CENTER FOR TRANSPORTATION RESEARCH

PROJECT SUMMARY

Texas Department of Transportation

0-7055: Creating a Resilient Port System in Texas: Assessing and Mitigating Extreme Weather Events

Background

The Texas port system, situated along the coast of the Gulf of Mexico, plays a crucial role in the state and national economy. The Texas Gulf Coast is frequently exposed to extreme weather events that can disrupt port infrastructure systems, causing significant economic costs to ports. These costs are both direct, such as damages and lost import/export revenue, and indirect, such as losses to dependent industries, which rely heavily on ports for their business continuity. Disruptions to port systems in Texas can also have significant macroeconomic impacts. It is therefore of utmost importance to enhance the resilience of the Texas port system against such events.

This project aimed to determine ways to enhance the resilience of the Texas port system by: i) characterizing potential extreme weather events, ii) identifying the network and port-level vulnerabilities of the ports and their supporting infrastructure, iii) quantifying the physical and economic risks extreme events posed to them, and iv) developing metrics to evaluate their resilience.

What the Researchers Did

To achieve these objectives, CTR researchers performed a literature review and conducted surveys and interviews to obtain stakeholder input and collect information about disaster management practices in Texas ports and trucking operations.

They also developed a risk measurement framework to assess the risk and resilience of the port and supporting infrastructure systems. This framework provides port resilience assessment scores based on the four Rs (Robustness, Redundancy, Resourcefulness, Rapidity) and also assesses both direct and indirect potential economic impacts. This led to the creation of an MS Excel–based tool (PortRESECO) that gives stakeholders an easy way to assess the resilience of a port facility (Fig. 1) and estimate its economic losses for hurricanes of varying intensity (Fig. 2).

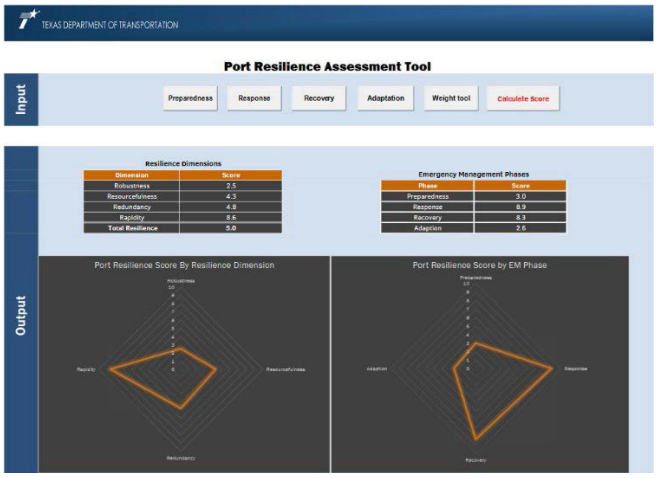

Figure 1. PortRESECO module for port resilience assessment

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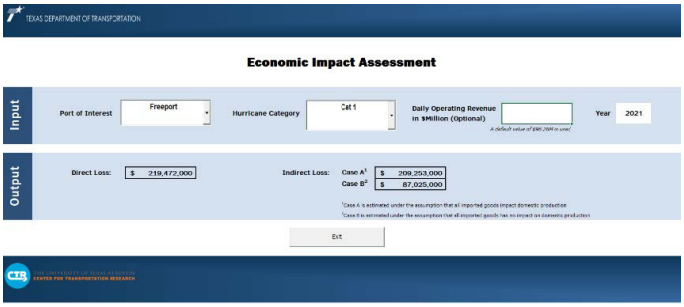

Figure 2. PortRESECO module for economic impact analysis

What They Found

The researchers utilized a Geographic Information System (GIS) to integrate data and information related to ports, supporting infrastructure systems, and natural hazards into one comprehensive data set.

The researchers found that with the GIS-based data set and stakeholder input from surveys and interviews, risk and resilience assessment could be analyzed quantitatively. As a result, the researchers developed a quantitative methodological framework that assesses the risk and resilience at both the individual facility and the infrastructure network levels, considering the dependency and interdependency between infrastructure systems.

The researchers identified that an easy-to-use tool would be helpful for Texas ports and stakeholders to better understand, assess, and improve their system resilience. Therefore, the PortRESECO tool was developed to provide quantitative values for resilience assessment and estimated economic losses.

The researchers also developed resilience improvement recommendations. Selected recommendations are targeted for priority improvements, while others are intended to be general emergency management recommendations for ports to implement.

What This Means

At the end of the project, the researchers provided these port resilience improvement recommendations to TxDOT, the Texas legislature, port authorities, port tenants, and other stakeholders.

If the tools and methodologies developed by this research are utilized and the resulting recommendations implemented, the anticipated benefits for TxDOT, port authorities, and other stakeholders include but are not limited to:

- a comprehensive GIS data set with infrastructure and trade information for future study of risk and resilience;
- a risk assessment framework for better understanding, assessing, and mitigating potential risks for the ports and supporting infrastructure systems due to natural hazards;
- a tool (PortRESECO) for better quantifying the resilience of ports and their economic risks;
- potentially improved resilience for Texas ports and the Texas coastal freight system; and
- reduced direct economic losses from disruptions of port operations and reduced large-scale macroeconomic losses resulting from natural hazards.

For More Information

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