Title:	Identify and Analyze Inundated Bridge Superstructures in High Velocity Flood Events
The Problem:	In separate high intensity flood events in May 2015 and October 2018, TxDOT had three separate bridges that succumbed to floodwaters on the Blanco and Llano Rivers, respectively. Such flood events were characterized by floods of significant stream velocity and drift. AASHTO LRFD Bridge Design Specifications, Eighth Edition, defines stream pressure and debris loads in Section 3.7.3, and also identifies wave loads in Section 3.7.4, indicating "site specific conditions should be considered" and referencing guidance in the USACE Shore Protection Manual. AASHTO also has Guide Specifications for Bridges Vulnerable to Coastal Storms. In May 2009, FHWA published a document, Hydrodynamic Forces on Inundated Bridge Decks, as a response to states asking for new design guidance to predict hydrodynamic forces on bridge decks for riverine conditions. This used both physical experimentation in scale model flume tests as well as computational fluid dynamics to study hydraulic forces on different deck shapes. TxDOT issued a design policy that is now represented in Chapter 4, Section 9, of the TxDOT LRFD Bridge Design Manual requiring shear keys in river and stream crossings based on a freeboard 100-year flood level. The question remains for bridges that only pass the 25-year and 50-year flood levels in areas with significant stream velocity and debris risk. What are the design forces and resisting details that can ensure adequate structure performance?
Technical Objectives:	The researchers shall address the following: 1. Use NBI and hydraulic/hydrologic data to identify bridges with potential inundation in high velocity flow events. Use this data to characterize velocity and flood levels. 2. Conduct scale flume tests to determine force effects on superstructures and substructures using typical TxDOT bridge details (TxGirder, Box Beam, and Slab Beam Superstructures). 3. Perform calculations to demonstrate if shear key details alone are adequate, or if additional hold down details are warranted. Coordinate with TxDOT design solutions. The expectation of this project is that the end product will obtain a TRL level 5.
Desired Deliverables:	1. Technical memorandum for each task completed. 2. Monthly progress reports. 3. Value of Research (VoR) that includes both qualitative and economic benefits, to be included in the final research report. 4. Research report documenting the findings of the research, including calculation shear key capacities and adequacy for modeled scenarios, and identification of potential hold down or superstructure selection considerations. 5. Project Summary Report.
Proposal Requirements:	1. Utilize the “Proj/Agre” and “PA_Form” templates located at the TxDOT RTI website. 2. 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, which is also located at the RTI website. 3. Proposals should be submitted in PDF format, 1 PDF file per proposal. File name should include project name and university abbreviation. 4. This project will be tracked during the life of the project using a Technology Readiness Level (TRL) scale. For more information about the use of a TRL, click.