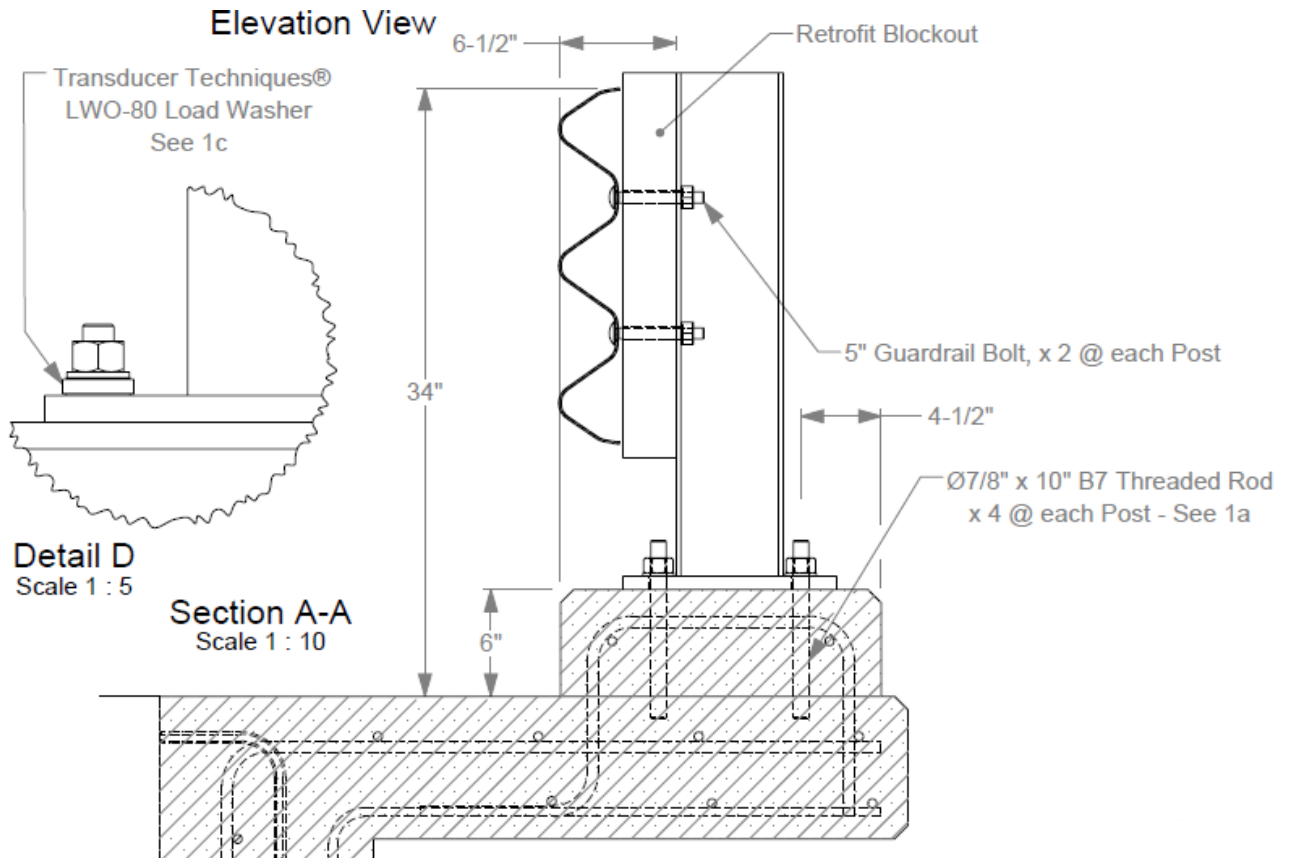


Project Title:

Phase 2 Thrie Beam Retrofit – Application of New Design without a Curb for MASH TL-3 and Performance and Improvements for MASH TL-4

TTI has designed and successfully crash tested a new thrie beam retrofit bridge rail design for Phase 1 to be used on obsolete bridges. Details of the Phase 1 crash tested design are as follows:



Project Synopsis:

For this as-tested design, the post spacing was 3 feet and 1 ½ inch on centers. The design utilized a single 10 gage thrie beam rail element with wood blockouts. The post size was W6x15. Load washers were used in the impact region for MASH Test 3-11 to measure the tension forces transmitted from the posts to the anchor bolts in the curb. It is understood that actual conditions on bridges may vary from this as-tested design. Several conditions such as taller curb, wider curb, changes in deck thickness and reinforcing steel, and the location of existing obsolete bridge rails left in place behind the new thrie beam retrofit can be addressed using separate analyses and professional opinions by the project team. However, a few conditions were selected for LS-DYNA simulations for this Phase 2 project. These conditions are as follows:

Conditions for LS-DYNA simulations:

- 1.) No curb for MASH TL-3 (MASH Test 3-10 and 3-11).
- 2.) LS-DYNA simulations of the AS-Tested Thrie Beam Retrofit for MASH TL-4 (MASH Test 4-12).
- 3.) If performance issues occur in Items 1 and 2 above, make recommendation(s) for improving the performance for each with respect to MASH TL-3 (Item 1) and MASH TL-4 (Item 2). Present any changes to the as-tested design to the research team, decide on changes, and perform LS-DYNA simulations on the modified designs.

The purpose of this project will be to perform LS-DYNA simulations on the as-tested design using no curb for MASH TL-3. If necessary, modification(s) will be made to the design to improve

	performance for MASH TL-3. In addition, LS-DYNA simulations will be performed on the as-tested design for MASH Test 4-12. If necessary, modification(s) will be made to the design to improve performance for MASH Test 4-12.
Project Goal(s):	Develop details for: 1.) Thrie Beam Retrofit without a curb for MASH TL-3 2.) Determine if modification(s) are needed to the as-tested design for MASH TL-4 3.) Full-scale crash tested will be required in another phase for this project.
Project Background:	TTI has successfully crash tested a new retrofit thrie beam bridge rail for Phase 1. Further engineering analyses and LS-DYNA simulation(s) are needed to determine if the as-tested design is acceptable as-is for MASH TL-4. Further analyses and simulation(s) are needed to determine if the as-tested design is acceptable for MASH TL-4.
Proposed Work Plan: Work with TTI	1.) Task 1 – Engineering Design 2.) Task 2 – Drafting and detailing 3.) Task 3 – LS-DYNA simulation of Thrie Beam Retrofit without a curb for MASH TL-3 4.) Task 4 – LSDYNA simulation of Thrie Beam Retrofit for MASH Test 4-12
Deliverables:	Brief letter report summarizing the simulation efforts, design, and details for both the no curb MASH TL-3 design and the MASH TL-4 design (2 designs). Professional opinions (separate tasks for each) will also be provided for the following conditions: 1.) Taller curb (approx. 9 inches) 2.) Wider curb (approximately 24 inches) 3.) Substandard bridge deck conditions (thinner deck, less reinforcing, lower compressive strength (1 case included here for this problem statement) 4.) Existing obsolete bridge rails that are left in place, i.e., reviewing the working width from the TL-3 crash test to determine if existing rails left in place will influence performance).
Urgency and Expected Benefit:	New Thrie Beam Bridge Rail Retrofit for a specific bridge application that meets the crash requirements of MASH TL-3 without a curb. Also, what changes are needed (if any) to the as-tested design to improve performance for MASH TL-4.
Problem Funding and Research Period: Work with TTI	Total Estimated Cost = \$115,000 Task 1 – Engineering Design and Detailing – 4 months Task 2 – Drafting – 2 months Task 3 - Simulation of As-Tested Design without curb for MASH TL-3 (start 2/2022) – 6 months Task 4 – Simulation of As-Tested Design for MASH Test 4-12 (start 2/2022) – 6 months Total = 18 months
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