6. Historic Buildings

Hurricane Katrina impacted a significant number of historic buildings and it is important to learn how these buildings responded. Information gathered on the behavior of these historic building systems will assist state and local officials in making sound decisions regarding their rehabilitation. Identifying best practices for rehabilitating historic building systems will also help communities nationwide as they prepare disaster plans and update historic building codes and guidelines.

Sections 6.1 and 6.2 discuss flood and wind damage to historic buildings in Mississippi and Louisiana, respectively. Appendix J contains information on pre- and post-disaster mitigation for historic buildings.

Storms claim historic properties that are exposed to coastal hazards, such as flooding and wind, and each year more efforts are undertaken to save these valuable historic assets. Although wind damage from Hurricane Katrina was observed throughout the declared disaster areas, most of the damage appeared to be flood related. In many of the towns and cities along the Mississippi Gulf Coast and in southeast Louisiana, historic properties (individual buildings and historic districts)

that escaped significant damage or complete destruction from flooding were in elevated locations or distant from the coast. The majority of the historic properties that suffered flood damage were those located in exposed locations and vulnerable to surge and wave impact, had floor elevations much lower than the severe surge elevations from Katrina, or were in low-lying areas.

6.1 Flood Damage

Flood damage to historic structures was caused by velocity flow (i.e., rapidly moving water and waves) and inundation, or rising waters. Damage from floodborne debris, associated with velocity flow, significantly contributed to the damage observed. General flooding from rising water impacted buildings differently depending on the direction of the inundation; this is discussed in more detail in Chapter 8.

Historically, many buildings were built near waterways, as they were part of the commerce transportation system. Many such buildings were designed to be intermittently flooded and included elevated floors, flood vents, or selected materials that stood up to floodwaters. These historic buildings, constructed on raised foundations to allow the water to pass underneath, or on foundations and exterior walls of substantial mass with flood vents, often fared relatively well where they were only impacted by rising water and not wave or debris impacts. One of these successes is shown in Figure 6-1.

In coastal areas, where velocity flow can have a tremendous impact on the buildings, the survivability of the buildings will be dependent on many of the design elements seen in newer construction. Regardless of these design successes, numerous historic buildings were devastated by waves and floodborne debris. On the Mississippi Gulf Coast, many historic buildings that might have otherwise survived high floodwaters were completely destroyed by waves and floodborne debris.

6.1.1 Biloxi Lighthouse (Biloxi, Mississippi)

The Biloxi lighthouse was built in 1848 just off the beach waterfront. It is constructed of brick encased by cast iron painted white. The height of the tower is 61 feet. Other than losing the door and one piece of glass, the Biloxi lighthouse suffered little damage and was one of the few successes (Figure 6-1).

Due to the location of many historic structures on the open coast, numerous buildings were damaged by floodborne casino barges (see Figures 6-2 and 6-3). It should be noted that the size of the casino barges, combined with the high storm surge that allowed the barges to reach the buildings, were unprecedented elements and unique to Katrina. The barge collisions were spectacular but not common. Beauvoir, Jefferson Davis' home (see Figures 6-4 through 6-6), represents the more common type of wave damage observed. Similar damage was observed in Mandeville, Louisiana, which is also home to many historic buildings (refer to Sections 4.1.1.3 and 9.2.2 for more information on Mandeville).

The before and after examples on the following pages illustrate the flood damage and devastation to historic properties from Hurricane Katrina.

Figure 6-1.
Other than losing the door (circled) and one piece of glass, the Biloxi lighthouse suffered little damage from Hurricane Katrina (Biloxi, Mississippi).

6.1.2 Tullis-Toledano House (Biloxi, Mississippi)

Built in 1856, the Tullis-Toledano House was an example of Greek Revival architecture with rich architectural detail. The house was furnished in a period style to interpret Biloxi's antebellum history. Badly damaged by Hurricane Camille, it was purchased by the City of Biloxi in 1975 and restored as a historic house museum and recreational area. The house was completely destroyed by a casino barge during Hurricane Katrina (see Figure 6-2). It is likely the house would have survived, although heavily damaged, had it not been struck by the barge.

Figure 6-2.
A casino barge moved by high surge completely destroyed the Tullis-Toledano House and now sits where the house was located. The inset shows the house prior to Hurricane Katrina (Biloxi, Mississippi).

6.1.3 Tivoli Hotel (Biloxi, Mississippi)

Built in 1927, the Tivoli Hotel, a 64-room luxury hotel, sat abandoned prior to Hurricane Katrina, waiting to be restored to its former glory. In 2003, the Mississippi Heritage Trust called the Tivoli Hotel one of the state's 10 most endangered historic places. With the surge from Katrina, a casino barge struck and destroyed the colonnade and four floors at the southeast corner of the hotel (see Figure 6-3).

Figure 6-3.
Tivoli Hotel after being struck by a casino barge during Hurricane Katrina. The inset shows the hotel prior to the storm (Biloxi, Mississippi).

6.1.4 Beauvoir, Jefferson Davis' Home (Biloxi, Mississippi)

Built in 1848, Beauvoir (see Figure 6-4) and the surrounding structures sustained serious flood (velocity flow) damage from Hurricane Katrina. Approximately 75 percent of the main house still stands, except for the front, side, and rear porches (see Figures 6-5 and 6-6). Many windows, doors, and columns are also gone.

Figure 6-4.
Front elevation of Beauvoir before Hurricane Katrina (Biloxi, Mississippi)

Figure 6-5.
Front elevation of Beauvoir after Hurricane Katrina (Biloxi, Mississippi)

Figure 6-6.
Rear elevation of Beauvoir after Hurricane Katrina (Biloxi, Mississippi)

The main house at Beauvoir is raised approximately 8 feet above grade with brick piers. The space between the piers was in-filled with break-away panels, allowing the surge to pass under the house, minimizing the damage to the main structure and preventing the house from collapsing. The surrounding porches and several piers were lost due to the uplift of the surge. Although not historic, the gift shop, a brick structure built slab-on-grade located approximately 200 feet east of the main house, was completely washed off its foundation (see Figure 6-7).

Figure 6-7.
Gift shop at Beauvoir completely destroyed by Hurricane Katrina (Biloxi, Mississippi)

6.1.5 Longue Vue House and Gardens (New Orleans, Louisiana)

Built in 1924, and rebuilt between 1939 and 1942 to its present state, the Longue Vue House and Gardens property borders the 17th Street Canal about 2 miles south of where the levee failed. The basement was completely flooded and water was within inches of the main level. During the MAT's visit, the water was being pumped out and staff members were working to stabilize the condition of the resident collection of museum pieces, composed of paintings, books, and other artifacts. The gardens, after a multi-year restoration, were badly damaged from immersion. Figures 6-8 and 6-9 show the front elevation and garden areas of this site, respectively.

Figure 6-8.
Front elevation of Longue Vue after Hurricane Katrina (New Orleans, Louisiana)

Figure 6-9.
Garden and fountain at Longue Vue after Hurricane Katrina (New Orleans, Louisiana)

6.1.6 Milne Boys Home (New Orleans, Louisiana)

Established in 1933, Milne Boys Home is a collection of large antebellum-style, white-columned buildings that housed orphans and wayward youths until 1986. Operated by the New Orleans Welfare Department, Milne is famous for its most notable non-resident, Louis Armstrong. Armstrong, contrary to popular lore, was never a resident at Milne. The Armstrong Manhood Development Program, however, provides assistance to wayward boys. The building experienced approximately 3 feet of flooding as shown in Figure 6-10.

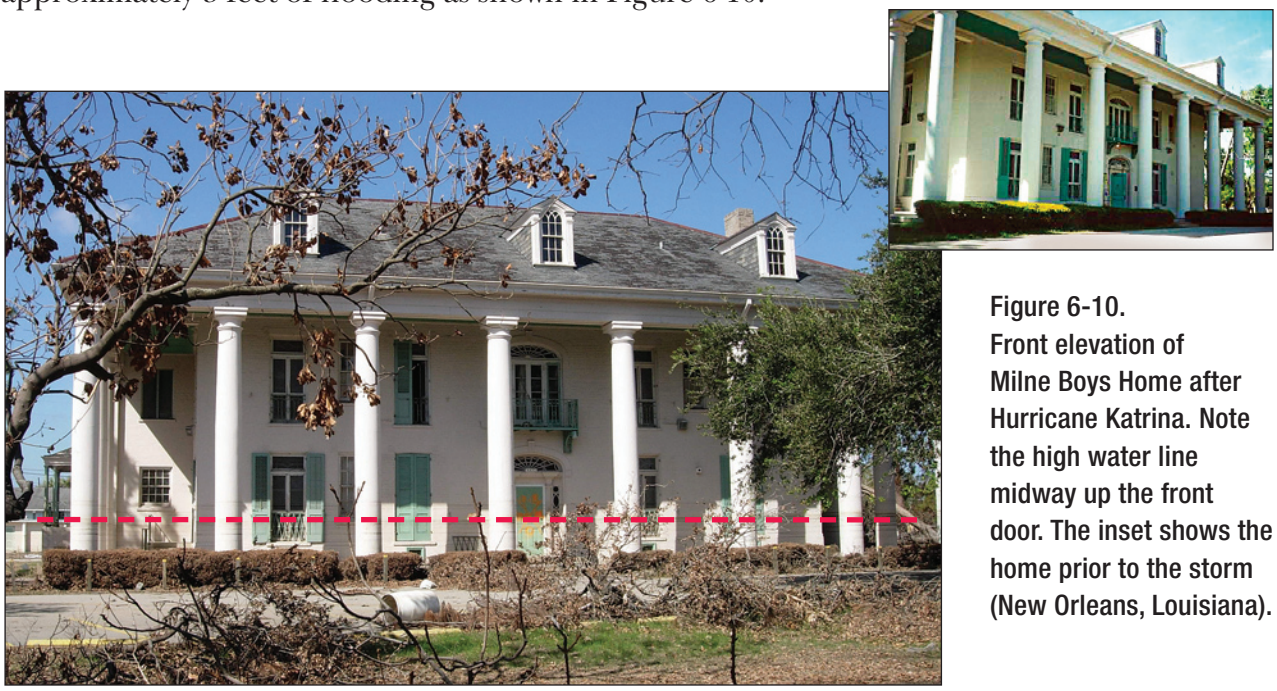

Figure 6-10.
Front elevation of Milne Boys Home after Hurricane Katrina. Note the high water line midway up the front door. The inset shows the home prior to the storm (New Orleans, Louisiana).

6.1.7 Bank Building (Bay St. Louis, Mississippi)

The "before" picture of this empty bank building (see Figure 6-11) was taken 2 weeks before Hurricane Katrina. Surge waters moved through the front windows and door, collapsing the side elevation and part of the second floor (see Figure 6-12).

Figure 6-11.
View of front elevation of bank before Hurricane Katrina (Bay St. Louis, Mississippi)

Figure 6-12.
View of front and side elevations of bank after Hurricane Katrina (Bay St. Louis, Mississippi)

6.2 Wind Damage

Katrina was not a major wind event and, with the exception of buildings within close proximity to the center of the hurricane, historic buildings sustained relatively little direct wind damage from this storm. Most of the observed damage to historic buildings was related to the effects of windborne debris or falling trees. Damage to windows allowed internal pressurization, which resulted in roof failure as shown in Figures 6-13 and 6-14.

Built in 1920, the Kress Building lost its exterior windows, allowing the wind to lift and tear off the roof. The original roof of the Kress Building was wood joist/rafters at 16 inches on center, which was lost in a fire. The replacement roof is light gauge steel framing with purlins at 4 feet on center and a standing seam metal roof covering. When the roof was replaced, the spacing of the fasteners holding down the roof covering was increased from 16 inches on center to 4 feet on center, contributing to its failure from uplift.

Figure 6-13.
Internal pressure from wind through the broken windows lifted the roof (Biloxi, Mississippi).

Figure 6-14.
Interior view of the Kress Building showing roof torn away (Biloxi, Mississippi)

Some wind damage to roof systems was observed; however, even though most historic structures do not meet today's building codes, there were many successes observed because construction techniques used in historic structures make some roofs more survivable than seen in present day framing practices. For instance, the overhangs and porches in historic structures were built with the structural framing of the porch integral with the main framing. Overhanging rafters of porches are often continuous with the main roof framing, allowing them to survive wind uplift (as seen in Figure 6-15), instead of being independently framed from the main framing, which contributes to the roof being blown away. In addition, in historic structures, roof sheathing is typically 1-x-6-inch or 1-x-8-inch board lumber, instead of plywood or oriented-strand board (OSB). Due to the frequency of fasteners and the smaller surface area per board, as compared to plywood or OSB, board lumber is less likely to act as a sail in the strong winds, compromising the integrity of the roof.

As it is in all buildings, the prevention of wind penetration into historic buildings is critical. Wind that penetrates buildings increases the interior wind pressure, contributing to additional uplift. Shutters are a common element found on many historic buildings; shutters were observed to have successfully protected windows from breakage.

Due to their age, many historic properties are surrounded by substantial tree growth. Many historic buildings, primarily residential, suffered considerable damage from trees blown over by high winds. A substantial number of trees blown over at the roots were observed by the MAT in the New Orleans area; however, the field survey was performed after Hurricane Rita, which followed Hurricane Katrina by 3 weeks, and it is believed that most of these trees were blown over during Rita as a result of the long-duration flooding and saturated ground conditions left in the wake of Hurricane Katrina.

The following series of photos illustrates some of the successes and failures observed from wind damage associated with Hurricane Katrina on the Mississippi Gulf Coast and in New Orleans.

6.2.1 Veterans Affairs Medical Center (Gulfport, Mississippi)

Built in 1917, the Gulfport Veterans Affairs Medical Center (VAMC) is a campus plan of a dozen historic structures. Although the VAMC in Gulfport lost the entire second floor porch and roof supports to velocity-flow floodwaters, the integral framing of the roof structure allowed the overhang to successfully survive the wind uplift from Hurricane Katrina (see Figure 6-15).

Figure 6-15.
Loss of the entire second floor porch and roof supports to flooding; the main roof stayed successfully intact due to integral framing of the roof structure (Gulfport, Mississippi).

6.2.2 Benachi House (New Orleans, Louisiana)

Built in 1858, the Benachi House lost two columns from the second floor front elevation from wind forces, as well as roof covering (see Figure 6-16). Its cottage house sustained structural damage from fallen trees (see Figure 6-17). The dead lawn and shrubs are an indication of long-term flooding.

Figure 6-16.
Wind damage to the second floor columns of the Benachi House. Note missing columns (circle) (New Orleans, Louisiana).

Figure 6-17.
Tree damage to the rear cottage house of the Benachi House (New Orleans, Louisiana)

6.2.3 Pitot House Museum (New Orleans, Louisiana)

Built in 1799, and located on historic Bayou St. John, the Pitot House is the only Creole colonial style house museum in New Orleans. It was home to James Pitot, the first mayor of New Orleans, who lived there from 1810-1819. The property, with its stucco-covered, brick-between-post construction and double-pitched hipped roof, was restored to its original 18th century condition in the 1960s. The house had been furnished with Louisiana and American antiques from the early 1800s, in keeping with the style and period of James Pitot.

The Pitot House Museum successfully weathered Hurricane Katrina in part due to the presence of shutters on the windows, which protected the building's glazings and prevented wind penetration into the museum (see Figures 6-18 and 6-19).

Figure 6-18.
Front elevation of Pitot House showing damage to the front wood fence. The house survived very well, with no evidence of flood damage and little wind damage (New Orleans, Louisiana).

Figure 6-19.
Although one window did sustain damage from windborne debris, the remaining windows of the Pitot House were not damaged (New Orleans, Louisiana).

6.2.4 Valence Street Baptist Church (New Orleans, Louisiana)

Built in 1886, the wood-framed Valence Street Baptist Church, registered as a historic building, sustained wind damage, which allowed water intrusion (see Figure 6-20).

Figure 6-20.
Hurricane Katrina wind damage to steeple, front door, and windows. The inset shows the church prior to Katrina (New Orleans, Louisiana).

6.2.5 Longue Vue House and Gardens (New Orleans, Louisiana)

Longue Vue House and Gardens, described in Section 6.1.5, suffered wind damage to shutters and roof covering materials during Hurricane Katrina (see Figures 6-21 and 6-22).

Figure 6-21. View of wind damage to flashing along rake of Longue Vue after Hurricane Katrina (New Orleans, Louisiana)

Figure 6-22. View of wind damage to shutters of Longue Vue after Hurricane Katrina (New Orleans, Louisiana)