



Mitigation Assessment Team Report

Hurricane Isaac in Louisiana

Building Performance Observations,
Recommendations, and Technical Guidance

FEMA P-938 / March 2013



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The Braithwaite Auditorium was rebuilt after it was damaged by Hurricane Katrina. The facility was built based on the preliminary Flood Insurance Rate Map base flood elevation (VE 21) and sustained minimal damage during Hurricane Isaac.

In response to Hurricane Isaac, the Federal Emergency Management Agency (FEMA) deployed a Mitigation Assessment Team (MAT) to assess damage from the hurricane and provide observations, conclusions, and recommendations on the performance of buildings and other structures affected by wind and flood forces. The MAT included representatives from FEMA Headquarters and other Federal agencies, local government officials, academia, and experts from the design and construction industry. The conclusions and recommendations of this report are intended to provide decision makers with information and technical guidance that can be used to reduce future hurricane damage.

Photographs that appear across the top of the first page of each chapter (from left to right): Cellular tower equipment on elevated platform near Port Sulphur Community Center. The damage to this Mandeville, LA, elevated Zone V residence was limited to the loss of stairs. Residential building in Madisonville, LA, under construction with a partially enclosed ground-level area. NASA satellite image taken on August 28, 2012 as Hurricane Isaac approached the Louisiana coastline. Residential building in Mandeville, LA with electric meter installed adjacent to side entrance. Exterior damage to the garage of a non-elevated residence in Plaquemines Parish, LA.



HURRICANE ISAAC

IN LOUISIANA

Executive Summary

Hurricane Isaac made landfall twice along the coast of Louisiana: first on August 28, 2012, at the mouth of the Mississippi River in the southeastern portion of the State and again the next day near Port Fourchon, LA.

Hurricane Isaac was the ninth named storm during the 2012 hurricane season and the third to make landfall on the continental United States. It was significant not only for its impact on the Louisiana coast, but also because it made landfall almost exactly 7 years after Hurricane Katrina and affected many of the same locations.

When Hurricane Isaac first made landfall in Louisiana, it was a Category 1 hurricane with sustained winds of 80 miles per hour and a broad wind field encompassing nearly 200 miles. The broad wind field produced a storm surge higher than usually associated with a Category 1 storm. After the initial landfall, the eye of the hurricane moved westward along the coast, making a second landfall on August 29 west of Port Fourchon, LA. The storm then turned to the north and weakened; it was downgraded to a tropical storm by 1 p.m. on August 29 and then further downgraded to a tropical depression on August 30 at 3 p.m.

Despite weakening upon landfall, Isaac's slow movement resulted in prolonged exposure to storm conditions for affected areas. Isaac produced more than 19 inches of rain in New Orleans and more than 12 inches in areas around the Gulf Coast. The peak storm surge was reported as 12 to 14 feet in the Braithwaite community.

Damage caused by Hurricane Isaac resulted primarily from flooding in areas not protected by the Federal levee system, the 2012 greater New Orleans area 100-year Hurricane and Storm Damage Risk Reduction System, including but not limited to Slidell, Mandeville, Madisonville, LaPlace, and Lafitte. The storm surge pushed floodwater over a non-Federal levee in Plaquemines Parish, flooding a large area on the East Bank of the Mississippi River. Hurricane Isaac damaged nearly 59,000 homes in southeast Louisiana. In addition to housing damage, power loss contributed to the widespread impact of the storm and affected nearly 43 percent of the State's energy users.

Total economic losses from Hurricane Isaac are estimated to be in excess of \$2 billion, with insured losses on land estimated at between \$500 million and \$1.5 billion by the claims forecasting company EQECAT (Sanburn 2012, Vanacore 2012). Losses of offshore assets are estimated at over \$1 billion.

Mitigation Assessment Team

In response to a request for technical support from the Federal Emergency Management (FEMA) Joint Field Office in Baton Rouge, LA, FEMA's Mitigation Division deployed a Mitigation Assessment Team (MAT) composed of national and regional experts to affected areas in Louisiana on October 8, 2012.

The MAT was charged with evaluating damage from Hurricane Isaac, especially for buildings constructed or reconstructed after Hurricane Katrina, assessing the performance of Emergency Operations Centers and other critical facilities affected by the storm, evaluating the performance of electrical distribution and communication facilities, and investigating possible claims of wind damage in newly constructed buildings.

Assessment Observations

In general, Hurricane Isaac was below a design level wind event, with flood elevations that did not exceed the effective base flood elevation (BFE) in areas visited by the MAT (excluding areas in LaPlace and along the East Bank of the Mississippi River in Plaquemines Parish). The key recommendations of this MAT report, which are based on the team's observations while in the field, are summarized in the following section.

Recommendations

The recommendations presented in this report are made based on the MAT's field observations. They are directed toward designers, contractors, building officials, and coastal populations and recommend disaster-resistant practices for hurricane-prone regions.

Residential Construction

- + **Elevation.** Build to the preliminary Flood Insurance Rate Maps or the best available data (i.e., Hurricane Katrina Advisory Base Flood Elevations). Incorporate freeboard requirements in accordance with the American Society of Civil Engineers *Flood Resistant Design and Construction* (ASCE 24) in addition to best available map data.
- + **Slab-on-grade elevation projects.** For slab-on-grade elevation projects, obtain necessary information regarding the structural properties of the slab prior to design. In design, properly detail and design connections and load paths to resist flotation, impact loads, and uplift.
- + **Stairs for building access.** Construct stairs used for access to elevated buildings with adequate connections to the structure and at the base. To improve performance, integrate partial openings in the risers. If this is not possible, construct stairs such that there are landings with supports that can resist flood forces, and construct risers parallel to wave action where possible.
- + **Enclosed areas.** Enclosed areas below the BFE should be constructed of flood damage-resistant materials and should have walls designed to break away under flood loads.
- + **Utilities and electrical service components.** Elevate all electrical service components to or above the BFE, and ensure that they are accessible. If this is not possible, elevate the electrical panel. Attach overhead service drop lines to the side of the residence rather than the roof if allowable by code.
- + **Fire separation and flood damage-resistant materials.** For elevated buildings on open foundations with enclosed parking underneath, introduce fire separation on the exposed underside of the building. Fire separation should meet the guidelines of the 2012 International Residential Code Table R302.6 for habitable rooms above a garage, which requires not less than 5/8-inch Type X gypsum board or equivalent. Considerations should be made to ensure that this material is also flood damage resistant.
- + **Raised floor system covering.** Proper fastener selection and attachment methods are recommended to reduce damage to raised floor system exterior covering on the underside of elevated buildings. Use materials that can withstand the wind loads expected on the structure.

Nonresidential Construction and Infrastructure

- + **Siting of critical facilities, community centers, and schools.** Site new and replacement community centers, critical facilities, and schools outside the 500-year floodplain where possible; where not possible, elevate the critical facilities and all utility equipment above the 500-year elevation or the best available BFE information.
- + **Infrastructure.** Where possible, site electrical substations, pump stations, and cellular towers outside the 500-year floodplain; where not possible, elevate facilities and electrical equipment above the 500-year elevation.

Outreach and National Flood Insurance Program Reform

- + **Outreach efforts.** Continue ongoing statewide efforts focused on educating the public on new flood insurance program provisions contained in the Biggert-Waters Act (EDEN 2012). Place continued emphasis on the implications elevation has on an individual's long-term flood insurance premiums.

Best Practices

- + **Mitigation Reconstruction Program.** Buildings constructed under the program were not damaged. Increase awareness of the pilot program, especially when older, non-compliant buildings are being considered for elevation projects.

Codes and Regulations

- + State statutes that predate adoption of Act 12 should be evaluated to identify and resolve contradictions that could complicate enforcement and interpretation, and an explicit statement that buildings in flood hazard areas are also subject to local regulations should be included. Act 12 provides the authority for adoption of the Louisiana State Uniform Construction Code (LSUCC).
- + National Flood Insurance Program (NFIP) communities should review local administrative and enforcement regulations to ensure their enforcement of the LSUCC provisions applicable in flood hazard areas are consistent with the NFIP.
- + A clear statement that work on existing dwellings in flood hazard areas is subject to the flood requirements of the LSUCC would eliminate misinterpretation.
- + The State should establish a freeboard requirement in areas with defined subsidence rates.
- + Opportunities to improve the reach of training courses should be pursued, and floodplain management courses offered by the State and others should be considered for continuing education credits for code officials.
- + Communities should evaluate the benefits of adopting requirements for additional freeboard in excess of what is required in the LSUCC.
- + Local floodplain management regulations should be reviewed to resolve inconsistencies with the minimum requirements of the NFIP.
- + Communities that have enforcement agreements with other governmental entities or with certified third parties should review those agreements to include local floodplain management requirements that are not already in the LSUCC.
- + The State should distribute notices of the availability of FEMA's revised publication on manufactured homes to manufactured home installers and local officials.



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