Structures

In the aftermath of Katrina several groups systematically documented the performance of affected structures. Of particular interest are bridges, major buildings, and residential construction. This work provides a number of lessons important to the rebuilding.

Approximately 45 bridges sustained damage in the gulf coast, with the damage ranging from minor damage to railings and approach spans to major damage, as was seen in the collapse of several bridges. The overall cost to repair or replace the bridges damaged during the hurricane, including emergency repairs, is estimated at over $1 billion. Bridge damage primarily resulted from storm surge, wind, and impact damage from debris. The I-10 twin span bridge across Lake Pontchartrain was the most catastrophic of the bridge failures, with over 473 spans shifting off their supports, and 64 spans completely fallen into the lake.

The aftermath of Hurricane Katrina revealed the limitations of the present technology to record wind speeds and storm surge. Several anemometers were non-functional almost three to four hours before the hurricane came ashore. Without accurate readings, the information on wind speeds was obtained by interpolation and/or approximation. The time and heights of waves when the storm surges reached the shore were sketchy at best. This created serious problems to determine the insurance claims both for the insurance companies as well as for those insured making lives uncertain and difficult for thousands of people along the Gulf Coast. It is important that the engineering community get involved to demand better and reliable instrumentation before such a calamity hits the coastal areas again.

Most engineers would agree that the majority of Katrina-related structural damage occurred due to flooding as opposed to wind. Along the Gulf Coast, most flooding damage was usually caused by Katrina's exceptional high storm surge. However, within southeastern Louisiana's hurricane protection system, flood damage was caused by long term flooding that resulted from overtopping and failure of the levee system. Potential methods of flood mitigation are different, depending on if the damage was due to storm surge or levee failure. FEMA Flood Insurance Rate Maps, with their special flood hazard areas (or zones) and base flood elevations, are used by communities as part of their building requirements. In general, Zone A indicates that a structure is located in an area of special flood hazard and Zone V indicates that a structure is located in an area of special flood hazard that includes inundation by tidal floods (coastal high hazard area). Upon review of structures damaged by storm surge, coastal engineers are now suggesting that another zone designation, Zone Coastal A, be instituted with requirements less stringent than those for Zone V but more stringent than Zone A requirements. Mitigation of flood damage within the metropolitan New Orleans' hurricane protection system is different. FEMA recommends that new construction and substantially damaged homes and businesses within the FEMA floodplain be elevated to the BFE or three feet above the highest adjacent ground elevation at the site and that new construction or substantially damaged buildings not in the floodplain also follow the three foot elevation recommendation. In addition, FEMA has assumed that the levee system will be certified, when repaired, to withstand inundation by a one percent chance storm event.

The structural topics for discussion during the forum include:

How did the various structural systems respond to the wind and flood loading?

What are the structural lessons to be learned from this experience?

Do these lessons apply to other regions susceptible to wind and flooding?

What new structural technologies offer immediate promise in reconstruction?

Which structural technologies merit research and development for possible future application?