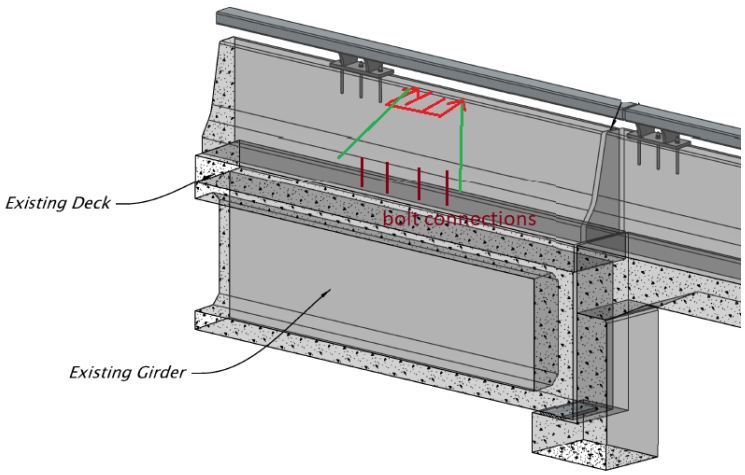
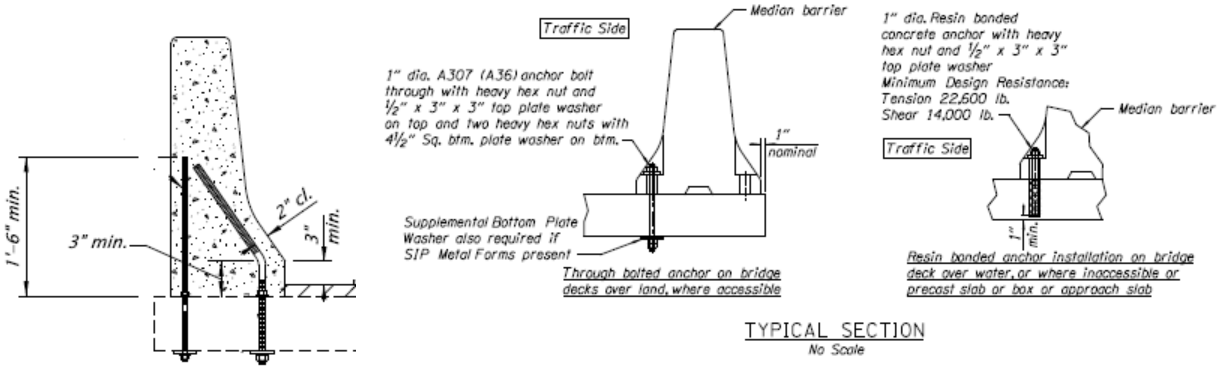
Roadside Safety Pooled Fund

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 connection, there will be too many anchor bolts and not practical to construct). If rigid connection is not a guarantee, it is important to determine the actual load transfer from the bridge rail to the bolt-through connection to properly design bolt connection and the deck overhang. Furthermore, with the increase of the MASH TL-4 design impact load, if actual load observed in the anchor bolt is not determined from testing, the design for the bolt-through anchor or resin bonded anchor per ACI for concrete anchor will not work.
Project Goal(s):	1. Provide an easy option to attach tested concrete rail to bridge deck shown below 2. Provide a connection option when the resin bonded anchor does not work on thin existing deck (<8in) with 3300psi concrete and poor reinforcing. 3. Determine the appropriate grade and size of anchor bolt to be used to avoid brittle failure. 4. Determine the actual load transfer to bolt connection. The yield line theory and design deck overhang for rail resistance shown is AASHTO LRFD Section 13 is not appropriate to be used for bolt connection where the rigid connection assumption is invalid. 5. Determine the limit of allowable bolt spacing, at/near joint, at mid wall, at end where concrete barrier is taper in width, to ensure load transfer to deck is achieve at any section (see sketch below). As shown, depend on the location and spacing, the load distribution could be over 3, or 4 or 5 bolts. If design by per ft basis, it will be overkill. 

Project Background:	Allow designer to design and attach concrete tested rail to concrete bridge decks. Oftentimes, the use of resin bonded anchors is not an option for retrofits on thin (< 8-inch) existing deck with lower concrete strength and poor reinforcing. 
Proposed Work Plan:	**<u>Tasks:</u>** 1. **Engineering Analysis** 2. **Construction and Demolition** 3. **Testing and Reporting**
Deliverables:	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:	Allow for designers to use resin bonded anchors to attach tested rails to thin (< 8-inch) existing concrete bridge decks with low concrete strength and poor reinforcing.
Problem Funding and Research Period:	**Total Estimated Cost = $230,000** **Work Schedule:** (Estimated Project Duration = 10 months from initiation of the project) • Task 1 = 3 months • Task 2 = 3 months • Task 3 = 4 months
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