Project Title:	Investigation and Testing of the Shallowest Embedment or Footing Required for a Cast-In-Place Concrete Median Barrier at MASH TL-5 Conditions
Project Synopsis:	*Using the results of past successful MASH TL-4 tests, this project will develop a design for a minimum embedment depth in ACP and/or the minimum footing dimensions required for a TL-5 concrete median barrier.*
Project Goal(s):	*Through testing or engineering analysis, identify minimum embedment depth in ACP and/or footing depth required to satisfy MASH TL-5 testing on a concrete median barrier, including the minimum barrier length required.*
Project Background:	*MASH TL-5 designs for single-slope concrete median barriers typically have a moment slab, a continuous shallow footing, and/or deep footings located at the ends of the barrier. Construction constraints, such as buried utilities or bridge pier footings, can make some footing designs impractical. TTI has successfully tested a MASH TL-4, single-slope, cast-in-place concrete median barrier with a 1" ACP embedment depth for both 75' and 40' long segments. TTI has also completed simulation analysis for the design of structurally independent foundations for a 54" barrier as part of TxDOT Project 0-6948, but the designs developed in that project have drilled shaft footing, a continuous moment slab footing, and a continuous concrete beam footing.* *Data from these past tests can be used to determine what the minimum embedment depth and/or footing size that would be required to accommodate the lateral impact loads that need to be contained in order to satisfy a TL-5 test. However, full-scale simulation and crash testing may be required to arrive at the new design since previous designs for MASH TL-5 did not have the asphalt key-in. Furthermore, the recent TxDOT Project 0-6948, which was more restrictive in terms of barrier deflection, required larger footing than the simpler ACP constraint desired.*
Proposed Work Plan:	*Following work plan is expected to meet the objectives of this project.* *Task 1: Simulation Analysis – In this task, full scale model of the barrier keyed into asphalt will be developed and impact simulations with MASH Test 5-12 with tractor-van trailer vehicle will be performed. Simulation analyses will be used to determine the acceptable minimum barrier segment length and ACP embedment depth for meeting MASH TL-5 load and stability requirements. In developing the models, the researchers will use results of the static tests described in Task 2 to calibrate the force-deflection response of various asphalt thicknesses.* *Task 2: Static Testing – In this task, the research team will perform several static pull tests to quantify force-deflection response of various thicknesses of the asphalt using a small-scale setup. These tests will enable the researchers to calibrate simulation models in Task 1 to accurately capture the asphalt restraint as function of thickness, which is one of the key factors in achieving accuracy of the simulation models.* *Task 2: Construction – In this task a full scale test installation of the concrete barrier embedded in ACP will be constructed* *Task 3: Testing and Reporting – In this task MASH Test 5-12 of the test installation will be performed and a final report will be prepared for the project.*

Deliverables:	*Design drawings for minimum embedment depth and/or footing size to accommodate a MASH TL-5 concrete median barrier.*
Urgency and Expected Benefit:	*With the release of NCHRP Report 892, TL-5 pier protection is likely to be a more commonly used design component. Reducing or eliminating some or all of the footing required for a TL-5 concrete barrier design will have an immediate cost reduction benefit.*

Problem Funding and Research Period:	*Estimated Costs: $270,325*
	  Task 1 - $54,997
	  Task 2 - $22,579
	  Task 3 - $137,548
	  Task 4 - $55,201
	
	Estimated Project Period: 15 months

Developer(s) of the Problem Statement:	Name: Jim Danila, MassDOT Email: james.danila@dot.state.ma.us Phone: 857-368-9640