5.4 Insurance Institute for Business & Home Safety FORTIFIED HOME™: An Incremental, Holistic Approach to Reducing Residential Property Damage and Losses from Extreme Weather-Related Events

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1. INTRODUCTION

Hurricane Andrew was clearly a wakeup call for the insurance industry as well as populations in hurricane-prone areas. In Andrew's aftermath, insurance companies were forced to change many of their processes and began to rely more and more on results of loss models to establish reserves and manage their businesses. Similarly, 2012's Hurricane Sandy has forced insurers to re-evaluate catastrophe exposures in the Northeast. According to NAPCO LLC, over the next few years, catastrophe models will be tweaked and hurricane risk assessment practices for the Northeast will begin to look similar to the current post-Andrew era practices common in the Southeast region (NAPCO, 2013).

As with most large-scale disasters, taxpayers bear some of the recovery expense. As of July 2013, federal recovery spending from Sandy totaled $3.8 billion (Hurricane Sandy Rebuilding Task Force, 2013). Additionally, Hurricane Sandy was the second most-expensive hurricane on record in 2012 in terms of economic and insured losses, causing an estimated total of $70 billion in economic losses. Insured losses from the storm were approximately $35 billion, out of which $20 to $25 billion were covered by the private insurance market. The remaining insured losses were incurred by the National Flood Insurance Program. (Swiss Re, 2013)

Hurricanes and tropical storms have accounted for 42.7 percent of insured losses since 1990, according to the Insurance Information Institute (Hartwig and Weisbart, 2012). There is no reason to expect that catastrophe losses from hurricanes and tropical storms will be any less devastating and costly in the coming years unless significant steps are taken to reduce the vulnerability of existing homes and businesses. This is due to the population migration and population growth that the country has experienced. In 2004, the National Oceanic and Atmospheric Administration (NOAA) reported that population trends were showing substantial increases in coastal communities. At the height of the last building boom, more than 1,540 single-family building permits were issued each day in coastal counties (Crossett et al., 2004). While that volume has certainly slowed during the downturn in the real estate market, it underscores two significant facts:

1. since 1980, millions of homes representing billions of dollars in property value have been built in harm's way; and

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2. higher population densities in high risk areas will result in greater economic losses when hurricanes strike.

Meteorologists have made improvements in predicting the number and intensity of hurricanes and tropical storms likely to occur during a particular year, with several groups issuing annual predictions before the start of the U.S. hurricane season. However, prediction models cannot say with certainty when and where these storms will come ashore months or even weeks in advance. Hurricane warnings do frequently provide time for homeowners to take last minute precautions and evacuate. The risk to personal safety has been significantly reduced, provided people heed the warnings and take early action. However, there is not sufficient time once a warning has been issued to make substantial changes to properties that will prevent property losses in the minutes, hours, or days leading up to an event. Furthermore, even if the labor is available, some mitigation measures, such as re-roofing with high-wind resistant shingles or adding adhesive under loose shingle tabs, require time and heat for the shingles to set.

As risk exposure has increased, efforts to mitigate the effects of high wind related events on the built environment have not kept pace. The National Science and Technology Council (NSTC) noted that the nation's primary focus on disaster response and recovery is "an impractical and inefficient strategy for dealing with these ongoing threats" (NSTC, 2005). In short, damaged and destroyed properties are rebuilt to insufficient standards, with either the hope that another storm of similar or greater intensity will not hit the same area again, or the expectation that the result, if a severe event does occur, will be different.

On the positive side, it has become clear that adoption and enforcement of engineering-based building codes and standards have resulted in substantial reductions in damage, property loss, and displacements of homeowners. In the aftermath of Hurricane Andrew, high wind engineering-based design and construction requirements were introduced in 1995 throughout most of Florida's coastal counties. In 2004, Hurricane Charley struck the Florida coastline in the Punta Gorda/Port Charlotte area with the highest hurricane winds to strike the U.S. mainland since Hurricane Andrew. A study of 5,636 insurance policies for properties in the Punta Gorda/Port Charlotte area following Hurricane Charley found that claims were filed on 37 percent of the policies. These policies represented the complete exposure for a single company in this area. When the policies were organized by year of construction, as shown in Figure 1, it appears that it took about a year (1996) before the benefits of the newer codes began to take effect. This is likely due to the learning curve for both builders and building officials.

The data in Figure 1 show that the claim frequency, on average, was reduced by 60 percent for homes constructed after 1996. The square footage of the homes was available for 84 percent of the 2,102 policies where claims were filed. On a per square foot basis, the average claim was $24 per square foot for homes built before 1996, and $14 per square foot for homes built in 1996 and later (IBHS, 2005). This study also showed that no homeowners in the study sample who had homes built after 1995 were displaced from their homes for more than one month. A study by Applied Research Associates for the Florida Department of Insurance Regulation (ARA, 2008) includes graphs with claims trends for other companies that are similar to those shown in Figure 1.

An IBHS study of 270 randomly selected closed insurance claim files for homes damaged by Hurricane Charley in 2004 found a payout for roof damage in more than 90 percent of the claims (IBHS, 2005). Aluminum-framed screen enclosures are widely used for screen porches and to cover pools in Florida, and the IBHS study showed that these structures failed about 80 percent of the time. After the roof cover, the next most frequent type of damage to the home, one that showed up 75 percent of the time, was loss of soffit cover at the eaves and along gable ends.

Window and garage door damage occurred in approximately half of the claims. Figure 2 shows the results of the closed claim file analysis (IBHS, 2005). Aside from attached structures such as the aluminum-framed pool enclosures and screen porches, which are designed for lower loads than the homes, the first signs of structural damage to homes are typically associated with the loss of roof sheathing at gable ends, or failures of porch roofs and other roof overhangs.

Hurricane loss models have proliferated in the years following Hurricane Andrew and are being used widely to help manage insurance risks. Each hurricane loss model has attempted to capture certain building features and develop fragility curves that correlate wind speed with damage and losses for that element, or some combination of elements. Most of the early model validations relied on fine-tuning parameters so that the models produced reasonable estimates of the total portfolio losses. Post-event studies and closed-claim file analyses have been used to improve the models and the fragility curves in attempts to provide better estimates for risks associated with particular homes. Nevertheless, the various models can produce significantly different results, particularly when it comes to estimating the benefits associated with strengthening a particular element. It is not unusual for insurance companies, and particularly re-insurers and brokers, to run several different models. All of these models produce results that show reduced losses for homes built to modern engineering-based building codes.

While the adoption and enforcement of modern engineering-based building codes and standards are the most effective ways to reduce damage to the whole population of new homes, many states with hurricane exposures have resisted adopting and enforcing these codes and standards. A recent study by IBHS of building codes and education and/or enforcement systems in hurricane-prone states found significant deficiencies in code adoption, building inspector training, and certification, and in builder licensing (IBHS, 2011). Further compounding these complex issues is the prevailing attitude in many states that hurricanes and high wind events are only coastal issues. This, despite the fact that storms like Hurricane Ike in 2008 came ashore in Galveston, Texas and produced greater than 74 mph wind gusts (NOAA, 2008) and more than $1.25 billion in insured losses in states like Ohio (OII, 2009).

As part of the negotiations behind Florida's move to adopt a statewide building code in the early 2000's, the state enacted mandatory discounts in hurricane insurance premiums for certain wind-resistant building features. Unfortunately, this resulted in an à la carte approach to discounts that focus on specific building and/or construction features, and these discounts have been extended to existing homes without careful consideration of the overall performance of the homes. The result has been major disruptions to the insurance market in the state of Florida.

Several other states have passed legislation requiring insurers to offer policyholders discounts for strengthening their homes. However, Louisiana is the only state among those most affected by Hurricane Katrina to enact a strong statewide code. In Mississippi, while the state has received a $22 million grant from the Federal Emergency Management Agency (FEMA) to provide funds for upgrading homes to stronger construction standards, only seven of its 82 counties are required to enforce wind and flood standards. Mississippi made efforts to pass a stronger statewide code but was met with stiff opposition from the construction industry. Alabama is another state to take action in its two coastal counties, requiring admitted carriers to provide discounts for new homes and retrofitted existing homes that meet specific requirements, including IBHS' FORTIFIED standards. Like Mississippi, however, Alabama has stopped short of adopting a mandatory statewide building code and does not have incentives for upgrading construction beyond coastal communities.

Regardless of the status of building code adoption and enforcement in a particular jurisdiction or state, homes built before the new

codes were adopted and enforced properly remain a potential source of huge losses for property insurance and reinsurances companies in future hurricanes. Particularly vulnerable are state-administered “insurers of last resort,” or “wind pools,” that provide coverage when wind-related risk coverage is not available in the market. Loss experience from recent hurricanes, as outlined above, suggests that retrofitting an existing home so that it comes closer to compliance with modern building code requirements will lead to substantial reductions in damage, loss, and displacement of homeowners. However, few people have the resources needed, or the will required, to make the kinds of changes that will bring their home up to compliance with new building codes. The challenge becomes one of finding the most cost-effective measures that can be taken to reduce damage and losses.

2. Reducing Catastrophe Losses

2.1 Reducing Losses for Existing Homes

In 2010, IBHS released guidance for retrofitting existing residential structures to resist high winds and wind-driven water through its FORTIFIED Home™ - Hurricane program (IBHS, 2010). This program utilizes engineering principles and draws on more than 20 years of experience in hurricane damage investigations to develop retrofits designed to reduce losses by improving performance of vulnerable systems, not just selected components. The program seeks to reduce damage, property loss, and displacement of homeowners by making improvements to the roof system, reducing water intrusion through attic ventilation systems, strengthening of gable end construction, protecting openings, and strengthening critical elements of the continuous load path from the roof to the foundation.

A key aspect of the program is that it uses an incremental approach to retrofitting that allows homeowners to strengthen their home in steps where the most common failure points are addressed first and each step builds on strengthening already completed. As steps are taken, the home’s expected performance in a hurricane begins to approach that of new homes built to modern engineering-based building codes and standards. In some cases, the performance of specific elements is expected to exceed that of new code compliant homes.

2.2 Reducing Losses for New Homes

In 2012, due to high levels of interest in Alabama, Mississippi, and North Carolina, where FORTIFIED incentives were legislated or required through rules promulgated by departments of insurance, FORTIFIED Home™ was expanded to include guidance for new construction and utilizing the incremental approach to resilience. The nature of new construction, and large scale maintenance projects like re-roofing, present ideal opportunities for making resilience upgrades to systems that are generally concealed by finished materials once complete. It is always more cost effective to make changes at the original installation than retrofitting an existing assembly. Builders are finding the systems approach utilized in FORTIFIED Home™ to be easier to implement because they can adapt their building processes gradually, with limited re-training of sub-contractors and their construction staff. The FORTIFIED resilience levels also can be priced as packages to make them easier to market to consumers with variable price sensitivities and mortgage qualification constraints.

3. Systems-Based Hurricane Mitigation Versus À La Carte Strengthening

Since Hurricane Andrew, there have been attempts to establish simple ways to identify simple building and site characteristic that make a property less vulnerable to hurricane-related damage. The most common approach involves focusing on a few building characteristics and/or elements that could be readily observed or assessed, and then try to estimate the impact of these building characteristics/elements. Items that make most lists include opening protection, strapping to connect the roof structure to the wall structure, hip roof shape as opposed to roof gables, properly fastened roof sheathing, and building exposure. Opening protection means providing pressure and impact-rated door or

window products, or covering existing windows and doors with pressure and impact-rated products. Roof shape and building exposure are elements that affect risk but cannot, or will not, be changed after a home is built.

After Hurricane Andrew – where extensive structural damage including loss of roof sheathing, collapse of gable ends, and even loss of entire roof systems was widespread – little attention was paid to the loss of soffit covers or water intrusion through attic ventilation systems. Andrew clearly exposed serious structural flaws that needed to be addressed. However, damage observations from the 2004 and 2005 hurricanes where structural damage was less prevalent has shown that significant losses and prolonged displacement of homeowners can occur from other sources beyond major structural damage.

An approach to rating buildings that has gained popularity through the sustainability programs administered by US Green Building Council (LEED) and National Association of Home Builders (NAHB Green Building Program), is the assignment of points for individual improvements. This is an à la carte approach and the natural progression is then to accumulate the points and assign a designation based on the total points accumulated. Many of the systems devised for assigning benefits of hurricane retrofitting have followed this component-based approach and the result frequently has been to mandate insurance premium discounts for each feature.

Unfortunately, this type of system that encourages point accumulation versus meaningful changes in performance is not as useful when it comes to reducing losses from hurricanes or other types of natural hazards. If enough water enters a house to cause the attic insulation to become saturated – resulting in ceiling collapse – it does not matter whether the water entered because the roof cover was lost and water poured in through seams between the sheathing, or the roof cover stayed intact but soffits blew out and water streamed into the attic through the soffit opening, or an attic ventilation system component such as a roof vent or gable end vent allowed the water to enter the attic. The fact is that the home will have significant interior water damage in any of these cases, and the homeowner may well be out of the home for an extended period of time. Similarly, if a home burns because embers entered the attic through the ventilation system or through a broken window, or the home was ignited by flame contact from a burning wood fence or a flammable tree next to the house, it is still damaged.

Using this à la carte approach, with variable combinations of improvements to a building's components, is risky when the intent is to reduce property damage and loss of use. The emphasis is not on how resulting upgrades function as a system during an extreme event, but on the ability of individual components to resist extreme conditions. This can produce wide variations in actual performance that fall short of desired results. This is a particular concern with respect to resiliency and durability. Natural disaster mitigation efforts are tested only under severe conditions. If the desired level of performance is not achieved, the result can be a period of prolonged displacement for property owners, or even a catastrophic loss of a building and its contents. IBHS and several federal agencies are leading the way towards recognizing the need to improve the performance of an entire home and how it resists Mother Nature's fury through a systems-based approach to mitigation. The IBHS FORTIFIED Home™ - Hurricane standard and the Wind Retrofit Guide published by FEMA (FEMA P-804, 2010) both provide systems-based, holistic approaches to strengthen properties. Unlike the "score card" methodology, these property-hardening programs and guidelines group upgrades together to deliver significant improvements in resiliency.

An IBHS FORTIFIED Home™ - Hurricane designation means that materials and assemblies that make a home vulnerable to hurricane damage have been upgraded in a specific order. In select cases, these upgrades exceed the requirements of current model building codes. In all cases, the upgrades have been verified by trained evaluators. There is no mixing and

matching of component improvements within each system. Each system must be fully mitigated to qualify. This allows the IBHS standard to be applied uniformly and enforced, reducing the chances of wide variations in performance.

In 2013, the Department of Homeland Security (DHS) authorized a pilot for its residential resilience rating program called Resilience STAR™. After a more than two-year vetting process, DHS selected FORTIFIED Home™ and another IBHS standard called FORTIFIED for Safer Living® as the only two qualifying resilience programs in the country for the pilot.

Additionally, the Department for Housing and Urban Development (HUD) also recognized the value of the systems approach found in FORTIFIED Home by referring to the program in its recommendations to the President of the United States, titled *Hurricane Sandy Rebuilding Strategy*. FORTIFIED is mentioned by name in the report's Recommendation #31 as a program that should be encouraged and promoted (Hurricane Sandy Rebuilding Task Force, 2013).

4. IBHS FORTIFIED Home™ - Hurricane Program

The IBHS FORTIFIED Home™ - Hurricane designation levels were created to allow housing units to be evaluated (and if necessary, upgraded) to perform better in the face of the hurricane risks for property location. The different levels allow property owners to make meaningful incremental changes in their home's resiliency by improving the most frequently damaged systems first and then progressing to the systems that fail as the intensity of the event gets higher.

FORTIFIED Home™ - Hurricane has three levels of designation:

- **Bronze:** focusing on roof cover, roof deck attachment and attic ventilation systems (including soffits);
- **Silver:** focusing on gable construction, opening protection systems, and anchorage of porches and large overhangs;
- **Gold:** focusing on developing a continuous load path system from the roof to the foundation.

Each level incorporates the upgrades of the preceding level(s). For existing homes the designation process begins with an evaluation of the home to assess its current condition. This initial evaluation is essentially a customized risk assessment for the property owner to use as the basis for their mitigation plan.

This approach can also be used for new homes and required upgrades can be incorporated as the home is being built. Upgrades in construction must be documented and verified either during construction or once the home has received a certificate of occupancy.

The FORTIFIED Home™ - Hurricane designation system provides a number of prescriptive solutions that make it easier for contractors to make the necessary resilience upgrades. However, these prescriptive requirements are based on performance goals, allowing program administrators to accommodate alternative design solutions that achieve the desired level of mitigation.

4.1 FORTIFIED Home - Hurricane Bronze Designation

Two options are available for obtaining this designation. One involves improving the existing roof and roofing system without replacing the existing roof cover, while the second requires re-roofing and is most economical when the home is being re-roofed (or new construction). The Bronze designation performance goals are:

a) Ensure that the roof sheathing attachment provides a factor of safety of 2 relative to design uplift loads on the sheathing;
b) Provide a sealed roof deck so that water intrusion is minimized if the roof cover is damaged;
c) Keep soffit covers in place by strengthening their attachment to meet design wall pressures;

d) Ensure that attic ventilation system elements remain in place and resist water intrusion during a hurricane.

4.1.1 Improving the existing roof. This method is not as effective as re-roofing because it does not ensure that a wind-resistant roof cover is in place. This option is considered appropriate when the home has a relatively new roof or has an expensive roof covering that has a long life expectancy under normal conditions. If a property qualifies for this option, and the property owner selects it, then the home designation will be FORTIFIED Home™ - Hurricane Bronze Existing Roof.

Designation Requirements

Pre-requisite: Roof sheathing on the property must be a minimum of 7/16in.OSB or plywood.

- Improve anchorage of roof deck and/or outlookers at gable ends by installing additional uplift connectors, thereby securing the outlookers to the top of the gable end wall and improved anchorage of the end of the outlookers where they connect with the roof framing.
- Reduce chances of attic ventilation system failure, including securing soffits by providing intermediate support and/or blocking for spans of 16 inches or greater (measured from the face of the exterior wall to the backside of the fascia board), utilizing roof mounted vents that meet the Florida Building Code standard TAS 100 (A), and replacing gable end vents with approved products or covering gable end vents with shutters.
- The roof deck must be sealed (all joints in the roof sheathing covered to prevent water intrusion if the cover is damaged or removed) and the deck must have adequate attachment. When the roof covering is not being replaced, both providing supplemental deck attachment (required when either the roof sheathing has insufficient fasteners (6d nails or staples) or inadequate fastener spacing, or both) and sealing the roof deck can be accomplished by having a closed-cell, urethane-based adhesive foam applied to joints between roof sheathing and all structural members (on both sides of the members). This adhesive foam will provide a sealed roof deck and increase the strength of the sheathing attachment to roof framing members. The spray foam adhesive application must achieve a minimum Design Uplift Pressure of 110 PSF (in accordance with TAS 202-94 test protocol).
- If applicable, install structural sheathing (minimum of 7/16in.) on all gable end walls greater than or equal to 48 inches in height (measured from the lowest framing member of the wall or truss to the peak of the gable).

4.1.2 Replacing the roof covering. This option takes advantage of the opportunity to re-nail the roof deck and install a sealed roof deck system on the exterior surface of the roof to reduce chances of water intrusion if the roof cover is damaged. If the property owner chooses this option, the home designation will be FORITFIED Home™ - Hurricane Bronze New Roof.

Designation Requirements

Pre-requisite: Roof sheathing on the property must be a minimum of 7/16in. OSB or plywood.

- Add nails to improve the roof sheathing connection to the roof structure if roof sheathing has insufficient fasteners (6d nails or staples) or inadequate fastener spacing, or both. Added nails must be 8d ring shank nails and the actual number of nails to be added depends on the type and spacing of existing nails, as well as the location of the house. Generally, all retrofitted houses will have a minimum of 8d nails with a maximum nail spacing of 6 inches on-center. For wind speeds greater than 120 mph, maximum nail spacing of 4 inches on-center is required in a 4-foot zone at the edge of gable roofs and the corners of hip roofs.
- Ensure the roof deck is sealed properly by installing a qualified system before the roof cover is applied. Alternatives include installing a modified bitumen tape (peel and

stick) over seams where roof decking meets and covering this with an ASTM D 226 Type II underlayment installed over the entire roof deck; installing a peel and stick product that covers the entire roof deck; or installing a reinforced synthetic underlayment with a high tear resistance that has an ICC approval as an alternate to ASTM D 226 Type II underlayment. The synthetic underlayment must be properly attached to the roof deck for high winds and have the seams sealed.

- Improve the anchorage of roof deck and/or outlookers at gable ends by installing additional uplift connectors securing outlookers to the top of the gable end wall and improved anchorage of the end of the outlookers where they connect with the roof framing.
- Reduce chances of attic ventilation system failure, including securing soffits by providing intermediate support/blocking for spans of 16 inches or greater (measured from the face of the exterior wall to the backside of the fascia board), utilizing roof mounted vents that meet the Florida Building Code standard TAS 100 (A), and replacing gable end vents with approved products or covering gable end vents with shutters.
- Apply a high-wind rated roof cover that meets wind speed requirements for the site. Requirements for shingles are an ASTM D 7158 (Class G or H) or ASTM D 3161 (Class F) rating for inland areas with design wind speeds at or below 110 mph, ASTM D7158 (Class G or H) for areas with design wind speeds at or below 120 mph, and ASTM D7158 (Class H) for areas with design wind speeds greater than 120 mph.

4.2 FORTIFIED Home - Hurricane Silver Designation

A prerequisite to this designation is satisfaction of FORTIFIED Home™ - Hurricane Bronze requirements (either Existing Roof or New Roof). IBHS tracks which option was used since “New Roof”, which requires a high-wind rated roof cover, is expected to achieve better performance in hurricane conditions than “Existing Roof”, which does not require a new roof cover. The Silver designation performance goals are:

a) Protect all glazed openings and all entry doors (with or without glazing) from windborne debris by using products that meet the impact protection requirements of ASTM E 1886 and ASTM E 1996 for Missile D (9-pound 2x4 lumber striking end on at 34 mph);
b) Ensure that garage doors meet ASCE 7 design pressure requirements for the location and exposure.
c) Strengthen gable end walls on gables that are 48-in tall or taller so that they meet the ASCE 7 wind pressures for the location and exposure of the home; and;
d) Improve the anchorage of porch roofs and other attached roofs so that the load path from the roof structure to the foundation meets the ASCE 7 design uplift loads for the location and exposure of the home.

The Silver upgrades provide prescriptive methods for protection of glazed openings, entry doors, and garage doors, structural retrofits to gable ends that are more than 4 feet tall, and improving the anchorage of attached structures.

Designation Requirements

Protect Openings

- Windows, sliding glass doors, skylights, and garage and entry doors with glazing (including side and transom glass), etc., must be either impact-rated to comply with approved standards (Large Missile Test ASTM E 1996 and E 1886 or TAS 201,202,203), or be protected by an opening protection system that meets these same standards or was approved under the old SSTD 12 standard. Code minimum shutters made of plywood and OSB sheathing are not accepted in areas where design wind speeds (ASCE 7-98 through ASCE 7-05 maps) are greater than or equal to 120 mph.

- Garage doors (without glazing) must meet design pressure requirements for the location and exposure, or be protected by a shutter system that meets the design pressure required for the home's location and is approved for impact protection using the standards listed above.
- Entry doors (without glazing) must be impact-rated and design pressure-rated, passing the standards listed above, or be protected by an opening protection system that meets these standards.

Strengthening Gable Ends

- Strengthen gable ends that are more than 4 feet tall by bracing the top and bottom of the gable wall, adding wall studs as needed (this will be dictated by the method of retrofit) and strengthening the connection of the gable end to the wall below. Bracing design must be verified by professional engineer and installation must be verified by installing contractor using FORTIFIED Compliance Forms.

Improve Anchorage of Porches or Carports

- Provide or strengthen uplift connections from roof to beam, beam to column and column to structure below. Load path design must be verified by professional engineer and installation must be verified by the installing contractor using FORTIFIED Compliance Forms.

4.3 FORTIFIED Home™ - Hurricane Gold Designation

A prerequisite for achieving the Gold Designation is meeting the FORTIFIED Home™ - Hurricane Bronze requirements (either Exiting Roof or New Roof), and FORTIFIED Home™ - Hurricane Silver requirements. Once again, IBHS tracks the option that was used since New Roof, which requires a high-wind rated roof cover, is expected to achieve better performance in hurricane conditions than Existing Roof, which does not require a new roof cover. The Gold designation performance goal is to improve the overall structure of the house so that it approaches that of a new home built to a modern engineering-based building code.

FORTIFIED Gold requires development of a continuous load path from roof to foundation; chimneys must be adequately anchored; and windows and entry doors, even those that are protected from wind-borne debris, must meet wind design pressure requirements for the location. Property owners may want to anticipate the requirements of Gold before investing in opening protection devices that cover windows or doors with deficient design pressure ratings.

Designation Requirements

Load Path Development and Chimney Anchorage

- Performance requirements are provided for load path development from roof to foundation and for chimney anchorage;
- Prescriptive guidance is provided for simple building shapes and types of construction, so that the expense of engaging an engineer is not required for these simple types of homes;
- However, engaging a professional engineer to develop specific solutions may result in more cost-effective solutions for developing the required load paths and likely will be needed for complicated structures.
- Unless the building has a simple shape where prescriptive solutions can be used, load path design must be verified by a professional engineer using FORTIFIED Compliance Forms. Regardless, the installation must be verified by the installing contractor using FORTIFIED Compliance Forms.

Windows and Entry Doors

- All windows and entry doors (with or without glazing) must meet design pressure requirements for the location, even when protected by shutter systems. Most shutter

systems have gaps that are large enough to allow the hurricane-induced external pressures to build up on windows and doors being protected. There have been numerous cases where windows or doors have failed due to wind pressure despite the fact that they were protected by shutters.

(Note: for FORTIFIED Home™ - Hurricane Silver, it is sufficient to protect windows and doors enough to prevent pressurization of the house.)

For this higher level of designation, IBHS seeks to have critical elements of the building envelope (roof sheathing fastening, roof cover, windows and doors) improved to the level of a new home built to current high-wind requirements. In some cases, such as roof sheathing fastening and water intrusion protection, the requirements actually exceed those of the current building code high-wind requirements.

5. REFERENCES

Applied Research Associates, Inc., (2008) "2008 Florida Residential Wind Loss Mitigation Study," ARA Final Report 18401, prepared for Florida Office of Insurance Regulation, October 2008. http://www.floir.com/siteDocuments/ARALossMitigationStudy.pdf

Crossett, K. M., Culliton, T. J., Wiley, P. C., and Goodspeed, T. R., (2004), "Population Trends Along the Coastal United States: 1980-2008," National Oceanic and Atmospheric Administration, National Ocean Service, Management and Budget Office, September 2004 http://oceanservice.noaa.gov/programs/mb/pdfs/coastal_pop_trends_complete.pdf

Federal Emergency Management Agency, (2010) "Wind Retrofit Guide for Residential Buildings," FEMA P-804, December 2010. http://www.fema.gov/library/viewRecord.do?&id=4569

Hartwig, R.P. and Wilkinson, C. (2005) "Public/Private Mechanisms For Handling Catastrophic Risks in the United States," Insurance Information Institute, October 2005, http://archives.tci1.org/publications/disasterpaper.pdf

Hartwig, R.P. and Weisbart, S.N. (2012) "Coastal Crossroads: Hurricanes and the Shifting Nature of Catastrophic Loss in the United States," Insurance Information Institute, 2012 National Hurricane Conference http://www.iii.org/assets/docs/pdf/NHC-032712.pdf

Hurricane Sandy Rebuilding Task Force, (2013) "HURRICANE SANDY REBUILDING STRATEGY: Stronger Communities, A Resilient Region" August 2013.

Insurance Institute for Business & Home Safety, (2010) "FORTIFIED for Existing Homes: Hurricane Standards," 2010 Edition. http://64.16.194.32/content/data/file/hurricane-2012.pdf

Insurance Institute for Business & Home Safety, (2011) "Rating the States: An Assessment of Residential Building Code and Enforcement Systems for Life Safety and Property Protection in Hurricane-Prone Regions, December 2011. http://64.16.194.32/content/data/file/ibhs-rating-the-states.pdf

Insurance Institute for Business & Home Safety, (2005) "Hurricane Charley: Nature's Force vs. Structural strength," http://www.disastersafety.org/content/data/file/hurricane_charley.pdf

National Science and Technology Council, Committee on Environment and Natural Resources, Subcommittee on Disaster Reduction, (2005) "Grand Challenges for Disaster Reduction" Executive Office of the President of the United States, Office of Science technology Policy, Washington, DC http://www.sdr.gov/GrandChallengesSecondPrinting.pdf

National Weather Service (2008) "September 14, 2008 Remnants of Hurricane Ike" National Weather Service Forecast Office, Wilmington, OH, http://www.erh.noaa.gov/iln/events/20080914/

NAPCO (2013) “State of the Market NAPCO Property Catastrophe Insurance Insights” Spring 2013 http://www.napcollc.com/articles/NAPCOInsuranceInsights-TheStateOfTheMarket-2013-April.pdf

Ohio Insurance Information Institute (2009) “9/14 is Ike anniversary – Ohio’s costliest natural disaster,” https://www.ohioinsurance.org/914-is-ike-anniversary-ohios-costliest-natural-disaster/

Risk Management Solutions, Inc., (2010) “Study of Florida’s Windstorm Mitigation Credits: Assessing the Impact on the Florida Insurance Market,” RMS Final Report DFS 09/10-14, prepared for Florida Legislature under contract to the Florida Department of Financial Services, March 2010. https://www.rms.com/Publications/RMS_Study_of_Floridas_Windstorm_Mitigation_Credits.pdf

Swiss Re, (2013) “Sigma”, http://media.swissre.com/documents/sigma6_2013_en.pdf

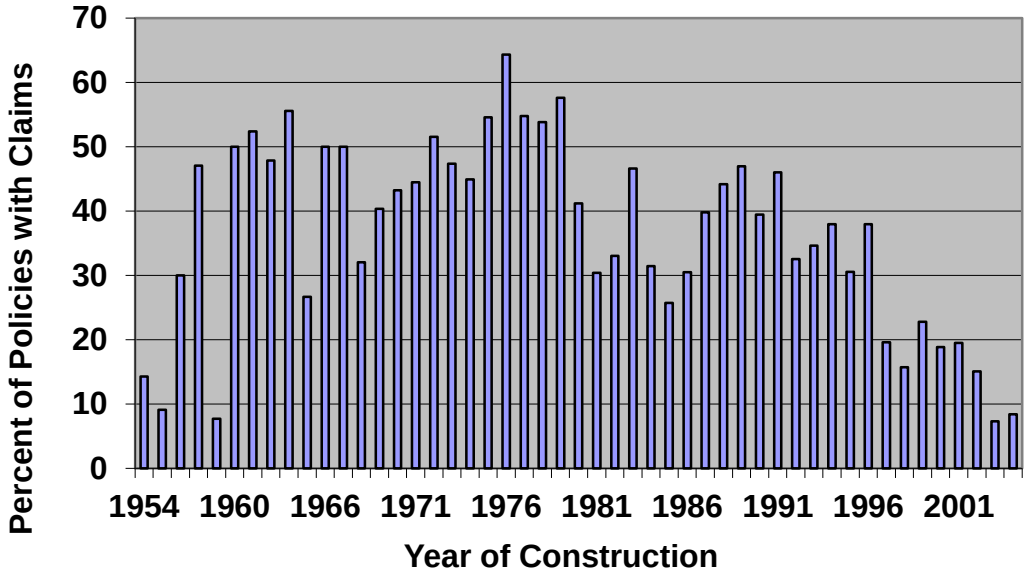

Figure 1. Relative Frequency of Damage in One Insurer's Portfolio as a Function of Property Age for Hurricane Charley in the Punta Gorda/Port Charlotte Area

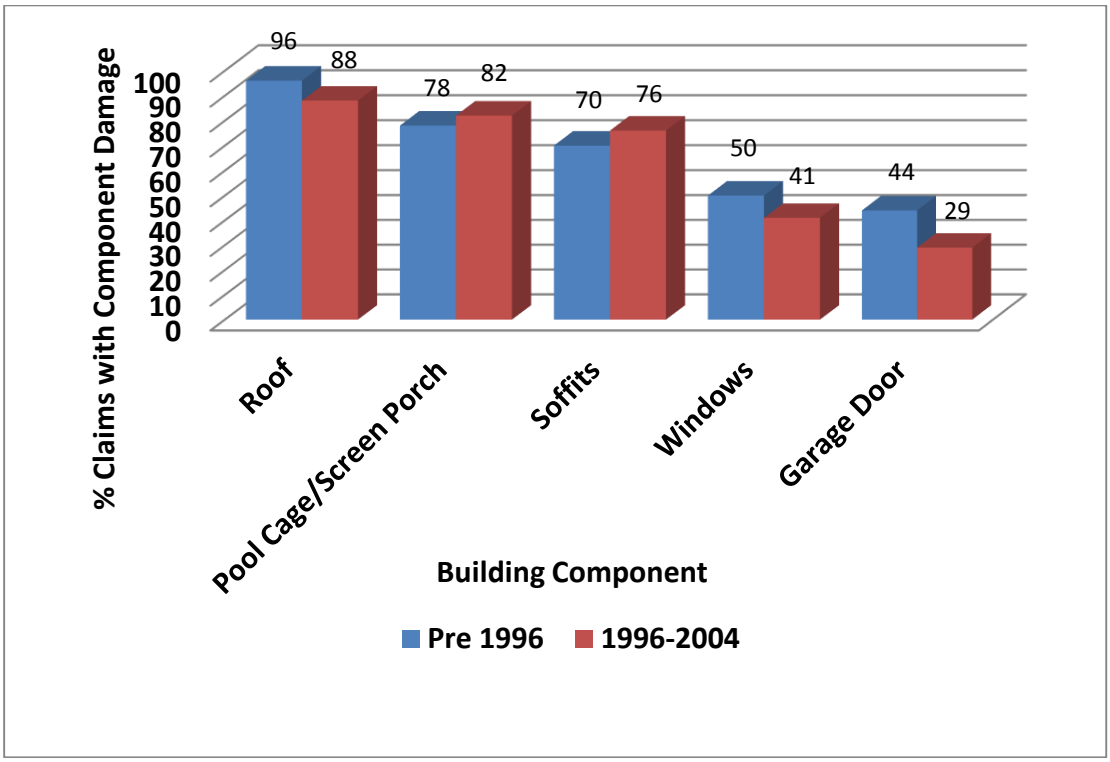

Figure 2. Frequency of Claims as a Function of Age of the Home in Closed Claim File Analysis for Hurricane Charley in the Punta Gorda/Port Charlotte Area