



# Construction of Residential Buildings in Coastal Areas

An Online Continuing Education Course for Engineers

**Course Number: BD-4015**

**Credit: 4 Hours / 4 PDH / 4 CPD**

# Construction of Residential Buildings in Coastal Areas

## Introduction

Construction of residential buildings in coastal zones presents challenges to the builder not usually found in more inland locations. For all coastal residential buildings, these challenges may include the following:

- connection details require additional inspections
- the need for careful surveying to place the building within property line setbacks and above the Design Flood Elevation (DFE)
- the additional care required to ensure that all elements of the building will withstand the large forces associated with high wind speeds and coastal flooding
- the additional care that must be taken in constructing a building envelope that will withstand the intrusion of air and moisture under the effects of high wind speeds
- the difficulty of providing durable exterior construction in a moist, sometimes salt-laden, environment
- the requirement to protect and, usually, place utilities above the DFE

### NOTE:

The National Flood Insurance Program (NFIP) regulations state that for buildings in V zones, “a registered professional engineer or architect shall develop or review the structural design, specifications and plans for the construction, and shall certify that the design and methods of construction to be used are in accordance with accepted standards of practice” for meeting the provisions of the NFIP regulations regarding buildings in V zones.

In constructing coastal residential buildings on elevated pile foundations, builders face additional challenges:

- the difficulty of constructing a driven pile foundation to accepted construction plan tolerances
- the difficulty of building on an elevated post-and-beam foundation, compared to building on continuous wall foundations

This course discusses construction aspects of the above challenges, as well as other aspects of the coastal construction process. Individual sections cover construction items that will probably require the most care or attention on the part of the builder in order for the design intent to be achieved.

While much of the discussion concerns constructing the building to meet the architect’s and engineer’s design intent for current and future conditions, it is also important that the building elements be

durable. Wood decay and termite infestation, metal corrosion, and concrete and masonry deterioration can weaken the building significantly so that it is hazardous to occupy under any conditions and more likely to fail in a severe natural hazard event.

**NOTE:**

If there is a conflict between design drawings and standard code practice, the most conservative should apply.

Builders may find that the permitting and inspection procedures in coastal areas are more involved than those in inland areas. Not only must all Federal, state, and local Coastal Zone Management and other regulatory requirements be met, the design plans and specifications may need to be sealed by a design professional. Building permit submittals often must include detailed

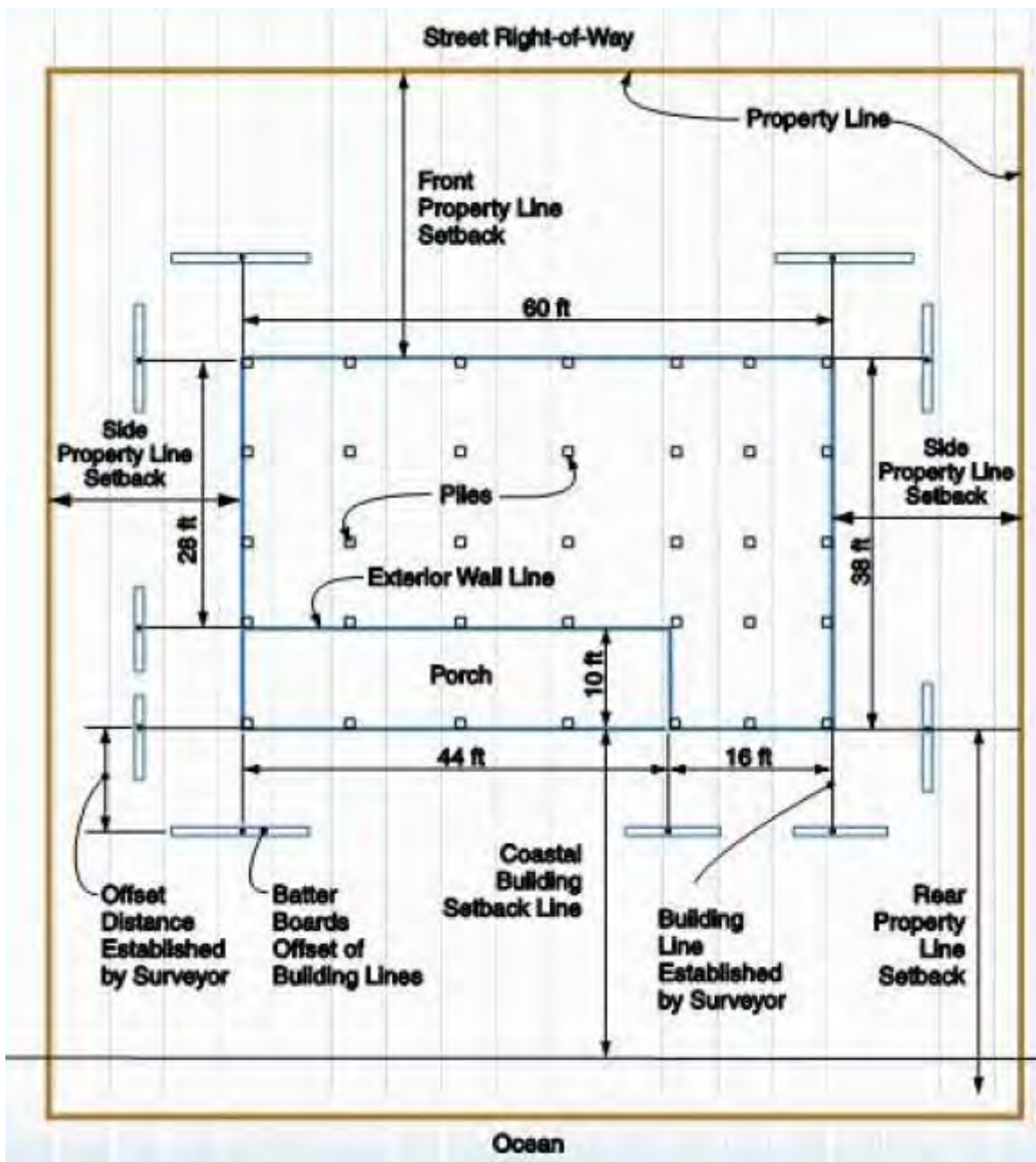
drawings and information for all the elements of the wind-resisting load path, including sheathing material, sheathing nailing, strap and tie down descriptions, bolted connections, and pile description and placement. The placement of utilities above the DFE, breakaway walls, and flood equalization openings must be clearly shown. Site inspections will likely focus on the approved plans, and building officials may be less tolerant of deviations from these approved construction documents. Several sections of this chapter identify points for possible inspections.

## Foundation Construction

### Layout

After the permit submittal and approval process is completed, the construction site must be made ready for the foundation construction. Surveying and staking must be done accurately to establish the building setback locations, the DFE, and the house plan and pile locations. Figure 1, a site layout illustration that shows pile locations, batter boards, and setbacks, is intended to show the possible constraints a contractor may face in actually laying out a pile-supported structure on a narrow coastal lot. There may be conflicts between what the contractor would like to do to prepare the site and what environmental controls dictate can be done at that site. Leveling of the site, especially altering dunes, and removal of existing vegetation may be restricted. These restrictions may constrict access by pile drivers and other heavy equipment. In an elevated building with a pile foundation, the layout of the horizontal girders and beams should anticipate the fact that the final plan locations of the tops of the piles will likely not be precise. Irregularities in the piles and the soil will often prevent the piles from being driven perfectly plumb. The use of thick shims or overnotching for alignment at bolted pile-girder connections will often have a significant adverse effect on the connection capacity.

Figure 2 shows the typical process of pile-notching. The use of a chain saw for this process can lead to inaccuracies at this early stage of construction. Figure 3 shows a wood pile that is overnotched; Figure 4 shows a pile properly notched to support the floor girder, and cut so that there is plenty of wood remaining at the top of the pile.



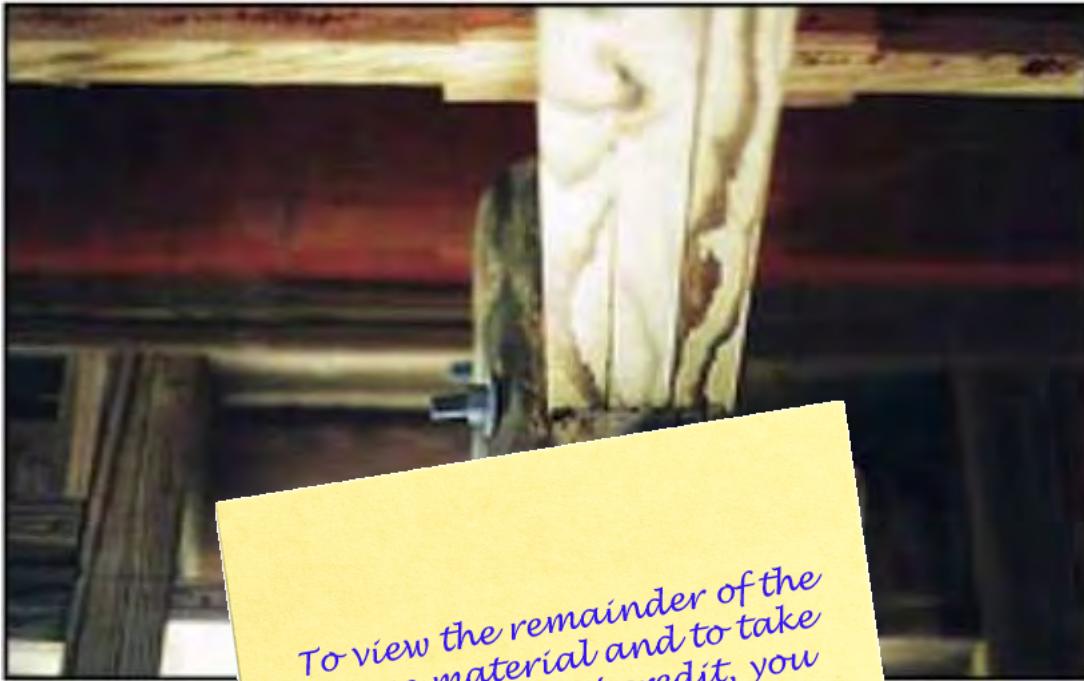
*Figure 1. Site Layout*

A rule of thumb regarding notching is to notch no more than 50 percent of the pile cross-sectional area. Notching more than this area will require reinforcing the pile with a steel plate (or material of similar strength). A previous section in this course presents additional information concerning the reinforcement of overnotched and misaligned piles.

The primary floor girders spanning between pile or foundation supports should preferably be oriented parallel to the primary flow of potential flood water and wave action. This orientation (normally at right angles to the shoreline) allows the lowest horizontal structural member perpendicular to flow to be the floor joists. Thus, in an extreme flood, the girders would not likely be subjected to the full force of the storm water and debris along their more exposed surfaces.



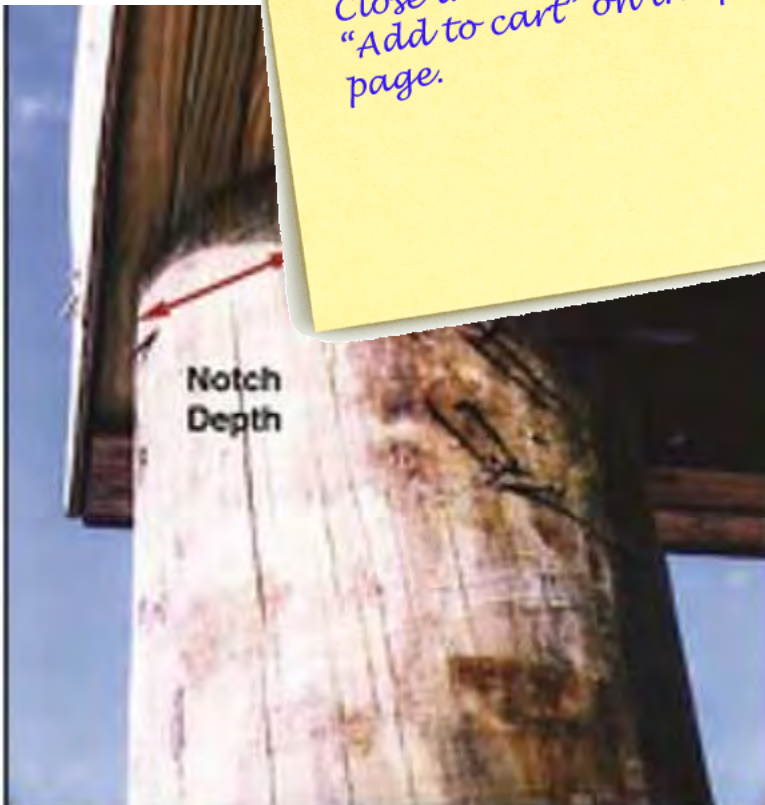
*Figure 2. Typical pile notching process. Photograph by Patty McDaniel.*



*Fig.*

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*Property notched  
that the outer  
member of this three-  
member beam is supported  
by the through-bolt rather  
than the beam seat.*