- Accessory buildings (including their foundations) must not be attached to the primary building; otherwise, failure of the accessory building could damage the primary building.
- Orienting the narrowest dimension of an accessory building perpendicular to the expected flow of water will create less of an obstruction to flowing water or wave action, and may result in less damage.



Small accessory building anchored to resist wind forces.

### **Additional Resources**

FEMA. NFIP Technical Bulletin 2-08, *Flood Damage-Resistant Materials Requirements for Buildings Located in Special Flood Hazard Areas*. (http://www.fema.gov/library/viewRecord.do?id=1580)

FEMA. NFIP Technical Bulletin 4-10, *Elevator Installation for Buildings Located in Special Flood Hazard Areas*. (http://www.fema.gov/library/viewRecord.do?id=1717)

FEMA. NFIP Technical Bulletin 5-08, *Free-of-Obstruction Requirements for Buildings Located in Coastal High Hazard Areas*. (http://www.fema.gov/library/viewRecord.do?id=1718)



Developed in association with the National Association of Home Builders Research Center

# **Protecting Utilities**

HOME BUILDER'S GUIDE TO COASTAL CONSTRUCTION

#### Technical Fact Sheet No. 8.3

Purpose: To identify the special considerations that must be made when installing utility equipment in a coastal home.

# **Kev Issues:**

Hazards, requirements, and recommendations - Special considerations must be made when installing utility systems in coastal homes. **Proper placement and connection** of utilities and mechanical equipment can significantly reduce the costs of damage caused by coastal storms and will enable homeowners to reoccupy their homes soon after electricity, sewer, and water are restored to a neighborhood.

### **Coastal Hazards That Damage Utility Equipment**

- Standing or moving floodwaters
- Impact from floating debris in floodwaters
- Erosion and scour from floodwaters
- High winds
- Windborne missiles

# **Common Utility Damage in Coastal Areas**

Floodwaters cause corrosion and contamination, short-circuiting of electronic and electrical equipment, and other physical damage.

Electrical – Floodwaters can corrode and short-circuit electrical system components, possibly leading to electrical shock. In velocity flow areas, electrical panels can be torn from their attachments by the force of breaking waves or the impact of floating debris.

Water/Sewage - Water wells can be exposed by erosion and scour caused by floodwaters with velocity flow. A sewage backup can occur even without the structure flooding.

Fuel - Floodwaters can float and rupture tanks, corrode and short-circuit electronic components, and sever pipe connections. In extreme cases, damage to fuel systems can lead to fires.



Electrical lines and box dislocated by hurricane forces.

# **Basic Protection Methods**

The primary protection methods are *elevation* or component protection.

#### Elevation

Elevation refers to the location of a component and/or utility system above the Design Flood Elevation (DFE).

#### **Component Protection**

Component protection refers to the implementation of design techniques that protect a component or group of components from flood damage when they are located below the DFE.

# **NFIP Utility Protection Requirements**

The NFIP regulations [Section 60.3(a)(3)] state that:

All new construction and substantial improvements shall be constructed with electrical, heating, ventilation, plumbing, and air conditioning equipment and other service facilities that are designed and/ or located so as to prevent water from entering or accumulating within the components during conditions of flooding.

Elevation of utilities and mechanical equipment is the preferred method of protection.





#### 8.3: PROTECTING UTILITIES

FEMA HOME BUILDER'S GUIDE TO COASTAL CONSTRUCTION

# **Utility Protection Recommendations**

#### **Electrical**

- Limit switches, wiring, and receptacles below the DFE to those items required for life safety. Substitute motion detectors above the DFE for below-DFE switches whenever possible. Use only ground-fault-protected electrical breakers below the DFE.
- Install service connections (e.g., electrical lines, panels, and meters; telephone junction boxes; cable junction boxes) above the DFE, on the landward side of interior piles or other vertical support members.
- Use drip loops to minimize water entry at penetrations.
- Never attach electrical components to breakaway walls.

#### Water/Sewage

- Attach plumbing risers on the landward side of interior piles or other vertical support members.
- When possible, install plumbing runs inside joists for protection.
- Never attach plumbing runs to breakaway walls.

#### HVAC

- Install HVAC components (e.g., condensers, air handlers, ductwork, electrical components) above the DFE.
- Mount outdoor units on the leeward side of the building.
- Secure the unit so that it cannot move, vibrate, or be blown off its support.
- Protect the unit from damage by windborne debris.



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**TTACHMENTS** 

#### Fuel

- Fuel tanks should be installed so as to prevent their loss or damage. This will require one of the following techniques: (1) elevation above the DFE and anchoring to prevent blowoff, (2) burial and anchoring to prevent exposure and flotation during erosion and flooding, (3) anchoring at ground level to prevent flotation during flooding and loss during scour and erosion. The first method (elevation) is preferred.
- Any anchoring, strapping, or other attachments must be designed and installed to resist the effects of corrosion and decay.

# **Additional Resources**

American Society of Civil Engineers. *Flood Resistant Design and Construction* (SEI/ASCE 24-05). (http://www.asce.org)

FEMA. *Free-of-Obstruction Requirements*. Technical Bulletin 5-08, (http://www.fema.gov/library/viewRecord.do?id=1718).

FEMA. *Protecting Building Utilities From Flood Damage*. FEMA 348. November 1999. (http://www.fema.gov/library/viewRecord.do?id=1750)



Elevated air conditioning compressors.



Developed in association with the National Association of Home Builders Research Center

# Repairs, Remodeling, Additions, and Retrofitting – Flood

#### HOME BUILDER'S GUIDE TO COASTAL CONSTRUCTION

**Technical Fact Sheet No. 9.1** 

**Purpose:** To outline National Flood Insurance Program (NFIP) requirements for repairs, remodeling, and additions, and opportunities for retrofitting in coastal flood hazard areas; to provide recommendations for exceeding those minimum requirements.

#### **Key Issues**

- Existing buildings that sustain substantial damage or that are substantially improved (see box on page 3) will be treated as new construction and must meet the community's current floodresistant construction requirements (e.g., lowest floor elevation, foundation, and enclosure requirements).
- Work on post-Flood Insurance Rate Map (FIRM)<sup>1</sup> existing buildings that are not substantially damaged or substantially improved (see box on page 3) must meet the community's flood-resistant construction requirements that were in effect when the building was originally constructed.
- Work on pre-FIRM<sup>1</sup> existing buildings that are not substantially damaged or substantially improved (see box on page 3) is not subject to NFIP floodresistant construction requirements.
- With some minor exceptions (e.g., code violations and historic buildings), substantial damage and substantial improvement requirements apply to all buildings in the flood hazard area, whether or not a flood insurance policy is in force.
- Buildings damaged by a flood and covered by flood insurance may be eligible for additional payments through the Increased Cost of Compliance (ICC) policy provisions. Check with an insurance agent and the authority having jurisdiction (AHJ) for details.
- Repairs and remodeling—either before or after storm damage—provide many opportunities for retrofitting homes and making them more resistant to flood damage.

# Factors That Determine Whether and How Existing Buildings Must Comply With NFIP Requirements

Rules governing the applicability of NFIP new construction requirements to existing buildings are confusing to many people; this fact sheet and Fact Sheet No. 1.2, Summary of Coastal Construction Requirements and Recommendations for Flood Effects provide guidance on the subject.

When repairs, remodeling, additions, or improvements to an existing building are undertaken, four basic factors determine whether and how the existing building must comply with NFIP requirements for new construction:

- Value of damage/work- whether the cost of repairs to the damaged building triggers substantial damage or substantial improvement regulations (see page 3).
- Nature of work- whether the work involves an expansion of the building, either laterally or vertically (an addition), or an enclosure of space below the Base Flood Elevation (BFE), or the demolition and reconstruction of an existing building, or the relocation of an existing building.

**Note:** Repairs, remodeling, additions, and retrofitting may also be subject to other community and code requirements, some of which may be more restrictive than the NFIP requirements. Check with the AHJ before undertaking any work.

1 Pre-FIRM is defined as a building for which construction or substantial improvement occurred on or before December 31, 1974, or before the effective date of the initial Flood Insurance Rate Map (FIRM) for the community. Post-FIRM is defined as a building for which construction or substantial improvement occurred after December 31, 1974, or on or after the effective date of the initial Flood Insurance Rate Map (FIRM) for the community.

2 This fact sheet and Fact Sheet No. 2 recommend meeting current NFIP/community requirements in these instances.





#### 9.1: REPAIRS, REMODELING, ADDITIONS, AND RETROFITTING - FLOOD

HOME BUILDER'S GUIDE TO COASTAL CONSTRUCTION

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- Pre-FIRM or post-FIRM building different requirements may apply to pre-FIRM existing buildings.
- Flood zone- different requirements may apply in V Zones and A Zones (this includes both the Coastal A Zone and A Zone).

Two other factors may need to be considered (consult the AHJ regarding whether and how these factors apply):

- Code violations- if cited by a code official, the NFIP regulations exempt certain work to correct existing violations of state or local health, sanitary, or safety code requirements from the substantial improvement and substantial damage calculations.
- Historic structures- a building that is on the National Register of Historic Places or that has been designated as historic by federally certified state or local historic preservation offices (or that is eligible for such designation) may be exempt from substantial damage and substantial improvement requirements, provided any work on the building does not cause the building to lose its historic designation.

A Zones Subject to Breaking Waves and Erosion Home Builder's Guide to Coastal Construction (HBGCC) Recommendations: Treat buildings and lateral additions in A Zones subject to breaking waves and erosion like V Zone buildings. Elevate all A Zone lateral additions (except garages) such that the bottom of the lowest horizontal structural member is at, or above, the DFE. For garages (in A Zones subject to breaking waves and erosion) below the DFE, construct with breakaway walls.

#### **Code Compliance**

Definitions from the International Code Council Model Building Codes

**ADDITION:** An extension or increase in floor area or height of a building or structure.

**ALTERATION:** Any construction or renovation to an existing structure other than repair or addition that requires a permit. Also, a change in a mechanical system that involves an extension, addition or change to the arrangement, type or purpose of the original installation that requires a permit.

**REPAIR:** The reconstruction or renewal of any part of an existing building for the purpose of its maintenance.

#### 2009 International Residential Code Requirements for Additions, Alterations or Repairs

R102.7.1 Additions, alterations or repairs. Additions, alterations, or repairs to any structure shall conform to the requirements for a new structure without requiring the existing structure to comply with all of the requirements of this code, unless otherwise stated. Additions, alterations or repairs shall not cause an existing structure to become unsafe or adversely affect the performance of the building.

#### What Is Substantial Damage?

Substantial damage is damage, **of any origin**, where the cost to restore the building to its predamage condition equals or exceeds 50 percent of the building's market value before **the damage occurred**.

#### What Is Substantial Improvement?

Substantial improvement is any reconstruction, rehabilitation, addition, or improvement of a building, the cost of which equals or exceeds **50** *percent of the building's pre-improvement market value.* 

When repairs and improvements are made simultaneously, all costs are totaled and compared with the 50 percent of market value threshold.

# Substantial Damage and Substantial Improvement

It is not uncommon for existing coastal buildings to be modified or expanded over time, often in conjunction with the repair of storm damage. All repairs, remodeling, improvements, additions, and retrofitting to buildings in flood hazard areas must be carried out in conformance with floodplain management ordinances pertaining to substantial improvement and substantial damage.

# What Costs Are Included in Substantial Damage and Substantial Improvement Determinations?

All structural items and major building components (e.g., foundations; beams; trusses; sheathing; walls and partitions; floors; ceilings; roof covering; windows and doors; brick, stucco, and siding; attached decks and porches).

- Interior finish elements (e.g., tile, vinyl flooring, stone, carpet; plumbing fixtures; gypsum wallboard and wall finishes; built-in cabinets, bookcases and furniture; hardware).
- Utility and service equipment (e.g., HVAC equipment; plumbing and wiring; light fixtures and ceiling fans; security systems; built-in appliances; water filtration and conditioning systems).
- Market value of **all labor and materials** for repairs, demolition, and improvements, including management, supervision, overhead, and profit (do not discount volunteer or self-labor or donated/discounted materials).

# What Costs Are Not Included in Substantial Damage and Substantial Improvement Determinations?

- Design costs (e.g., plans and specifications, surveys and permits).
- **Clean-up** (e.g., debris removal, transportation, and landfill costs).
- **Contents** (e.g., furniture, rugs, appliances not built in).
- Outside improvements (e.g., landscaping, irrigation systems, sidewalks and patios, fences, lighting, swimming pools and hot tubs, sheds, gazebos, detached garages).

**Note:** Some jurisdictions have enacted more restrictive requirements—some use a less-than-50-percent damage/improvement threshold. Some track the cumulative value of damage and improvements over time. Consult the AHJ for local requirements.

### **Additions**

Additions increase the square footage or external dimensions of a building. They can be divided into lateral additions, vertical additions, and enclosures of areas below existing buildings. When considering additions, it is important to consider that changes to the shape of the building may impact the potential damages to the house. A lateral addition may change the way flood waters travel around the structure and potentially create obstructions for flood-borne debris that may require additional foundation modifications. Vertical additions may also impose greater loads on the existing structure. A qualified design professional should evaluate the loading to the entire structure to see if additional structural modifications are required in order to maintain the structure's ability to sustain flood loading.

# **Lateral Additions**

If a lateral addition constitutes a substantial improvement to a V Zone building, both the addition and the existing building must comply with the effective base flood elevation, foundation, and other flood requirements for new V Zone construction (see Figure 1).



of lowest horizontal structural member at or above DFE.

Figure 1. Substantial improvement: Renovated/remodeled building in a V Zone.

9.1: REPAIRS, REMODELING, ADDITIONS, AND RETROFITTING - FLOOD

- If a lateral addition constitutes a substantial improvement to an A Zone building, only the addition must comply with the current floor elevation, foundation, and other flood requirements for new construction, as long as the alterations to the existing building are the minimum necessary.<sup>3</sup> *Minimum alterations necessary* means the existing building is not altered, except for cutting an entrance through the existing building wall into the addition, and except for the minimum alterations necessary to the the addition to the building. If more extensive alterations are made to the existing building, it too must be brought into compliance with the requirements for new construction.
- If a lateral addition to a pre-FIRM building does not constitute a substantial improvement, neither the addition nor the existing building must be

elevated. However, the HBGCC recommends that both the existing building and the addition be elevated to, or above, the current DFE, in a manner consistent with current NFIP requirements for new construction, and using a V Zone-type foundation in V Zones and in Coastal A Zones.

If a lateral addition to a post-FIRM building does not constitute a substantial improvement, the addition must be elevated in accordance with the flood requirements in effect at the time the building was originally constructed, even if the BFE and flood hazard have changed over time. The HBGCC recommends that both the existing building and the addition be elevated to, or above, the current DFE, in a manner consistent with current NFIP requirements for new construction, and using a V Zone-type foundation in V Zones and in Coastal A Zones (see Figure 2).



Existing, NFIP-compliant post-FIRM building with bottom of lowest horizontal structural member at or above old DFE (in effect at time of original construction) **Requirement:** Both existing building and addition must be elevated on open (pile/column) foundation with bottom of lowest horizontal structural member at or above new DFE (in effect at time of construction of lateral addition)



3 However, the HBGCC recommends that both the existing building and the addition be elevated to, or above, the current DFE, in a manner consistent with current NFIP requirements, and using a V Zone-type foundation in Coastal A Zones.

### **Vertical Additions**

- If a vertical addition to a V Zone or A Zone building constitutes a substantial improvement, both the addition and the existing building must comply with the effective base flood elevation, foundation, and other flood requirements for new construction (see Figure 3).
- If a vertical addition to a pre-FIRM V Zone or A Zone building does not constitute a substantial improvement, neither the addition nor the existing building must be elevated or otherwise brought into compliance with NFIP requirements. However, the HBGCC recommends that both the addition and the existing building be elevated to, or above, the current DFE in a manner consistent with current NFIP requirements for new construction, and using a V Zone-type foundation in V Zones and in Coastal A Zones (see Figure 3). The HBGCC also recommends strongly against

using any space below the current BFE for habitable uses (uses permitted by the NFIP are parking, storage, and building access).

If a vertical addition to a post-FIRM V Zone or A Zone building does not constitute a substantial improvement, the addition must be designed and constructed in accordance with the flood requirements in effect at the time the building was originally constructed. However, BFEs and flood zones change over time as areas are remapped. The HBGCC recommends that both the addition and the existing building be elevated to, or above, the current DFE in a manner consistent with current NFIP requirements for new construction, and using a V Zone-type foundation in V Zones and in Coastal A Zones. The HBGCC also recommends strongly against using any space below the current BFE for habitable uses (uses permitted by the NFIP are parking, storage, and building access).



Figure 3. Substantial improvement: Vertical addition to a pre-FIRM building in a V Zone.

9.1: REPAIRS, REMODELING, ADDITIONS, AND RETROFITTING - FLOOD

# Enclosures of Areas Below Existing Buildings

Enclosures below existing buildings are treated like vertical additions.

Existing NFIP requirements: (1) do not enclose and convert to habitable use any space below the BFE under any circumstances, and (2) construct only breakaway enclosures below existing buildings in V Zones and in Coastal A Zones. HBGCC recommendation: in V Zones and Coastal A Zones the area below the BFE should be built free of obstruction. Use open lattice, screening, or breakaway walls. For requirements concerning enclosures below elevated buildings see Fact Sheet 8.1. It should be noted that enclosures built with breakaway walls below the BFE may result in increased insurance premiums when compared to an open foundation.

# Reconstruction of a Destroyed or Razed Building

In all cases (pre-FIRM or post-FIRM, V Zone or A Zone) where an entire building is destroyed or purposefully demolished or razed, the replacement building is considered "new construction" and the replacement building must meet the current NFIP requirements, even if it is built on the foundation of the original building.

# Moving an Existing Building

When an existing building (pre-FIRM or post-FIRM, V Zone or A Zone) is moved to a new location or site, the work is considered "new construction" and if the relocated building is in the SFHA, it must be installed so as to comply with NFIP requirements.

# **Materials**

When constructing in coastal environments, carefully consider what construction materials to select. The NFIP Technical Bulletin 2, *Flood Damage-Resistant Materials Requirements* (August 2008), provides valuable information regarding the applicability of various construction materials in a coastal environment. For additional information, see Fact Sheet 1.7, Coastal Building Materials. Following a storm event, repairs should not be started until the problem is properly evaluated and materials are selected that will entirely remedy the damage. All costs of repairs should be identified and quantified prior to starting repairs.

#### Repairs

Correction of only the apparent surface damage can lead to unaddressed or overlooked problems beneath the surface that can potentially cause major issues with the structural stability of the building. Proper inspections of damage often not only require demolition or removal of the physically damaged building component, but also removal of associated exterior cladding. Wind-driven rain for example can lead to compromised connections and the decaying or rotting of building materials that may not be visible without further investigation.

#### **Insurance Consequences**

Designers and owners should know that the work described previously may have insurance consequences, especially if not completed strictly in accordance with NFIP requirements.

In general, most changes to an existing building that result from less-than-substantial damage, or that do not constitute substantial improvement, will not change the status from pre-FIRM to post-FIRM. However, it is required that substantially improved or substantially damaged buildings be brought into compliance. NFIP flood insurance policies on those buildings are written using rates based on elevation. In most cases, the premium will decrease when a pre-FIRM building is substantially improved and brought into compliance. The building becomes a post-FIRM building and premiums are calculated using elevation rates. Failure to comply with the substantial damage or substantial improvement requirements will result in a building's status being changed and in higher flood insurance premiums. For example:

- If an NFIP-compliant enclosure built with breakaway walls is added below a post-FIRM V Zone building, the building will no longer be rated as "free of obstructions." Flood insurance premiums on these buildings will be higher. If the enclosure is not compliant with all NFIP requirements, higher premiums will result.
- If work on an existing V Zone building constitutes a substantial improvement, the building will be rated on a current actuarial basis. Any pre-FIRM designation will be lost and current post-FIRM rates will be used.
- If an NFIP-compliant lateral addition constituting a substantial improvement is made to a pre-FIRM A Zone building and no changes were made to the existing building, the building will retain its pre-FIRM designation and rating. However, if the addition does not comply with all requirements, or if more than the minimum alteration necessary was made to the existing building, the building and addition's lowest floor must be elevated to or above the BFE. The building including the addition will be rated with post-FIRM actuarial rates.

# **Retrofit and Remodeling Opportunities**

Retrofit opportunities will likely present themselves any time repair or maintenance work is undertaken for a major element of a building. Improvements to the building that are made to increase resistance to the effects of natural hazards should focus on those items that will potentially return the largest benefit to the building owner. Some examples of retrofit opportunities may include:

- Improving *floor-framing-to-beam* connections whenever they are accessible (see Fact Sheet 4.1, Load Paths and Fact Sheet 4.3, Use of Connectors and Brackets for additional information).
- Improving beam-to-pile connections whenever they are accessible (see Fact Sheet 3.3, Wood-Pile-to-Beam Connections for additional information).
- Periodically checking and inspecting flood openings to make sure that they are not blocked and functioning properly. If the house is older, check to make sure that flood openings are sized correctly. Consult NFIP Technical Bulletin 1, Openings In Foundation Walls and Walls of Enclosures (August 2008) for proper flood opening guidance. Also see Fact Sheet 3.5, Foundation Walls for additional information.
- At any time deficient *metal connectors* are found, they should be replaced with stainless steel connectors or metal connectors with proper corrosion protection, such as hot-dip galvanized steel (see Fact Sheet 1.7, *Coastal Building Materials* for additional information).
- When HVAC equipment is replaced, the replacement equipment selected should incorporate a more corrosion-resistant design—so that it will last longer in a coastal environment—and should be elevated to, or above, the DFE. The equipment should be adequately anchored to resist wind and seismic loads (see Fact Sheet 8.3, Protecting Utilities for additional information).
- Improving utility attachments when the outside equipment is replaced or relocated (see Fact Sheet 8.3, Protecting Utilities for additional information).
- To minimize the effects of corrosion, carbon steel handrails can be replaced at any time with vinylcoated, plastic, stainless steel, or wood handrails. Wood handrails may require frequent treatment or painting and appropriate fasteners must be used (see Fact Sheet 1.7, Coastal Building Materials for additional information). Carbon steel handrails may also be painted with a zincrich, vinyl, or epoxy paint appropriate for exposed wet and salt-spray environments. Regardless of the product used, proper maintenance is always necessary in order to ensure a safe handrail.
- Consider **sewer backflow preventer** values if they are not currently part of the building's plumbing.

The installation should be done by a licensed plumber.

- If the current water heater is at, or below, the DFE, consider switching to a tankless water heater. A tankless water heater will take up less space and can be mounted to a wall due to its small size. In addition to allowing the user to mount it higher than a traditional water heater, it may also result in reduced energy costs.
- Older structures should consider elevation as a possible retrofit or mitigation opportunity. Older pre-FIRM structures can be at significant risk to flooding events. In coastal environments, even a little additional elevation can result in improved flood resistance. Costs can vary greatly depending on the type of foundation. It is important when considering an elevation project to consult a design professional before considering how much elevation and the appropriate foundation type. A contractor experienced with the elevation of buildings should be used for the actual lifting of the house. It is common for the house to require other structural work to the interior and exterior following the elevation. Before undertaking an elevation, consider the elevation process, which usually results in the structure being set on top of a foundation that is more level than the original foundation. This process can result in cosmetic cracking as the structure's foundation settles again and may require additional work to get the structure's aesthetics back to a pre-elevation appearance.

#### **Additional Resources**

FEMA. 2010. Substantial Improvement/Substantial Damage Desk Reference. FEMA P-758. http://www.fema.gov/library/viewRecord.do?id=4160

FEMA. 2005. Coastal Construction Manual, Chapter 14. FEMA 55. (http://www.fema.gov/library/viewRecord.do?id=1671)

Florida Department of Community Affairs. 2000. A Local Official's Guide to Implementing the National Flood Insurance Program in Florida. (See Chapter 6). (http://www.floridadisaster.org/Mitigation/NFIP/ NFIPStudyCourse/Appendix%20E%20-%20FL%20 Handbook.pdf)



Developed in association with the National Association of Home Builders Research Center

9.1: REPAIRS, REMODELING, ADDITIONS, AND RETROFITTING – FLOOD

# Repairs, Remodeling, Additions, and Retrofitting – Wind

### HOME BUILDER'S GUIDE TO COASTAL CONSTRUCTION

#### **Technical Fact Sheet No. 9.2**

**Purpose:** To outline requirements and "best practice" recommendations for repairs, remodeling, and additions, and propose opportunities for retrofitting in coastal high-wind areas.

### **Key Issue**

Repairs and remodeling– either before or after storm damage– provide many opportunities for retrofitting homes and making them more resistant to storm damage (see Figure 1).

# **Code Compliance**

#### Definitions from the International Code Council (ICC) Model Building Codes

**Addition:** An extension or increase in floor area or height of a building or structure.

Alteration: Any construction or renovation to an existing structure other than repair or addition that requires a permit. Also, a change in a mechanical system that involves an extension, addition, or change to the arrangement, type, or purpose of the original installation that requires a permit.

**Repair:** The reconstruction or renewal of any part of an existing building for the purpose of its maintenance.

#### Factors That Determine Whether and How Existing Buildings Must Comply With Current Building Code Requirements

When undertaking repairs, remodeling, additions, or improvements to an existing building, there are two basic factors that determine whether and how the existing building must comply with building code requirements for new construction.

Value of damage/work- whether the value of the building damage and/or work qualifies as substantial damage or substantial improvement under NFIP regulations (see text box).

#### International Residential Code (IRC) Requirements for Additions, Alterations or Repairs

**R102.7.1 Additions, alterations or repairs.** Additions, alterations, or repairs to any structure shall conform to the requirements for a new structure without requiring the existing structure to comply with all of the requirements of this code, unless otherwise stated. Additions, alterations, or repairs shall not cause an existing structure to become unsafe or adversely affect the performance of the building.





9.2: REPAIRS, REMODELING, ADDITIONS, AND RETROFITTING – WIND HOME BUILDER'S GUIDE TO COASTAL CONSTRUCTION



Figure 1. Storm-damaged homes need repairs, but also provide opportunities for renovation, additions, and retrofitting. Review substantial damage and substantial improvement regulations before undertaking any work.

Nature of work- whether the work involves an expansion of the building, either laterally or vertically (an addition), or the demolition and reconstruction of an existing building, or the relocation of an existing building.

Two other factors occasionally come into play (consult the authority having jurisdiction [AHJ] regarding whether and how these factors apply):

- Code violations certain work to correct existing violations of state or local health, sanitary, or safety code requirements that have been cited by a code official may be excluded from calculations of value of work used to determine substantial improvement or substantial damage.
- Historic structures- work on a building that is on the National Register of Historic Places or that has been designated as historic by federally certified state or local historic preservation offices (or that is eligible for such designation) may be excluded from calculations of value of work used to determine substantial damage and substantial improvement requirements, provided such work does not cause the building to lose its historic designation.

# Substantial Damage and Substantial Improvement

It is not uncommon for existing coastal buildings to be modified or expanded over time, often in conjunction with the repair of storm damage. All repairs, remodeling, improvements, additions, and retrofitting to buildings must be made in conformance with existing building code requirements pertaining to substantial improvement and substantial damage.

#### What Is Substantial Damage?

Substantial damage is damage, of any origin, where the cost to restore the building to its predamage condition equals or exceeds **50 percent** of the building's market value before the damage occurred.

#### What Is Substantial Improvement?

Substantial improvement is any reconstruction, rehabilitation, addition, or improvement of a building, the cost of which equals or exceeds **50** *percent of the building's pre-improvement market value.* 

When repairs and improvements are made at the same time, all costs are totaled and compared with the 50 percent of market value threshold.

# What Costs Are Included in Substantial Damage and Substantial Improvement Determinations?

- All structural items and major building components (e.g., foundations; beams; trusses; sheathing; walls and partitions; floors; ceilings; roof covering; windows and doors; brick, stucco, and siding; attached decks and porches).
- Interior finish elements (e.g., tile, linoleum, stone, carpet; plumbing fixtures; gypsum wall-board and wall finishes; built-in cabinets, book-cases and furniture; hardware).
- **Utility and service equipment** (e.g., HVAC equipment; plumbing and wiring; light fixtures and ceiling fans; security systems; built-in appliances; water filtration and conditioning systems).
- Market value of *all labor and materials* for repairs, demolition, and improvements, including management, supervision, overhead, and profit (do not discount volunteer or self-labor or donated/discounted materials).

# What Costs Are Not Included in Substantial Damage and Substantial Improvement Determinations?

- **Design costs** (e.g., plans and specifications, surveys and permits).
- **Clean-up** (e.g., debris removal, transportation, and landfill costs).
- **Contents** (e.g., furniture, rugs, appliances not built in).
- Outside improvements (e.g., landscaping, irrigation systems, sidewalks and patios, fences, lighting, swimming pools and hot tubs, sheds, gazebos, detached garages).

**Note:** Some jurisdictions have enacted more restrictive requirements—some use a less-than-50-percent damage/improvement threshold. Some track the cumulative value of damage and improvements over time. Consult the AHJ for local requirements.

# **Additions**

Additions increase the square footage or external dimensions of a building. They can be divided into *lateral additions, vertical additions,* and *enclosures* of areas below *existing buildings*. When considering additions, it is important to consider that changes to the shape and roof line of the structure may impact the potential damages to the house. A lateral addition may change the number of openings, the way wind travels around the structure, or create a large open space that may require additional bracing. Vertical additions may also impose greater loads on the existing structure. A qualified design professional should evaluate the loading to the entire structure to see if additional structural modifications are required in order to maintain the structure's ability to sustain high-wind loading.

#### **Lateral Additions**

If a lateral addition constitutes a substantial improvement to a building, both the addition and the existing building must comply with the current wind loading requirements. The foundation, walls, and roof may need to be altered in order to comply with wind loading requirements.

#### **Vertical Additions**

If a vertical addition to a building constitutes a substantial improvement, both the addition and the existing building must comply with the current wind loading requirements. The foundation, walls, and roof may need to be altered in order to comply with wind loading requirements. Vertical additions may apply significantly higher loadings to the foundation and first story, it is important to consider all of the framing and foundation modifications that need to be made (see Figure 2). Vertical additions may require the use of a geotechnical engineer and soil borings may be needed prior to design.

#### **Materials**

When constructing in coastal environments, carefully consider what construction materials to select. For additional information, see Fact Sheet 1.7, *Coastal Building Materials*. Wind events can cause damage to several parts of the structure. Often the damage will consist of not only wind related damage, but also water intrusion. Following a storm event, repairs should not be started until the problem is properly evaluated and materials are selected that will entirely remedy the damage.

#### Repairs

Correction of the apparent surface damage can lead to unaddressed or overlooked problems that can cause major issues with the structural stability of the building. Inspections often not only require demolition or removal of the physically damaged building component, but also removal of associated exterior cladding. Wind-driven rain can lead to compromised connections and decaying or rotting building materials that may not be visible without more investigation.

The repair of interior finishes damaged by wind-driven rain should be carefully considered. Coastal buildings are often subjected to high-wind events, which many times are accompanied by wind-driven rain. The wind pushes water through small openings in doors and windows. This does not suggest improper functioning of the door or window, but this is more the result of the pressures these openings are subjected to during high-wind events. Interior surfaces such as walls, floor, and cabinets may be subjected to water on a regular basis. These building components may require finishes that will resist repeated water contact.

Repairs may present an excellent opportunity to upgrade the house. Additional connectors for maintaining a load path, additional moisture barriers, and installation of wind-resistant components are some possible options. The section on "Retrofit and Remodeling Opportunities" will outline some options to consider when undergoing repairs.



Figure 2. Vertical addition to a home damaged by Hurricane Fran. Preexisting 1-story home became the second story of a home elevated to meet new foundation and floor elevation requirements.

# **Retrofit and Remodeling Opportunities**

Retrofit opportunities will present themselves every time repair or maintenance work is undertaken for a major element of the building. Improvements to the building that are made to increase resistance to the effects of natural hazards should focus on those items that will potentially return the largest benefit to the building owner. For example:

When the **roof covering** is replaced, the attachment of the sheathing to the trusses or rafters can be checked, and additional load path connectors can be installed as necessary. The Technical Fact Sheets located in Category 7 of this publication provide details on how to improve the roof system's ability to resist wind and water intrusion. The common elements of a roof system should be carefully evaluated in order to address opportunities to improve the load path and water resistance of the system. The most common repair necessary following a storm event is the roof covering. When reroofing, tear-off is recommended instead of re-covering. Although some jurisdictions allow for reroofing, this method may prevent the identification of more serious inadequacies in the system and result in more catastrophic failures in the next event. A roof covering project should be viewed as an opportunity to evaluate the strength of the roof sheathing. With the removal of the roof covering, a careful inspection of the sheathing should be conducted to look for darkened areas or areas subjected to water damage. If detected, these areas should be replaced. The thickness of the roof sheathing should be inspected to verify that it is of a sufficient thickness to resist the design wind speeds for your area. Also, consult the information in Fact Sheet 7.1, Roof Sheathing Installation, in order to improve roof system connections. Replacement of roof coverings also may provide opportunities to evaluate the adequacy of rafter or truss to wall system connections and install hurricane/seismic connectors. Information on these connections can be found in Fact Sheet 4.1, Load Paths and Fact Sheet 4.3, Use of Connectors and Brackets.

If *siding* or *roof sheathing* has to be replaced, hurricane/seismic connectors can be installed at the rafter-to-wall or truss-to-wall connections, the exterior wall sheathing attachment can be checked, and structural sheathing can be added to shearwalls. Adding wall-to-foundation ties may also be possible. Verify that all exterior sheathing (wall and roof) is approved for use on exterior surfaces. Verify that fasteners are indeed connecting the exterior sheathing to the framing. See Fact Sheet 4.1, *Load Paths* and Fact Sheet 4.3, *Use of Connectors and Brackets* for additional information.



- **Gable ends** can be braced in conjunction with other retrofits or by themselves. The illustration in Figure 3 shows a typical gable end wall bracing system. These improvements are typically inexpensive, allow the loads imposed on the gable end walls to be distributed through multiple roof trusses or rafters, and assist in distributing the wind loads on the gable ends. Additional guidance for gable ends can be found in the Gable End Retrofit Guide Florida Division of Emergency Management.
- Exterior **siding** attachment can be improved with more fasteners at the time the exterior is recoated. See Fact Sheet 5.3, *Siding Installation in High-Wind Regions* for additional information.
- Window, door, and skylight reinforcement and attachment can be improved whenever they are accessible. Following a high-wind event, windows and doors should be checked for leaks. The framing should be checked for cracked paint or discolored paint. If the doors and windows are not shutting correctly, then this may indicate that the framing around the window or door suffered water damage. Check for worn areas where paint or caulking is missing and investigate for water damage or intrusion. Repair any water-damaged areas immediately. Framing should be inspected to verify that it is sufficiently attached to the wall system to provide sufficient protection. Improperly framed windows and doors have been found forced from their framing. See Fact Sheet 6.1, Window and Door Installation for additional information.

When **windows** and **doors** are replaced, glazing and framing can be used that is impact-resistant and provides greater UV protection.

The windows and doors must meet wind-resistance standards and be installed in accordance with the manufacturer's installation instructions for high wind. Fasteners should be long enough to attach the window or door to wall framing around the opening. Fasteners should be spaced no greater than 16 inches unless otherwise stated by the manufacturer's recommended installation instructions. See Fact Sheet 6.2, Protection of Openings-Shutters and Glazing, for additional information on protecting openings. Verify that doors meet ASTM E330 and DASMA 108 and that windows meet ASTM E1886 and E1996 or Miami-Dade TAS 201, 202 and 203.

- Soffits should be inspected following high-wind events to determine whether structural upgrades are necessary. Soffit failures are common during storms and damage is often experienced in attics due to water being blown in through open soffits. Proper attachment is the most common problem noted with soffit failures. Wood backing or supports should be installed in order to provide a structural member to attach the soffit panels to. If it is not possible to install wood supports, the soffit should be secured at 12inch intervals on each side in order to limit its ability to flex during high-wind events. See Fact Sheet 7.5, Minimizing Water Intrusion through Roof Vents in High-Wind Regions for additional information.
- Hurricane shutters can be added at any time (see Fact Sheet 6.2, Protection of Openings-Shutters and Glazing). Shutter systems should be purchased and installed well before a storm event. It is important to take the time necessary to verify that hangers and attachment systems are properly anchored to the structural system of the building. Shutter systems should be anchored to the building and maintain the load path of the building.
- Floor-framing-to-beam connections can be improved whenever they are accessible. See Fact Sheet 4.1, Load Paths and Fact Sheet 4.3, Use of Connectors and Brackets for additional information.
- Beam-to-pile connections can be improved whenever they are accessible. See Fact Sheet 3.3, Wood Pile-to-Beam Connections for additional information.
- At any time, deficient *metal connectors* should be replaced with stainless steel connectors or metal connectors with proper corrosion protection such as hot-dip galvanized steel. See Fact Sheet 1.7, *Coastal Building Materials* for additional information.
- When HVAC equipment is replaced, the replacement equipment should be more durable so that it will last longer in a coastal environment. It should also be elevated at, or above, the Base Flood Elevation (BFE) and adequately anchored to resist wind and seismic loads. See Fact Sheet 8.3, Protecting Utilities for additional information.
- Utility attachment can be improved when the outside equipment is replaced or relocated. See Fact Sheet 8.3, *Protecting Utilities* for additional information.
- In the attic space, at any time, straps should be added to rafters across the ridge beam, straps should be added from rafters to wall top plates, and gable end-wall framing should be braced. In

addition, the uplift resistance of the roof sheathing can be increased through the application of APA AFG-01 or ASTM 3498 (see additional resources for more information) rated structural *adhesive* at the joints between the roof sheathing and roof rafters or trusses. The adhesive should be applied in a continuous bead and extended to the edges of the roof (where some of the highest uplift pressures occur). At the last rafter or truss at gable ends, where only one side of the joint is accessible, wood strips made of quarter-round molding may be embedded in the adhesive to increase the strength of the joint. For more information about the use of adhesive, see the "Additional Resources" section.

- The addition of *air admittance valves (AAV)* on all plumbing fixtures can reduce the need for roof penetrations required for conventional venting systems. The reduction in roof penetrations will reduce roof maintenance and reduce the number of openings available for water penetration. AAVs are not allowed in all jurisdictions, so verify with a licensed plumber that they are allowed in the jurisdiction where the house is being constructed.
- At any time, **garage doors** should be reinforced or replaced with new wind- and debris-resistant doors. There are some reinforcement kits available to provide both vertical and horizontal reinforcement of the garage door. If the garage door requires replacement, then select one that meets the design wind-speed requirements for your area. See Fact Sheet 6.2, *Protection of Openings- Shutters and Glazing*, for additional guidance on protecting openings and garage door guidance.
- To minimize the effects of corrosion, metal light fixtures can be replaced at any time with fixtures that have either wood or vinyl exteriors. However, wood may require frequent treatment or painting. See Fact Sheet 1.7, Coastal Building Materials for additional information.
- To minimize the effects of corrosion, carbon steel **handrails** can be replaced at any time with vinylcoated, plastic, stainless steel, or wood handrails. Wood handrails may require frequent treatment or painting and appropriate fasteners must be used (see Fact Sheet 1.7, Coastal Building Materials for additional information). Carbon steel handrails may also be painted with a zincrich, vinyl, or epoxy paint appropriate for exposed wet and salt-spray environments. Regardless of the product used, proper maintenance is always necessary in order to ensure a safe handrail.

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# **References and Resources**

#### HOME BUILDER'S GUIDE TO COASTAL CONSTRUCTION

**Technical Fact Sheet No. G.2** 

**Purpose:** To list references and resources that provide information relevant to topics covered by the Home Builder's Guide to Coastal Construction technical fact sheets.

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