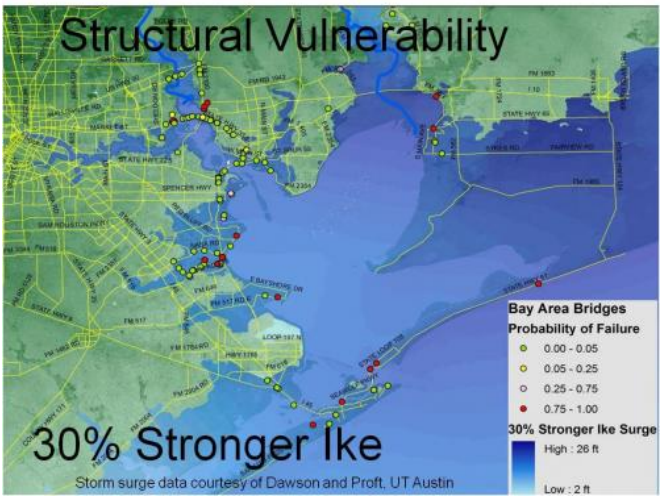
Rice research IDs vulnerable bridges (w/ Video)

5 June 2012



Preliminary results from a study of Gulf Coast infrastructure by Rice University researchers shows more than a dozen bridges that would be at risk of severe damage in a hurricane with a similar landfall as Hurricane Ike but with 30 percent stronger winds. (Credit: Padgett Group/Rice University)

Preliminary results from research at Rice University show more than a dozen Gulf Coast bridges on or near Galveston Island would likely suffer severe damage if subjected to a hurricane with a similar landfall as Hurricane Ike but with 30 percent stronger winds.

An awareness of which bridges are most at risk of damage in a strong hurricane helps public safety officials, said Jamie Padgett, a Rice assistant professor of civil and environmental engineering.

"We've been sharing these findings with emergency management agencies," Padgett said. "Some of the groups, particularly in the Clear Lake area, are interested in this information so they can plan emergency response routes, or at least do some hypothetical scenarios to think through their responses."

Padgett leads a research team modeling the performance of dozens of bridges in the Houston-Galveston region. They're determining how well bridges would withstand such a hurricane from their assessment of damage by 2008's Ike, the third-costliest storm in American history.

Padgett and Matthew Stearns, a former undergraduate student in her lab, wrote about the effect of hurricanes on bridges in a new book, "Lessons From Hurricane Ike," based on analyses after Ike and Hurricane Katrina in 2005. The book was published recently by Texas A&M University Press. The book incorporates material from more than 20 researchers associated with the Rice-based Severe Storm Prediction, Education and Evacuation from Disasters (SSPEED) Center.

After Ike, Padgett and Stearns published a paper in the American Society of Civil Engineers' journal on the impact of Ike on bridge infrastructure in Greater Houston and Galveston.

The first bridge featured in their lengthy report was the Rollover Pass Bridge on Bolivar Peninsula, northeast of Galveston. In 2008, the span, which sat 5.3 feet over the mean water elevation, was given National Bridge Inventory condition ratings of "good" for the superstructure and substructure, "very good" for the deck and "satisfactory" for the channel; yet that same year it was destroyed in Ike's 15-foot surge and five-foot waves. This highlights the fact that condition ratings alone are not sufficient indicators of bridge safety, particularly in the face of natural hazards, Padgett said, and it underscores the importance of risk-assessment studies such as those conducted by her group.

The bridge was one of 53 evaluated by Padgett and her team after Ike. They used data compiled by themselves and others, including the Texas Department of Transportation and design firm

HNTB, which worked on the state's recovery effort. Some bridges (mostly timber structures in rural areas) were destroyed by the storm surge and wave loading. Others were damaged by debris impact that accompanied the wind and water, and 25 more were weakened by scouring, where earth underneath the structures and supporting elements was washed away. Even 17 of the evaluated bridges that were far enough inland to escape significant storm surge suffered some degree of damage.

Advances in high-strength, corrosion-resistant materials and new design and construction techniques will help the next generation of bridges withstand such damage, said Padgett, who earned a coveted CAREER award from the National Science Foundation (NSF) last year to model sustainable solutions for bridge infrastructure subjected to multiple threats. But there are also fixes available to help existing bridges. "Through our work, we've identified some simple solutions," she said. "Adding details and retrofits to the structures, like shear keys or tie-downs, are potential solutions that would help protect bridges during hurricanes."

Padgett said the Houston Endowment's support of the SSPEED Center, along with her NSF award, were critical to her work. Her group also studies the impact of earthquakes and other factors, including increased load from a growing population, on bridges.

"Infrastructure reliability is certainly a hot topic worldwide," said Padgett, who is also studying bridges in California and Charleston, S.C. "We try to pick strategic locations that have an array of threats."

More information: Padgett Research Group: www.owlnet.rice.edu/~jp7/research.html

Provided by Rice University