HURRICANE ISAAC IN LOUISIANA

6 Conclusions and Recommendations

The conclusions and recommendations presented in this report are based on the MAT's observations in the areas studied; evaluations of relevant codes, standards, and regulations; and meetings with State and local officials and other interested parties. They are intended to assist the State of Louisiana, communities, businesses, and individuals in the reconstruction process and to help reduce future damage and impacts from flood and design level wind events similar to Hurricane Isaac.

Section 6.1 discusses conclusions and recommendations related to residential buildings. Section 6.2 includes conclusions and recommendations related to critical facilities and infrastructure. Section 6.3 discusses outreach and NFIP reform, Section 6.4 discusses best practices, and Section 6.5 discusses conclusions and recommendations related to building codes and floodplain management regulations.

6.1 Residential Construction

Louisiana State Emergency Officials estimate 59,000 residences were damaged by Hurricane Isaac. Flood depths reached as high as the rooftops of structures on foundations at or slightly above grade, but structures elevated to the BFE were largely undamaged.

Generally, the post-Katrina mitigated structures were not tested during Isaac. Because Hurricane Isaac's flood elevations did not exceed effective BFEs in areas visited by the MAT, excluding areas in LaPlace and along the East Bank of the Mississippi River in Plaquemines Parish, observations of severe flood damage to one- and two-family residential buildings were rare. Elevated residences that were either new construction or post-Katrina elevation projects had minimal or no flood damage compared to adjacent non-elevated structures.

6.1.1 Elevating to the Preliminary FIRM

Conclusion

Buildings elevated to the best available elevation data, including preliminary FIRMs, are far less likely to suffer damage in a flood. The MAT observed this in side-by-side comparisons of neighboring buildings in St. Tammany and Plaquemines Parishes. In these cases, one of the buildings was elevated and the other was not. When the area was flooded, the elevated building suffered little or no damage, while the non-elevated building was severely damaged. Most Louisiana parishes affected by Hurricane Isaac had not adopted the preliminary FIRMs. However, many communities adopted the ABFEs after Hurricane Katrina, which often represented the best available information for that community. Although this information may not be as current as the preliminary FIRMs in some areas, buildings elevated to these ABFEs suffered less damage than those not elevated. In addition, based on discussions with local building officials and the MAT review of local ordinances (Section 2.3), the MAT determined that some communities affected had adopted some form of freeboard requirement to elevate buildings above the regulatory BFEs.

Recommendation

Residential buildings should be built to the preliminary FIRM or best available elevation data, such as ABFEs. In addition, the adoption of freeboard requirements is beneficial. To facilitate this, NFIP communities in Louisiana should either adopt the preliminary FIRMs that were developed after Hurricane Katrina or require the use of the Hurricane Katrina ABFEs in determining structure elevation. Further, the communities should consider adopting freeboard requirements in accordance with ASCE 24-05. If the flood risk data indicate the structure is located within a flood zone subject to wave action, then the building should be elevated on an open foundation.

6.1.2 Slab-on-Grade Elevation Projects

Conclusions

Considering information regarding the slab's structural properties may minimize the potential for structural cracking during elevation. Properties that should be considered include slab thickness, steel reinforcement, and concrete cover of the steel reinforcement. Insufficient slab thickness,

steel reinforcement, or concrete cover of the steel reinforcement can result in bending, shear, or deflection failure of the elevated slab when exposed to design live and dead loads. This is illustrated in Section 3.3 for elevations observed in Slidell and Mandeville, where the slab thickness and steel reinforcement cover appeared to be deficient.

A lack of connections between the substructure and the superstructure increases the risk of failure during a design level flood or hurricane. Elevated slabs with no or minimal connections to their piers may not be able to withstand significant lateral or uplift forces from design flood and wind events. The MAT observed homes both elevated and in the process of being elevated that did not have sufficient connections between the foundation piers and the slab. Although the MAT did not observe failure of these connections, Hurricane Isaac was not a design level flood or wind event in most of the locations visited.

Recommendations

Gather information regarding the slab's reinforcement and structural properties during the design phase. Before beginning an elevation project for a home with a slab-on-grade foundation, the slab should be assessed to determine whether, once elevated, it can function as a structural element without the risk of failure when the structural system is exposed to design live and dead loads. In most cases, this will require drilling holes to measure slab thickness before excavation and thoroughly evaluating the slab after excavation. Slabs that are not adequate to support design loads without bending, shear, or deflection failure should be removed and replaced or reinforced.

FEMA-funded elevation projects should include details of the new foundation's capability to resist lateral forces from flood and wind loads as well as undermining by erosion or localized scour. Shallow foundations in areas visited by the MAT were most vulnerable to undermining. Piles and piers are susceptible to failure when improperly sized and/or spaced.

Properly detail and design the connections and load path between the substructure and superstructure. These connections must be able to withstand the significant lateral and uplift forces present in a design flood or wind event.

6.1.3 Stairs for Building Access

Conclusion

The design and location of stairways providing access to elevated buildings affects how they perform in a flood. More specifically, stairs with closed risers that are perpendicular to the flood source incur greater flood loads. The MAT observed several instances where long runs of exterior stairs with no intermediate landings and closed risers that were oriented perpendicular to the direction of flood flow experienced significant damage. This often resulted in complete loss of building access as shown in Section 3.5.

Recommendation

Design staircases to provide a reasonable means of safe and convenient access to the building. Stairways leading from ground level to elevated structures are vulnerable to flood forces and frequently separate from the point of attachment. Proper materials and connections are essential

for adequate performance. For residential buildings, stairs should be constructed with partially open risers in accordance with building code requirements and should be oriented perpendicular to the direction of flood flow to reduce flood damage, as shown in Figure 6-1. Constructing these stairs with open risers will reduce the forces incurred by the stair structure and thus reduce the likelihood that they will fail during a flood. If constructing stairs with open risers is not possible, construct stairs such that there are intermediate landings with supports that can resist flood forces.

Figure 6-1: Residential stairs with partially open risers to reduce potential flood damage (Mandeville, LA).

6.1.4 Utilities and Electrical Service Components

Conclusions

Utilities located below the BFE are more likely to sustain damage in a flood than those that are elevated. The MAT observed many instances of flood damage to electrical service components, even among elevated residential buildings. This was because either some or all of the electrical service components were located below the BFE. The MAT also observed utilities that had been successfully elevated, and as a result sustained minimal to no damage during Hurricane Isaac. Elevated equipment was generally accessible by stairs, walkways, and decks. Commonly elevated equipment consisted of condensers and other mechanical equipment such as generators.

Overhead electric service drop lines attached to the roof may fail in hurricane conditions. Where the service drop was attached to the roof, the MAT observed some instances where a utility pole collapsed or wind-borne debris struck it, causing the weatherhead to shift in a way that tore the roof and allowed water to penetrate.

Recommendations

Elevate electrical service components to or above the BFE. Submersion of electrical components during a flood causes damage that prevents power from being supplied to residences after floodwaters have receded. However, the NEC and local utility companies specify where electrical components can be installed, and the location is dictated by clearance and accessibility requirements. If elevating all service components is not possible, the electrical box should be elevated at the very least, as the replacement of that piece of equipment is the responsibility of the homeowner. In addition, meters and boxes below the BFE should not be attached to breakaway walls or other components not designed to resist flood loads.

Overhead electric service drop lines should be attached to the side of the residence if possible. Although service drops attached to the side of a house have the potential to allow heavy rains to penetrate the wall if the connection shifts, the water penetration is less problematic than for service drops attached through the roof.

6.1.5 Enclosed Areas

Conclusion

Above-grade enclosed areas located beneath elevated structures are likely to be damaged in a flood. The MAT observed a variety of enclosed areas beneath elevated structures, including partially enclosed areas and above-grade enclosures. According to the NFIP, all enclosures below the BFE must be constructed using flood damage-resistant materials. However, homeowners often finish these areas and use them as additional living space. Where damage was observed by the MAT, it occurred because flood damage-resistant materials were not used in the construction of the enclosed area. In addition, the failure of these above-grade enclosed areas creates debris that may impact surrounding structures.

Recommendation

Above-grade enclosed areas should be constructed of flood damage-resistant materials and should have walls designed to break away under flood loads. Solid breakaway wall panels used for enclosures become large flood-borne debris elements when they break away. Lattice or louvers should be used in the construction of these enclosed areas instead of solid breakaway walls, as they reduce debris and cost less to repair. If solid breakaway walls are used, they should have flood openings. Although not required by the NFIP or building codes, adding flood openings may delay the failure of the walls under flooding conditions below the BFE, reduce flood-borne debris, and reduce repair costs.

6.1.6 Fire Separation in Elevated Homes

Conclusion

Fire protection of homes elevated to protect against the flood hazard should be a design consideration. The MAT observed elevated buildings with inadequate fire separation between occupied space and below-BFE parking, access, and storage areas. Many of the elevated residential

buildings observed by the MAT had plywood sheathing or wood finish materials applied over standard wood floor joists or the lowest horizontal structural member. Elevations of residential buildings with concrete slabs were also observed to be lacking fire stop systems, solid fire blocking, or a fire barrier at penetrations.

Recommendation

Fire separation should be provided for elevated residential structures. For elevated buildings where the below-BFE space is used for parking or storage of flammable materials, fire separation is needed on the exposed underside of the building. Fire separation should meet the guidelines of the 2012 IRC Table R302.6 for habitable rooms above a garage, which requires not less than 5/8-inch Type X gypsum board or equivalent. This material should also be flood damage resistant.

6.1.7 Building Envelope

Conclusion

Insufficient attachment and/or material selection for the underside covering of elevated floor systems, as well as for roof covering and siding, may contribute to failure during wind events. The MAT observed widespread loss of underside paneling in relatively new elevated coastal construction. Although the most common building envelope damage observed by the MAT was loss of roof covering and vinyl siding, the damage to underside coverings was not anticipated. More specifically, for the loss of roof covering and vinyl siding, older homes typically suffered greater wind damage, but the loss of underside paneling was observed in relatively new construction.

Recommendation

Use proper fastener selection, attachment methods, and materials during construction. Homeowners should consider mitigation measures such as upgrading the attachment of the roof covering to the roof deck, applying a moisture barrier/housewrap over exterior walls, and upgrading the attachment of vinyl siding to exterior wall sheathing. Retrofitting residential structures to protect against wind damage should be done in conjunction with elevation projects to provide a more comprehensive protection system for the structure.

6.2 Nonresidential Construction and Infrastructure

Critical facilities performed as expected. Those elevated to or above the BFE and those located outside the 500-year floodplain sustained little to no damage. Facilities located in areas prone to flooding and not mitigated sustained damage.

6.2.1 Community Centers, Critical Facilities, and Schools

Conclusion

Facilities were usable after the event if they had been constructed above or outside of the 500-year floodplain. The MAT visited several community centers constructed in Plaquemines Parish after Hurricane Katrina. The following are brief summaries of the observations at each.

Braithwaite Auditorium. Reconstructed post-Katrina, the auditorium was built to the preliminary FIRM BFE (VE21), rather than the Katrina ABFE (AE18). Hurricane Isaac's flood depths of 11 feet at the auditorium were well below the structure's lowest horizontal structural member. Damage at the auditorium was primarily to electrical equipment located below the building's lowest horizontal structural member.

Boothville Community Center. Constructed in 2011, the community center is elevated 10 feet above grade. The building was undamaged by Isaac's floodwaters, but damaged by driven rain that penetrated the building after strong winds damaged the wall covering.

Woodlawn Fire Station. Hurricane Isaac flooded this station, located in Plaquemines Parish, with 8 feet of water. The station was not flooded by previous storms, including Hurricane Katrina. Despite being inundated with floodwater, no visible structural damage to the station was observed. However, nine pieces of equipment including fire trucks, engines, and ambulances and all of the department's fire gear were significantly damaged by floodwaters and unavailable for response and recovery efforts during Hurricane Isaac.

School Buildings. The MAT visited several schools throughout Plaquemines Parish that are under construction. The new schools are being constructed 10 feet above grade. The MAT verified that these new schools' first floors would not have been inundated by Hurricane Isaac.

Recommendations

Construct critical facilities outside of or above the 500-year floodplain. Community centers that were elevated to the preliminary FIRM BFE were observed to have little or no flood damage. New and replacement community centers and critical facilities should be sited outside the 500-year floodplain, where possible; where not possible, critical facilities should be elevated to the preliminary FIRM BFE, rather than the Hurricane Katrina ABFE. In most instances, the preliminary FIRM BFEs are higher than Hurricane Katrina ABFEs and afford more protection.

Equipment and utilities for community centers and critical facilities should also be elevated to the preliminary FIRM BFE. If elevation of these components is not feasible for critical facilities in Zone A, they should be dry floodproofed to an elevation several feet above the BFE.

Consider evacuation and continuity of operations plans in design. The elevation of and floodproofing measures for critical and public facilities are limited to the DFE; therefore, communities must plan accordingly. The facilities will be protected to reduce building damage and functional downtime following a major flood, but communities must still develop evacuation, continuity of operations, and sheltering plans along with triggers to implement these plans based on existing forecast capabilities and estimated implementation timelines.

6.2.2 Infrastructure

Conclusion

Electrical substations located in flood hazard areas are vulnerable to significant damage during flood events. Because the locations of substations are heavily dictated by the routing of the transmission lines that supply them and by the population that they serve, placing substations outside of areas prone to flooding is often not possible. The MAT observed several substations that had sustained flood damage and as a result were not operational or relied on temporary or emergency equipment.

Recommendations

Where feasible, new electrical substations should be located outside of SFHAs. When new electrical substations are constructed in SFHAs, they should be considered Risk Structure Category IV per ASCE 24, and vulnerable equipment should be elevated or protected to or above the elevation required in ASCE 24. Elevating vulnerable equipment within the substation will reduce damage and reduce the amount of time the substation is offline. Such equipment includes control panels, high-voltage circuit breakers, switchgear, and panelboards that supply electrical loads within the substation. This equipment can be readily elevated if platforms or other means to access equipment for maintenance and repairs is provided. Some equipment, such as large power transformers, is difficult to elevate, but damage can be reduced if all vulnerable components like gauges, transducers, and controls are placed as high as possible.

For existing substations located in SFHAs, critical equipment should be relocated as high as practical to reduce the potential for flood damage or a minimum of 3 feet above grade. Elevated platforms should be provided to allow access for maintenance, service, and repairs.

6.3 Outreach and NFIP Reform

Conclusion

Outreach efforts are in place and functioning well. Currently, the State of Louisiana and Louisiana State University conduct outreach to communicate with residents and business owners about the NFIP and the upcoming reform to the NFIP enacted through the Biggert-Waters Flood Insurance Reform and Modernization Act of 2012. Outreach focuses on educating the public on the implications of property owners elevating their buildings above the BFE in relation to insurance premiums and protecting against flood events that exceed the BFE.

Recommendation

Outreach efforts should continue and should focus on educating the public about the following new provisions contained within the Biggert-Waters Act (EDEN 2012):

- Pre-FIRM (subsidized) rates will be discontinued for all business properties, secondary residences, and residences that meet the definition of "severe repetitive loss property," through a series of 25 percent per year increases in flood insurance premiums until the premium reflects

the actuarial rate for the property. When any Pre-FIRM-rated property is sold, the new flood policy will reflect actuarial rates; this includes both primary residences and properties for which the loss of subsidy is being phased out. In addition, no extension of subsidy will be provided for new policies, policies that have a lapse in coverage as a result of deliberate choice of the policyholder, or any prospective policyholder who refuses to accept any offer for mitigation assistance by the Administrator.

- + Grandfathered rates will be discontinued, with policies moving to actuarial rates over a period of 5 years. Each annual increase in premium over those 5 years will reflect 20 percent of the *difference* between the grandfathered and actuarial rates. The rate increase will begin with the first renewal following the effective date of the FIRM in which the higher risk is identified; the schedule of 20 percent increases will not change with a sale of the property.

6.4 Best Practices

This section presents the findings of building performance evaluations conducted separately from the MAT assessments but that are relevant to the focus of this report.

Conclusions

Review of post-Katrina projects highlighted best practices. FEMA's Hazard Performance Analysis (HPA) Group evaluated residential structures in Barataria, Mandeville, and Slidell that had been elevated after Katrina using HMGP funds and were also located in areas flooded by Hurricane Isaac.

The HPA Group evaluated 13 elevated properties along Bayou Barataria in an area not protected by a Federal levee. Although the storm surge for Hurricane Isaac was not as severe as that of Hurricane Katrina, the duration of flooding was longer. All 13 properties had been elevated, some as much as 36 inches above the BFE, and none were flooded by Hurricane Isaac. Homes along Bayou Barataria that were not elevated were flooded by Hurricane Isaac's storm surge, which varied from 18 to 24 inches above grade (HPA 2012a).

In Mandeville, the HPA Group evaluated 14 elevated residences. All had been elevated and all were undamaged by Hurricane Isaac floodwaters. In examining losses avoided, the HPA Group focused on one home and compared the pre-mitigated floor elevation to the depth of flooding. They found that, had the house not been elevated, it would have been inundated with 36 inches of water (HPA 2012b).

The HPA Group also evaluated 54 elevated properties in Slidell. Thirty-nine of the 54 homes were impacted by Hurricane Isaac, and it was determined that the elevation of these homes reduced the flood damage. Homes in this area that had not been elevated were inundated by 30 to 36 inches of water. The remaining 15 properties evaluated were in areas not affected by Hurricane Isaac flooding (HPA 2012c).

New residential buildings constructed under the FEMA HMGP Reconstruction Grant Pilot for Hurricanes Katrina, Rita, and Wilma had no observed damage; however, the number of properties built under this program was low compared to the number of elevation projects. The Reconstruction Grant Pilot requires that a community first evaluate the feasibility of elevating a building before

considering reconstruction. If a community chooses not to support structural elevation, either due to non-compliance with existing codes or because of unaddressed vulnerabilities, then mitigation reconstruction may be considered as an alternative.

Recommendations

Distribute HPA reports to the public. FEMA and the State should distribute the Hazard Performance Analysis of Post-Katrina Mitigated Properties reports for three communities in Louisiana (Jefferson Parish, and Slidell and Mandeville in St. Tammany Parish) to the public to encourage mitigation.

States should conduct losses avoided studies of mitigated properties after future flood events to evaluate project effectiveness. Such studies would compare the losses that would have been incurred for mitigated homes had they not been mitigated to the losses that were actually incurred.

Local building officials should increase public awareness of the FEMA HMGP Reconstruction Grant Pilot for Hurricanes Katrina, Rita, and Wilma. The lack of mitigation reconstruction projects may be a result of numerous factors (limited awareness of the pilot program, grant process, financial reasons, etc.), but local officials should be encouraged to make building owners aware of this program, especially when older, non-compliant buildings are being considered for elevation projects. Communities should not support or permit elevation projects of structures that do not comply with all local codes and standards, not just the local floodplain management ordinance.

6.5 Codes and Regulations

The following sections present conclusions and recommendations that are based on the MAT's review of building codes and floodplain regulations in Louisiana and six of the communities visited by the MAT.

6.5.1 Louisiana Revised Statutes and Building Codes

6.5.1.1 Existing Statutes

Conclusions

A number of existing statutes remain unchanged and create conflicts with new statutes. The MAT's review of the Louisiana Revised Statutes found that, subsequent to passage of Act 12 in 2005, a number of older statutory provisions remain unchanged and, thus, appear to create conflicts with more recent statutory provisions. For example, R.S. 33:1236(35)(b) permits parishes to adopt the Southern Building Code and other obsolete codes, while Act 12, in R.S. 40:1730.21–40 specifies that all municipalities and parishes shall enforce the codes adopted by the State, which are based on the I-Codes (see Chapter 2).

Another example of conflicting statutory provisions that could lead to misinterpretation is the use of the term "extensive alteration" (R.S. 40:1730.28), which has no direct relationship to whether work

on existing buildings located in flood hazard areas is determined to be Substantial Improvement or Substantial Damage.

The MAT's review of the statutes also determined that State amendments to the model I-Codes exempt several buildings from the LSUCC, including farm structures, residential accessory structures, private recreational structures (such as hunting or fishing camps), and additions to dwellings that pre-date the first LSUCC. An explicit exemption applies to the construction or improvement of certain industrial facilities engaged in specific activities, provided the facilities are "inside the restricted access area" (R.S. 40:1730.29). Although R.S. 40:1730.30 specifies that the "standards" published by FEMA for the NFIP apply to "residential construction," the impression is left that the listed exempt structures are not required to comply with local floodplain management regulations enforced by NFIP-participating communities.

The State of Louisiana Hazard Mitigation Strategy, in Section Eight, identifies a number of refinements or corrections to Act 12:

- Regulation of additions and improvements to existing structures
- Refining the definition of "work area" such that extensive alterations, renovations, and repairs are covered, even if less than 50 percent of the total area is involved (see IRC Appendix J)
- Resolving confusion in wording that implies that commercial properties under the NFIP are not covered by the LSUCC

Recommendations

Review existing statutes to determine and resolve conflicts. The Louisiana State Uniform Construction Code Council should review the existing statutes to identify provisions that conflict with Act 12 or that appear contradictory, and should evaluate whether to act on the recommendations in the Louisiana State Hazard Mitigation Strategy. Based on the review, the Council should request "cleanup" legislation.

In addition, misinterpretation could be avoided if the statutes include a clear statement that all structures that are exempt or otherwise not within the scope of the LSUCC are still subject to local floodplain management regulations. Communities that participate in the NFIP are required to regulate all development; any perceived barriers that could prevent fulfilling that requirement should be removed.

6.5.1.2 LSUCC and Administrative Provisions

Conclusion

LSUCC excludes Chapter 1 – Administration from the building code. As part of its adoption of the building code, the Council excludes IBC Chapter 1 – Administration. Many Louisiana communities separately adopt one or more of the administrative chapters of the I-Codes, sometimes with amendments, and some communities write their own administrative provisions. For example, Plaquemines Parish adopted the administrative chapters of each of the I-Codes included in the LSUCC. The City of Slidell adopted each of the codes that make up the LSUCC, thereby including

the administrative chapters. The City of Mandeville wrote complete administrative provisions, although requirements similar to the administrative provisions of the I-Codes specific to flood hazard areas are not included.

Recommendations

Communities should review local provisions to ensure that requirements related to enforcing flood provisions are sufficient. Communities in Louisiana handle the administrative provisions in a number of ways. Communities should compare their locally adopted provisions for administration and enforcement of the LSUCC to the administrative provisions of Chapter 1, Scope and Administration, of the IBC and IRC [1] to ensure that requirements related to enforcing the flood provisions are sufficient. In addition, local code administrative provisions should be reviewed by the NFIP State Coordinating Agency and FEMA when conducting Community Assistance Visits.

6.5.1.3 Existing Buildings

Conclusion

With respect to existing buildings, the LSUCC incorporates the IEBC and the IRC. The IRC is scoped to cover work that can only be performed on existing dwellings (e.g., alteration, movement, enlargement, replacement, repair, equipment, use and occupancy, location, removal, demolition). Communities are permitted to adopt IRC Appendix J, Existing Dwellings. Despite this, based on discussion with the Louisiana State Uniform Construction Code Council's Administrator, some code officials and others may not clearly understand whether and how existing dwellings are regulated, which may lead to different interpretations.

Recommendation

The Council should provide a clear statement that work on existing dwellings is subject to the LSUCC. In particular, the NFIP and code requirement to regulate Substantial Improvement and restoration of Substantial Damage should be enforced.

6.5.1.4 Flood Protection in Subsidence Areas

Conclusion

The State of Louisiana Hazard Mitigation Strategy, in Section Eight, recommends that the State "establish a state freeboard requirement for construction in areas with significant (to be defined) subsidence rates, such that during the useful life of a building (e.g., as defined by FEMA BCA standards) no increased risk should be encountered." Subsidence has occurred throughout the area affected by Hurricane Isaac, which may be a contributing factor to increased flood risk and damage.

1 http://www.fema.gov/building-science/building-code-resources

Recommendation

The State should act on the recommendation in the Louisiana Hazard Mitigation Strategy to **establish a State freeboard requirement for construction in areas with significant (to be defined) subsidence rates.**

6.5.2 Code Officials and Continuing Education

Conclusion

After Hurricane Katrina, FEMA awarded an HMGP grant to the State to help build State and local capacity to enforce building codes. The State has a continuing education requirement for code officials. Some funding was used for training and education, which contributed to a significant increase in the number of certified code officials. FEMA, the NFIP State Coordinating Agency (Louisiana Department of Transportation and Development), the Louisiana Floodplain Management Association, and the Louisiana Building Code Alliance offer or sponsor floodplain management training courses. The Association of State Floodplain Managers lists nearly 200 individuals who are Certified Floodplain Managers.[2]

Recommendation

The State Hazard Mitigation Strategy indicates the Council may convert regional training seminars to an "interactive, on-line certification program." The Council should evaluate this activity in the interest of increasing opportunities for code officials to learn about the code and obtain continuing education credits. The content of the courses should be reviewed to determine whether the flood provisions of the code are addressed.

Floodplain management courses offered or sponsored by FEMA, the NFIP State Coordinating Agency, and the Louisiana Floodplain Management Association should be submitted to the Louisiana State Uniform Construction Code Council to determine whether the content, in whole or in part, warrants continuing education credits for code officials. The State and the Building Officials Association of Louisiana should notify building officials when floodplain management courses are offered.

6.5.3 Local Floodplain Management Regulations and Codes

6.5.3.1 Additional Elevation (Freeboard)

Conclusion

The requirements of local floodplain management regulations and the flood provisions of the LSUCC are enforced together. In general, any higher standard adopted in local regulations is deemed to prevail, especially a requirement for additional elevation (freeboard). The MAT's review of local regulations for Plaquemines Parish and the cities of Mandeville and Slidell determined

2 http://www.floods.org/Certification/certlist.asp#LA (accessed January 9, 2013)

that those cities require some additional elevation (see Tables 2-2, 2-3, and 2-4). The building codes include a requirement for some additional elevation (see excerpts of the IBC and IRC[3] and Highlights of ASCE 24 [FEMA 2010c][4]).

Recommendation

Communities should reevaluate the benefits of adopting additional elevation requirements so that new construction and Substantially Improved buildings are elevated higher than the minimum requirements of the LSUCC. This is especially important in areas where land subsidence has contributed to flood risk that is not reflected on FIRMs. Of particular benefit will be additional elevation requirements for dwellings, because the building code does not require freeboard for most dwellings. At a minimum, local officials should be diligent in enforcing the elevation requirements of the building code, which has some elevation requirements that exceed the minimum NFIP elevation requirements and, thus, also exceed any local floodplain requirement that is the same as the NFIP.

6.5.3.2 Consistency with the NFIP

Conclusion

The MAT's review of the floodplain management regulations for Jefferson Parish, St. John the Baptist Parish, and Plaquemines Parish and the Cities of Madisonville, Mandeville, and Slidell identified one or more specific provisions that may not be fully consistent with the minimum requirements of the NFIP. Although the flood provisions of the LSUCC are consistent with the NFIP, because a number of buildings and some additions are not subject to the building code, complete local floodplain management regulations are necessary.

Recommendation

The NFIP State Coordinating Agency and the FEMA Regional Office should review the floodplain management regulations adopted by communities affected by Hurricane Isaac to verify the MAT's conclusion that one or more provisions may not be fully consistent with the NFIP. Identified deficiencies should be corrected as soon as possible by adoption of amendments to those regulations.

6.5.3.3 Agreements for Enforcement

Conclusion

The statute provides that municipalities and parishes may enter into agreements with other governmental entities, or with certified third parties, to issue permits and enforce the building code (R.S. 40:1730.24 and 25). Because the building codes include flood provisions, those agreements cover buildings in flood hazard areas, but do not explicitly cover other requirements adopted by communities in their local floodplain management regulations. Although Plaquemines Parish and

3 http://www.fema.gov/building-science/building-code-resources

4 http://www.fema.gov/library/viewRecord.do?id=3515

the Cities of Mandeville and Slidell do not have such agreements, other communities in the State do, especially in the more rural areas.

Recommendation

The NFIP State Coordinating Agency and the Council should encourage communities that have agreements with other governmental entities or agreements with certified third parties to review those agreements and include specific provisions related to local floodplain management requirements that are not already in the building code, such as an explicit requirement to conduct floodplain management inspections and make Substantial Damage determinations. Model language should be prepared to facilitate inclusion in third-party agreements. These provisions are also important if a community has adopted a higher standard that affects buildings (such as additional elevation), so that the entity responsible for permits and code enforcement is aware of those higher standards and can ensure that buildings and certain additions not subject to the building code are regulated. In addition, because local floodplain management regulations are adopted for participation in the NFIP, the agreements should include a specific requirement that the entity providing services participate in Community Assistance Visits and Community Assistance Contacts conducted by the NFIP State Coordinating Agency and FEMA.

6.5.3.4 Manufactured Homes

Conclusion

Statutory provisions for manufactured homes are not in the same section of law as the building code, but are found in R.S. 51:912.21–31. Oversight of manufactured home installers and of installation requirements (foundations, anchoring, and set up) was recently transferred to the Office of the State Fire Marshal. For installation in floodprone areas, the statute explicitly requires compliance with FEMA's Manufactured Home Installation in Flood Hazard Areas (1985).

Recommendation

FEMA's most recent revision of the guidance publication referenced in R.S. 51:912.21–31is FEMA P 85, *Protecting Manufactured Homes from Floods and Other Hazards* (2009c). The NFIP State Coordinating Agency should work with the Office of the State Fire Marshal to distribute notices of the revised document to manufactured home installers and local officials. Of particular interest to many manufactured home installers and local officials is the inclusion of a number of pre-engineered foundation solutions that are designed for a range of both wind and flood conditions.