HURRICANE ISAAC IN LOUISIANA

5 Evaluation of Elevation Projects

Hurricane Isaac's landfall and impact in Louisiana afforded the MAT the unique opportunity to observe the performance of mitigation measures put in place as a result of Hurricane Katrina.

One of the primary objectives of the Hurricane Isaac MAT was to evaluate the performance of buildings constructed or elevated after Hurricane Katrina. To assess the performance of mitigation projects, this chapter compares damage to buildings located adjacent to one another as well as pre- versus post-Katrina construction of the same building. The chapter also examines buildings that were originally built to a higher elevation than surrounding structures. Sites were randomly selected based on communities visited while the MAT conducted field investigations and the availability of data to complete the comparisons. The damage summaries are based on observations made by the MAT as well as data collected from other sources (Substantial Damage determinations,

A **depth-damage function** is a mathematical relationship between the depth of floodwater above or below the first floor of a building and the amount of damage that can be attributed to that water.

interviews with building officials, community damage summary reports, etc.). Estimated damage in this section is based on *depth-damage functions* used to estimate building, contents, and loss-of-function based on flood depths at each structure. Although the assessments of buildings are as accurate as possible based on MAT observations, statements made herein are not intended to represent final judgments as to the severity of damage to individual buildings.

The two adjacent properties (see Figures 5-1 and 5-2) along Highway 23 in Plaquemines Parish were in the inundation area during Hurricane Isaac and located within the SFHA (effective FIRM – Zone A13 [EL5] 05/01/1985; Katrina ABFE – Zone AE [EL10]; Post-Katrina Preliminary FIRM – Zone VE [EL16]). The slab-on-grade house was built about 2004/2005 and was severely damaged during Hurricane Isaac. Winds caused roof cover loss, and approximately 5 feet of flood inundation damaged interior and exterior finishes (see Figures 5-3 through 5-7). The elevated wood-frame house was built on masonry piers about 2007 and received minor damage during Hurricane Isaac. Most of the damage to the elevated house was limited to the exterior finishes, including roof cover loss, and was caused by wind (see Figure 5-8); water did not reach the first floor. Estimated damages based on depth-damage functions are included in Table 5-1.

Figure 5-1: Comparison of elevated versus at-grade constructions (Plaquemines Parish, LA).

Figure 5-2: Post-Hurricane Isaac aerial of the residences in Figure 5-1 (Plaquemines Parish, LA).

SOURCE: NOAA; GENERATED FROM HURRICANE ISAAC RESPONSE IMAGERY VIEWER AT HTTP://STORMS.NGS.NOAA.GOV/STORMS/ISAAC/

Figure 5-3:
Roof cover loss at non-elevated residential building (Plaquemines Parish, LA).

Figure 5-4:
Interior damage to the garage of the non-elevated residence (Plaquemines Parish, LA).

Figure 5-5:
Exterior damage to the garage of the non-elevated residence (Plaquemines Parish, LA).

Figure 5-6:
Interior damage to the non-elevated residence (Plaquemines Parish, LA).

Figure 5-7:
Interior damage to the non-elevated residence (Plaquemines Parish, LA).

Figure 5-8:
Exterior damage (wood siding) to the elevated house (Plaquemines Parish, LA).

Table 5-1: Estimated Isaac Damages at Adjacent Properties Along Highway 23 (West Bank)

Description	Flood Depth Above Lowest Floor (feet)	Estimated Damages*
Slab-on-Grade	5	$148,243
Elevated	<0	$4,000

* Assumes 1,600-square-foot residence with building construction cost of $100 per square foot.

The single-family residence on Lakeshore Drive in Mandeville was a slab-on-grade property during Hurricane Katrina (see Figure 5-9) and had 3 to 4 feet of flooding in 2005. The property is in the SFHA (effective FIRM – VE [EL12] 05/16/2012; Katrina ABFE – Zone VE [EL15]) after Hurricane Katrina (see Figure 5-10). The building was not inundated during Hurricane Isaac. See Table 5-2 for a comparison of estimated damages.

Figure 5-9:
Single-family residence post-Katrina (Mandeville, LA).

Figure 5-10:
Single-family residence elevated post-Katrina (Mandeville, LA).

Table 5-2: Estimated Katrina versus Isaac (pre- versus post-elevation) Damages at Lakeshore Drive Property

Description	Flood Depth Above Lowest Floor (feet)	Estimated Damages*
Slab-on-Grade	5	$162,643
Elevated	<0	No observed damage

* Assumes 2,000-square-foot residence with building construction cost of $100 per square foot.

A nonresidential building along Lakeshore Drive in Mandeville was floodproofed 2 to 3 feet above ground level prior to Hurricane Katrina but experienced flooding of 7 feet that overtopped the floodproofed elevation by 4 feet (see Figures 5-11 through 5-13). After being Substantially Damaged by Hurricane Katrina, the building was reconstructed on an open foundation (see Figure 5-14). The building was not inundated during Hurricane Isaac. See Table 5-3 for a comparison of estimated damages. The property is located within the SFHA (effective FIRM – Zone VE [EL12] 05/16/2012; Katrina ABFE – Zone VE [EL15]).

Figure 5-11: A nonresidential building on Lakeshore Drive in Mandeville post-Hurricane Katrina (Mandeville, LA).

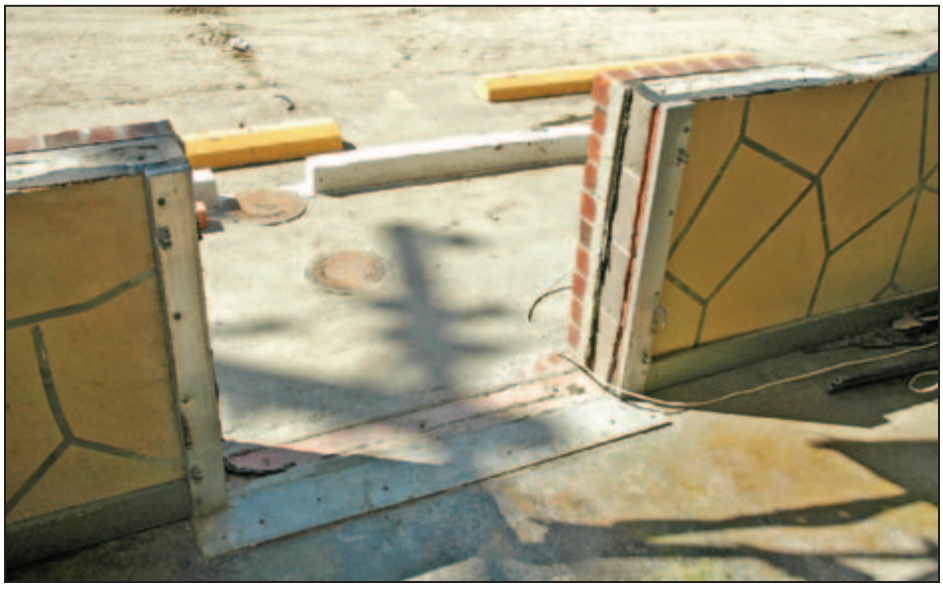

Figure 5-12: Entrance to nonresidential building on Lakeshore Drive in Mandeville post-Hurricane Katrina (Mandeville, LA).

Figure 5-13:
Interior damage from Hurricane Katrina to nonresidential building on Lakeshore Drive (Mandeville, LA).

Figure 5-14:
The same nonresidential building along Lakeshore Drive in Mandeville elevated post-Hurricane Katrina (Mandeville, LA).

Table 5-3: Estimated Isaac Damages at Lakeshore Drive Nonresidential Property

Description	Flood Depth Above Lowest Floor (feet)	Estimated Damages*
Slab-on-Grade	4	$172,587
Elevated	<0	No observed damage

* Assumes 1,800-square-foot building with building construction cost of $120 per square foot.

In one of the areas with the deepest inundation from Hurricane Isaac, the MAT visited an elevated property that almost avoided flood damage. This residence along Highway 39 was built in 2009 and is located within the SFHA (effective FIRM – Zone A6 [EL3] 05/01/1985; Katrina ABFE – Zone AE [EL18]; Post-Katrina Preliminary FIRM – AE [EL17]). Although the house was inundated with 2 feet of water, the damage was much less compared to older homes nearby that were built at grade (see Figures 5-15 through 5-17). Estimated damages based on depth-damage functions are shown in Table 5-4.

Figure 5-15: Post-Hurricane Isaac aerial of elevated residence along Highway 39 (Plaquemines Parish, LA).

SOURCE: NOAA; GENERATED FROM HURRICANE ISAAC RESPONSE IMAGERY VIEWER AT HTTP://STORMS.NGS.NOAA.GOV/STORMS/ISAAC/

Figure 5-16: Elevated house built in 2009 on Highway 39 had approximately 2 feet of water infiltrate the first floor; inset: yellow line illustrates observed HWM on door (Plaquemines Parish, LA).

Figure 5-17: Debris pile near at-grade residence (Plaquemines Parish, LA).

Table 5-4: Estimated Isaac Damages at Adjacent Properties Along Highway 39 (East Bank)

Description	Flood Depth Above Lowest Floor (feet)	Estimated Damages*
Slab-on-Grade	8	$244,389
Elevated	2	$61,969

* Assumes 1,600-square-foot residence with building construction cost of $100 per square foot.

The MAT visited the Frenier Fishing Village, a small community along the west bank of Lake Pontchartrain, with estimated building ages ranging from less than 5 years to more than 30 years old. The entire community is located in the Coastal High Hazard Area (effective FIRM – Zone VE [EL16] 11/04/2010; Katrina ABFE – N/A; Historic FIRM – Zone V16 [EL16]) and consists of about a dozen residential and nonresidential buildings. All buildings were constructed on an open foundation; however, the first floor elevations vary from approximately 1 to 12 feet above grade. As a result, the magnitude of flood damage from Isaac varied from collapse/failure to no damage (see Figures 5-18 through 5-25). See Table 5-5 for a comparison of estimated damage.

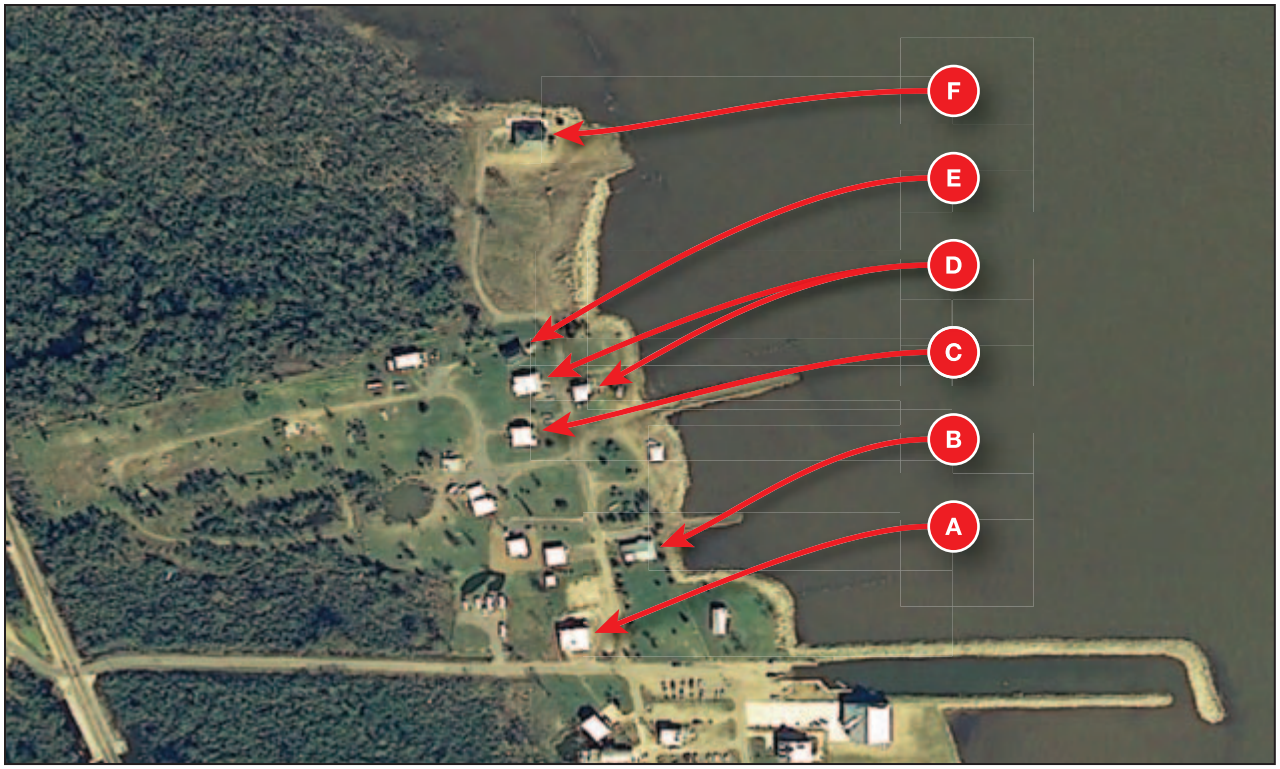

Figure 5-18: 2008 aerial of the Frenier Fishing Village (St. John the Baptist Parish, LA).

AERIAL COURTESY OF LOUISIANA LA COASTAL WETLANDS PLANNING, PROTECTION AND RESTORATION ACT AND THE USGS NATIONAL WETLANDS RESEARCH CENTER; GENERATED FROM HTTP://LACOAST.GOV/NEW/PUBS/MAP_DATA/2008DOQQ/DEFAULT.ASPX.

Figure 5-19:
Surge damage to lakefront residential structure (Structure B in Figure 5-18) (St. John the Baptist Parish, LA).

Figure 5-20:
Elevated residence with no observed damage (Structure E in Figure 5-18) (St. John the Baptist Parish, LA).

Figure 5-21:
Remains of residential building that was approximately 2 to 3 feet above grade (Structure D in Figure 5-18) (St. John the Baptist Parish, LA).

Figure 5-22:
Debris pile of waterfront single-family residence along the west bank of Lake Pontchartrain (Structure D in Figure 5-18) (St. John the Baptist Parish, LA).

Figure 5-23: Residential building elevated approximately 3 to 4 feet above grade that lost stairs and received other damage below the lowest floor (Structure C in Figure 5-18) (St. John the Baptist Parish, LA).

Figure 5-24: Nonresidential structure with damage to the screen surrounding the area under the lowest floor (Structure A in Figure 5-18) (St. John the Baptist Parish, LA).

Figure 5-25:
Residence built about 2000 with minimal damage to partially enclosed areas below the lowest floor (Structure F in Figure 5-18) (St. John the Baptist Parish, LA).

Table 5-5: Estimated Isaac Damages at Adjacent Properties in Frenier Fishing Village

Description	Flood Depth Above Lowest Floor (feet)	Estimated Damages*
1 to 2 Feet Above Lowest Horizontal Structural Member (Structure D)	2	Destroyed
1 Foot Above Lowest Horizontal Structural Member (Structure B)	0-1	Substantially damaged
Elevated and New Construction (Structures A, C, E, & F)	< 0	$3,000

* Assumes 1,500-square-foot residence with building construction cost of $100 per square foot.