Tran-SET
Transportation Consortium of South-Central States

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Key Points

Project Number:
17GTLSU12

Start Date:
05/08/2017

End Date:
11/08/2018

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Lead Institution:
Tulane University

Funds Requested to UTC:
$41,963

Funding Source(s):
Tran-SET
Tulane University
University of New Orleans
University of Louisiana at Lafayette

Total Project Cost:
$91,742

Synthesis of Faults Traces in SE Louisiana Relative to Infrastructure

Brief Project Description

Geological faulting has been implicated as a contributor to subsidence, coastal land loss, and submergence of marshlands in southern Louisiana. Fault motion, either by slow creep or more sudden slip, can cause deformation of engineered structures. In addition, the compaction of thick soils and Holocene sediments on the down-dropped sides of faults contributes to land subsidence that can result in increased infrastructure maintenance and repair costs. This project will synthesize current fault mapping and produce fault trace maps relative to critical infrastructure in areas underlain by existing three dimensional (3D) seismic surveys, and in other areas having a high density of wells and two dimensional (2D) seismic data.

Problem Statement

The modern surface of the Mississippi River delta plain is influenced by geological faults that developed long before historical times, and are typical of deltaic, passive-margin sedimentary basins (Diegel et al., 1995; Owoyemi & Willis, 2006). Well-known subsurface stratigraphic relationships indicate that fault motion has been a fundamental geologic control on sedimentation patterns and geomorphic evolution along the northern Gulf of Mexico. Many studies now document the presence of active faults in southeastern Louisiana. Where these faults underlie critical infrastructure, deformation by fault slip, as well as compaction of locally thickened sediment along faults, can create added costs related to mitigation and rehabilitation. This project aims to create maps of surface fault patterns and attributes in relation to critical infrastructure in the coastal zone of southeastern Louisiana.

Objective

The objective of this project is to determine locations of geological faults in southeastern Louisiana through the compilation of existing literature and, in particular, the synthesizing of recent university research on surface and near-surface faults mapped using high-quality energy industry datasets. This will include the development of best practices and methodologies for describing and characterizing the attributes of faults and quality of geological interpretations. The synthesis will form a knowledge base of surface fault locations in relation to critical infrastructure in the coastal zone of southeastern Louisiana.

An additional aim is the development of a list of potential mitigation techniques to assist in the preliminary design phase for critical infrastructure projects. In-place infrastructure that may be affected by faults will also be identified, and a list of potential mitigation and rehabilitation techniques for critical infrastructure projects will be generated.

Intended Implementation of Research

Technology Transfer

Fault trace maps will be compiled and information (metadata, including the quality and reliability of the data used to interpret the faults) will be gathered and reported. These include fault traces ranked from least well-defined to confirmed using criteria including surface scarps (i.e., as imaged on LIDAR), high-res 2D seismic, 2D deep industry seismic, industry 3D seismic, faults correlated or drilled through in wells, and/or age dates in wells and sediment borings. In addition, the PI Dawers will work in conjunction with technology transfer personnel at Tulane University.

Education, Workforce Development, and Outreach

Workforce development: The lead PI and team members will meet with professional staff within DOTD, including civil and geotechnical engineers, to disseminate results and transfer knowledge about how to further study the faults identified in the research phase (Phase I). This will be done in Baton Rouge and possibly at field sites where highway infrastructure has or may be impacted, or anywhere requested by DOTD and LTRC. Anticipated field workshop sites include Golden Meadow and Leeville, along the Louisiana 1 corridor, and near various bridges in the Lake Borgne region.

Outreach activities: A major goal within Tulane's Department of Earth and Environmental Sciences is recruitment of both undergraduate and graduate students from under-represented groups. The lead PI has already identified an undergraduate geology major from and under-represented group (African-American) to potentially undertake a research project related to the proposal, but at no additional cost. Recruitment of under-represented graduate students will take several approaches. These include the dissemination of information about the research at Xavier and Dillard universities. We will also recruit prospective graduate students via the National Association of Black Geoscientists; one of Dawers' current PhD students working on a coastal fault project is active in this organization. In addition, the PI will apply for opportunities for funding of under-represented STEM graduate students through programs administered by the La. Board of Regents and Tulane's Provost's Office.

Education: The PI Dawers will develop material from this project to be utilized in two existing courses she teaches at Tulane – Subsurface Geology and Applied Basin Analysis. Materials, including field trip guidebooks, will be developed for her Tectonic Geomorphology and/or Structural Geology course, which is required for Geology majors at Tulane. Noting that Tulane does not have a Civil Engineering department, the PI is very motivated to share results and knowledge within civil engineering programs at other universities in the Tran-SET university consortium. Data and knowledge obtained may be useful to deep foundations and geotechnical engineering courses, as well as courses in structural design and rehabilitation. Because of recent collaboration with ULL and UNO faculty in geology and geophysics, any presentations or workshops etc. to engineering departments within those institutions will have the added benefit of fostering ties between the geosciences and engineering, in general at those institutions. Dawers will also plan presentations and/or workshops for LSU's departments of Geology & Geophysics and Civil & Environmental Engineering.

Anticipated Impacts/Benefits of Implementation

Transportation Consortium of South Central States

A new work flow to include geologic surface fault mapping early in development stages of DOTD projects will be developed. The knowledge of the pattern of faulting and its controls on sediment compaction could be utilized to better assess coastal risks related to relative sea level rise. This would result in significant cost savings to the State by decreasing uncertainty, and increasing resiliency of critical infrastructure

Weblinks:

- Tran-SET's website (http://transet.lsu.edu/research-in-progress/)
- TRB's Research in Progress (RIP) database (https://rip.trb.org/View/1466908)