

Rhode Island Coastal Hazard, Analysis, Modeling, and Prediction System (RICHAMP)

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Homeland Security Challenge

Emergency managers (EMs) need nuanced critical infrastructure consequence data that contextualize the local-scale risks from major storm events (e.g., hurricanes and nor'easters). New high-resolution ADCIRC storm models can inform storm preparedness measures at the local scale. Our team created a tool that integrates storm models with site-specific asset consequence data to be used by EMs in real time emergency situations within the Rhode Island State Emergency Operations Centers (SEOC). This research includes pilot studies in Providence and Westerly (Rhode Island) and is currently being expanded statewide (Figure 1)

One undergraduate, four masters, and three PhD students have contributed to this project, including:

- Develop the Consequence Threshold Framework (Years 1 -4)
- Interview facility and emergency managers (Year 5 & Year 6)
- Develop the survey tool for collecting consequence thresholds (Year 6)
- Develop dashboard and related protocols for EOC users (Year 6)
- Test and pilot tool within existing EM hurricane preparedness exercises (Year 6)

Students developed PhD and Master's theses, collected data (Figure 2), published papers, and developed survey design and methodological skills. The project connected students with individuals across public agencies and organizations.

Approach / Methodology

This project mixes quantitative and qualitative approaches to bring rich, actionable, data into the hands of end users. It is in the third phase of data collection and in the process of being operationalized. The research team conducts interviews and site visits at critical infrastructure facilities to collect asset data and facility manager concerns about storm impacts (Textbox 1). Data is collected through Survey123, a web and mobile GIS application developed by ESRI, integrated with ADCIRC models, and visualized at the Emergency Operations Center through web-based ArcGIS dashboard viewer which integrates critical infrastructure database points with wind, wave, and surge from real time storm models.

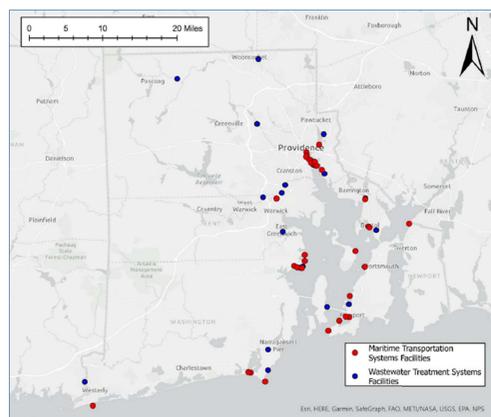


Figure 1. Wastewater and Maritime Transportation System sector facilities targeted for data collection in 2020-2021



Figure 2. Student performing in field data collection (Photo: Authors)

Approach / Methodology (cont.)

All project activities were guided by a Steering Committee composed of end-users including the RI Emergency Mgmt. Agency, RI Dept. of Transportation, RI Dept. of Environmental Mgmt., and US Coast Guard, and the RI Dept. of Health. Data collection protocols were developed with input from the steering committee and designed for handoff to Critical Infrastructure sector leads.

Asset of concern: An asset that is directly impacted by a storm hazard (waves, wind, flooding/surge)
The location of concern: The latitude and longitude of the specified asset
Hazard: The storm hazard (wind, wave, flooding/surge)
Hazard threshold: the magnitude of the hazard at which the functioning of the specified asset would be compromised
Consequence(s): the outcomes if the storm force exceeds the threshold at the location of the asset
Recovery period: The length of time needed for the asset of concern functionality to be restored

Example: At 6" of storm surge flooding, a computer server room at x/y is flooded resulting in loss of a communications network statewide and access to critical classified files. Recovery expected to take weeks.

Textbox 1 - Components of a Consequence Threshold collected from facility managers during interviews and site visits

Outcomes / Results

Over the course of six years, the research team collected data from Westerly, Providence, and now statewide. In total, approximately 600 "consequence thresholds" have been collected from 422 assets at 66 facilities across the state (Figure 3). The resulting Infrastructure Assets Consequence Thresholds database is integrated with ADCIRC storm models to result in a dashboard viewer hosted on Rhode Island's Enterprise GIS system.

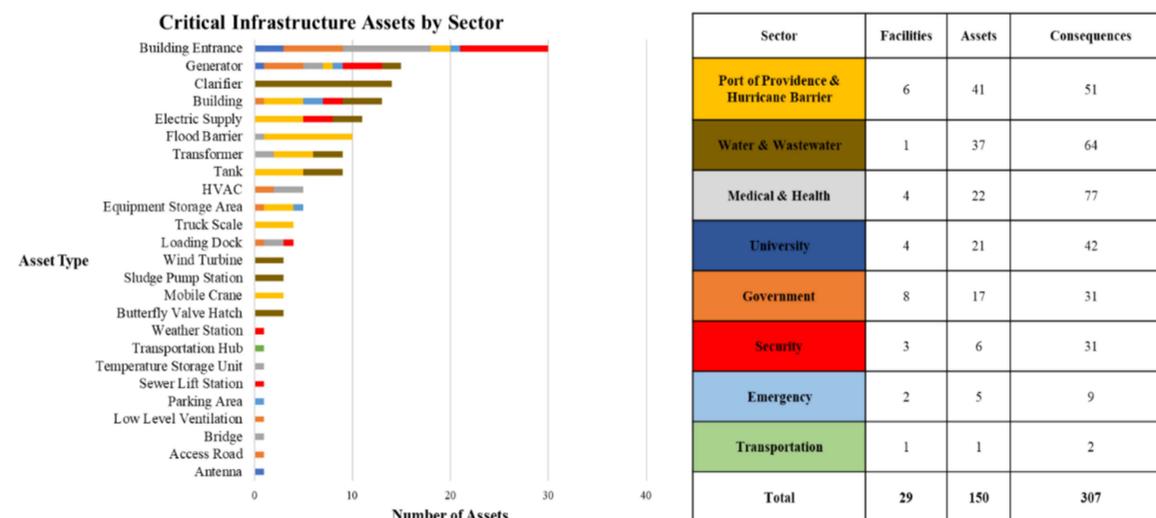


Figure 3. Example of assets identified by asset type and critical infrastructure sector from Providence Pilot Study

Conclusions

The team developed a standardized approach for capturing facility manager concerns that contains rich, actionable information that is relevant to the emergency management community. Grad students worked directly with facility and emergency managers across sectors and organizations to collaborate in the emergency planning and response process.

The resulting database and dashboard will enhance emergency management and planning for the State by providing emergency managers with pertinent, actionable information for local scale planning and response during a major storm event.

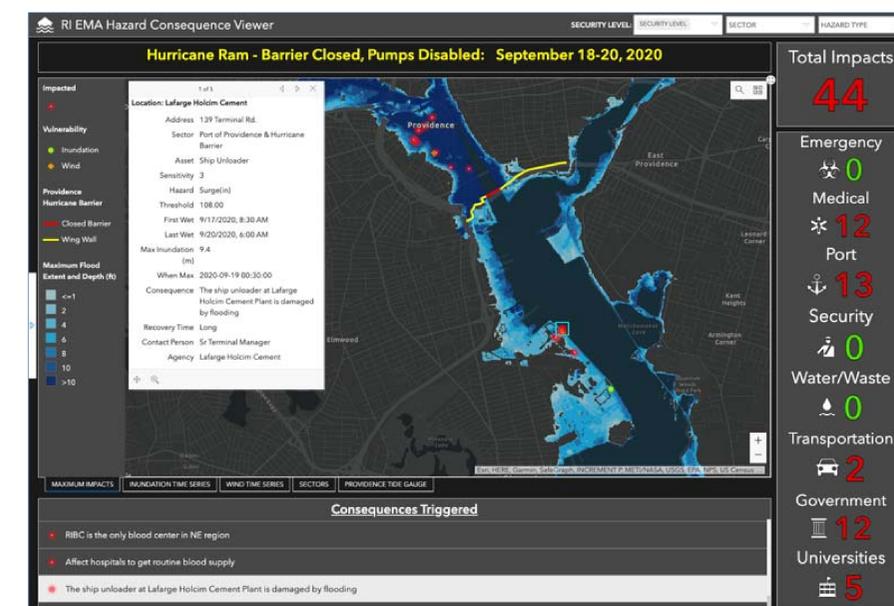


Figure 4. Example of final dashboard with database assets and storm modeling surge outputs. Pop up shown includes consequence of triggered asset.

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