



WARREN

Construction Issues and Inspection Points for Building in Coastal Areas

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With the start of a new Hurricane season fastly approaching and last year's Super Storm Sandy still fresh in our minds, construction and reconstruction of residential buildings in coastal regions continue to present challenges to both designer and builder especially with elevated pile construction. Some of these challenges as taken from the FEMA reference¹ and summarized below may include the following:

- complying with construction tolerances for pile foundations
- building on elevated post-and-beam foundation
- requiring connection details with additional inspections
- constructing buildings within property line setbacks
- placing buildings above the DFE (Design Flood Elevation)
- designing elevated buildings to withstand large forces associated with high wind speeds and coastal flooding
- constructing building envelope to withstand intrusion of air and moisture
- selecting durable, exterior construction materials for a moist, salt-laden environment

Construction Issues Facing Designers and Builders

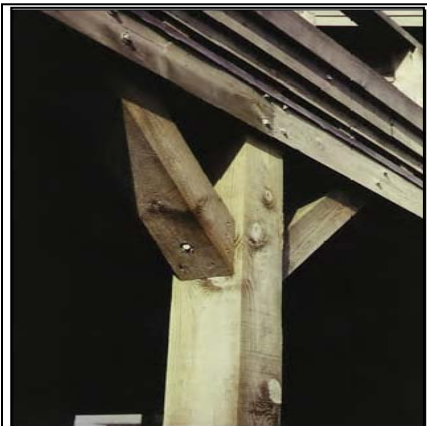
The construction issues listed above will *"probably require the most care and/or attention on the part of the builder in order for the design intent to be achieved."* Constructing the building to meet the design intent now and in the future requires that building components be tough, long-lasting and resilient. The components should remain free from *"decay and termite infestation, metal corrosion, and concrete and masonry deterioration"* all of which could weaken any portion of the building structural systems. Below is a sampling of potential areas of concern during the design effort and construction phase of the building:

Building Foundation

- Piles, piers, or columns properly aligned
- Piles, piers, or columns driven or placed at proper elevation to resist failure and expected depth of scour and erosion
- Foundation materials designed for flood damaging-resistance



**Typical pile foundation with diagonal bracing.
(FEMA News Photo)**

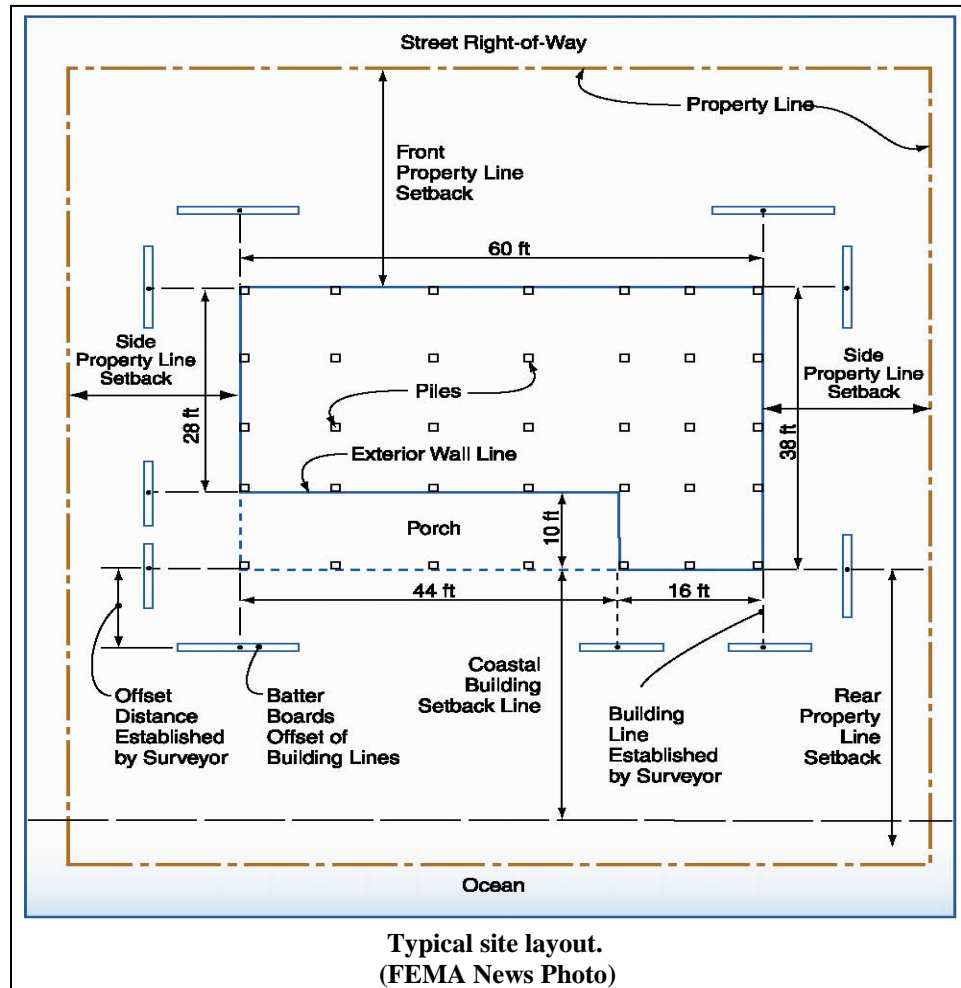


Typical knee bracing and pile support. (FEMA News Photo)

- Adequate support provided at top of foundation element to attach floor framing system
- Breakaway wall design intended to fail and not be over connected to foundations
- Pressure-treated wood cut or drilled and treated in the field to resist water and future decay

Structural Frame (floor, wall and roof)

- Connection of structural elements to resist full natural hazard forces transferred along a continuous load path
- Nail/fastener components fully embedded
- Comply with manufacturer's recommendations on hardware use and load ratings
- Materials properly rated and specified for expected use in environmental conditions
- Weakest connections fail first; apply concept of continuous load path for every structural connection
- Selection and placement of proper materials to resist corrosion
- Comply with suggested nailing schedules for all building components and elements



Building Envelope

- Materials properly designed, rated and reliable for coastal environment loadings
- Eliminate wind-driven rain paths left exposed by properly sealing openings and provide clear paths for shedding water
- Window and door products vulnerable to wind-driven rain leakage and air infiltration require testing with rated certification for use in coastal regions
- High-wind prone areas of roof surfaces properly designed with extra sealing and attachment at eaves and gable end edges
- Materials selected for coastal buildings that provide trouble-free care and maintenance

Specific Inspection Points

Many construction details in the foundation, framing and building envelope, if not completed properly, can cause failure during severe weather events or cause premature failure due to deterioration from the harsh coastal environment. It is very important to inspect the foundation, framing and envelope members and components while construction is in progress to ensure that the design is completed as intended. Below are suggested critical inspection points taken from the FEMA reference for the foundation system, structural frame and building envelope:



Typical floor framing connections.
(FEMA News Photo)

Foundation and Floor Framing

<i>Inspection Point</i>	<i>Reason</i>
Pile-to-girder connection	Ensure proper connection is established
Joist-to-girder connection	Verify presence of positive connection
Joist blocking	Ensure joists are prevented from bending/buckling
Floor sheathing connection	Floor sheathing acts as a shear diaphragm
Material storage prior to construction	Ensure all precautions are taken protect elements from weather and exposure
Framing material is within design tolerances	Ensure levelness and eliminate repair

Wall Framing

<i>Inspection Point</i>	<i>Reason</i>
Wall-to-floor attachment	Ensure nails are of sufficient size, type and number
Size and location of openings	Critical to performance of shear wall
Wall stud blocking	Ensure support for sheathing material edges
Wall sheathing connection	Wall sheathing acts as a shear diaphragm
Material storage prior to construction	Ensure all precautions are taken protect elements from weather and exposure
Stud material	Maintain plumb walls and eliminate eccentricities in vertical loading
Header support over openings	Ensure vertical and lateral loads are transferred along load path

Roof Framing

<i>Inspection Point</i>	<i>Reason</i>
Roof framing-to-wall attachment	Ensure nails are of sufficient size, type and number
Size and location of openings	Critical to performance of shear wall
“H” clips or roof frame blocking	Ensure support for edges of sheathing material
Roof sheathing connection	Roof sheathing acts as a shear diaphragm
Material storage prior to construction	Ensure all precautions are taken protect elements from weather and exposure
Rafter or ceiling joist material	Maintain level ceiling
Gable-end bracing	Ensure bracing conforms to design requirements and specifications

Building Envelope

<i>Inspection Point</i>	<i>Reason</i>
Siding-to-wall framing attachment	Ensure nails are of sufficient size, type and number
Window/door-to-wall framing attachment	Ensure nails are of sufficient size, type and number
Flashing around wall and roof openings, roof perimeters, and at changes in building shape	Prevent water penetration into building envelope
Roof covering-to sheathing attachment and special connection details	Minimize potential for wind blow off
Vent/fan-to-roof/wall attachment	Reduce chance of blow off of vents/fans and ensure wind-driven rain from entering building

The FEMA Coastal Construction Manual: *“Principles and Practices of Planning, Siting, Designing, Constructing, and Maintaining Residential Buildings in Coastal Areas”*, is a great resource and design tool that identifies potential construction issues and points for inspections.

Reference

1. Federal Emergency Management Agency, Coastal Construction Manual: Principles and Practices Of Planning, Siting, Designing, Constructing, And Maintaining Residential Buildings In Coastal Areas, Chapter 13, Constructing the Building, 2011 CCM, 4th Ed. (FEMA P-55)