THE STORM AS A TEACHER:
Lessons in Preparedness from Hurricanes Ike and Rita

By Calvin Powitzky

What were the lessons learned from the devastating storms created by Hurricanes Ike and Rita? What building and design practices proved reliable, and how can advance planning help to mitigate confusion and speed recovery in the aftermath of such disasters?

Structures on the Texas Gulf Coast must withstand a wide variety of environmental challenges, but perhaps none so potentially catastrophic as the high winds and flooding typically associated with hurricanes. The two most recent Gulf Coast weather disasters, Hurricanes Ike and Rita, proved to be adept teachers for builders of coastal area schools and public structures. What were the lessons learned from these devastating storms? What building and design practices proved reliable, and how can advance planning help to mitigate confusion and speed recovery in the aftermath of such storms?

Crenshaw School – sole survivor of Hurricane Ike

Learning from buildings that survived

Design and Construction

When Hurricane Ike roared across Bolivar Peninsula, impacting the entire upper Texas Gulf Coast early on the morning of September 13, 2008, the category 2 storm with a category 4 storm surge destroyed most of the town's buildings – but one structure escaped damage: **Galveston ISD's Crenshaw School.** This Pre-K through 8th grade school completed in 2005 is located a quarter mile from the Gulf of Mexico. Because of its proximity to the ocean, it was elevated above grade and designed to withstand a 140 MPH wind load. Crenshaw was the only commercial building on Bolivar Peninsula to survive the storm as the hurricane's eye passed directly over the town. In fact, in the aftermath of Ike, Crenshaw immediately became a regional relief headquarters for FEMA, the County of Galveston, and the State of Texas, providing greatly needed assistance to the devastated area.

School officials predicated their selection of an architectural firm on the firm's knowledge of successful coastal construction techniques and of understanding of the applicable building and wind codes established by the State Department of Insurance and local jurisdictions. In some cases, the district elected to exceed those requirements—first by increasing the wind load criteria from 130 (mandatory) to 140 MPH, and secondly, increasing the finish floor elevation from 17 (mandatory) to 22 feet above sea level. Hurricane Ike proved both were very wise decisions. Crenshaw accounted for only $50,000, predominantly clean-up costs, of the over $68 million in damage in Galveston ISD facilities. In addition, several design decisions

In an area of extreme devastation, Crenshaw School stands up to Hurricane Ike.

contributed to the stability and safety of the building, including:

- A roof assembly consisting of a poured, insulated, lightweight concrete deck with a fully adhered, multi-ply roof system. Because this design had little reliance on mechanical fasteners, it proved to be superior to mechanically-fastened / rigid insulation roof assemblies and metal roofing systems. Roof failures accounted for more than 75% of the destructive cost of Hurricane Ike.
- Additionally, rooftop equipment was installed with supplemental anchoring to prevent becoming airborne debris.
- An elevated, cast-in-place concrete slab, rising 18 feet above grade and several feet above coastal code requirements. Having a mostly unobstructed area below the building allowed for the estimated 16 foot storm surge to pass safely below the building, rather than into it.
- All glass doors and windows were designed with curtain wall type framing with 9/16 inch large missile impact resistant safety glass. Although the glass areas were left unprotected during the storm, there was not a single failure of any glazed assemblies.
- Use of carpet in areas of high vulnerability was limited; for example, directly inside storefront glass entrances, as these doors are not completely waterproof in a horizontal driven rain.
- Careful consideration was given to the use, location and construction of walkway covers and similar open type assemblies. These types of structures have to withstand the full extent of the storm's positive and negative pressures.
- An automatic transfer switch was included to connect an emergency generator, if not an actual onsite generator, to have the ability to quickly provide much needed power to essential elements of the building after the storm to prevent further loss.

Another school, **Sabine Pass School,** was similarly designed and constructed, and survived without damage, despite receiving 16 feet of water and up to three feet of mud left behind by Ike. It also stood squarely in the path of Hurricane Rita in 2005 and escaped undamaged. **Sabine Pass School,** with its landmark "lighthouse" design, stood firm – largely as a result of careful design and planning done almost a decade before. Unlike the program of Crenshaw School, Sabine Pass was designed to be a community refuge to remain functional both during and after a catastrophic storm. During both the referenced storms, the school served as shelter for local residents during the storm and then functioned in the aftermath as the area's primary recovery headquarters. Like Crenshaw School, Sabine Pass School incorporated the same design considerations described above. Where roof failures elsewhere accounted for the majority of storm-related damage, neither roof on the aforementioned schools suffered membrane failure, in spite of winds in excess of 110 MPH. Both communities however, were for all practical purposes, devastated.

Disaster Preparedness

Timely recovery after a major storm depends heavily on planning before the storm, the ability of teams to coordinate and communicate, and the ability to quickly and efficiently secure needed supplies and services. Basic steps of preparedness prior to landfall make this possible, for example:

- Review facility design and remediate any potential hazards where possible (remove or secure loose equipment and materials, position extra tie-downs on roof equipment, trim or remove hazardous trees, etc.).
- Assign team leaders and alternates for post storm efforts including recovery, assessment, administration and communication.
- Review essential personnel; establish evacuation criteria as well as return criteria. In most cases, areas subjected to a storm will be without electricity and possibly even clean water for several days or weeks. Having personnel return to unlivable conditions will certainly impede any recovery progress.
- Assign specific post-storm tasks and responsibilities for recovery management team, damage assessment and recovery team, and administrative support team.
- Assemble pre-staged resource kits which might include flash-

lights, tarps, rain ponchos, batteries, respirators, air blowers, laptops and wireless cards to facilitate damage assessment and potential hazards left in the storm's wake.

- Plan for an alternate command post location in case of power failure, damage or lack of accessibility. This location could house all communications, team reporting, and personnel assignments.
- Secure commitments from contractors / vendors prior to the storm to provide the services and equipment necessary for immediate storm response and on-going recovery. The demand for such services is so great after a storm that without pre-arrangements it may be impossible to get the outside help needed.
- Make sure computer servers are backed up and crucial data is removed from the area to a safe location and provide security for computer hardware in a very protected environment.
- Prepare pre-staged templates for website updates, press releases and phone tree messages. Communication is a critical element in the recovery process. Should some forms of communication be unavailable, pre-planning in developing contingency plans is essential.
- Test cell phones and secure duplicative phone/radio systems where possible.
- Top off fuel storage tanks and have a non-electric means for dispensing. Local fuel supply may be down for as long as power is down, and mobility after the storm is critical to assessing and addressing damage as quickly as possible.
- Execute a "dry run" or table top drill to test the hurricane disaster plan before the storm. Testing the plan in a real event is not the time to discover any deficiencies.

Wise planning and sound design can avert disaster.

Post-storm Assessment

Every catastrophic weather event is a learning experience. There is much that can be done pre-storm, both in terms of design and construction, and in disaster planning. But there are also lessons to take away post-storm. Conduct a post recovery effort evaluation to determine what can be done in a future event to better protect the elements of a building that suffered damage. Also conduct a "lessons learned" evaluation with respect to the pre-storm recovery plan and what can be done to improve it. No two storms will have identical impact and results; however, they all share common elements that will have to be addressed.

Finally, even the most damaging of storms can be weathered. With knowledgeable design, wind resistant construction assemblies, and well-practiced preparedness planning, damage can be at least lessened, if not prevented. These two schools – both in the direct pathway of the Texas Gulf Coast's last two most threatening storms, are proof that wise planning and sound design can withstand extreme weather. ■

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