



**PDHonline Course C599 (1 PDH)**

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## **Selecting a Lot and Siting the Building**

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### Using a Flood Insurance Rate Map (FIRM)

**HOME BUILDER'S GUIDE TO COASTAL CONSTRUCTION** Technical Fact Sheet No. 3

**Purpose:** To explain the purpose of FIRMs, highlight features that are important to coastal builders, and explain how to obtain FIRMs.

**What is a FIRM?**

- FIRMs have been prepared by FEMA for approximately 23,000 communities in the United States, and currently, no FIRM is a product of the Flood Insurance Study (FIS) for a community and is available in paper form and digital form.
- FIRMs determine Special Flood Hazard Areas (SFHAs) – that are subject to inundation by a flood that has a 1-percent annual chance of being equalled or exceeded in any given year through the base 1-percent annual chance flood. The SFHAs are shown on the FIRM and are divided into different flood hazard zones, depending on the nature and severity of the flood hazard.

**Why Are FIRMs Important?**

- FIRMs show the areas of expected flood hazard areas in a community.
- The insurance rate designations shown on FIRMs are used in the determination of flood insurance rates and premiums.
- The 100-year flood elevation and flood depth shown on FIRMs are the minimum regulatory elevations on which community floodplain management ordinances are based.
- The information shown on FIRMs is used for design and construction of new buildings, the improvement and repair of existing buildings, and additions to existing buildings (see Fact Sheet No. 2 and 3).

**What Are Flood Hazard Zones and Base Flood Elevation?**

**Base Flood Elevation (BFE)** is typically shown on FIRMs for flood hazard zones A and V. The BFE is the expected elevation of flood waters and some effects during the 100-year flood, also known as the "base flood." The BFE is referenced to the vertical datum shown on the FIRM.

**FIRMs Are Used By:**

- Communities to regulate new construction (i.e., construction that cannot meet existing) and existing buildings, to determine flood hazard and other flood information.
- Landowners, to determine whether flood insurance is required.
- Insurance agents, to establish flood insurance rates.
- Local engineers and architects, to complete National Flood Insurance Program (NFIP) elevation certificates (see Fact Sheet No. 4).

**Flood Hazard Zones in Coastal Areas** (see the sample FIRM on the next page)

- Zone A: Areas shown on the FIRM that are not subject to wave action, high velocity flow, and erosion during the 100-year flood.
- Zone AE: Areas are shown subject to flooding during the 100-year flood, but where flood conditions are less severe than Zone V.
- Zone V: Areas are shown subject to shallow flooding or about flow during the 100-year flood. Flood depths, other than BFE, are shown for Zone V.
- Zone VE: Areas are shown that are not protected by flood walls during the 100-year flood.
- Zone VE1: Areas are shown with a water and/or wind surge (e.g., A1, VE1, VE2) shown by number and inch of the water.
- Zone VE2: Areas are shown with a water and/or wind surge (e.g., A2, VE2, VE3) shown by number and inch of the water.
- Zone VE3: Areas are shown with a water and/or wind surge (e.g., A3, VE3, VE4) shown by number and inch of the water.

**Recommended Practice:**

**Fact Sheet No. 3, Using a Flood Insurance Rate Map (FIRM)** – Explains the purpose of FIRMs; highlights features of a FIRM that are important to coastal builders, including flood hazard zones and flood elevations; and explains how to obtain FIRMs.

### Lowest Floor Elevation

**HOME BUILDER'S GUIDE TO COASTAL CONSTRUCTION** Technical Fact Sheet No. 4

**Purpose:** To discuss benefits of exceeding the National Flood Insurance Program (NFIP) minimum elevation requirements, to point out common construction practices that are violations of NFIP regulations, and to discuss the NFIP Elevation Certificate.

**Why is the Lowest Floor Elevation Important?**

In flood areas, experience has shown that flood damage areas of buildings situated above the flood level and within certain of these areas, in coastal areas, have other causes over their lifetimes, often increasing structural building areas above the flood level and one building more than the other. This is the case for substantial support.

**Recommended Lowest Floor Elevations\***

- In flood areas, experience has shown that flood damage areas of buildings situated above the flood level and within certain of these areas, in coastal areas, have other causes over their lifetimes, often increasing structural building areas above the flood level and one building more than the other. This is the case for substantial support.
- It is recommended that the lowest floor elevation (LFE) of a building be at least 1 foot above the BFE (1.0 ft, and 1.5 ft, and 2.0 ft).
- It is recommended that the lowest floor elevation (LFE) of a building be at least 1 foot above the BFE (1.0 ft, and 1.5 ft, and 2.0 ft).

**Recommended Practice:**

**Fact Sheet No. 4, Lowest Floor Elevation** – Defines “lowest floor,” discusses benefits of exceeding the NFIP minimum building elevation requirements, points out common construction practices that are violations of NFIP regulations, and discusses the NFIP Elevation Certificate. Also includes a copy of the certificate.

### V-Zone Design and Construction Certification

**HOME BUILDER'S GUIDE TO COASTAL CONSTRUCTION** Technical Fact Sheet No. 5

**Purpose:** To explain the certification requirements for structural design and construction in V zones.

**Structural Design and Methods of Construction Certification**

As part of the requirements for meeting flood insurance requirements for the National Flood Insurance Program (NFIP), the community is required to submit a floodplain management ordinance that specifies minimum design and construction requirements. These requirements include a certification of the structural design and methods of construction.

**Required Certifications in V Zones**

The design and methods of construction certification should be completed for the lowest floor of the building. The design and methods of construction certification should be completed for the lowest floor of the building. The design and methods of construction certification should be completed for the lowest floor of the building.

**Lowest Floor Elevation:** In a V-zone, the lowest floor elevation is the elevation of the lowest floor of the building. The lowest floor elevation is the elevation of the lowest floor of the building.

**Design and Methods of Construction Certification:** The design and methods of construction certification should be completed for the lowest floor of the building. The design and methods of construction certification should be completed for the lowest floor of the building.

**Fact Sheet No. 5, V-Zone Design and Construction Certification** – Explains the certification requirements for structural design and construction in V zones. Also includes a copy of a sample certificate and explains how to complete it.

### How Do Siting and Design Decisions Affect the Owner's Costs?

**HOME BUILDER'S GUIDE TO COASTAL CONSTRUCTION** Technical Fact Sheet No. 6

**Purpose:** To show the effects of planning, siting, and design decisions on coastal home costs.

**Key Issues**

- When building a coastal home, initial spending, and long-term costs (i.e., life cycle costs) must be considered. Based on available market data, the cost of building a coastal home is significantly higher than the cost of building a non-coastal home.
- Determining the risks associated with a particular building site or design is important.
- Initial spending, and long-term costs (i.e., life cycle costs) must be considered. Based on available market data, the cost of building a coastal home is significantly higher than the cost of building a non-coastal home.

**Costs**

- A variety of costs should be considered when planning a coastal home and the construction cost. Costs should be aware of such as the following: lot costs, land costs, and the construction cost. Costs should be aware of such as the following: lot costs, land costs, and the construction cost.
- Initial spending includes primary construction and acquisition costs and the costs of siting, design, and construction. Ongoing costs include costs associated with the use of the building, such as the costs of utility and insurance.
- Long-term costs include costs for preventive maintenance and for repair and replacement of deteriorated or damaged building components.

**Risk**

One of the most important building decisions is the location of the building. The location of the building is the location of the building. The location of the building is the location of the building.

	Low	Medium	High
Low Risk	Low Risk	Low Risk	Medium Risk
Medium Risk	Low Risk	Medium Risk	High Risk
High Risk	Medium Risk	High Risk	Extreme Risk

**Recommended Practice:**

**Fact Sheet No. 6, How Do Siting and Design Decisions Affect the Owner's Costs?** – Discusses effects of planning, siting, and design decisions on coastal home costs. Topics include initial, operating, and long-term costs; risk determination; and the effect on costs of meeting and exceeding code and NFIP design and construction requirements.

### Selecting a Lot and Siting the Building

HOME BUILDER'S GUIDE TO COASTAL CONSTRUCTION

**Purpose:** To provide guidance on lot selection and siting considerations for coastal residential buildings.

**Key Issues:**

- Purchase and siting decisions should be made early in the building process, and based on property location and conditions.
- Factor characteristics, including topography, environmental factors, and owner desires on lot siting options.
- Conformance with local state regulatory codes and local building codes.
- Information about site conditions and history is available from several sources.



**The Importance of Property Purchase and Siting Decisions:** The single most common and costly siting mistake occurs for purchasers, builders, and owners in failing to consider factors such as lot location, topography, and environmental conditions.

**What Factors Consider Siting Decisions?** Many factors affect lot and siting decisions, including a owner's ability to select residential or other structures, regulatory constraints, and environmental constraints.

**Fact Sheet No. 7, *Selecting a Lot and Siting the Building*** – Presents guidance concerning lot selection and building siting considerations for coastal residential buildings. Topics include factors that constrain siting decisions, coastal setback lines, common siting problems, and suggestions for builders, designers, and owners.

### Coastal Building Materials

HOME BUILDER'S GUIDE TO COASTAL CONSTRUCTION

**Purpose:** To provide guidance on the selection of building materials used for coastal construction.

**Key Issues:**

- The durability of a coastal home relies on the types of materials used to construct it. For more details, see the U.S. Department of Housing and Urban Development (HUD) report Coastal Building Materials for Residential Builders and Designers, available at the HUD Blue Book at <http://www.huduser.org/publications/bldgmat/bldgmat.html>.
- Materials and construction methods should be resistant to flood and other damage, including salt, corrosion, mold, and decay.

**Section 602 (b) of the National Flood Insurance Program (NFIP) regulations require that all new construction and substantial improvement be designed and constructed to meet the design flood elevation (DFE) that is resistant to flood damage (see Fact Sheet No. 20 for a definition of "substantial improvement")."**

**Flood-Resistant Materials:** Flood-resistant materials for a large percentage of the damage caused by a coastal storm. Building materials resistant to flooding must be resistant enough to resist a certain amount of water exposure in order to avoid the need for complete replacement after the flood.



**Fact Sheet No. 8, *Coastal Building Materials*** – Provides guidance on the selection of building materials used for coastal construction. Flood, wind, corrosion, and decay resistance are discussed, including protection recommendations.

### Moisture Barrier Systems

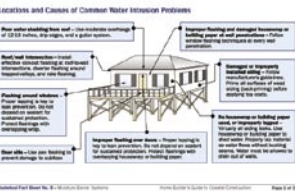
HOME BUILDER'S GUIDE TO COASTAL CONSTRUCTION

**Purpose:** To describe the various barrier systems, explain how typical wall moisture barrier work, and identify common problems associated with moisture barriers.

**Key Issues:**

- A successful moisture barrier system will limit water infiltration into exterior walls and allow drainage and drying of wetted building materials.
- Most moisture barrier systems for walls (i.e., liquid and tank systems) are "waterproof" systems, which prevent water from passing through the wall.
- Membrane or liquid systems (applied after framing) will provide an additional moisture barrier system.
- Proper framing and moisture and mold-resistant sheathing are critical to a successful moisture barrier system.
- Sealing should never be substituted for proper framing.

**Locations and Causes of Common Water Intrusion Problems:**



**Fact Sheet No. 9, *Moisture Barrier Systems*** – Describes the moisture barrier system, explains how typical wall moisture barrier systems work, and discusses common problems associated with moisture barrier systems.

### Load Paths

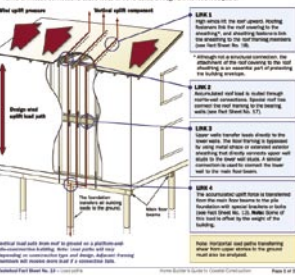
HOME BUILDER'S GUIDE TO COASTAL CONSTRUCTION

**Purpose:** To describe the concept of load paths and highlight important connections in a wind uplift load path.

**Key Issues:**

- Loads acting on a building follow many paths through the building and must eventually be resisted by the ground, or the building will fail.
- Loads accumulate as they are resisted through key connections in a building.
- Member connections are usually the weak link in a load path.
- Failed or missed connections cause loads to be resisted through unintended load paths.

**Wind uplift pressure:** Wind uplift pressure is the force exerted on the roof and walls of a building by the wind.



**Fact Sheet No. 10, *Load Paths*** – Illustrates the concept of load paths and highlights important connections in a typical wind uplift load path.

### Foundations in Coastal Areas

HOME BUILDER'S GUIDE TO COASTAL CONSTRUCTION Technical Fact Sheet No. 11

**Purpose:** To describe foundation types suitable for coastal environments.

**Key Issues:**

- Foundations in coastal areas must elevate buildings above the base flood elevation (BFE), meet windborne-blast loads, resist waves, surge and erosion and floating debris.
- Foundations used for braced construction are generally not suitable for coastal construction.
- Single cantilevered piles in concrete foundations are required for most coastal areas. In other coastal areas, they are recommended. Instead of solid and masonry walls, or other masonry foundations, they can be embedded into "Deeply Underlaid" means. Additional penetration into the ground to accommodate additional surge and erosion and to resist of design vertical and lateral loads without distortion (settlement).
- Areas below elevated buildings in V zones must be "free of obstructions" that can transfer flood loads to the foundation and building (see Fact Sheet No. 27).

**Foundation Design Criteria:**

All foundations for buildings in flood hazard areas must be constructed with flood-resistant materials (see Fact Sheet No. 8) and must also be designed to address the requirements for conventional construction. (1) ensure the building above the BFE, and (2) prevent flotation, collapse, and lateral movement of the building, resulting from loads and conditions during the design flood event (5) located areas (see Fact Sheet No. 10) and conditions include installation by full-tension walls, bracing, bolts, floating debris, erosion, and high winds.

Because the most hazardous coastal areas are subject to erosion and extreme flood loads, the only permitted way to penetrate these areas is to elevate a building to a deeper underlaid level ("see" i.e., pile or braced foundation). This approach requires a structural analysis and design of a foundation. The foundation surface area subject to lateral flood loads - it is subject to the National Flood Insurance Program (NFIP) in V zones (see Fact Sheet No. 27) and is recommended for coastal A zones. Areas below elevated buildings in V zones must be "free of obstructions" that can transfer flood loads to the foundation and building (see Fact Sheet No. 27).

**Performance of Various Foundation Types in Coastal Areas:**

There are many types of foundations used in coastal areas. All foundation types, including walls, walls, pier columns, and piles. Not all of these are suitable for coastal areas. In fact, several of them are prohibited in V zones and are not recommended by the Home Builder's Guide to Coastal Construction for A zones (see Fact Sheet No. 10).

**PI - Because PI is susceptible to erosion, it is prohibited as a means of providing structural support to elevated V zones and must not be used as a means of bracing buildings in any other coastal area subject to erosion, surge, or floating debris.**

Technical Fact Sheet No. 11 - Foundations in Coastal Areas Home Builder's Guide to Coastal Construction Page 2 of 9

**Fact Sheet No. 11, Foundations in Coastal Areas** – Explains foundation design criteria and describes foundation types suitable for coastal environments. Also addresses foundations for high-elevation coastal areas (e.g., bluff areas).

### Pile Installation

HOME BUILDER'S GUIDE TO COASTAL CONSTRUCTION Technical Fact Sheet No. 12

**Purpose:** To provide basic information about pile design and installation.

**Key Issues:**

- Use a pile type that is appropriate for local conditions.
- Have piles designed by a foundation engineer for ultimate lateral, axial, and length.
- Use installation methods that are appropriate for the conditions.
- Brace piles properly during construction.
- Make accurate field logs, and level off caps and drilled holes to prevent drift.
- Have all pile-to-beam connections engineered, and use recommended hardware. (See Fact Sheet No. 13)

**Pile Types:**

Timber and steel piles are the most common type of pile used in coastal construction. They can be square or round in cross section. Steel piles are readily cut and adapted to fit field and are suitable for most conditions. Concrete piles are used for deep foundations. Concrete piles are used for deep foundations. Steel piles are used for shallow foundations. Steel piles are used for shallow foundations.

**Pile Size and Length:**

Pile size and length are determined by the foundation engineer based on bearing and penetration requirements. Pile size should have no less than an 8 inch top diameter. The total length of the pile is based on code requirements, calculated penetration requirements, weather protection, Design Flood Elevation (DFE), and allowance for set-off and beam width (see figure at right).

**Note:** Modified piles for braced construction. See Fact Sheet No. 13 for information about bracing connections to modified piles.

Technical Fact Sheet No. 12 - Pile Installation Home Builder's Guide to Coastal Construction Page 2 of 9

**Fact Sheet No. 12, Pile Installation** – Presents basic information about pile design and installation, including pile types, sizes and lengths, layout, installation methods, bracing, and capacities.

### Wood-Pile-to-Beam Connections

HOME BUILDER'S GUIDE TO COASTAL CONSTRUCTION Technical Fact Sheet No. 13

**Purpose:** To illustrate typical wood-pile-to-beam connections, provide basic construction guidelines on various connection methods, and show pile bracing connection techniques.

**NOTE:** The foundation engineer is responsible for the design. This connection must be designed by an engineer. See Fact Sheet No. 13 for "Load-Carrying" information. The number of bolts and special bolt placement dimensions shown on the drawings are for illustrative purposes only. The design is for three piles per beam, and not all of the information to be considered in the design is included in these illustrations. **Pile design is the responsibility of the engineer.**

**Key Issues:**

- Verify pile alignment and contact, or resistance before loading connections.
- Capable of full pile to ensure required load capacity.
- Use steel-to-steel connections with 50 percent of pile penetration.
- Use carbon-steel or hardware, such as stainless steel or aluminum, when used in salt water.
- Accurate caps and steel-to-steel work.
- Field-trip all caps and holes to prevent drift.
- Use sufficient size and beam width to allow proper edge distances.

**Pile-to-beam connections must:**

- provide required bearing area for beam to rest on pile
- provide required **axial** (compression) resistance
- provide **lateral** or **uplift** resistance
- be capable of resisting beam loads (dead and seismic)
- be constructed with **ductile** connectors and hardware

**Note:** Pile-to-beam connections must be designed by an engineer.

Technical Fact Sheet No. 13 - Wood-Pile-to-Beam Connections Home Builder's Guide to Coastal Construction Page 2 of 9

**Fact Sheet No. 13, Wood-Pile-to-Beam Connections** – Illustrates typical wood-pile-to-beam connections; presents basic construction guidance for various connection methods, including connections for misaligned piles; and illustrates pile bracing connection techniques.

### Reinforced Masonry Pier Construction

HOME BUILDER'S GUIDE TO COASTAL CONSTRUCTION Technical Fact Sheet No. 14

**Purpose:** To provide an alternative to piles in V zones and A zones in coastal areas where soil properties preclude pile installation, or the need for an "open foundation system" still exists. Includes recommendations for good masonry practice in coastal environments.

**Key Issues:**

- The footing must be designed for the soil conditions present. Pier foundations are generally not recommended for use in A zones.
- The connection between the pier and its footing must be properly designed and constructed to resist separation of the pier from the footing and vertical loads, including forces.
- The base of the footing must be below the anticipated erosion and scour depth.
- The pier must be reinforced with steel and fully grouted.
- There must be a positive connection to the beam at the top of the pier.
- Special attention must be given to the application of mortar in order to prevent weather intrusion into the pier when the pier cap is completed.

**Piers vs. Piles:**

Use only where the following conditions exist: (1) where the soil is such that piles are not recommended; (2) where the pier cap is not recommended; (3) where the pier cap is not recommended; (4) where the pier cap is not recommended.

**Note:** In coastal areas, masonry pier foundations are not recommended in V zones with erosion risk, or in A zones subject to waves and erosion - use pile foundations in these areas.

Technical Fact Sheet No. 14 - Reinforced Masonry Pier Construction Home Builder's Guide to Coastal Construction Page 2 of 9

**Fact Sheet No. 14, Reinforced Masonry Pier Construction** – Provides an alternative to piles in V zones and A zones in coastal areas where soil properties preclude pile installation, but the need for an "open foundation system" still exists. Includes recommendations for good masonry practice in coastal environments.

### Foundation Walls

HOME BUILDER'S GUIDE TO COASTAL CONSTRUCTION Technical Fact Sheet No. 15

**Purpose:** To discuss the use of foundation walls in coastal buildings.

**Key Issues**

- Foundation walls include stemwalls, single walls, and other walls.
- Foundation walls are permitted for the National Flood Insurance Program (NFIP) in a zone.
- Use of foundation walls in zones in coastal areas should be limited to locations where only shallow flooding occurs, and where the potential for erosion and breaching waves is low.
- When foundation walls are used, appropriate design of foundations will need careful evaluation, height, materials and workmanship, lateral support at the top of the wall, flood openings and ventilation openings, and interior grade elevation.

**Foundation Walls - When Are They Appropriate?**

Use of foundation walls - such as those in stemwalls and other sub-wall foundations - is generally discouraged in coastal areas for two reasons: (1) they present an obstruction to flooding waves and (2) they are susceptible to erosion. If they are used, they should be constructed in a manner that allows them to be removed or repaired in the event of a problem.

**Design Requirements:**

- Design of foundation walls should be limited to areas subject to shallow flooding, where waves are not expected to be over 2 feet high.
- Design of foundation walls should be limited to areas subject to shallow flooding, where waves are not expected to be over 2 feet high.
- Design of foundation walls should be limited to areas subject to shallow flooding, where waves are not expected to be over 2 feet high.

Technical Fact Sheet No. 15 - Foundation Walls

**Fact Sheet No. 15, *Foundation Walls*** – Discusses and illustrates the use of foundation walls in coastal buildings. Topics include footing embedment, wall height, materials and workmanship, lateral support, flood openings and ventilation requirements, and interior grade elevations for crawlspaces.

### Masonry Details

HOME BUILDER'S GUIDE TO COASTAL CONSTRUCTION Technical Fact Sheet No. 16

**Purpose:** To highlight several important details for masonry construction in coastal areas.

**Key Issues**

- Vertical masonry corners need extra attention because of the higher vertical and lateral loads in coastal areas.
- Building materials must be durable enough to withstand the coastal environment.
- Masonry reinforcement requirements are more stringent in coastal areas.

**Load Paths**

A properly connected load path from roof to foundation is crucial in coastal areas. See Fact Sheets No. 13 and 17. The following details show important connections for a typical masonry system.

Technical Fact Sheet No. 16 - Masonry Details

**Fact Sheet No. 16, *Masonry Details*** – Illustrates important roof-to-wall and wall-to-foundation connection details for masonry construction in coastal areas. Topics include load paths, building materials, and reinforcement.

### Use of Connectors and Brackets

HOME BUILDER'S GUIDE TO COASTAL CONSTRUCTION Technical Fact Sheet No. 17

**Purpose:** To highlight important building connections and illustrate the proper use of various types of connection hardware.

**Key Issues**

- In high-wind regions, special hardware is used for steel framing connections.
- Fasteners must be installed according to the manufacturer's or engineer's specifications.
- The correct number of the specified fasteners (length and diameter) must be used with connector hardware.
- Anchor bolts must be installed in accordance with the manufacturer's specifications.
- Anchor bolts must be installed in accordance with the manufacturer's specifications.
- Anchor bolts must be installed in accordance with the manufacturer's specifications.

Technical Fact Sheet No. 17 - Use of Connectors and Brackets

**Fact Sheet No. 17, *Use of Connectors and Brackets*** – Illustrates important building connections and the proper use of connection hardware throughout a building.

### Roof Sheathing Installation

HOME BUILDER'S GUIDE TO COASTAL CONSTRUCTION Technical Fact Sheet No. 18

**Purpose:** To provide information about proper roof sheathing installation, importance of proper construction, and outline of fastening methods that will enhance the durability of a building in a high-wind area.

**Key Issues**

- Roof sheathing can lead to roof failure in a hurricane.
- Roof sheathing can lead to roof failure in a hurricane.
- Roof sheathing can lead to roof failure in a hurricane.

**Fastener Selection and Spacing:**

- Fastener selection and spacing requirements for roof sheathing are based on the manufacturer's specifications.
- The highest-wind forces occur at roof corners, ridges, and rafter ends.
- Increased fasteners such as ring shank nails increase the uplift resistance of the roof sheathing.

**Sheathing Type:**

- OSB, 5/8" plywood, or 1/2" plywood are required in high-wind areas. OSB is preferred over plywood.
- OSB or plywood can be used with ring shank nails.
- OSB or plywood can be used with ring shank nails.

**Sheathing Layout:**

- Roof sheathing panels should be installed in a staggered pattern.
- Roof sheathing panels should be installed in a staggered pattern.
- Roof sheathing panels should be installed in a staggered pattern.

Technical Fact Sheet No. 18 - Roof Sheathing Installation

**Fact Sheet No. 18, *Roof Sheathing Installation*** – Presents information about proper roof sheathing installation and its importance in coastal construction; also discusses fastening methods that will enhance the durability of a building in a high-wind area. Topics include sheathing types and layout methods for gable-end and hip roofs, fastener selection and spacing, the treatment of ridge vents and ladder framing, and common sheathing attachment mistakes.



### Housewrap

**HOME BUILDER'S GUIDE TO COASTAL CONSTRUCTION** Technical Fact Sheet No. 23

**Purpose:** To explain the function of housewrap, examine its attributes, and address common problems associated with its use.

**Key Issues**

- Housewrap is not a vapor barrier. It is designed to allow water vapor to pass through.
- The intent is to use housewrap in building exterior assemblies to prevent air and water vapor from entering the building.
- Housewrap must be installed properly or it could cause moisture-related problems. Proper installation, especially in lap areas, is the key to successful housewrap use.

**Purpose of Housewrap**

Housewrap serves as a substitute weather barrier. It not only minimizes the flow of air in and out of a house, but also blocks liquid water from entering as a vapor stream. The vapor characteristics of housewrap is that it allows water vapor to pass through it while blocking liquid water from entering the home.

**When Should Housewrap Be Used?**

Housewrap is used on exterior building walls, on roof sheathing, and on exterior concrete surfaces. It is used on exterior walls, roof sheathing, and exterior concrete surfaces. It is used on exterior walls, roof sheathing, and exterior concrete surfaces.

**Housewrap or Building Paper?**

To answer this question, it is important to know what attributes are most important for a particular climate. The attributes to consider are:

- Air permeability** - ability to allow air to pass through.
- Water permeability** - ability to prevent liquid water from passing through.
- Moisture resistance** - ability to prevent moisture absorption.
- Flexibility** - resistance to tearing and abrasion.



**Fact Sheet No. 23, Housewrap** – Explains the function of housewrap, examines its attributes, and addresses common problems associated with its use. Topics include housewrap vs. building paper and housewrap installation.

### Roof-to-Wall and Deck-to-Wall Flashing

**HOME BUILDER'S GUIDE TO COASTAL CONSTRUCTION** Technical Fact Sheet No. 24

**Purpose:** To emphasize the importance of proper roof and deck flashing, and to provide typical and enhanced flashing techniques for coastal homes.

**Key Issues**

- Proper performance of flashing and subsequent water intrusion is a common problem for coastal homes.
- Enhanced flashing techniques are recommended to areas that frequently experience high winds and driving rain.
- Water penetration of deck ledges can lead to rot and corrosion of structure leading to deck collapse.

**Roof and Deck Flashing Recommendations for Coastal Areas**

Areas at risk for water intrusion include:


- Roof-to-wall flashing.
- Deck-to-wall flashing.
- Roof-to-deck flashing.
- Deck-to-deck flashing.

**Roof-to-Wall Flashing**

- Use increased sloping for added protection.
- Do not rely on mortar as a substitute for proper flashing.
- Use fasteners that are compatible with all of the same side of metal as the flashing material.
- Use flashing cement at joints to help secure flashing.
- Use flashing overlappings (see Figure 1).
- Use a step flashing that has a 2" to 4" overhang vertical leg that is notched.
- Use the top of step flashing with airtight sealant, with flashing modified to meet roof slope.
- Do not seal flashing on the inside of the roof.
- Use roof flashing.
- Follow proper installation sequence to prevent water penetration at deck ledger (see Figure 2).
- Leave gap between roof deck and flashing to allow for thermal movement (see Figure 3).
- Use a metal deck ledger to provide gap for drainage (see Figure 3).
- Use drainage over deck connection hardware.

**Deck-to-Wall Flashing**

- Use roof to wall flash (1/2" and 2" for deck and over deck).



**Fact Sheet No. 24, Roof-to-Wall and Deck-to-Wall Flashing** – Emphasizes the importance of proper roof and deck flashing, and presents typical and enhanced flashing techniques for coastal homes.

### Siding Installation and Connectors

**HOME BUILDER'S GUIDE TO COASTAL CONSTRUCTION** Technical Fact Sheet No. 25

**Purpose:** To provide basic installation tips for various types of siding, including vinyl, wood, and fiber cement.

**Key Issues**

- Always follow manufacturer's installation instructions.
- Use products that are suitable for a coastal environment. Many manufacturers do not use their products in a way that makes it easy to determine whether the product will be suitable for the coastal environment. Request suppliers to provide information about product suitability in the environment.
- Use high-wind installation procedures if available. These may include spacing nailing strips longer, longer nails, or nails.
- Use recommended fasteners to avoid charring. Avoid using stainless steel fasteners.
- Coastal building requires more maintenance than inland buildings. The maintenance requirements should be considered at time of selection and installation of siding.

**Vinyl Siding**

Vinyl siding can be used successfully in a coastal environment if certain criteria are met:

- Choose siding that has been tested for high winds. These products usually have an enhanced nailing system and are sometimes made from heavier vinyl. Tight joints provide greater wind resistance, withstand salt, and do not rot and delaminate.
- Use the manufacturer's recommended nailing schedule. The nailing schedule should be 12" on center, depending on style and design. Thinner gauge vinyl walls will be more likely to fail under high wind pressure.
- Use a nailing system designed for areas with high winds and extreme temperature changes.
- Position nails in the center of the nailing slot.
- Do not drive the head of the nail against the nail from further than the nail has been specifically designed for. Drive 1/2" or 3/4" into the wall between the fastener head and the nailing slot.
- Do not drive the nails into the wall to prevent charring and burning in the joint.
- Do not use the species where they meet the exterior wall surface, outside corners, or joints. Do not use the species joints.
- Do not fasten or attach through siding.
- Use aluminum, galvanized steel, or other corrosion-resistant nails when installing vinyl siding. Aluminum pins require aluminum or stainless steel fasteners.
- Nail heads should be 5/16" inch minimum in diameter. Shank should be 1/8" inch in diameter.

**High wind siding**

**Standard siding**

**Fasteners of equal length siding and standard siding**



**Fact Sheet No. 25, Siding Installation and Connectors** – Provides basic installation tips for various types of siding, including vinyl, wood, and fiber cement.

### Shutter Alternatives

**HOME BUILDER'S GUIDE TO COASTAL CONSTRUCTION** Technical Fact Sheet No. 26

**Purpose:** To provide general information about the installation and use of storm shutters in coastal environments. Shutter types addressed include temporary plywood panels; temporary manufactured panels; permanent, manual closing; and permanent, motor-driven.

**Why Are Storm Shutters Needed?**

Shutters are an important part of a home's protection against wind and debris. They protect windows and doors from wind damage and debris impact. Shutters are needed to protect windows and doors from wind damage and debris impact.

**Where Are Storm Shutters Required and Recommended?**

Storm shutters are required for windows and doors in coastal areas. They are recommended for windows and doors in all areas of the building.

**How to Choose a Storm Shutter**

When choosing a storm shutter, consider the following factors:

- Material: Plywood, manufactured panels, or permanent materials.
- Installation: Manual or motor-driven.
- Cost: Temporary or permanent.
- Performance: Wind resistance and debris protection.

**Notes:** Many coastal homes have large and unusually shaped windows, which will require custom shutters. Alternatives, such as windows can be protected with laminated (insulated) glass.



**Fact Sheet No. 26, Shutter Alternatives** – Presents general information about the installation and use of storm shutters in coastal environments. Shutter types addressed include temporary plywood panels; temporary manufactured panels; permanent, manual closing; and permanent, motor-driven.



### Enclosures and Breakaway Walls

**HOME BUILDER'S GUIDE TO COASTAL CONSTRUCTION** Technical Fact Sheet No. 27

**Purpose:** To discuss requirements and recommendations for enclosures and breakaway walls below the Base Flood Elevation (BFE).

**Key Issues:**

- Enclosures below enclosed buildings can be used only for building access, service, and storage.
- Areas enclosed by walls below the BFE ("enclosures") are subject to strict regulations under the National Flood Insurance Program (NFIP). Note that some local jurisdictions enforce stricter regulations for enclosures.
- Nonbreakaway enclosures are prohibited in V-zone buildings. Breakaway enclosures in V-zones must meet specific requirements and must be certified by a registered design professional.
- Enclosures (breakaway and nonbreakaway) in A-zone buildings must be equipped with flood openings that allow water to freely flow into and around them (see Fact Sheet No. 30).
- For V-zone enclosures below the average flooding water level in higher flood insurance premiums.

**Special Below the BFE – What Can Be A Used Full?**

**Special Below the BFE – What Can Be A Used Full?**

**What is an Enclosure?**

**Enclosures can be divided into two types: breakaway and non-breakaway.**

**Breakaway enclosures are designed for other than flood openings without breaching the enclosed building, and non-breakaway enclosures are designed for other than flood openings without breaching the enclosed building.**

**Fact Sheet No. 27, Enclosures and Breakaway Walls** – Defines enclosures and breakaway walls, and discusses requirements and recommendations for their use below the Base Flood Elevation (BFE).

### Decks, Pools, and Accessory Structures

**HOME BUILDER'S GUIDE TO COASTAL CONSTRUCTION** Technical Fact Sheet No. 28

**Purpose:** To summarize National Flood Insurance Program (NFIP) requirements and general guidelines for the construction and installation of decks, pools and climbing, swimming pools, and accessory buildings for coastal buildings.

**Key Issues:**

- Any deck, accessory building, or other construction element that is attached to or dependent on a primary building must meet the NFIP regulatory requirements for construction in the A-zone (see NFIP Technical Bulletin 2015-01 and Fact Sheet No. 2, A, V, R, L, L, 27, and 30). Attached construction elements that do not meet these requirements are prohibited.
- If prohibited elements are attached to a building that is otherwise compliant with NFIP requirements, a separate design professional must be engaged against the entire building.
- Swimming pools, accessory buildings, and other construction elements attached to the perimeter (top, side, or end) of a primary building must meet the NFIP regulatory requirements for construction in the A-zone (see NFIP Technical Bulletin 2015-01 and Fact Sheet No. 2, A, V, R, L, L, 27, and 30). Attached construction elements that do not meet these requirements are prohibited.
- A design professional should consider their general effects on nearby buildings.
- The Home Builder's Guide to Coastal Construction provides requirements for all decks, pools, accessory structures, and other construction elements in A-zones in coastal areas that are designed and constructed to meet the NFIP regulatory requirements.

**Decks**

**Requirements:**

- If a deck is structurally attached to a primary building, the bottom of the lowest horizontal member of the deck must be elevated to exceed the elevation of the building's lowest horizontal member.
- A deck built below the Design Flood Elevation (DFE) must be structurally independent of the main building and must not cause an obstruction.
- If an eligible, structurally independent deck is to be constructed, a design professional must evaluate the proposed deck to determine whether it will adversely affect nearby buildings (e.g., by diverting flood flows or creating wind tunnels).

**Swimming Pools:**

- Decks should be built on the same type of foundation as the primary building. Decks should be structurally independent of the primary structure and designed to resist the respective wind and wave forces for the applicable foundation method.
- Attachment decks can be constructed from the primary structure. An technique can minimize the need for additional foundation methods.

**Fact Sheet No. 28, Decks, Pools, and Accessory Structures** – Summarizes NFIP requirements, general guidelines, and recommendations concerning the construction and installation of decks, access stairs and elevators, swimming pools, and accessory buildings under or near coastal residential buildings.

### Protecting Utilities

**HOME BUILDER'S GUIDE TO COASTAL CONSTRUCTION** Technical Fact Sheet No. 29

**Purpose:** To identify the special considerations that must be made when installing utility equipment, such as fuel, sewage, and water/sewage lines in a coastal home, and presents recommendations for utility protection.

**Key Issues, Hazards, Requirements, and Recommendations:**

Special considerations must be made when installing utility systems in coastal homes. **Proper placement and installation of utility and mechanical equipment is absolutely critical to the safety of the building.**

**Coastal Hazards That Damage Utility Equipment:**

- Standing or moving floodwaters
- Impact from floating debris in floodwaters
- Erosion or scour from floodwaters
- High winds
- Whirlpools/misales

**Common Utility Damage in Coastal Areas:**

Floodwaters (from coastal and inland) can cause damage to utility equipment and other critical damage.

**Pool – Floodwaters can float and capture tanks, containers, and other critical components and cause gas accumulations. In addition, damage to fuel systems can lead to fires.**

**Basement – Floodwaters can corrode and short critical electrical systems components, causing heating to electrical shorts. In coastal low areas, electrical shorts can lead to fire.**

**Water Damage – Water can be exposed to erosion and scour caused by floodwaters with velocity. Risk A damage buildup can occur even without the structure flooding.**

**Basic Protection Methods:**

The primary protection method is an **elevated 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.

**Fact Sheet No. 29, Protecting Utilities** – Identifies the special considerations that must be made when installing utility equipment, such as fuel, sewage, and water/sewage lines in a coastal home, and presents recommendations for utility protection.

### Repairs, Remodeling, Additions, and Retrofitting

**HOME BUILDER'S GUIDE TO COASTAL CONSTRUCTION** Technical Fact Sheet No. 30

**Purpose:** To outline National Flood Insurance Program (NFIP) requirements for repairs, remodeling, and additions, and discusses opportunities for retrofitting in coastal flood hazard areas. Also presents recommendations for exceeding the minimum NFIP requirements. Definitions of "substantial damage" and "substantial improvement" are included.

**Key Issues:**

- Existing buildings that exhibit substantial damage or that are substantially improved (see fact sheet No. 27) will be treated as new buildings and must meet the minimum NFIP regulatory requirements (e.g., meet floor elevation, foundation, and structural requirements).
- Work on any NFIP-insured building that is not substantially damaged or substantially improved (see fact sheet No. 27) will be treated as NFIP regulatory construction elements.
- With a single minor exception (e.g., code updates and historic buildings), substantial damage and substantial improvement mean only if a building is the flood hazard zone, exterior or not a best insurance policy is in force.
- Buildings damaged by flood and placed in flood insurance may be eligible for additional protection through the **Advanced Care of Compliance (ACC)** policy provisions. Check with an insurance agent and the authority having jurisdiction (AHJ) for details.
- Hazards and mitigation – either before or after storm damage – provide many opportunities for retrofitting homes and making them more resistant to storm damage (see Fact Sheet No. 27).
- Building structural safety and other conditions – the addition of flood hazard risk or otherwise referred to as "pre-DFE" or "pre-NFIP" requirements.

**Factors That Determine Whether and How Existing Buildings Meet Coastal NFIP Requirements:**

When repairs, remodeling, additions, and retrofitting are done to other structures, some of which may be more expensive than the NFIP requirements. Check with the AHJ before undertaking any work.

**Fact Sheet No. 30, Repairs, Remodeling, Additions, and Retrofitting** – Outlines NFIP requirements for repairs, remodeling, and additions, and discusses opportunities for retrofitting in coastal flood hazard areas. Also presents recommendations for exceeding the minimum NFIP requirements. Definitions of "substantial damage" and "substantial improvement" are included.



**Fact Sheet No. 31, References** – Lists references that provide information relevant to topics covered by the *Home Builder’s Guide to Coastal Construction* technical fact sheets.