Critical National Research Need

Peak Coastal Storm Water Elevations when Major Hurricanes Come Ashore Along the U.S. Gulf of Mexico and Atlantic Ocean Coastlines

An increasingly common occurrence when strong hurricanes come ashore along the Gulf of Mexico and Atlantic Ocean coastlines is that the hurricane surge/surface waves lift and push the superstructures of coastal bridges from their support bents into the water as shown in Figs. 1 and 2. Obviously the replacement/rehabilitation cost for the bridge shown in Figs 1 and 2 was very large and the disruptions in traffic and costs to the users of this bridge were very substantial as well.

The U.S. currently has design guidelines/standards which provide maps of the country showing the appropriate design

- wind speed and loads
- earthquake ground acceleration and loads
- snow depths and loads

at all locations in the country. When hurricanes make landfall for example, their extreme wind speeds and wind loads are covered in our design standards via maximum projected wind speed maps. However, the extreme storm surge wave levels/elevations along with the extreme surface wave heights superimposed on top of the surge wave that are a major part of hurricane loadings on coastal bridges and other structures along the coastlines are not covered in our design standards.

Sufficient data on peak hurricane storm surge elevations and peak surface wave heights should now be available in our data banks to create first generation maps of these

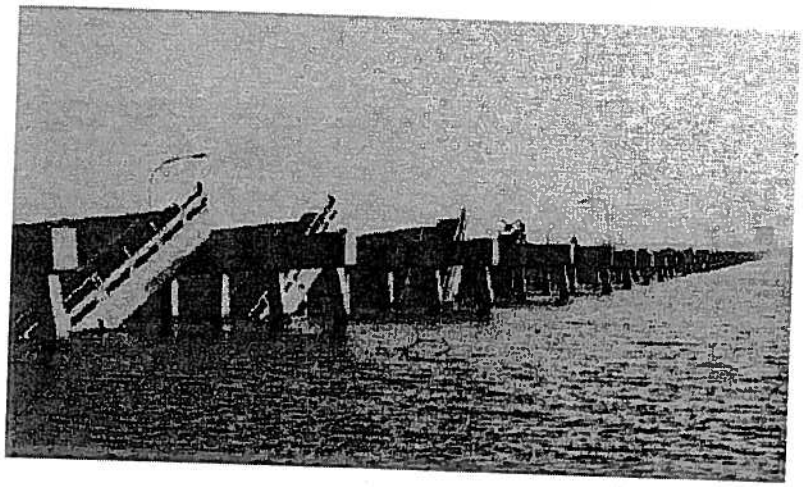

Figure 1 US-90 Biloxi-Ocean Spring Bridge After Hurricane Katrina
(photo credit: J. O'Connor, MCEER) [1].

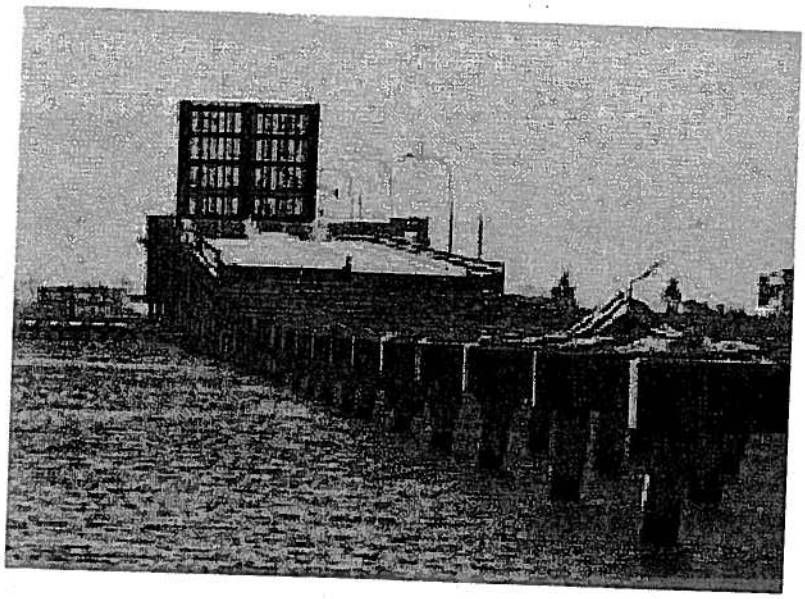

Figure 2 US-90 Biloxi-Ocean Spring Bridge Near
Navigation Channel After Hurricane Katrina
(photo credit: J. O'Connor, MCEER) [1].

[1]. NIST Technical Note 1476, "Performance of Physical Structures in Hurricane Katrina and Hurricane Rita: A Reconnaissance Report," National Institute of Standards and Technology, Gaithersburg, MD, June 2006.

parameters for our Gulf of Mexico and Atlantic Ocean coastlines. The creation of these extreme water surface level maps would be the purpose of this recommended investigation.

Maximum storm surge wave elevation along with the associated wind induced significant surface wave height at the bridge location are the critical parameters needed in designing coastal bridges to withstand major hurricane events. In designing new coastal bridges these parameters are needed to determine the minimum underneath superstructure clearance to allow the hurricane surge plus surface waves to pass underneath the new bridge superstructure. For existing coastal bridges, these same parameters are needed in conjunction with the bridge superstructure elevation dimensions in order to identify appropriate retrofit actions to allow the bridge to withstand a major hurricane event.

A critical national research need to minimize the happenings illustrated in Figs 1 and 2 is to develop accurate maps which provide mean sea levels (MSL) and tidal ranges along with estimated maximum storm surge elevations above MSL and maximum wind induced surface wave heights associated with strong hurricanes for the U.S. Atlantic and Gulf of Mexico coastlines. The maps should provide the above recorded and estimated peak water surface levels/elevations/heights along the Atlantic and Gulf of Mexico coastlines for a 100-year design hurricane event.

Highway and railroad agencies for all states having coastlines along the Gulf of Mexico and Atlantic Oceans would benefit greatly from such maps. In turn the travelling public would benefit from unnecessary detouring and time delays as well as from the high cost of replacing coastal bridges. For new coastal bridges, such maps would better allow engineers to design their heights so as to allow hurricane surge and surface waves

to pass beneath the bridge superstructure without making the heights too excessive and costly. Additionally, such maps would allow highway and railroad agencies to evaluate the adequacy of their existing coastal bridges for a major hurricane event. If such evaluations indicate the need, these same agencies could take retrofit actions to strengthen their coastal bridge substructures, superstructures or the connections between the sub- and superstructures to allow them to withstand a 100-year design hurricane event.