9. Mitigation Successes and Best Practices

In addition to the wide range of damage observed, the MAT also found a series of mitigation projects and activities implemented prior to Hurricane Katrina that showcased the successes of mitigation in the affected area.

This chapter highlights certain noteworthy examples of successful mitigation projects and best practices, organized under the general categories of acquisition projects (Section 9.1), elevation projects (Section 9.2), wind retrofit projects (Section 9.3), higher regulatory standards implemented by local jurisdictions (Section 9.4), and other best practices (Section 9.5). Figure 9-1 provides an overview of site locations.

9.1 Acquisition Projects

9.1.1 Brickyard Bayou Acquisition Project (Gulfport, Mississippi)

This acquisition project was begun following Hurricane Georges in 1998 and completed in 2002 as a result of coastal flooding repetitive losses from the adjacent Brickyard Bayou. The at-risk

properties included in this acquisition project consisted of approximately 230 buildings located along both sides of Brickyard Bayou on Jeffrey Circle, Johnson Drive, 30th Street, Katz Avenue, Boyd Avenue, Brookwood Avenue, Audubon Drive, Pineland Drive, Hunter Avenue, and Altbach Avenue in Gulfport, Mississippi.

The community's goal in administering this project was to acquire as many properties as possible along these streets to avoid a "checkerboard" approach to mitigation, by uniformly removing all at-risk buildings from the target area. A number of the buildings acquired were repetitive loss properties (at least 17 of these had 4 or more insured losses since 1978 according to NFIP data). Several were also on State of Mississippi and Federal target repetitive loss lists. Based on MAT observations in the area (post-Katrina), the initial indication was that the majority of the acquired homes would have been flooded by up to 6 feet of water had they not been removed. As further evidence of this, houses just outside the project area appeared to have sustained significant damage from flooding.

Figure 9-1.
Locations of some of the mitigation successes and best practices observed by the MAT

Figure 9-2 shows a typical building within the project area prior to its acquisition and subsequent demolition. Figure 9-3 shows a small representative portion of the cleared area after the acquisition and demolition of the houses.

Figure 9-2.
Pre-acquisition/pre-demolition photo of representative building included in project (photo ca. 1999/2000) (Gulfport, Mississippi)

Figure 9-3.
This photo, taken post-Katrina, shows a few of the vacant lots after the acquisition project removed approximately 230 residential buildings from the flood hazard area. The primary source of flooding (Brickyard Bayou) is located just beyond and running perpendicular to the south end of this street (arrow) (Gulfport, Mississippi).

Approximately $19 million in Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance (FMA) program, and supplemental funding was used. (This total may include some additional buildings in Gulfport that have been approved, but not yet mitigated.) This project has essentially paid for itself with losses avoided in this one event.

9.1.2 Acquisition Project (Pascagoula, Mississippi)

The City of Pascagoula used a combination of HMGP and supplemental funding (approved in 2001) to acquire and demolish approximately 10 at-risk buildings on Parsley Avenue, Chickasaw Avenue, Edgewood Avenue, Canty Street, Sherwood Street, Tupelo Avenue, 11th Street, and 14th Street (see Figure 9-4). Over half of the buildings included in this project were repetitive loss properties. Structures within the area that were not part of this project sustained damages from up to 6 feet of water.

Figure 9-4.
An example of a vacant lot resulting from the acquisition/demolition project (right arrow) next to a property that did not participate in the program and that was damaged by Hurricane Katrina (left arrow) (Pascagoula, Mississippi).

9.2 Elevation Projects

9.2.1 Lacombe, Louisiana

The residential property shown in Figure 9-5, located in Lacombe, Louisiana (in St. Tammany Parish southwest of Slidell), was elevated using HMGP funding to a height well above the flood depth associated with Hurricane Katrina. No flood damage was observed to the lowest finished floor. Some wind damage was noted to the roof, as evidenced by the blue roof covering.

The house shown in Figure 9-6 was also elevated (using HMGP funding) above the flood depths associated with Katrina.

Figure 9-5.
Post-Katrina photo of an HMGP-elevated house. Note the estimated water line associated with Hurricane Katrina (red line) (Lacombe, Louisiana).

Figure 9-6.
Another post-Katrina photo of an HMGP-elevated house. Note the estimated water line associated with Hurricane Katrina (red line) (Lacombe, Louisiana).

9.2.2 Elevations Along Lakeshore Drive in Mandeville, Louisiana

Much of central Mandeville has a shorefront road along Lake Pontchartrain (Lakeshore Drive) with houses only on the north side. The houses range in elevation from those close to ground level to higher elevations designed to accommodate under-house parking. The elevated houses represent a mix of mitigation projects, owner-elevated houses (no Federal funding used), local building inspector recommendations, and historic buildings that were elevated by the owner/builder long before any official flood maps would have been created for the community. In all observed instances, the low-elevation houses were heavily damaged, while the elevated houses survived the event in good condition. Figures 9-7 through Figure 9-11 illustrate the range of elevations observed and the level of damage to each.

Figure 9-7.
This building, elevated only a few feet above ground level, was heavily damaged by storm surge and flooding during Hurricane Katrina. Note the estimated flood depth in relation to the first floor (red line) (Mandeville, Louisiana).

Figure 9-8.
This building is the oldest house in Mandeville (built in 1836) and is on the National Register of Historic Places. The house is elevated 3 feet on piers and suffered wave damage to 18 inches above the floor. Note the estimated flood depth in relation to the first floor (red line) (Mandeville, Louisiana).

Figure 9-9.
In contrast to the preceding examples, this 100-year-old building, also on the National Register of Historic Places and located next door to the house in Figure 9-7, received minimal damage. Note the estimated flood depth in relation to the first floor (red line) (Mandeville, Louisiana).

Figure 9-10.
Another example of an elevated house that sustained only minor damage. Note the estimated flood depth in relation to the first floor (red line) (Mandeville, Louisiana).

Figure 9-11.
This building was relocated from New Orleans for use as a restaurant. The local building inspector recommended the elevation seen here, which protected this building from flood damage. Note the estimated flood depth in relation to the first floor (red line) (Mandeville, Louisiana).

According to local officials, recent flood retrofit successes were apparent to other homeowners, many of whom have since expressed interest in considering Increased Cost of Compliance or mitigation grant program funding for elevation retrofits, if available.

9.3 Wind Retrofit Projects

9.3.1 Harrison County Courthouse (Gulfport, Mississippi)

In 1999/2000 (following Hurricane Georges in 1998, which heavily impacted the Mississippi Gulf Coast), officials from Harrison County, Mississippi Emergency Management Agency, and FEMA's Building Sciences division met to evaluate the Harrison County Courthouse, which also currently houses the Harrison County EOC, as an opportunity for a potential hurricane wind retrofit project. Among other observations, the team noted rows of unprotected windows around the building, under which were stored valuable records and documents (some dating back to 1841), computers, and other electrical equipment. Roll-down metal shutters were installed using HMGP funding (see Figure 9-12).

During Hurricane Katrina, windows of vehicles located in the building's parking lot were broken by windborne aggregate blown from the roof of the building. At least some of this aggregate, along with branches from nearby trees, is likely to have struck the shutters and may have broken the glass had the windows not been protected. The estimated wind speed for this location is 130 mph. (See Section 7.1.2 for additional information on this building.)

Figure 9-12. Closeup of the roll-down metal shutters on the Harrison County Courthouse building. Note the partially lowered shutters on the middle windows (circle) (estimated wind speed: 130 mph. Gulfport, Mississippi).

9.3.2 Ocean Springs Middle School (Ocean Springs, Mississippi)

In September 1998, Ocean Springs Middle School was awarded $49,477 in HMGP funding for the installation of roll-down shutters to protect all exterior classroom windows from windborne debris (see Figure 9-13). Without glazing protection, occupants would be susceptible to injury from glass shards, and the building interior would be susceptible to damage from wind and wind-driven rain. The school was used as a shelter during Hurricane Katrina for as many as 400 people. Homeowners, urban search and rescue, police and fire personnel, and the National Guard used the facility as a shelter for up to a week. Following Hurricane Katrina, the MAT observed only minimal damage to the facility. In addition to the use of the shutters, other windows on the building were observed to have polycarbonate glazing.

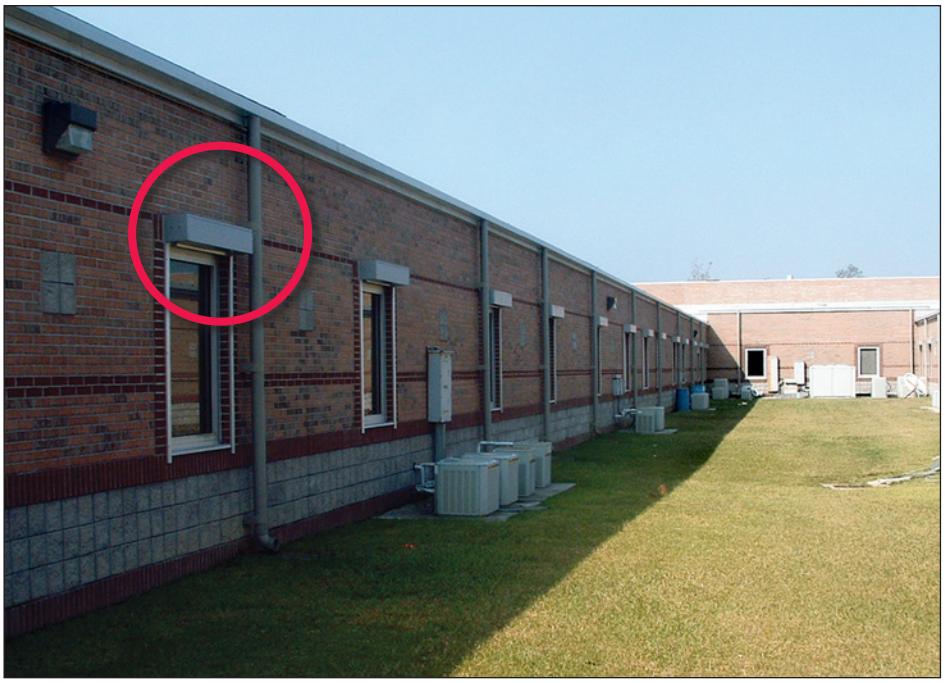

Figure 9-13. View of the Ocean Springs Middle School. Note the roll-down shutters over the windows (one example circled) (estimated wind speed: 120 mph. Ocean Springs, Mississippi).

9.3.3 Hancock County Senior Citizens Center (Bay St. Louis, Mississippi)

The Hancock County Senior Citizens Center received HMGP funding for the installation of shutters in 1999/2000 to protect windows and glazed doors from windborne debris (see Figure 9-14). The facility was identified in the local Hazard Identification and Risk Assessment Plan as a critical and essential facility, and was designated for use as a local shelter.

Hancock County Civil Defense ordered an evacuation of the facility as Hurricane Katrina approached. Water did not enter the building from the ground (e.g., stillwater flooding or storm surge), but water did enter the building via the roof, although structurally the roof remained intact.

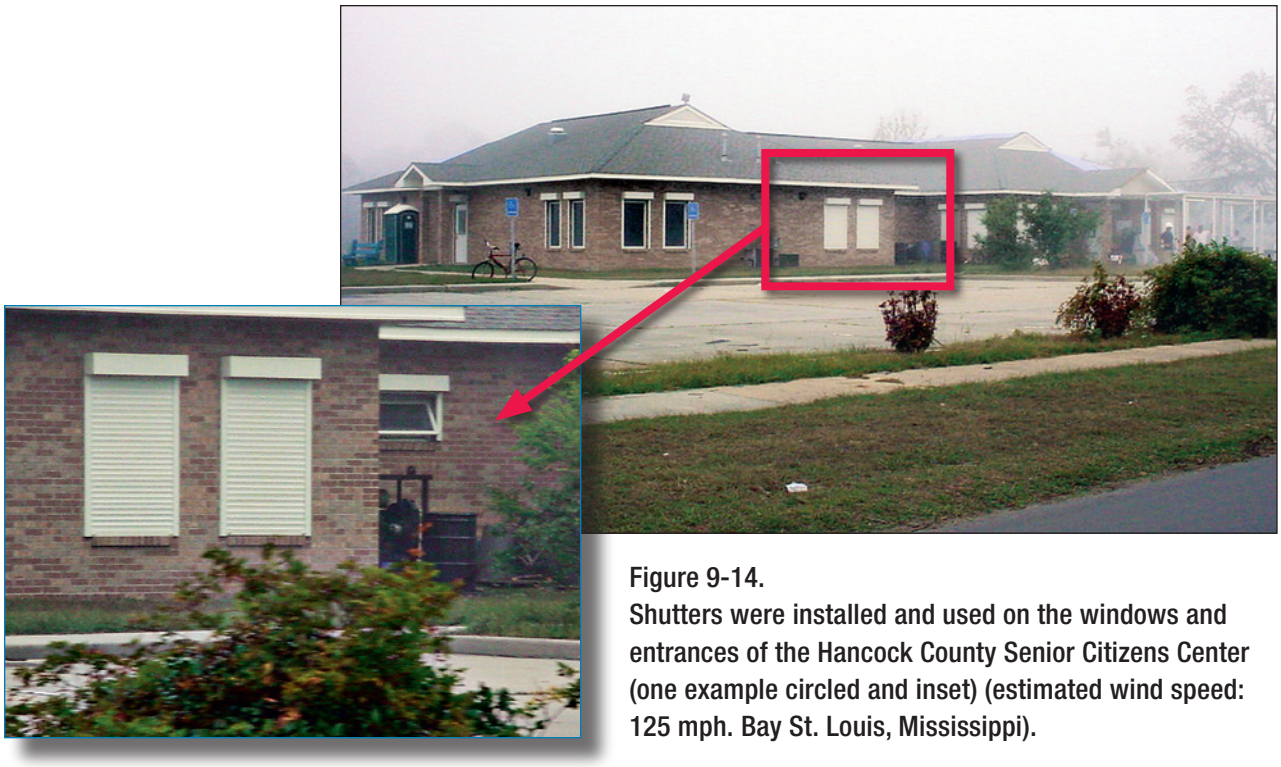

Figure 9-14.
Shutters were installed and used on the windows and entrances of the Hancock County Senior Citizens Center (one example circled and inset) (estimated wind speed: 125 mph. Bay St. Louis, Mississippi).

9.3.4 Jackson County EOC (Pascagoula, Mississippi)

The Jackson County EOC facility was observed by the MAT to have several prudent retrofit/wind-hardening features that helped the building survive Katrina. Polycarbonate shutters had been permanently mounted over the exterior windows and glazed door at this facility (see Figure 9-15). The roof deck and walls were constructed of concrete, which provided substantial wind resistance and excellent protection from windborne debris. In addition, the emergency generator had been sufficiently elevated to keep it from being inundated by Katrina's floodwaters. (See Section 7.1.1 for more detailed information.)

Figure 9-15.
Exterior view of the Jackson County EOC. Note the polycarbonate shutters over the windows (estimated wind speed: 105 mph. Pascagoula, Mississippi).

9.4 Higher Regulatory Standards – Citywide Elevation Standard (Pascagoula, Mississippi)

Following Hurricane Georges in 1998, the City of Pascagoula established an elevation standard of 13.1 feet msl for new construction, a standard higher than the BFEs stated on the community's FIRMs. In some cases, this represented up to a 5-foot increase above mapped BFEs. As a result, buildings impacted by Hurricane Katrina that were built to this standard suffered less flood damage than older housing built to lower elevation requirements (see Figures 9-16 and 9-17). The example shown in Figure 9-16 was the first elevation project in the State of Mississippi to use Increased Cost of Compliance funding. The estimated flood depth at this location from Hurricane Katrina was approximately 1 foot above the first finished floor and reportedly caused only minor damage to the house. According to the effective FIRM at the time of Hurricane Katrina, the building is located in Zone AE with a BFE of 11 feet.

Figure 9-16.
This photo was taken pre-Katrina ca. 1999/2000. Note the "Build Safe! 13.1' MSL Pascagoula Elevation Standard" sign in front yard (circle) (Pascagoula, Mississippi).

Figure 9-17.
This photo was taken post-Katrina, illustrating the successful survival of this elevated building. The house was elevated to the citywide standard of 13.1' msl using Increased Cost of Compliance funding (Pascagoula, Mississippi).

9.5 Other Best Practices

9.5.1 Cantilevered Condenser Platforms

Condensers placed at ground level or elevated but not secured typically fail from hurricane wind and flood forces. Cantilevered platforms are preferable over knee-brace platforms and platforms that use piles at the outward corners, because knee-braces can be broken by flood-borne debris and piles for condenser platforms are usually smaller in diameter than the piles used for the building itself, and are more easily broken. Figure 9-18 shows a cantilevered condenser platform that performed successfully during Hurricane Katrina.

Figure 9-18. This condenser was strapped to a cantilevered platform to enhance blow-off resistance (estimated wind speed: 125 mph. Plaquemines Parish, Louisiana).

9.5.2 Shutters over Windows (Non-Retrofit)

Shutters protected vulnerable glazing in the home shown in Figure 9-19. The home is located in St. Bernard Parish near Hurricane Katrina's path. The wind speeds in the area were sufficient to create damaging windborne debris; however, the shutters successfully protected the vulnerable glazing from breakage.

Figure 9-19.
The black area at the left window and the two black areas at the middle window (circles) are pieces of asphalt shingle debris. Had the windows not been protected by shutters, they would have likely been broken by windborne debris (estimated wind speed: 125 mph. Shell Beach, Louisiana).