Roadside Safety Pooled Fund

Research Problem Statement

2020-03-LCB

Project Title:	Develop Guidelines for attaching MASH-compliant thrie beam transitions to rigid concrete barriers other than the rigid barrier tested when evaluating the thrie beam transition.
Project Synopsis:	Evaluate and develop guidelines using engineering analysis, and/or simulation for attachment of a MASH compliant TL-3 thrie beam transition to various rigid concrete barriers. The barrier types, profiles, and heights evaluated as part of this project will be determined on a case by case basis, and will be prioritized based on frequency of usage and/or interest in usage by participating member agencies. Considerations will be given, but not limited to, 32-inch or 42-inch Vertical Wall, F-shape, NJ shape, single slope Concrete Bridge Barriers with/without flare.
Project Goal(s):	Evaluate and develop guidelines for connecting MASH-compliant thrie beam transitions to rigid barriers other than the tested rigid barrier. Determine whether MASH-compliant transitions, in general, may be connected to rigid barriers other than those tested. If so, determine what factors must be considered before connecting a different rigid barrier than tested.
Project Background:	States use transitions to connect w-beam guardrail to rigid barrier. Establishing whether a MASH-compliant TL-3 thrie beam transition can be installed to a variety of other rigid barriers would enhance adaptability of MASH-compliant hardware. A variety of MASH-compliant thrie beam transitions exist for connecting w-beam to rigid barrier. Transitions developed by TxDOT's T131RC bridge rail transition, MwRSF's 34-inch thrie beam transition to concrete buttress, and Alaska's MASH thrie beam transition to two-tube bridge rail are a few examples. Examples of rigid barrier includes, however not limited to, 32-inch or 42-inch Vertical Wall, F-shape, NJ shape, single slope Concrete Bridge Barriers with/without flare. Establishing recommendations for acceptable connection of a MASH-tested transition to a variety of rigid barriers would provide flexibility to states.
Proposed Work Plan:	**Tasks:** **1. Literature Review and Engineering Analysis:** a. Evaluate various current thrie beam transition designs from states and determine which designs (i.e., vertical wall, F-Shape, Single Slope, etc…) are commonly used by states, and which represent critical conditions for analysis and simulation. b. Determine the critical transition design. c. Since a TL-4 thrie beam transition has not yet been developed, limit the analysis transition to MASH TL-3 compliance. d. Evaluate what is necessary for MASH determination (i.e., professional opinion, simulation) **2. Engineering Analysis and Simulation** **a**- Prioritization some systems to work on will depend on the outcomes from Task 1. **b**- For each prioritized system, conduct the computer simulation to investigate the crashworthiness of the base-line design. **c**- For each prioritized, conduct computer simulations parametrically to replicate the real-world installations by varying a single parameter each time. **d**- TTI team anticipate that the total number of combinations that will be investigated by computer simulation could be 5-10. **3. Report and Guidelines** Describing the transition(s) considered and included in the analysis, results of engineering analysis and computer simulations.

Deliverables:	A report and a standalone guidance document. The report should describe the transition(s) considered and included in the analysis, results of engineering analysis and simulation, determination whether other MASH-compliant transitions can be treated in the same manner as the analyzed transition(s). The Guidance Document should provide design solutions to adapt connection of MASH tested thrie beam transition to a rigid barrier having different material, slope, or snagging potential than the tested rigid barrier. Guidance should address opposite direction hits at the connection. The researchers will introduce recommendations regarding conducting the real crash tests to satisfy MASH requirements for some critical cases for the second phase (new Problem Statement). Design solutions and guidance may include or address: • details for tapering the toe of various concrete barrier shapes; • connection options to vertical wall or buttress • connection options to sloped barriers (e.g., tapered block-outs, direct attachment); • curbs - presence, function, alternatives; • alternatives for terminating rigid barrier; • modification of existing barrier to accept transition; • discussion of cast-in-place versus pre-cast rigid barrier, etc.
Urgency and Expected Benefit:	Several states need to connect w-beam guardrail to various rigid barriers and bridge rails including vertical wall barrier, which is fairly common among States. Guidelines are needed for connecting existing MASH compliant transitions to rigid barriers other than those tested. Guidelines will reduce development cost of multiple options, and give states flexibility by adapting tested transitions to various needs on the highway system.
Problem Funding and Research Period: Work with TTI	**Task 1: $10,000** **Task 2: $70,000** **Task 3: $10,000** **Total Cost = $90,000** **Work Schedule:** (Project Duration = 12 months from initiation of the project)
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