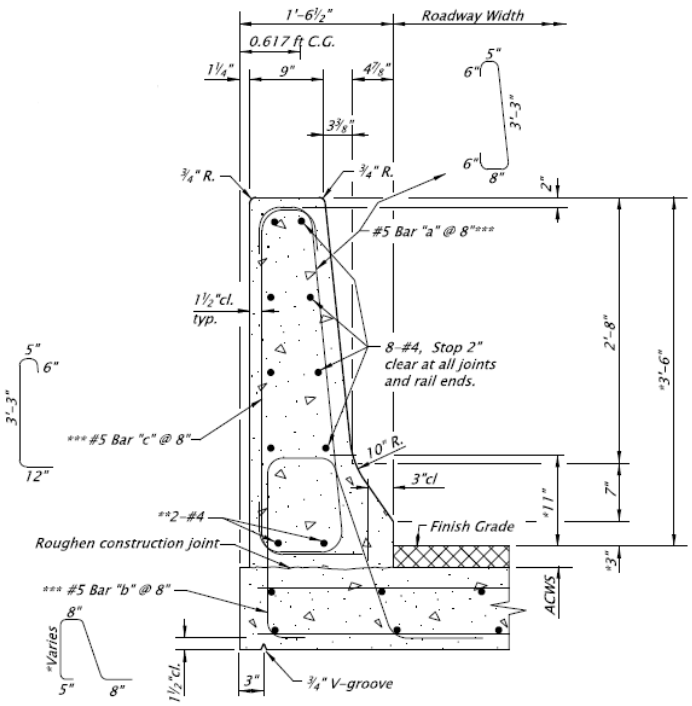
Roadside Safety Pooled Fund

Research Problem Statement

2019-34-BR

Project Title:	Resistance of Bolt-through anchor to Repeated Impact Loading
Project Synopsis:	State transportation agencies will need bridge rail retrofit option, bolt through connection, to attach tested concrete rail to existing bridge deck to bring the railing to acceptable performance level, MASH TL-4. However, after the 1985, Research Report 382-2F Response of Highway Barriers to Repeated Impact Loading: Concrete Barriers (https://library.ctr.utexas.edu/digitized/texasarchive/phase2/382-2f-ctr.pdf), there is no further study to conclude the proper detailing, size and grade of anchor bolt to be used to connect concrete rail to deck. When bolt-through connection is used, the yield line theory per AASHTO LRFD Section 13 is probably invalid, since the bridge rail is not rigidly connected to the deck (in order to achieve absolute rigid and continuous connection (there will be too many anchor bolts and not practical to construct). It is preferred that bolt-thru anchors, similar to what is shown here in the problem statement be widely spaced for ease of construction and costs and still meet the crash requirements of MASH TL-4. The load resistance and transfer of loading to the deck without excessive damage will be evaluated as part of this project. Furthermore, with the increase of MASH TL-4 load, if actual load observed in the anchor bolt will be measured from load transducer washers for use on other deck designs in the future.
Project Goal(s):	1. Provide an option to attach a 42-inch F-Shape MASH TL-4 tested concrete barrier 9see details herein), using 15-foot segment to an 8-inch concrete bridge deck. Details of the barrier with cast-in-place anchors is shown on the Typical Rail Section (WithThru Anchor Rods) herein. 2. Provide a bolted-thru deck connection to the concrete deck for 15-foot barrier sections cast directly on top of the concrete deck. 3. Determine the appropriate grade and size of anchor bolt to be used to avoid failure of the bolts and deck for MASH TL-4 impact conditions. 4. Determine the actual load transfer to bolt connection from the crash testing from instrumented load washers. Perform engineering analyses to determine anchor size and spacing for MASH TL-4 Impact conditions. 5. Provide a crashworthy design that can be used for MASH TL-4 impact conditions by all states needing a bolt thru barrier design. Provide loading information for bolts to be used for other deck designs.

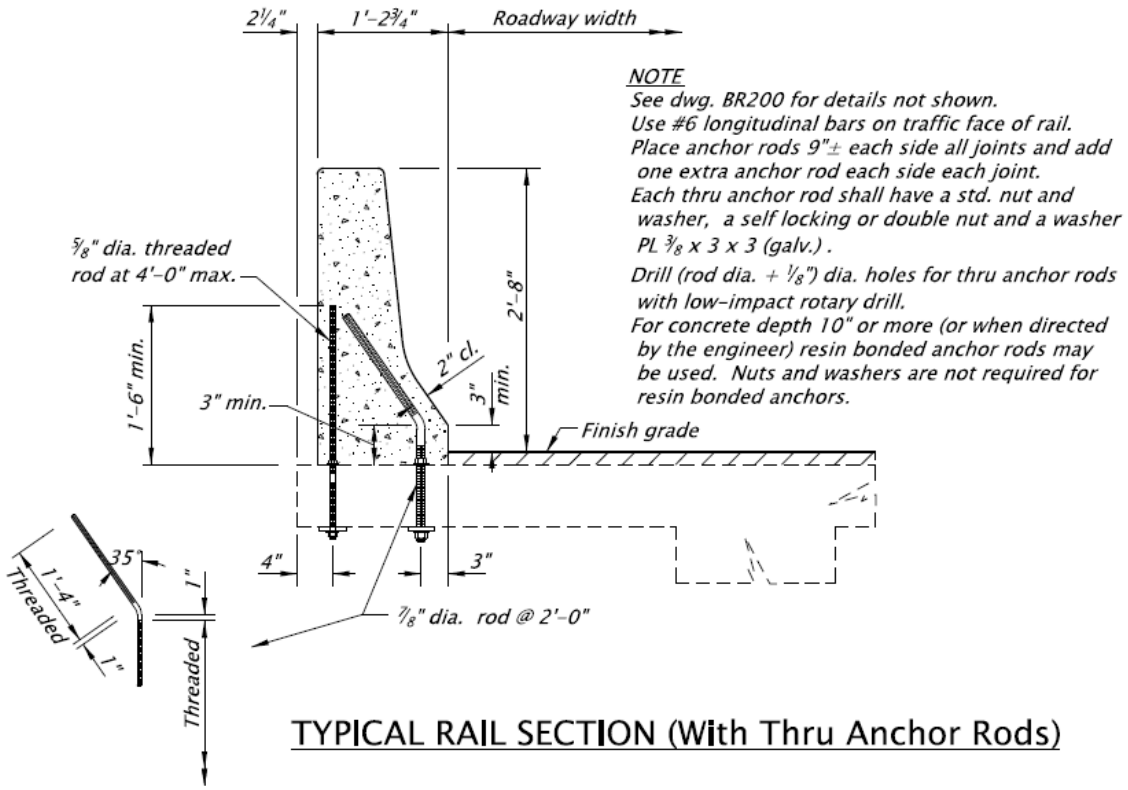


TYPICAL SECTION (FIXED FORMS)

Barrier Details for Project

Project Background & Details:

Utilize barrier details above using thru anchor bolts with size and spacing to be determine for this project. Utilize load transducing washers to measure bolt forces from MASH TL-4 Single Unit Truck Test (maximum force on anchor bolts).



TYPICAL RAIL SECTION (With Thru Anchor Rods)

Proposed Work Plan:	**Tasks:** 1.) Perform literature search on similar bolt-down barrier designs. 2.) Engineering Analyses Design, and Detailing of Barrier Anchorage 3.) Drafting & Detailing of Barrier Installation 4.) Construction of Test Installation with instrumented Load Washers (12) 5.) Perform Full-Scale Crash Testing 5a.) MASH Test 4-12 with instrumentation 5b.) MASH Test 4-11 no instrumentation 5c.) MASH Test 4-10 no instrumentation 6.) Prepare and Submit Full Test Report with instrumentation results
Deliverables:	TTI Suggestion: A report providing details of the test installation, documentation of the evaluation, the results of the tests performed, and the assessment of the results.
Urgency and Expected Benefit:	TTI Suggestion: Developer(s) of problem statement to complete this section.
Problem Funding and Research Period:	**Total Estimated Cost = $345,000** **Work Schedule:** (Project Duration = 10 months from initiation of the project) Task 1 = 1 months Task 2 = 3 months Task 3 = 1 months Task 4 = 7 months Task 5 = 0.5 month Task 6 = 2.5 months Total = 15 Months

	Name: Alex Lim (OR) Email: Alex.K.LIM@odot.state.or.us Phone: (503) 986-3402