Title:	Address Knowledge Gaps in Scour Analyses for Cohesive and Other Challenging Channel Materials
The Problem:	Two knowledge gaps exist in our scour analysis methods. One is the lack of a pressure scour method for cohesive soils. The other is related to challenges with material characterization for scour analyses. When flooding causes the water surface elevation to inundate a bridge's low chord, a pressure flow condition can develop below the bridge. Pressure flow amplifies the potential for contraction scour. HEC-18 provides an equation for this condition, which is known by two names: pressure scour, or vertical contraction scour. However, the HEC-18 pressure scour equation is intended for sand-bed channels and is overly conservative for channels composed of less erodible, cohesive soils. The TxDOT Scour Analysis Guide recommends a method called SRICOS for scour analyses in cohesive soils, but the SRICOS method does not include an equation for pressure scour. Scour analyses are intended to evaluate "superfloods" which may exceed a 100-year return interval. It is quite common for a scour analysis to involve bridge inundation and overtopping. Therefore, the lack of a pressure scour method for cohesive soils represents a significant knowledge gap that needs to be filled. The second knowledge gap exists with material characterization for scour analyses. In recent decades, more attention has been given to erosion testing for channel bed materials. Simplified procedures based on D_{50} work reasonably well for sand, but cohesive soils are more complex and have required more advanced testing to characterize erodibility. For example, the Erosion Function Apparatus was first conceived, designed, and built at Texas A&M in the early 1990s and used for TxDOT research beginning in 1994 (project 7-2937). More recently, the FHWA has used its Ex-situ Scour Testing Device (ESTD), In-situ Scour Testing Device (ISTD), and Portable Scour Testing Device (PSTD) for erosion testing through pooled fund study TPF-5(461). Advanced erosion testing remains state-of-the-art and is not always feasible for design projects. Slake Durability is a more economical index test for characterizing durability and could serve as a useful proxy for more advanced erosion testing. Soil samples will be obtained at up to 20 different bridges around the state to characterize materials that have traditionally been difficult to characterize for scour analyses (e.g., shale, caliche, sandstone). This effort will include advanced erosion testing and Slake Durability testing, as well as applicable shear strength lab/field tests. The study will characterize the materials under investigation, determine if Slake Durability tests serve as a reasonable surrogate for advanced erosion testing, and (if so) develop erodibility characterization guidance that can be used to characterize these materials on the basis of Slake Durability test results.

Technical Objectives:	The objectives of this project are:
	• Conduct a literature review and summarize state-of-the practice and key findings.
	• Develop vertical contraction scour equations (i.e., pressure scour equations) for bridges with cohesive channel bed materials.
	  ○ Develop pressure scour equations, on the basis of flume studies and/or computational fluid dynamics (CFD) modeling, for bridges in cohesive channel materials that meets state and federal scour evaluation requirements.
	  ○ Ensure the proposed pressure scour equations utilize the same erosion categories and parameters as the SRICOS method described in the TxDOT Scour Analysis Guide.
	• Develop improved design guidance for erodibility characterization.
	  ○ Conduct erosion testing of channel materials to support the development of improved design guidance for erodibility characterization.
	  ○ Laboratory study shall include advanced erosion testing, slake durability testing, applicable shear strength lab/field tests, and erosion category designation (per Appendix A in 2023 in TxDOT Scour Analysis Guide).
	
	The expected technology readiness level (TRL) for this project is 8.

Anticipated Deliverables:	1. Technical memorandum for each task completed. 2. Monthly progress reports. 3. Project Summary Report 4. Research report documenting the findings of this research, including: • Modeling documentation from CFD and/or flume testing results. • Details of developing pressure scour method. • Results from lab. • Synthesis of results to assess the usefulness of Slake Durability as a proxy for advanced erosion testing and recommend best practices for characterizing these challenging materials. • Design guidance for erodibility criteria. • Value of Research (VoR) that includes both qualitative and economic benefits.
Proposal Requirements:	1. RFP#1 Q&A Deadline: 12:00 p.m. Central Time, **Tuesday, February 20, 2024.** 2. Proposal Deadline: 12:00 p.m. Central Time, **Thursday, March 21, 2024**. 3. Use the current "ProjAgre" and "PA Forms" templates located at the RTI Forms webpage. 4. Proposals will be considered non-responsive and will not be accepted for technical evaluation if they are not received by the deadline or do not meet the requirements stated in RTI's University Handbook. 5. Proposals should be submitted by the University Liaison in PDF format; (1) PDF file per proposal. File name should include project name and university abbreviation. 6. This project will be tracked during the life of the project using the Technology Readiness Level (TRL) scale. 7. The 2021 Texas Legislative Session requires that universities be in compliance with Senate Bill 475 by submitting a completed and signed TxDOT Security Questionnaire (TSQ) to RTIMAIN@txdot.gov. Universities that have not submitted a completed and signed TSQ one week after award will be considered non-compliant and unable to participate in the Program.