Roadside Safety Pooled Fund

Research Problem Statement

2019-17-LSRB

Project Title:	BIB Terminal Variations in Foreslope/Backslope/Ditch Configurations
Project Synopsis:	*Please describe the proposed project synopsis within 200 words.* Evaluate range of foreslope/backslope/ditch configurations, i.e. site variations from crash tested conditions, producing acceptable results under MASH conditions. Project will use analysis, simulation, and physical testing, as required, to evaluate acceptable range(s) of variation.
Project Goal(s):	Consider variations from crash tested configuration (4:1 Foreslope/ 2:1 Backslope/ V-Ditch, under TTI project 608431, tests 3-34, 3-35) to address the following: • Establish whether the BIB terminal may be installed on foreslopes of 4:1 or flatter. • Establish the minimum foreslope threshold; a threshold for requiring area free of fixed objects behind the terminal; and investigate whether there is a limit for backslope steepness. • Establish whether the BIB terminal may be installed in flat-bottomed ditches. Establish necessary design alterations from previous tested configuration, if any, when: the foreslope is flatter than 4:1; foreslope of the ditch is wider than 6 feet; the backslope varies from 2:1; or the ditch is flat-bottomed.
Project Background:	*Please describe the problem you would like to address.* The Buried-in-Backslope (BIB) Terminal project (TTI project 608431) demonstrated the BIB system performs effectively under MASH conditions. Because testing was conducted for just one configuration, applicability of the terminal to other site conditions should be investigated. Ideally, the system could be installed where site conditions vary from the tested configuration. The MASH BIB was tested to the same configuration used under NCHRP 350 in the early 2000s. Successive NCHRP 350 tests varied conditions of foreslope and backslope over three tests. The sequence of testing gave credibility to some acceptable site variability for the installation. The most extreme configuration was matched for the MASH test: 4:1 foreslope, 2:1 backslope, and V-ditch. The problem for this project is to show that the BIB is adaptable to variations in ditch slope, depth, and shape, because field conditions may not match the previous MASH-tested configuration of 4:1 foreslope, 2:1 backslope, and V-ditch. It would be important for the project to establish limits for variability, and any changes to the design to adjust for site variations

Proposed Work Plan:	*Please describe what work or test will be done and what the result will be.* **Task 1. DOT Members Survey.** Identify the most common applicable ranges with respect to the research parameters that are in use (and needed) by the DOT Members: examples are degree of backslope, type of ditch configuration, ditch width, rubrail /no rubrail. **Task 2. Engineering Analysis and Finite Element Investigation.** Conduct engineering analysis to identify most critical cases based on Task 1 results. Conduct finite element computer simulations to investigate the critical cases in terms of system crashworthiness. **Task 3. Recommendations.** Summarize recommendations based on engineering analysis (and FEA).
Deliverables:	Acceptable limits for foreslope (flatter than 4:1), and backslope (range of variation from 2:1 and critical slope), offset to ditch bottom or width of foreslope, and width of flat-bottomed ditch. Necessary changes to the design for variations, if any, including threshold for backslope which requires clearing and grading of area free of fixed objects behind the terminal.
Urgency and Expected Benefit:	*Please describe the expected benefits of the research.* MASH tests have been successfully completed (3-34, 3-35) for one site configuration. States have variable design standards for ditches and adapting the device for site variability would increase the number of locations this device could be installed. BIB Terminal eliminates the potential for terminal end strike. Because of the slopes involved, other issues need to be considered. If acceptable limits for site variability can be shown, wider installation may reduce risk to the traveling public.
Problem Funding and Research Period:	**Task 1: $10,476** **Task 2: $60,158** **Task 3: $14,986** **Total: $85,620** Research Period: **1 year**
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