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Project Name: **Engineering Support Services and Recommendations for Roadside Safety Issues/Problems for Member States**

Sponsor: **Roadside Safety Pooled Fund**

Task 21-13: **Illinois Transition Block Out Comparison with Alaska MASH TL-3 Transition Design**

DATE: **April 08, 2022**

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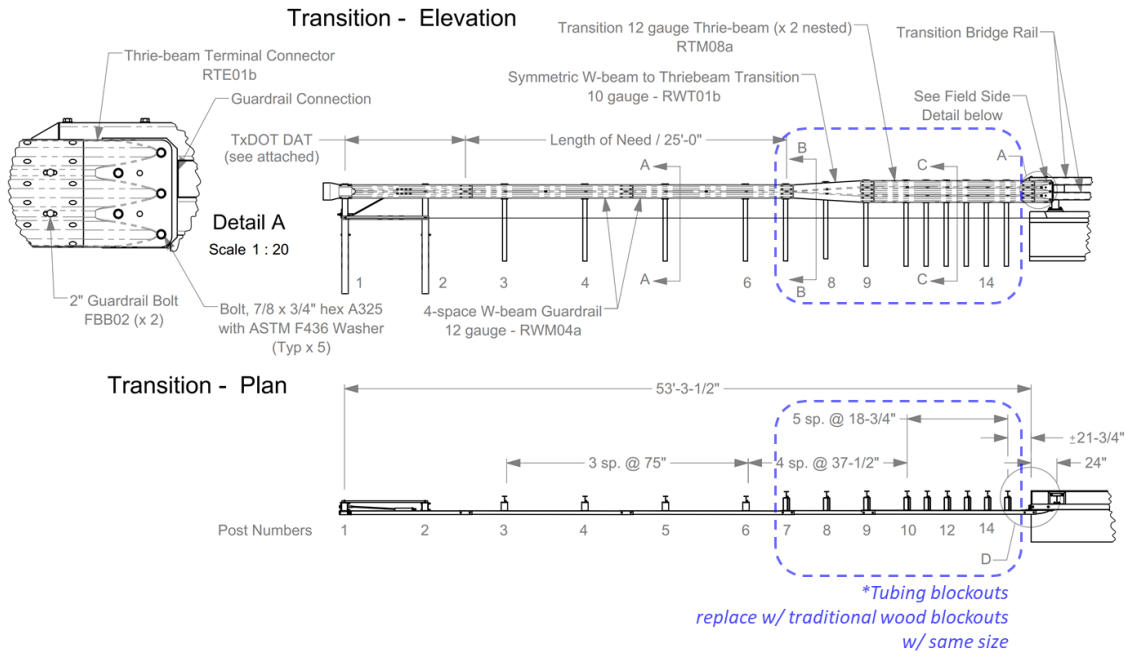
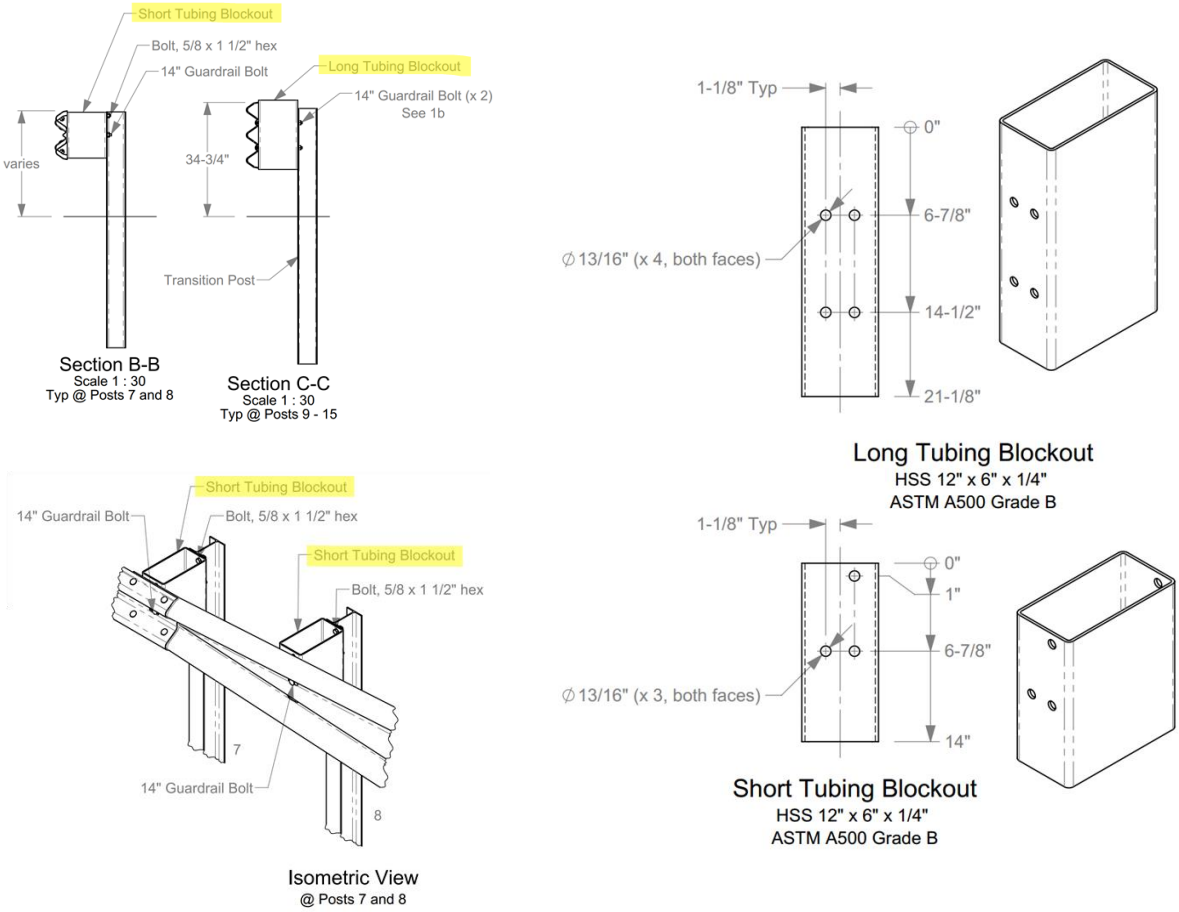
Overview/Problem Statement

Illinois Department of Transportation (ILDOT) is working to develop their own transition standard for the IL Steel Bridge Railing, Type CO-10. We understand ILDOT would like to use the Alaska MASH TL-3 transition successfully crash tested as part of the new Alaska 2-Tube Bridge Rail designed and tested at TTI in 2020 (Test Report No. 608331-4-6). The transition developed for this project utilized HSS steel hollow structural tubing blockouts. ILDOT would like to use wood blockouts of the same size instead of the HSS steel sections that were crash tested for the Alaska project. We understand all the other features and details of the Illinois transition will remain the same as the as-test design.

An overview of the Alaska transition and the details of the HSS tubing blockouts are presented in Figure 1. Figure 2a shows the details of the current Illinois 2-tube bridge rail bridge rail. These details are taken from the Colorado Type 10 Bridge Rail which was successfully crash tested here at TTI to MASH TL-4 in May 2020 (TTI Project 609761). Figure 2b shows the details of the Alaska 2-Tube Bridge Rail which was successfully crash tested here at TTI to MASH TL-4 (TTI Project No. 608331-1-3).

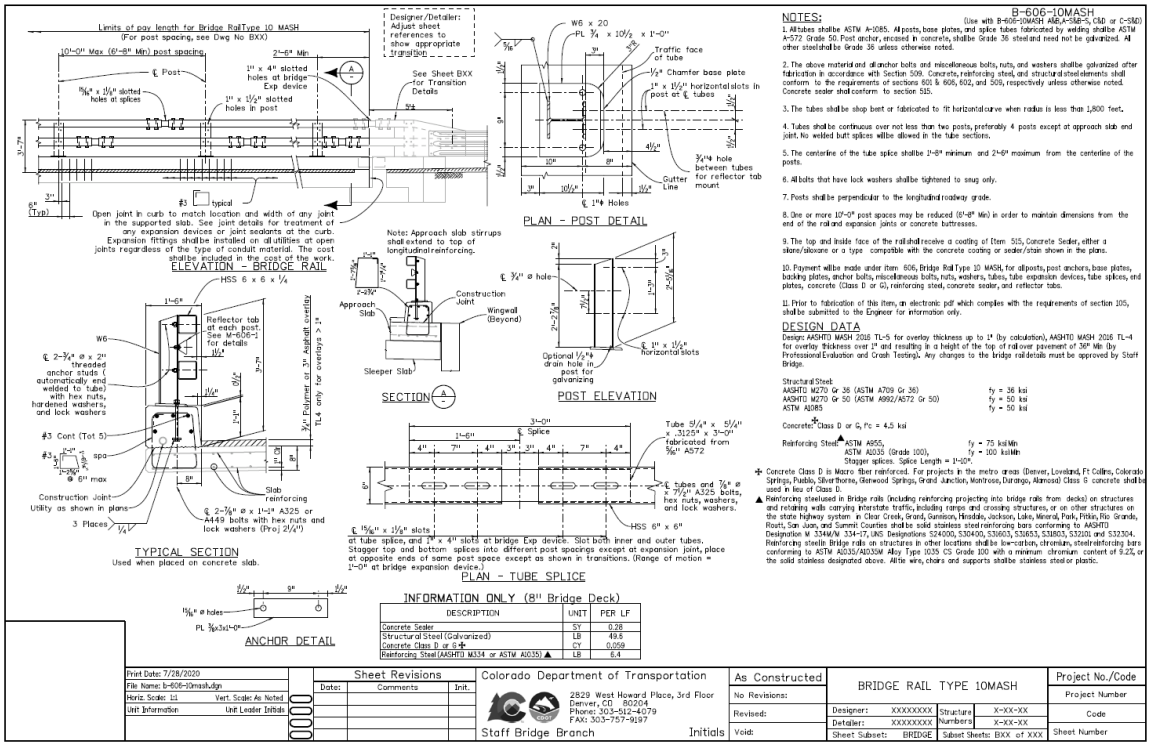


(a) Transition overview

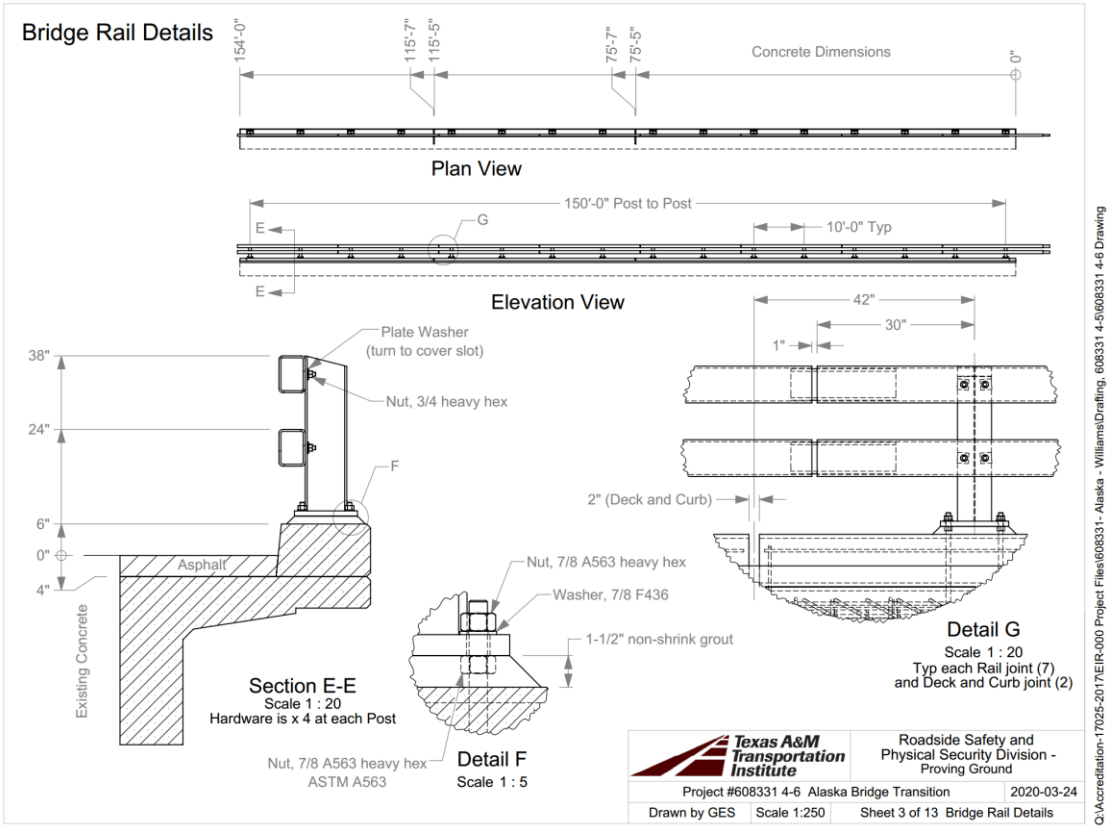


(b) Tubing blockout details

Figure 1. Overview of Alaska Transition and Tubing Blockouts



(a) Illinois Type 10 2-Tube Bridge Rail



(b) Alaska 2-Tube Rail

Figure 2. Illinois and Alaska Steel Railing

Crash Tests Performed on Alaska Transition

The Alaska Thrie-Beam transition design shown in Figure 1 was successfully crash tested with respect to MASH TL-3. The total length of the installation was approximately 207 ft-3½ inches with 53 ft-3½ inches transition and 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 top of the upper bridge rail was 38 inches above the bridge deck.

Posts 3 through 6 were 72 inches long (embedded 40 inches), posts 7 and 8 were 72 inches long with, 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 tubing blockouts, and posts 9 through 15 were fitted with 12-inch deep, long (21⅛ inches) steel tubing blockouts.

Table 1 shows the test conditions and evaluation criteria for MASH TL-3 transitions. Please refer to the MASH Specifications for additional information.

Table 1. Test Conditions and Evaluation Criteria Specified for MASH TL-3 Transition.

Test Article	Test Designation	Test Vehicle	Impact Conditions		Evaluation Criteria
			Speed	Angle	
Transitions	3-20	1100C	62 mi/h	25°	A, D, F, H, I
	3-21	2270P	62 mi/h	25°	A, D, F, H, I

Two crash tests (Tests 3-20 and 3-21) were performed in the immediate transition area just upstream of the end of the bridge rail. A third crash test, MASH Test 3-21, was performed upstream of the symmetric thrie beam to w-beam transition section. The CIP for this test was 7.3 feet upstream of the centerline of Post 7 as shown in the drawings and photos here. All three crash tests performed on the new transition design met the performance of MASH Test Level 3. Figure 3 below shows the transition before crash testing. Figures 4 through Figure 6 shows the transition after the crash tests, 3-20, 3-21 (both in the immediate transition area) and 3-21 (upstream of the symmetric thrie beam to w-beam transition section) were performed.

Texas A&M Transportation Institute Professional Opinion on Replacing Alaska Transition HSS Tubing Blockouts with Traditional Wood Blockouts of the Same Size and Shape

It is our professional opinion that the transition will work equally well with the wood blockouts of the same size and shape in lieu of the tested steel tubular blockouts. There has been extensive MASH testing using 12-inch wood blockouts in w-beam and thrie beam transitions. We are not aware of any issues or unexpected failure of wood blockouts causing undesirable performance with respect to the MASH Specifications in these applications. A technical memorandum was

prepared in July 2020 by Midwest Roadside Safety Facility (MwRSF) for Central Federal Lands Highway Division recommending equivalent steel blockouts for approach guardrail transitions that utilize wood blockouts. In this memorandum, steel tubular blockouts were designed to be crashworthy alternatives to wood blockouts used in crashworthy approach guardrail transitions. Please refer to the technical memorandum entitled "Equivalent Steel Blockouts for Approach Guardrail Transitions" and dated July 14, 2020 included with the professional opinion.

Figure 3. Alaska 2-Tube Bridge Rail Thrie Beam Transition prior to Testing

Figure 4. MASH Test 3-20 (Test NO. 608331-01-4)

Figure 5. MASH Test 3-21 (Test NO. 608331-01-5)

Figure 6. MASH Test 3-21 (Test NO. 608331-01-6)