CHAPTER 45

COASTAL AND FLOOD PLAIN CONSTRUCTION STANDARDS

SECTION 4501
PURPOSE, APPLICATION AND SCOPE

The requirements set forth in this chapter shall apply to all construction located within areas identified by governmental agencies (state and federal) as coastal high hazard areas, ocean hazard areas, the regulatory flood plain areas, and all areas designated as 130 mph (57 m/s) wind zone [see Table No. R301.2(1)].

SECTION 4502
DEFINITIONS

MSL. Mean Sea Level as defined by National Geodetic Vertical Datum.

BASE FLOOD ELEVATION. The peak water elevation in relation to MSL expected to be reached during a flood having a one percent chance of being equaled or exceeded in any given year.

COASTAL HIGH HAZARD AREA. An area, as identified by the North Carolina Coastal Resources Commission, near the shoreline of the Atlantic Ocean which are subject to at least one of the following hazards: (A) Historical or predicted future trends of long term erosion, (B) erosion expected to occur during a coastal storm reaching the base flood elevation, or (C) shoreline fluctuations due to tidal inlets.

FLOOD PLAIN. Land below base flood elevation, which has in the past been flooded by storm water-surface runoffs or tidal influx, as defined by the Corps of Engineers' maps, the Federal Emergency Management Agency maps or as determined by the Building Code Council.

LOWEST FLOOR. The lowest floor of the lowest enclosed area (including basement). An unfinished or flood resistant enclosure, usable solely for parking of vehicles, building access or storage in an area other than a basement area is not considered a building's lowest floor; provided:

1. That the walls are substantially impermeable to the passage of water and the structural components have the capability of resisting hydrostatic and hydrodynamic loads and effects of buoyancy, or
2. Construction shall be designed to automatically equalize hydrostatic flood forces on exterior walls by allowing the entry and exit of flood waters.

SECTION 4503
PILING STANDARDS

4503.1 All one- and two- family dwellings in areas identified as coastal high hazard areas or ocean hazard areas shall be constructed on a pile foundation of wood or concrete.

4503.2 Concrete piles. Concrete piles may be used if made and installed in accordance with North Carolina State Building Code, General Construction, Chapter 18.

4503.3 Size of wood piles. Round timber piles shall not be less than 8 inches (203 mm)in diameter at building level and have a minimum tip diameter of 6 inches (152 mm). Square timber piles shall not be less than 8 inches square, (0.74 m^2) nominal. Piles supporting uncovered stairs, uncovered stairs, uncovered walkways and uncovered decks shall be 6-inch by 6-inch (152 mm by 152 mm) minimum, or if round, have a minimum tip diameter of 6 inches (152 mm). Piles supporting uncovered stairs, uncovered walkways and uncovered decks less than 5 feet (1524 mm) above grade may be 4-inch by 4-inch (102 mm by 102 mm) minimum.

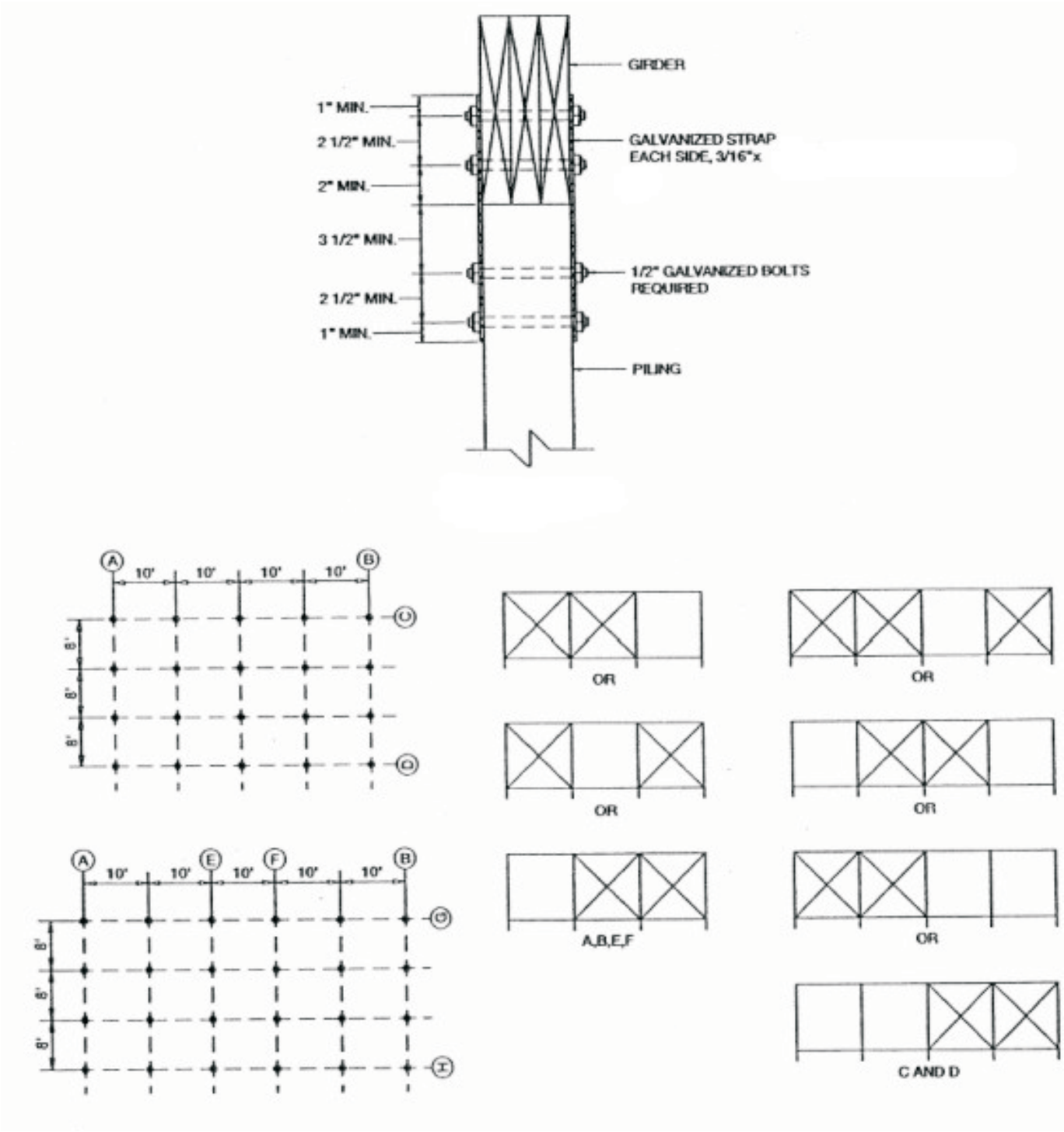
4503.4 Required depth of piles. Pile tip shall extend to a depth of not less than 8 feet below the natural grade or finished grade of the lot whichever is lower. All pilings within the Ocean Hazard Area shall have a tip penetration of at least 5.0 feet below mean sea level or 16 feet (406 mm) below average original grade whichever is least. Structures within Ocean Hazard Areas which are placed upon the site behind a line 60 times the annual erosion rate, as determined by the Division of Coastal Management, away from the most seaward line of stable natural vegetation area are exempt from this additional tip penetration requirement.

4503.5 Spacing of wood piles. The maximum center-to-center spacing of wood piles shall not be more than 8 feet on center under load bearing sills, beams, or girders. However, for dwellings having more than two stories above piles or where the piling spacing exceeds 8 feet (2438 mm) o.c., the pile foundation shall be designed by a registered design professional. Pile spacing in the nonload bearing direction may be 12 feet (3658 mm).

4503.6 Tieing and bracing and wood piles. If sills, beams, or girders are attached to the piling, a minimum of two $^5/_8$-inch galvanized steel bolts per beam member shall be through bolted at each piling connection. Piling shall not be notched so that the cross-section is reduced below 50 percent. Sills, beams, or girders may be attached using $^3/_{16}$-inch by 4-inch by 18 inch hot dip galvanized straps, each side, bolted with two $^1/_2$-inch galvanized through bolts (see Figure 4503.6). Bracing of pile foundations is required where the clear height from ground to sill, beam, or girder exceeds 10 feet or the dwelling is more than one story above piles. A line of X-bracing is defined as a row of piles with X-bracing provided in at least 2 bays. A line of X-bracing shall be provided at all exterior pile lines. Where the perimeter lines of X-bracing exceed 40 feet, an additional line of X-bracing shall be provided near the center of the building (see Figure 4503.6). X-bracing shall be with 2 × 10's through bolted with two $^3/_4$-inch bolts at each end. The building inspector may accept bracing designs if they bear the seal of a registered design professional.

4503.7 The minimum net retention of preservatives shall be in accordance with Section R319.

4503.8 Piling may be placed by auger, jetting, or drop hammer. Piling shall receive a final set by drop hammer or other ap-



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

FIGURE 4503.6
ELEVATIONS
(SHOWING POSSIBLE ARRANGEMENT OF X BRACING IN LINE) (G AND H SIMILAR)

proved methods, determined by the Building Inspector to insure compaction of material at end bearing.

SECTION 4504
ELEVATION STANDARDS

4504.1 The lowest structural member excluding pilings and bracing supporting the lowest habitable floor in the coastal high hazard area and ocean hazard area, shall be elevated above the base flood elevation.

4504.2 The elevation of the first habitable floor of all structures in the Regulatory Flood Plain except in the coastal high hazard areas shall be above the base flood elevation.

Exception: This requirement does not apply to the addition, renovation or reconstruction to any building which was constructed prior to the Federal Emergency Management Agency (FEMA), initial Flood Insurance Study for that area if the addition, renovation or reconstruction does not exceed 50 percent of the present market value of the structure.

4504.3 Where walls are constructed below flood elevation in a Coastal high Hazard Area and Ocean Hazard Area, they shall be constructed in a manner to eliminate wave forces on the piling.

SECTION 4505
CONSTRUCTION MATERIALS AND METHODS STANDARDS

4505.1 The requirements of Sections 4505.2 through 4505.9 are applicable in the Coastal High Hazard Area, the Ocean Hazard Area, and all areas designated as 130 mph (57 m/s) wind zone.

4505.2 Every rafter or roof truss shall be anchored to the bearing wall as required by Section 4408. At the ridges, rafters shall have a minimum 1 × 6 or 2 × 4 collar or wind beam. Every third rafter not to exceed 4 feet (1219 mm) o.c. shall be anchored vertically with a minimum 1 × 6 or 2 × 4 from its midpoint to ceiling joists below.

4505.3 Wood frame wall construction. Maximum stud spacing shall be 16 inches o.c. for 2 × 4s and 24 inches for 2 × 6s. See Section 4405 for wall construction requirements (see Section 4408 for uplift anchorage requirements). Wood structural panel sheathing including endwall sheathing shall extend 12 inches (305 mm) beyond construction joints and shall overlap girders their full depth. Panels may be installed with face grain either parallel or perpendicular to stud.

4505.4 Equal or better methods of tieing structures together and to foundations designed for a specific building by a Professional Engineer or Architect shall be accepted by the Building Inspector.

4505.5 In the Coastal Hazard Area and the Ocean Hazard Area, all metal connectors and fasteners outside of conditioned spaces shall not be hot dip galvanized steel after fabrication and shall meet ASTM A 153. Exposed metal connectors, such as tie-down straps on porches, decks, and areas under the structure shall be a minimum of $^{3}/_{16}$ inch thick, and shall be hot dip galvanized after fabrication and meet ASTM A 123 or ASTM A 153. Stainless steel light-gage metal connectors shall be permitted in exposed or partially exposed locations. Metal connectors of approved equivalent corrosion resistant material shall be accepted (see Table 4505.5).

4505.6 Building anchorage.

1. For masonry buildings, the roof structure, including rafters and joists shall be securely anchored to the wall per Section R606.8.2.1. All mortar used for masonry walls shall be Type M or S.
2. For masonry or wood frame buildings, all sills, beams or girders which resist uplift (including interior sills, beams, girders, and joists where the perimeter is unenclosed) shall be securely anchored to the footing per Section 4404. Footing dowel bars shall have an 8 inch (203 mm) hook.
3. Where wood partitions and masonry walls join, the stud abutting the masonry shall be double and bolted to the masonry with three $^{1}/_{2}$ inch galvanized bolts.

TABLE 4505.5
CORROSION RESISTANCE
(Applies only to Structure Located in Coastal High Hazard Areas and Ocean Hazard Areas)

	Open (exterior, porches, underhouse)	Exposure Level Vented/Enclosed (attic, floor trusses, enclosed crawl spaces and stud cavity)	Conditioned (heated/cooled living areas)
Nails, staples, screws	Hot dip galvanized	Hot dip galvanized	-
Nuts, bolts, washers, tie rods	Hot dip galvanized	Hot dip galvanized	-
Steel connection plates & straps ($^{3}/_{16}$" minimum thickness)	Hot dip galvanized after fabrication	Hot dip galvanized	-
Sheet metal connectors, wind anchors, joists hangers, steel joists and beams	Stainless steel or hot dipped galvanized after fabrication	Hot dip galvanized after plate fabrication	Hot dip galvanized
Truss plates	Stainless steel or hot dipped galvanized after fabrication	Hot dip galvanized after fabrication or stainless steel within 6'-0" of a gable louver or soffit vent. Otherwise in accordance with TPI-95 of the Truss Plate Institute	Standard galvanized

For SI: 1 inch = 25.4 mm.

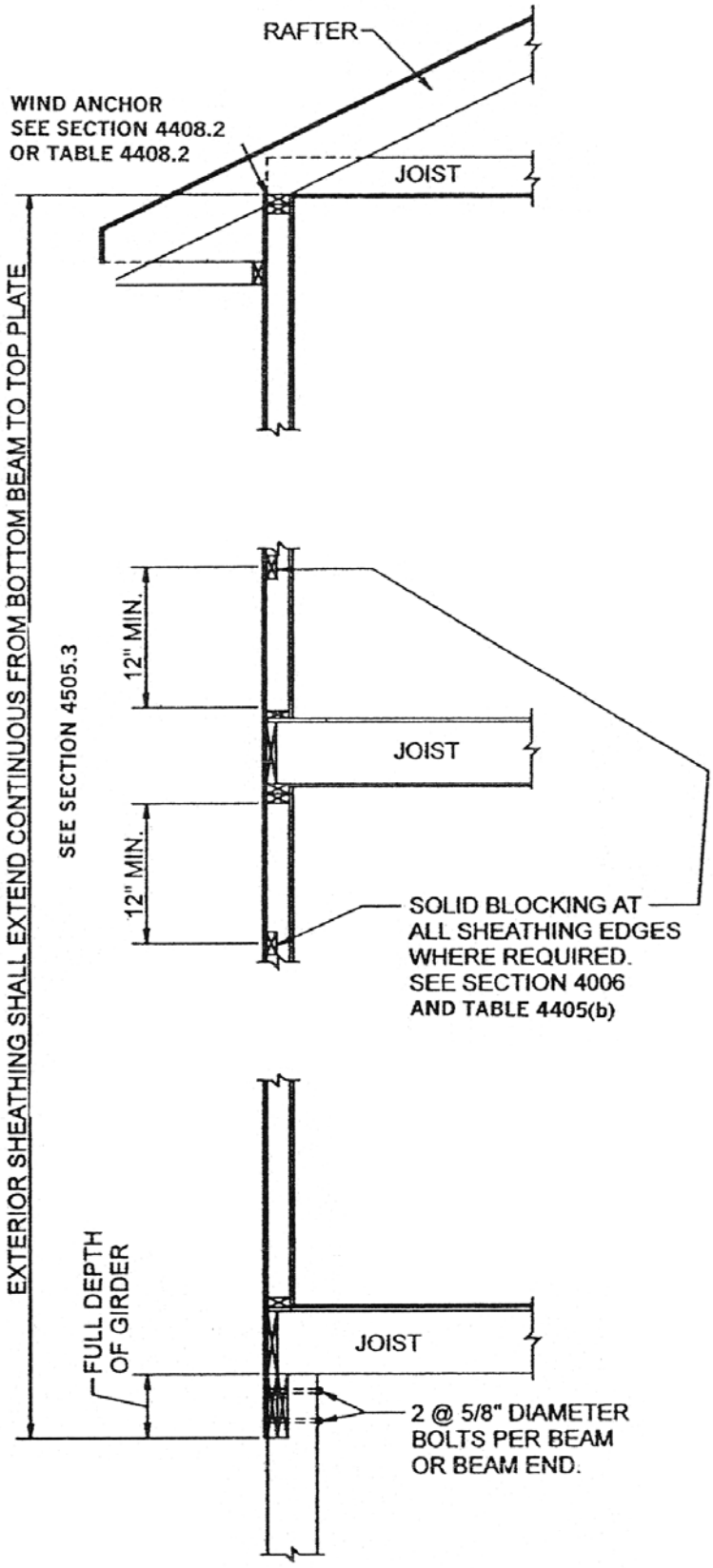
4. Steel and wooden columns and posts, including porch columns shall be anchored with metal ties and bolts to their foundations to and to the members which they support.

4505.7 Roof coverings.

1. Attaching devices shall be hot dip galvanized after fabrication or be of other corrosion resistant material.
2. All butts or tabs on roof shingles shall be securely spotted or tabbed with plastic fibrous, asphaltic cement, or anchored by clips or locks. The use of seal-o-matic roofing may be used as the equivalent of this requirement.
3. Where two or more layers of roll or built-up roofing are applied, the deck shall be thoroughly mopped before the anchor sheet is nailed to the sheathing with sheet metal caps and nails not over 12 inches (305 mm) o.c. in each direction and 6 inches (152 mm) along edges and laps. Each additional sheet above the anchor sheet shall be mopped and finished with corrosion resistant capping around edges of the roof.
4. All roof covering shall be Class A or Class B covering, or Class C asphalt covering.

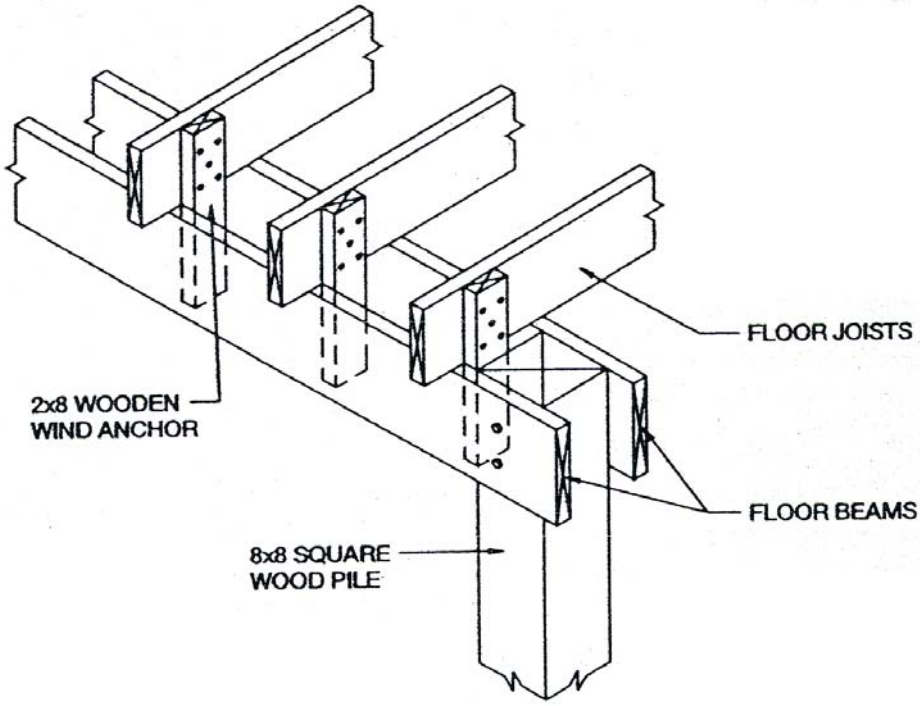
4505.8 Insulation. Insulation installed in floors in buildings elevated on pilings shall be held in place with plywood with exterior glue or other material approved by the building inspector.

4505.9 Accessory structures. Detached accessory structures and out buildings shall be bolted to their foundation or otherwise constructed so as to prevent overturning during high winds.

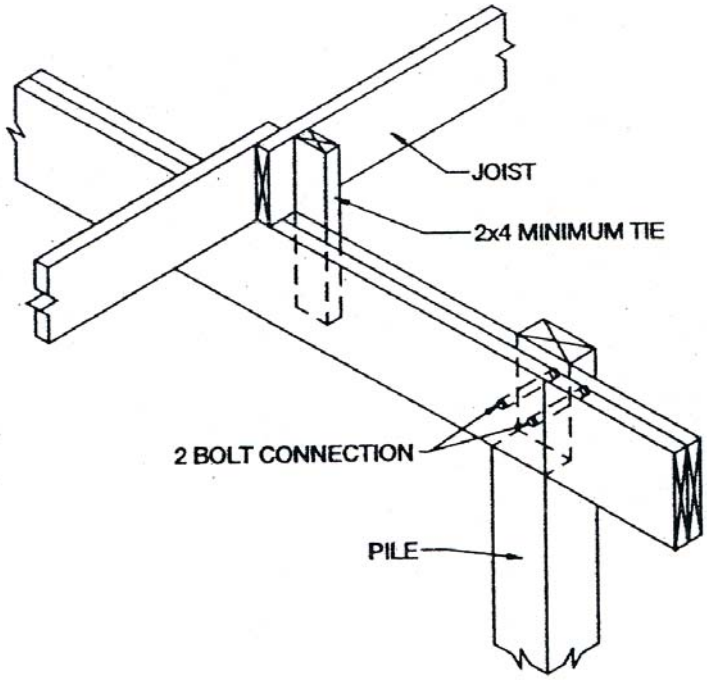


For SI: 1 inch = 25.4 mm.

FIGURE 4505.3(a)
TWO-STORY WALL SECTION (TYPICAL)



SPACED BEAM TIE DETAILS



SOLID BEAM TIE DETAIL

FIGURE 4505.3(b)
TWO-STORY WALL SECTION (TYPICAL)