exit box criteria defined in MASH. Maximum dynamic deflection of the rail during the test was 3.5 inches. Maximum permanent deformation was 1.25 inches. Working width was 26.1 inches. No detached elements, fragments, or other debris were present to penetrate, or to show potential for penetrating, the occupant compartment, or to present undue hazard for others in the area. The 1100C vehicle remained upright during and after the collision event. Maximum roll and pitch angles were 12° and 3°, respectively. Longitudinal OIV was 22.6 ft/s and lateral OIV was 30.5 ft/s. Maximum longitudinal occupant ridedown acceleration was 14.5 g, and maximum lateral occupant ridedown acceleration was 9.2 g. Occupant risk factors were within the maximum limits specified in MASH. Maximum exterior crush to the vehicle was 14.0 inches in the side plane in the front plane at the left front corner at bumper height. Maximum occupant compartment deformation was 3.5 inches in the left kick panel area. No damage to the fuel tank was observed. The 2019 MASH 2-Tube Bridge Rail Transition performed acceptably for MASH test 3-20.	PASS

Required Test Number	Narrative Description	Evaluation Results
3-21 (2270P)	Test 3-21 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 left corner of the front bumper was 7.0 ft upstream of the end of the concrete curb/deck. The results of the test conducted on September 5, 2019, are found in TTI Test Report No. 608331-4-6 as Test #5. The test vehicle was traveling at a speed of 61.9 mi/h as it made contact with the 2019 MASH 2-Tube Bridge Rail Transition 6.52 ft upstream of the end of the concrete curb/deck and at an impact angle of 25.3°. After loss of contact with the transition, the vehicle came to rest 174 ft downstream of the impact point and in-line with the rail. The 2019 MASH 2-Tube Bridge Rail Transition contained and redirected the 2270P vehicle. The vehicle did not penetrate, underride, or override the installation. The vehicle exited within the exit box criteria defined in MASH. Maximum dynamic deflection during the test was 6.1 inches. Maximum permanent deformation was 3.75 inches. Working width was 26.9 inches. No detached elements, fragments, or other debris were present to penetrate, or to show potential for penetrating, the occupant compartment, or to present undue hazard for others in the area. The 2270P vehicle remained upright during and after the collision event. Maximum roll and pitch angles were 8° and 11°, respectively. Longitudinal OIV was 20.3 ft/s and lateral OIV was 23.6 ft/s. Maximum longitudinal occupant ridedown acceleration was 7.4 g and maximum lateral occupant ridedown acceleration was 13.0 g. Occupant risk factors were within the preferred limits specified in MASH. Maximum exterior crush to the vehicle was 15.0 inches in the side plane at the left front corner at bumper height. Maximum occupant compartment deformation was 4 inches in the left side kick panel. No damage to the fuel tank was observed. The 2019 MASH 2-Tube Bridge Rail Transition performed acceptably for MASH test 3-21.	PASS

3-10, 3-11	The reported tests were for the Transition section. Tests 3-10 & 3-11 pertain to Length-of-Need. The Length-of-Need Tests 4-10, 4-11, & 4-12 were performed in December 2018, and are found in TTI Test Report No. 608331-1A, 2, 3. ========== >>>>> Continued on Page 7 of 8 <<<<<<	Non-Relevant Test, not conducted

3-21 (2270P)	Test 3-21 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 left corner of the front bumper was 7.3 ft upstream of centerline of Post #7. The results of the test conducted on December 19, 2019, are found in TTI Test Report No. 608331-4-6 as Test #6. The test vehicle was traveling at aspeed of 62.6 mi/h as it made contact with the 2019 MASH 2-Tube Bridge Rail Transition 7.5 ft upstream of the centerline of Post #7 and at an impact angle of 24.9°. After loss of contact with the barrier, the vehicle came to rest 133 ft downstream of the impact point and 2 ft toward the traffic side. The 2019 MASH 2-Tube Bridge Rail Transition contained and redirected the 2270P vehicle. The vehicle did not penetrate, underride, or override the installation. The vehicle exited within the exit box criteria defined in MASH. Maximum dynamic deflection during the test was 33.6 inches. Maximum permanent deformation was 28.0 inches. Working width was 44.7 inches. No detached elements, fragments, or other debris were present to penetrate or to show potential for penetrating the occupant compartment, or to present undue hazard for others in the area. The 2270P vehicle remained upright during and after the collision event. Maximum roll and pitch angles were 15° and 14°, respectively. Longitudinal OIV was 24.9 ft/s and lateral OIV was 16.4 ft/s. Maximum longitudinal occupant ridedown acceleration was 10.7 g and maximum lateral occupant ridedown acceleration was 9.8 g. Occupant risk factors were within the preferred limitsspecified in MASH. Maximum exterior crush to the vehicle was 20.0 inches in the side plane at the left front corner at bumper height. No occupant compartment deformation or intrusion was observed. No damage to the fuel tank was observed. The 2019 MASH 2-Tube Bridge Rail Transition performed acceptably for MASH test 3-21.	PASS

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 AM Transportation Institute	
Laboratory Signature:	Digitally signed by Darrell L. Kuhn 'Date: 2020.09.28 14:02:31 -05'00	
Address:	TTI, TAMU 3135 College Station, TX 77843-3135	Same as Submitter ☐
Country:	United States of America	Same as Submitter ☒
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*: Jeff. CJeffers Digitally signed by Jeff. CJeffers Date: 2020.09.28 13:32:31 -08'00'

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:

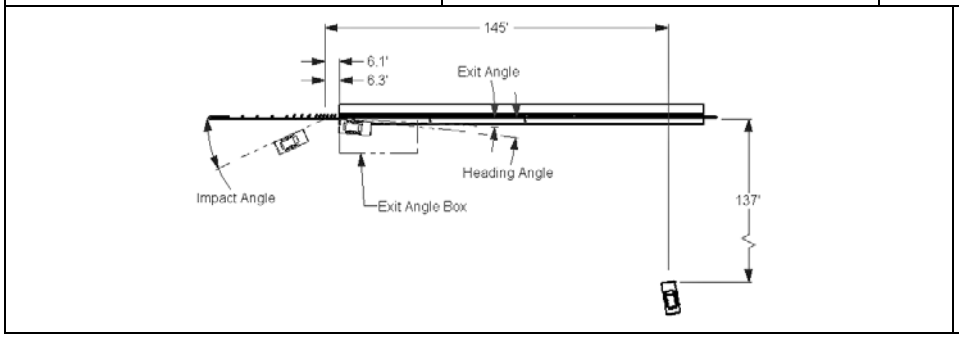
Eligibility Letter		
Number	Date	Key Words

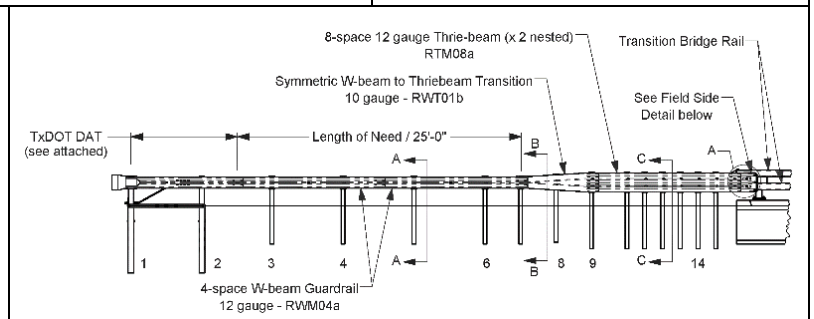
0.000 s

0.100 s

0.300 s

0.500 s





General Information
- Test Agency ..... Texas A&M Transportation Institute (TTI)
- Test Standard Test No. ..... MASH Test 3-20
- TTI Test No. 608331-01-4
- Test Date 2019-09-02

Test Article
- Type ..... Transition
- Name ..... 2019 MASH 2-Tube Bridge Rail Thrie Beam Transition
- Installation Length ..... 207 ft 3½ inches (incl 154 ft of deck)
- Material or Key Elements ... Thrie beam guardrail terminal to 38-inch tall 2-tube bridge rail, 34¾ inch tall thrie beam guardrail section, symmetrical W-beam to thrie beam terminal, 25 ft of W-beam guardrail

Soil Type and Condition ..... AASHTO M147 Grading B Soil (crushed limestone), Damp

Test Vehicle
- Type/Designation 1100C
- Make and Model ..... 2007 Kia Rio
- Curb ..... 2470 lb
- Test Inertial ..... 2446 lb
- Dummy ..... 165 lb
- Gross Static ..... 2611 lb

Impact Conditions
- Speed ..... 60.9 mi/h
- Angle ..... 26.5°
- Location/Orientation ..... 6.06 ft upstream of end of curb/deck

Impact Severity ..... 61 kip-ft

Exit Conditions
- Speed ..... 39.5 mi/h
- Trajectory/Heading Angle ... 7.1° / 14.0°

Occupant Risk Values
- Longitudinal OIV ..... 22.6 ft/s
- Lateral OIV ..... 30.5 ft/s
- Longitudinal Ridedown ..... 14.5 g
- Lateral Ridedown ..... 9.2 g
- THIV ..... 41.0 km/h
- ASI 2.17

Max. 0.050-s Average
- Longitudinal ..... -12.0 g
- Lateral ..... 16.8 g
- Vertical ..... -3.6 g

Post-Impact Trajectory
- Stopping Distance ..... 145 ft downstream 137 ft twd traffic

Vehicle Stability
- Maximum Yaw Angle ..... 63°
- Maximum Pitch Angle ..... 3°
- Maximum Roll Angle ..... 12°
- Vehicle Snagging ..... No
- Vehicle Pocketing ..... No

Test Article Deflections
- Dynamic ..... 3.5 inches
- Permanent ..... 1.25 inches
- Working Width ..... 26.1 inches
- Height of Working Width ..... 34.75 inches

Vehicle Damage
- VDS 11LFQ6
- CDC 11FLEW5
- Max. Exterior Deformation ..... 14.0 inches
- OCDI FL0010000
- Max. Occupant Compartment Deformation ..... 3.5 inches

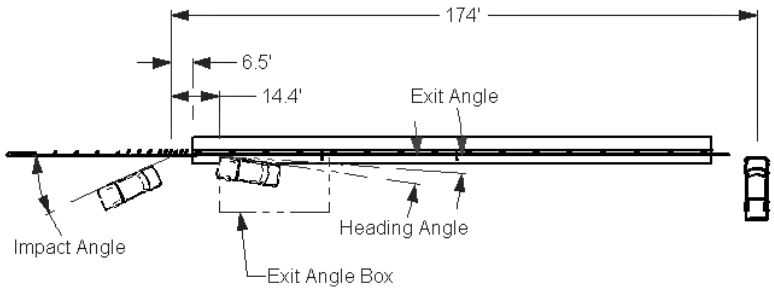
Figure 5.6. Summary of Results for *MASH* Test 3-20 on 2019 MASH 2-Tube Bridge Rail Thrie Beam Transition.

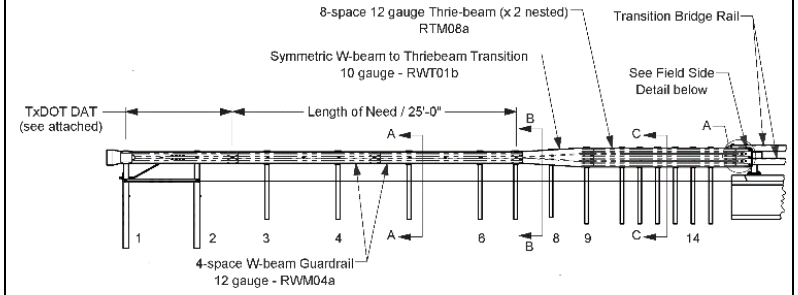
0.000 s

0.100 s

0.200 s

0.400 s





General Information
- Test Agency ..... Texas A&M Transportation Institute (TTI)
- Test Standard Test No. ..... MASH Test 3-21
- TTI Test No. 608331-01-5
- Test Date 2019-09-05

Test Article
- Type ..... Transition
- Name ..... 2019 MASH 2-Tube Bridge Rail Thrie Beam Transition
- Installation Length ..... 207 ft 3½ inches (incl 154 ft of deck)
- Material or Key Elements ... Thrie beam guardrail terminal to 38-inch tall 2-tube bridge rail, 34¾ inch tall thrie beam guardrail section, symmetrical W-beam to thrie beam terminal, 25 ft of W-beam guardrail

Soil Type and Condition ..... AASHTO M147 Grading B Soil (crushed limestone), Damp

Test Vehicle
- Type/Designation 2270P
- Make and Model ..... 2013 RAM 1500 Pickup
- Curb ..... 5168 lb
- Test Inertial ..... 5050 lb
- Dummy ..... 165 lb
- Gross Static ..... 5215 lb

Impact Conditions
- Speed ..... 61.9 mi/h
- Angle ..... 25.3°
- Location/Orientation ..... 6.52 ft upstream of end of curb/deck

Impact Severity ..... 118 kip-ft

Exit Conditions
- Speed ..... 47.9 mi/h
- Trajectory/Heading Angle ... 6.9° / 6.5°

Occupant Risk Values
- Longitudinal OIV ..... 20.3 ft/s
- Lateral OIV ..... 23.6 ft/s
- Longitudinal Ridedown ..... 7.4 g
- Lateral Ridedown ..... 13.0 g
- THIV ..... 33.5 km/h
- ASI 1.51

Max. 0.050-s Average
- Longitudinal ..... −8.7 g
- Lateral ..... 10.9 g
- Vertical ..... −4.7 g

Post-Impact Trajectory
- Stopping Distance ..... 174 ft downstream Aligned w/traffic face

Vehicle Stability
- Maximum Yaw Angle ..... 43°
- Maximum Pitch Angle ..... 11°
- Maximum Roll Angle ..... 8°
- Vehicle Snagging ..... No
- Vehicle Pocketing ..... No

Test Article Deflections
- Dynamic ..... 6.1 inches
- Permanent ..... 3.75 inches
- Working Width ..... 26.9 inches
- Height of Working Width ..... 34.75 inches

Vehicle Damage
- VDS 11LFQ5
- CDC 11FLEW4
- Max. Exterior Deformation ..... 15.0 inches
- OCDI FL0011000
- Max. Occupant Compartment Deformation ..... 4.0 inches

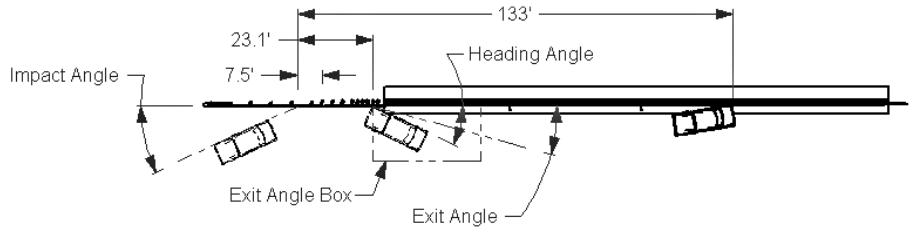
Figure 6.6. Summary of Results for *MASH* Test 3-21 on 2019 MASH 2-Tube Transition from Thrie Beam to Bridge Rail.

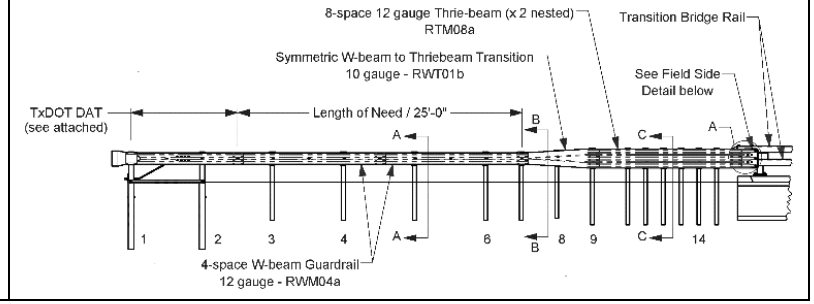
0.000 s

0.200 s

0.400 s

0.600 s





General Information
- Test Agency ..... Texas A&M Transportation Institute (TTI)
- Test Standard Test No. ..... MASH Test 3-21
- TTI Test No. 608331-01-6
- Test Date 2019-12-19

Test Article
- Type ..... Transition
- Name ..... 2019 MASH 2-Tube Bridge Rail Thrie Beam Transition
- Installation Length ..... 207 ft 3½ inches (incl 154 ft of deck)
- Material or Key Elements ... Thrie beam guardrail terminal to 38-inch tall 2-tube bridge rail, 34¾ inch tall thrie beam guardrail section, symmetrical W-beam to thrie beam terminal, 25 ft of W-beam guardrail
- **Soil Type and Condition** ..... AASHTO M147 Grading B Soil (crushed limestone), Damp

Test Vehicle
- Type/Designation 2270P
- Make and Model ..... 2013 RAM 1500 Pickup
- Curb ..... 4890 lb
- Test Inertial ..... 5038 lb
- Dummy ..... No dummy
- Gross Static ..... 5038 lb

Impact Conditions
- Speed ..... 62.6 mi/h
- Angle ..... 24.9°
- Location/Orientation ..... 7.5 ft upstream of post 7

Impact Severity ..... 117 kip-ft

Exit Conditions
- Speed ..... 31.8 mi/h
- Trajectory/Heading Angle ... 23.3° / 24.7°

Occupant Risk Values
- Longitudinal OIV ..... 24.9 ft/s
- Lateral OIV ..... 16.4 ft/s
- Longitudinal Ridedown ..... 10.7 g
- Lateral Ridedown ..... 9.8 g
- THIV ..... 8.6 m/s
- ASI 1.02

Max. 0.050-s Average
- Longitudinal ..... -9.1 g
- Lateral ..... 7.7 g
- Vertical ..... -4.6 g

Post-Impact Trajectory
- Stopping Distance ..... 133 ft downstream 2 ft twd traffic

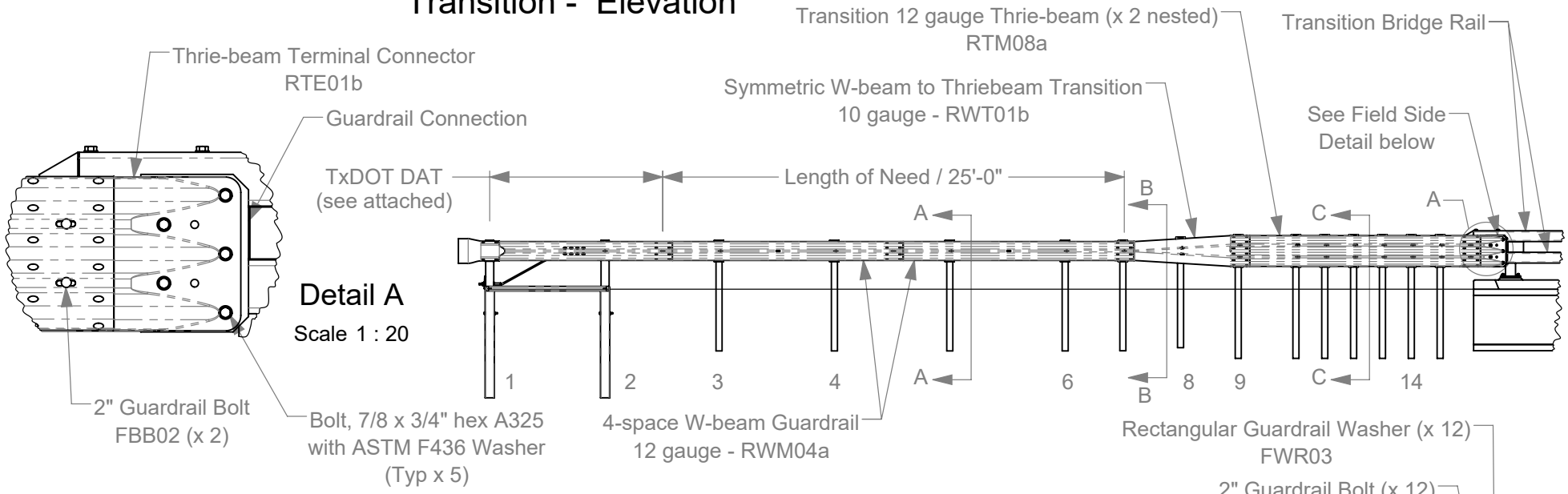
Vehicle Stability
- Maximum Yaw Angle ..... 53°
- Maximum Pitch Angle ..... 14°
- Maximum Roll Angle ..... 15°
- Vehicle Snagging ..... No
- Vehicle Pocketing ..... No

Test Article Deflections
- Dynamic ..... 33.6 inches
- Permanent ..... 28.0 inches
- Working Width ..... 44.7 inches
- Height of Working Width ..... 61.8 inches

Vehicle Damage
- VDS 11LFQ5
- CDC 11FLEW4
- Max. Exterior Deformation ..... 20.0 inches
- OCDI LF0000000
- Max. Occupant Compartment Deformation ..... None

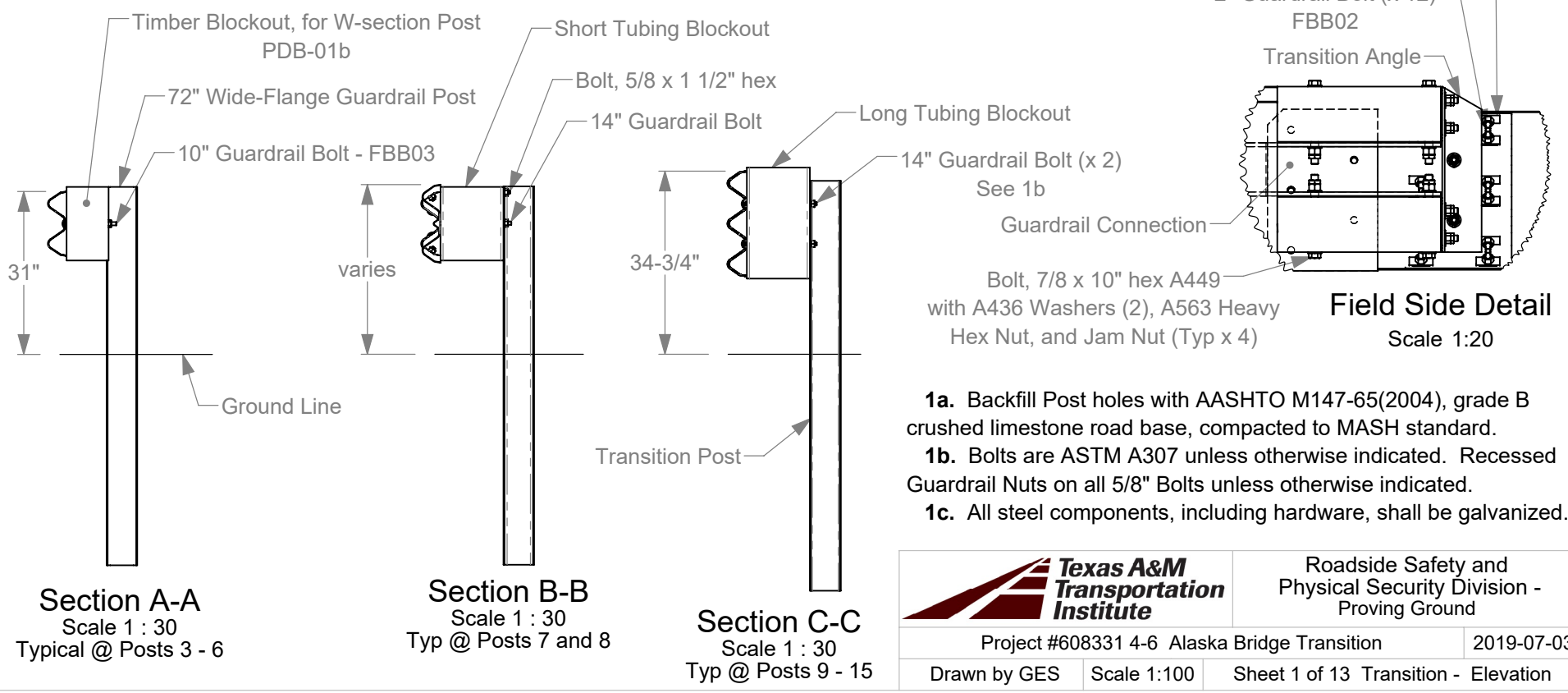
Figure 7.8. Summary of Results for *MASH* Test 3-21 2019 MASH 2-Tube Transition from W-Beam to Thrie Beam.

Transition - Elevation



Detail A

Scale 1 : 20



Field Side Detail

Scale 1:20

Section A-A

Scale 1 : 30
Typical @ Posts 3 - 6

Section B-B

Scale 1 : 30
Typ @ Posts 7 and 8

Section C-C

Scale 1 : 30
Typ @ Posts 9 - 15

1a. Backfill Post holes with AASHTO M147-65(2004), grade B crushed limestone road base, compacted to MASH standard.

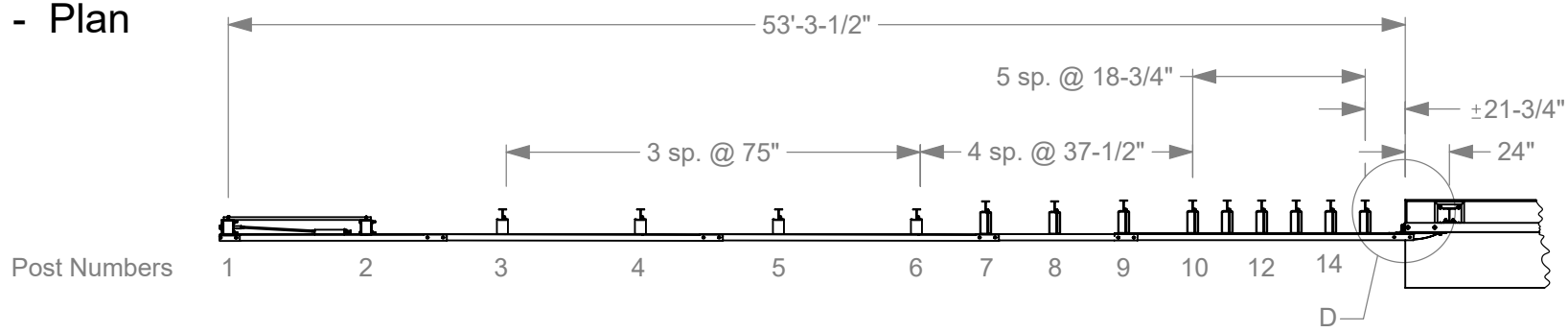
1b. Bolts are ASTM A307 unless otherwise indicated. Recessed Guardrail Nuts on all 5/8" Bolts unless otherwise indicated.

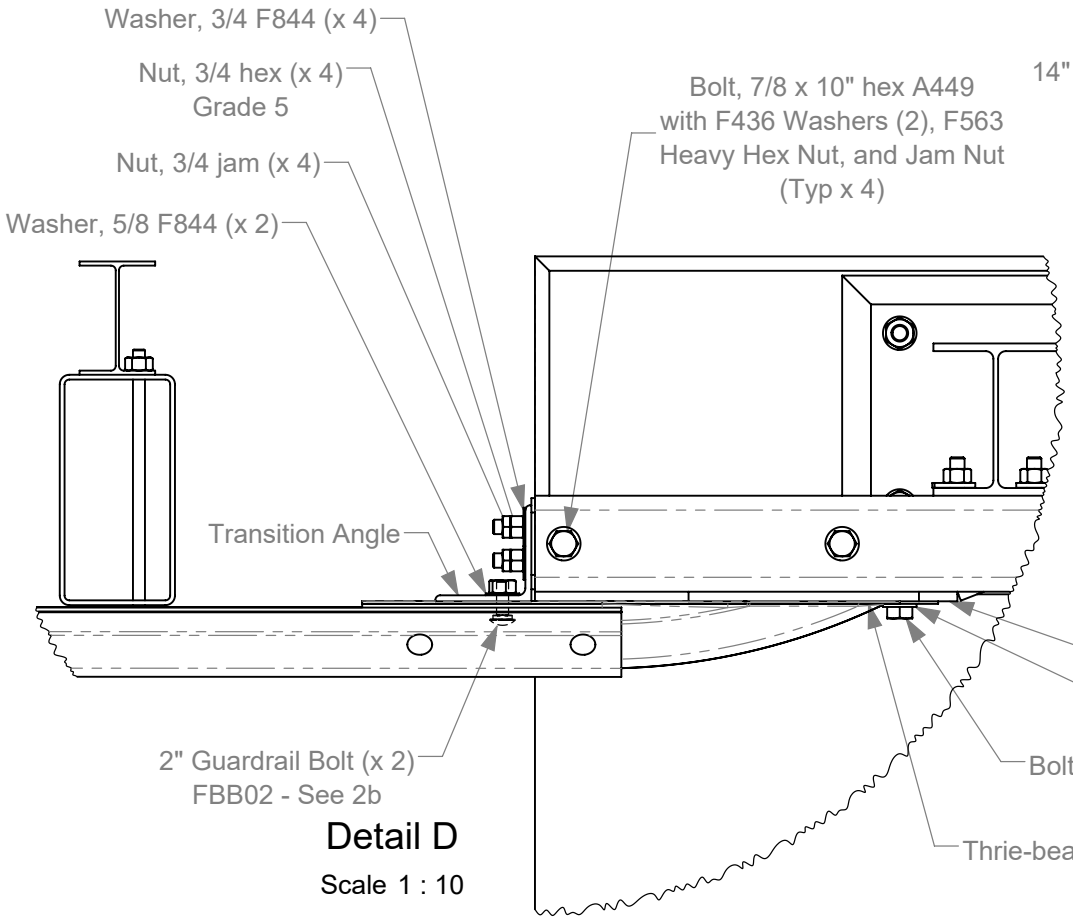
1c. All steel components, including hardware, shall be galvanized.

Texas A&M Transportation Institute	Roadside Safety and Physical Security Division - Proving Ground	
Project #608331 4-6 Alaska Bridge Transition		2019-07-03
Drawn by GES	Scale 1:100	Sheet 1 of 13 Transition - Elevation

T:\1-ProjectFiles\608331- Alaska - Williams\Drafting, 608331 4-5\608331 4-6 Drawing

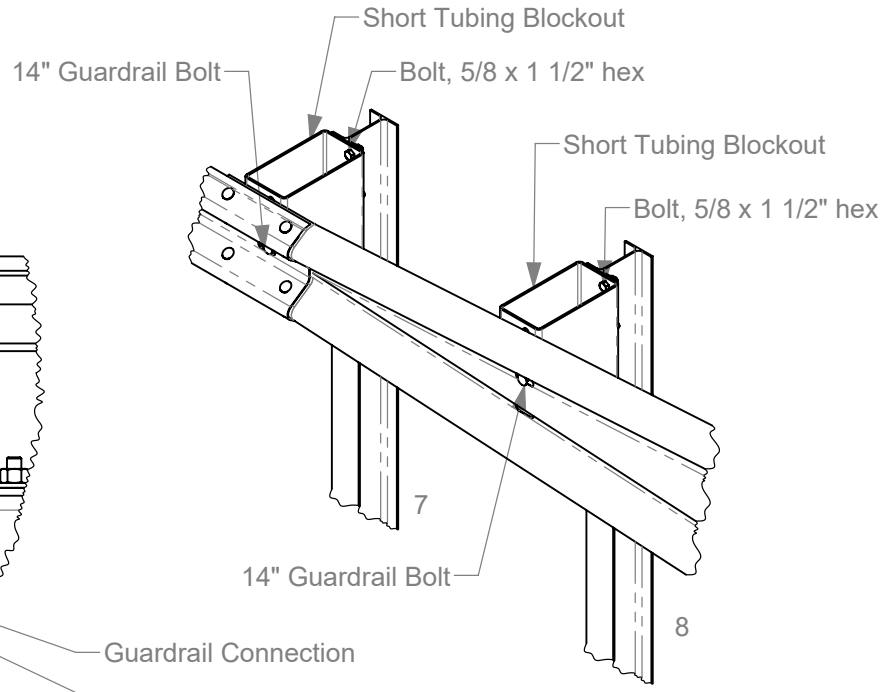
Transition - Plan





Detail D

Scale 1 : 10



Isometric View

@ Posts 7 and 8

2a. Backfill Post holes with AASHTO M147-65(2004), grade B crushed limestone road base, compacted to MASH standard.

2b. Recessed Guardrail Nuts on all 5/8" Bolts unless otherwise indicated.

2C. All steel components, including hardware, shall be galvanized.

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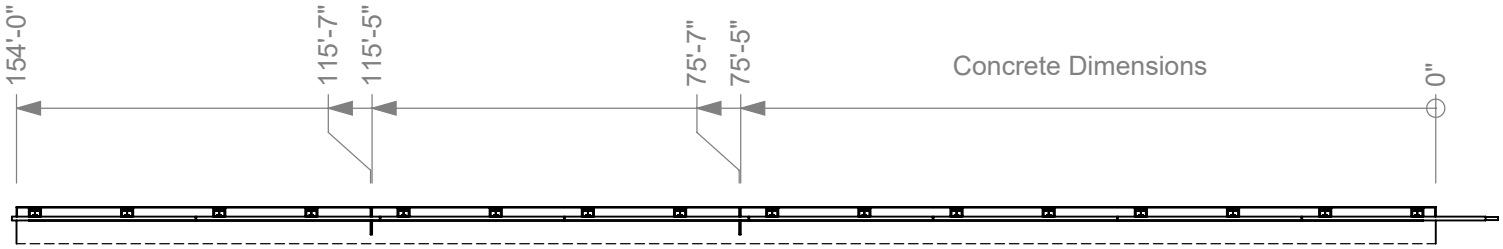
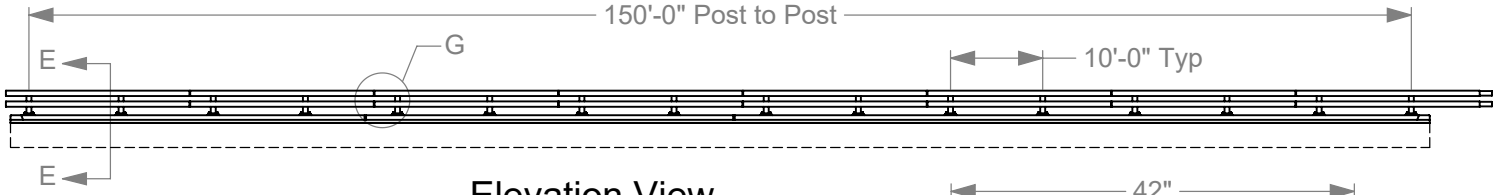
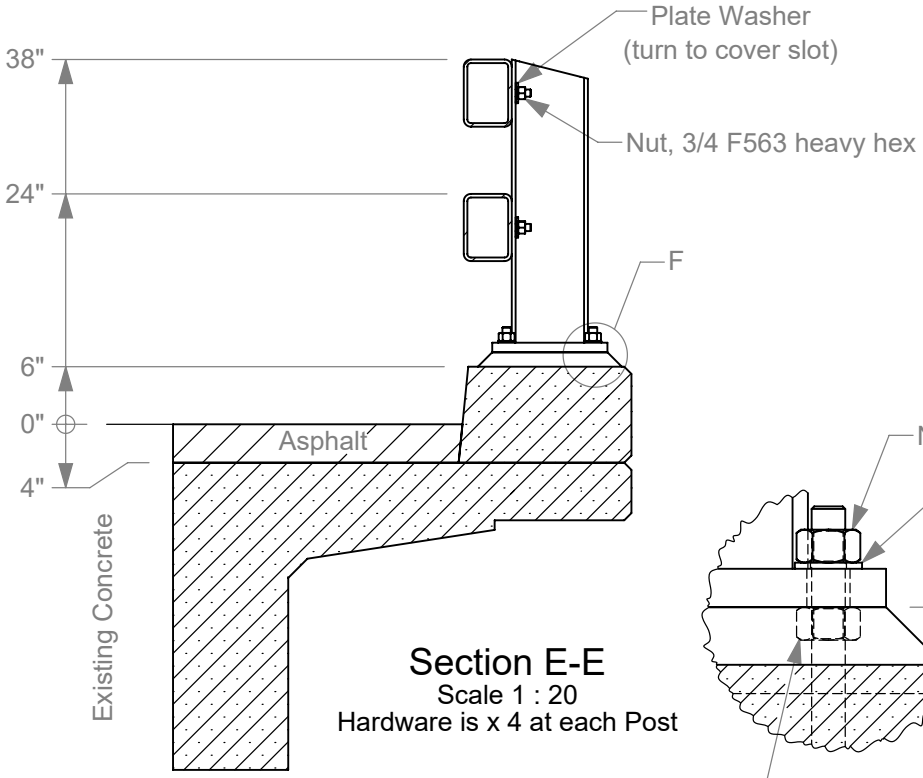
Bridge Rail Details



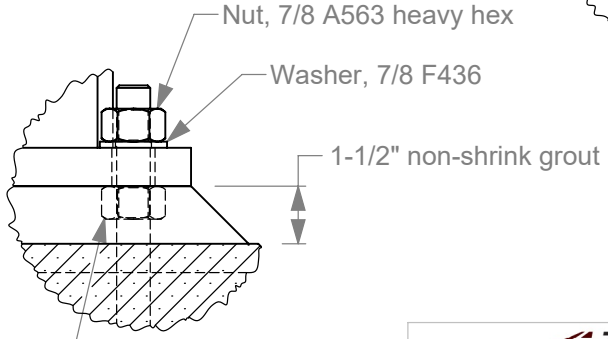
Plan View



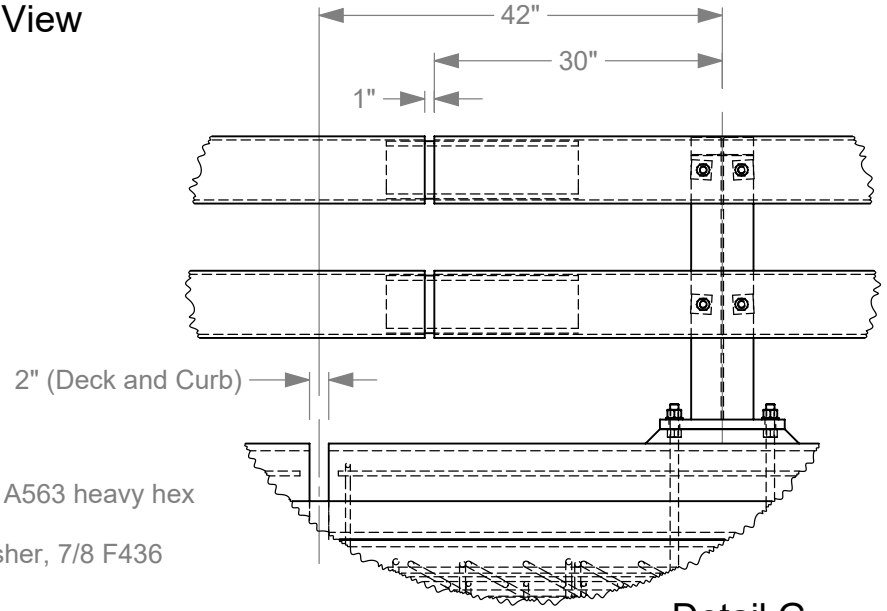
Elevation View



Section E-E
Scale 1 : 20
Hardware is x 4 at each Post



Detail F
Scale 1 : 5



Detail G
Scale 1 : 20
Typ each Rail joint (7)
and Deck and Curb joint (2)

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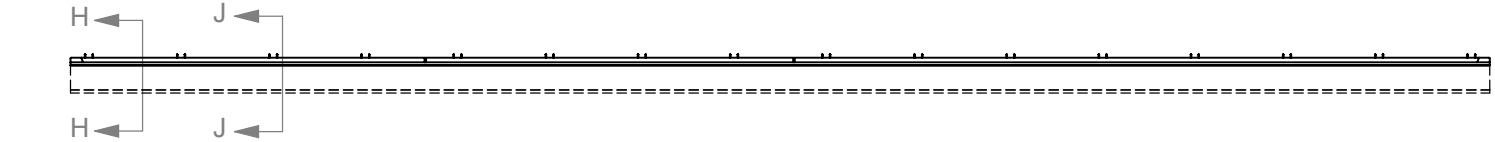
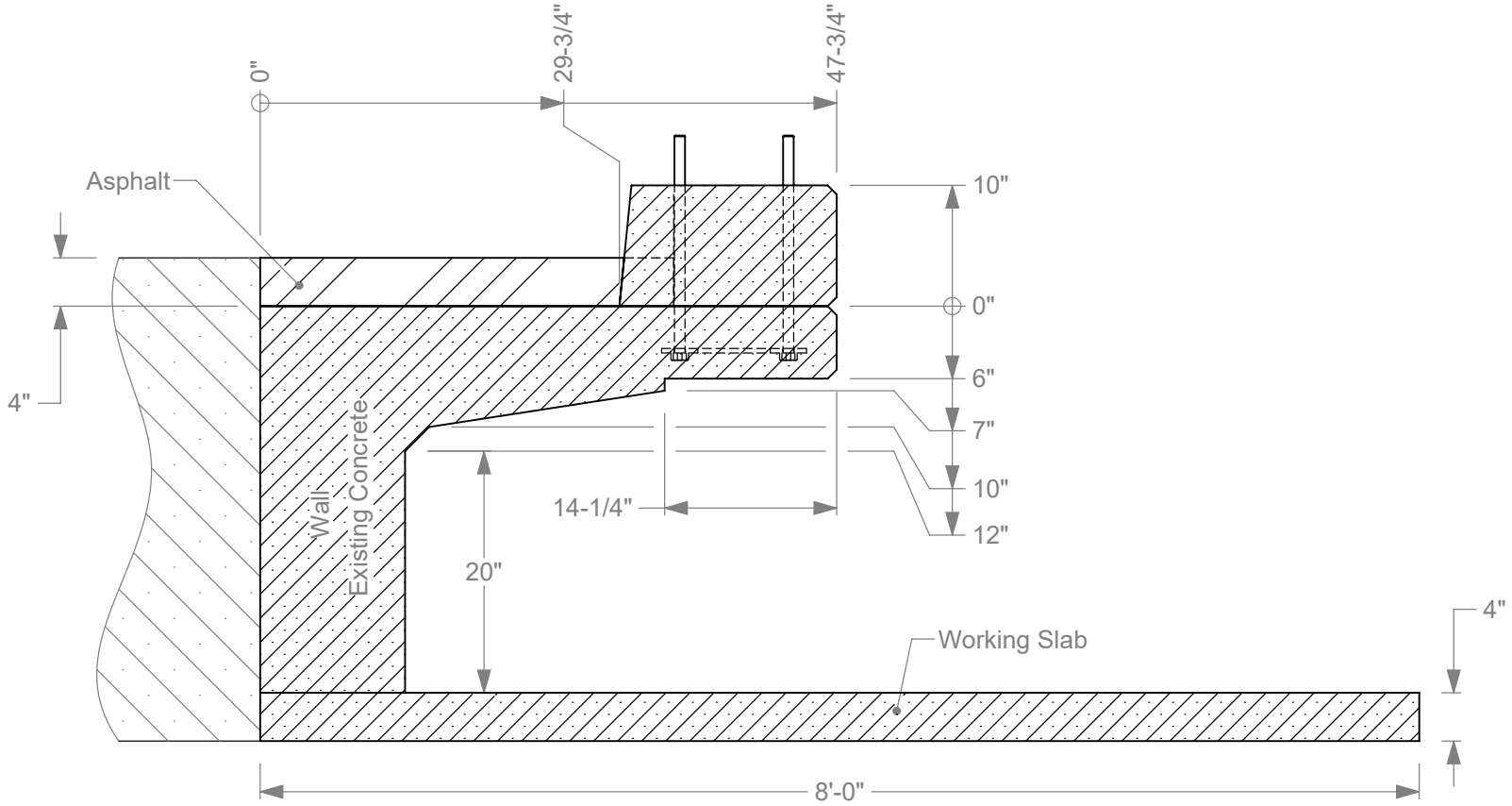
Concrete Details, Elevation



see next sheet



Section J-J

Scale 1 : 15

4a. Concrete Strength is 5000psi for the Wall and Deck, 3000 psi for the Working Slab, and 4000 psi for the Curb.

4b. Chamfer Field Side edges of Deck, and field side and top edges at end of Curb 3/4" each way as shown.

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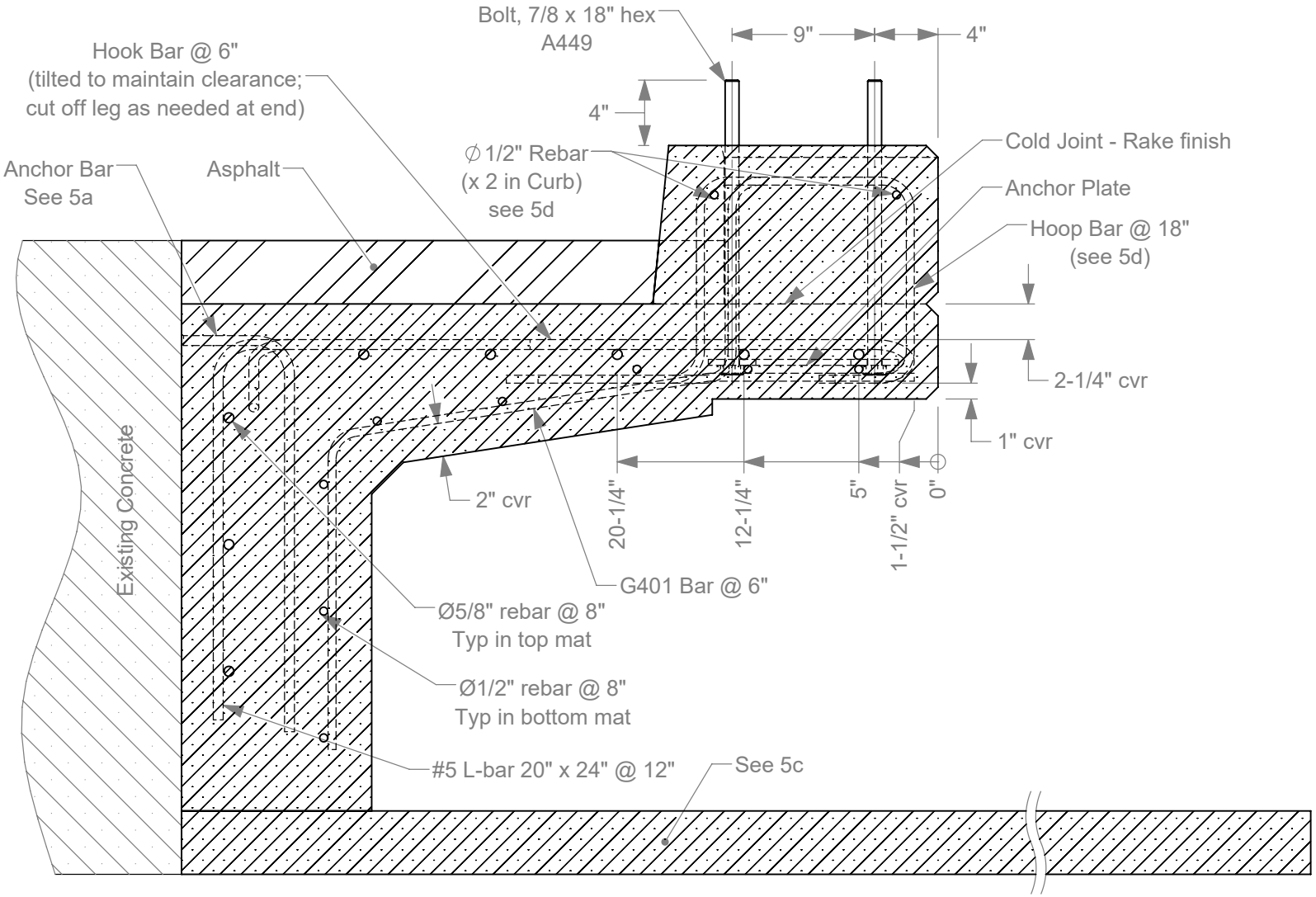

Section H-H

Scale 1 : 10

5a. Place the Anchor Bars @ maximum 18" spacing and secure to existing rebar protruding from the runway with minimum 3" weld. (Existing rebar not shown here.)

5b. Minimum rebar lap is 24" for #4 bars and 30" for #5 bars.

5c. Place one mat of Ø1/2 (#4) bars in Working Slab @ 12" each way with ≈1-1/2" cover at top. These bars are not shown here.

5d. Field bend traffic side longitudinal bar and turn Hoop Bars at ends of Curb to maintain cover.

5e. The Anchor Bars will be bare steel, and the bars in the Working Slab may be bare steel. All other bars shall be epoxy coated, and all bars are grade 60.

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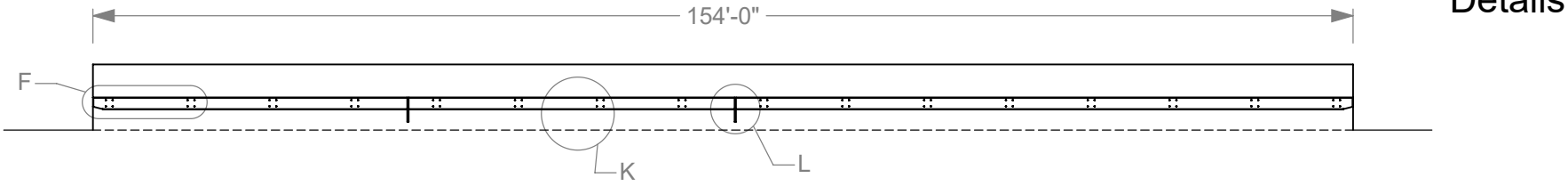
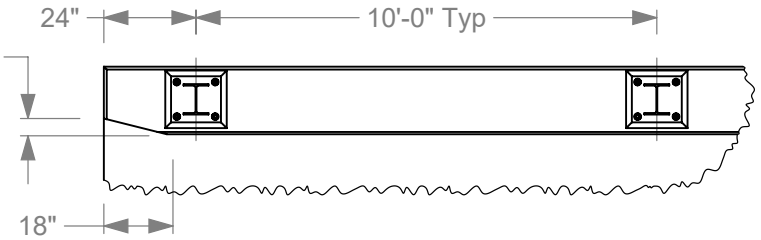
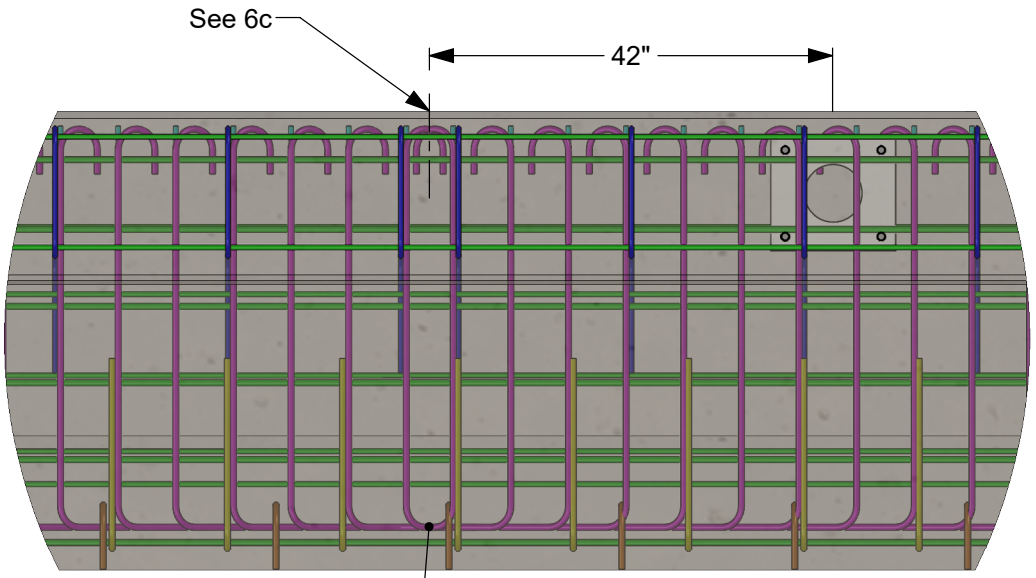
Details, Plan

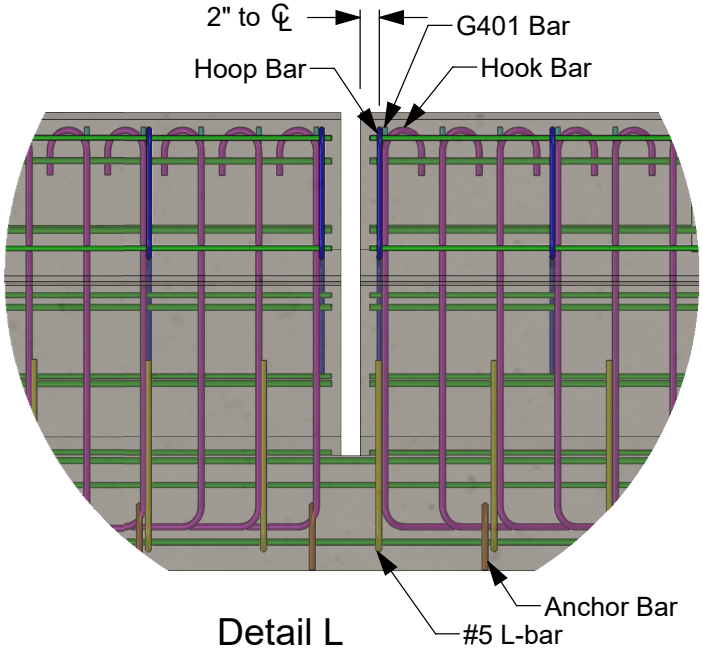




Detail F
Scale 1 : 50
Typ each end



Detail K
Scale 1 : 20



Detail L
Scale 1 : 20
Typ each Joint

6a. Concrete Strength is 5000psi for the Wall and Deck, 3000 psi for the Working Slab, and 4000 psi for the Curb.

6b. Chamfer Field Side edges of Deck, and field side and top edges at end of Curb 3/4" each way as shown.

6c. Rebar placement shown in Detail View at joint is typical each joint. Adjust spacing and Hook Bar direction as needed at location shown.

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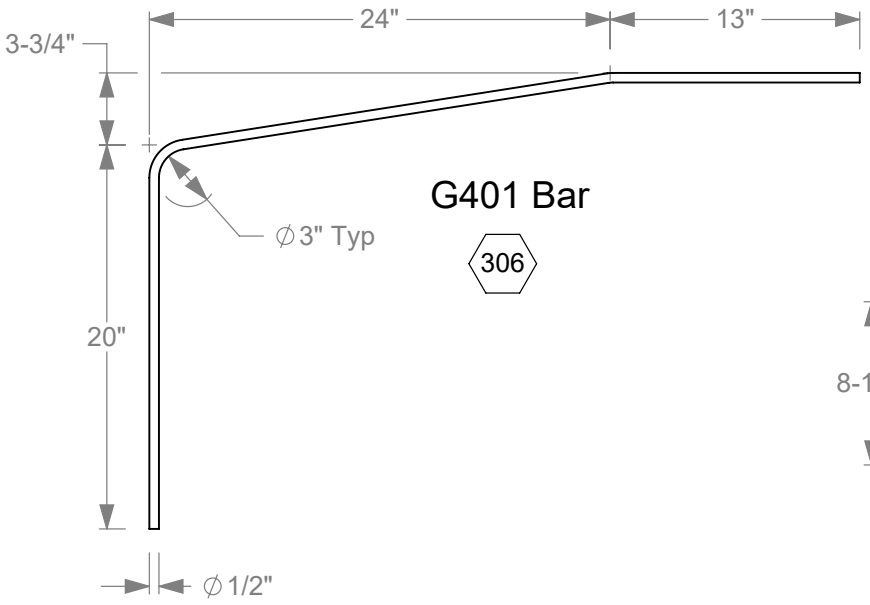

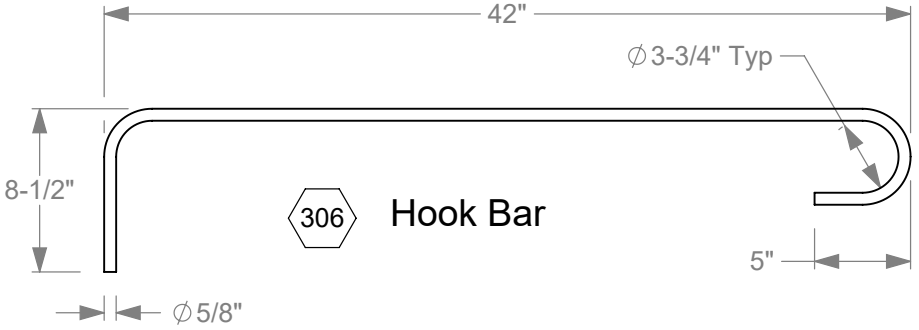

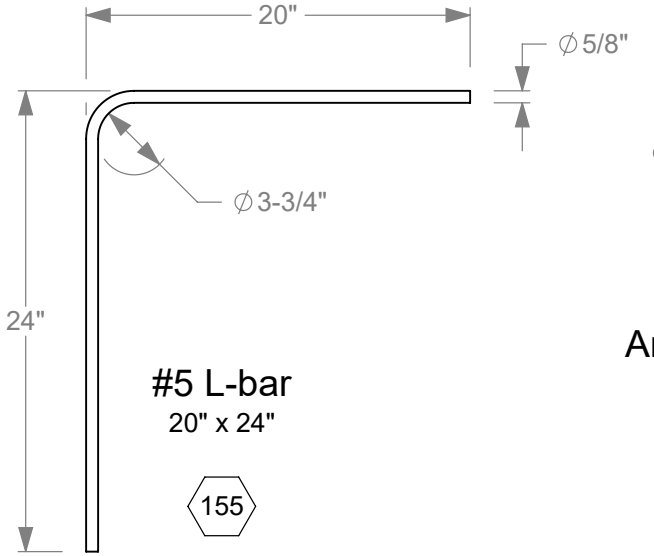

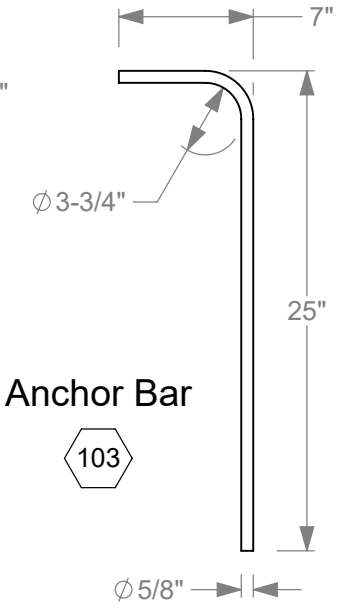

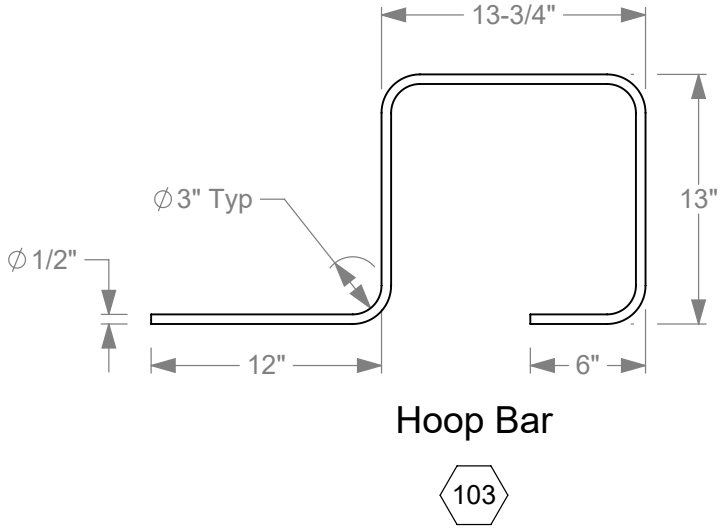

7a. All bent bars, and all longitudinal bars in the Curb, Deck and Wall shall be epoxy coated. All bars are grade 60..

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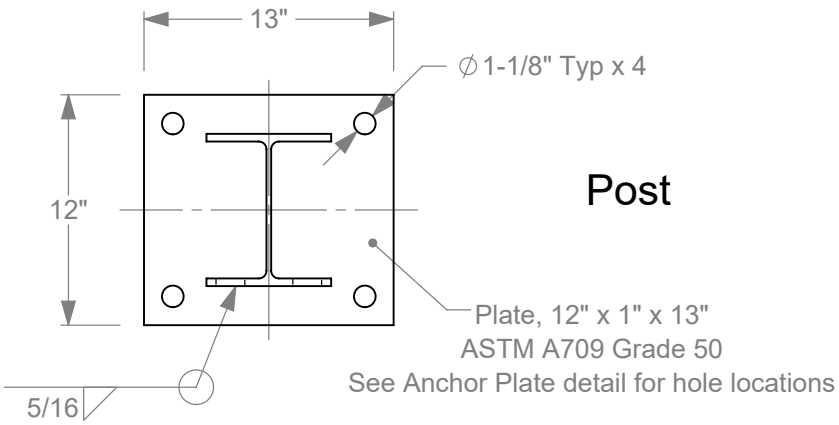
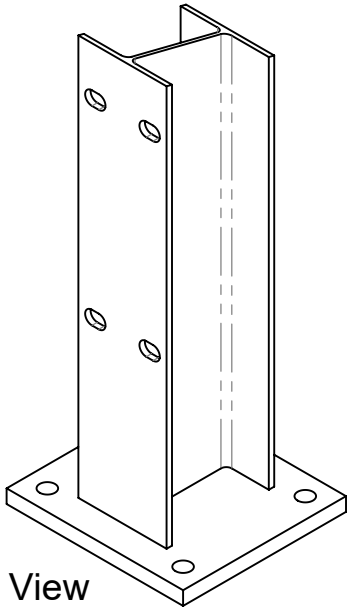


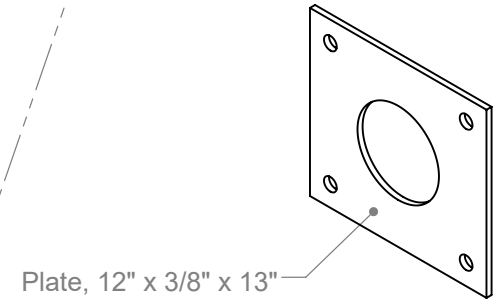
Post

Plan View

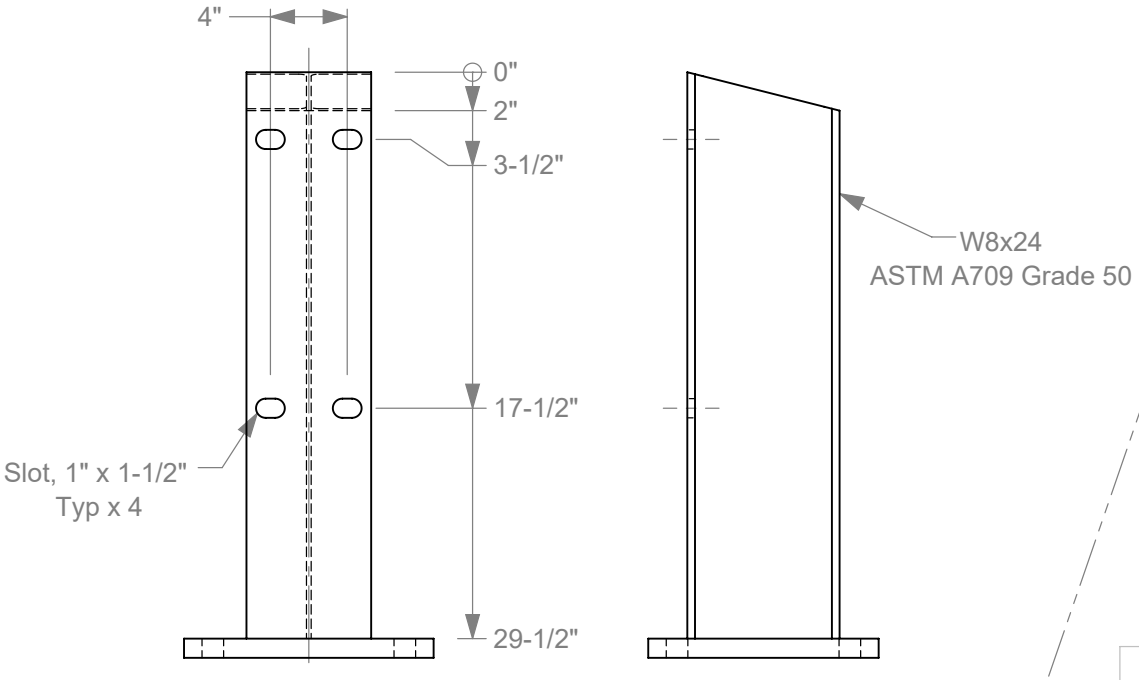


Isometric View

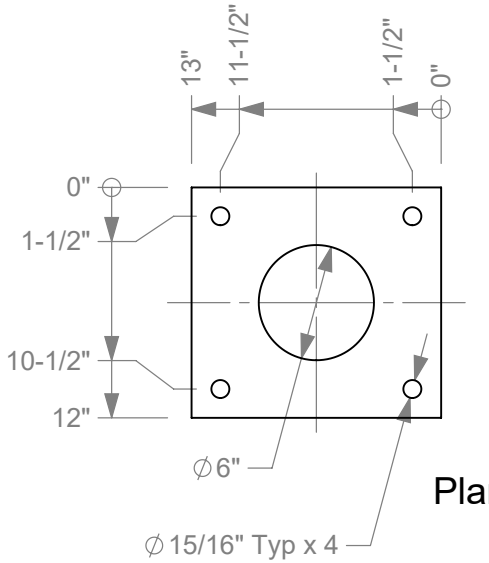
Anchor Plate



Isometric View



Elevation Views



Plan View

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Drawn by GES	Scale 1:10	Sheet 8 of 13 Post and Anchor Plate

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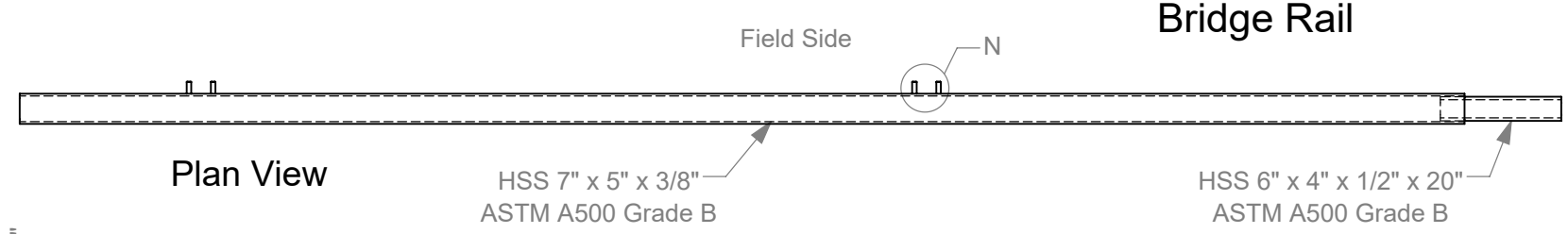
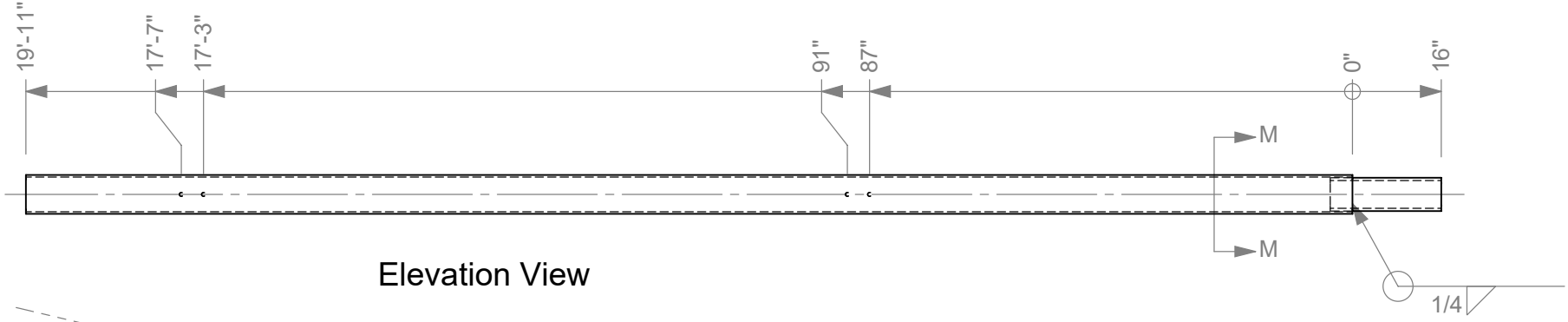
Bridge Rail



Plan View



Elevation View

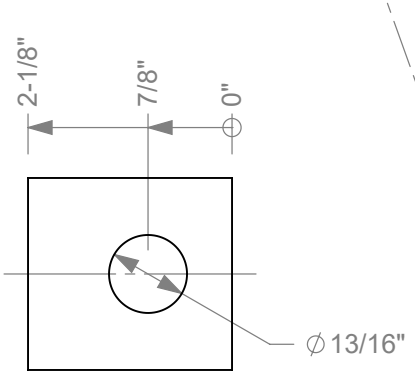
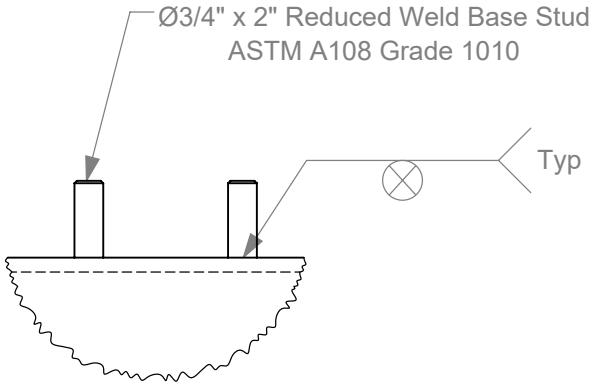


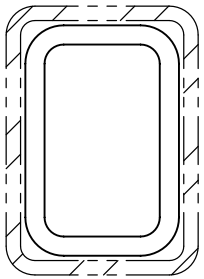
Plate Washer

Plate, 2" x 1/4" x 2 1/8"
ASTM A709 Grade 36



Detail N

Scale 1 : 5



Section M-M

Scale 1 : 5

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Drawn by GES	Scale 1:30	Sheet 9 of 13 Rail and Plate Washer

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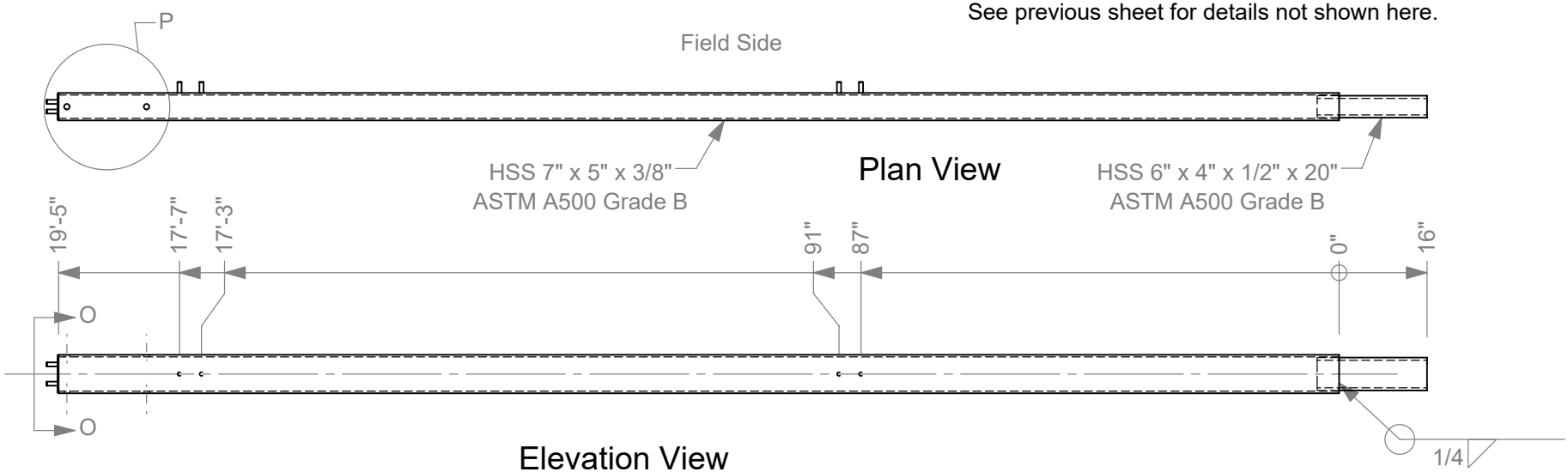
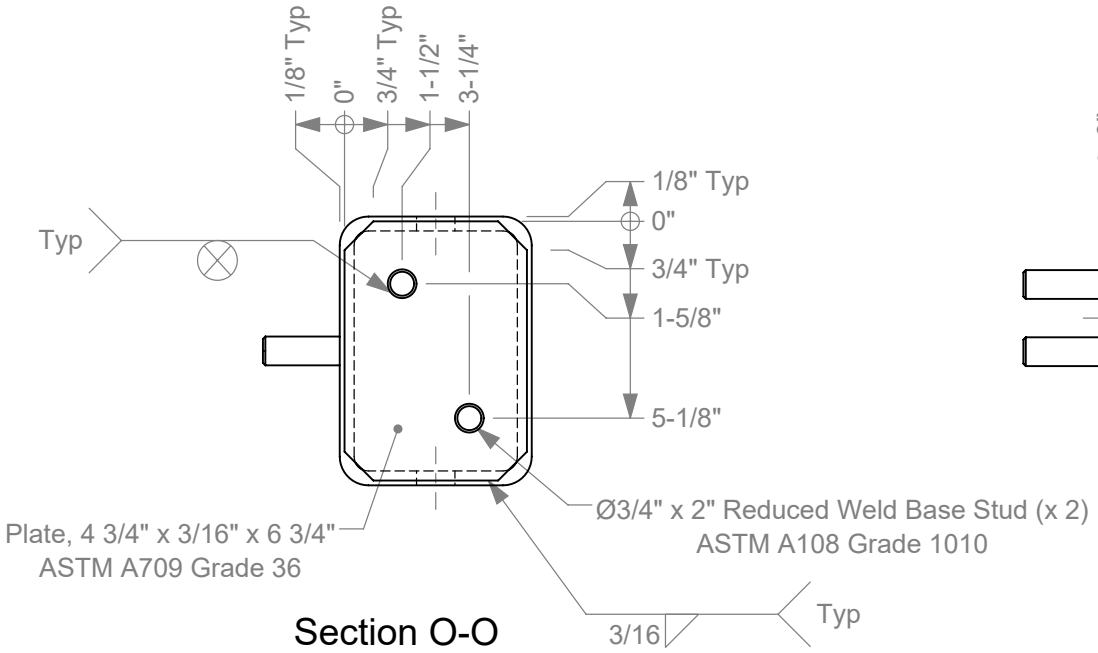
Transition Rail

See previous sheet for details not shown here.



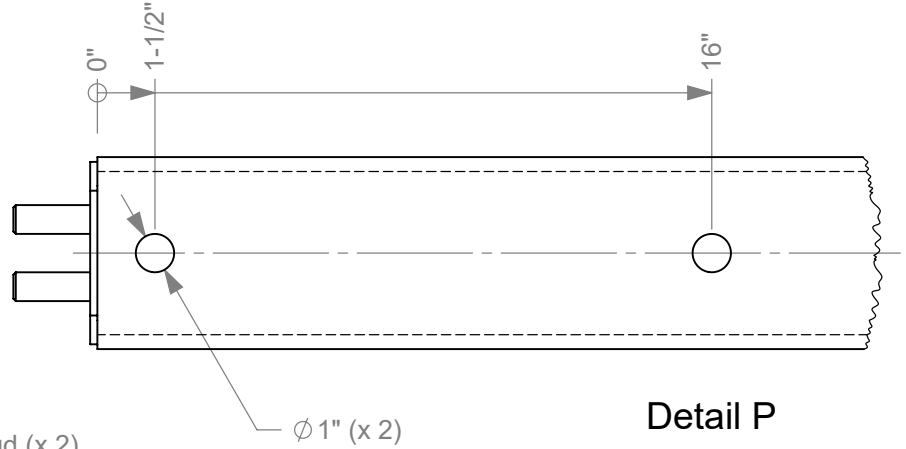
Plan View

Elevation View



Section O-O

Scale 1 : 5



Detail P

Scale 1 : 5

Texas A&M Transportation Institute	Roadside Safety and Physical Security Division - Proving Ground	
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Drawn by GES	Scale 1:30	Sheet 10 of 13 Transition Rail

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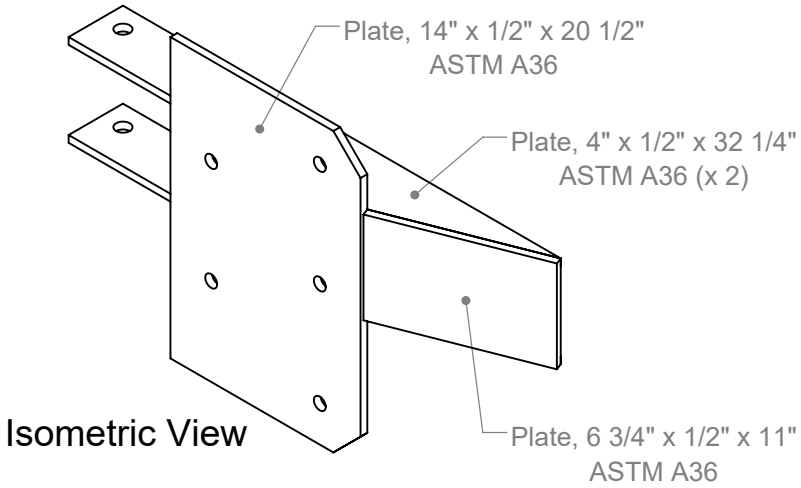
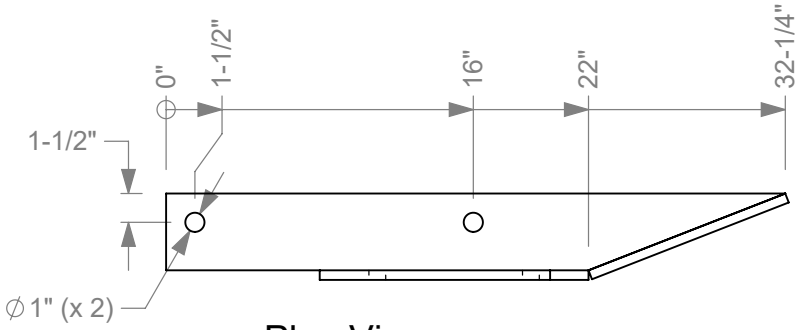
Guardrail Connection



Isometric View



Plan View

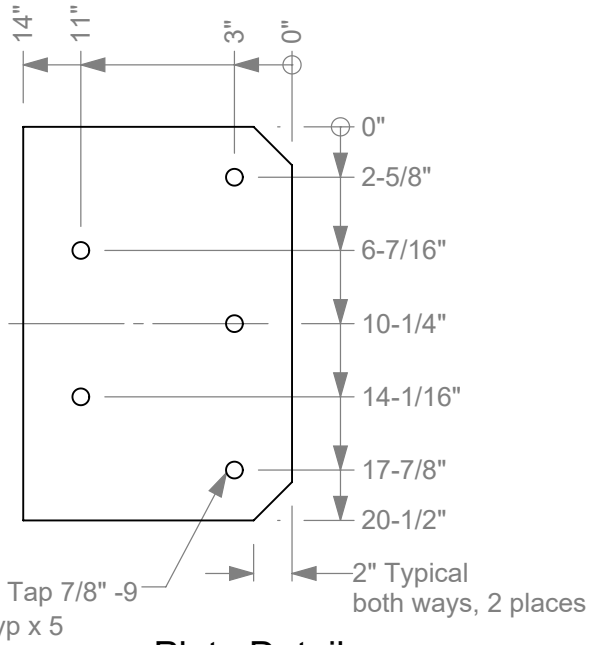
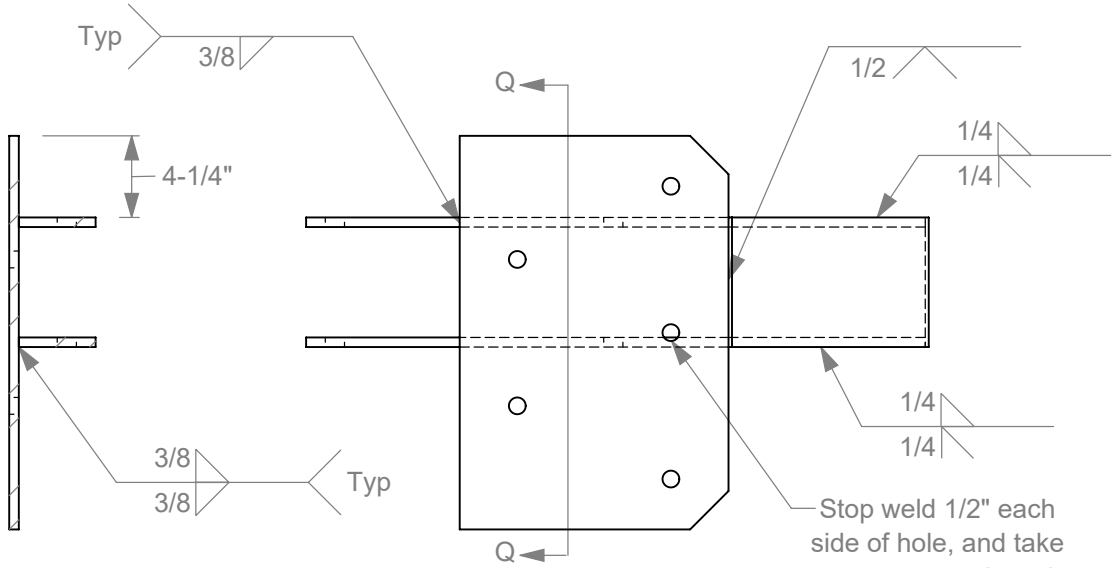


Plate Details



Section Q-Q

Elevation View

11a. All welding must be performed by certified welders using industry standard practices.
11b. Galvanize all components after fabrication is complete.

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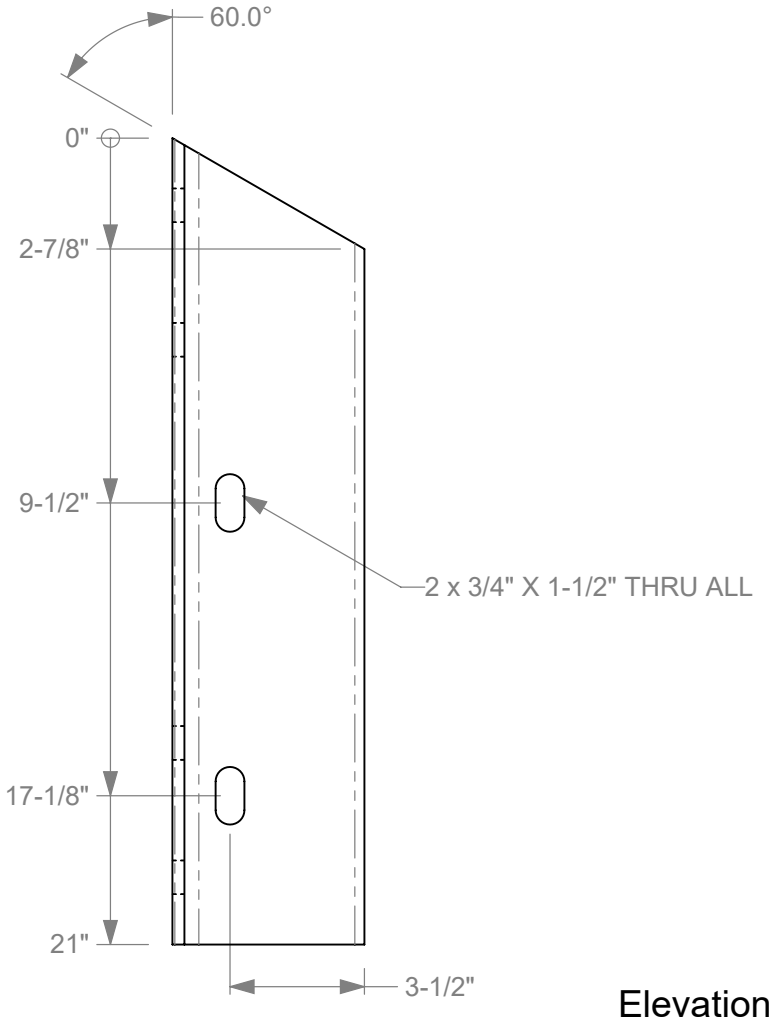
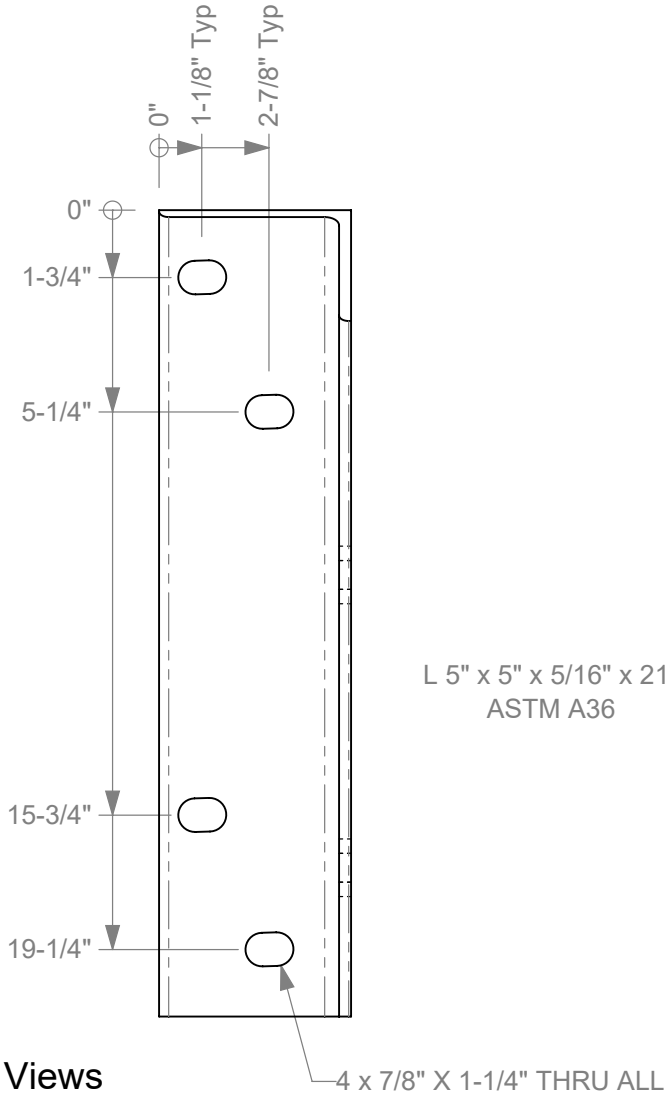
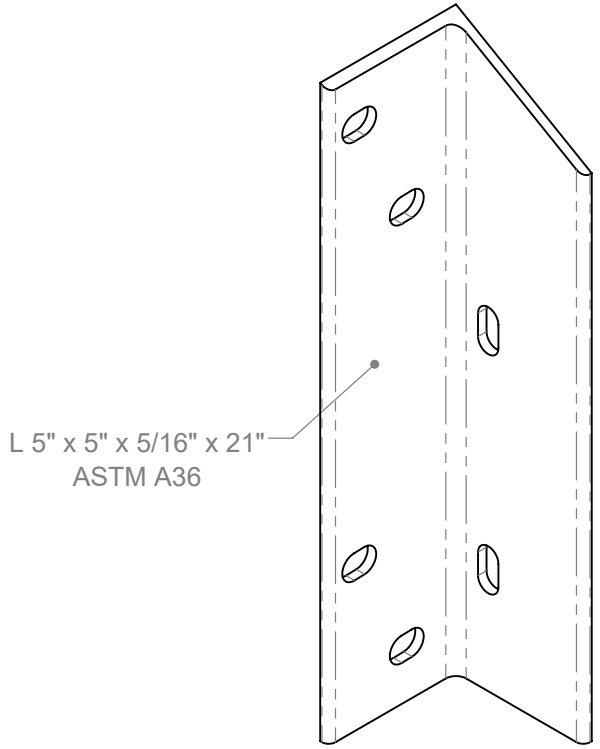
Transition Angle





Elevation Views



Isometric View

12a. Galvanize after fabrication is complete.

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Drawn by GES	Scale 1:5	Sheet 12 of 13 Transition Angle

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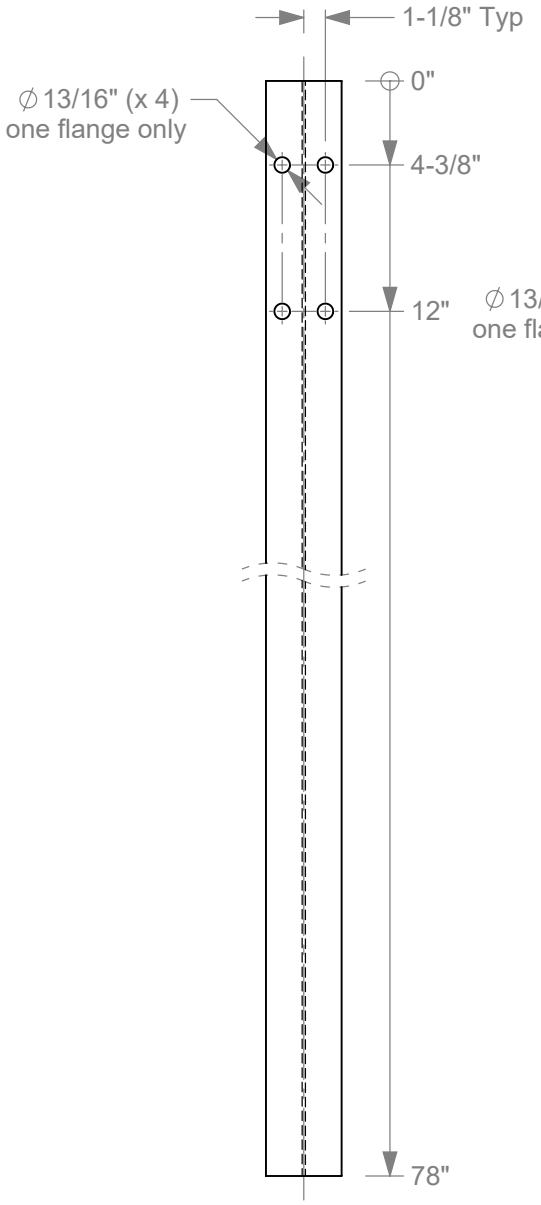
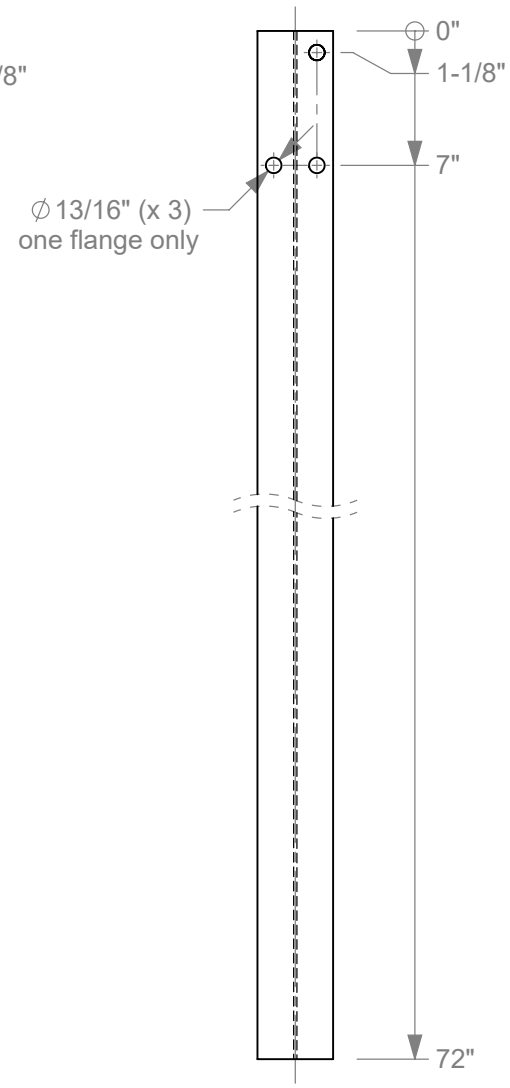
Posts and Blockouts



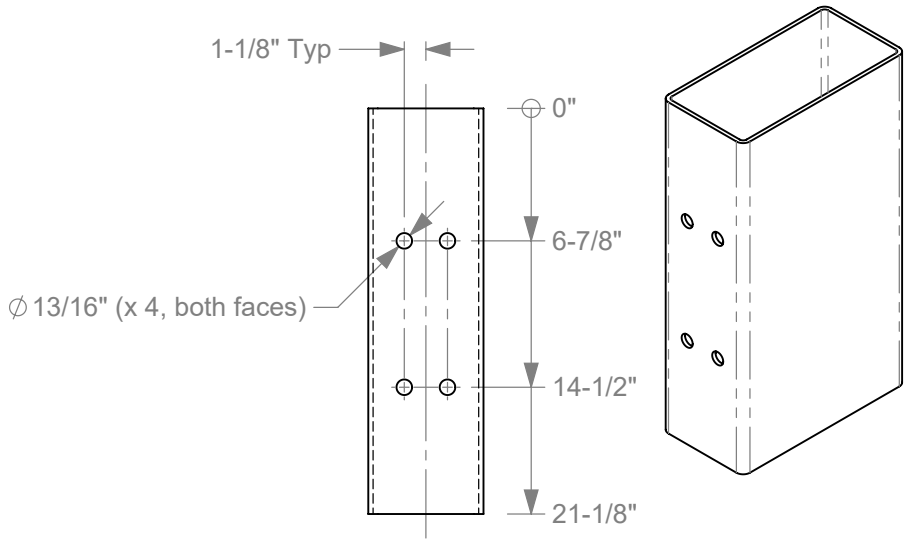
Transition Post

W6x8.5 x 78"
ASTM A992 Steel
(at 9 - 15)



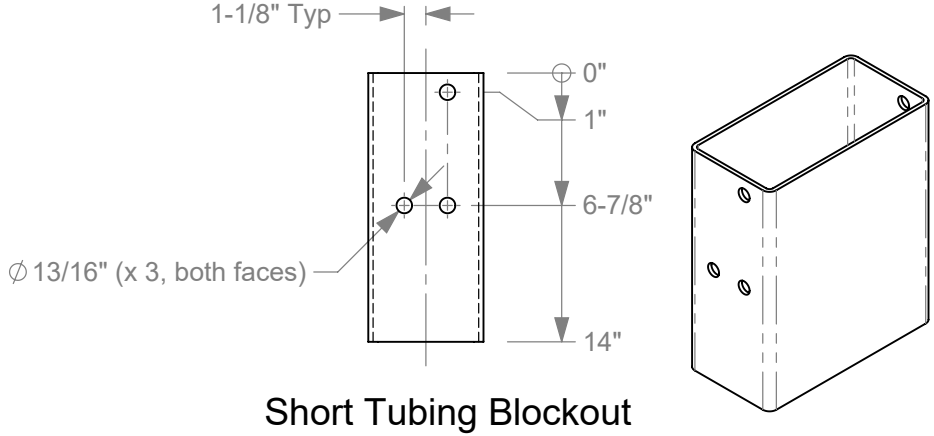
Posts 7 and 8

W6x8.5 x 72"
ASTM A992



Long Tubing Blockout

HSS 12" x 6" x 1/4"
ASTM A500 Grade B



Short Tubing Blockout

HSS 12" x 6" x 1/4"
ASTM A500 Grade B

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Drawn by GES	Scale 1:10	Sheet 13 of 13 Posts and Blockouts

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