Title:	Creating a Resilient Port System in Texas: Assessing and Mitigating Extreme Weather Events
The Problem:	Creating a resilient transportation system has been identified as a priority by public and private organizations to address the risks of climate change and extreme weather events; however, few agencies have extensively investigated vulnerability to specific transportation sectors and resources. Currently transportation providers and user organizations emphasize disaster response and recovery, with less focus on preparing decision makers to plan for extreme events by evaluating vulnerabilities and opportunities for resilience. Waterborne commerce associated with Texas ports representing over $82.8 billion in economic value to the state. More than 522 million tons of cargo pass through Texas ports annually, including machinery, grain, seafood, oil, cars, retail merchandise and military freight. Hurricane Harvey had significant impacts to the Port of Houston. Floodwaters that dumped silt along the port's shipping channel caused shoaling that reduced both the width and depth in certain sections of the channel. Short and long-term economic impacts were severe. Vessels diverted to other ports and ships were loading at less than full capacity to prevent grounding. A recent study found that each foot of depth loss in the channel costs the U.S. economy as much as $281 million. A recent study for the Texas Legislature evaluated how extreme weather events impact freight infrastructure and found that the extreme weather events of greatest concern were hurricanes and the risk associated with intense rainfall events. The study identified the impacts of extreme weather events and found that privates sector firms are most concerned about infrastructure that is out of their control, such as energy supply. To address these issues, the Federal Highway Administration held a workshop to identify opportunities for transportation agencies to assess and address their vulnerabilities to climate change and extreme weather by incorporating resilience into the transportation planning process to meet federal requirements. Lack of systematic vulnerability assessments and resiliency planning will have significant impacts to deep water ports and freight infrastructure with significant risk for extreme economic impact.
Technical Objectives:	The objective of this research is to: 1. Assess the vulnerability and resiliency of the Texas port system to extreme weather events. 2. Investigate the economic impact of the vulnerability and the primary industries. 3. Identify proxy measures that can assist with the development of mitigation strategies. The research will focus on the deep water ports of Texas. The researchers shall address the following: 1. Characterize the extreme weather event risks; i.e., frequency and magnitude, to deep water ports and the related freight industry in Texas. 2. Document the potential physical and economic impacts imposed by extreme weather events on the waterways, port facilities, and port inland connectivity in consultation with the port and related freight industry. 3. Identify simple reliable metrics that link potential threats; i.e., adverse weather events, to likely impacts in terms of disruptions and costs. 4. Propose mitigation strategies for the port system that can prepare the deep water ports and related freight transportation system for extreme weather events. The expectation of this project is that the end product will obtain a TRL level 8.
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 an extreme weather vulnerability impact assessment of deep water ports in Texas. 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.