

Resiliency of Transportation Infrastructure and the Environment after Hurricanes

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Evaluating the resiliency of transportation infrastructure after hurricanes

In the midst of a natural disaster, information and the ability to access various site locations may be compromised by blockage of roads and bridges, collapsed buildings, flooded roads, electricity outages, among other possible circumstances. Having the ability to communicate and access any given location is of extreme importance to ensure the safety and recovery of the public. State DOTs collect large volumes of digital data after a hurricane to identify the current state of transportation infrastructure, water levels, road blockages, waste debris, and many other information of importance before, during, and after a natural disaster. Lessons learned from such data collection should help in improving the resilience of the infrastructure including better roadmaps on conducting recovery and repair operations during hazard events. The proposed research will review and improve the efficiency of the data that agencies currently use to collect and analyze data, which aids in the decision-making process during and after a natural disaster. Pavements are backbone of infrastructure during these events and hence an attempt is made to enhance the resiliency features of them by studying and exploring ways to strengthen the subsoil conditions supporting pavements near and around coastal regions. The research will lead to a comprehensive final research report documenting ways to enhance existing road infrastructure and also strategies to assess infrastructure conditions during and after hazard events. This information will also be made available to state transportation and city agencies.

pavement infrastructure is the major component based on the mileage of the intermodal transportation network that connects communities, waterways, ports, and rail. As a result, improving pavement infrastructure design, construction, and maintenance to withstand coastal hazards is of strategic and economic importance. State DOTs collect significant amounts of data during a disaster to understand pavement infrastructure performance and how to estimate the current level of serviceability, along with how to rehabilitate the infrastructure. To achieve this goal, DOTs are to (1) collect and analyze data and conditions of flood impacted pavements; (2) make decisions that facilitate evacuation and recovery; and (3) disseminate decisions to all concerned agencies and individuals. To achieve objective (1), State DOTs need to continuously adopt technologies, such as unmanned aerial systems (UAV or UAS), and combine it with efficient data mining to extract as much information possible to fulfill objectives (2) and (3). Documenting the current operational inefficiencies, technology gaps, and data analysis limitations of DOTs in relation to understanding the performance of transportation infrastructure are important to drive improvements in DOT disaster preparedness and response.

Objectives

The objectives of this research project is (1) to identify the performance of transportation pavement infrastructure after hurricanes, (2) to evaluate the service condition of such pavement infrastructure to restore its operation post-event, and (3) to develop remedial measures to improve its resiliency of pavements to future extreme events.

Problem Statement

Seven of the top ten costliest U.S. natural disasters are coastal events, with hurricanes alone causing \$23.5 billion in damage annually to infrastructure. This was even more evident in Louisiana in 2020, where major hurricanes Laura, Delta, and Zeta made landfall in a two month period over Lake Charles and New Orleans. The impacts of these hurricanes are amplifying infrastructure vulnerability to coastal storms, nuisance flooding, and wave actions, especially towards surface transportation infrastructure. In particular,





Figure 1. Photogrammetry Data Identifying Disaster Debris Volumes and Failure of a Pavement Section Immediately after Hurricane Harvey

Intended Implementation of Research

A final report will be delivered which will detail information on the methodology, data acquisition, and analysis of pertinent information during and after natural disasters such as the street level conditions of roads, and comprehensive stabilization methods to strengthen the subgrade support so less distress will be recorded on the pavements. This will help State DOTs to more efficiently adopt and implement stabilization methods to field data collection and analyses in their hazard preparedness during hurricane seasons.

Anticipated Impacts/Benefits of Implementation

The findings of this research will result in more effective hazard preparedness to tackle the transportation infrastructure issues for the states in the South Central area and all other States as they are all prone to the adverse effects of natural disasters. A greater reach to all other States is also intended.

Web links

- Tran-SET's website <https://transet.lsu.edu/research-in-progress/>

Tran-SET

Tran-SET is Region 6's University Transportation Center. It is a collaborative partnership between 11 institutions (see below) across 5 states (AR, LA, NM, OK, and TX). Tran-SET is led by Louisiana State University. It was established in late November 2016 "to address the accelerated deterioration of transportation infrastructure through the development, evaluation, and implementation of cutting-edge technologies, novel materials, and innovative construction management processes".

Learn More

For more information about Tran-SET, please visit [our website](#), LinkedIn, Twitter, Facebook, and YouTube pages. Also, please feel free to contact Dr. Momen Mousa (Tran-SET Program Manager) directly at transet@lsu.edu.

