Proposed 2009 North Carolina Amendments to the 2006 International Residential Code

Chapter 1 – Administration

101.1 Title. These provisions shall be known as the North Carolina *Residential Code for One- and Two-Family Dwellings* and shall be cited as such and will be referred to herein as is this code. These regulations were adopted by the North Carolina Building Code Council on March 11, 2008, to be effective January 1, 2009. References to the International Codes shall mean the North Carolina Codes.

101.2 Scope. The provisions of the *International Residential Code for One- and Two-Family Dwellings* shall apply to the construction, alteration, movement, enlargement, replacement, repair, equipment, use and occupancy, location, removal and demolition of detached one- and two-family dwellings and multiple single-family dwellings (townhouses) not more than three stories above grade in height with a separate means of egress and their accessory buildings and structures. Accessory buildings with any dimension greater than 12 feet must meet the provisions of this code. Accessory buildings may be constructed without a masonry or concrete foundation, except in coastal high hazard or ocean hazard areas, provided all of the following conditions are met:

1. The building shall not exceed 400 sq. ft. or one story in height:
2. The building is supported on a wood foundation of a minimum 2x6 or 3x4 mud sill of approved wood in accordance with Section 319: and
3. The building is anchored to resist overturning and sliding by installing a minimum of one ground anchor at each corner of the building. The total resisting force of the anchors shall be equal to 20 psf times the plan area of the building.

Accessory structures are not required to meet the provisions of this code, except decks, gazebos, and retaining walls as required by Section R404.1.3. For swimming pools and spas, see Appendix G.

Exception: Deleted.

R102
APPLICABILITY

R102.5 Appendices. Provisions in the appendices shall not apply unless specifically referenced in the Code text.

[EB] R102.7 Existing structures. For requirements of existing structures, refer to the North Carolina Administrative Code and Policies.

[EB] R102.7.1 Additions, alterations or repairs. The requirements for additions, alterations or repairs may be found in the North Carolina Administrative Code and Policies.

R103
DEPARTMENT OF BUILDING SAFETY

Deleted. Information concerning the creation and operation of inspections departments may be found in the North Carolina Administrative Code and Policies.

R104
DUTIES AND POWERS OF THE BUILDING OFFICIAL

Deleted. Information concerning the duties and powers of the building official may be found in the North Carolina Administrative Code and Policies.

R105
PERMITS

Deleted. Information concerning permits may be found in the North Carolina Administrative Code and Policies.

R106
CONSTRUCTION DOCUMENTS

Deleted. Information concerning construction documents may be found in the North Carolina Administrative Code and Policies.

R107
TEMPORARY STRUCTURES AND USES

Deleted.

R108
FEES

Deleted.

R109
INSPECTIONS

Deleted.

R110
CERTIFICATE OF OCCUPANCY

Deleted.

R111
SERVICE UTILITIES

Deleted.

R112
BOARD OF APPEALS

Deleted.

R113
VIOLATIONS

Deleted.

R114
STOP WORK ORDER

Deleted.

Chapter 2 – Definitions

Section R202 Definitions

ACCEPTED ENGINEERING PRACTICE. Design, analysis and testing methods that are used in developing design solutions for compliance with the requirements of this code. Accepted engineering practice is the level at which the average, prudent designer in a given community would practice.

ACCESSORY BUILDINGS. In one and two family dwellings not more than three stories high with separate means of egress, a building, the use of which is incidental to that of the main building and which is detached and located on the same lot.

ACCESSORY STRUCTURE. Accessory structure is any structure not roofed over and enclosed that is not considered an accessory building located on one and two family dwelling sites which is incidental to that of the main building. Examples of accessory structures are; fencing, decks, gazebos, arbors, retaining walls, barbecue pits, detached chimneys, tree houses, playground equipment, yard art, etc. Accessory structures are not required to meet the provisions of this code, except decks, gazebos, and retaining walls as required by Section R404.1.3.

AIR ADMITTANCE VALVE. Deleted.

AIR BREAK (DRAINAGE SYSTEM). Deleted.

AIR CIRCULATION, FORCED. Deleted.

AIR-CONDITIONING SYSTEM. Deleted.

AIR GAP, DRAINAGE SYSTEM. Deleted.

AIR GAP, WATER-DISTRIBUTION SYSTEM. Deleted.

ANTISIPHON. Deleted.

BACKFLOW, DRAINAGE. Deleted.

BACKFLOW PREVENTER. Deleted.

BACKFLOW PREVENTER, REDUCED-PRESSURE ZONE TYPE. Deleted.

BACKFLOW, WATER DISTRIBUTION. Deleted.

BACKPRESSURE. Deleted.

BACKPRESSURE, LOW HEAD. Deleted.

BACKSIPHONAGE. Deleted.

BACKWATER VALVE. Deleted.

BALL COCK. Deleted.

BEDROOM. Sleeping room.

BEND. Deleted.

BOILER. Deleted.

BRANCH. Deleted.

BRANCH, FIXTURE. Deleted.

BRANCH, HORIZONTAL. Deleted.

BRANCH, INTERVAL. Deleted.

BRANCH, MAIN. Deleted.

BRANCH, VENT. Deleted.

BUILDING DRAIN. Deleted.

BUILDING SEWER. Deleted.

CIRCUIT VENT. Deleted.

[B] CLEANOUT. Deleted.

CLOSED CRAWL SPACE. a foundation without wall vents that uses air sealed walls, ground and foundation moisture control, and mechanical drying potential to control crawl space moisture. Insulation may be located at the floor level or at the exterior walls.

COMBINATION WASTE AND VENT SYSTEM. Deleted.

COMBUSTION AIR. Deleted.

COMMON VENT. Deleted.

CONDENSATE. Deleted.

CONDENSING APPLIANCE. Deleted.

CONDITIONED CRAWL SPACE. A conditioned crawl space is a foundation without wall vents that encloses an intentionally heated or cooled space. Insulation is located at the exterior walls.

CONFINED SPACE. Deleted.

CONTINUOUS WASTE. Deleted.

CONTAMINATION. Deleted.

CONTROL, LIMIT. Deleted.

CONTROL, PRIMARY SAFETY. Deleted.

CONVECTOR. Deleted.

CROSS CONNECTION. Deleted.

DAMPER, VOLUME. Deleted.

DAMPPROOFING. A coating or the application of coatings applied to retard the penetration of water vapor and moisture through or into walls or into interior spaces.

DEAD END. Deleted.

DEVELOPED LENGTH. Deleted.

DILUTION AIR. Deleted.

DIRECT-VENT APPLIANCE. Deleted.

DRAFT. Deleted.

DRAFT HOOD. Deleted.

DRAFT REGULATOR. Deleted.

DRAIN. Deleted.

DRAINAGE FITTING. Deleted.

DUCT SYSTEM. Deleted.

DURHAM FITTING. Deleted.

DURHAM SYSTEM. Deleted.

DWV. Deleted.

EFFECTIVE OPENING. Deleted.

ELBOW. Deleted.

EQUIVALENT LENGTH. Deleted.

ESSENTIALLY NONTOXIC TRANSFER FLUIDS. Deleted.

ESSENTIALLY TOXIC TRANSFER FLUIDS. Deleted.

EVAPORATIVE COOLER. Deleted.

EXCESS AIR. Deleted.

EXHAUST HOOD, FULL OPENING. Deleted.

EXISTING INSTALLATIONS. Deleted.

FAMILY. Family is an individual; two or more persons related by blood, marriage or law; or a group of not more than any five persons living together in a dwelling unit. Servants having common housekeeping facilities with a family consisting of an individual or more persons related by blood, marriage or law, are a part of the family for this code.

[B] FIREPLACE. An assembly consisting of a hearth and fire chamber and smoke chamber, beginning at the hearth and ending at the top of the smoke chamber, of noncombustible material and provided with a chimney, for use with solid fuels.

Factory-built fireplace. A listed and labeled fireplace and chimney system composed of factory-made components, and assembled in the field in accordance with manufacturer's instructions and the conditions of the listing.

Masonry chimney. A field-constructed chimney composed of solid masonry units, bricks, stones or concrete, beginning at the top of the smoke chamber and the flue termination.

Masonry fireplace. A field-constructed fireplace composed of solid masonry units, bricks, stones or concrete, beginning at the hearth and ending at the top of the smoke chamber.

Smoke chamber. That part of a masonry fireplace which extends from the top of the firebox to the start of the chimney flue lining. A smoke chamber shall have a damper and a smoke shelf.

FIXTURE. Deleted.

FIXTURE BRANCH, DRAINAGE. Deleted.

FIXTURE BRANCH, WATER-SUPPLY. Deleted.

FIXTURE DRAIN. Deleted.

FIXTURE FITTING Deleted.

FIXTURE GROUP, MAIN. Deleted.

FIXTURE SUPPLY. Deleted.

FIXTURE UNIT, DRAINAGE (d.f.u.). Deleted.

FIXTURE UNIT, WATER-SUPPLY (w.s.f.u.). Deleted.

FLOOD-LEVEL RIM. Deleted.

FLOOR DRAIN. Deleted.

FLOOR FURNACE. Deleted.

FLOW PRESSURE. Deleted.

FLUE GASES. Deleted.

FLUSH VALVE. Deleted.

FLUSHOMETER TANK. Deleted.

FLUSHOMETER VALVE. Deleted.

FUEL-PIPING SYSTEM. Deleted.

FULLWAY VALVE. Deleted.

FURNACE. Deleted.

GRADE, PIPING. Deleted.

GROUND-SOURCE HEAT PUMP LOOP SYSTEM. Deleted.

GRIDDED WATER DISTRIBUTION SYSTEM. Deleted.

HAZARDOUS LOCATION. Deleted.

HAZARDOUS LOCATION, GLAZING. See Section R308.4.

HORIZONTAL BRANCH, DRAINAGE. Deleted.

HORIZONTAL PIPE. Deleted.

HYDROGEN GENERATING APPLIANCE. Deleted

INDIRECT WASTE PIPE. Deleted.

INDIVIDUAL SEWAGE DISPOSAL SYSTEM. Deleted.

INDIVIDUAL VENT. Deleted.

MACERATING TOILET SYSTEMS. Deleted.

MANIFOLD WATER DISTRIBUTION SYSTEMS. Deleted.

MASONRY CHIMNEY. Deleted.

[B] MASONRY UNIT. Brick, tile, stone, glass block or concrete block conforming to the requirements specified in Section 2103 of the North Carolina *Building Code.*

Clay. A building unit larger in size than a brick, composed of burned clay, shale, fire clay or mixtures thereof.

Concrete. A building unit or block larger in size than 12 inches by 4 inches by 4 inches (305 mm by 102 mm by 102 mm) made of cement and suitable aggregates.

Glass. Nonload-bearing masonry composed of glass units bonded by mortar.

Hollow. A masonry unit whose net cross-sectional area in any plane parallel to the loadbearing surface is less than 75 percent of its gross cross-sectional area measured in the same plane.

Solid. A masonry unit whose net cross-sectional area in every plane parallel to the loadbearing surface is 75 percent or more of its cross-sectional area measured in the same plane.

OFFSET. Deleted.

PELLET FUEL-BURNING APPLIANCE. Deleted.

PELLET VENT. Deleted.

PLANS. Construction documents.

PLUMBING. See the North Carolina Plumbing Code for definition.

PLUMBING APPLIANCE. Deleted.

PLUMBING APPURTENANCE. Deleted.

PLUMBING FIXTURE. Deleted.

PLUMBING SYSTEM. Deleted.

POLLUTION. Deleted.

PORTABLE FUEL CELL APPLIANCE. Deleted

[B] POSITIVE ROOF DRAINAGE. Deleted.

PRESSURE-RELIEF VALVE. Deleted.

PURGE. Deleted.

QUICK-CLOSING VALVE. Deleted.

RECEPTOR. Deleted.

REFRIGERANT. Deleted.

REFRIGERANT COMPRESSOR. Deleted.

REFRIGERATING SYSTEM. Deleted.

[B] REGISTERED DESIGN PROFESSIONAL. An individual who is registered or licensed to practice his respective design profession as defined by the statutory requirements of the professional registration laws of the state or jurisdiction in which the project is to be constructed. Design by a Registered Design Professional is not required where exempt under the registration or licensure laws.

RELIEF VALVE, VACUUM. Deleted.

RETURN AIR. Deleted.

RISER. Deleted.

ROOM HEATER. Deleted.

ROUGH-IN. Deleted.

SEPTIC TANK. Deleted.

SEWAGE. Deleted..

SEWAGE PUMP. Deleted.

SIDE VENT. Deleted.

SLEEPING ROOM. A room designated as sleeping or bedroom on the plans.

SLIP JOINT. Deleted.

SLOPE. The fall (pitch) of a line in reference to a horizontal plane. In drainage, the slope is expressed as the fall in units vertical per units horizontal (percent).

SOIL STACK OR PIPE. Deleted.

STACK. Deleted.

STACK VENT. Deleted.

STACK VENTING. Deleted.

STATIONARY FUEL CELL POWER PLANT. Deleted.

STORM SEWER, DRAIN. Deleted

[B] STORY. That portion of a building included between the upper surface of a floor and the upper surface of the floor or roof next above. A flood resistant enclosure, designed to break away so as not to cause collapse, shall not be considered as a story when determining height.

STORY, ATTIC. Any story situated wholly or partly in the roof, so designated, arranged or built as to be used for storage or habitation. If an attic which is accessible by a fixed stairway has a 7 ft. clear height for greater than 50% of the floor area of the story below, then the space shall be considered as a story.

STRUCTURE. Deleted.

SUMP PUMP. Deleted.

SUPPLY AIR. Deleted.

SWEEP. Deleted.

TEMPERATURE- AND PRESSURE-RELIEF (T AND P) VALVE. Deleted.

TEMPERATURE-RELIEF VALVE. Deleted.

TOWNHOUSE. A single-family dwelling unit constructed in a row of attached units separated by property lines and with open space on at least two sides.

TRAP. Deleted.

TRAP ARM. Deleted.

TRAP PRIMER. Deleted.

TRAP SEAL Deleted.

UNUSUALLY TIGHT CONSTRUCTION. Construction in which all three conditions are met:

1. Walls comprising the building thermal envelope have a continuous water vapor retarder with a rating of 1 perm [57.4 ng/(s · m^2 · Pa)] or less with openings therein gasketed or sealed.
2. Doors and openable windows meet the air leakage requirements of IECC Section 502.1.4.1; and
3. Caulking or sealants are applied to areas such as joints around window and door frames between sole plates and floors, between wall-ceiling joints, between wall panels, at penetrations for plumbing, electrical and gas lines, and at other openings.

VACUUM BREAKERS. Deleted.

VENT COLLAR. Deleted.

VENT CONNECTOR. Deleted.

VENT DAMPER DEVICE, AUTOMATIC. Deleted.

VENT GASES. Deleted.

VENT STACK. Deleted.

VENT SYSTEM. Deleted.

VENTING. Deleted.

VENTING SYSTEM. Deleted.

VERTICAL PIPE. Deleted.

WALL VENTED CRAWL SPACE. A foundation that uses foundation wall vents as a primary means to control space moisture. Insulation is located at the floor level.

WASTE. Deleted.

WASTE PIPE OR STACK. Deleted.

WATER-DISTRIBUTION SYSTEM. Deleted.

WATER OUTLET. Deleted.

WATERPROOFING. A coating or the application of coatings applied to prevent the penetration of water through or into walls or into interior spaces.

WATER-SERVICE PIPE. Deleted.

WET VENT. Deleted.

WINDOW. See “Fenestration.”

WIND BORNE DEBRIS REGION. Areas within hurricane prone regions defined as that area east of the inland waterway from the NC/SC state line north to Beaufort Inlet and from that point to include the barrier islands to the NC/VA state line.

Chapter 3 – Building Planning

R301 – Design Criteria

R301.2.1 Wind limitations. Buildings and portions thereof shall be limited by wind speed, as defined in Table R301.2(1) and construction methods in accordance with this code. Basic wind speeds shall be determined from Figure R301.2(4). Where different construction methods and structural materials are used for various portions of a building, the applicable requirements of this section for each portion shall apply. Where loads for curtain walls, exterior windows, skylights, garage doors and exterior doors are not otherwise specified, the loads listed in Table R301.2(2) adjusted for height and exposure using Table R301.2(3) shall be used to determine design load performance requirements for curtain walls, exterior windows, skylights, garage doors and exterior doors.

R301.2.1.1 Design criteria. Construction in regions where the basic wind speeds from Figure R301.2(4) equal or exceed 110 miles per hour (49 m/s) shall be designed in accordance with one of the following:

1. American Forest and Paper Association (AF&PA) *Wood Frame Construction Manual for One- and Two-Family Dwellings (WFCM)*; or
2. Southern Building Code Congress International Standard for Hurricane Resistant Residential Construction (SSTD 10); or
3. Minimum Design Loads for Buildings and Other Structures (ASCE-7); or
4. American Iron and Steel Institute (AISI), Standard for Cold-Formed Steel Framing—Prescriptive Method for One- and Two-family Dwellings *(COFS/PM) with Supplement to Standard for Cold-Formed Steel Framing—Prescriptive Method For One- and Two-Family Dwellings.*
5. Concrete construction shall be designed in accordance with the provisions of this code.
6. *High wind chapters 44 and 45*

Table R301.2(1)

Climatic and Geographic Design Criteria

Roof Load	Wind Speed (mph)	Seismic Design Category	Subject to Damage From				Winter Design Temp	Ice Barrier Under-Layment Required	Flood Hazard[b]	Air Freezing Index	Mean Annual Temp
			Weathering[a]	Frost Line Depth	Termite[c]	~~Decay~~					
20	Figure 301.2(4)	301.2(2)	Moderate	12"	Moderate - Heavy	~~Moderate~~	Local	Local	Local	Local	Local

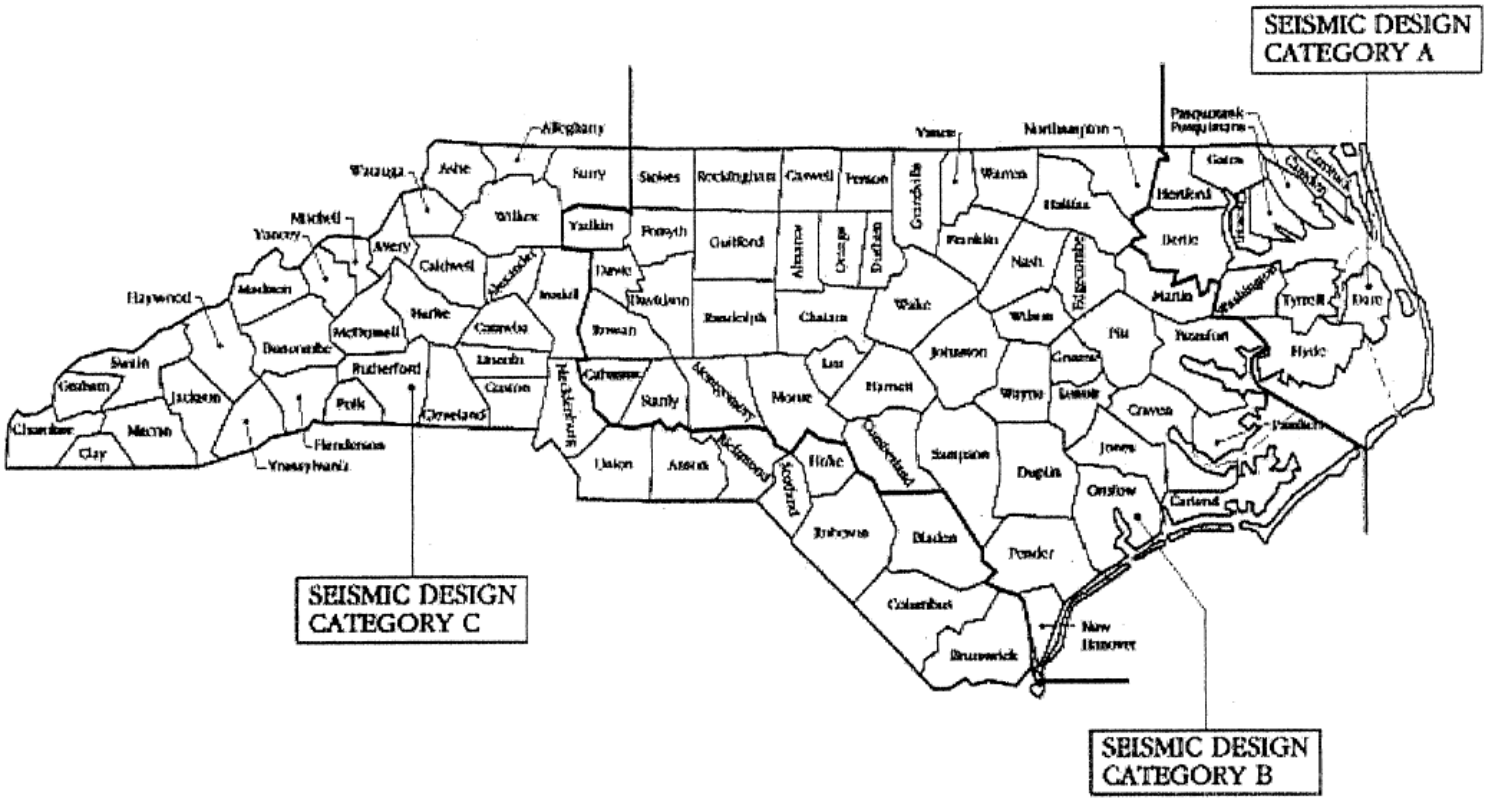
For SI: 1 pound per square foot = 0.0479 kN/m.^{2}, 1 mile per hour = 1.609 km/h.

a. Weathering may require a higher strength concrete or grade of masonry than necessary to satisfy the structural requirements of this code. The grade of masonry units shall be determined from ASTM C 34, C 55, C 62, C 73, C 90, C 129, C 145, C 216 or C 652.

b. The Jurisdiction shall fill in this part of the table with (a) the date of the jurisdiction's entry into the National Flood Insurance Program (date of adoptions of the first code or ordinance for management of flood hazard areas), (b) the date(s) of the currently effective FIRM and FBFM, or other flood hazard map adopted by the community, as may be amended.

c. Protection is required in all of NC per section R320.

Delete Figure R301.2 (2) on pages 27, 28, 29, 30, 31 and add NC Figure R301.2 (2) – remove word "continued" from NC Figure.



For SI: 1 foot = 304.8 mm.

a. Seismic data is based upon FIGURE R301.2(2) - continued in the International Residential Code, as adjusted for North Carolina.
b. The seismic provisions of this code shall apply to buildings constructed in Seismic Design Categories C in accordance with Section R301.2.2.

Exception: Detached one- and two-family dwellings located in Seismic Design Category C are exempt from the seismic requirements of this code.

FIGURE R301.2(2) - continued
INTERNATIONAL RESIDENTIAL CODE - NORTH CAROLINA AMENDMENTS
SEISMIC DESIGN CATEGORIES - SITE CLASS D

COUNTIES IN SEISMIC DESIGN CATEGORY C

Alleghany
Alexander
Anson
Ashe
Avery
Bladen
Brunswick
Buncombe
Brunswick
Burke
Caldwell
Catawba
Cherokee
Cleveland
Columbus
Gaston
Graham
Haywood
Henderson
Hoke
Iredell
Jackson
Lincoln
Macon
Madison
McDowell
Mecklenburg
Mitchell
Polk
Richmond
Robeson
Rutherford
Scotland
Surry
Swain
Transylvania
Union
Watauga
Wilkes
Yancey

FIGURE R301.2(2)-continued

Table 301.2(4)

Design Pressures For Doors and Windows a,b,c,d

Positive and Negative In PSF

Velocity (mph)	Mean Roof Height (ft)		
	15	**25**	**35**
90	15	17	19
100	20	23	25

a. Alternate design pressures may be determined by using North Carolina State Building Code – General Construction, ASCE-7, or the *International Building Code*.

b. If window or door is more than 4 ft. from a corner, the pressure from this table shall be permitted to be multiplied by 0.87. This adjustment does not apply to garage doors.

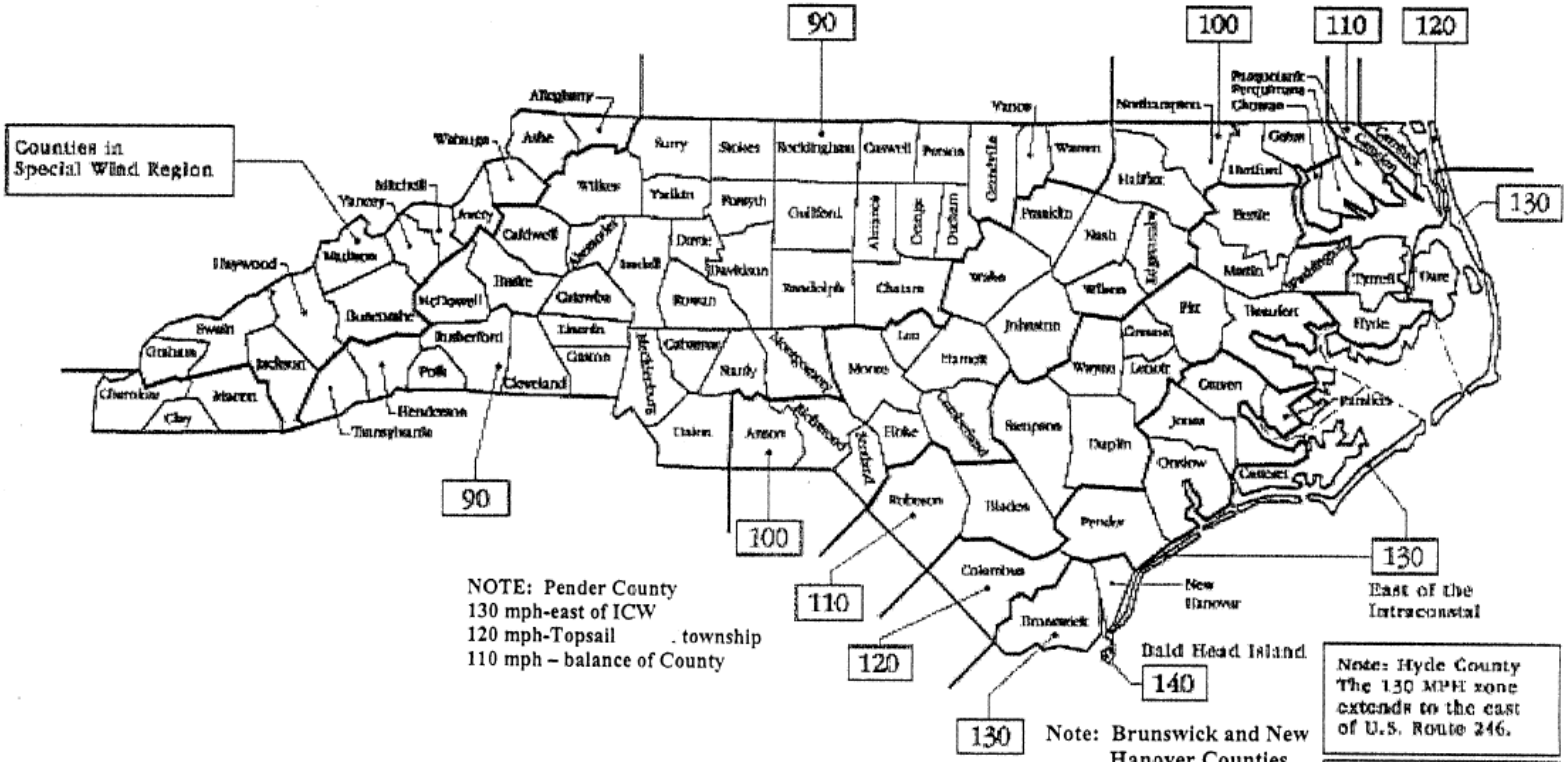
c. For windows and doors in structures with a roof slope of 10 degrees or less (2:12) from the table may be multiplied by 0.90.

d. Design pressure ratings based on standards listed in Section 613 are adequate documentation of capacity to resist pressures from the table.

301.2.4 Floodplain construction. Buildings and structures constructed in flood hazard areas (including A or V Zones) as established in Table R301.2(1) shall be designed and constructed in accordance with Section R324.

Exception: Buildings in floodways that are designated on the Flood Insurance Rate Maps (FIRM) or the Flood Boundary and Floodway Maps (FBFM) that are provided by the National Flood Insurance Program shall not be approved under this section; the provisions of the *International Building Code* shall apply.

Delete Figure R301.2 (4) pages 33,34,35,36,37 and replace with following NC Figure R301.2 (4) –remove word “continued” from NC figure. Change spelling on NC County “Harnet” to “Harnett” on County listing, also remove from footnote #4 the word Island behind Topsail.



For SI: 1 foot = 304.8 mm, 1 mile per hour = 1.609 km/h.

a. Values are nominal design 3-second gust wind speeds in miles per hour at 33 feet above grade for Exposure C category.
b. Wind speed data is based upon FIGURE R301.2(4) - continued in the International Residential Code, as adjusted for North Carolina.
c. Mountain terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.

FIGURE R301.2(4) - continued
INTERNATIONAL RESIDENTIAL CODE - NORTH CAROLINA AMENDMENTS
BASIC WIND SPEEDS FOR 50-YEAR MEAN RECURRENCE INTERVAL

BASIC DESIGN WIND SPEEDS

Counties not listed	90		
Anson	100	Lee	100
Alleghany	special mountain region	Lenior	110
Ashe	special moutain region	Madison	special mountain region
Avery	special mountain region	Martin	110
Beaufort	110	Mitchell	special mountain region
Bertie	110	Moore	100
Bladen	110	Nash	100
Brunswick[1]	120/130	New Hanover[3]	120/130
Buncombe	special mountain region	Northampton	100
Camden	110	Onslow	120/130 east of ICW
Carteret	130	Pamlico[5]	120/130
Chowan	110	Pasquotank	110
Columbus	120	Pender[4]	110/120/130
Craven	120	Perquimans	110
Cumberland	100	Pitt	110
Currituck	120	Richmond	100
Dare	130	Robeson	110
Duplin	110	Sampson	110
Edgecombe	100	Scotland	100
Franklin	100	Swain	special mountain region
Gates	100	Tyrell	120
Graham	special mountain region	Wake	100
Greene	110	Washington	110
Halifax	100	Watauga	special mountain region
Harnet	100	Wayne	110
Haywood	special mountain region	Wilson	100
Hertford	100	Yancey	special mountain region
Hoke	100		
Hyde[2]	120/130		
Jackson	special mountain region		
Johnston	100		
Jones	120		

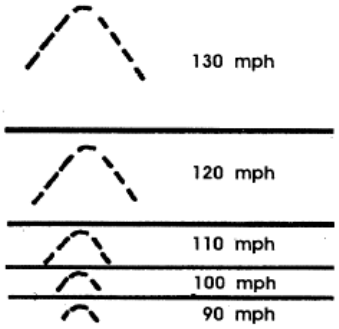
FIGURE R301.2(4)-continued

1. Brunswick County - 120 mph zone west of Hwy 17, 130 mph zone east of Hwy 17, 140 mph on Bald Head Island.
2. Hyde County - 120 mph zone west of US Route 246, 130 mph zone east of US Route 246.
3. New Hanover County - 120 mph zone west of Hwy 17, 130 mph zone east of Hwy 17.
4. Pender County - 130 mph zone east of the Intercoastal Waterway, 120 mph zone in the Township of Topsail Island, and the remainder of the County is the 110 mph zone.
5. Pamilico County - 130 mph zone east of SR 55 and Hwy 304, 120 mph zone west of SR 55 and Hwy 304.

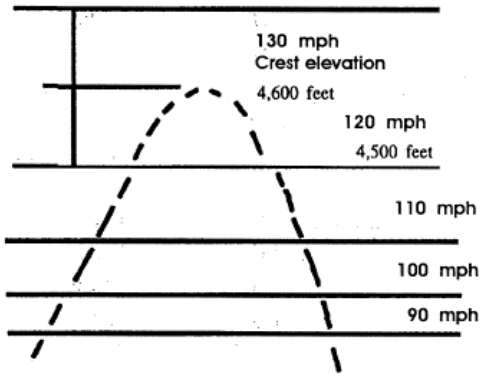
BASIC DESIGN WIND VELOCITIES FOR MOUNTAIN REGIONS

Controlling Elevation in Feet (1), (2), (3), (4), (5)	Design Wind (MPH)
2,700 or lower	90
2,700 to 3,000 feet	100
3,000 to 3,500 feet	110
3,500 to 4,500 feet	120
4,500 and above	130

1. Wind velocities are to apply to all mountain tops, crests, knobs or peaks as named on the USGS Quadrangle maps.
2. Effect of the 130 mph wind is to extend downward from crest for 200 ft. or to the controlling elevation for 120 mph wind, whichever is the lesser.
3. Effect of the 120 mph wind is to extend downward from crest for 100 feet or to the controlling elevation for 110 mph wind, whichever is the lesser.
4. Effect of the 110 mph wind is to extend downward from crest for 70 feet or to the controlling elevation for 100 mph wind, whichever is the lesser.
5. Effect of the 100 mph wind is to extend downward from crest for 50 feet or to the controlling elevation for the 90 mph wind, whichever is the lesser.



Wind Velocity Diagram



Example
Note # 2 Modification
Note 3, 4, and 5 Similar

R301.2(4)-Continued
Figure

Delete Figure R301.2 (5) pages #38, #39

Table 301.7

Allowable Deflection of Structural Members a,b,c,d

STRUCTURAL MEMBER	ALLOWABLE DEFLECTION
Rafters having slopes greater than 3/12 with no finished ceiling attached to rafters	L/180
Interior walls and partitions	H/180
Floors and plastered ceilings	L/360[b,d]
All other structural members	L/240
Exterior walls with plaster or stucco finish	H/360
Exterior walls-wind loads[a] with brittle finishes	L/240
Exterior walls-wind loads[a] with flexible finishes	L/120
Masonry-vertical support	L/600

Note: L = span length, H = span height.

(Keep footnote a,b,c, as is but add footnote d per below)

d. When floor spans exceed 20 feet, joists, built-up beams and trusses shall not be spaced greater than 24 inches and deflection shall not exceed L/480.

SECTION R302
LOCATION ON LOT

R302.1 Exterior walls. Exterior walls with a fire separation distance less than 3 feet (914mm) shall have not less than a one-hour fire-resistive rating with exposure from both sides. Projections shall not extend to a point closer than 2 feet (610 mm) from the line used to determine the fire separation distance.

Exception: Detached garages accessory to a dwelling located within 2 feet (610 mm) of a lot line shall be permitted to have roof eave projections not exceeding 4 inches (102 mm).

Projections extending into the fire separation distance shall have not less than one-hour fire-resistive construction on the underside. The above provisions shall not apply to walls which are perpendicular to the line used to determine the fire separation distance.

Exceptions:

1. Tool and storage sheds, playhouses and similar structures exempted from permits by R105.2 are not required to provide wall protection based on location on the lot. Projections beyond the exterior wall shall not extend over the lot line.
2. In Townhouse construction (with 3 or more attached dwellings) the soffit material beyond the fire separation distance shall be securely attached to framing members and shall be constructed using either non-combustible soffit material; fire retardant treated soffit material; vinyl soffit installed over ¾ inch wood sheathing or 5/8 inch gypsum board; or aluminum soffit installed over ¾ inch wood sheathing or 5/8 inch gypsum board. Venting requirements shall be provided in both soffit and underlayments. Vents shall be either nominal 2-inch continuous or equivalent intermittent and shall not exceed the minimum net free air requirements established in section R806.2 by more than 50 percent. Vents in soffit are not allowed within four feet of fire walls or property lines.

R302.2 Openings. Openings shall not be permitted in the exterior wall of a dwelling or accessory building with a fire separation distance less than 3 feet (914 mm). This distance shall be measured perpendicular to the line used to determine the fire separation distance.

Exceptions:

1. Openings shall be permitted in walls that are perpendicular to the line used to determine the fire separation distance.
2. Foundation vents installed in compliance with this code are permitted.

R302.3 Penetrations. Penetrations located in the exterior wall of a dwelling with a fire separation distance less than 3 feet (914 mm) shall be protected in accordance with Section R317.3.

Exception: Penetrations shall be permitted in walls that are perpendicular to the line used to determine the fire separation distance.

R303 – Light, Ventilation and Heating

303.4.1 Intake openings. Mechanical and gravity outside air intake openings shall be located in accordance with the NC Mechanical Code.

303.4.2 Exhaust openings. Outside exhaust openings shall be located in accordance with the NC Mechanical Code.

305.1 Minimum height. Habitable rooms, hallways, corridors, bathrooms, toilet rooms, and laundry rooms shall have a ceiling height of not less than 7 feet (2134 mm).

The required height shall be measured from the finish floor to the lowest projection from the ceiling.

Exceptions:

1. Beams and girders spaced not less than 4 feet (1219 mm) on center may project not more than 6 inches (152 mm) below the required ceiling height.
2. Ceilings in basements may project to within 6 feet, 8 inches (2032 mm) of the finished floor; and beams, girders, ducts or other obstructions may project to within 6 feet, 4 inches (1931 mm) of the finished floor.
3. For rooms with sloped ceilings, at least 50 percent of the required floor area of the room must have a ceiling height of at least 7 feet (2134 mm) and no portion of the required floor area may have a ceiling height of less than 5 feet (1524 mm).
4. Bathrooms shall have a minimum ceiling height of 6 feet 8 inches (2036 mm) measured at the front of the fixture. A shower or tub equipped with a shower head shall have a minimum ceiling height of 6 feet 8 inches (2036 mm) above a minimum area 30 inches (762 mm) by 30 inches (762 mm) at the shower head.

R308 – Glazing

R308.1 Identification. Except as indicated in Section R308.1.1 each pane of glazing installed in hazardous locations as defined in Section R308.4 shall be provided with a manufacturer's designation specifying who applied the designation, designating the type of glass and the safety glazing standard with which it complies, which is visible in the final installation. The designation shall be acid etched, sandblasted, ceramic-fired, laser etched, embossed, or be of a type which once applied cannot be removed without being destroyed.

Exceptions:

1. For other than tempered glass, manufacturer's designations are not required provided the building official approves the use of a certificate, affidavit or other evidence confirming compliance with this code.
2. Tempered spandrel glass is permitted to be identified by the manufacturer with a removable paper designation.

[B] R308.4 Hazardous locations. The following shall be considered specific hazardous locations for the

purposes of glazing:

1. Glazing in swinging doors except jalousies.
2. Glazing in fixed and sliding panels of sliding door assemblies and panels in sliding and bifold closet door assemblies.
3. Glazing in storm doors.
4. Deleted.
5. Glazing in doors and enclosures for hot tubs, whirlpools, saunas, steam rooms, bathtubs and showers. Glazing enclosing these compartments where the bottom exposed edge of the glazing is less than 60 inches (1524 mm) measured vertically above any standing or walking surface.
6. Glazing, in an individual fixed or operable panel within the same plane as a door where the nearest vertical edge is within 24 inches (610 mm) of the door in a closed position and whose bottom edge is less than 60 inches (1524 mm) above the floor or walking surface.
7. Glazing in an individual fixed or operable panel, other than those locations described in Items 5 and 6 above, that meets all of the following conditions:
   - 7.1. Exposed area of an individual pane greater than 9 square feet (0.836 m^2).
   - 7.2. Bottom edge less than 18 inches (457 mm) above the floor.
   - 7.3. Top edge greater than 36 inches (914 mm) above the floor.
   - 7.4. One or more walking surfaces within 36 inches (914 mm) horizontally of the glazing.
8. All glazing in railings regardless of an area or height above a walking surface. Included are structural baluster panels and nonstructural infill panels.
9. Glazing in walls and fences enclosing indoor and outdoor swimming pools, hot tubs and spas where the bottom edge of the glazing is less than 60 inches (1524 mm) above a walking surface and within 60 inches (1524 mm) horizontally of the water's edge. This shall apply to single glazing and all panes in multiple glazing.
10. Glazing in walls enclosing stairway landings or within 60 inches (1524 mm) of the top and bottom of stairways in the direction of travel within 60 inches (1524 mm) above the walking surface.
11. Deleted.

Exception: The following products, materials and uses are exempt from the above hazardous locations:

1. Openings in doors through which a 3-inch (76 mm) sphere is unable to pass.
2. Decorative glass in Items 1, 6 or 7.
3. Glazing in Section R308.4, Item 6, when there is an intervening wall or other permanent barrier between the door and the glazing.
4. Glazing in Section R308.4, Item 6, where access through the door is to a closet or storage area 3 feet (914 mm) or less in depth.
5. Glazing in Section R308.4, Items 7 and 10, when a protective bar is installed on the accessible side(s) of the glazing 36 inches ± 2 inches (914 mm ± 51 mm) above the floor. The bar shall be capable of withstanding a horizontal load of 50 pounds per linear foot (74.5 kg/m) without contacting the glass and be a minimum of 1 1/2 inches (38 mm) in height.
6. Outboard panes in insulating glass units and other multiple glazed panels in Section R308.4, Item 7, when the bottom edge of the glass is 25 feet (7620 mm) or more above grade, a roof, walking surface, or other horizontal [within 45 degrees (0.79 rad) of horizontal] surface adjacent to the glass exterior.
7. Louvered windows and jalousies complying with the requirements of Section R308.2.
8. Mirrors and other glass panels mounted or hung on a surface that provides a continuous backing support.

9. Deleted.
10. Glass block panels complying with Section R610.

R309 – Garages and Carports

R309.1.2 Other penetrations. Penetrations through the separation required in Section R309.2 shall be protected by filling the opening around the penetrating item with approved material.

309.2 Separation required. The garage shall be separated from the residence and its attic area by not less than 1/2-inch (12.7 mm) gypsum board applied to the garage side.

R310 – Emergency Escape and Rescue Openings

R310.1 Emergency escape and rescue required. Basements with habitable space and every sleeping room shall have at least one operable emergency and rescue opening. Such opening shall open directly into a public street, public alley, yard or court. Where basements contain one or more sleeping rooms, emergency egress and rescue openings shall be required in each sleeping room, but shall not be required in adjoining areas of the basement. Where emergency escape and rescue openings are provided they shall have a sill height of not more than 44 inches (1118 mm) above the floor. Where a door opening having a threshold below the adjacent ground elevation serves as an emergency escape and rescue opening and is provided with a bulkhead enclosure, the bulkhead enclosure shall comply with Section R310.3. The net clear opening dimensions required by this section shall be obtained by the normal operation of the emergency escape and rescue opening from the inside. Emergency escape and rescue openings with a finished sill height below the adjacent ground elevation shall be provided with a window well in accordance with Section R310.2. Emergency escape and rescue openings shall open directly into a public way, or to a yard or court that opens to a public way.
Exception: Deleted.

310.1.1 Minimum opening area. All emergency escape and rescue openings shall have a minimum net clear openable area of 4.0 square feet (0.372 m^2). The minimum net clear opening height shall be 22 inches (558 mm). The minimum net clear opening width shall be 20 inches (508 mm). Emergency escape & rescue openings must have a minimum total glazing area of not less than 5.0 sq. ft. (0.465 m^2) in the case of a ground window and not less than 5.7 sq. ft. (0.530 m^2) in the case of an upper story window.

Exception: Deleted.

310.1.2 Minimum opening height. Deleted.

310.1.3 Minimum opening width. Deleted.

(*no change to 310.1.4*)

R310.4 Bars, grilles, covers and screens. Bars, grilles, covers, screens or similar devices are permitted to be placed over emergency escape and rescue openings, bulkhead enclosures, or window wells that serve such openings, provided the minimum net clear opening size complies with Section R310.1.1 and such devices shall be releasable or removable from the inside without the use of a key, tool, special knowledge or force greater than that which is required for normal operation of the escape and rescue opening.

R311 – Means of Egress

311.1 General. Stairways, ramps, exterior exit balconies, hallways and doors shall comply with this section.

Exception: Equipment service platforms may be served by ladders constructed per R310.2.1.

311.2 Construction.

311.2.1 Attachment. Deleted

311.2.2 Under stair protection. Enclosed accessible space under stairs shall have walls, under stair surface and any soffits protected on the enclosed side with $^1/_2$-inch (13 mm) gypsum board.

311.3 Hallways and interior doors.

R311.3.1 Hallways. The minimum width of a hallway shall be not less than 3 feet (914 mm) measured from the finish surface of the walls.

R311.3.2 Interior doors. All doors providing egress from habitable rooms shall have nominal minimum dimensions of 2 feet 6 inches (762 mm) width by 6 feet 8 inches (2032 mm) height.

R311.4.3 Landings at doors. There shall be a floor or landing on each side of each exterior door. The floor or landing at the exterior door shall not be more than 1.5 inches (38 mm) lower than the top of the threshold. The landing shall be permitted to have a slope not to exceed 0.25 unit vertical in 12 units horizontal (2-percent).

Exceptions:

1. Where a stairway is located at other than the required exit door, a landing is not required for the exterior side of the door provided the door, other than an exterior storm or screen door does not swing over the stairway.

2. The exterior landing at an exterior doorway shall not be more than 8 ¼" inches (210 mm) below the top of the threshold, provided the door, other than an exterior storm or screen door does not swing over the landing.

3. The height of floors at exterior doors other than the exit door required by Section R311.4.1 shall not be more than 8 ¼" inches (210 mm) lower than the top of the threshold.

The width of each landing shall not be less than the door served. Every landing shall have a minimum dimension of 36 inches (914 mm) measured in the direction of travel.

311.4.4 Type of lock or latch. All interior and exterior egress doors shall be openable from the side from which egress is to be made without the use of a key or special knowledge or effort.

311.5.3.1 Riser height. The maximum riser height shall be 8-1/4 inches (210 mm). The riser shall be measured vertically between leading edges of the adjacent treads. The greatest riser height within any flight of stairs shall not exceed the smallest by more than 3/8 inch (9.5 mm). The top and bottom riser of interior stairs shall not exceed the smallest riser within that stair run by more than ¾ inch (19 mm). The height of the top and bottom riser of the interior stairs shall be measured from the permanent finished surface (carpet excluded). Where the bottom riser of an exterior stair adjoins an exterior walk, porch, driveway, patio, garage floor, or finish grade, the height of the riser may be less than the height of the adjacent risers.

311.5.3.2 Tread depth. The minimum tread depth shall be 9 inches (229 mm). The tread depth shall be measured horizontally between the vertical planes of the foremost projection of adjacent treads and at a right angle to the tread's leading edge. The greatest tread depth within any flight of stairs shall not exceed the smallest by more than 3/8 inch (9.5 mm). Winder treads shall have a minimum tread depth of 9 inches (229 mm) measured as above at a point 12 inches (305) mm from the side where the treads are narrower. Winder treads shall have a minimum tread depth of 4 inches (102 mm) at any point. Within any flight of stairs, the greatest winder tread depth at the 12 inch (305 mm) walk line shall not exceed the smallest by more than 3/8 inch (9.5 mm).

311.5.5 Stairway walking surface.

The walking surface of treads and landings of stairways shall be sloped no steeper than one inch vertical in 48 inches horizontal (2-percent slope).

311.5.6 Handrails.
Handrails shall be provided on at least one side of each continuous run of treads or flight with four or more risers.

311.5.6.1 Height.
Handrail height, measured vertically from the sloped plane adjoining the tread nosing, or finish surface of ramp slope, shall be not less than 30 inches (762 mm) and not more than 38 inches (965 mm).

311.5.6.2 Continuity. Handrails for stairways shall be continuous for the full length of the flight, from a point directly above the top riser of the flight to a point directly above lowest riser of the flight. Handrail ends shall be returned or shall terminate in newel posts or safety terminals. Handrails adjacent to a wall shall have a space of not less than 1 1/2 inch (38 mm) between the wall and the handrails.

Exceptions:

1. Handrails shall be permitted to be interrupted by a newel post.
2. The use of a volute, turnout, starting easing or starting newel shall be allowed over the lowest tread.
3. Two or more separate rails shall be considered continuous if the termination of the rails occurs within 6 inches (152 mm) of each other. If transitioning between a wall-mounted handrail and a guardrail/handrail, the wall-mounted rail must return into the wall.

R311.5.6.3 Handrail grip size. All required handrails shall be of one of the following types or provide equivalent graspability.

1. Type I. Handrails with a circular cross section shall have an outside diameter of at least 11/4 inches (32mm) and not greater than 2 inches (51 mm). If the handrail is not circular it shall have a perimeter dimension of at least 4 inches (102 mm) and not greater than 61/4 inches (160 mm) with a maximum cross section of dimension of 21/4 inches (57 mm).
2. Type II. Handrails with a perimeter greater than 61/4 inches (160 mm) shall provide a graspable finger recess area on both sides of the profile. The finger recess shall begin within a distance of 3/4 inch (19 mm) measured vertically from the tallest portion of the profile and achieve a depth of at least 5/16 inch (8mm) within 7/8 inch (22mm) below the widest portion of the profile. This required depth shall continue for at least 3/8 inch (10 mm) to a level that is not less than 13/4 inches (45 mm) below the tallest portion of the profile. The minimum width of the handrail above the recess shall be 11/4 inches (32 mm) to a maximum of 23/4 inches (70 mm). Edges shall have a minimum radius of 0.01 inches (0.25 mm).
   Exception: Exterior handrails (garages and areas exposed to the weather) shall not be more than 3-1/2 inches in cross-section dimension.

R311.6.1 Maximum Slope. Ramps shall have a maximum slope of one unit vertical in eight units horizontal (12.5-percent slope).

311.6.3.1 Height. Handrail height, measured above the finished surface of the ramp slope, shall be not less than 30 inches (762 mm) and not more than 38 inches (965 mm).

R312 – Guards

R312.1 Guards. Porches, balconies, ramps or raised floor surfaces located more than 30 inches (762 mm) above the floor or grade below shall have guards not less than 36 inches (914 mm) in height. Open sides of stairs with a total rise of more than 30 inches (762 mm) above the floor or grade below shall have guards not less than 30" inches (762 mm) in height measured vertically from the nosing of the treads.

Porches and decks which are enclosed with insect screening shall be equipped with guards where the walking surface is located more than 30 inches (762 mm) above the floor or grade below.

312.2 Guard opening limitations. Required guards on open sides of stairways, raised floor areas, balconies and porches shall have intermediate rails or ornamental closures which do not allow passage of an object 6 inches (152 mm) or more in diameter. Horizontal spacing between the vertical members in required guardrails shall be a maximum of 4 inches (102 mm) at the nearest point between members.

Exceptions:

1. The triangular openings formed by the riser, tread and bottom rail of a guard at the open side of a stairway are permitted to be of such a size that a sphere 6 inches (152 mm) cannot pass through.
2. Openings for required guards on the sides of stair treads shall not allow a sphere 4 3/8 inches (107 mm) to pass through.

R313.2.1 Alterations, repairs and additions. When alterations, repairs or additions requiring a building permit occur, or when one or more sleeping rooms are added or created in existing dwellings, the individual dwelling unit shall be equipped with smoke alarms located as required for new dwellings; the smoke alarms shall be interconnected and hard wired.

317.4 Sound Transmission. See Appendix K.

R318 - Moisture Vapor Retarders

318.1 Moisture control. Only in Zone 11 counties identified in Table N1101.2, above grade, shall frame walls, floors, and ceilings not ventilated to allow moisture to escape be required to have an approved vapor retarder. The vapor retarder shall be installed on the warm-in winter side of the insulation.

Exceptions:

1. In construction where moisture or freezing will not damage the materials.
2. Where the framed cavity or space is ventilated to allow moisture to escape.
3. Deleted.

R319 – Protection Against Decay

319.1 Location required. In areas subject to decay damage as established by Table R301.2(1), the following locations shall require the use of an approved species and grade of lumber, pressure treated in accordance with AWPAC1, C2, C3, C4, C9, C15, C18, C22, C23, C24, C28, C31, C33, P1, P2 and P3, or decay-resistant heartwood of redwood, black locust, or cedars.

1. Wood joists or the bottom of a wood structural floor when closer than 18 inches (457 mm) or wood girders when closer than 12 inches (305 mm) to the exposed ground in crawl spaces or unexcavated area located within the periphery of the building foundation.
2. All exterior sills and plates that rest on concrete or masonry exterior foundation walls.
3. Sills and sleepers on a concrete or masonry slab, unless the slab that is in direct contact with the ground is separated from the ground by an approved impervious moisture barrier.
4. The ends of wood girders entering exterior masonry or concrete walls having clearances of less than 0.5 inch (12.7 mm) on tops, sides and ends.
5. Wood siding and sheathing on the exterior of a building having a clearance of less than 6 inches (152 mm) from the ground.
6. Wood structural members supporting moisture-permeable floors or roofs that are exposed to the weather, such as concrete or masonry slabs, unless separated from such floors or roofs by an impervious moisture barrier.
7. Wood furring strips or other wood framing members attached directly to the interior of exterior masonry walls or concrete walls below grade except where an approved vapor retarder is applied between the wall and the furring strips or framing members.
8. All portions of a porch, screen porch or deck from the bottom of the header down, including posts, guardrails, pickets, steps, and floor structure.

R319.1.1 Field treatment. Deleted.

319.3 Fasteners. Fasteners for pressure preservative and fire-retardant-treated wood shall be in accordance with Table R319.3. The coating weights for zinc-coated fasteners shall be in accordance with ASTM A 153.

Exception: One-half-inch (12.7 mm) diameter or greater steel bolts.

***Table R319.3**
Acceptable Fasteners per Chemicals used in Pressure-Preservatively Treated Wood

****Chemical**	**Fasteners**
Borate (disodium octaborate tetrahydrate "DOT")	Carbon steel, galvanized steel, stainless steel, Copper, and silicon bronze
ACQ (copper with quaternary ammonium compound "QUAT")	Hot-dipped galvanized, stainless steel, and Triple coated zinc polymer
Wolmanized (copper with organic fungicide and tebuconazole)	Hot dipped galvanized, stainless steel, and triple coated zinc polymer
*All data is based on research conducted by ICC Evaluation Service, Inc. and National Evaluation Service, Inc. **If chemical not listed above, the fastener used in pressure-preservatively treated wood is subject to approval from the building official.	

R320.1.2 Field treatment. Deleted.

320.2 Chemical soil treatment. The concentration, rate of application and treatment method of the termiticide shall be consistent with and never less than the termiticide label and applied according to the standards of the North Carolina Department of Agriculture.

320.3 Pressure preservatively treated and naturally resistant wood. Heartwood of redwood and eastern red cedar shall be considered termite resistant. Pressure preservatively treated wood and naturally termite-resistant wood shall not be used as a physical barrier unless a barrier can be inspected for any termite shelter tubes around the inside and outside edges and joints of a barrier.

320.4 Barriers. Deleted.

320.5 Foam plastic, General. This section shall apply to both treated and untreated foam plastic.

320.5.1 Foundation walls. All foam plastic shall be a minimum of 8" (203 mm) above grade. See Appendix O.

Exception: Foam plastic less than 8" (203 mm) above or in contact with grade shall be installed in accordance with Section 320.5.5 and Appendix O.

320.5.2 Termite control. When foam plastic is in contact with the ground, subterranean termite control shall be in accordance with Section 320.1.

320.5.3 Slab-on-grade (non-structural). Foam plastic shall be installed along the vertical edge and underneath the slab as specified in Section R320.5.5.

320.5.4 Slab-on-grade (structural). All slabs which distribute the wall loads to the foundation shall be insulated as specified in this Section. Foam plastic shall be installed along the vertical edge and underneath grade as specified in Appendix O figure O-3.

320.5.5 Foam plastic in contact with ground.

320.5.5.1 Inspection and treatment gaps. Foam plastic in contact with the ground shall not be

continuous to the bottom of the weather resistant siding. A clear and unobstructed -2 inch (51- mm) minimum inspection gap shall be maintained from the bottom of the weather resistant siding to the top of any foam plastic. A minimum 4-inch (102-mm) treatment gap shall be provided beginning not more than 6 inches (152 mm) below grade. The top and bottom edges of the foam plastic installed between the inspection gap and the treatment gap shall be cut at a 45 degree angle. See Appendix O.

Exception: For ICF foundations, see Section R404.4.7.2.

320.5.5.2 Protection of exposed foam plastic. Exposed foam plastic shall be protected from physical damage. The required inspection gap, foam plastic, and treatment gap, shall be on the exterior with a cementitious coating that extends at least 2 inches (51 mm) below the foam plastic onto the surface of the foundation wall. See Appendix O.

320.5.5.3 Waterproofing foam plastic between inspection gap and treatment gap. Waterproofing shall be installed over the required cementitious coating from 6 inches (152 mm) above grade to the treatment gap per manufacturer's installation instructions.

320.5.5.4 Dampproofing of below grade walls. Any foam plastic applied below the treatment gap shall be installed after required foundation wall dampproofing is in place. See Section R406 and Appendix O.

R323.1 Elevators. Where provided, elevators shall comply with ASME A17.1.

R323.2 Platform lifts. Where provided, platform lifts shall comply with ASME A18.1.

R323.3 Accessibility. Deleted.

R323.4 Certification. The installer shall certify that the following conditions have been met.

1. The elevator or platform lift has been installed in accordance with the manufacturer's installation instructions.
2. The elevator meets the requirements of ASME A17.1, Part 5, Section 5.3 and other applicable parts.
3. The elevator or platform lift meets the requirements of the NC Electrical Code. Before a Certificate of Occupancy is issued, the permit holder shall provide the Code Enforcement Official a letter of certification from the installer, evidencing compliance with the above conditions. Any maintenance requirements required by the manufacturer shall be stated and affixed to the component. When an elevator or platform lift or its components has been serviced, the service provider shall certify to the owner that the elevator continues to meet the above conditions.

R324– Flood-Resistant Construction

R324.1 General. Buildings and structures constructed in whole or in part in flood hazard areas (including A or V Zones) as established in Table R301.2(1) shall be designed and constructed in accordance with the provisions contained in this section. See additional provisions of Chapter 45.

R324.3.1 Location and site preparation. Deleted.

Chapter 4 – Foundations

401.4.1 Geotechnical evaluation. The load bearing values greater than 2000 psf in Table R401.4.1 require an engineering evaluation.

TABLE R401.4.1

PRESUMPTIVE LOAD-BEARING VALUES OF FOUNDATIONS MATERIALS[a]

Class of Material	Load-Bearing Pressure (pounds per square foot)
Crystalline bedrock	12,000
Sedimentary and foliated rock	6,000
Sandy gravel and/or gravel (GW and GP)	5,000
Sand, silty sand, clayey sand, silty gravel and clayey gravel (SW, SP, SM, SC, GM and GC)	3,000
Clay, sandy clay, silty clay, clayey silt, silt and sandy silt (CL, ML, MH and CH)	2,000[b]

For SI: 1 pound per square foot = 0.0479 kN/m^2.

a. When soil tests are required by Section R401.4, the allowable bearing capacities of the soil shall be part of the recommendations.

b. Where the building official determines that in—place soils with an allowable bearing capacity of less than 2000 psf are likely to be present at the site, the allowable bearing capacity shall be determined by a soils investigation.

TABLE R403.1
MINIMUM WIDTH OF CONCRETE OR MASONRY FOOTINGS
(inches)[a]

	LOAD-BEARING VALUE OF SOIL (psf)			
	1,500	2,000	3,000	4,000
Conventional light–frame construction				
1-story	16[b]	16[b]	12	12
2-story	16	16[b]	12	12
3-story	23	17	12	12
4-inch brick veneer over light frame or 8-inch hollow concrete masonry				
1-story	16[b]	16[b]	12	12
2-story	21	16	12	12
3-story	32	24	16	12
8-inch solid or fully grouted masonry				
1-story	16	16[b]	12	12
2-story	29	21	14	12
3-story	42	32	21	16

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kPa.

a. Where minimum footing width is 12 inches, use of a single wythe of solid or fully grouted 12-inch nominal concrete masonry units is permitted.

b. A minimum footing width of 12" is acceptable for monolithic slab foundations.

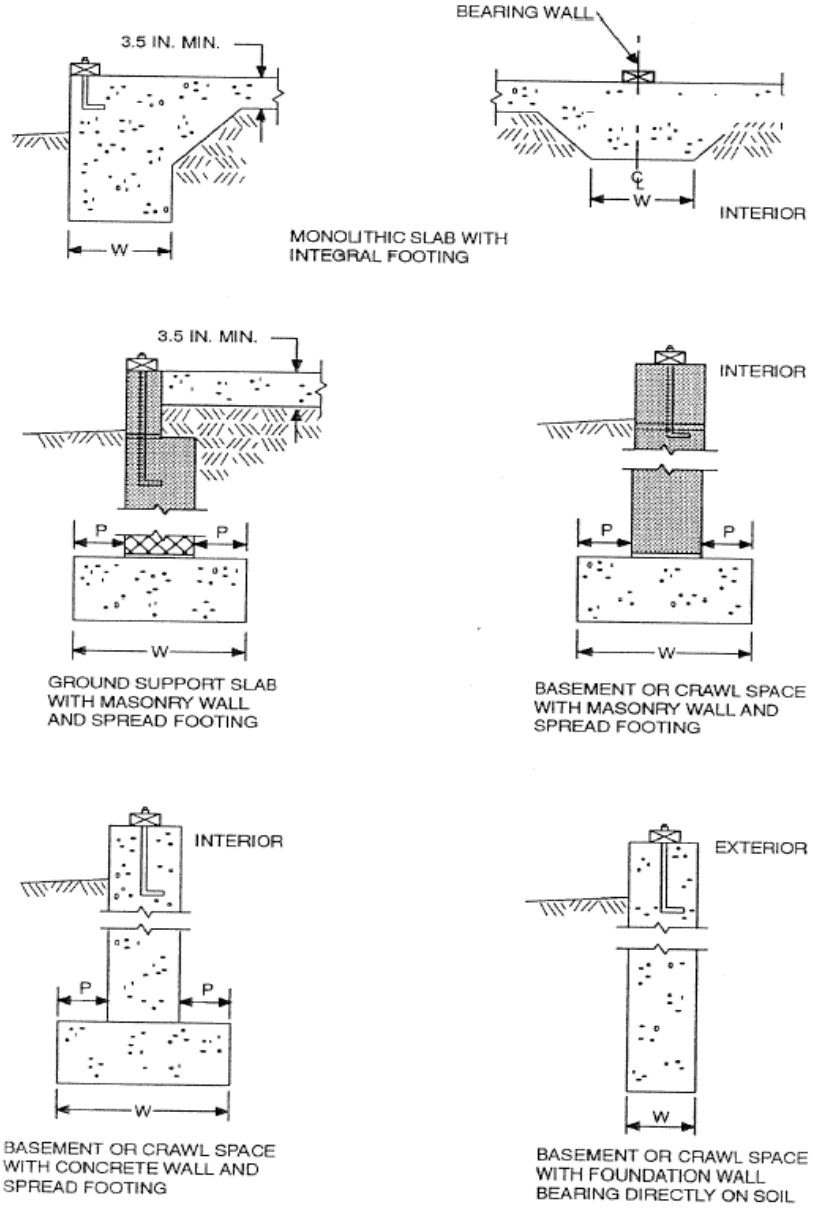
TABLE R403.1a
PIER[1] AND FOOTING[2] SIZES FOR SUPPORT OF GIRDERS

1 (One) Story			2 (Two) Story		2-1/2 (Two & One Half) Story	
Area[5]	Pier[3,4]	Footing	Pier[3,4]	Footing	Pier[3,4]	Footing
50	*8" x 16"*	*1' –4" x 2' –0" x 8"*	*8" x 16"*	*1' –4" x 2' –6" x 8"*	*8" x 16"*	*1' –4" x 2' –6" x 8"*
100	*8" x 16"*	*1' –4" x 2' –0" x 8"*	*8" x 16"*	*2' –0" x 2' –0" x 10"*	*16" x 16"*	*2' –6" x 2' –6" x 10"*
150	*8" x 16"*	*2' –0" x 2' –0" x 8"*	*16" x 16"*	*2' –8" x 2' –8" x 10"*	*16" x 16"*	*3' –0" x 3' –0" x 10"*
200	*8" x 16"*	*2' –4" x 2' –4" x 10"*	*16" x 16"*	*3' –0" x 3' –0" x 10"*	*16" x 16"*	*3' –11" x 3' –8" x 1' –0"*
250	-	-	*16" x 16"*	*3' –4" x 3' –4" x 1' –0"*	*16" x 24"*	*4' –0" x 4' –0" x 1' –0"*
300	-	-	*16" x 16"*	*3' –8" x 3' –8" x 1" –0"*	*16" x 24"*	*4' –6" x 4' –6" x 1' –0"*

FOOTNOTES:

1. *Pier sizes are based on hollow CMU capped with 4" of solid masonry or concrete for 1 (one) story and 8" of solid masonry or concrete for 2 (two) and2 –½ (two and one half) story houses or shall have cavities of the top course filled with concrete or grout or other approved methods. Mortar shall be Type S.*
2. *Footing sizes are based on 2000 psf allowable soil bearing and 2500 psi concrete. This table is based upon the limitations of a tributary area using dimensional framing lumber only.*
3. *Centers of piers shall bear in the middle 1/3 of the footings. Girders must have full bearing on piers. Footings shall be full thickness over the entire area of the footing.*
4. *Pier sizes given are minimum. For height/thickness limitations see Section 606.5.*
5. *Area at first level supported by pier and footing (sq. ft.).*

FIGURE R403.1(1)
CONCRETE AND MASONRY FOUNDATION DETAILS
(Replace with the 2006 NCRC, remove word "finished" in Note 1)



1. Foundations shall extend not less than 12 inches below the finished natural grade or engineered fill and in no case less than the frost line depth.
2. Footing sizes are based on soil with an allowable soil Pressure of 2,000 pounds per square foot. Footings on soil with a lower allowable soil pressure shall be designed in accordance with accepted engineering practice.
3. Footing projections shall not exceed the footing thickness.
4. For minimum footing width (W) see TABLE R403.1
5. Minimum footing thickness (T) is: 6" for 1 story, 8" for 1-1/2, 2, or 2-1/2 story, and 10" for 3 story.
6. Install anchor bolts per Section R403.1.6.

or SI: 1 inch = 25.4 mm.

FIGURE R403.1(1)
CONCRETE AND MASONRY FOUNDATION DETAILS

403.1.4 Minimum depth. All exterior footings and foundation systems shall extend below the frost line specified in Table R301.2(1). In no case shall the bottom of the exterior footings be less than 12 inches below the undisturbed ground surface or engineered fill.

Exception: Footings and foundations erected on solid rock shall not be required to extend below the frost line.

403.1.4.1 Frost protection. Deleted.

403.1.5 Slope. The top surface of footings shall be level (1/2 inch in 10 feet)or shall be brought level, under the width of the wall, with masonry units with full mortar joints. The bottom surface of footings may have a slope not exceeding one unit vertical in 10 units horizontal (10-percent slope). Footings shall be stepped where it is necessary to change the elevation of the top surface of the footings or where the slope of the bottom surface of the footings will exceed one unit vertical in ten units horizontal (10-percent slope).

403.1.6 Foundation anchorage. When braced wall panels are supported directly on continuous foundations, the wall wood sill plate or cold-formed steel bottom track shall be anchored to the foundation in accordance with this section.

The wood sole plate at exterior walls on monolithic slabs and wood sill plate shall be anchored to the foundation with anchor bolts spaced a maximum of 6 feet (1829 mm) on center and not more than 12 inches from the corner. There shall be a minimum of two bolts per plate section. In Seismic Design Categories D1 and D2, anchor bolts shall also be spaced at 6 feet (1829 mm) on center and located within 12 inches (305 mm) from the ends of each plate section at interior braced wall lines when required by Section R602.10.9 to be supported on a continuous foundation. Bolts shall be at least 1/2 inch (12.7 mm) in diameter and shall extend a minimum of 7 inches (178 mm) into masonry or concrete. Interior bearing wall sole plates on monolithic slab foundations shall be positively anchored with approved fasteners. A nut and washer shall be tightened on each bolt to the plate. Sills and sole plates shall be protected against decay and termites where required by Sections R318 and R319. Cold-formed steel framing systems shall be fastened to the wood sill plates or anchored directly to the foundation as required in Section R505.3.1 or R603.1.1.

(Exceptions as listed in IRC2006)

403.1.6.1 Foundation anchorage in Seismic Design Categories C, D1 and D2. In addition to the requirements of Section R403.1.6, the following requirements shall apply to wood light-frame structures in Seismic Design Categories D1 and D2 and wood light-frame townhouses in Seismic Design Category C.

1. Plate washers conforming to Section R602.11.1 shall be used on each bolt.
2. Interior braced wall plates shall have anchor bolts spaced at not more than 6 feet (1829 mm) on center and not more than 12 inches (305 mm) from the corner.
3. Interior bearing wall sole plates shall have anchor bolts spaced at not more than 6 feet (1829 mm) on center and not more than 12 inches (305 mm) from the corner.
4. The maximum anchor bolt spacing shall be 4 feet (1219 mm) for buildings over two stories in height.
5. Stepped cripple walls shall conform to Section R602.11.3.
6. Where continuous wood foundations in accordance with Section R404.2 are used, the force transfer shall have a capacity equal to or greater than the connections required by Section R602.11.1 or the braced wall panel shall be connected to the wood foundations in accordance with the braced wall panel-to-floor fastening requirements of Table 602.3(1).

403.1.7 Footings on or adjacent to slopes. ***Deleted***

(also delete subsections)

403.1.8 Foundations on expansive soils. ***Deleted***

(also delete subsections)

403.3 Frost protected shallow foundations. ***Deleted***

(also delete subsections)

TABLE R403.3
MINIMUM INSULATION REQUIREMENTS FOR FROST-PROTECTED FOOTINGS IN HEATED BUILDINGS

DELETED

FIGURE R403.3(1)
INSULATION PLACEMENT FOR FROST-PROTECTED FOOTINGS IN HEATED BUILDINGS
DELETED

FIGURE R403.3(3)
INSULATION PLACEMENT FOR FROST-PROTECTED FOOTINGS ADJACENT TO UNHEATED SLAB-ON-GROUND STRUCTURE
DELETED

FIGURE R403.3(4)
INSULATION PLACEMENT FOR FROST-PROTECTED FOOTINGS

ADJACENT TO HEATED STRUCTURE

DELETED

R404.1 Concrete and masonry foundation walls. Concrete and masonry foundation walls shall be selected and constructed in accordance with the provisions of Section R404 or in accordance with ACI 318, ACI 332, NCMA TR68–A or ACI 530/ASCE 5/TMS 402 or other approved structural standards. When ACI 318, ACI 332 or ACI 530/ASCE 5/TMS 402 or the provisions of Section R404 are used to design concrete or masonry foundation walls, project drawings, typical details and specifications are not required to bear the seal of the architect or engineer responsible for design, unless otherwise required by the state law of the jurisdiction having authority.

Foundation walls that meet all of the following shall be considered laterally supported:

1. Full basement floor shall be 3.5 inches (89 mm) thick concrete slab poured tight against the bottom of the foundation wall.
2. Deleted.
3. Bolt spacing for the sill plate shall be no greater than 36 inches (914 mm).
4. Deleted.
5. Where foundation walls support unbalanced load on opposite sides of the building, such as a daylight basement, the building aspect ratio, L/W, shall not exceed the value specified in Table R404.1(3). For such foundation walls, the rim board shall be attached to the sill with a 20 gage metal angle clip at 24 inches (610 mm) on center, with five 8d nails per leg, or an approved connector supplying 230 pounds per linear foot (3.36 kN/m) capacity.

TABLE R404.1(1)

TOP REACTIONS AND PRESCRIPTIVE SUPPORT FOR FOUNDATION WALLS

Deleted.

TABLE R404.1(2)

MAXIMUM PLATE ANCHOR-BOLT SPACING FOR SUPPORTED FOUNDATION WALL

Deleted.

404.1.3 Design required. Design in accordance with accepted engineering practice shall be provided for concrete or masonry foundation walls when any of the following conditions exist:

1. Walls are subject to hydrostatic pressure from ground water.
2. Walls supporting more than 48 inches (1219 mm) of unbalanced backfill that do not have permanent lateral support at the top and bottom. Included are retaining walls located on residential sites and any retaining wall systems that cross over adjacent property lines regardless of vertical height.
3. Retaining walls that support buildings and their accessory structures.

FIGURE R404.1.5(1)
FOUNDATION WALL CLAY MASONRY CURTAIN WALL WITH CONCRETE MASONRY PIPES
Deleted.

R404.1.5.1 Pier and curtain walls. Curtain walls 4 inch (nominal) minimum thickness between piers and bonded into piers supported on concrete footings poured integrally with pier footings may be used for frame construction and for masonry veneer frame construction not more than 2 stories in height subject to the following limitations:

1. All load-bearing walls shall be placed on continuous concrete footings placed integrally with the exterior wall footings.
2. The minimum actual thickness of a load-bearing masonry wall shall be not less than 4 inches (102 mm) nominal or 3 3/8 inches (92 mm) actual thickness, and shall be bonded integrally with piers spaced in accordance with Section R606.8.
3. Piers shall be constructed in accordance with Section R606.5 and Section R606.5.1, and shall be bonded into the load-bearing masonry wall in accordance with Section R608.1.1 or Section R608.1.1.2.
4. The maximum height of a 4-inch (102 mm) load-bearing masonry foundation wall supporting wood framed walls and floors shall not be more than 6 feet (1829 mm) in height.
5. Anchorage shall be in accordance with R403.1.6 or as specified by engineered design accepted by the building official.
6. The unbalanced fill for 4-inch (102 mm) foundation walls shall not exceed 24 inches (610 mm) for solid masonry or 16 inches (406 mm) for hollow masonry.
7. Pier size shall be based on Table 403.1(a).
8. See Chapter 44 for special anchorage and reinforcement in high wind zones.

R404.1.5.2 Piers The unsupported height of masonry piers shall not exceed 10 times their least dimension. When structural clay tile or hollow concrete masonry units are used for isolated piers to support beams and girders, the cellular spaces shall be filled solidly with concrete or Type M or S mortar, except that unfilled hollow piers may be used if their unsupported height is not more than four times their least dimension. When hollow masonry units are solidly filled with concrete or Type M or S mortar, the allowable compressive stress may be increased as provided in Table 606.4.

404.4.7.2 Termite hazards. Foam plastic insulation shall be permitted below grade on foundation walls in accordance with one of the following:

1. When in addition to the requirements in Section R320.1, an approved method of protecting the foam plastic and structure from subterranean termite damage is provided such as metal or plastic termite shield.
2. The structural members of walls, floors, ceilings and roofs are entirely of noncombustible materials or pressure preservatively treated wood.
3. On the interior side of basement walls.

405.1 Concrete or masonry foundations. Drains shall be provided around all concrete or masonry foundations that retain earth and enclose habitable or usable spaces located below grade. Drain age tiles, gravel or crushed stone drains, perforated pipe or other approved systems or materials shall be installed at or below the area to be protected and shall discharge by gravity or mechanical means into an approved drainage system. Gravel or crushed stone drains shall extend at least 1 foot (305 mm) beyond the outside edge of the footing and 6 inches (153 mm) above the top of the footing and be covered with an approved filter membrane material. The top of open joints of drain tiles shall be protected with strips of building paper, and the drainage tiles or perforated pipe shall be placed on a minimum of 2 inches (51 mm) of washed gravel or crushed rock at least one sieve size larger than the tile joint opening or perforation and covered with not less than 6 inches (153 mm) of the same material.

Exceptions:

1. A drainage system is not required when the foundation is installed on well-drained ground or sand gravel mixture soils according to the Unified Soil Classification System, Group I Soils, as detailed in Table R405.1.
2. When the interior grade is less than 12 inches below the exterior grade.

406.1 Concrete and masonry foundation dampproofing. Foundation walls where the outside grade is higher than the inside grade shall be dampproofed from the top of the footing to the finished grade. Masonry walls shall have not less than 3/8 inch (9.5 mm) portland cement parging applied to the exterior of the wall. The foundation walls shall be dampproofed with a bituminous coating, 3 pounds per square yard (1.63 kg/m^2) of acrylic modified cement, 1/8-inch (3.2 mm) coat of surface-bonding mortar complying with ASTM C 887 or any material permitted for waterproofing in Section R406.2. Concrete walls shall be dampproofed by applying any one of the above listed dampproofing materials or any one of the waterproofing materials listed in Section R406.2 to the exterior of the wall.

407.3 Structural requirements. The columns shall be restrained to prevent lateral displacement at the top and bottom ends. Wood columns shall not be less in nominal size than 4 inches by 4 inches (102 mm by 102 mm) and steel columns shall not be less than 3-inch-diameter (76 mm) standard pipe or approved equivalent.

R408
WALL VENTED CRAWL SPACES

R408.1 Space moisture vapor control. Vented crawl space foundations shall be provided with foundation vent openings through the exterior foundation walls.

R408.1.1 Foundation vent sizing. The minimum net area of ventilation openings shall be not less than 1 square foot (0.0929 m^2) for each 150 square feet (13.9 m^2) of crawl space ground area.

Exception: The total area of ventilation openings may be reduced to 1/1,500 of the crawl space ground area where the required openings are placed so as provide cros- ventilation of the crawl space. The installation of operable louvers shall not be prohibited.

R408.1.2 Foundation vent location. One foundation vent shall be within 3 feet (914mm) of each corner of the building. To prevent rainwater entry when the crawlspace is built on a sloped site, the uphill foundation walls may be constructed without wall vent openings. Vent dams shall be provided when the bottom of the foundation vent opening is less than 4 inches above the finished exterior grade.

R408.1.3 Covering material. To prevent rodent entry, foundation vents shall be covered with any of the following materials provided that the ventilation holes through the covering material shall not exceed ¼ inch (6.4 mm) in any direction:

1. Perforated sheet metal plates not less than 0.070 inch (1.8 mm) thick.
2. Expanded sheet metal plates no less than 0.047 inch (1.2 mm) thick.
3. Cast iron grills or grating.
4. Extruded load-bearing brick vents.
5. Hardware cloth of 0.035 inch (0.89 mm) wire or heavier.
6. Corrosion-resistant mesh, with the least dimension being 1/8 inch (3.2 mm).

R408.1.4 Drains and vent terminations. Drains (including but not limited to pressure relief and drain pans) shall terminate outdoors, to crawl space floor drains or interior pumps, and shall not intentionally discharge water into the crawl space. Crawl space drains shall be separate from roof gutter drain systems and foundation perimeter drains. Dryer vents shall terminate outdoors.

R408.1.5 Space separation. Wall vented crawl spaces shall be separated from adjoining basements, porches and garages by permanent solid wall surfaces with all utility penetrations thru the separating wall sealed. Latched, weather-stripped doors or access panels shall provide access between the crawl space and such adjoining spaces.

R408.2 Ground vapor retarder. Requires full coverage ground vapor retarders for all wall vented ground spaces. Wall vented crawl spaces shall be protected from water entry by the evaporation of water from the ground surface. A minimum 6-mil (0.15 mm) polyethylene vapor retarder or equivalent shall be installed to nominally cover all exposed earth in the crawl space, with joints lapped not less than 12 inches. Where there is no evidence that the groundwater table can rise to within 6 inches (152 mm) of the floor of the crawl space, it is acceptable to puncture the ground vapor retarder at low spots to prevent water puddles from forming on top of the vapor retarder due to condensation. The floor of the crawl space shall be graded so that it drains to one or more low spots. Install a drain to daylight or sump pump at each low spot. Crawl space drains shall be kept separate from roof gutter drain systems and foundation perimeter drains.

R408.3 Wall dampproofing. Where the outside grade is higher than the inside grade the exterior walls shall be dampproofed from the top of the footing to the finished grade as required by R406.1.

R408.4 Site grading. Building site shall be graded to drain water away from the crawl space foundation per the requirements of R401.3.

R408.5 Insulation. The thermal insulation in a wall vented crawl space shall be placed in the floor system. Wall insulation is not allowed as the only insulation system in a wall vented crawl space. The required insulation value can be determined from Table N1102.1.

R408.6 Floor air leakage control. All plumbing, electrical, duct, plenum, phone, cable, computer wiring and other penetrations through the subfloor shall be sealed with non-porous materials, caulks, or sealants. The use of Rockwool or fiberglass insulation is prohibited as an air sealant.

R408.7 Duct air leakage control. All heating and cooling ductwork located in the crawl space shall be sealed with mastic or other industry approved duct closure systems.

R408.8 Access. A minimum access opening measuring 18 inches by 24 inches (457 mm by 610 mm) shall be provided to the crawl space. See the North Carolina Mechanical Code for access requirements where mechanical equipment is located under floors.

R408.9 Removal of debris. The crawl space floor shall be cleaned of all vegetation and organic material. All

wood forms used for placing shall be removed before the building is occupied or used for any purpose. All construction materials shall be removed before the building is occupied or used for any purpose.

R408.10 Finished grade. The finished grade of the crawl space may be located at the bottom of the footings; however, where there is evidence that the groundwater table can rise to within 6 inches (152 mm) of the finished grade of the crawl space at the perimeter or where there is evidence that the surface water does not readily drain from the building site, the grade in the crawl space shall be as high as the outside finished grade, unless an approved drainage system is provided.

R408.11 Flood resistance. For buildings located in areas prone to flooding as established in Table R301.2(1), the walls enclosing the crawl space shall be provided with flood openings in accordance with Section R323.2.2.

R409 – Closed Crawl Spaces

R409.1 Air sealed walls. Closed crawl spaces shall be built to minimize the entry of outdoor air into the crawl space. Specifically prohibited are foundation wall vents and wall openings to ventilated porch foundations. When outdoor packaged heating and cooling equipment is used, solid blocking and sealants shall be used to seal gaps between the exterior wall opening and the smaller supply and return ducts that pass through the opening.

R409.1.1 Caulking and sealants. Air sealing caulk, gaskets or sealants shall be applied to the foundation wall and floor assemblies that separate the crawl space from outside and other ventilated areas such as joints around access door and frame, between foundation and sill plate, at penetrations for plumbing, mechanical, electrical and gas lines and at duct penetrations.

R409.1.2 Access panel/door. A minimum access opening measuring 18 inches by 24 inches (457 mm by 610 mm) shall be provided to the crawl space. See the North Carolina Mechanical Code for access requirements where mechanical equipment is located under floors. To minimize air entry, provide a tight fitting access panel/door with a latch mechanism. Access panels or doors shall be insulated to a minimum of R-2.

R409.2 Groundwater vapor retarder. Closed crawl spaces shall be protected from water entry by the evaporation of water from the ground surface.

R409.2.1 Ground vapor retarder. A minimum 6-mil (0.15 mm) polyethylene vapor retarder or equivalent shall be installed to nominally cover all exposed earth in the crawl space, with joints lapped not less than 12 inches. Minor pockets or wrinkles that prevent total drainage across the surface of the vapor retarder are allowed. The floor of the crawl space shall be graded so that it drains to one or more low spots. Install a drain to daylight or sump pump at each low spot. Crawl space drains shall be kept separate from roof gutter drain systems and foundation perimeter drains.

R409.2.2 Liner. The ground vapor retarder may be installed as a full interior liner by sealing the edges to the walls and beam columns and sealing the seams. Single piece liner systems are approved. The top edge of the wall liner shall terminate 3 inches below the top edge of the masonry foundation wall. The top edge of the liner shall be brought up the interior columns a minimum of 4 inches above the crawl space floor. The floor of the crawl space shall be graded so that it drains to one or more low spots. Install a drain to daylight or sump pump at each low spot. Crawl space drains shall be separate from roof gutter drain systems and foundation perimeter drains.

R409.2.1.1 Wall liner termite inspection gap. Provide a clear and unobstructed 3” minimum inspection gap between the top of the wall liner and the bottom of the wood sill. This inspection gap may be ignored with regards to energy performance and is not intended to create an energy penalty.

R409.2.3 Concrete floor surfacing. The ground vapor retarder may be protected against ripping and displacement by pouring an un-reinforced, minimum 2-inch thick, concrete surface directly over the vapor barrier. A base course of gravel or other drainage material under the ground moisture barrier is not required. The floor of the crawl space shall be graded so that the concrete surface drains to one or more low spots. Install a drain to daylight or sump pump at each low spot. Crawl space drains shall be separate from roof gutter drain systems and foundation perimeter drains.

R409.2.4 Drains and vent terminations. Drains (including but not limited to pressure relief and drain pans) shall terminate outdoors, to crawl space floor drains or interior pumps, and shall not intentionally discharge water into the crawl space. Crawl space drains shall be separate from roof gutter drain systems and foundation perimeter drains. Dryer vents shall terminate outdoors.

R409.3 Wall dampproofing. Where the outside grade is higher than the inside grade the exterior walls shall be dampproofed from the top of the footing to the finished grade as required by R406.1.

R409.4 Site grading. Building site shall be graded to drain water away from the crawl space foundation per the requirements of R401.3.

R409.5 Space moisture vapor control. Closed crawl spaces shall be provided with a mechanical drying capability to control space moisture levels. The allowed methods are listed below in R409.5.1 – R409.5.5. At least one method shall be provided; however, combination systems shall be allowed.

R409.5.1 Dehumidifier. A permanently installed dehumidifier shall be provided in the crawl space. The minimum rated capacity per day is 15 pints (7.1 Liters). Condensate discharge shall be drained to daylight or interior condensate pump. Permanently installed dehumidifier shall be provided with an electrical outlet.

R409.5.2 Supply air. Supply air from the dwelling air conditioning system shall be ducted into the crawl space at the rate of 1 cubic foot per minute (0.5 L/s) per 30 square feet (4.6 m^2) of crawl space floor area. No return air duct from the crawl space to the dwelling air conditioning system is allowed. The crawl space supply air duct shall be fitted with a backflow damper to prevent the entry of crawl space air into the supply duct system when the system fan is not operating. An air relief vent to the outdoors may be installed. Crawl spaces with moisture vapor control installed in accordance with this section are not considered plenums.

R409.5.3 House air. House air shall be blown into the crawl space with a fan at the rate of 1 cubic foot per minute (0.5 L/s) per 50 square feet (4.6 m^2) of crawl space floor area. The fan motor shall be rated for continuous duty. No return air duct from the crawl space to the dwelling air conditioning system is allowed. An air relief vent to the outdoors may be installed. Crawl spaces with moisture vapor control installed in accordance with this section are not considered plenums.

R409.5.4 Exhaust fan. Crawl space air shall be exhausted to outside with a fan at the rate of 1 cubic foot per minute (0.5 L/s) per 50 square feet (4.6 m^2) of crawl space floor area. The fan motor shall be rated for continuous duty. There is no requirement for make-up air.

R409.6 Plenums. Closed crawl spaces used as supply or return plenums for distribution of heated or cooled air shall comply with the requirements of the NC Mechanical Code. Crawl space plenums shall not contain plumbing cleanouts, gas lines or other prohibited components. Foam plastic insulation located in a crawl space plenum shall be protected against ignition by an approved thermal barrier.

R409.7 Combustion air. The air sealing requirements of a closed crawl space may result in a foundation which can not provide adequate combustion air for fuel-burning appliances; therefore, fuel-burning appliances located in the crawl space such as furnaces and water heaters shall obtain combustion air from outdoors as per the NC Mechanical Code.

R409.8 Insulation. The thermal insulation in a crawl space may be located in the floor system or at the exterior walls. The required insulation value can be determined from Table N1102.1.

Exception: Insulation shall be placed at the walls when the closed crawl space is designed to be intentionally heated or cooled, conditioned space.

R409.8.1 Wall insulation. Where the floor above a crawl space is not insulated, the walls shall be insulated. Wall insulation can be located on any combination of the exterior and interior surfaces and within the structural cavities or materials of the exterior crawl space walls. Wall insulation systems require that the band joist area of the floor frame be insulated. Wall insulation shall begin 3 inches below the top of the masonry foundation wall and shall extend down to 3 inches above the top of the footing or concrete floor, 3 inches above the interior ground surface or 24-inches below the outside finished ground level, whichever is less. No insulation shall be required on masonry walls of 9 inches height or less.

R409.8.1.1 Foam plastic termite inspection gap. For outside wall Section R324 governs applications. When expanded polystyrene, polyisocyanurate, or other foam plastic insulation is installed on the inside surface of the exterior foundation walls, provisions R409.8.1.1.1 – 2 below apply.

R409.8.1.1.1 Earth floored crawl spaces. Provide a clear and unobstructed 3-inch minimum termite inspection gap between the top of the foam plastic wall insulation and the bottom of the wood sill. Because insulation ground contact is not allowed, provide a continuous 3-inch minimum clearance gap between the bottom edge of the foam plastic wall insulation and the earth floor surface. Refer to N1102.1.7 to determine maximum allowances for insulation gaps.

R409.8.1.1.2 Concrete floor surfaced crawl spaces. Provide a clear and unobstructed 3-inch minimum termite inspection gap between the top of the foam plastic wall insulation and the bottom of the wood sill. Provide a continuous 3-inch minimum clearance gap between the bottom edge of the foam plastic wall insulation and the earth floor surface. Refer to N1102.1.7 to determine maximum allowances for insulation gaps.

R409.8.1.2 Porous insulation materials. When fiberglass, rockwool, cellulose or other porous insulation materials are installed on the inside wall surface of a closed crawl space, provide a clear and unobstructed 3-inch minimum termite inspection gap between the top of the porous wall insulation and the bottom of the wood sill.

To reduce wicking potential, porous insulation ground contact is not allowed in earth floored or concrete surfaces crawl spaces. Provide a continuous 3-inch minimum wicking gap between the bottom edge of the porous wall insulation and the earth or concrete floor surface. Refer to N1102.1.7 to determine maximum allowances for insulation gaps.

R409.8.2 Foam plastic fire safety. Foam plastic insulation may be installed inside crawl spaces without a thermal barrier or ignition barrier when the insulation product has been tested in accordance with Section R318.3. Foam plastic tested in accordance with section R318.3 shall be installed according to the limitations stated in the ICC Evaluation Service Report (ICC-ES) for the product. Foam plastics that have not been tested to meet these ratings shall be protected against ignition per section R318.2.3.

Exception: Foam plastic insulation located in closed crawl spaces as defined in section R409.5.5 Conditioned Space or section R409.6 Plenums shall be protected against ignition by an approved thermal barrier.

R409.9 Floor air leakage control. All plumbing, electrical, duct, plenum, phone, cable, computer wiring and other penetrations through the subfloor shall be sealed with non-porous materials, caulks, or sealants. The use of Rockwool or fiberglass insulation is prohibited as an air sealant.

R408.7 Duct air leakage control. All heating and cooling ductwork located in the crawl space shall be sealed with mastic or other industry approved duct closure systems.

R409.10 Access. A minimum access opening measuring 18 inches by 24 inches (457 mm by 610 mm) shall be provided to the crawl space. See the North Carolina Mechanical Code for access requirements where mechanical equipment is located under floors.

R409.11 Removal of debris. The crawl space floor shall be cleaned of all vegetation and organic material. All wood forms used for placing shall be removed before the building is occupied or used for any purpose. All construction materials shall be removed before the building is occupied or used for any purpose.

R409.12 Finished grade. The finished grade of the crawl space may be located at the bottom of the footings; however, where there is evidence that the groundwater table can rise to within 6 inches (152 mm) of the finished grade of the crawl space at the perimeter or where there is evidence that the surface water does not readily drain from the building site, the grade in the crawl space shall be as high as the outside finished grade, unless an approved drainage system is provided.

Chapter 5 – Floors

502.2.2 Decks. Where supported by attachment to an exterior wall, decks shall be positively anchored to the primary structure and designed for both vertical and lateral loads as applicable. Such attachment shall not be accomplished by the use of toenails or nails subject to withdrawal. Where positive connection to the primary building structure cannot be verified during inspection, decks shall be self-supporting.
For decks with cantilevered framing members, connections to exterior walls or other framing members, shall be designed and constructed to resist uplift resulting from the full live load specified in Table R301.5 acting on the cantilevered portion of the deck. Exterior decks shall be permitted to be constructed in accordance with Appendix M.

TABLE R502.5(1)
GIRDER SPANS[a] AND HEADER SPANS[a] FOR EXTERIOR BEARING WALLS
(Maximum spans for Douglas fir-larch, hem-fir, southern pine and spruce-pine-fir[b] and required number of jack studs)

GIRDERS AND HEADERS SUPPORTING	SIZE	GROUND SNOW LOAD (psf)[e]											
		30						50					
		Building width[c] (feet)											
		20		28		36		20		28		36	
		Span	NJ[d]	Span	NJ[d]	Span	NJ[d]	Span	NJ[d]	Span	NJ[d]	Span	NJ[d]
Roof and ceiling 	2-2×4	3-6	1	3-2	1	2-10	1	3-2	1	2-9	1	2-6	1
	2-2×6	5-5	1	4-8	1	4-2	1	4-8	1	4-1	1	3-8	2
	2-2×8	6-10	1	5-11	2	5-4	2	5-11	2	5-2	2	4-7	2
	2-2×10	8-5	2	7-3	2	6-6	2	7-3	2	6-3	2	5-7	2
	2-2×12	9-9	2	8-5	2	7-6	2	8-5	2	7-3	2	6-6	2
	3-2×8	8-4	1	7-5	1	6-8	1	7-5	1	6-5	2	5-9	2
	3-2×10	10-6	1	9-1	2	8-2	2	9-1	2	7-10	2	7-0	2
	3-2×12	12-2	2	10-7	2	9-5	2	10-7	2	9-2	2	8-2	2
	4-2×8	9-2	1	8-4	1	7-8	1	8-4	1	7-5	1	6-8	1
	4-2×10	11-8	1	10-6	1	9-5	2	10-6	1	9-1	2	8-2	2
	4-2×12	14-1	1	12-2	2	10-11	2	12-2	2	10-7	2	9-5	2
Roof, ceiling and one center-bearing floor 	2-2x4	3-1	1	2-9	1	2-5	1	2-9	1	2-5	1	2-2	1
	2-2x6	4-6	1	4-0	1	3-7	2	4-1	1	3-7	2	3-3	2
	2-2x8	5-9	2	5-0	2	4-6	2	5-2	2	4-6	2	4-1	2
	2-2x10	7-0	2	6-2	2	5-6	2	6-4	2	5-6	2	5-0	2
	2-2x12	8-1	2	7-1	2	6-5	2	7-4	2	6-5	2	5-9	3
	3-2x8	7-2	1	6-3	2	5-8	2	6-5	2	5-8	2	5-1	2
	3-2x10	8-9	2	7-8	2	6-11	2	7-11	2	6-11	2	6-3	2
	3-2x12	10-2	2	8-11	2	8-0	2	9-2	2	8-0	2	7-3	2
	4-2x8	8-1	1	7-3	1	6-7	1	7-5	1	6-6	1	5-11	2
	4-2x10	10-1	1	8-10	2	8-0	2	9-1	2	8-0	2	7-2	2
	4-2x12	11-9	2	10-3	2	9-3	2	10-7	2	9-3	2	8-4	2
Roof, ceiling and one clear span floor 	2-2×4	2-8	1	2-4	1	2-1	1	2-7	1	2-3	1	2-0	1
	2-2×6	3-11	1	3-5	2	3-0	2	3-10	2	3-4	2	3-0	2
	2-2×8	5-0	2	4-4	2	3-10	2	4-10	2	4-2	2	3-9	2
	2-2×10	6-1	2	5-3	2	4-8	2	5-11	2	5-1	2	4-7	3
	2-2×12	7-1	2	6-1	3	5-5	3	6-10	2	5-11	3	5-4	3
	3-2×8	6-3	2	5-5	2	4-10	2	6-1	2	5-3	2	4-8	2
	3-2×10	7-7	2	6-7	2	5-11	2	7-5	2	6-5	2	5-9	2
	3-2×12	8-10	2	7-8	2	6-10	2	8-7	2	7-5	2	6-8	2
	4-2×8	7-2	1	6-3	2	5-7	2	7-0	1	6-1	2	5-5	2
	4-2×10	8-9	2	7-7	2	6-10	2	8-7	2	7-5	2	6-7	2
	4-2×12	10-2	2	8-10	2	7-11	2	9-11	2	8-7	2	7-8	2
Roof, ceiling and two center-bearing floors 	2-2×4	2-7	1	2-3	1	2-0	1	2-6	1	2-2	1	1-11	1
	2-2×6	3-9	2	3-3	2	2-11	2	3-8	2	3-2	2	2-10	2
	2-2×8	4-9	2	4-2	2	3-9	2	4-7	2	4-0	2	3-8	2
	2-2×10	5-9	2	5-1	2	4-7	3	5-8	2	4-11	2	4-5	3
	2-2×12	6-8	2	5-10	3	5-3	3	6-6	2	5-9	3	5-2	3
	3-2×8	5-11	2	5-2	2	4-8	2	5-9	2	5-1	2	4-7	2
	3-2×10	7-3	2	6-4	2	5-8	2	7-1	2	6-2	2	5-7	2
	3-2×12	8-5	2	7-4	2	6-7	2	8-2	2	7-2	2	6-5	3
	4-2×8	6-10	1	6-0	2	5-5	2	6-8	1	5-10	2	5-3	2
	4-2×10	8-4	2	7-4	2	6-7	2	8-2	2	7-2	2	6-5	2
	4-2×12	9-8	2	8-6	2	7-8	2	9-5	2	8-3	2	7-5	2

TABLE R502.5(1)—continued
GIRDER SPANS[a] AND HEADER SPANS[a] FOR EXTERIOR BEARING WALLS
(Maximum spans for Douglas fir-larch, hem-fir, southern pine and spruce-pine-fir[b] and required number of jack studs)

GIRDERS AND HEADERS SUPPORTING	SIZE	GROUND SNOW LOAD (psf)[e]											
		30						50					
		Building width[c] (feet)											
		20		28		36		20		28		36	
		Span	NJ[d]	Span	NJ[d]	Span	NJ[d]	Span	NJ[d]	Span	NJ[d]	Span	NJ[d]
Roof, ceiling and two clear span floor 	2-2×4	2-1	1	1-8	1	1-6	2	2-0	1	1-8	1	1-5	2
	2-2×6	3-1	2	2-8	2	2-4	2	3-0	2	2-7	2	2-3	2
	2-2×8	3-10	2	3-4	3	3-0	3	3-10	2	3-4	2	2-11	3
	2-2×10	4-9	2	4-1	3	3-8	3	4-8	2	4-0	3	3-7	3
	2-2×12	5-6	3	4-9	3	4-3	3	5-5	3	4-8	3	4-2	3
	3-2×8	4-10	2	4-2	2	3-9	2	4-9	2	4-1	2	3-8	2
	3-2×10	5-11	2	5-1	2	4-7	3	5-10	2	5-0	2	4-6	3
	3-2×12	6-10	2	5-11	3	5-4	3	6-9	2	5-10	3	5-3	3
	4-2×8	5-7	2	4-10	2	4-4	2	5-6	2	4-9	2	4-3	2
	4-2×10	6-10	2	5-11	2	5-3	2	6-9	2	5-10	2	5-2	2
	4-2×12	7-11	2	6-10	2	6-2	3	7-9	2	6-9	2	6-0	3

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kN/m^2.

a. Spans are given in feet and inches.

b. Tabulated values assume #2 grade lumber.

c. Building width is measured perpendicular to the ridge. For widths between those shown, spans are permitted to be interpolated.

d. NJ - Number of jack studs required to support each end. Where the number of required jack studs equals one, the header is permitted to be supported by an approved framing anchor attached to the full-height wall stud and to the header.

e. Use 30 psf ground snow load for cases in which ground snow load is less than 30 psf and the roof live load is equal to or less than 20 psf.

TABLE R502.5(2)
GIRDER SPANS[a] AND HEADER SPANS[a] FOR INTERIOR BEARING WALLS
(Maximum spans for Douglas fir-larch, hem-fir, southern pine and spruce-pine-fir[b] and required number of jack studs)

HEADERS AND GIRDERS SUPPORTING	SIZE	BUILDING WIDTH[c] (feet)					
		20		28		36	
		Span	NJ[d]	Span	NJ[d]	Span	NJ[d]
One floor only 	2-2×4	3-1	1	2-8	1	2-5	1
	2-2×6	4-6	1	3-11	1	3-6	1
	2-2×8	5-9	1	5-0	2	4-5	2
	2-2×10	7-0	2	6-1	2	5-5	2
	2-2×12	8-1	2	7-0	2	6-3	2
	3-2×8	7-2	1	6-3	1	5-7	2
	3-2×10	8-9	1	7-7	2	6-9	2
	3-2×12	10-2	2	8-10	2	7-10	2
	4-2×8	5-10	1	5-1	2	4-6	2
	4-2×10	10-1	1	8-9	1	7-10	2
	4-2×12	11-9	1	10-2	2	9-1	2
Two floors 	2-2×4	2-2	1	1-10	1	1-7	1
	2-2×6	3-2	2	2-9	2	2-5	2
	2-2×8	4-1	2	3-6	2	3-2	2
	2-2×10	4-11	2	4-3	2	3-10	3
	2-2×12	5-9	2	5-0	3	4-5	3
	3-2×8	5-1	2	4-5	2	3-11	2
	3-2×10	6-2	2	5-4	2	4-10	2
	3-2×12	7-2	2	6-3	2	5-7	3
	4-2×8	4-2	2	3-7	2	3-2	2
	4-2×10	7-2	2	6-2	2	5-6	2
	4-2×12	8-4	2	7-2	2	6-5	2

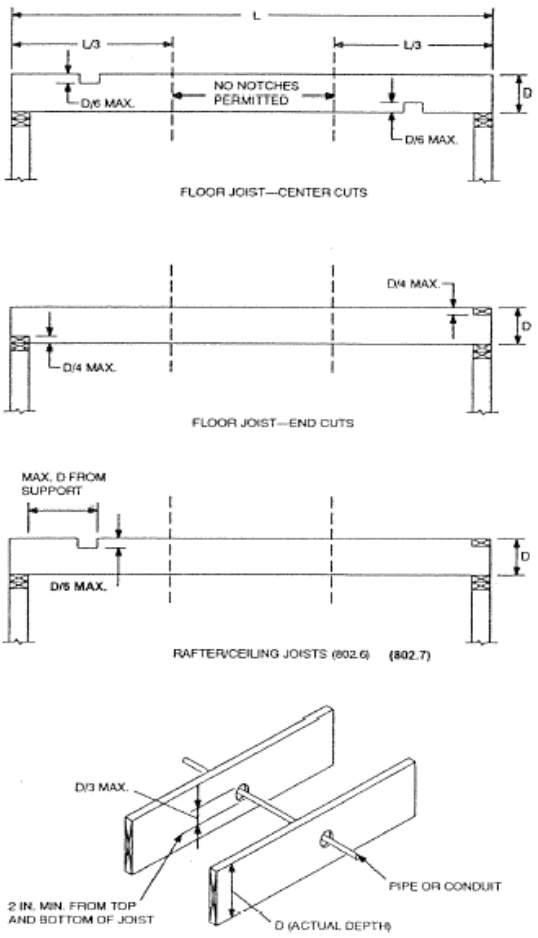
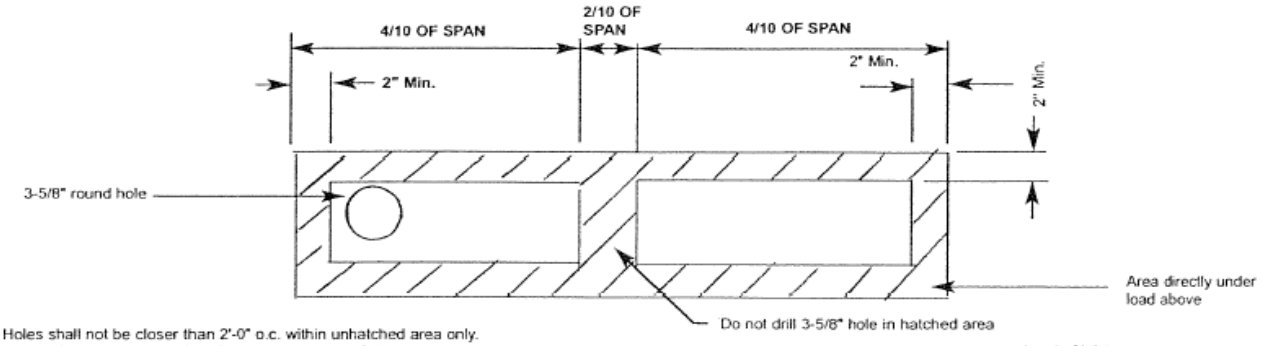


FIGURE R 502.8
CUTTING, NOTCHING AND DRILLING

1. Do not drill in center 2/10's of joist span.
2. Do not drill directly under load bearing walls at ends.
3. Do not drill closer than 2" to top or bottom edge.
4. Apply 4'-0" joist width x 1/2" CDX plywood with face grain running with joist to both sides using 6d nails or 1-1/2" screws 1" from top and bottom 4" o.c.



5. Holes shall not be closer than 2'-0" o.c. within unhatched area only.
6. Plywood shall be attached such that 2" minimum of plywood is on each side of the hole location, except when the hole is located within 2 feet of end of joist.

FIGURE R502.8a
ACCEPTABLE LOCATION OF 3 5/8" DIAMETER HOLE IN 2 X 10 JOIST

(Note: footnote 6 to read "Plywood shall be attached such that 2'-0" minimum of plywood is centered on each side of the hole location, except when the hole is located within 2'-0" of the end of joist.")

R503 – Floor Sheathing

TABLE R503.2.1.1(1)
ALLOWABLE SPANS AND LOADS FOR WOOD STRUCTURAL PANELS FOR ROOF AND SUBFLOOR SHEATHING AND COMBINATION SUBFLOOR UNDERLAYMENT[a,b,c]

SPAN RATING *ROOF/FLOOR*	MINIMUM NOMINAL PANEL THICKNESS (inch)	MAXIMUM SPAN (inches)[d]		LOAD (pounds per square foot, at maximum span)		MAXIMUM SPAN (inches)
		With edge support	Without edge support	Total load	Live load	
Sheathing[e]		Roof[f]				Subfloor[l]
12/0	5/16	12	12	40	30	0
16/0	5/16	16	16	40	30	0
20/0	5/16	20	20	40	30	0
24/0	3/8	24	20[g]	40	30	0
24/16	7/16	24	24	50	40	16
32/16	15/32, 1/2	32	28	40	30	16[h]
40/20	19/32, 5/8	40	32	40	30	20[h,i]
48/24	23/32, 3/48	48	36	45	35	24
60/32	7/8	60	48	45	35	32
Underlayment, CC plugged, single floor[e]		Roof[f]				Combination subfloor underlayment[k]
16 o.c.	19/32, 5/8	24	24	50	40	16[i]
20 o.c.	19/32, 5/8	32	32	40	30	20[i,j]
24 o.c.	23/32, 3/4	48	36	35	25	24
32 o.c.	7/8	48	40	50	40	32
48 o.c.	1 3/32, 1 1/8	60	48	50	40	48

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kN/m^2.

a. The allowable total loads were determined using a dead load of 10 psf. If the dead load exceeds 10 psf, then the live load shall be reduced accordingly.
b. Panels continuous over two or more spans with long dimension perpendicular to supports. Spans shall be limited to values shown because of possible effect of concentrated loads.
c. Applies to panels 24 inches or wider.
d. Lumber blocking, panel edge clips (one midway between each support, except two equally spaced between supports when span is 48 inches), tongue-and-groove panel edges, or other approved type of edge support.
e. Includes Structural 1 panels in these grades.
f. Uniform load deflection limitation: $1/180$ of span under live load plus dead load, $1/240$ of span under live load only.
g. Maximum span 24 inches for $15/32$- and $1/2$-inch panels.
h. Maximum span 24 inches where $3/4$-inch wood finish flooring is installed at right angles to joists.
i. Maximum span 24 inches where 1.5 inches of lightweight concrete or approved cellular concrete is placed over the subfloor.
j. Unsupported edges shall have tongue-and-groove joints or shall be supported with blocking unless minimum nominal $1/4$-inch-thick underlayment with end and edge joints offset at least 2 inches or 1.5 inches of lightweight concrete or approved cellular concrete is placed over the subfloor, or $3/4$-inch wood finish flooring is installed at right angles to the supports. Allowable uniform live load at maximum span, based on deflection of $1/360$ of span, is 100 psf.
k. Unsupported edges shall have tongue-and-groove joints or shall be supported by blocking unless nominal $1/4$-inch-thick underlayment with end and edge joints offset at least 2 inches or $3/4$-inch wood finish flooring is installed at right angles to the supports. Allowable uniform live load at maximum span, based on deflection of $1/360$ of span, is 100 psf, except panels with a span rating of 48 on center are limited to 65 psf total uniform load at maximum span.

TABLE R602.3(1)
FASTENER SCHEDULE FOR STRUCTURAL MEMBERS

DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER[a,b,c,d]	SPACING OF FASTENERS
Joist to sill or girder, toe nail	3-8d	—
1″ × 6″ subfloor or less to each joist, face nail	2-8d 2 staples, $1^3/_4$″	— —
2″ subfloor to joist or girder, blind and face nail	2-16d	—
Sole plate to joist or blocking, face nail	16d	16″ o.c.
Top or sole plate to stud, end nail	2-16d	—
Stud to sole plate, toe nail	3-8d or 2-16d	—
Double studs, face nail	10d	24″ o.c.
Double top plates, face nail	10d	24″ o.c.
Sole plate to joist or blocking at braced wall panels	3-16d	16″ o.c.
Double top plates, minimum 24-inch offset of end joints, face nail in lapped area	8-16d	—
Blocking between joists or rafters to top plate, toe nail	3-8d	—
Rim joist to top plate, toe nail	8d	6″ o.c.
Top plates, laps at corners and intersections, face nail	2-10d	—
Built-up header, two pieces with $^1/_2$″ spacer	16d	16″ o.c. along each edge
Continued header, two pieces	16d	16″ o.c. along each edge
Ceiling joists to plate, toe nail	3-8d	—
Continuous header to stud, toe nail	4-8d	—
Ceiling joist, laps over partitions, face nail	3-10d	—
Ceiling joist to parallel rafters, face nail	3-10d	—
Rafter to plate, toe nail	2-16d	—
1″ brace to each stud and plate, face nail	2-8d 2 staples, $1^3/_4$″	— —
1″ x 6″ sheathing to each bearing, face nail	2-8d 2 staples, $1^3/_4$″	— —
1″ x 8″ sheathing to each bearing, face nail	2-8d 3 staples, $1^3/_4$″	— —
Wider than 1″ x 8″ sheathing to each bearing, face nail	3-8d 4 staples, $1^3/_4$″	— —
Built-up corner studs	10d	24″ o.c.
Built-up girders and beams, 2-inch lumber layers	10d	Nail each layer as follows: 32″ o.c. at top and bottom and staggered. Two nails at ends and at each splice.
2″ planks	2-16d	At each bearing
Roof rafters to ridge, valley or hip rafters: toe nail face nail	 4-16d 3-16d	 — —
Rafter ties to rafters, face	3-8d	—

DESCRIPTION OF BUILDING MATERIALS	DESCRIPTION OF FASTENER[b,c,d,e]	SPACING OF FASTENERS	
		Edges (inches)[i]	Intermediate supports[c,e] (inches)
Wood structural panels, subfloor, roof and wall sheathing to framing, and particleboard wall sheathing to framing			
$^5/_{16}$"-$^1/_2$"	6d common nail (subfloor, wall) 8d common nail (roof)[f]	6	12[g]
$^{19}/_{32}$" -1"	8d common nail	6	12[g]
$1^1/_8$"-$1^1/_4$"	10d common nail or 8d deformed nail	6	12
Other wall sheathing[h]			
$^1/_2$" regular cellulosic fiberboardsheathing	$1^1/_2$" galvanized roofing nail 6d common nail staple 16 ga., $1^1/_2$ long	3	6
$^1/_2$" structural cellulosic fiberboard sheathing	$1^1/_2$" galvanized roofing nail 8d common nail staple 16 ga., $1^1/_2$ long	3	6
$^{25}/_{32}$" structural cellulosic fiberboard sheathing	$1^3/_4$" galvanized roofing nail 8d common nail staple 16 ga., $1^3/_4$ long	3	6
$^1/_2$" gypsum sheathing	$1^1/_2$" galvanized roofing nail; 6d common nail; staple galvanized, $1^1/_2$" long; $1^1/_4$" screws, Type W or S	4	8
$^5/_8$" gypsum sheathing	$1^3/_4$" galvanized roofing nail; 8d common nail; staple galvanized, $1^5/_8$" long; $1^5/_8$" screws, Type W or S	4	8
Wood structural panels, combination subfloor underlayment to framing			
$^3/_4$" and less	6d deformed nail or 8d common nail	6	12
$^7/_8$"-1"	8d common nail or 8d deformed nail	6	12
$1^1/_8$"-$1^1/_4$"	10d common nail or 8d deformed nail	6	12

For SI: 1 inch = 25.4mm, 1 foot = 304.8 mm, 1 mile per hour = 1.609 km/h.

a. All nails are smooth-common, box or deformed shanks except where otherwise stated. Nails used for framing and sheathing connections shall have minimum average bending yield strengths as shown: 80 ksi (551MPa) for shank diameter of 0.192 inch (20dcommon nail),90 ksi (620MPa) for shank diameters larger than 0.142 inch but not larger than 0.177 inch, and 100 ksi (689 MPa) for shank diameters of 0.142 inch or less.

b. Staples are 16 gage wire and have a minimum 7/16-inch on diameter crown width.

c. Nails shall be spaced at not more than 6 inches on center at all supports where spans are 48 inches or greater.

d. Four-foot-by-8-foot or 4-foot-by-9-foot panels shall be applied vertically.

e. Spacing of fasteners not included in this table shall be based on Table R602.3(2).

f. For regions having basic wind speed of 110 mph or greater, 8d deformed nails shall be used for attaching plywood and wood structural panel roof sheathing to framing within minimum 48-inch distance from gable end walls, if mean roof height is more than 25 feet, up to 35 feet maximum.

g. For regions having basic wind speed of 100mph or less, nails for attaching wood structural panel roof sheathing to gable endwall framing shall be spaced 6 inches on center. When basic wind speed is greater than 100mph, nails for attaching panel roof sheathing to intermediate supports shall be spaced 6 inches on center for minimum 48-inch distance from ridges, eaves and gable end walls; and 4 inches on center to gable end wall framing.

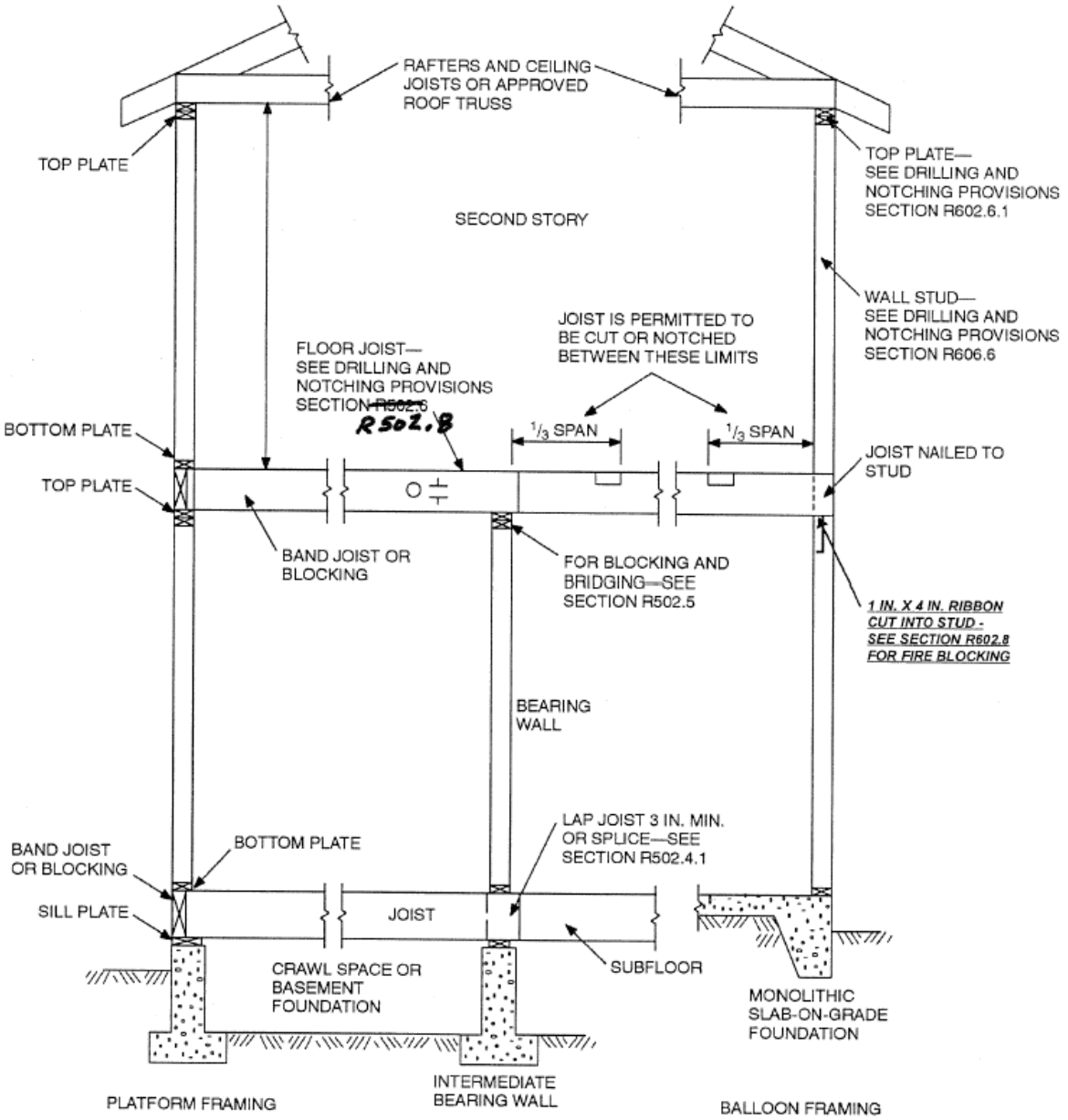
h. Gypsum sheathing shall conform to ASTM C 79 and shall be installed in accordance with GA 253. Fiberboard sheathing shall conform to either AHA 194.1 or ASTM C 208.

i. Spacing of fasteners on floor sheathing panel edges applies to panel edges supported by framing members and at all floor perimeters only. Spacing of fasteners on roof sheathing panel edges applies to panel edges supported by framing members and at all roof plane perimeters. Blocking of roof or floor sheathing panel edges perpendicular to the framing members shall not be required except at intersection of adjacent roof planes. Floor and roof perimeter shall be supported by framing members or solid blocking. Roof sheathing 7/16" or greater in thickness does not require perimeter blocking.

(Note: Add ledger strip nailing to this section)

FIGURE 602.3(1)

WALL CONSTRUCTION



For SI: 1 inch = 25.4 mm.

FIGURE R602.3(1)
TYPICAL WALL, FLOOR AND ROOF FRAMING

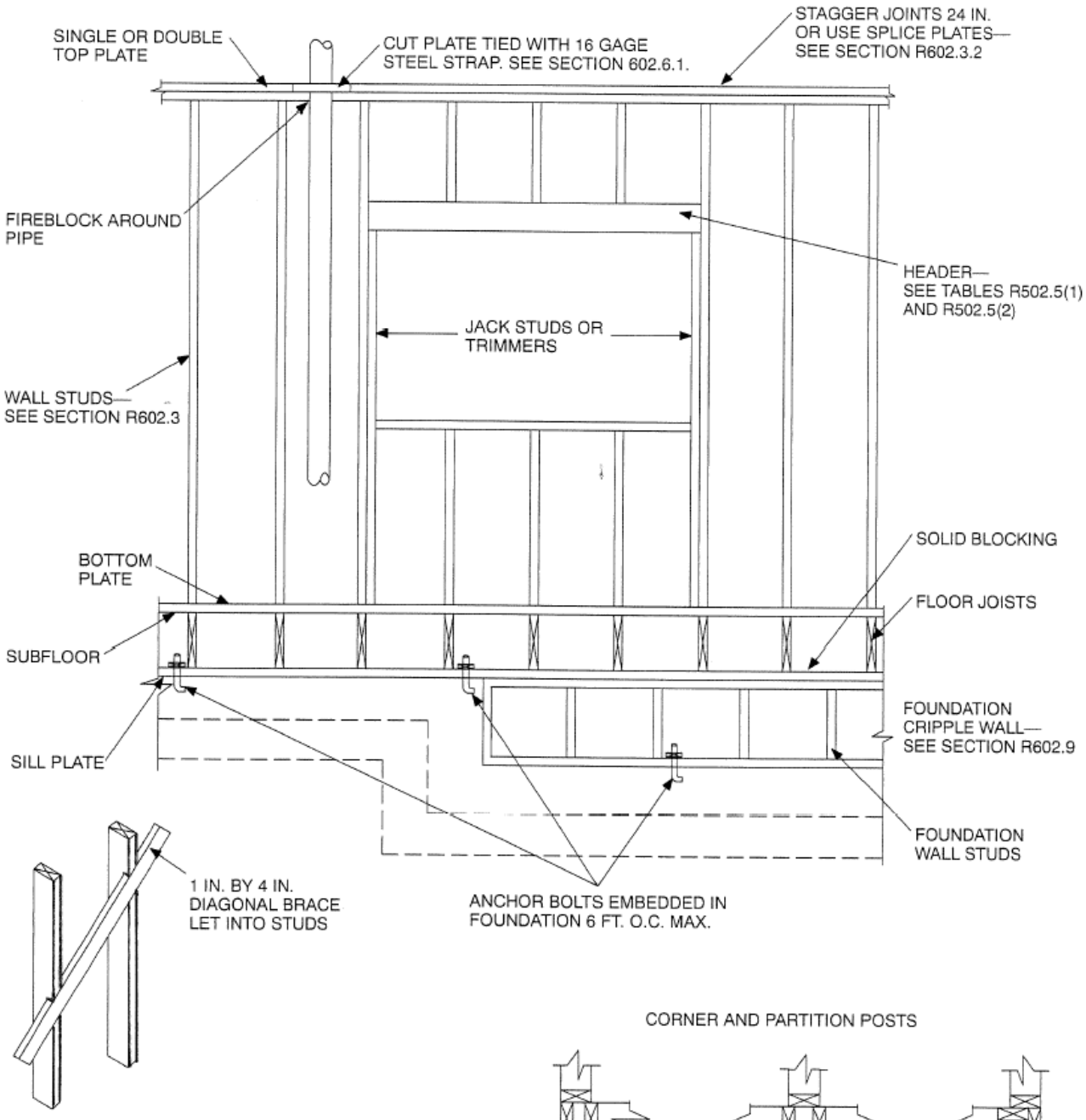


FIGURE R602.3(2)
FRAMING DETAILS

R602.3.1 Stud size, height and spacing. The size, height and spacing of studs shall be in accordance with Table R602.3.1.

Exceptions:

1. Utility grade studs shall not be spaced more than 16 inches (406 mm) on center, shall not support more than a roof and ceiling, and shall not exceed 8 feet (2438 mm) in height for exterior walls and load-bearing walls or 10 feet (3048mm) for interior nonload-bearing walls.

2. Studs more than 10 feet (3048 mm) in height which are in accordance with Table R602.3.1.

R602.6 Drilling and notching–studs. Drilling and notching of studs shall be in accordance with the following:
1. Notching. Any stud in an exterior wall or bearing partition may be cut or notched to a depth not exceeding 25 percent of its width. Studs in nonbearing partitions may be notched to a depth not to exceed 40 percent of a single stud width. Notching of bearing studs shall be on one edge only and not to exceed ¼ the height of the stud. Notching shall not occur in the bottom or top 6" of bearing studs.
2. Drilling. Any stud may be bored or drilled, provided that the diameter of the resulting hole is no more than 60 percent of the stud width, the edge of the hole is no more than 5/8 inch (16 mm) to the edge of the stud, and the hole shall not be closer than 6" from an adjacent hole or notch. Holes not exceeding ¾" diameter can be as close as 1 ½" on center spacing. Studs located in exterior walls or bearing partitions drilled over 40 percent and up to 60 percent shall also be doubled with no more than two successive doubled studs bored. See Figures R602.6(1) and R602.6(2).
Exception: Use of approved stud shoes is permitted when they are installed in accordance with the manufacturer's recommendations.
3. Cutting and notching of studs may be increased to 65% of the width of the stud in exterior and interior walls and bearing partitions, provided that one of the following conditions are met:

3.1. The wall section is reinforced with ½ inch exterior grade plywood or equivalent reinforcement on the notched side of the wall. Plywood, if used, shall reach from the floor to ceiling and at least one stud further on each side of the section that has been notched or cut.

3.2. The exterior walls of a kitchen may be reinforced by placing ½ inch plywood or equivalent reinforcement on the notched side of the wall. Plywood, if used, shall reach from the floor to countertop height and at least one stud further on each side of the section that has been notched or cut.

602.10 Wall bracing. All exterior walls shall be braced in accordance with this section.

602.10.1.1 Spacing. Spacing of exterior braced wall lines shall not exceed 50 feet on center in both the longitudinal and transverse directions in each story without an intersecting interior wall.
Exception: Deleted.

602.10.5 Continuous structural panel sheathing. When continuous wood structural panel sheathing is provided in accordance with Method 3 of R602.10.3 on all sheathable areas of a braced wall line including areas above and below openings, braced wall panel lengths shall be in accordance with Table R602.10.5. Wood structural panel sheathing shall be installed at corners in accordance with Figure R602.10.5. The bracing amounts in Table R602.10.1 for Method 3 shall be permitted to be multiplied by a factor of 0.9 for walls with a maximum opening height that does not exceed 85 percent of the wall height or a factor of 0.8 for walls with a maximum opening height that does not exceed 67 percent of the wall height.

TABLE R602.10.5
LENGTH REQUIREMENTS FOR BRACED WALL PANELS IN A

CONTINUOUSLY SHEATHED WALL[a, b]

LENGTH OF BRACED WALL PANEL (inches)			MAXIMUM OPENING HEIGHT NEXT TO THE BRACED WALL PANEL (% of wall height)
8-foot wall	9-foot wall	10-foot wall	
48	54	60	100%
32	36	40	85%
24	27	30	65%

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound per square foot = 0.0479 kN/m^2.

a. Linear interpolation shall be permitted.

b. Full-height sheathed wall segments to either side of garage openings that support light frame roofs with roof covering dead loads of 3 psf or less shall be permitted to have a 4:1 aspect ratio.

c. Braced wall panels, assembled in accordance with Section R602.10.3, with wood structural panel sheathing on both sides, may be used to reduce the panel lengths shown by 50%.

(Notes: Figure R602.10.6.2, add foundation break line all the way to the top on side listing minimum double 2x4 post, add language at "Min. Double 2x4 post in a braced wall segment", at the top add under the 6'-18' the words "Finished opening")

606.1.1 Professional registration not required. When the empirical design provisions of ACI 530/ASCE 5/TMS 402 Chapter 5 or the provisions of this section are used to design masonry, project drawings, typical details and specifications are not required to bear the seal of the architect or engineer.

R606.1.2 Used Brick. Used Materials shall not be used unless such materials conform to these requirements and have been cleaned.

Exception: Used materials may be used for interior non-bearing conditions.

606.6.1 Pier cap. Hollow piers shall be capped with 4 inches (102 mm) of solid masonry or concrete for one story; and 8 inches of solid masonry or concrete for two story and two and one-half story or shall have cavities of the top course filled with concrete or grout or other approved methods.

(Note: Table R606.5 footnote C need to check with ICC to see if reference should be R609 instead of R608)

607.2.1.1 Mortar joint thickness tolerance. Mortar joint thickness shall be within the following tolerances from the specified dimensions:

1. Bed joint: -1/8 inch (3.2mm), + 3/8 inch (9.5 mm).

   Exception: For the purposes of leveling, the thickness of the bed joint of the starting course placed over foundation shall not be less than ¼ inch and not more than 1-1/2 inches.

2. Head joint: -1/4 inch (6.4 mm), + 3/8 inch (9.5 mm).

3. Deleted

Exception: Nonload-bearing masonry elements and masonry veneers designed and constructed in accordance with Section R703.7 are not required to meet these tolerances.

R611.1 General. Insulating Concrete Form walls shall be designed and constructed in accordance with the provisions of this section or in accordance with the provisions of ACI 318. When ACI 318 or the provisions of this section are used to design insulating concrete form walls, project drawings, typical details and specifications are not required to bear the seal of a registered design professional.

R613.1 General. This section prescribes performance and construction requirements for exterior window systems installed in wall systems. Windows shall be installed and flashed in accordance with the manufacturer's written installation instructions or ASTM E 2112 Standard Practice for Installation of Exterior Windows, Doors, and Skylites. Written installation instructions shall be provided by the manufacturer for each window.

R613.2 Window sills. Deleted.

Exceptions: Deleted.

TABLE R702.3.5
MINIMUM THICKNESS AND APPLICATION OF GYPSUM BOARD

THICKNESS OF GYPSUM BOARD (inches)	APPLICATION	ORIENTATION OF GYPSUM BOARD TO FRAMING	MAXIMUM SPACING OF FRAMING MEMBERS (inches o.c.)	MAXIMUM SPACING OF FASTENERS (inches)		SIZE OF NAILS FOR APPLICATION TO WOOD FRAMING[c]
				Nails[a]	Screws[b]	
Application without adhesive						
3/8	Ceiling[d]	Perpendicular	16	7	12	13 gage, 1 1/4" long, 19/64" head; 0.098 diameter, 1 1/4" long, annular-ringed; or 4d cooler nail, 0.080" diameter, 1 3/8" long, 7/32" head.
	Wall	Either direction	16	8	16	
1/2	Ceiling	Either direction	16	7	12	13 gage, 1 3/8" long, 19/64" head; 0.098 diameter, 1 1/4" long, annular-ringed; 5d cooler nail, 0.086 diameter, 1 5/8" long, 15/64" head; or gypsum board nail, 0.086 diameter, 1 5/8" long, 9/32" head.
	Ceiling[d]	Perpendicular	24	7	12	
	Wall	Either direction	24	8	12	
	Wall	Either direction	16	8	16	
5/8	Ceiling	Either direction	16	7	12	13 gage, 1 5/8" long, 19/64" head; 0.098 diameter, 1 3/8" long, annular-ringed; 6d cooler nail, 0.092 diameter, 1 7/8" long, 1/4" head; or gypsum board nail, 0.0915 diameter, 1 7/8" long, 19/64" head.
	Ceiling[e]	Perpendicular	24	7	12	
	Wall	Either direction	24	8	12	
	Wall	Either direction	16	8	16	
Application with adhesive						
3/8	Ceiling[d]	Perpendicular	16	16	16	Same as above for 3/8" gypsum board
	Wall	Either direction	16	16	24	
1/2 or 5/8	Ceiling	Either direction	16	16	16	Same as above for 1/2" and 5/8" gypsum board, respectively
	Ceiling[d]	Perpendicular	24	12	16	
	Wall	Either direction	24	16	24	
two 3/8 layers	Ceiling	Perpendicular	16	16	16	Base ply nailed as above for 1/2" gypsum board; face ply installed with adhesive
	Wall	Either direction	24	24	24	

For SI: 1 inch = 25.4 mm.

a. For application without adhesive, a pair of nails spaced not less than 2 inches apart or more than 2 1/2 inches apart may be used with the pair of nails spaced 12 inches on center.

b. Screws shall be Type S or W per ASTM C 1002 and shall be sufficiently long to penetrate wood framing not less than 5/8 inch and metal framing not less than 3/8 inch.

c. Where metal framing is used with a clinching design to receive nails by two edges of metal, the nails shall be not less than 5/8 inch longer than the gypsum board thickness and shall have ringed shanks. Where the metal framing has a nailing groove formed to receive the nails, the nails shall have barbed shanks or be 5d, 13 1/2 gage, 1 5/8 inches long, 1 5/64-inch head for 1/2-inch gypsum board; and 6d, 13 gage, 1 7/8 inches long, 15/64-inch head for 5/8-inch gypsum board.

d. Three-eighths-inch-thick single-ply gypsum board shall not be used on a ceiling where a water-based textured finish is to be applied, or where it will be required to support insulation above a ceiling. On ceiling applications to receive a water-based texture material, either hand or spray applied, the gypsum board shall be applied perpendicular to framing. When applying a water-based texture material, the minimum gypsum board thickness shall be increased from 3/8 inch to 1/2 inch for 16-inch on center framing, and from 1/2 inch to 5/8 inch for 24-inch on center framing or 1/2-inch sag-resistant gypsum ceiling board shall be used.

e. Deleted.

R702.3.7 Horizontal gypsum board diaphragm ceilings. Deleted.

TABLE R702.3.7
SHEAR CAPACITY FOR HORIZONTAL WOOD-FRAMED GYPSUM BOARD DIAPHRAM CEILING ASSEMBLIES
Deleted.

TABLE R703.4
(Note: Delete footnote L and in the table)

Table R703.7.3
ALLOWABLE SPANS FOR LINTELS
SUPPORTING MASONRY VENEER

Size of Angles (1,3)	Maximum Span (2,4)
3-½″ x 3-½″ x ¼″	6'0"
5" x 3-½" x 5/16"	10'-0"

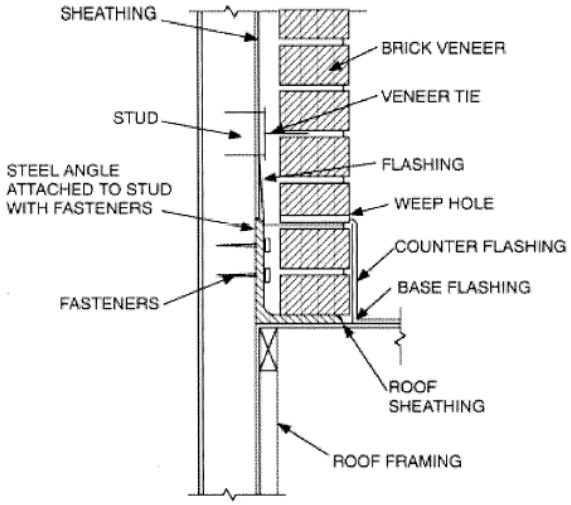
1. Long leg of the angle shall be placed in a vertical position.
2. Spans over 4' shall be shored up until cured.
3. Steel members indicated are adequate typical examples: other steel members including light gauge steel meetings structural design requirements may be used.
4. Spans over 10'-0" shall be designed in accordance with approved standard.

703.7.2.1 Support by steel angle. A minimum 6 inches by 4 inches by 5/16 inch (152 mm by 102 mm by 8 mm) steel angle, with the long leg placed vertically, shall be anchored to double 2 inches by 4 inches (51 mm by 102 mm) wood studs at a maximum on center spacing of 16 inches (406 mm) or shall be anchored to solid double 2x blocking firmly attached between single 2 inches by 4 inches (51 mm by 102 mm) wood studs at a maximum on center spacing of 16 inches (406 mm). Anchorage of the steel angle shall be a minimum of two 7/16 inch (11.1 mm) diameter by 4 inches (102 mm) lag screws at every double stud or shall be a minimum of two 7/16 inch (11.1 mm) diameter by 4 inches (102 mm) lag screws into solid double blocking with each pair of lag screws spaced at horizontal intervals not to exceed 16 inches (406 mm). The steel angle shall have a minimum clearance to underlying construction of 1/16 inch (1.6 mm). A minimum of two-thirds the width of the masonry veneer thickness shall bear on the steel angle. Flashing and weep holes shall be located in the masonry veneer wythe in accordance with Figure R703.7.2.1. The maximum height of masonry veneer above the steel angle support shall be 12 feet, 8 inches (3861 mm). The air space separating the masonry veneer from the wood backing shall be in accordance with R703.7.4 and R703.7.4.2. The method of support for the masonry veneer on steel angle shall be constructed in accordance with Figure R703.7.2.1.
The maximum slope of the roof construction without stops shall be 7:12. Roof construction with slopes greater than 7:12 but not more than 12:12 shall have stops of a minimum 3 inches x 3 inches x 1/4 inch (76 mm x 76 mm x 6 mm) steel plate welded to the angle at 24 inches (610 mm) on center along the angle or as approved by the building official.

703.7.2.2 Support by roof construction.
Veneer may be vertically supported on sloping surfaces as shown in Figure R703.7.2.2 and as described in the following provisions:
a. Surface slope shall not exceed 12:12.
b. Member supporting veneer loading shall have three times the capacity of similar beams, joist or rafters supporting the sloped surface.

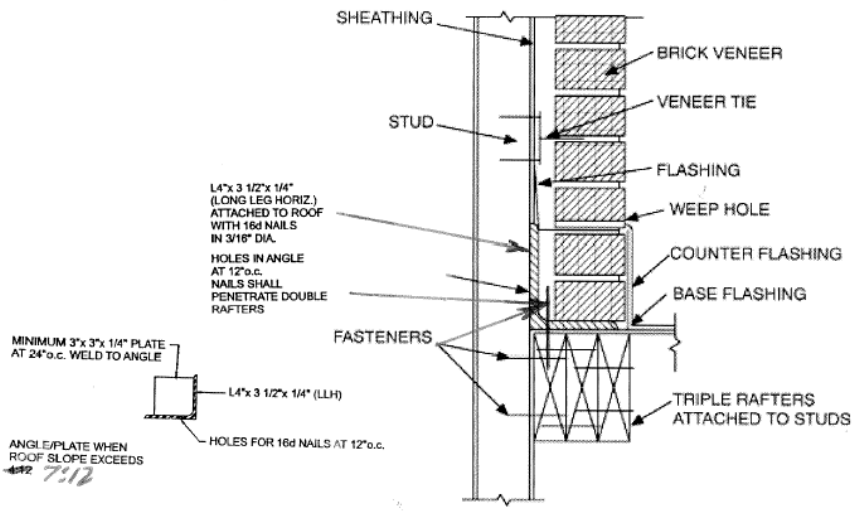
c. Minimum of 4 inches X 3-1/2 inches X ¼ inch steel angle be attached to the sloping surface. Attachment shall be made by drilling 3/16 inch diameter holes in the 4 inch leg of the angle at 12 inch o.c. and using 16d nails penetrating the triple members. When the slope exceeds 7:12, minimum 3 inches x 3 inches x ¼ inch plates shall be welded at 24 inches o.c. along the steel angle as stops to prevent the veneer from sliding down the slope. Minimum of 1 inch air space shall be maintained between the wall and veneer.
d. Flashing shall be installed over steel angle and a minimum of 6 inches under the wall sheathing.
e. Maximum height of 12 feet 8 inches above steel angle or as approved by a North Carolina design professional.

FIGURE R703.7.2.1
EXTERIOR MASONRY VENEER SUPPORT BY STEEL ANGLES



SUPPORT BY STEEL ANGLE

FIGURE R703.7.2.2
EXTERIOR MASONRY VENEER SUPPORT BY ROOF MEMBERS



SUPPORT BY ROOF MEMBERS

703.7.5 Flashing. Flashing of 6 mil poly or other corrosion-resistive material shall be located beneath the first course of masonry above finished ground level above the foundation wall or slab and at other points of support, including structural floors, shelf angles and lintels when masonry veneers are designed in accordance with Section R703.7. Top of base flashing shall be installed with a minimum 2" lap behind building paper or water repellent sheathing. See Section R703.8 for additional requirements.

703.7.6 Weepholes. Weepholes shall be provided in the outside wythe of masonry walls at a maximum spacing of 48 inches (1219 mm) on center. Weepholes shall not be less than 3/16 inch (4.8 mm) in diameter. Weepholes shall be located immediately above the flashing.

703.8 Flashing. Approved corrosion-resistive flashing shall be provided in the exterior wall envelope in such a manner as to prevent entry of water into the wall cavity or penetration of water to the building structural framing components. Install flashing per ASTM E 2112 Standard Practice for Installation of Exterior Windows, Doors, and Skylights, or in accordance with the manufacturer's supplied written instructions. Aluminum flashing may not be used in contact with cementitious material, except at counter flashing. The flashing shall extend to the surface of the exterior wall finish. Approved corrosion-resistant flashings shall be installed at all of the following locations:

(Note: no change to items 1-7)

R703.9 Exterior insulation finish systems, general. All Exterior Insulation Finish Systems (EIFS) shall be installed in accordance with the manufacturer's installation instructions and the requirements of this section. Decorative trim shall not be face nailed through the EIFS. The EIFS shall terminate not less than 6 inches (152 mm) above the finished ground level. Non drainable Exterior Insulation Finish Systems shall not be permitted.

R802.3.1 Ceiling joist and rafter connections. Ceiling joists and rafters shall be nailed to each other in accordance with Table R802.5.1(9), and the rafter shall be nailed to the top wall plate in accordance with Table R602.3(1). Ceiling joists shall be continuous or securely joined in accordance with Table R802.5.1(9) where they meet over interior partitions and are nailed to adjacent rafters to provide a continuous tie across the building when such joists are parallel to the rafters.

Where ceiling joists are not connected to the rafters at the top wall plate, joists connected higher in the attic shall be installed as rafter ties, or rafter ties shall be installed to provide a continuous tie. Where ceiling joists are not parallel to rafters, rafter ties shall be installed. Rafter ties shall be a minimum of 2-inch by 4-inch (51 mm by 102 mm) (nominal), installed in accordance with the connection requirements in Table R802.5.1(9), or connections of equivalent capacities shall be provided. Where ceiling joists or rafter ties are not provided, the ridge formed by these rafters shall be supported by a wall or girder designed in accordance with accepted engineering practice.

Collar ties or ridge straps to resist wind uplift shall be connected in the upper third of the attic space in accordance with Table R602.3(1).

A 1"x6" or 2"x4" collar ties shall be nailed in the upper third of the roof to every third pair of rafters not to exceed 4-feet on centers. Collar ties shall be connected to the rafters as specified in Table R602.3(1) for rafter ties.

TABLE R802.11

REQUIRED STRENGTH OF TRUSS OR RAFTER CONNECTIONS TO RESIST WIND UPLIFT FORCES of 20 PSF or Greater [a,b, c,e,f]

(Pounds per connection)

BASIC WIND SPEED (mph) (3–second gust)	ROOF SPAN (feet)							OVERHANGS[d] (pounds/foot)
	12	20	24	28	32	36	40	
85	-72	-120	-145	-169	-193	-217	-241	-38.55
90	-91	-151	-181	-212	-242	-272	-302	-43.22
100	-131	-218	-262	-305	-349	-393	-436	-53.36
110	-175	-292	-351	-409	-467	-526	-584	-64.56

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 mph = 0.447 m/s, 1 pound/foot = 14.5939 N/m, 1 pound = 0.454 kg.

The uplift connection requirements are based on a 30 foot mean roof height located in Exposure B. For Exposures C and D and for other mean roof heights, multiply the above loads by the Adjustment Coefficients in Table R301.2(3).

The uplift connection requirements are based on the framing being spaced 24 inches on center. Multiply by 0.67 for framing spaced 16 inches on center and multiply by 0.5 for framing spaced 12 inches on center.

The uplift connection requirements include an allowance for 10 pounds of dead load.

The uplift connection requirements do not account for the effects of overhangs. The magnitude of the above loads shall be increased by adding the overhang loads found in the table. The overhang loads are also based on framing spaced 24 inches on center. The overhang loads given shall be multiplied by the overhang projection and added to the roof uplift value in the table.

The uplift connection requirements are based on wind loading on end zones as defined in Figure 6-2 of ASCE 7. Connection loads for connections located a distance of 20% of the least horizontal dimension of the building from the corner of the building are permitted to be reduced by multiplying the table connection value by 0.7 and multiplying the overhang load by 0.8.

For wall-to-wall and wall-to-foundation connections, the capacity of the uplift connector is permitted to be reduced by 100 pounds for each full wall above. (For example, if a 600-pound rated connector is used on the roof framing, a 500-pound rated connector is permitted at the next floor level down).

802.11.1 Uplift resistance. Roof assemblies which are subject to wind uplift pressures of 20 pounds per square foot (0.958 kN/m^2) or greater shall have roof rafters or trusses attached to their supporting wall assemblies by connections capable of providing the resistance required in Table R802.11. Wind uplift pressures shall be determined using an effective wind area of 100 square feet (9.3 m^2) and Zone 1 in Table R301.2(2), as adjusted for height and exposure per Table R301.2(3). If the resulting adjusted wind-uplift pressure is 20 psf (0.96kN/m^2 or more, then uplift resistance must be provided in accordance with Table R802.11.

A continuous load path shall be provided to transmit the uplift forces from the rafter or truss ties to the foundation.

806.2 Minimum area. The total net free ventilating area shall not be less than 1 to 150 of the area of the space ventilated except that the total area is permitted to be reduced to 1 to 300, provided at least 50 percent and not more than 80 percent of the required ventilating area is provided by ventilators located in the upper portion of the space to be ventilated at least 3 feet (914 mm) above eave or cornice vents with the balance of the required ventilation provided by eave or cornice vents. As an alternative, the net free cross-ventilation area may be reduced to 1 to 300 when a vapor barrier having a transmission rate not exceeding 1 perm (5.7×10^{-11} kg/s $\cdot$ m^2 $\cdot$ Pa) is installed on the warm side of the ceiling.

Exceptions:

1. Enclosed attic/rafter spaces requiring less than 1 square foot of ventilation may be vented with continuous soffit ventilation only.
2. Enclosed attic/rafter spaces over unconditioned space may be vented with continuous soffit vent only.

807.1 Attic access. An attic access opening shall be provided to attic areas that exceed 100 square feet (9.29 m^2) and have a vertical height of 60 inches (1524 mm) or greater. The net clear opening shall not be less than 20 inches by 30 inches (508 mm by 762 mm) and shall be located in a hallway or other readily accessible location. A 30-inch (762 mm) minimum unobstructed headroom in the attic space shall be provided at some point above the access opening. See Section M1305.1.3 for access requirements where mechanical equipment is located in attics.

Exception: Concealed areas not located over the main structure including porches, areas behind knee walls, dormers, bay windows, etc. are not required to have access.

903.3 Coping. Parapet walls shall be coped with noncombustible, weatherproof materials of a width no less than the thickness of the parapet wall. Parapet coping shall extend 2 inches minimum down the faces of the parapet.

R903.5 Hail exposure. Deleted.

R903.5.1 Moderate hail exposure. Deleted.

R903.5.2 Severe hail exposure. Deleted.

Figure R903.5 Deleted.

905.2.6 Attachment. Asphalt shingles shall have the minimum number of fasteners required by the manufacturer. For normal application, asphalt shingles shall be secured to the roof with not less than four fasteners per strip shingle or two fasteners per individual shingle. Where the roof slope exceeds 20 units vertical in 12 units horizontal (20:12), special methods of fastening are required. For roofs located where the basic wind speed per Figure R301.2(4) is 110 mph (49 m/s) or higher, special methods of fastening are required. Special fastening methods shall be tested in accordance with ASTM D 3161, Class F. Asphalt shingle wrappers shall bear a label indicating compliance with ASTM D 3161, Class F.

Exceptions: Asphalt strip shingles shall have a minimum of six fasteners per shingle where the roof is in one of the following categories:

1. The basic wind speed per Figure R301.2(4) is 110 miles per hour (177 km/h) or greater and the eave is 20 feet (6096 mm) or higher above grade.
2. The basic wind speed per Figure R301.2(4) is 120 miles per hour (193 km/h) or greater.
3. Special mountain regions per Figure R301.2.(4).

R905.2.7.1 Ice Protection. In areas where the average daily temperature in January is 25°F (-4°C) or less or when Table R301.2(1) criteria so designates, an ice barrier that consists of a least two layers of underlayment cemented together or of a self-adhering polymer modified bitumen sheet, shall be used in lieu of normal underlayment and extend from the eave's edge to a point at least 24 inches (610 mm) inside the exterior wall line of the building.
Exception: Detached accessory structures that contain no conditioned floor area.

R905.2.8.3 Crickets and saddles. A cricket or saddle shall be installed on the ridge side of any chimney or penetration more than 30 inches (762 mm) wide as measured perpendicular to the slope. Cricket or saddle coverings shall be sheet metal or of the same material as the roof covering. Provide flashing at the intersection of the cricket or saddle and the chimney. See Section R703.8.

R905.4.3.1 Ice Protection. In areas where the average daily temperature in January is 25°F (-4°C) or less or when Table R301.2(1) criteria so designates, an ice barrier that consists of a least two layers of underlayment cemented together or of a self-adhering polymer modified bitumen sheet, shall be used in lieu of normal underlayment and extend from the eave's edge to a point at least 24 inches (610 mm) inside the exterior wall line of the building.
Exception: Detached accessory structures that contain no conditioned floor area.

R905.5.3.1 Ice Protection. In areas where the average daily temperature in January is 25°F (-4°C) or less or when Table R301.2(1) criteria so designates, an ice barrier that consists of a least two layers of underlayment cemented together or of a self-adhering polymer modified bitumen sheet, shall be used in lieu of normal underlayment and extend from the eave's edge to a point at least 24 inches (610 mm) inside the exterior wall line of the building.
Exception: Detached accessory structures that contain no conditioned floor area.

R905.6.3.1 Ice Protection. In areas where the average daily temperature in January is 25°F (-4°C) or less or when Table R301.2(1) criteria so designates, an ice barrier that consists of a least two layers of underlayment cemented together or of a self-adhering polymer modified bitumen sheet, shall be used in lieu of normal underlayment and extend from the eave's edge to a point at least 24 inches (610 mm) inside the exterior wall line of the building.
Exception: Detached accessory structures that contain no conditioned floor area.

R905.7.3.1 Ice Protection. In areas where the average daily temperature in January is 25°F (-4°C) or less or

when Table R301.2(1) criteria so designates, an ice barrier that consists of a least two layers of underlayment cemented together or of a self-adhering polymer modified bitumen sheet, shall be used in lieu of normal underlayment and extend from the eave's edge to a point at least 24 inches (610 mm) inside the exterior wall line of the building.
Exception: Detached accessory structures that contain no conditioned floor area.

R905.8.3.1 Ice Protection. In areas where the average daily temperature in January is 25°F (-4°C) or less or when Table R301.2(1) criteria so designates, an ice barrier that consists of a least two layers of underlayment cemented together or of a self-adhering polymer modified bitumen sheet, shall be used in lieu of normal underlayment and extend from the eave's edge to a point at least 24 inches (610 mm) inside the exterior wall line of the building.
Exception: Detached accessory structures that contain no conditioned floor area.

R907.3 Re-covering versus replacement. New roof coverings shall not be installed without first removing existing roof coverings where any of the following conditions occur:

1. Where the existing roof or roof covering is water-soaked or has deteriorated to the point that the existing roof or roof covering is not adequate as a base for additional roofing.
2. Where the existing roof covering is wood shake, slate, clay, cement or asbestos-cement tile.
3. Where the existing roof has two or more applications of any type of roof covering.
4. Deleted.

Exceptions:

1. Complete and separate roofing systems, such as standing-seam metal roof systems, that are designed to transmit the roof loads directly to the building's structural system and that do not rely on existing roofs and roof coverings for support, shall not require the removal of existing roof coverings.
2. Installation of metal panel, metal shingle, and concrete and clay tile roof coverings over existing wood shake roofs shall be permitted when the application is in accordance with Section R907.4.
3. The application of new protective coating over existing spray polyurethane foam roofing systems shall be permitted without tear-off of existing roof coverings.

TABLE R1003.1
SUMMARY OF REQUIREMENTS FOR MASONRY FIREPLACES AND CHIMNEYS

ITEM	LETTER[a]	REQUIREMENTS
Hearth slab thickness	A	4"
Hearth extension (each side of opening)	B	8" fireplace opening < 6 sq. ft. 12" fireplace opening ≥ 6 sq. ft.
Hearth extension[c] (front of opening)	C	16" fireplace opening < 6 sq. ft. 20" fireplace opening ≥ 6 sq. ft.
Hearth reinforcing	D	Reinforced to carry its own weight and all imposed loads.
Thickness of wall of firebox	E	10" solid brick or 8" where a firebrick lining is used. Joints in firebrick $^1/_4$" max.
Distance from top of opening to throat	F	8"
Smoke chamber wall thickness unlined walls	G	6"
Chimney Vertical reinforcing[b]	H	8"
Horizontal reinforcing[b]	J	Four No. 4 full-length bars for chimney up to 40" wide. Add two No. 4 bars for each additional 40" or fraction of width or each additional flue.
Bond beams[b]	K	$^1/_4$" ties at 18" and two ties at each bend in vertical steel.
Fireplace lintel	L	Noncombustible material.
Chimney walls with flue lining	M	Solid masonry units or hollow masonry units grouted solid with at least 4 inch nominal thickness.
Walls with unlined flue	N	8" solid masonry.
Distances between adjacent flues	—	See Section R1001.10.
Effective flue area (based on area of fireplace opening)	P	See Section R.1001.12
Clearances: Combustible material Mantel and trim Above roof	R	 See Sections R1001.15 and R1003.12. See Section R1001.13. 2' at roofline and 2' at 10'.
Anchorage[b] Strap Number Embedment into chimney Fasten to Bolts	S	 $^3/_{16}$" x 1" Two 12" hooked around outer bar with 6 extension 4 joists Three $^1/_2$" diameter.
Footing Thickness Width	T	 12" min. 12" each side of fireplace wall.

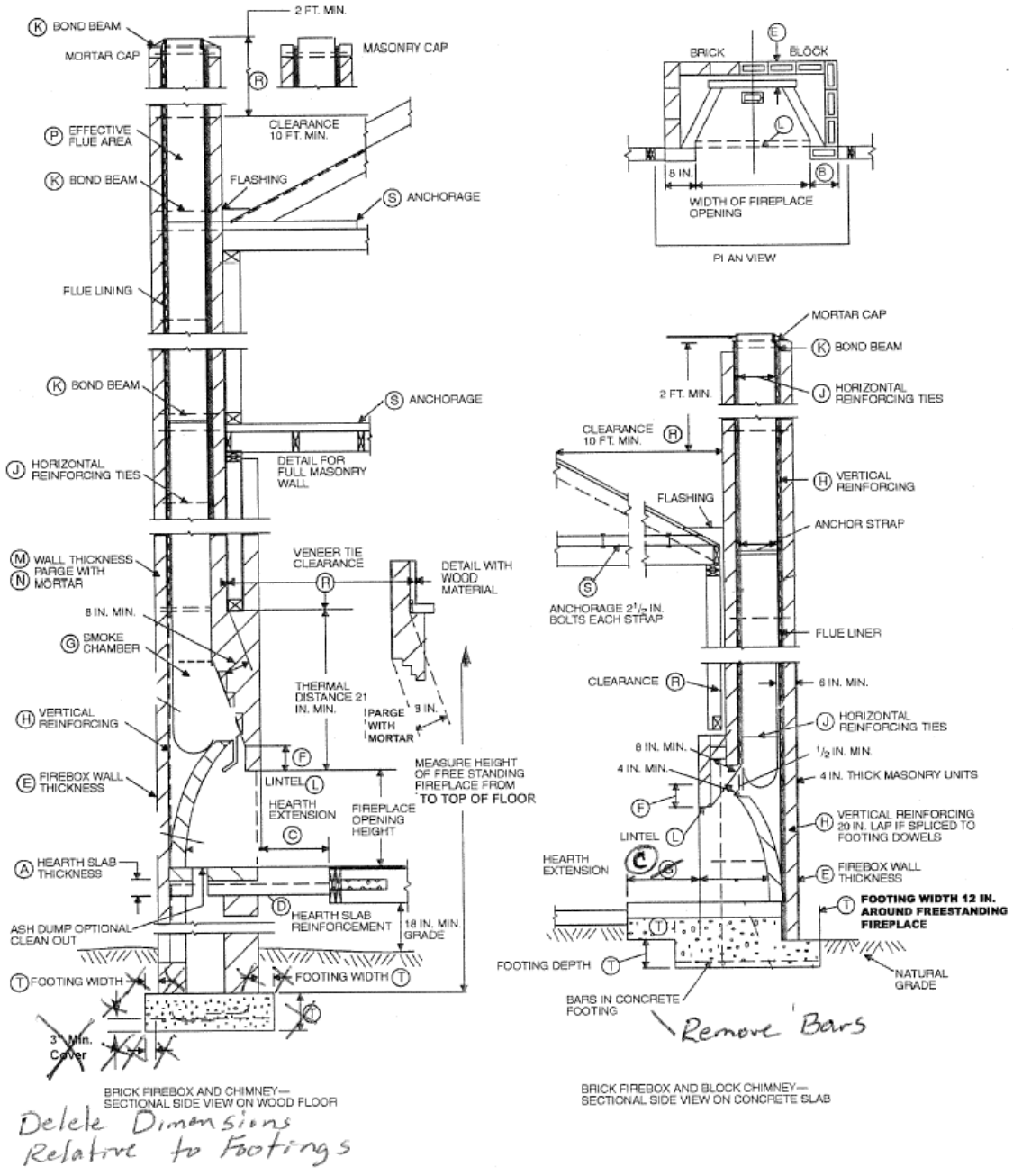
For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 square foot = 0.0929 m^2.

NOTE: This table provides a summary of major requirements for the construction of masonry chimneys and fireplaces. Letter references are to Figure R, which shows examples of typical construction. This table does not cover all requirements, nor does it cover all aspects of the indicated requirements. For the actual mandatory requirements of the code, see the indicated section of text.

a. The letters refer to Figure R1003.1.

b. Not required in Seismic Design Category A, B or C.

c. *See Exception #2, Section 1003.11.*



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

FIGURE R1003.1
FIREPLACE AND CHIMNEY DETAILS

1003.2 Footings and foundations. Footings for masonry fireplaces and their chimneys shall be constructed of concrete or solid masonry at least 12 inches (305 mm) thick and shall extend at least 12 inches (305 mm) beyond the face of the fireplace or foundation wall on all sides. Footings shall be founded on natural, undisturbed earth or engineered fill below frost depth. In areas not subjected to freezing, footings shall be at least 12 inches (305 mm) below finished grade.

1003.9 Termination. Chimneys shall extend at least 2 feet (610 mm) higher than any portion of a building within 10 feet (1048 mm), but shall not be less than 2 feet (610 mm) above the highest point where the chimney passes through the roof.

1003.12 Clay flue lining (installation). Flue liners shall be installed in accordance with ASTM C 1283 and extend from a point not less than 8 inches (203 mm) below the lowest inlet or, in the case of fireplaces, from the top of the smoke chamber to a point above the enclosing walls. The lining shall be carried up vertically, with a maximum slope no greater than 30 degrees from the vertical.

Flue liners shall be laid in medium-duty refractory mortar conforming to ASTMC199 (Types M or S) with tight mortar joints left smooth on the inside and installed to maintain an air space or insulation not to exceed the thickness of the flue liner separating the flue liners from the interior face of the chimney masonry walls. Flue lining shall be supported on all sides. Only enough mortar shall be placed to make the joint and hold the liners in position.

1003.18 Chimney clearances. All wood framing members shall be kept at least one (1) inch from chimney masonry and two (2) inches from fireplace masonry, excluding the fireplace facing material. Masonry chimneys which are completely on the exterior of a building against the sheathing are not required to comply with these provisions. (See Figure R1003.18).

Exception: Masonry chimneys equipped with a chimney lining system listed and labeled for use in chimneys in contact with combustibles in accordance with UL 1777 and installed in accordance with the manufacturer's installation instructions are permitted to have combustible material in contact with their exterior surfaces. However, this shall not eliminate the requirement for noncombustible firestopping in accordance with Section R1003.19

FIGURE R1003.18
CLEARANCE FROM COMBUSTIBLES R1005 – Factory Built Fireplace Stoves

Deleted.

R1005.1 General. Factory-built fireplace stoves, consisting of a freestanding fire chamber assembly, that have been tested and are listed by a nationally recognized testing laboratory, shall be installed in accordance with the requirements of said listing and the manufacturer's instructions. The supporting structure for a hearth extension shall be at the same level as the supporting structure for the fireplace unit of the firebox opening on or near the floor. The inlet shall be closable and designed to prevent burning material from dropping into concealed combustible spaces.

N1101.2 Compliance. *(add to end of IRC section)*
REScheck 4.0.0 for the 2006 IECC shall be permitted to demonstrate compliance, except that a SHGC of 0.4 is required for all zones and that envelope requirements may not be traded off against the use of high efficiency heating and cooling equipment. No trade-off calculations are required for termite inspection and treatment gaps required for slabs and basement walls.

N1101.7 Above code programs. Deleted.

N1101.8 Certificate. A permanent certificate shall be posted on or in the electrical distribution panel, inside the kitchen cabinet or other approved location. The certificate shall be completed by the builder or registered design professional. The certificate shall list the predominant *R*-values of insulation installed in or on ceiling/roof, walls, foundation (slab, basement wall, crawlspace wall and/or floor) and ducts outside conditioned spaces; *U* –factors for fenestration; and the solar heat gain coefficient (SHGC) of fenestration. Where there is more than one value for each component, the certificate shall list the value covering the largest area.

(Note: Add a NC specific map)
(Note: Table N1101.2 – Remove all states except NC and list the Zone 3 NC counties)
(Note: Table N1101.2.1 – Remove all states except NC)

Table N1102.1 Insulation and Fenestration Requirements By Component[a]

CLIMATE ZONE	FENESTRATION *U*-Factor	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC	CEILING *R*-VALUE	WOOD FRAME WALL *R-VALUE*	MASS WALL *R*-VALUE	FLOOR *R*-VALUE	BASEMENT[c] WALL *R*-VALUE	SLAB[d] *R*-VALUE AND DEPTH	CRAWL SPACE[c] WALL *R*-VALUE
1	1.20	0.75	0.40	30	13	3	13	0	0	0
2	0.75	0.75	0.40	30	13	4	13	0	0	0
3	0.40	0.65	0.40[e]	30	13	5	19	0	0	5/13
4 except Marine	0.40	0.60	0.40	38	13	5	19	10/13	5, 2 ft	10/13
5 and Marine 4	0.40	0.60	0.40	38	19 or 13+5[g]	13	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	19 or 13+5[g]	15	30[f]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19	30[f]	10/13	10, 4 ft	10/13

a. *R*-values are minimums. *U*-factors and SHGC are maximums. R-19 insulation shall be permitted to be compressed into a 2 x 6 cavity.
b. The fenestration *U*-factor column excluded skylights. The solar heat gain coefficient (SHGC) column applies to all glazed fenestration.
c. The first *R*-value applies to continuous insulation, the second to framing cavity insulation; either insulation meets the requirement.
d. R-5 shall be added to the required slab edge R-values for heated slabs.
e. Deleted.
f. Or insulation sufficient to fill the framing cavity. R-19 minimum. There is no requirement to exceed R-30.
g. "13+5" means R-13 cavity insulation plus R-5 insulated sheathing. If structural sheathing covers 25% or less of the exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.

Table N1102.1.2 Equivalent *U*-Factors[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR	SKYLIGHT[b] *U*-FACTOR	CEILING *U*-FACTOR	FRAME WALL *U*-FACTOR	MASS WALL *U*-FACTOR	FLOOR *U*-FACTOR	BASEMENT WALL *U*-FACTOR	CRAWL SPACE WALL *U*-FACTOR
1	1.20	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	0.75	0.75	0.035	0.082	0.165	0.064	0.360	0.477
3	0.40	0.65	0.035	0.082	0.141	0.047	0.360	0.136
4 except Marine	0.40	0.60	0.030	0.082	0.141	0.047	0.059	0.065
5 and Marine 4	0.40	0.60	0.030	0.060	0.082	0.033	0.059	0.065
6	0.35	0.60	0.026	0.060	0.06	0.033	0.059	0.065
7 and 8	0.35	0.60	0.026	0.057	0.057	0.033	0.059	0.065

N1102.2.5 Floors. Floor insulation shall be installed to maintain permanent contact with the underside of the subfloor decking.
Exception: Enclosed floor cavity such as garage ceiling, cantilevers or house on pilings with enclosed floor cavity. Band boards shall be insulated to maintain thermal envelope continuity.

N1102.2.7 Slab-on-grade floors. Slab-on-grade floors with a floor surface less than 23 inches below grade shall be insulated in accordance with Table N1102.1. The insulation shall extend downward from the top of the slab on the outside or inside of the foundation wall. Insulation located below grade shall be extended the distance provided in Table N1102.1 by any combination of vertical insulation, insulation extending under the slab or insulation extending out from the building. Insulation extending away from the building shall be protected by pavement or by a minimum of 10 inches (254 mm) of soil. The top edge of the insulation installed

between the exterior wall and the edge of the interior slab shall be permitted to be cut at a 45-degree (0.79 rad) angle away from the exterior wall. Slab-edge insulation is not required in jurisdictions designated by the code official as having a very heavy termite infestation. Slab edge insulation may be eliminated if trade-off calculations are performed.

N1102.2.8 Crawl space walls. As an alternative to insulating floors over crawl spaces, insulation of crawl space walls when the crawl space is not vented to the outside is permitted. See table N1102.1 for crawl space wall *R*-value requirements. See R-409.8.1 for installation requirements.

N1102.3.3 Glazed fenestration exemption. Up to 15 square feet (1.4 m^2) of glazed fenestration per dwelling unit shall be permitted to be exempt from *U*-factor and solar heat gain coefficient (SHGC) requirements in Section N1102.1. In addition, all door glazing shall be exempt from the SHGC requirement. In addition, impact glazing in windborne debris regions meeting the requirements of the Large Missle Test of ASTM E 1996 and of ASTM E 1886 shall be exempt from the *U*-factor requirement.

N1102.3.4 Opaque door exemption. Opaque doors separating conditioned and unconditioned space shall have a maximum *U*-factor of 0.35. One opaque door assembly is exempted from the *U*-factor requirement.

N1102.3.5 Thermally isolated sunroom *U*-factor. The maximum fenestration *U*-factor shall be 0.50 and the maximum skylight *U*-factor shall be 0.75. New windows and doors separating the sunroom from conditioned space shall meet the building thermal envelope requirements. Conditioned sunroom additions shall maintain thermal isolation; shall not be used as kitchens or sleeping rooms; and shall be served by a separate heating or cooling system, or be thermostatically controlled as a separate zone of the existing system.

N1102.3.6 Replacement fenestration. Where an entire existing fenestration unit is replaced with a new fenestration product, including frame, sash and glazing, the replacement fenestration unit shall meet the applicable requirements for *U*-factor and solar heat gain coefficient (SHGC) in Table N1102.1.

N1102.4.1 Building thermal envelope. The building thermal envelope shall be sealed to limit infiltration. The sealing methods between dissimilar materials shall allow for differential expansion and contraction. The following shall be caulked, gasketed, weatherstripped or otherwise sealed with an air barrier material, suitable film or solid material.

1. Deleted.
2. Site-built windows, doors and skylights.
3. Opening between window and door assemblies and their respective jambs and framings.
4. Utility penetrations.
5. Dropped ceilings or chases adjacent to the thermal envelope.
6. Floor framing under knee walls.
7. Walls and ceilings separating the garage from conditioned spaces.
8. Behind tubs and showers on exterior walls.
9. Common walls between dwelling units.
10. Other sources of infiltration.

N1102.5 Moisture control. The building design shall not create conditions of accelerated deterioration from moisture condensation. Above-grade frame walls, floors and ceiling not ventilated to allow moisture to escape shall be provided with an approved vapor retarder. The vapor retarder shall be installed on the warm-in-winter side of the thermal insulation.

Exceptions:

1. In construction where moisture or its freezing will not damage the materials.
2. Frame walls, floors and ceilings in jurisdictions in Zones 3 and 4A. (Crawl space floor vapor retarders are not exempted.)
3. Where other approved means to avoid condensation are provided.

N1102.5.1 Maximum fenestration *U*-factor. Deleted.

N1103.2.2 Sealing. Ducts, air handlers, filter boxes and building cavities used as ducts shall be sealed. Joints and seams shall comply with the NC Mechanical Code.

N1103.6 Equipment sizing. Heating and cooling equipment shall be sized as specified in the NC Mechanical Code.

CHAPTERS 12 THROUGH 42

Delete Chapters 12 through 42 of the International Residential Code and refer to:

1. **The North Carolina Mechanical Code, or**
2. **The North Carolina Fuel Gas Code, or**
3. **The North Carolina Plumbing Code, or**
4. **The North Carolina Electrical Code**

NEW CHAPTER
Chapter 44 – High Wind Zones

SECTION 4401
GENERAL

The provisions of this Chapter shall be applicable to buildings constructed in high wind zones as noted by the text. These provisions shall be in addition to or in lieu of the requirements for the Code requirements of Chapters 1-8.

4401.1 Alternate construction. In lieu of specific code requirements for structures in the 110, 120, and 130 miles per hour wind zones, compliance with Southern Building code Congress International Standard SSTD 10-99 or AF&PA Wood Frame Construction Manual for One and Two-Family Dwellings-01 is acceptable.

Section 4402

Table 4402(a)
Design Pressures For Doors and Windows[1,2,3,4] Positive and Negative In psf

Velocity (mph)	Mean Roof Height (ft)		
	15	**25**	**35[5]**
110	25	29	32
120	31	35	39
130	37	43	47

1. Alternate pressures may be determined by using the North Carolina Building Code, ASCE-7, or the *International Building Code*.
2. If window or door is more than 4 ft. from a corner, the pressure from this table shall be permitted to be multiplied by 0.87. This adjustment does not apply to garage doors.
3. For windows or doors in structures with a roof slope of 10 degrees (2:12) or less from the horizontal, the pressure from this table may be multiplied by 0.90.
4. Design pressure ratings based on the standards listed in Section R613 are adequate documentation of capacity to resist pressures from the table.
5. Where the mean roof height exceeds this table, values shall be determined by a design professional.

Table 4402(b)
Design Pressures in psf Garage Doors

Velocity (mph)	Mean Roof Height (ft)		
	15	**25**	**35**
110	20	23	26
120	25	29	32
130	30	35	39

1. The pressures in this table are for garage doors at least 9 ft. x 7 ft. and at least 2 ft. from the corner.
2. Alternate design pressures may be determined by using the North Carolina Building Code, ASCE-7, or the *International Building Code*.
3. For doors in a structure with a roof slope of 10 degrees (2:12) or less from the horizontal the pressures from this table may be multiplied by 0.90.
4. Design pressure ratings based on tests done according to ASTM E330 are adequate documentation.
5. Garage doors on the ground level of a structure in a flood zone do not have to meet the above design pressures provided all of the following conditions are met:
    a. Structure is anchored to the girders and top of the piling to resist the forces given in Chapter 44.
    b. The garage door occurs below the top of the piling.
    c. Provide openings at the garage level that comply with either of the following options:
        1. Design all exterior walls at the garage level to break away at 20 psf or less or:
        2. Provide openings (in walls at the garage level without the garage level without the garage door) equal to at least 20% of the total wall area from the ground to the roof.

SECTION 4403
Footings

4403.1 Foundation wall footings. Foundation wall footings in the 120 and 130 mph wind zones shall be a minimum of 8" x 24" for houses 2-1/2 stories and less. The footing for a three story building shall be 10" x 24". Footings shall be reinforced with three #4 (or two #5 bars) at 3 inches above the bottom of the footing. The bars shall be continuous or lapped 25 inches at all splices.

4403.2 Pier and curtain wall footings.

4403.2.1 Enlarged footings at piers. The curtain wall footing must meet the minimum projection requirements in Figure R403.1(1) and footing dimensions for the pier footings shall comply with Table 4403.2.1.

Table 4403.2.1
Footings to Resist Uplift From Piers in 120 and 130 mph Wind Zones Supporting Girders in Exterior Walls

Footing Size **Girder Span**			
Velocity (mph(	**4'-0"**	**6'-0"**	**8'-0"**
120	2'-0" x 2'-0" x 10"	2'-4" x 2'-4" x 10"	2'-8" x 2'-8" x 10"
130	3'-0" x 3'-0" x 10"	3'-4" x 3'-4" x 12"	3'-8" x 3'-8" x 12"

Note: See Table 4403.1a for 110 mph.

4403.2.2 Continuous width footings. Uniform continuous width footings for pier and curtain wall foundations shall be a minimum of 8 inches thick and 24 inches wide. Footings shall be reinforced with three #4 bars (or two #5 bars) at 3 inches above the bottom of the footing. The bars shall be continuous or lapped 25 inches at all splices.

4403.3 Footing dowels. All footings shall have dowels to match reinforcing in the foundation wall or pier above (See Section 4404.1.1 and 4404.3). Dowels shall have a standard hook length of 12 times the bar diameter embedded in the footing and shall lap the wall or pier reinforcing at least 25 inches.

Section 4404
WALL AND FOUNDATION ANCHORAGE

4404.1 Anchorage. Exterior walls of structures in the 120 and 130 mph wind zones shall be anchored to the footing to resist the forces specified in Section 4408.2, by the prescriptive requirements of this Section, or as allowed by Section 4408.4 and Figure 4404.3 (e). Exterior walls of structures in the 110 mph wind zone shall be anchored to the foundation wall, pier/curtain wall, or slab on grade with ½-inch anchor bolts 4-feet on center extended 15-inches into masonry and 7-inches into concrete and are exempt from the requirements of this Section.

Table 4404.1(a)
Structural Anchorage

Wind Speed (mph)	120	130
Maximum spacing (inches)	21	18

1. Required spacing of ½-inch anchor bolts where a **bond beam** is required and **for slab on grade with a single sole plate.** (See figure R403.1(1) for 110mph or less)

4404.1.1 Exterior foundation walls. Vertical reinforcement shall be installed not more than 2 feet from each corner at intervals not to exceed Table 4404.1.1 with all reinforced cells grouted and shall either terminate in a bond beam or connect to the wall above.

Tables 4404.1.1
Wall Reinforcement or Continuous Anchorage

Bar/Bolt Size (inches)	5/8	½	3/8
Maximum Spacing (inches)	96	72	42

1. Apples to 120 and 130 MPH wind zones.
2. Continuous anchorage from footing to girder or wall framing.
3. Applies to footing dowel bars, vertical reinforcement, and anchor bolts.
4. Spacing may exceed the tabulated values by up to 8 inches provided the total number of required bars is installed.

4404.1.2: An 8" x 8" concrete or CMU bond beam with one #5 bar shall be used at the floor level. The bar shall be continuous or lapped 25 inches at all splices.

Exception: The bond beam may be eliminated where the uplift connectors are continuous from the footing to the exterior wall framing and the rim band is continuous (doubled or adequately spliced).

4404.2 Sill Plates. A minimum 2 x 6 sill plate shall be installed.

Exception: Where the uplift connectors are continuous from the footing to the exterior wall framing.

4404.2.1 Sill plates shall be anchored with ½ inch anchor bolts with 2 x 2 x 1/8 inch washers at intervals not to exceed Table 4404.1(a). Where the vertical reinforcement bars/bolts terminate at the sill plate with a connector capable of developing the bar/bolt capacity, approved strap anchors from the sill plate to the wall framing shall be installed (Note: Cable clamps have no rated capacity when used with reinforcing steel or bolts).

Exception: Where the uplift connectors are continuous from the footing to the exterior wall framing, the spacing of the continuous anchorage may be increased per Table 4404.1.1.

4404.3 Exterior foundation piers. Vertical reinforcement shall be installed not more than 2 feet from each corner at intervals not to exceed Table 4404.1.1 with all reinforced cells grouted and shall connect to all sill plates, to the exterior girder, or to the wall above. SE figures 4404.3(a) thru 4404.3(d).

4404.3.1 Where the vertical reinforcement bars terminate at the sill plate, a minimum 2 x 6 sill plate and approved strap anchors from the sill plate to the wall framing shall be installed.

4404.3.2 Two #4 footing dowel bars shall be embedded into the footing and grouted to the top of each pier. If the vertical reinforcement bars are placed inside the piers (not between the pier/curtain wall), then one footing dowel bar may be omitted from each pier.

4404.4 Exterior concrete slab-on-grade footings. Anchorage shall be installed at intervals not to exceed Table 4404.1.1 and shall terminate in a minimum 2x4 double sole plate.

Exception: Anchorage shall be installed at intervals not to exceed Table 4404.1a where the bars terminate in a single sole plate. Approved strap anchors shall be installed from the single sole plate to the wall.

Table 4405(a)
Studs in 110, 120, and 130 mph Zones

Requirements for Wood Stud In:
Exterior Walls Supporting One Floor, Roof and Ceiling or Less
Exterior Non Loadbearing Walls in Two Story Structure or less
Interior Walls Supporting One Floor, Roof and Ceiling or Less

		110 MPH		110 MPH		120 MPH		130 MPH	
Stud Length	**Stud Spacing**	**2x4**	**2x6**	**2x4**	**2x6**	**2x4**	**2x6**	**2x4**	**2x6**
8	16	Species: Spruce Pine Fir (South) Without Structural Sheathing		Species: Spruce Pine Fir (South) With 3/8" Wood Structural Sheathing					
		#2	Stud	Stud	Stud	Stud	Stud	#2	Stud
8	24	#2	Stud	#2	Stud	#2	Stud	#2	Stud
10	16	#2	Stud	#2	Stud	#2	Stud	#2	Stud
10	24	Design	#2	Design	#2	Design	#2	Design	#2
		Species: Spruce Pine Fir Without Structural Sheathing		Species: Spruce Pine Fir (South) With 3/8" Wood Structural Sheathing					
8	16	Stud	Stud	Stand	Stud	Stud	Stud	#3	Stud
8	24	#2	Stud	#3	Stud	#2	Stud	#2	Stud
10	16	#2	Stud	#2	Stud	#2	Stud	#2	Stud
10	24	Design	Stud	#2	Stud	Design	Stud	Design	Stud
		Species: Southern Pine without Structural Sheathing		Species: Southern Pine with 3/8" Wood Structural Sheathing					
8	16	Stud	Stud	Stand	Stud	Stud	Stud	Stud	Stud
8	24	#2	Stud	Stud	Stud	#2	Stud	#2	Stud
10	16	#2	Stud	Stud	Stud	#2	Stud	#2	Stud
10	24	Design	Stud	#2	Stud	#2	Stud	Design	Stud

Explanation of Table Entries
Design – Studs with this entry shall be in accordance with accepted engineering practice.
#2 - #2 Grade Construction
#3 - #3 Grade
Stud – Stud Grade
Standard – Standard Grade
Utility – Utility Grade
3/8" wood structural sheathing shall be attached with 8 D nails at 6" at perimeter & 12" at intermediate supports. When a grade is specified in the table any grade above it in this list may be used.

Section 4405
WALL CONSTRUCTION

4405.1 Construction. Exterior walls of wood frame construction shall be in accordance with Figures

R602.3(1) and R602.3(2). Components of exterior walls shall be fastened in accordance with Table R602.3(1). Walls of wood frame construction shall be designed and constructed in accordance with NFPA "National Design Specifications for Wood Construction", listed in Chapter 43.

Exterior walls subject to wind pressures of 110 miles per hour or greater as established in Table R301.2(1) shall be designed in accordance with accepted engineering practice (such as Tables 4405(a) and 4405(b)).

In bearing walls, studs which are not more than 10 feet in length shall be spaced not more than is specified in table 4405(a) and 4405(b) for the corresponding stud size.

SECTION 4406
STRUCTURAL BRACING

4406.1 Structural bracing in 110 mph wind zone.

1. When the wall studs are engineered and do not require structural sheathing, for one story or top story – brace each corner and at 25 foot intervals with 1 x 4 let-in bracing or 4'0" x 8'0" wood structural panels.
2. All other stories – wood structural sheathing panels.
3. See also Section 602.10.

4406.2 Structural bracing in 120 and 130 mph wind zones. All stories – wood structural sheathing panels. Blocking shall be installed if less than 50% of the wall length is sheathed. Where blocking is required, all panels shall be fastened at 3 inches on center along the edges and 6 inches on center at intermediate framing. If a wall is sheathed less than 25% of its length, then that wall shall be designed in accordance with approved engineering practice. See also Section 602.10

4406.3 Gable endwalls. Gable endwalls in the 110, 120, and 130 mph wind zones shall either be supported by lateral bracing at the ceiling or have continuous studs from the floor to the roof. 2 x 4 studs at 16 inches on center are limited to 10 feet in length between supports. Non-bearing 2 x 6 SPF#2 studs at 16 inches on center with 3/8" wood structural panel sheathing are limited to unsupported lengths of 18 feet in 110 mph, 16 feet in 120 mph and 14 feet in 130 mph wind zones. Wood structural panel sheathing shall extend 12 inches beyond construction joints.

4406.4 Lateral support at ceiling. Where studs are not continuous, the ceiling must be used to support the endwall. 2 x 4 lateral bracing shall be installed on the top of ceiling joists or truss bottom chords at 8 feet on center and extend 8 feet inward from the gable endwall. See Figure 4406.7(a).

4406.5 Full height studs. Full height studs may be sized using the bracing at the ceiling to limit the stud length. See Figure 4406.5

Table 4405(b)

Exterior Bearing Walls[1,2,3,4,5] First Floor of Three Story						
SPF			**SP**			
Wind Zone (mph)	**2x4 @ 12" oc Structural Sheathing**	**3x4 or 2x6 @ 16" oc Structural Sheathing**	**2x4 @ 12" oc Structural Sheathing**		**3x4 or 2x6 @ 16" oc Structural Sheathing**	
110	#2	Any Grade	Any Grade		Any Grade	
120	#2	Any Grade	#2, #3, Stud		Any Grade	
130	#2	Any Grade	#2, #3, Stud		Any Grade	
Exterior Non-Bearing Walls1,2,3,4,6 First Floor of Three Story						
Wind Zone (mph)	**2x4 @ 12" oc Blocking**	**2x4 @ 16" oc Blocking**	**3x4 or 2x6 @ 16" oc Blocking**	**2x4 @ 12" oc Blocking**	**2x4 @ 16" oc Blocking**	**3x4 or 2x6 @ 16" oc Blocking**
110	#2, Stud	#2	Any Grade	Any Grade	#2, #3, Stud	Any Grade
120	#2, Stud	NP	Any Grade	#2, #3, Stud	#2, #3 Stud	Any Grade
130	#2	NP	Any Grade	#2, #3, Stud	#2	Any Grade

1. Any Grade = any grade except Standard, Utility and Economy
2. Corner bracing is REQUIRED where "Blocking" is specified.
3. 2 – 2x4's @ 16" or 1 – 2x4 @ 8" may be used where 3x4 @ 16" is specified.
4. Refer to 4406 and 4408.4 for sheathing requirements.
5. Bearing stud height is limited to 10 feet.
6. 2x full depth blocking @ mid-height.

4406.6 Cathedral endwalls. Studs shall be continuous from the uppermost floor to either the ceiling or the roof.

4406.7 Overhang at endwalls. The overhang is limited to 12 inches where a laddered soffit is installed. The overhang may be increased to 24 inches where outlookers are framed over a dropped endwall into the first rafter or truss. See Figure 4406.7(a) and 4406.7(b). If the overhang exceeds 24 inches, then the overhang shall be designed in accordance with approved engineering practice.

4406.8 Roof sheathing attachment. The roof sheathing panel edges shall be blocked and nailed at the end two rafter or truss spaces. See Figure 4406.8.

> **Exception:** The panel edges need not be blocked where 2x4 diagonal braces are framed from the top of the endwall to the lateral bracing at the ceiling.

SECTION 4407
MASONRY WALL CONSTRUCTION

4407.1 Reinforcement. Masonry walls subject to wind loads of 120 mph or greater, as established in Table R301.2(1), shall be constructed in accordance with Tables 4407.1a or Table 4407.1b or the requirements of Figures 4407.1(a) and 4407.1(b) and this Section. In addition, the minimum area of reinforcement shall not be less than 0.002 times the gross cross-sectional area wall, not more than two-thirds of which may be used in either direction. No required vertical reinforcement shall be less than 3/8 inch (9.5 mm) in diameter. Principal wall reinforcement shall have a maximum spacing of 4 feet (1219 mm) on center.

Note: For 110 mph wind zones See Figure 606.10(1) and Table 606.8.

Table 4407.1a
H/t Lateral Support Ratios for Unreinforced Exterior Masonry Walls[1,2,4,5]

Other than Enclosed Buildings[3] Design Wind Speed mph		
Wall Construction	120	130
Solid Mass. Units	13	11
Hollow concrete Mass. Units or Mass. Bonded Hollow Walls	9	8
Cavity Walls Identical wythes	The H/t ratio shall be 0.70 of the H/t ration for single wythe walls. The t value shall be the sum of the nominal thickness of the individual wythes.	
Cavity Walls with wythes of different types or size masonry	The wall shall be designed based on ACI-530 or the H/t ratio may be 0.70 of the H/t ration of a single wythe hollow wall/ The t value shall be the sum of the nominal thickness f the individual wythes.	

1. H = clear height or length between lateral supports.
   t = nominal wall thickness
2. All masonry units shall be laid in Type M, S or N mortar. Where Type N mortar is used and the wall spans in the vertical direction, the ratios shall be reduced by 10%.
3. Design based on partially enclosed building.
4. These values are based on using masonry cement mortar. If nonairentrained Portland cement/lime mortar is used the values in the table may be increased by 1.25. Larger H/t ratios may be used if the design is done in accordance with ACI-530.
5. Larger H/t ratios may be used if the design is done in accordance with ACI-530.

Table 4407.1b
H/t Lateral Support Ratios for Unreinforced Exterior Masonry Walls[1,2,4,5]

	Enclosed Building[3] Design Wind Speed, mph	
Wall Construction	120	130
Solid Mass. Units	15	13
Hollow Concrete Mass. Units or Mass. Bonded Hollow Walls	10	9
Cavity Walls Identical Wythes	The H/t ratio shall be 0.70 of the H/t ratio for single wythe walls. The t value shall be the sum of the nominal thickness of the individual wythes.	
Cavity Walls with Wythes of Different Types or Size Masonry	The wall shall be designed based on ACI-530 or the H/t ratio may be 0.70 of the H/t ration of a single wythe hollow wall. The t value shall be the sum of the nominal thickness of the individual wythes.	

1. H = clear height or length between lateral supports
   t = nominal wall thickness
2. All masonry units shall be laid in Type M, S or N mortar. Where Type N mortar is used and the wall spans in the vertical direction, the rations shall be reduced by 10%.
3. Enclosed buildings are buildings in which the openings in any wall do not exceed the sum of the percentages of openings in the remaining walls and roof surfaces by 5%. Buildings in which the 5%

limit is exceeded by one wall may still be considered enclosed if the percentage of openings in no other wall exceeds 20%.

4. These values are based on using masonry cement mortar. If nonairentrained Portland cement/lime mortar is used the values in the table may be increased 1.2.
5. Larger H/t ratios may be used if the design is done in accordance with ACI-530.

SECTION 4408
Roof Tie Down

4408.1 Roof tie down. Roof assemblies in the 110, 120, and 130 mph wind zones as established in Table 301.2(1) shall have rafter or truss ties provided in accordance with either Table 4408.2 or the prescriptive requirements of this Section 4408. Anchorage in the 110 mph wind zone shall be continuous from the roof to the foundation wall or pier. Anchorage in the 120 and 130 mph wind zones shall be continuous from the roof to the footing (See Section 4404.1).

4408.2 Considerations. For trusses, the nailing requirements from Table 4408.2 shall include the nailing requirements for both rafters and ceiling joists. As an alternate to the anchorage requirements of Tables 602.3(1) and 4408.2, the anchorage for roof members may be based on a designed connection taking into account all horizontal and vertical forces. Forces for alternate anchorage design may result from wind uplift: wind lateral on roof; wind lateral on walls to be transferred to the top plate of the wall; roof/ceiling loads; and other loads depending on the specific building design. If roof members align with the studs, the connection may be made from the roof member directly to the studs. If the connection is from the roof member to the top plate, a double top plate is required and both connections must meet the requirements of Table 4408.2. Where ceiling joists are not parallel with and connect to the roof members, the anchorage requirements for each roof member shall be increased by 110 pound. Hip end walls and hip rafters shall be anchored in accordance with this section.

Table 4408.2
Roof Tie Down Requirements Along Exterior Walls (plf)

Wind Speed (mph)	Structure Width	
	24 feet	36 feet
110	240	345
120	330	470
130	430	615

1. Alternate to the requirements of this table or roof not covered by this table shall be designed in accordance with the North Carolina State Building Code or SSTD10, “Standard for Hurricane Resistant Residential Construction.”
2. See Section 4505 for material requirements in Coastal High Hazard Areas and Ocean Hazard Areas and Ocean Hazard Areas.
3. Roof slope 2:12 to 12:12.
4. The uplift load requirements may be interpolated for intermediate structure widths.

4408.3 Anchorage from roof to wall. 1 1/2 inch by 18 gage fabricated metal ties at 24 inches on center with five 8d nails at each end may be used to resist the uplift loads from the roof to the double top plate. Install one tie at each end of each rafter in 110 mph and two ties at each end of each rafter in 120 mph and 130 mph wind zones. Truss anchorage shall be per designed specifications.

4408.4 Anchorage using wood structural panels. Wood structural panel sheathing may be used to resist both lateral load and uplift simultaneously. Panels shall be installed as follows:

1. Panels may be installed with face grain parallel or perpendicular to studs.
2. Panels shall be 3/8” minimum thickness.
3. Nail spacing shall be 8d at 6 inches on center along vertical edges of panel and 12 inches at intermediate vertical framing.
4. Horizontal nail spacing at double top plates, double sill plates, band joists, and girders shall be a double row of 8d staggered at 3 inches on center.
5. Panel shall extend 12 inches beyond construction joints and shall overlap girders and double sill plate their full depth.

6. Panel attachment to framing shall be as illustrated in Figure 4408.4.
7. Blocking shall be required at all joints if sheathing is used to resist uplift.

Table 4408.4
Uplift Capacity of Wood Structural Panel Sheathing
Used to Resist Both Lateral Load and Uplift

Vertical Nail Spacing	**8d @ 6” Edge and 12” Intermediate**		
Alternate Nail Spacing @ Top and Bottom Edges	6”	4”	3”
Uplift Capacity (PLF) Nails – Double Row	240	474	710

1. Tabulated values are for Spruce-Pine-Fir framing. For Southern Pine framing the uplift values listed may be divided by 0.82.

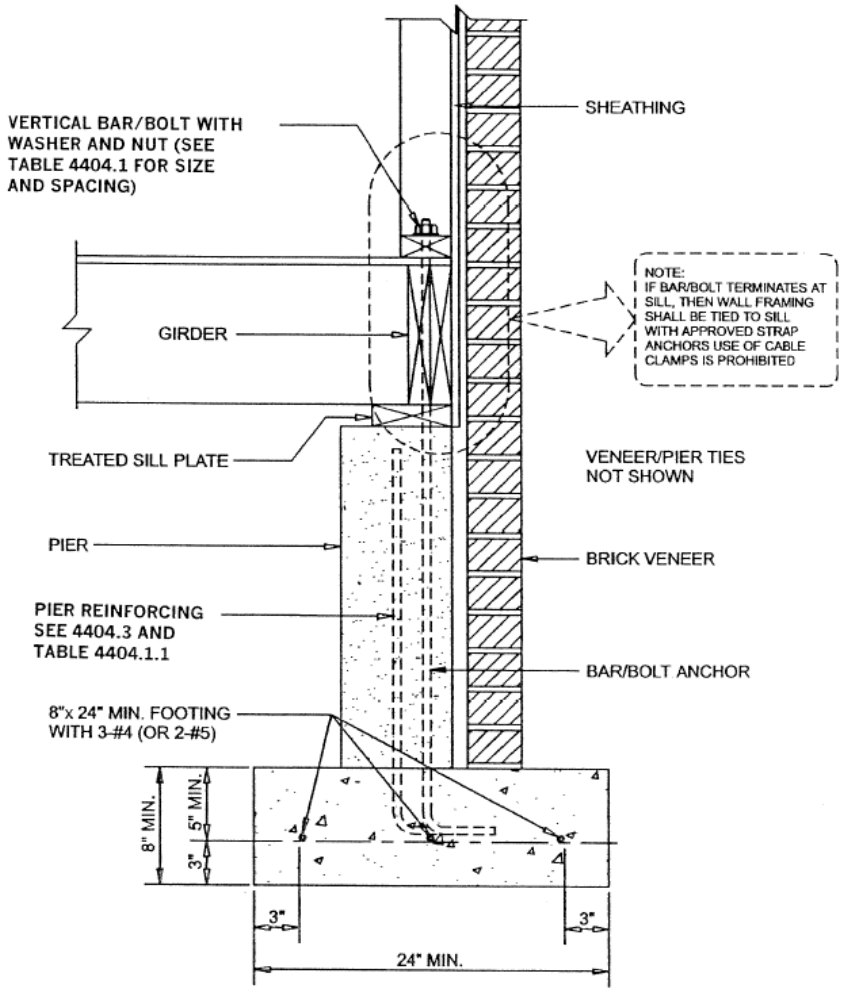


FIGURE 4404.3a
CONTINUOUS VENEER
PIER/CURTAIN WALL

At top left change wording to read (see table 4404.1.1 for size and spacing)

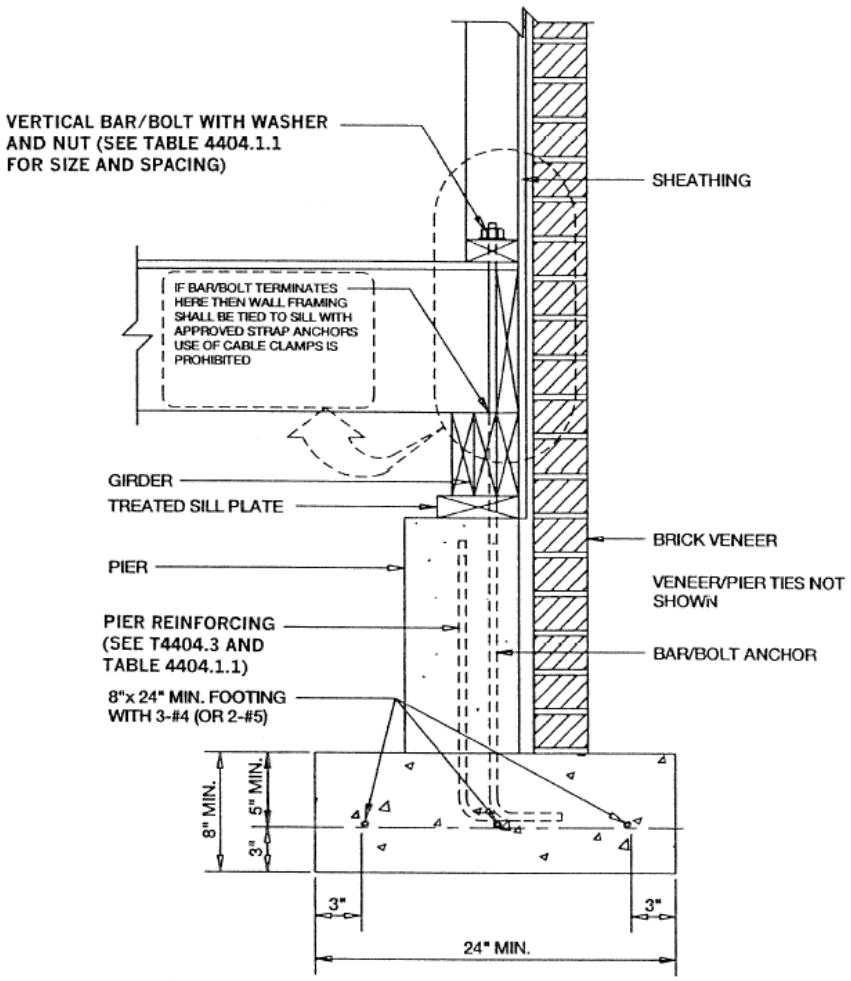


FIGURE 4404.3b
CONTINUOUS VENEER
PIER/CURTAIN WALL

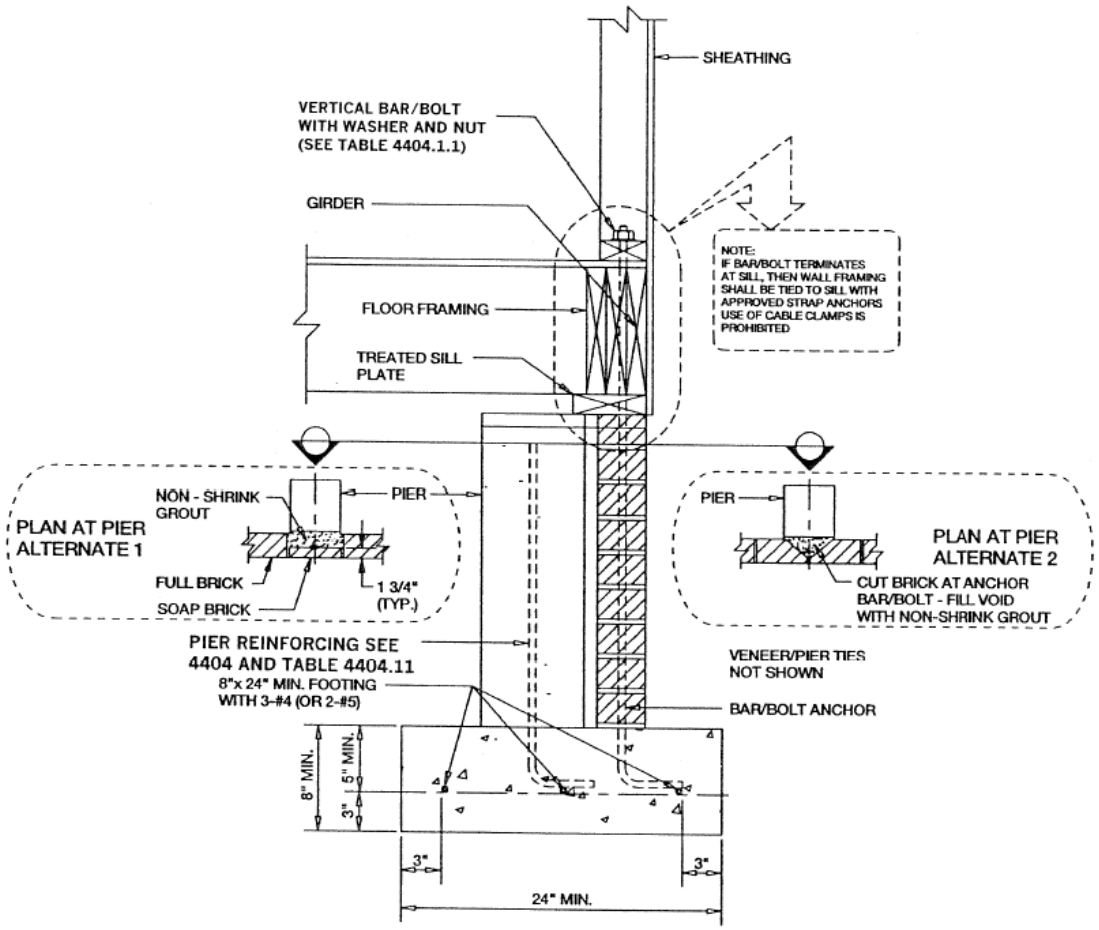


FIGURE 4404.3c
VENEER SHIRT WALL
PIER/CURTAIN WALL

Remove wording “Veneer/pier ties not shown”

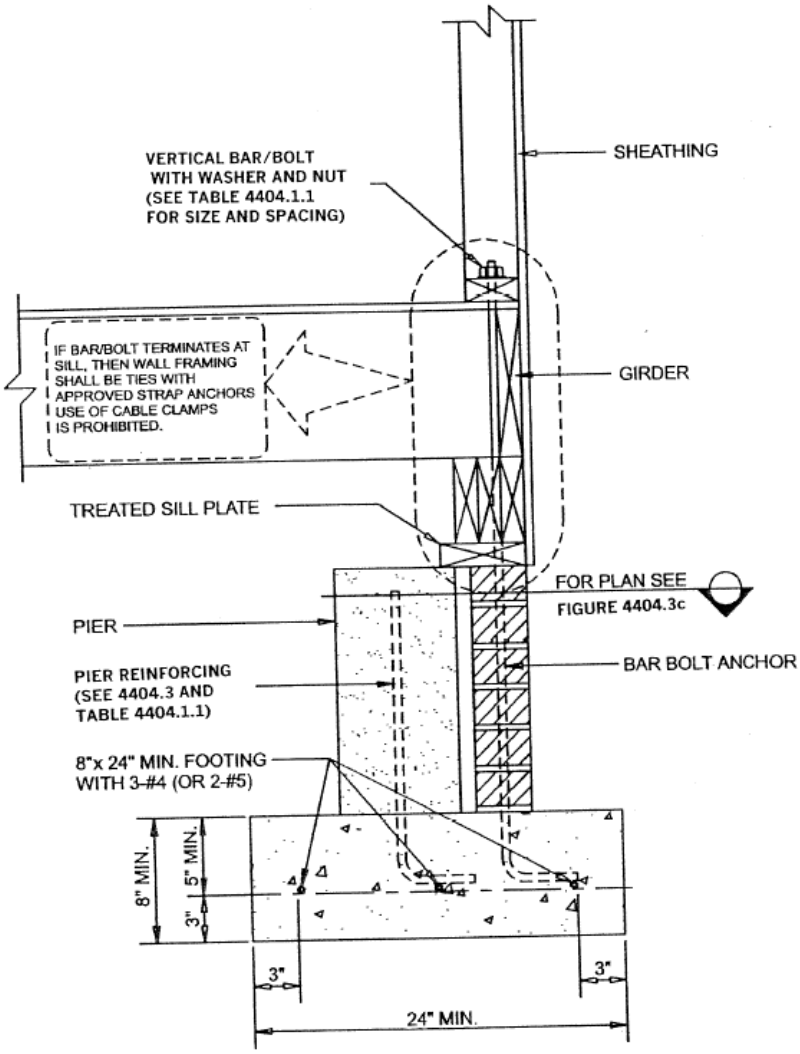
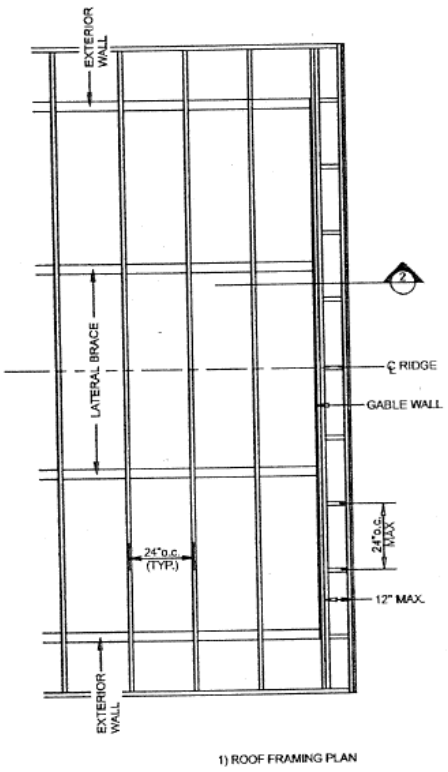


FIGURE 4404.3D
VENEER SHIRT WALL
PIER/CURTAIN WALL

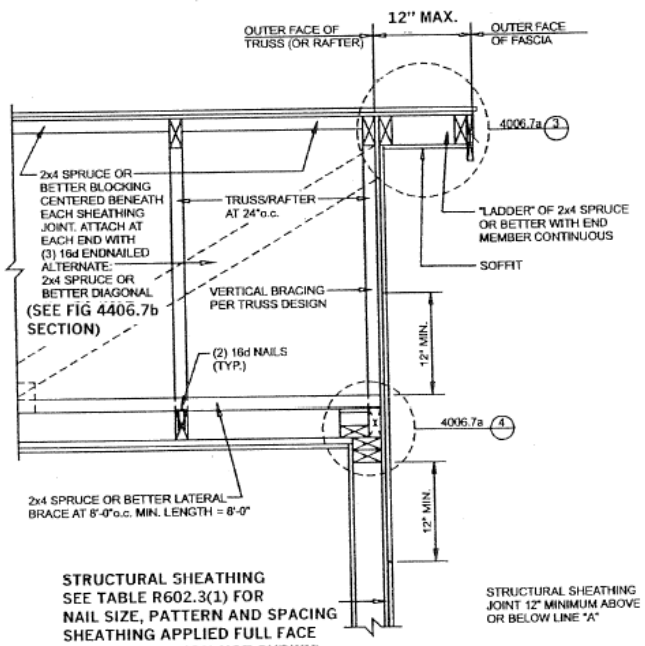
At the top left change wording to “say shall be tied”

Add to figure 4404.3 A-D, required bonding not shown

Add figure 4404.3 (e)



1) ROOF FRAMING PLAN

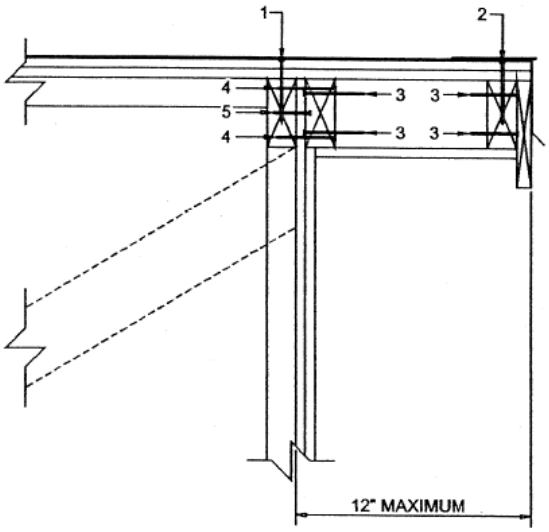


2) SECTION THRU "LADDER" SOFFIT

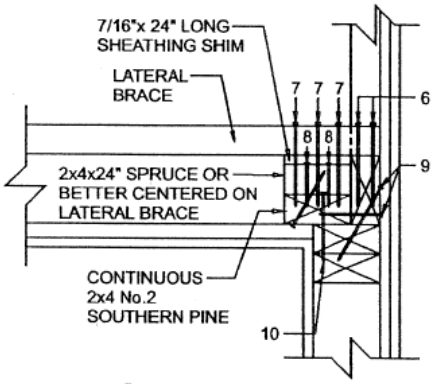
FIGURE 4406.7a
OVERHANG AT ENDWALLS
CONTINUED ON NEXT PAGE

Change table reference at top from 602.3a footnote 7 to Table 602.3 (1) FOOTNOTE G

Change reference at top right corner from 4006.7a to 4406.7a



3 4406.7a "LADDER" ATTACHMENT
NAILING DETAIL AT TOP OF GABLE



4 4406.7a
NAILING DETAIL AT LATERAL BRACE

NAIL SCHEDULE

MARK	No. & SIZE	SPACING	REMARKS
1	8d	4"o.c.	
2	8d	6"o.c.	
3	(2) 16d		EACH SIDE
4	(2) 16d	24"o.c.	
5	8d	6"o.c.	
6	(2) 16d		EACH TRUSS
7	(5) 16d		TYPICAL
8	(6) 16d (* TO 2x4 BELOW)		ALTERNATE: (8) 8d
9	16d	8"o.c.	ALTERNATE TOENAIL & ENDNAIL
10	16d	8"o.c.	

FIGURE 4406.7A
OVERHANG AT ENDWALLS

Change figure to 4406.7a (continued from previous page)

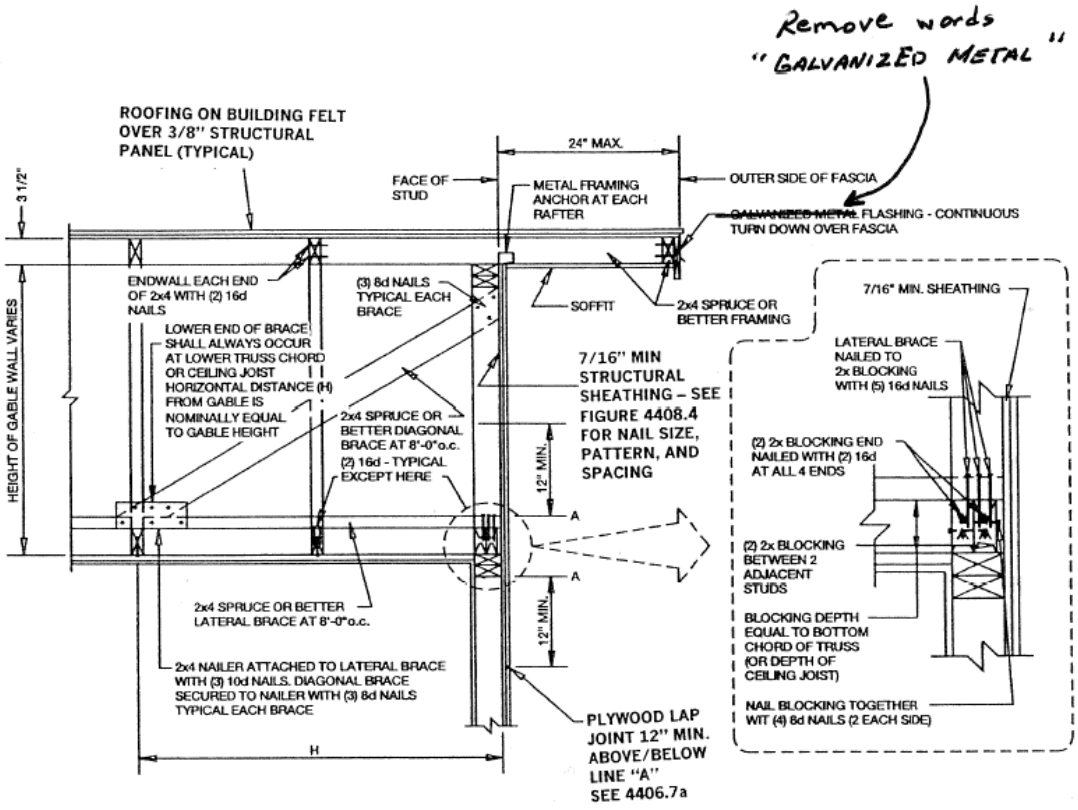
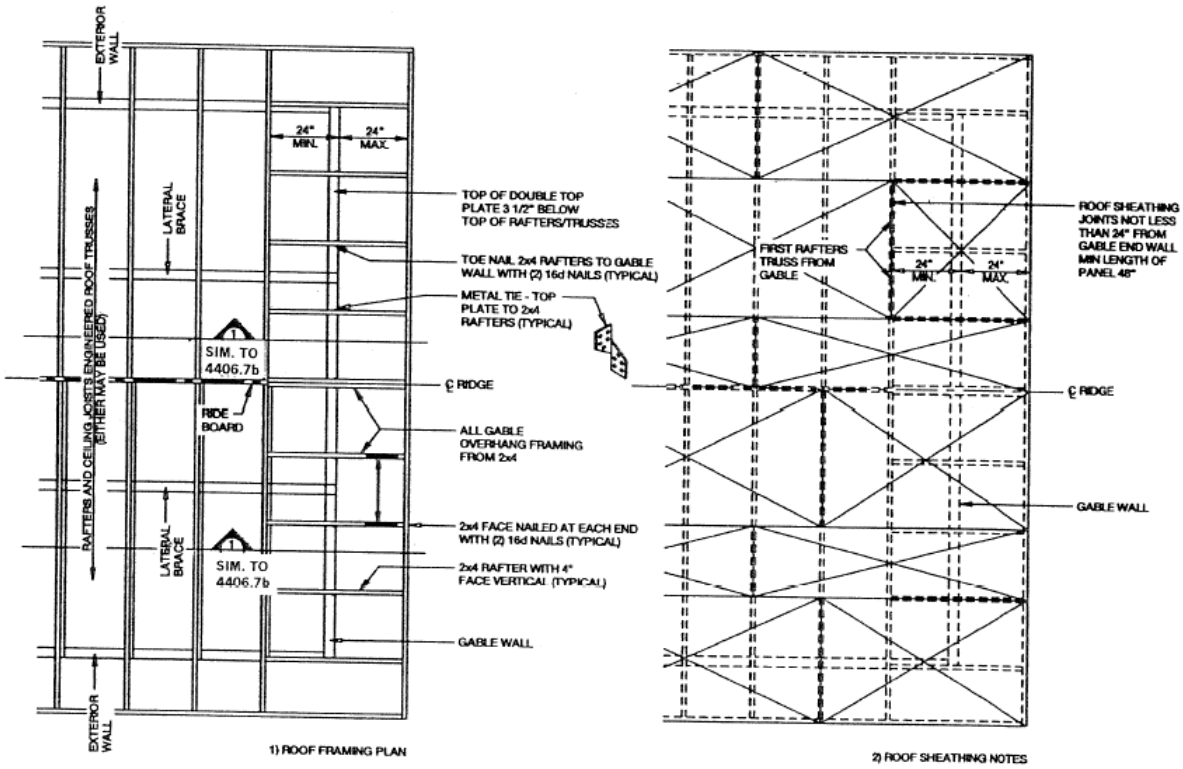


FIGURE 4406.7B
GABLE END OVERHANG

Change figure to read Figure 4406.7b
Change reference to structural sheathing from 7/16 to 3/8" min.



~~FIGURE 4406.7B~~ FIGURE 4406.7C

GABLE OVERHANG

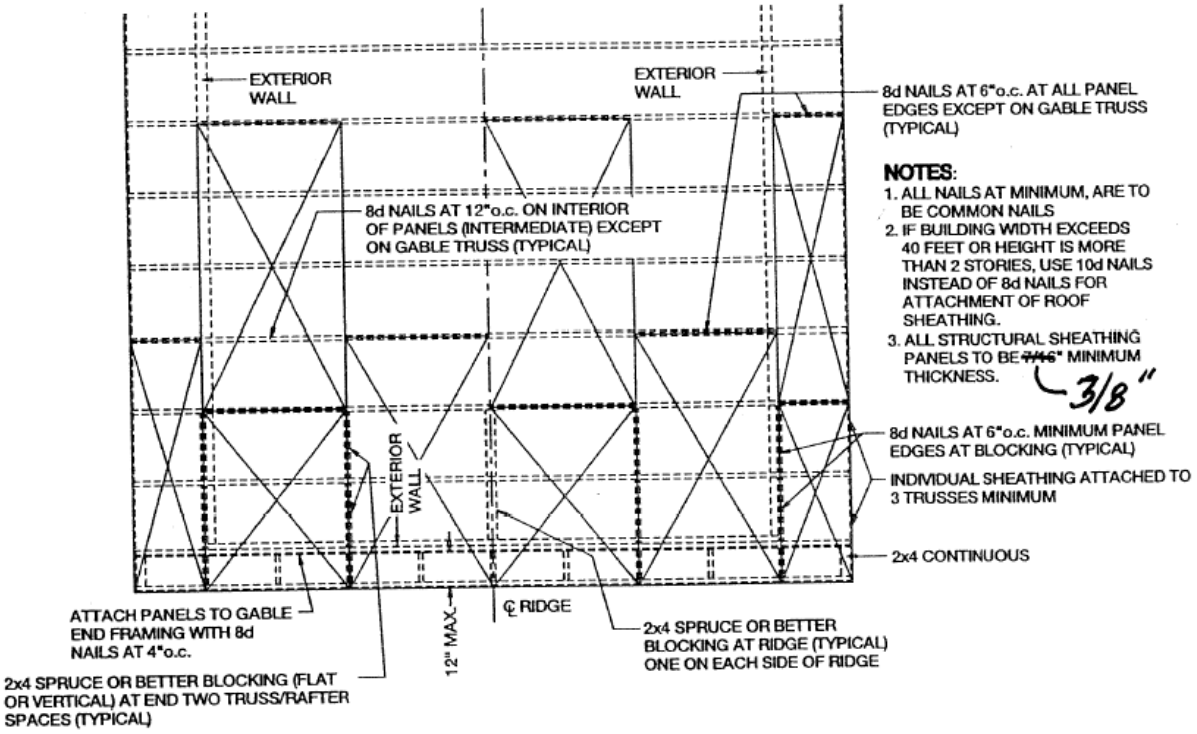
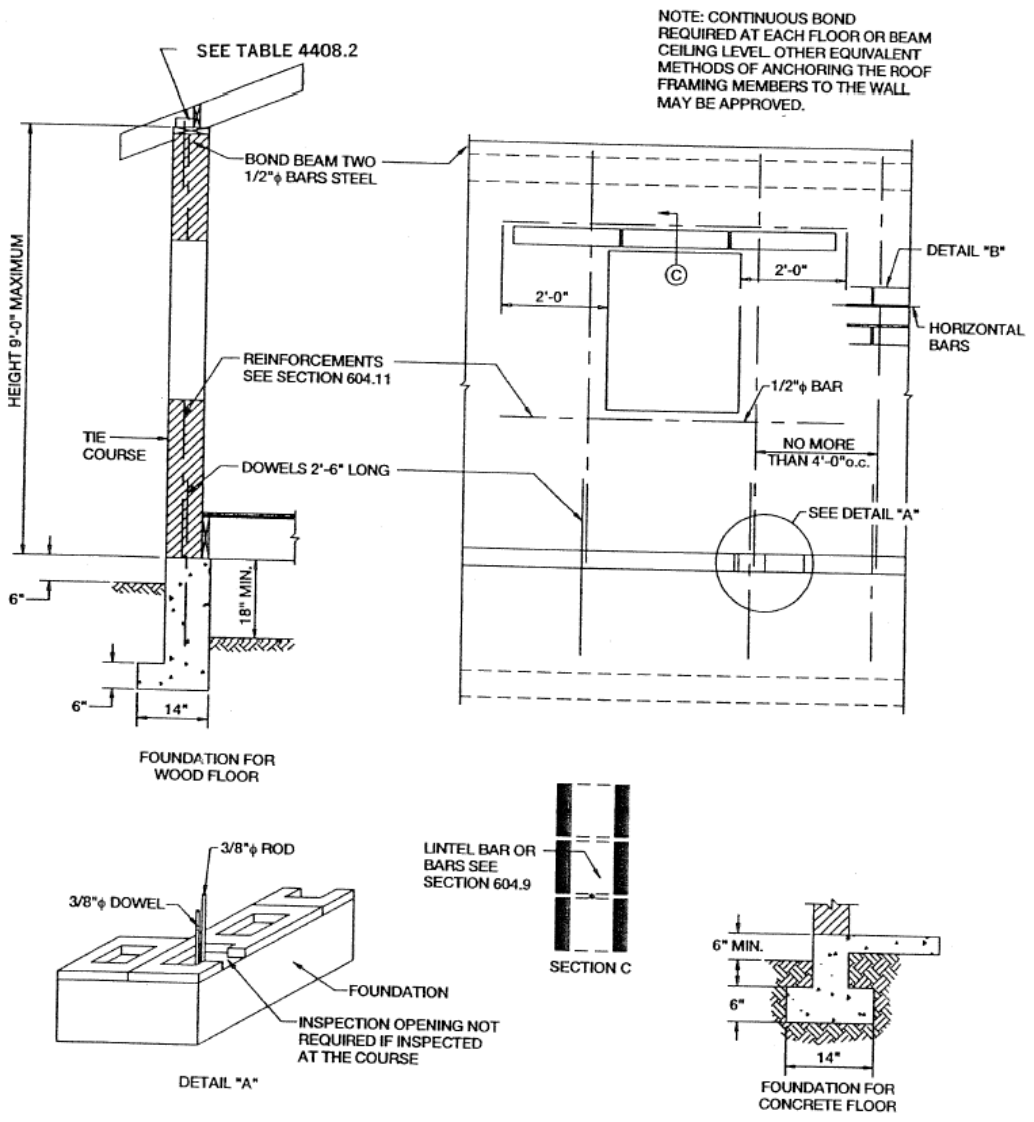


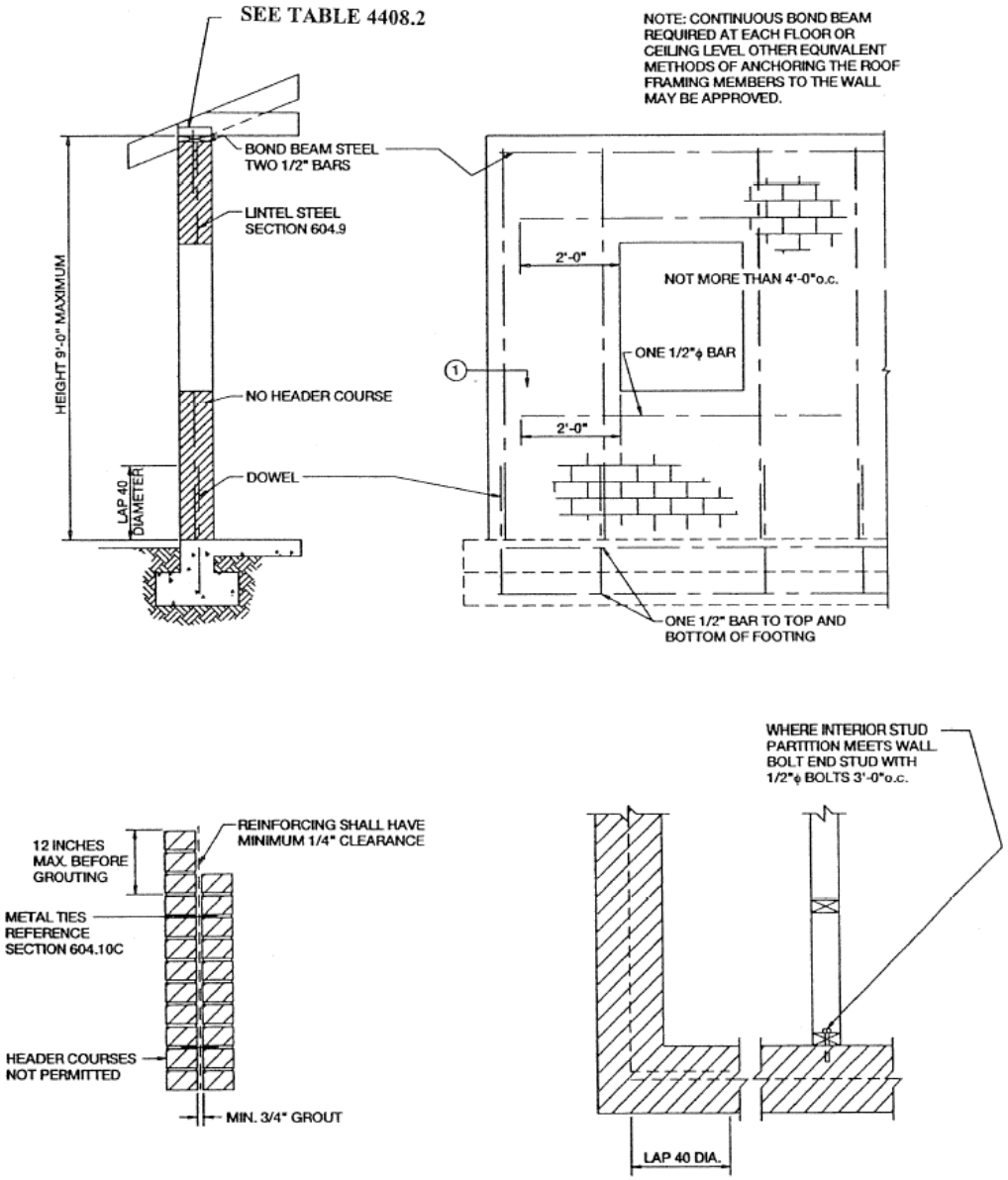
FIGURE 4406.8
ROOF SHEATHING ATTACHMENT PLAN



For SI: 1 inch 25.4 mm, 1 foot = 304.8 mm, 1 psf = 0.0479 kN/m^2

FIGURE 4407.1(a)
REQUIREMENTS FOR REINFORCED GROUTED MASONRY CONSTRUCTION
WHERE WIND ZONES ARE 120 MPH OR GREATER

Delete the dimensions on footer width and depth (2 locations)
Delete 9' height reference
Change section 604.11 reference to 606.13



For SI: 1 inch = 24.5 mm, 1 foot = 304.8 mm, 1 psf = 0.0479 kN/m^2

FIGURE 4407.1(b)
REQUIREMENTS FOR REINFORCED HOLLOW-UNIT MASONRY CONSTRUCTION
WHERE WIND ZONES ARE 120 MPH OR GREATER

Change lintel steel section 604.9 to R606.10
Change metal ties reference bottom left from 604.10c to R608.1.2

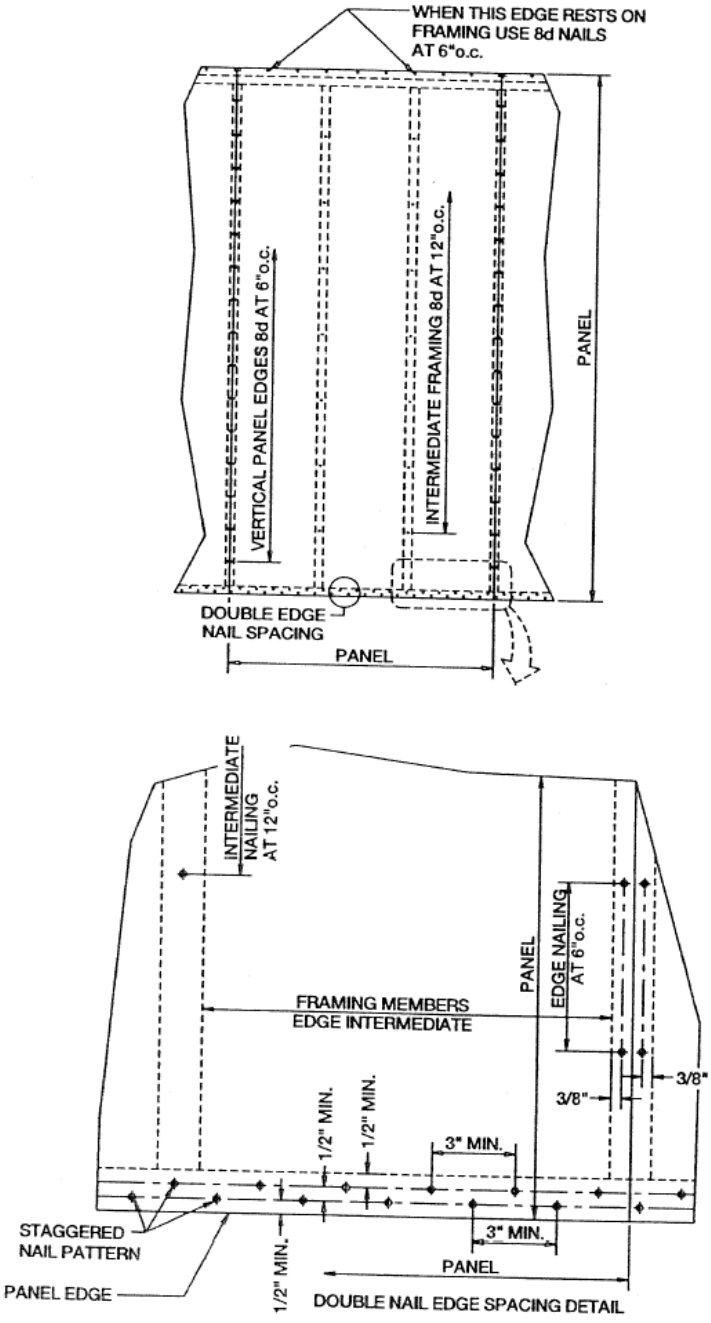


FIGURE 4408.4
PANEL ATTACHMENT TO COUNTER UPLIFT
HORIZONTAL OR VERTICAL

Revise 6” nail spacing in top figure to 3”.

Show double bottom plate in bottom figure (add horizontal line centered between rows of nails).
Change 3” MIN. dimension in bottom figure to 3”.
Remove all three ½” MIN dimensions for nailing in bottom plate.
Add note to indicate nailing of sheathing to be centered in each piece of both top and bottom plates.

New Chapter
Chapter 45 – Coastal and Flood Plane Construction Standards

SECTION 4501
PURPOSE, APPLICATION, AND SCOPE

The requirements set forth in this section shall apply to all construction located within areas identified by governmental agency (state and federal) as coastal high hazard areas, ocean hazard areas, the regulatory flood plain areas, and all areas designated as 130 MPH 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 design flood which is established by the Building Code Council as a flood having a one percent chance of being equaled or exceeded in any given year.

Coastal High Hazard Area. An area subject to coastal flooding and high velocity waters including storm wave wash, as shown by Federal Emergency Management Agency Maps and subject to the approval of the Building Code Council.

Ocean Hazard Area. An area, as identified by the North Carolina Coastal Resources Commission, and subject to approval by the Building Code Council, near the shoreline of the Atlantic Ocean which has been identified as 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 of record has in the past been flooded by storm water-surface runoffs, or tidal influx, and as defined by the Corps of Engineers' maps, the Federal Emergency Management Agency maps or as approved 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 the North Carolina Building Code, Chapter 18.

4503.3 Size of wood piles. Round timber piles shall not be less than 8 inches in diameter at building level and have a minimum tip diameter of 6 inches. Square timber piles shall not be less than 8 inches square, nominal. Piles supporting uncovered stairs, uncovered walkways and uncovered decks shall be 6 inches x 6 inches minimum, or if round, have a minimum tip diameter of 6 inches. Piles supporting uncovered stairs, uncovered walkways and uncovered decks less than five (5) feet above grade may be 4 inches x 4 inches 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 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 away from the most seaward line of stable natural vegetation area 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 on center, the pile foundation shall be designed by a Professional Engineer or Architect. Pile spacing in the non-load bearing direction may be 12 feet.

4503.6 Tieing and bracing of 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%. Sills, beams, or girders may be attached using 3/16 inch x 4 inch x 18 inch hot dip galvanized straps, one each side, bolted with two ½ inch galvanized through bolts. (See Figure 4503.6a). 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 4503.6b). X bracing shall be with 2x10s through bolted with two-3/4 inch bolts at each end. The building inspector may accept alternate bracing designs if they bear the seal of a Professional Engineer or Architect.

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 approved methods, acceptable to 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 initial Flood Insurance Study for that area if the addition, renovation or reconstruction does not exceed 50% of the present market value of the structure.

4504.3 Where walls are constructed below flood elevation in 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 Section 4505.2 through 4505.9 are applicable in the Coastal High Hazard Area, the Ocean Hazard Area, and all areas defined as 130 MPH 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 x 6 or 2 x 4 collar or wind beam. Every third rafter not to exceed 4 feet on center shall be anchored vertically with minimum 1 x 6 or 2 x 4 from its midpoint to ceiling joists below.

4505.3 Wood frame wall construction. Maximum stud spacing shall be 16 inches oc for 2 x 4's and 24 inches for 2 x 6's. 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 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 Registered Design Professional 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 be hot dip galvanized steel after fabrication and 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 A123 or ASTM A153. Stainless steel light-gage metal connectors shall be permitted in exposed or partially exposed locations. Metal connectors of approved equivalent corrosion resistant material may be accepted. See Table 4505.5.

4505.6 Building anchorage.

1. For masonry buildings, the roof structure, including rafters and joists shall be 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 anchored to the footing per Section 4404. Footing dowel bars shall have an 8 inch hook.
3. Where wood partitions and masonry walls join, the stud abutting the masonry shall be double and bolted to the masonry with three ½ inch galvanized bolts.
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.

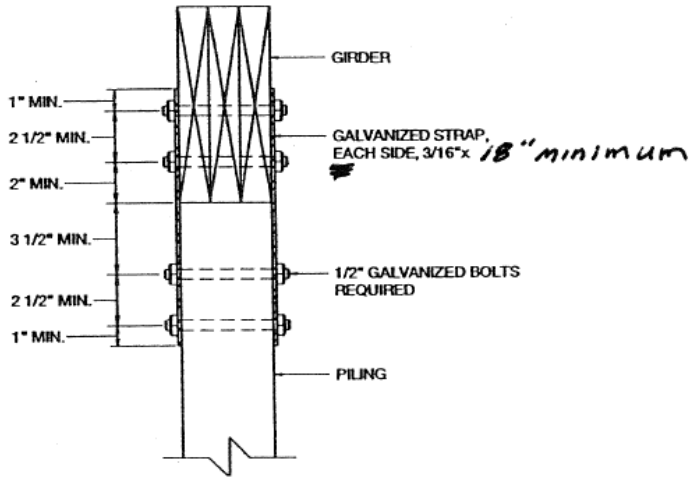


FIGURE 4503.6

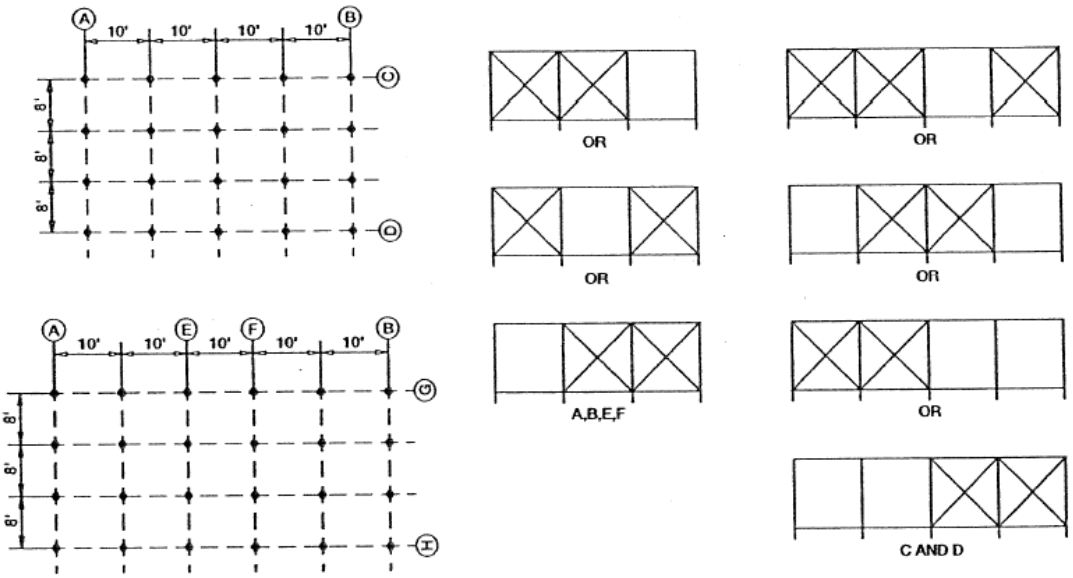


FIGURE 4503.6
ELEVATIONS
(SHOWING POSSIBLE ARRANGEMENT OF X BRACING IN LINE) (G AND H SIMILAR)

Top figure to be Fig. 4503.6a
Bottom figure to be Fig. 4503.6b
Change 3/16”x18” to 3/16”x4”x18” min in Fig 4503.6a

Table 4505.5[1]
Corrosion Resistance
(Applies only to Structure Located in Coastal High Hazard Areas and Ocean Hazard Areas)

	Open (exterior, porches, under house)	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-1 of the Truss Plate Institute	Standard galvanized

1. Applies only to structures located in Coastal High Hazard Area and Ocean High Hazard Area.

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 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 mopped before the anchor sheet is nailed to the sheathing with sheet metal caps and nails not over 12 inches on center in each direction and 6 inches along edges and laps. Each additional sheet above the anchor sheet shall be thoroughly 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.

FIGURE ~~4103.3(a)~~ 4505.3 (4)

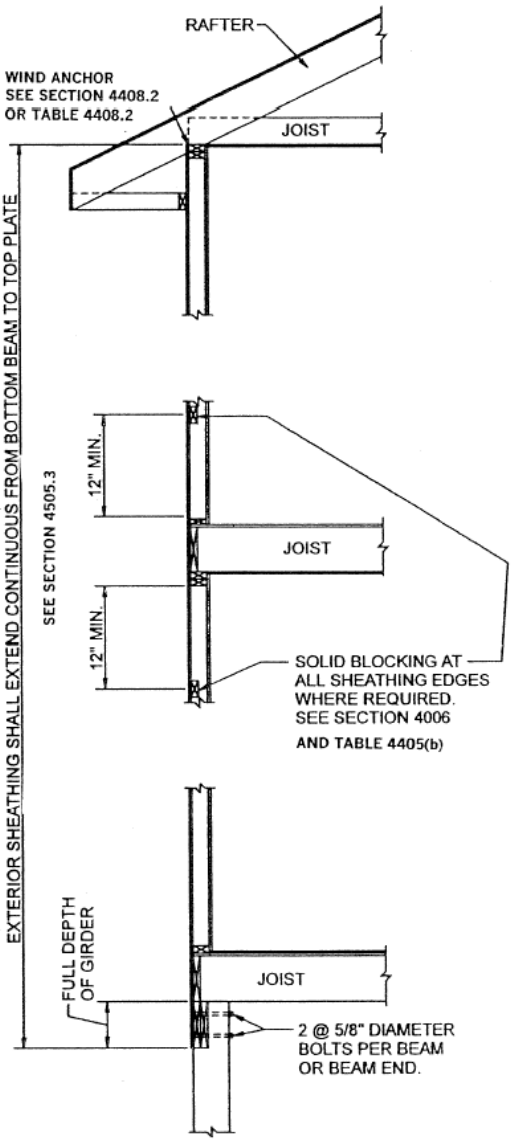
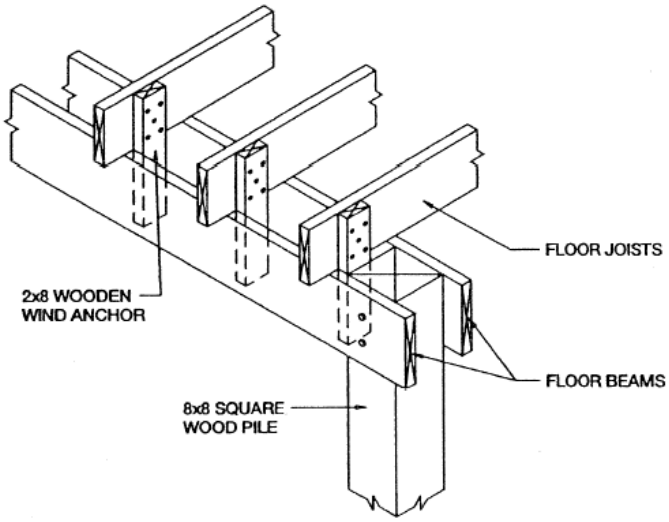
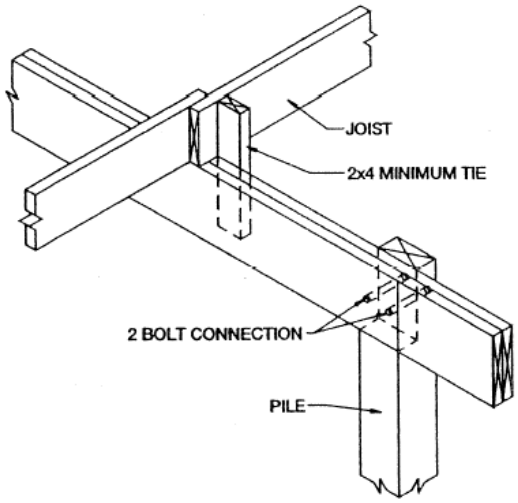


FIGURE 4505.3(a)
TWO STORY WALL SECTION
(TYPICAL)

Change Section 4006 to Section 4406.



SPACED BEAM TIE DETAILS



SOLID BEAM TIE DETAIL

TYPICAL CONNECTIONS ON INTERIOR COLUMN LINES

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

Remove bottom title on Figure 4505.3(b): ~~Two Story Wall Section (Typical)~~

APPENDIX A (IFGS)
SIZING AND CAPACITIES OF GAS PIPING

(Deleted)

APPENDIX B (IFGS)
SIZING OF VENTING SYSTEMS SERVING APPLIANCES EQUIPPED WITH DRAFT HOODS, CATEGORY I APPLIANCES, AND APPLIANCES LISTED FOR USE AND TYPE B VENTS

(Deleted)

APPENDIX C (IFGS)
EXIT TERMINALS OF MECHANICAL DRAFT AND DIRECT-VENT VENTING SYSTEMS

(Deleted)

APPENDIX D (IFGS)
RECOMMENDED PROCEDURE FOR SAFETY INSPECTION OF AN EXISTING APPLIANCE INSTALLATION

(Deleted)

APPENDIX E
MANUFACTURED HOUSING USED AS DWELLINGS

For Manufactured Housing Regulations
refer to the North Carolina State Regulations for Manufactured/Mobile Homes

APPENDIX F
RADON CONTROL METHODS

(Deleted)

APPENDIX G
SWIMMING POOLS, SPAS AND HOT TUBS

The provisions contained in this appendix are adopted as part of this code.

APPENDIX H
PATIO COVERS

(Deleted)

APPENDIX I
PRIVATE SEWAGE DISPOSAL

(Deleted)

[EB] APPENDIX J
EXISTING BUILDINGS AND STRUCTURES

(Deleted)

APPENDIX K
SOUND TRANSMISSION

The provisions contained in this appendix are adopted as part of this code.

APPENDIX L
PERMIT FEES

(Deleted)

APPENDIX M
WOOD DECKS

1. A deck is an exposed exterior wood floor structure which may be attached to the structure or freestanding. Roofed porches (open or screened-in) may be constructed using these provisions.

   Computer deck design program printouts may be accepted by the Code Enforcement Official.

2. Support posts shall be supported by a footing.

3. When attached to a structure, the structure to which attached shall have a treated wood band for the length of the deck, or corrosion-resistant flashing shall be used to prevent moisture from coming in contact with the untreated framing of the structure. Aluminum flashing may not be used in conjunction with deck construction. The deck band and the structure band shall be constructed in contact with each other except on brick veneer structures and where and where plywood sheathing is required and properly flashed (when plywood is required, use pressure preservatively treated plywood). Siding shall not be installed between the structure and the deck band. If attached to a brick structure, neither flashing nor a treated band for the brick structure is required. In addition, the treated deck band shall be constructed in contact with the brick veneer.

4. When the deck is supported at the structure by attaching the deck to the structure, the following attachment schedules shall apply for attaching the deck band to the structure.

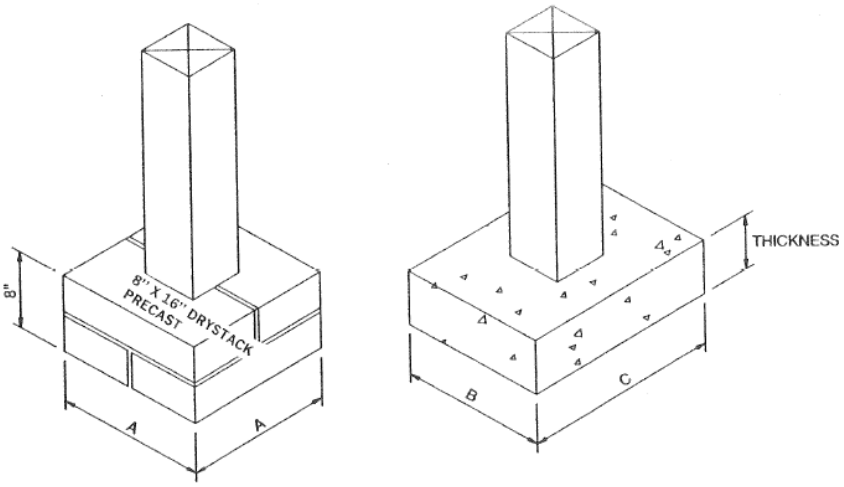


FIGURE A-1

FOOTING CHART

SIZE (inches)		TRIBUTARY AREA (sq. ft.)	THICKNESS (inches)	
AxA	BxC	(sq. ft.)	Precast	Cast-in-Place
8 x 16	8 x 16	36	4	6
12 x 12	12 x 12	40	4	6
16 x 16	16 x 16	70	8	8
	16 x 24	100		8
	24 x 24	150		8

Delete paragraph 4 above (duplicate of paragraph 4 below).

Change all locations of 5/8" hot dipped Galv. bolts in the following two pages to read: "5/8" hot dipped galv. bolts with nuts and washers".

4. When the deck is supported at the structure by attaching the deck to the structure, the following attachment schedules shall apply for attaching the deck band to the structure.

A. All Structures Except Brick Veneer Structures:

Fastemers	8' Max Joist Span	16' Max Joist Span
5/8" Hot Dipped Galv. Bolts and Washers* and 12d Common Hot Dipped Galv. Nails**	1 @ 3'-6" o.c. and 2 @ 8" o.c.	1@ 1'-8" o.c. and 3 @ 6" o.c.

* Minimum edge distance for bolts is 2-1/2 inches.
** Nails must penetrate the supporting structure band a minimum of 1-1/2 inches.

B. Brick Veneer Structures:

Fastemers	8' Max Joist Span	16' Max Joist Span
5/8" Hot Dipped Gal. Bolts*	1 @ 2'-4" o.c.	1 @ 1'-4" o.c.

*Minimum edge distance for bolts is 2-1/2 inches.

C. Masonry Ledge Support:

If the deck band is supported by a minimum of 1/2 inch masonry ledge along the foundation wall, 5/8 inch hot dipped galvanized bolts with washers spaced at 48 inches o.c. may be used for support.

D. Other means of support, such as joist hangers, may be connected to treated house band and properly flashed.

5. Girders shall bear directly on posts or be connected to the side of posts with 2 - 5/8 inch hot dipped galvanized bolts.

6. Floor decking shall be No. 2 grade treated Southern Pine or equivalent. The minimum floor decking thickness shall be as follows:

Joist Spacing	Decking (Nominal)
12" o.c.	1" S4S
16" o.c.	1" T & G
24" o.c.	1-1/4" S4S
32" o.c.	2" S4S

7. Maximum Height of Deck Support Posts as follows:

Post Size*	Max. Post Height**
4 x 4	8'-0
6 x 6	20'-0"
***	

* This table is based on No. 2 Southern Pine posts. Maximum tributary area is based on 128 total square feet which may be located at different levels.
** From top of footing to bottom of girder.
*** Decks with post heights exceeding this table shall be designed by a registered design professional.

8. Decks shall be braced to provide lateral stability. The following are acceptable means to provide lateral stability:

   A. When the deck floor height is less than 4′-0″ and the deck is attached to the structure in accordance with Section (4) above, lateral bracing is not required.

   B. 4 x 4 wood knee braces may be provided on each column in both directions. The knee braces shall attach to each post a point not less than 1/3 of the post length from the top of the post, and the braces shall be angled between 45 degrees and 60 degrees from the horizontal. Knee braces shall be bolted to the post and the girder with one 5/8 inch hot dipped galvanized both at each end of the brace.

   C. For freestanding decks without knee braces or diagonal bracing, lateral stability may be provided by embedding the posts in accordance with the following:

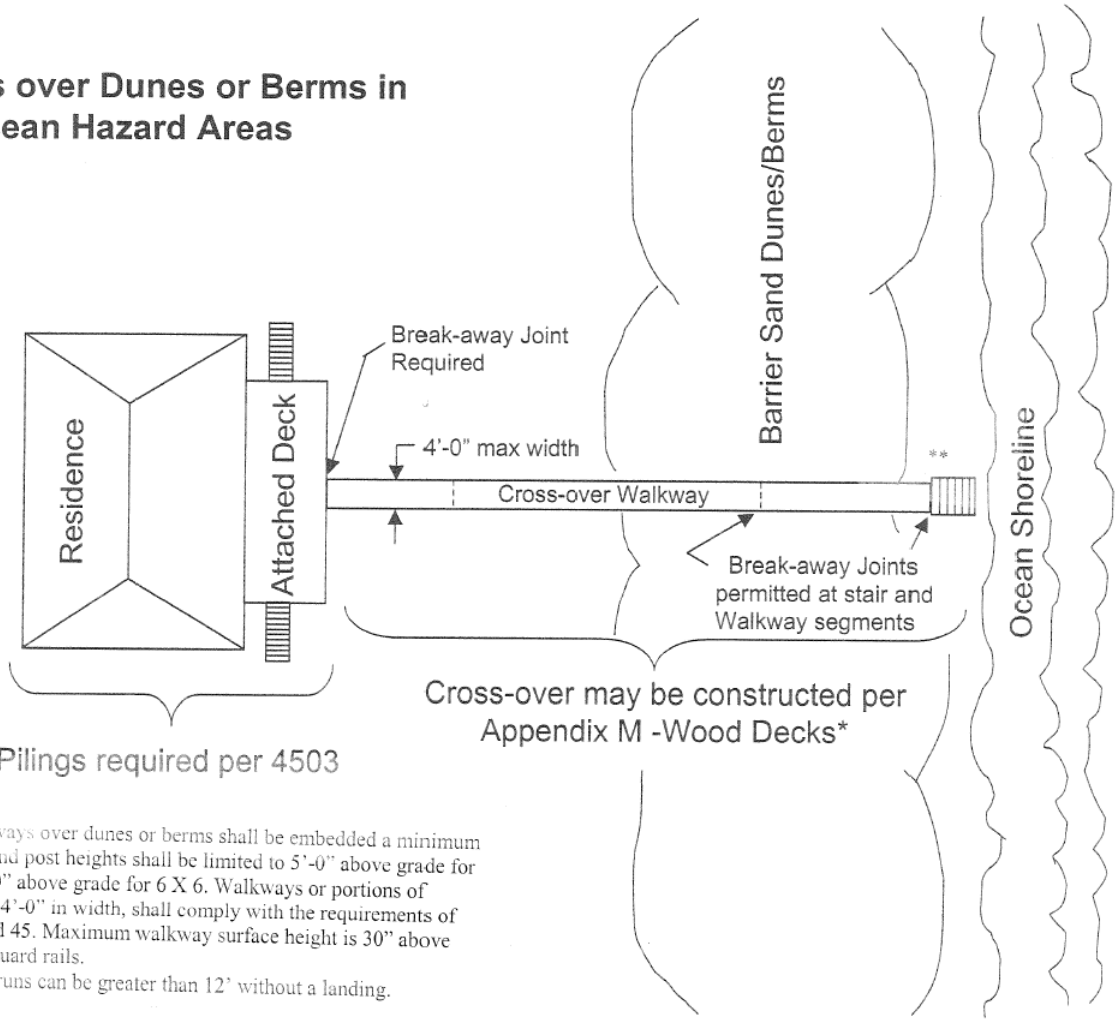
Post Size	Max. Tributary Area	Max. Post Height	Embedment Depth	Concrete Diameter
4 x 4	48 SF	4′-0″	2′-6″	1′-0″
6 x 6	120 SF	6′-0″	3′-6″	1′-8″

   D. 2 x 6 diagonal vertical cross bracing may be provided in two perpendicular directions for freestanding decks or parallel to the structure at the exterior column line for attached decks. The 2 X 6's shall be attached to the posts with one 5/8 inch hot dipped galvanized bolt at each end of each bracing member.

   E. For embedment of piles in Coastal Regions, see Chapter 45.

9. Floor joists for exterior decks may be cantilevered per Table R502.3.3(1).

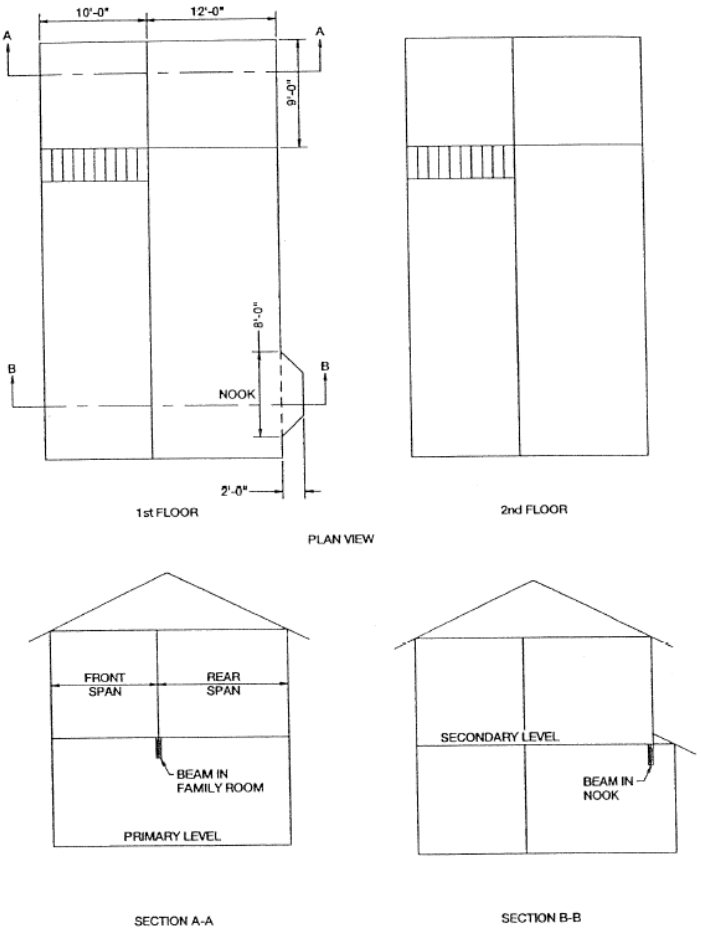
Walkways over Dunes or Berms in Ocean Hazard Areas



* Posts for walkways over dunes or berms shall be embedded a minimum depth of 4'-0"and post heights shall be limited to 5'-0" above grade for 4 X 4 and 10'-0" above grade for 6 X 6. Walkways or portions of walkways over 4'-0" in width, shall comply with the requirements of Chapters 44 and 45. Maximum walkway surface height is 30" above grade without guard rails.

** Walkway stair runs can be greater than 12' without a landing.

APPENDIX N
BASIC LOAD ESTIMATING



ASSUMPTIONS:

Loads

Secondary floor level is 30# L.L. + 10# D.L.	= 40#/sq ft
Attic level is 20# live load + 10# dead load	= 30#/sq ft
Nook ceiling is 10# dead load	= 10#/sq ft

Wall load

Studs @ 16", 1/2" gypsum	= 8#/sq ft

Roof load

20# live load + 10# dead load	= 30#/sq ft

EXAMPLE OF LOAD ESTIMATING LOAD ON BEAM IN FAMILY ROOM

Loads in Section A - A as follows: TOTAL LOADS

2nd floor load = $\frac{\text{front span}}{2} + \frac{\text{rear span}}{2}$ x 2nd floor (dead load + load) = LOAD/linear foot

$= \frac{10}{2} + \frac{12}{2}$ x 40 = 11 x 40 = 440#/1ft 2nd floor = 440#/1ft

Interior wall load = 8#/sq ft x 8 ft. (Ceiling height) = 64#/1ft Interior wall = 64#/1ft

Attic load $= \frac{\text{front span}}{2} + \frac{\text{rear span}}{2}$ x attic (dead load + live load) =

$= \frac{10}{2} + \frac{12}{2}$ x 30 = 11 x 30 = 330#/linear ft Attic = 330#/1ft

Roof load: No roof load is transmitted to the beam in the family room. Roof = 0

TOTAL LOAD ON BEAM IN FAMILY ROOM = 834#/1ft

BEAM SPAN IN FAMILY ROOM IS 9 FEET AND TOTAL ESTIMATED LOAD IS 834#/LINEAR FOOT:

BY USING TABLE NO. H-1, THE REQUIRED BEAM is 4 @ 2" x 12" Southern Pine

OR

BY USING TABLE NO. H-2, THE REQUIRED MINIMUM FLITCH BEAM IS
2 @ 2" X 8" WITH 1/2" X 7" STEEL PLATE BOLTED WITH 1/2" BOLTS SPACED AT 2' ON CENTER.

EXAMPLE OF LOAD ESTIMATING ON BEAM IN NOOK AREA

Loads in Section B - B as follows TOTAL LOADS

2nd floor load = $\frac{\text{joist span}}{2}$ x 2nd floor (dead load + live load) = $\frac{12}{2}$ x 40 = 240#/1ft

Wall load = 64#/1ft Wall load = 64#/1ft

Attic floor load = $\frac{\text{joist span}}{2}$ x Attic (dead load + live load) = $\frac{12}{2}$ x 30 = 180#/1ft

Roof load = [rafter span + overhang] x Roof (live load + dead load) =

$= [\ 12 + 1\ ]$ x 30 = 390#/1ft (nook span) Roof load = 390#/1ft (nook span)

Nook roof load = $\frac{\text{nook span}}{2}$ x roof load (live + dead) + $\frac{\text{nook span}}{2}$ x ceiling dead load =

$= \frac{2}{2}$ x 30 + $\frac{2}{2}$ x 10 = 40#/1ft Nook = 40#/1ft

TOTAL LOAD ON BEAM IN NOOK = 914#/1ft

BEAM SPAN IN NOOK IS 8 FEET AND TOTAL ESTIMATED LOAD IS
914#/LINEAR FOOT:

BY USING TABLE NO. H-1, THE REQUIRED BEAM IS 4 @ 2" X 12" Southern Pine, or

4 @ 2" x 12" Spruce-Pine-Fir

OR

BY USING TABLE NO. H-2, THE REQUIRED MINIMUM FLITCH IS 2 @ 2" x 8" WITH 3/8" X 7" STEEL PLATE BOLTED WITH 1/2" BOLTS SPACED AT 2' ON CENTER.

TABLE N-1

WOOD BEAMS AND GIRDERS (19%) #2 GRADE, ALLOWABLE LOADS IN POUNDS PER LINEAR FOOT SIMPLE SPAN, DEFLECTION = L/360, LOAD DURATION FACTOR 1.0, ADEQUATE BEARING AND LATERAL SUPPORT MUST BE PROVIDED

2 X 8 (1-1/2 X 7-1/4) SPECIES	SPRUCE-PINE-FIR[1] NUMBER OF MEMBERS			SOUTHERN PINE NUMBER OF MEMBERS		
SPAN[2] (feet)	2	3	4	2	3	4
3	1133	1700	2266	1457	2186	2914
4	727	1091	1454	935	1403	1870
5	535	803	1070	688	1032	1376
6	424	636	848	538	807	1076
7	350	525	700	400	600	800
8	270	405	540	309	464	618
9	215	323	430	246	369	492
10	175	263	350	200	300	400
12	107	161	214	123	185	246
14	68	102	136	78	117	156

2 x 10 (1-1/2 x 9-1/4) SPECIES	SPRUCE-PINE-FIR[1] NUMBER OF MEMBERS			SOUTHERN PINE NUMBER OF MEMBERS		
SPAN[2] (feet)	2	3	4	2	3	4
3	1776	2664	3552	2283	3425	4566
4	1054	1581	2108	1355	2033	2710
5	749	1124	1498	963	1445	1926
6	581	872	1162	747	1121	1494
7	475	713	950	570	855	1140
8	401	602	802	440	660	880
9	321	482	642	350	525	700
10	261	392	522	285	428	570
12	183	275	366	200	300	400
14	135	203	270	147	221	294

2 x 12 (1-1/2 x 11-1/4) SPECIES	SPRUCE-PINE-FIR[1] NUMBER OF MEMBERS			SOUTHERN PINE NUMBER OF MEMBERS		
SPAN[2] (feet)	2	3	4	2	3	4
3	2800	4200	5600	3600	5400	7200
4	1482	2223	2964	1906	2859	3812
5	1008	1512	2016	1296	1944	2592
6	764	1146	1528	982	1473	1964
7	615	923	1230	783	1175	1566
8	514	771	1028	604	906	1208
9	431	647	862	481	722	962
10	351	527	702	392	588	784
12	246	369	492	274	411	548
14	182	273	364	203	305	406

1. SPRUCE-PINE-FIR NOT SPRUCE-PINE-FIR (SOUTHERN) IS USED IN THIS TABLE
2. SPAN IS CLEAR SPAN – EFFECTIVE SPAN FOR BENDING AND DEFLECTION IS CLEAR SPAN PLUS 3"

TABLE N-2

FLITCH PLATE BEAMS-DESIGN VALUES & ASSUMPTIONS

Steel- Fb = 24000(psi) E = 29000000(psi)
Wood- Fb = 1200(psi) E = 1600000(psi)
Deflection- 1/360 of Span
(Top of Beam Laterally Supported)

2 - 2 x 6

1 PLATE	Bm Wgt(lbs/ft)		8	10	13	15	17	21
	Span (ft)	Plate	1/4 x 5	3/8 x 5	1/2 x 5	5/8 x 5	3/4 x 5	1 x 5
	6.00		756	965	1175	1385	1595	2014
	7.00		555	709	863	1018	1172	1480
	8.00		411 *	520 *	638 *	739 *	848 *	1067 *
	9.00		289 *	365 *	442 *	519 *	596 *	749 *
	10.00		210 *	266 *	322 *	378 *	434 *	546 *
	11.00		158 *	200 *	242 *	284 *	326 *	410 *
	12.00		122 *	154 *	187 *	219 *	251 *	316 *

ALLOWABLE LOAD (Pounds/Ft)

* Denotes Load Controlled by Deflection

2 - 2 x 8

1 PLATE	Bm Wgt(lbs/ft)		11	14	17	20	23	29
	Span (ft)	Plate	1/4 x 7	3/8 x 7	1/2 x 7	5/8 x 7	3/4 x 7	1 x 7
	6.00		1406	1818	2229	2640	3051	3873
	7.00		1033	1335	1637	1939	2242	2846
	8.00		791	1022	1254	1485	1716	2179
	9.00		625	808	991	1173	1356	1722
	10.00		506	654	802	950	1098	1394
	11.00		400 *	516 *	631 *	746 *	862 *	1092 *
	12.00		308 *	397 *	486 *	575 *	664 *	841 *
	13.00		243 *	312 *	382 *	452 *	522 *	662 *
	14.00		194 *	250 *	306 *	362 *	418 *	530 *
	15.00		158 *	203 *	249 *	294 *	340 *	431 *
	16.00		130 *	168 *	205 *	243 *	280 *	355 *

ALLOWABLE LOAD (Pounds/Ft)

* Denotes Load Controlled by Deflection

2 - 2 x 10

1 PLATE	Bm Wgt(lbs/ft)		14	18	22	26	30	37
	Span (ft)	Plate	1/4 x 9	3/8 x 9	1/2 x 9	5/8 x 9	3/4 x 9	1 x 9
	6.00		2310	2990	3669	4349	5029	6388
	7.00		1697	2197	2696	3195	3695	4693
	8.00		1299	1682	2064	2446	2829	3593
	9.00		1027	1329	1631	1933	2235	2839
	10.00		832	1076	1321	1566	1810	2300
	11.00		687	890	1092	1294	1496	1901
	12.00		576	747	917	1087	1257	1597
	13.00		492	637	782	926	1071	1361
	14.00		409 *	528 *	647 *	765 *	884 *	1122 *
	15.00		332 *	429 *	526 *	622 *	719 *	912 *
	16.00		274 *	353 *	433 *	513 *	592 *	752 *
	17.00		228 *	295 *	361 *	427 *	494 *	627 *
	18.00		192 *	248 *	304 *	360 *	416 *	528 *
	19.00		164 *	211 *	259 *	306 *	354 *	449 *
	20.00		140 *	181 *	222 *	263 *	303 *	385 *

ALLOWABLE LOAD (Pounds/Ft)

* Denotes Load Controlled by Deflection

2 - 2 x 12

1 PLATE	Bm Wgt(lbs/ft)		18	22	27	32	36	46
	Span (ft)	Plate	1/4 x 11	3/8 x 11	1/2 x 11	5/8 x 11	3/4 x 11	1 x 11
	6.00		3437	4452	5468	6483	7498	9529
	7.00		2525	3271	4017	4763	5509	7001
	8.00		1933	2504	3076	3647	4218	5360
	9.00		1528	1979	2430	2881	3333	4235
	10.00		1237	1603	1968	2334	2699	3430
	11.00		1023	1325	1627	1929	2231	2835
	12.00		859	1113	1367	1621	1875	2382
	13.00		732	948	1165	1381	1597	2030
	14.00		631	818	1004	1191	1377	1750
	15.00		550	712	875	1037	1200	1525
	16.00		483	626	769	912	1054	1340
	17.00		414 *	535 *	657 *	778 *	899	1142 *
	18.00		349 *	451 *	553 *	655 *	757	962 *
	19.00		297 *	384 *	470 *	557 *	644	818 *
	20.00		254 *	329 *	403 *	478 *	552	701 *
	21.00		220 *	284 *	348 *	413 *	477	606 *
	22.00		191 *	247 *	303 *	359 *	415	527 *
	23.00		167 *	216 *	265 *	314 *	363 *	461 *
	24.00		147 *	190 *	233 *	276 *	320	406 *

ALLOWABLE LOAD (Pounds/Ft)

* Denotes Load Controlled by Deflection.

APPENDIX O
FOAM PLASTIC DIAGRAMS

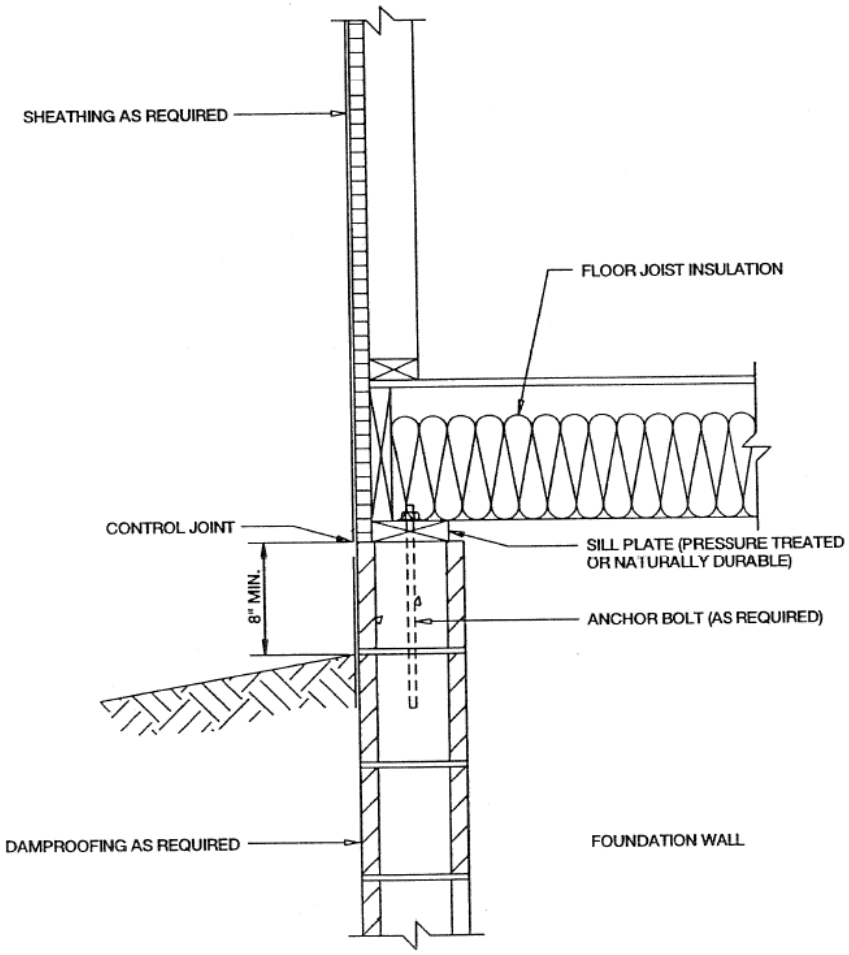


FIGURE O-1

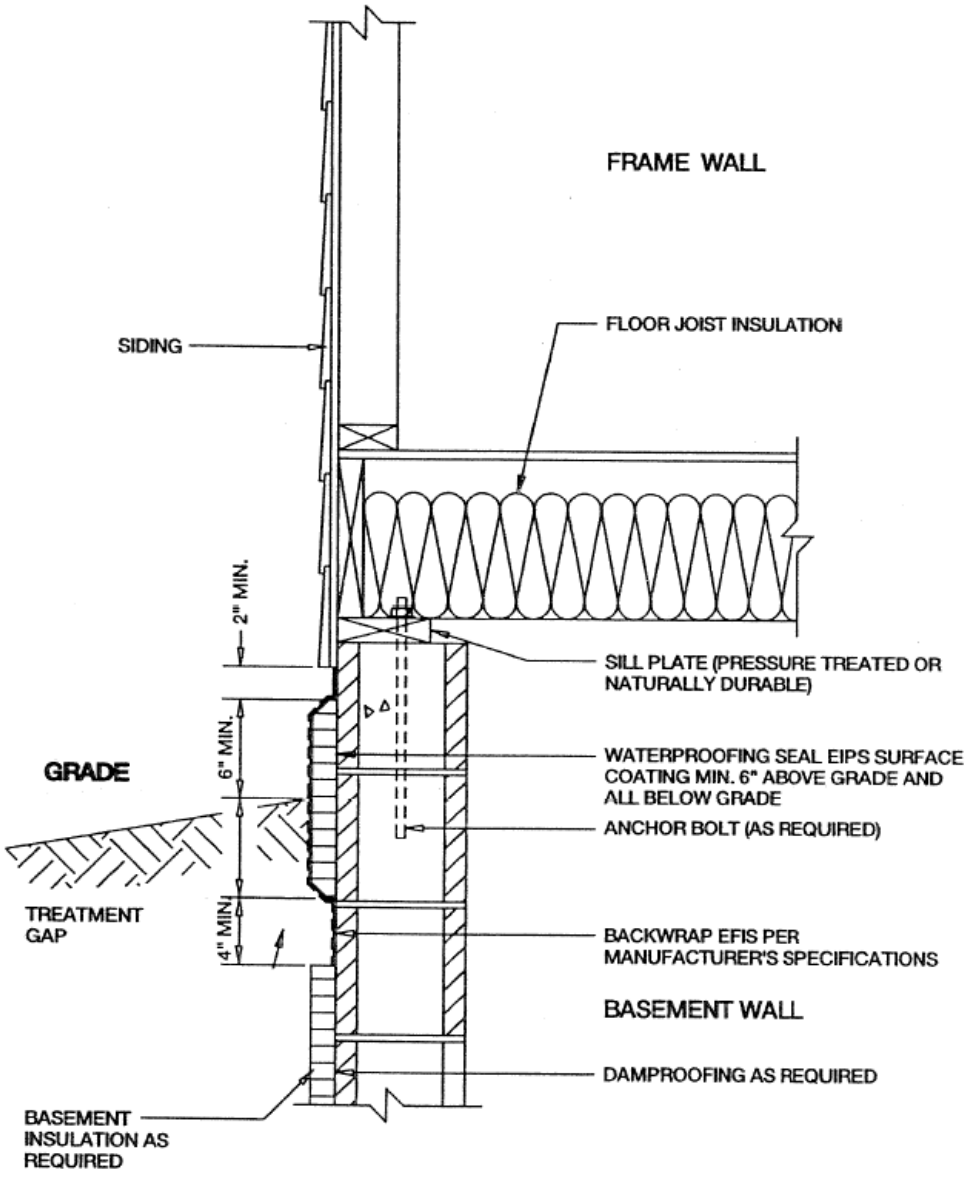
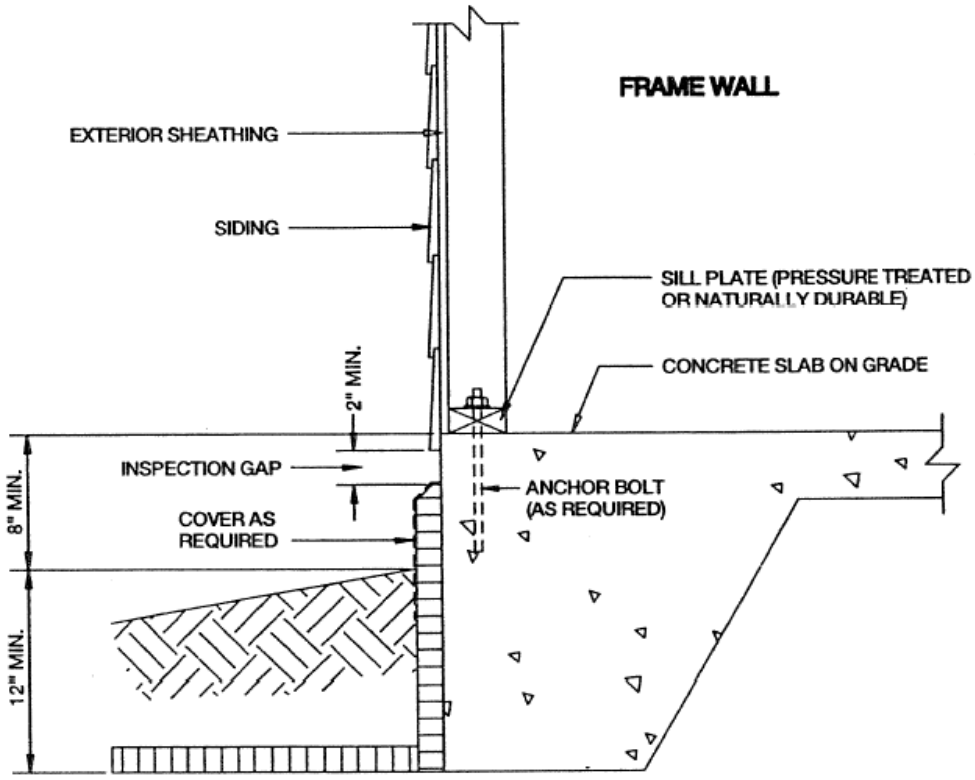

FRAME WALL
SIDING
FLOOR JOIST INSULATION
2" MIN.
SILL PLATE (PRESSURE TREATED OR NATURALLY DURABLE)
6" MIN.
GRADE
WATERPROOFING SEAL EIPS SURFACE COATING MIN. 6" ABOVE GRADE AND ALL BELOW GRADE
ANCHOR BOLT (AS REQUIRED)
TREATMENT GAP
4" MIN.
BACKWRAP EFIS PER MANUFACTURER'S SPECIFICATIONS
BASEMENT WALL
DAMPROOFING AS REQUIRED
BASEMENT INSULATION AS REQUIRED

FIGURE O-2



FOUNDATION INSULATION

24" VERTICAL DEPTH OR A COMBINATION OF VERTICAL AND HORIZONTAL DIMENSION EQUAL TO 24"

FIGURE O-3

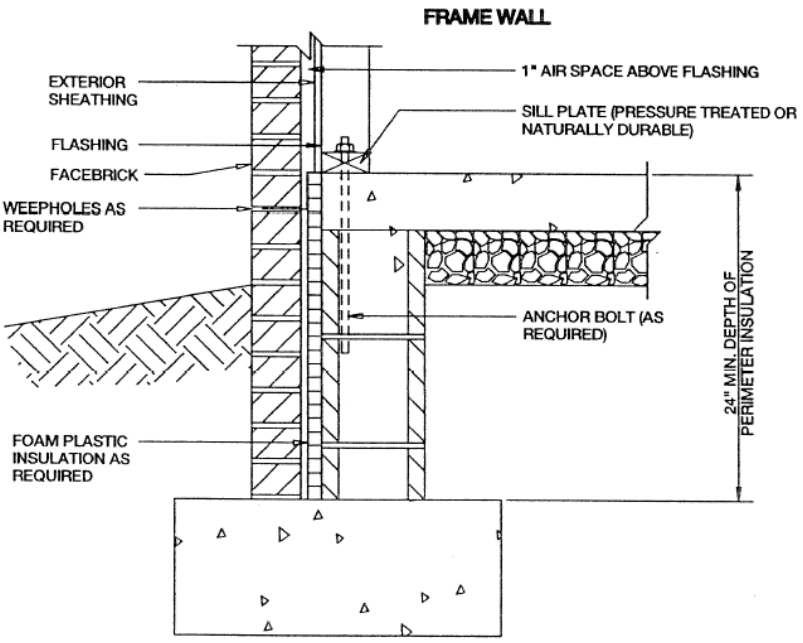

FRAME WALL
EXTERIOR SHEATHING
FLASHING
FACEBRICK
WEEPHOLES AS REQUIRED
FOAM PLASTIC INSULATION AS REQUIRED
1" AIR SPACE ABOVE FLASHING
SILL PLATE (PRESSURE TREATED OR NATURALLY DURABLE)
ANCHOR BOLT (AS REQUIRED)
24" MIN. DEPTH OF PERIMETER INSULATION

FIGURE O-4

APPENDIX P
SPRINKLING

(Deleted)