



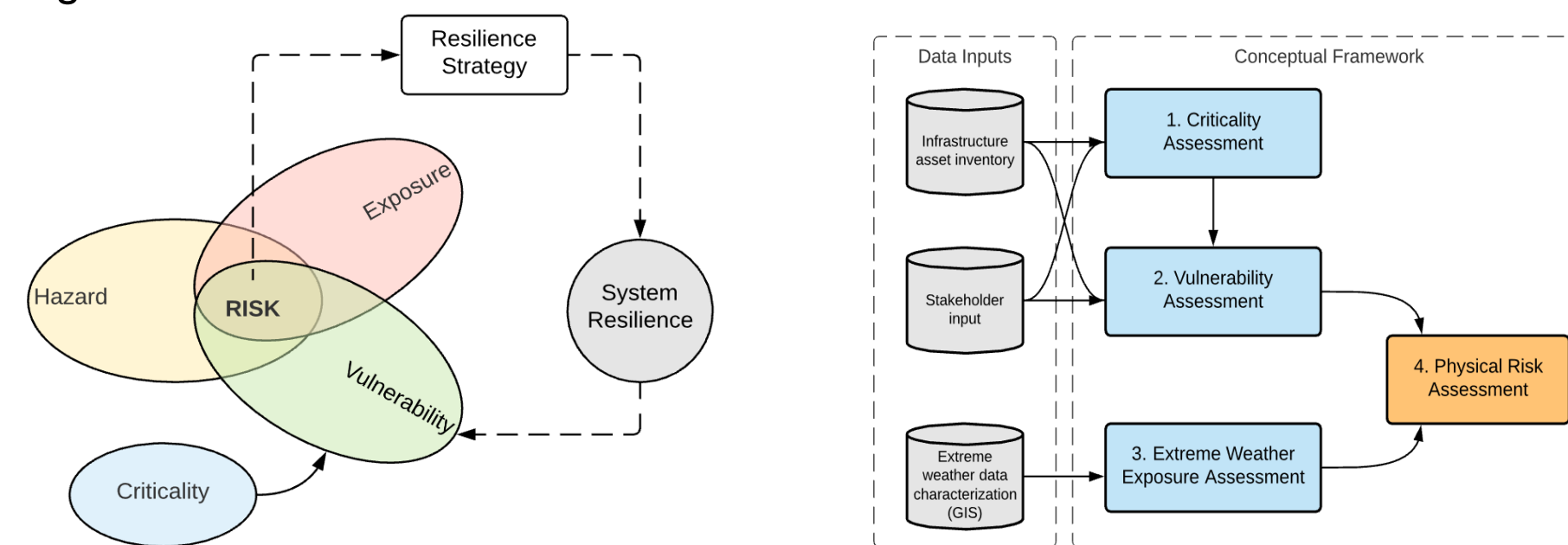
Background

- Infrastructure resilience is the ability of a system to reduce the impact of a disruption and restore operations rapidly
- Methods for quantifying, measuring, and improving resilience are needed to ensure that transportation networks remain safe and efficient during and after disasters

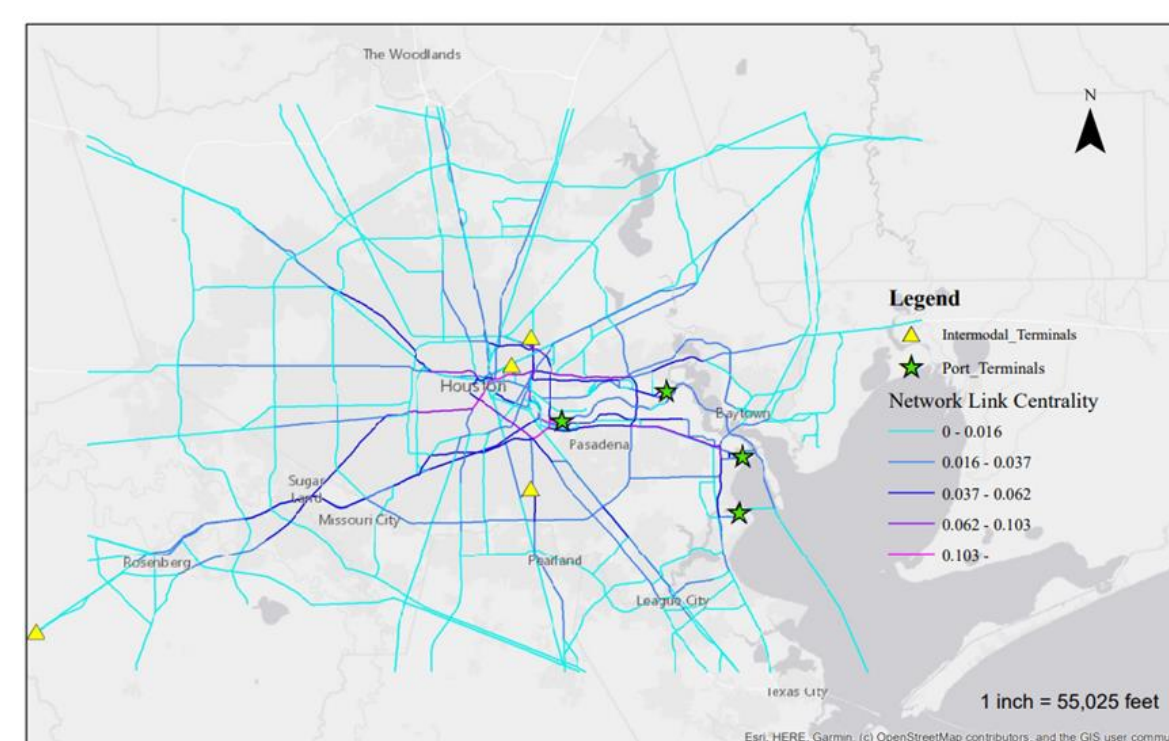
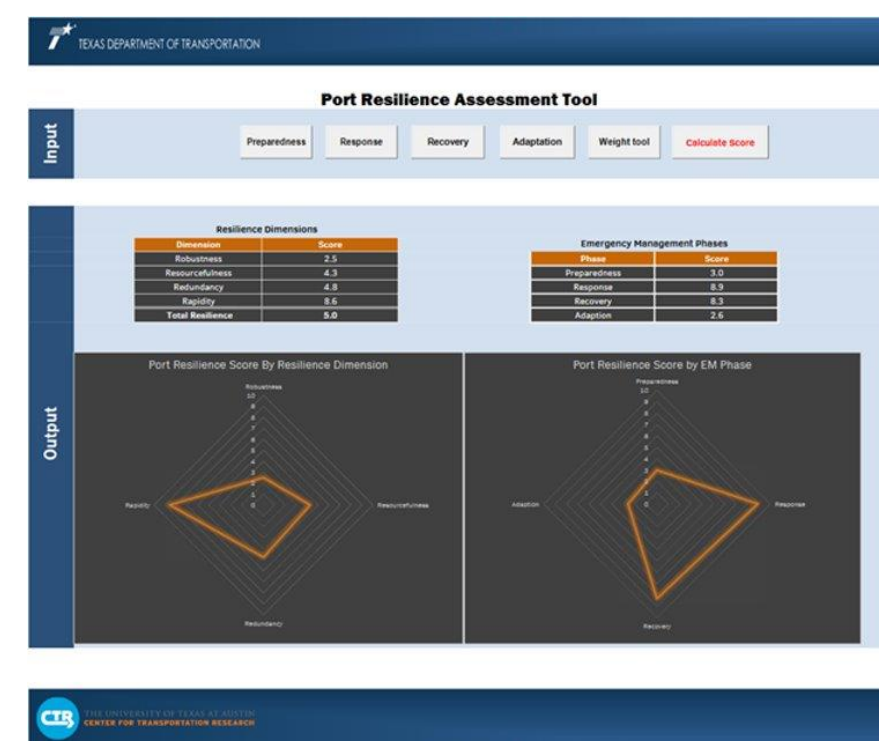
Sponsored Research Projects

TxDOT Project 0-7055: Creating a Resilient Port System in Texas: Assessing and Mitigating Extreme Weather Events (2020-2022)

- Collected data from port stakeholders to understand existing resilience capabilities and shortcomings
- Created framework to assess port vulnerability, exposure, and risk to hurricane storm surge and sea level rise



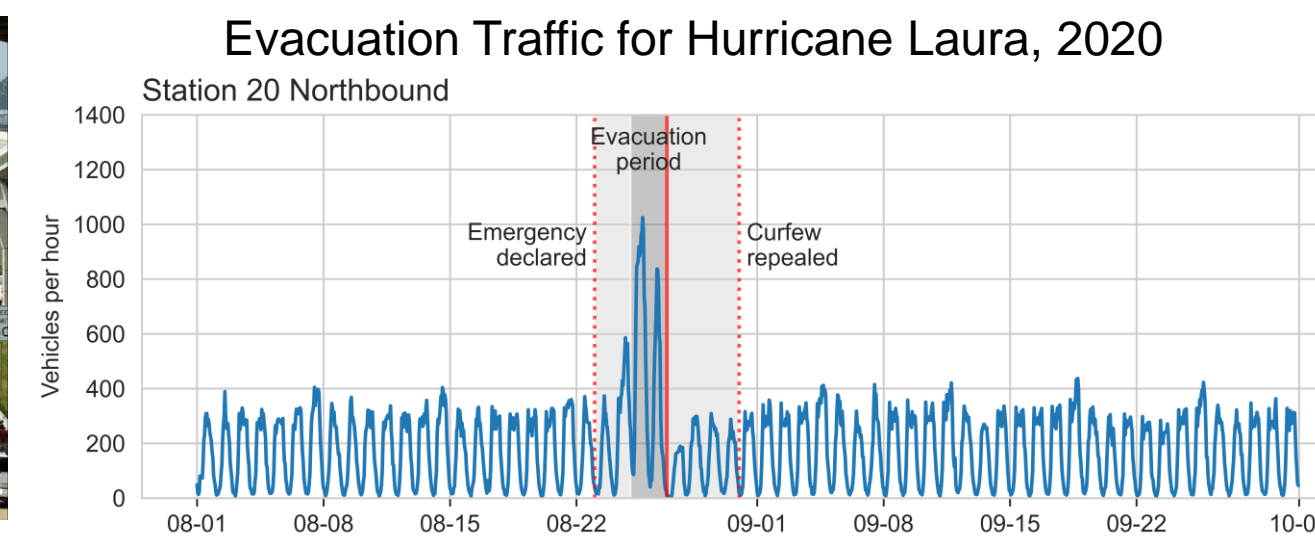
- Estimated economic impacts of hurricanes on Texas ports
- Developed PortRESECO tool for resilience and economic impact assessment



- Recommended action items to improve port resilience capabilities

TxDOT Project 0-7123: Define a Statewide Plan for a Sustainable Real-Time Travel Time Network for Texas Hurricane Evacuations and Safe Citizen Return (2022-Present)

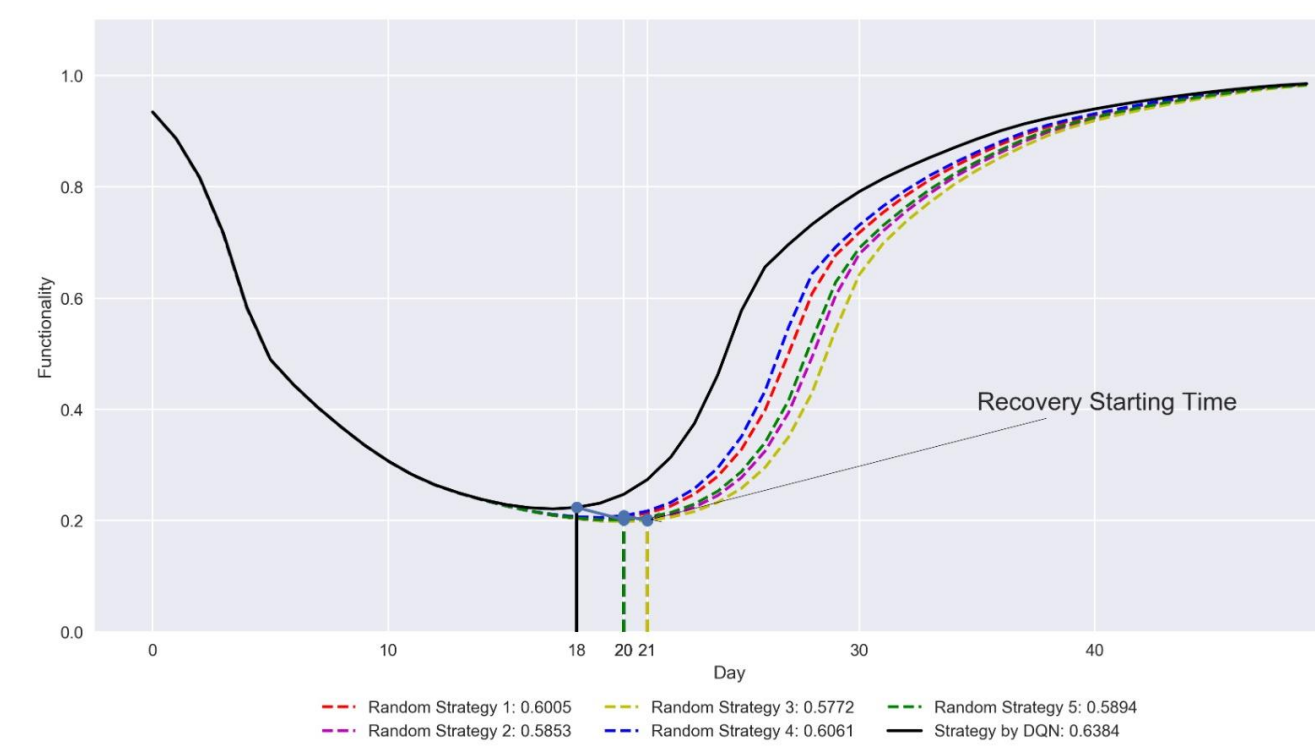
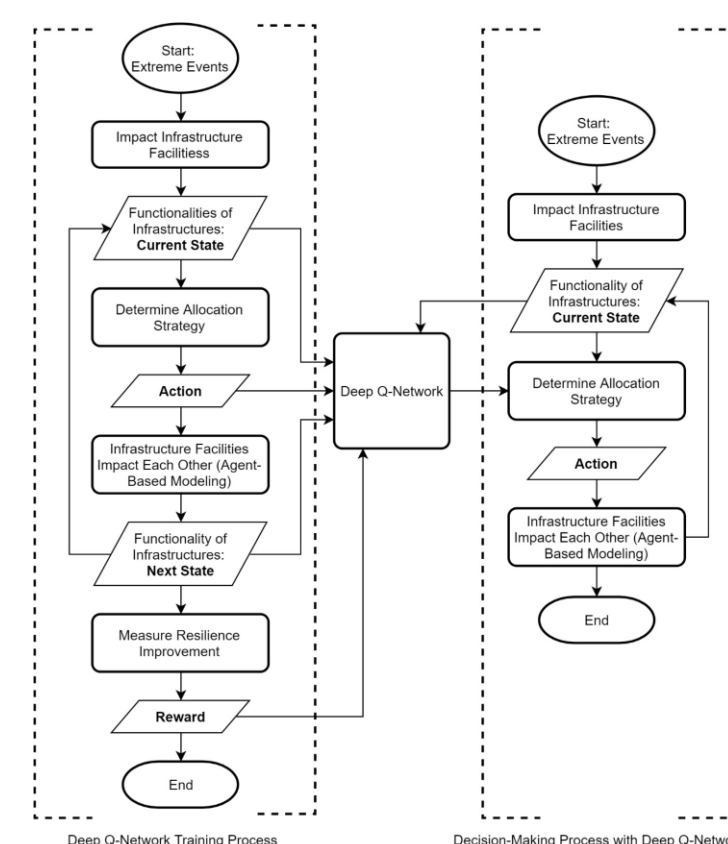
- Surveyed hurricane evacuees and decisionmakers in Texas
- Modeled evacuation networks and identified corridors for traffic monitoring system expansion
- Prioritized traffic monitoring device upgrade and expansion using asset management methods



Selected Relevant Research

Sun and Zhang. (2020). "A Post-disaster Resource Allocation Framework for Improving Resilience of Interdependent Infrastructure Networks." *Transportation Research Part D*

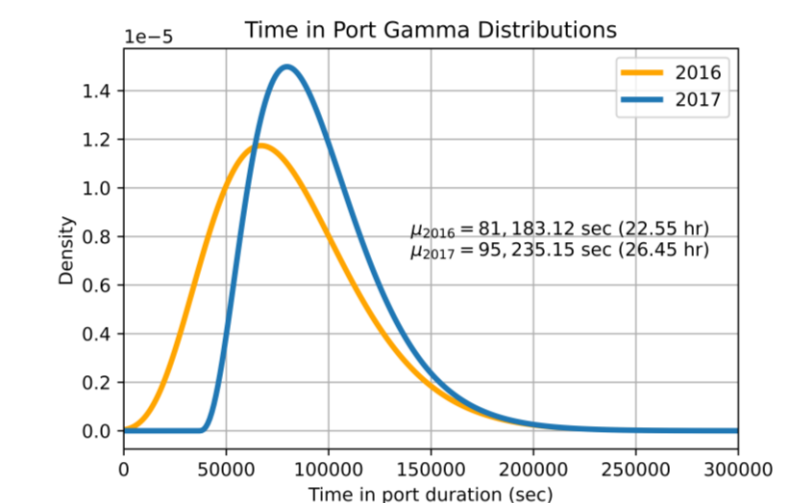
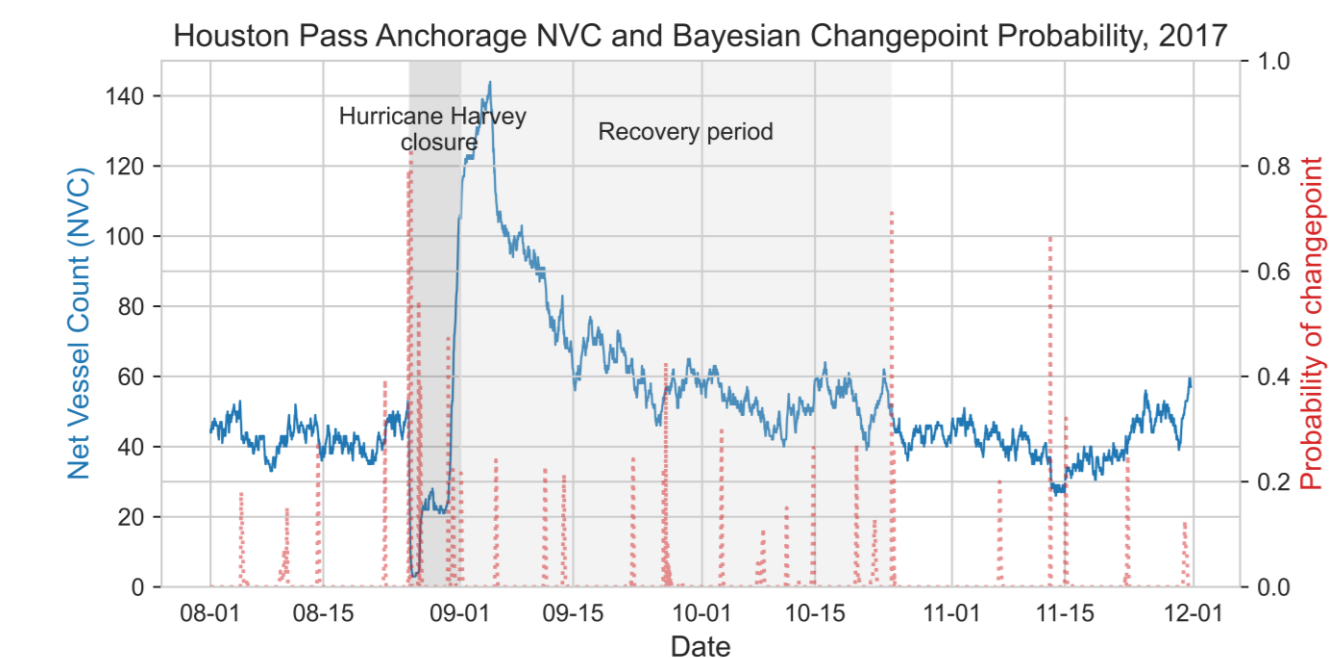
- Interdependent infrastructure network resilience can be improved by optimizing the restoration process after a disruption
- Combines reinforcement learning and agent-based modeling to allocate limited repair crews for fast recovery after an extreme event



Selected Relevant Research (Cont'd)

Bathgate, Perez, and Zhang. (2022). "Quantitative Analysis of Hurricane Harvey Impacts on Texas Maritime Facilities." *Transportation Research Record*

- Hurricane Harvey resulted in a mean increase of 4 hours in port and 18 hours in anchorage for freight vessels in the Houston area
- Bayesian changepoint detection analysis is effective technique for AIS data; Hurricane Harvey disruption on Houston ports lasted 2 months



Balakrishnan and Zhang. (2020). "Criticality and Susceptibility Indexes for Resilience-Based Ranking and Prioritization of Components in Interdependent Infrastructure Networks." *Journal of Management in Engineering*

- Criticality and susceptibility indices to rank and prioritize nodes with a heuristic algorithm
- Agent-based model to simulate the interdependent effects of node failures
- Development of a redundancy enhancement plan for improving network resilience

