

0-7123: Define a Statewide Plan for a Sustainable Real-Time Travel Time Network for Texas Hurricane Evacuations and Safe Citizen Return

Background

Texas coastal areas are prone to hurricanes, which pose a threat to life, public safety, and critical infrastructure. Mass evacuation can be ordered to relocate residents to safe areas in advance of a hurricane. The availability of accurate real-time traffic information can assist public agencies in managing evacuation operations and aid evacuees in making decisions about when to evacuate or what route to take. Given the crucial role of real-time information in evacuation events, it is essential to ensure that the Intelligent Transportation System (ITS) devices in evacuation corridors in Texas can perform adequately during hurricanes. Developing asset management strategies for the installation, maintenance, and operation of these devices is necessary to improve future Texas hurricane evacuations. This research study was conducted to assess the existing level of implementation, user preferences for the usage of real-time data, and gaps in the current traffic monitoring system. Understanding these aspects is crucial for determining the effective device deployment strategies, and developing recommendations for monitoring, prioritizing system expansion, and creating resilient systems for information transfer.

What the Researchers Did

To ensure that Texas ITS devices can sufficiently assist with evacuation travel, the research team conducted a thorough review of the existing state of the system and proposed methods that can be used to study potential ITS expansion. A detailed survey was conducted among Texas residents to understand how they use real-time traffic information during evacuations. A hurricane evacuation study traffic simulation was implemented to identify critical links in the evacuation roadway network that may benefit from ITS device deployments. Asset management methods were employed to prioritize ITS device location alternatives and a life cycle cost assessment was performed to estimate the installation and

maintenance costs of devices under various scenarios. Finally, recommendations to enhance the resilience of the information transfer system were provided.

What They Found

Utilization of traffic monitoring platforms

The research team conducted a detailed survey in Texas and found that evacuees commonly rely on radio and navigation apps for selecting evacuation routes. The choice to use these platforms depends on service availability, ease of use, and accessibility. Two areas of improvement were identified: enhancing the accuracy of real-time data with backup power services and providing educational resources to increase user awareness of the available platforms. Respondents with more past evacuation experience tend to use navigation apps and social media apps for obtaining traffic information, and users of TxDOT information sources highly value data accuracy.

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Monitoring system expansion

The research team conducted a hurricane evacuation study to determine critical links as locations for potential ITS expansion with two independent evacuation case studies: the Houston-Galveston region and the Corpus Christi region. The study used a network simulation to model evacuees traveling from impacted counties to areas of safety further inland. The results recommend that guiding evacuees towards system optimal routes using data from ITS devices and real-time information on preferred routing can efficiently manage the evacuation.

Optimal deployment for ITS devices

The research team developed a scoring method for prioritizing ITS device deployments on hurricane evacuation routes using the Analytical Hierarchy Process, a multi-criteria decision analysis tool, and organizing a series of workshops with TxDOT employees to collect data. This method can be used to develop short and long-term strategic plans for implementing ITS devices to assist with hurricane evacuation operations.

Life cycle costs for ITS devices

The research team estimated the life cycle cost for ITS device deployments on hurricane evacuation routes for different cost scenarios in Texas. They found that the estimated annual cost to maintain cameras on Texas hurricane evacuation routes is around \$97.8 million for entirely new cameras and poles, and around \$34.5 million to replace or upgrade existing cameras, considering a camera spacing of 0.5 miles and an annual device replacement rate of 10%. They also extended the analysis to the district level, revealing that the annual cost of the coastal districts is higher due to the presence of more evacuation route centerline miles.

Recommendations for a resilient information transfer system

The research team summarized the current ITS telecommunication structure in Texas and examined the potential disruptions that may impact the system during evacuations. They provided mitigation measures to address each aspect of the challenges and specifically discussed three information transfer challenges regarding infrastructure damage, power outages, and accurate information transfer among the public.

What This Means

From the work conducted in this study, TxDOT has acquired a better understanding of the usage of real-time traffic data during evacuations and methods that may be used to develop strategies for the implementation of new devices. The project's findings yielded the following benefits for hurricane evacuations in Texas:

1. Increased understanding of Texas residents' utilization of real-time traffic information during hurricane evacuations.
2. Developed methods that can be used to create a comprehensive plan for improving ITS capabilities.

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