# Part III — Building Planning and Construction

# CHAPTER 3 BUILDING PLANNING

#### SECTION R301 DESIGN CRITERIA

**R301.1 Design.** Buildings and structures, and all parts thereof, shall be constructed to safely support all loads, including dead loads, live loads, roof loads, flood loads, snow loads, wind loads and seismic loads as prescribed by this code. The construction of buildings and structures shall result in a system that provides a complete load path capable of transferring all loads from their point of origin through the load-resisting elements to the foundation.

**R301.1.1 Alternative provisions.** As an alternative to the requirements in Section R301.1 the following standards are permitted subject to the limitations of this code and the limitations therein. Where engineered design is used in conjunction with these standards the design shall comply with the North Carolina Building Code.

- 1. American Forest and Paper Association (AF&PA) *Wood Frame Construction Manual* (WFCM).
- 2. American Iron and Steel Institute (AISI), *Standard* for Cold-Formed Steel Framing—Prescriptive Method for One- and Two-family Dwellings (COFS/PM).

**R301.1.2 Construction systems.** The requirements of this code are based on platform and balloon-frame construction for light-frame buildings. The requirements for concrete and masonry buildings are based on a balloon framing system. Other framing systems must have equivalent detailing to ensure force transfer, continuity and compatible deformations.

**R301.1.3 Engineered design.** When a building of otherwise conventional construction contains structural elements exceeding the limits of Section R301 or otherwise, not conforming to this code, these elements shall be designed in accordance with accepted engineering practice. The extent of such design need only demonstrate compliance of nonconventional elements with other applicable provisions and shall be compatible with the performance of the conventional framed system. Engineered design in accordance with the <u>North Carolina</u> Building Code is permitted for all buildings and structures, and parts thereof, included in the scope of this code.

**[B] R301.2 Climatic and geographic design criteria.** Buildings shall be constructed in accordance with the provisions of this code as limited by the provisions of this section. Additional criteria shall be established by the local jurisdiction and set forth in Table R301.2(1).

**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 windows, skylights and exterior doors are not otherwise specified, the loads listed in Table R301.2(2) adjusted for height and exposure per Table R301.2(3), shall be used to determine design load performance requirements for windows and 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 (177.1 km/h) 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).
- 5. Concrete construction shall be designed in accordance with the provisions of this code.
- 6. High wind Chapters 44 and 45.

**R301.2.1.2 Internal pressure.** Windows in buildings located in windborne debris regions shall have glazed openings protected from windborne debris or the building shall be designed as a partially enclosed building in accordance with the <u>North Carolina</u> Building Code. Glazed opening protection for windborne debris shall meet the requirements of the Large Missile Test of ASTM E 1996 and of ASTM E 1886 referenced therein.

**Exception:** Wood structural panels with a minimum thickness of  $7/_{16}$  inch (11.1 mm) and a maximum span of 8 feet (2438 mm) shall be permitted for opening protection in one- and two-story buildings. Panels shall be precut to cover the glazed openings with attachment hardware provided. Attachments shall be provided in accordance with Table R301.2.1.2 or shall be designed to resist the components and cladding loads determined in accordance with the provisions of the *International Building Code*.

			SUE	JECT TO DA	MAGE FRO	М		ICE SHIELD				
ROOF LOAD	WIND SPEED (mph)	SEISMIC DESIGN CATEGORY	Weathering <sup>a</sup>	Frost line depth	Termite	Decay	WINTER DESIGN TEMP	UNDER- LAYMENT REQUIRED	FLOOD HAZARD <sup>₅</sup>	AIR FREEZING INDEX	MEAN ANNUAL TEMP	
<u>20</u>	<u>Figure</u> <u>301.2(4)</u>	<u>Figure</u> <u>301.2(2)</u>	Moderate	<u>12"</u>	<u>Moderate -</u> <u>Heavy</u>	Moderate	Local	Local	Local	Local	Local	

#### TABLE R301.2(1) CLIMATIC AND GEOGRAPHIC DESIGN CRITERIA

For SI: 1 pound per square foot =  $0.0479 \text{ kN/m}^2$ , 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 adoption 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.

#### TABLE R301.2.1.2 WINDBORNE DEBRIS PROTECTION FASTENING SCHEDULE FOR WOOD STRUCTURAL PANELS<sup>a,b,c</sup>

	FASTENER SPACING						
FASTENER TYPE	Panel span ≤ 4 foot	4 foot < panel span ≤ 6 foot	6 foot < panel span ≤ 8 foot				
$2^{1}/_{2}$ " #6 Wood screws	16″	12″	9″				
2 <sup>1</sup> / <sub>2</sub> " #8 Wood screws	16″	16″	12″				

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound = 0.454 kg, 1 mile per hour = 1.609 km/h.

a. This table is based on 130 mph wind speeds and a 33-foot mean roof height.

b. Fasteners shall be installed at opposing ends of the wood structural panel.

c. Where screws are attached to masonry or masonry/stucco, they shall be attached utilizing vibration-resistant anchors having a minimum ultimate withdrawal capacity of 490 pounds.

**R301.2.1.3 Wind speed conversion.** When referenced documents are based on fastest mile wind speeds, the three second gust wind velocities of Figure R301.2(4) shall be converted to fastest mile wind velocities using Table R301.2.1.3.

**R301.2.1.4 Exposure category.** For each wind direction considered, an exposure category that adequately reflects the characteristics of ground surface irregularities shall be determined for the site at which the building or structure is to be constructed. For a site located in the transition zone between categories, the category resulting in the largest wind forces shall apply. Account shall be taken of variations in ground surface roughness that arise from natural topography and vegetation as well as from constructed features. For any given wind direction, the exposure in which a specific building or other structure is sited shall be assessed as being one of the following categories:

1. Exposure A. Large city centers with at least 50 percent of the buildings having a height in excess of 70 feet (21 336 mm). Use of this exposure category shall be limited to those areas for which terrain representative of Exposure A prevails in the upwind direction for a distance of at least 0.5 mile (0.8 km) or 10 times the height of the building or other structure, whichever is greater. Possible channeling effects or increased velocity pressures due to the building or structure being located in the wake of adjacent buildings shall be taken into account.

- 2. Exposure B. Urban and suburban areas, wooded areas, or other terrain with numerous closely spaced obstructions having the size of single-family dwellings or larger. Exposure B shall be assumed unless the site meets the definition of another type exposure.
- 3. Exposure C. Open terrain with scattered obstructions, including surface undulations or other irregularities, having heights generally less than 30 feet (9144 mm) extending more than 1,500 feet (457 m) from the building site in any quadrant. This exposure shall also apply to any building located within Exposure B type terrain where the building is directly adjacent to open areas of Exposure C type terrain in any quadrant for a distance of more than 600 feet (183 m). This category includes flat open country, grasslands and shorelines in hurricane prone regions.
- 4. Exposure D. Flat, unobstructed areas exposed to wind flowing over open water (excluding shorelines in hurricane prone regions) for a distance of at least 1 mile (1.61 km). Shorelines in Exposure D include inland waterways, the Great Lakes and coastal areas of California, Oregon, Washington and Alaska. This exposure shall apply only to those buildings and other structures exposed to the wind coming from over the water. Exposure D extends inland from the shoreline a distance of 1,500 feet (457 m) or 10 times the height of the building or structure, whichever is greater.

#### TABLE R301.2.1.3 EQUIVALENT BASIC WIND SPEEDS<sup>a</sup>

3-second gust	85	90	100	105	110	120	125	130	140	145	150	160	170
Fastest mile	70	75	80	85	90	100	105	110	120	125	130	140	150

For SI: 1 mile per hour = 1.609 km/h.

a. Linear interpolation is permitted.

		EFFECTIVE		BASIC WIND SPEED (mph—3-second gust)																					
	ZONE	WIND AREA (feet <sup>2</sup> )	85	9	0	10	00	1(	05		10	12		-	25		30	14	10	14	45	1!	50	1	70
	1	10	10.0 -13.0	-	-14.6	10.0	-18.0	10.0	1	10.0	-21.8	10.5	-25.9	11.4	-28.1	12.4		14.3	-35.3	15.4	-37.8	16.5		21.1	
	1	20	10.0 -12.7		-14.2	10.0	-17.5	10.0	-19.3	10.0	-21.2	10.0	-25.2	10.7	-27.4	11.6	-29.6	13.4	-34.4	14.4	-36.9	15.4	-39.4	19.8	
se	1	50	10.0 -12.2		-13.7	10.0	-16.9	10.0	-18.7	10.0	-20.5	10.0	-24.4	10.0	-26.4	10.6	-28.6	12.3	-33.2	13.1	-35.6	14.1	-38.1	18.1	-48.9
degrees	1	100	10.0 -11.9	10.0	-13.3	10.0	-18.5	10.0	-18.2	10.0	-19.9	10.0	-23.7	10.0	-25.7	10.0	-27.8	11.4	-32.3	12.2	-34.6	13.0	-37.0	16.7	-47.6
0 de	2	10	10.0 -21.8	10.0	-24.4	10.0	-30.2	10.0	-33.3	10.0	-36.5	10.5	-43.5	11.4	-47.2	12.4	-51.0	14.3	-59.2	15.4	-63.5	16.5	-67.9	21.1	-87.2
to 10	2	20	10.0 -19.5	10.0	-21.8	10.0	-27.0	10.0	-29.7	10.0	-32.6	10.0	-38.8	10.7	-42.1	11.6	-45.6	13.4	-52.9	14.4	-56.7	15.4	-60.7	19.8	-78.0
× 0 1	2	50	10.0 -16.4	10.0	-18.4	10.0	-22.7	10.0	-25.1	10.0	-27.5	10.0	-32.7	10.0	-35.5	10.6	-38.4	12.3	-44.5	13.1	-47.8	14.1	-51.1	18.1	-65.7
Roof	2	100	10.0 -14.1	10.0	-15.8	10.0	-19.5	10.0	-21.5	10.0	-23.6	10.0	-28.1	10.0	-30.5	10.0	-33.0	11.4	-38.2	12.2	-41.0	13.0	-43.9	16.7	-56.4
В	3	10	10.0 -32.8	10.0	-36.8	10.0	-45.4	10.0	-50.1	10.0	-55.0	10.5	-65.4	11.4	-71.0	12.4	-76.8	14.3	-89.0	15.4	-95.5	16.5	-102.2	21.1	-131.3
	3	20	10.0 -27.2	10.0	-30.5	10.0	-37.6	10.0	-41.5	10.0	-45.5	10.0	-54.2	10.7	-58.8	11.6	-63.6	13.4	-73.8	14.4	-79.1	15.4	-84.7	19.8	-108.7
	3	50	10.0 -19.7	10.0	-22.1	10.0	-27.3	10.0	-30.1	10.0	-33.1	10.0	-39.3	10.0	-42.7	10.6	-46.2	12.3	-53.5	13.1	-57.4	14.1	-61.5	18.1	-78.9
	3	100	10.0 -14.1	10.0	-15.8	10.0	-19.5	10.0	-21.5	10.0	-23.6	10.0	-28.1	10.0	-30.5	10.0	-33.0	11.4	-38.2	12.2	-41.0	13.0	-43.9	16.7	-56.4
	1	10	10.0 -11.9	10.0	-13.3	10.4	-16.5	11.4	-18.2	12.5	-19.9	14.9	-23.7	16.2	-25.7	17.5	-27.8	20.3	-32.3	21.8	-34.6	23.3	-37.0	30.0	-47.6
	1	20	10.0 -11.6	10.0	-13.0	10.0	-16.0	10.4	-17.6	11.4	-19.4	13.6	-23.0	14.8	-25.0	16.0	-27.0	18.5	-31.4	19.9	-33.7	21.3	-36.0	27.3	-46.3
Lee	1	50	10.0 -11.1	10.0	-12.5	10.0	-15.4	10.0	-17.0	10.0	-18.6	11.9	-22.2	12.9	-24.1	13.9	-26.0	16.1	-30.2	17.3	-32.4	18.5	-34.6	23.8	-44.5
degrees	1	100	10.0 -10.8	10.0	-12.1	10.0	-14.9	10.0	-16.5	10.0	-18.1	10.5	-21.5	11.4	-23.3	12.4	-25.2	14.3	-29.3	15.4	-31.4	16.5	-33.6	21.1	-43.2
30 6	2	10	10.0 -25.1	10.0	-28.2	10.4	-34.8	11.4	-38.3	12.5	-42.1	14.9	-50.1	16.2	-54.3	17.5	-58.7	20.3	-68.1	21.8	-73.1	23.3	-78.2	30.0	-100.5
9	2	20	10.0 -22.8	10.0	-25.6	10.0	-31.5	10.4	-34.8	11.4	-38.2	13.6	-45.4	14.8	-49.3	16.0	-53.3	18.5	-61.8	19.9	-66.3	21.3	-71.0	27.3	-91.2
> 10	2	50	10.0 -19.7	10.0	-22.1	10.0	-27.3	10.0	-30.1	10.0	-33.0	11.9	-39.3	12.9	-42.7	13.9	-46.1	16.1	-53.5	17.3	-57.4	18.5	-61.4	23.8	-78.9
Roof >	2	100	10.0 -17.4	10.0	-19.5	10.0	-24.1	10.0	-26.6	10.0	-29.1	10.5	-34.7	11.4	-37.6	12.4	-40.7	14.3	-47.2	15.4	-50.6	16.5	-54.2	21.1	-69.6
В	3	10	10.0 -25.1	10.0	-28.2	10.4	-34.8	11.4	-38.3	12.5	-42.1	14.9	-50.1	16.2	-54.3	17.5	-58.7	20.3	-68.1	21.8	-73.1	23.3	-78.2	30.0	-100.5
	3	20	10.0 -22.8	10.0	-25.6	10.0	-31.5	10.4	-34.8	11.4	-38.2	13.6	-45.4	14.8	-49.3	16.0	-53.3	18.5	-61.8	19.9	-66.3	21.3	-71.0	27.3	-91.2
	3	50	10.0 -19.7	10.0	-22.1	10.0	-27.3	10.0	-30.1	10.0	-33.0	11.9	-39.3	12.9	-42.7	13.9	-46.1	16.1	-53.5	17.3	-57.4	18.5	-61.4	23.8	-78.9
	3	100	10.0 -17.4		-19.5	10.0	-24.1	10.0	-26.6	10.0	-29.1	10.5	-34.7	11.4	-37.6	12.4	-40.7	14.3	-47.2	15.4	-50.6	16.5			
	1	10	11.9 -13.0	13.3	-14.6	16.5	-18.0	18.2	-19.8	19.9	-21.8	23.7	-25.9	25.7	-28.1	27.8	-30.4	32.3	-35.3	34.6	-37.8	37.0	-40.5	47.6	-52.0
s	1	20	11.6 -12.3		-13.8	16.0	-17.1	17.6	-18.8	19.4	-20.7	23.0	-24.6	25.0	-26.7	27.0	-28.9	31.4	-33.5	33.7	-35.9	36.0	-38.4		
degree	1	50	11.1 -11.5		-12.8	15.4	-15.9	17.0		18.6	-19.2	22.2	-22.8	24.1	-24.8	26.0	-25.8	30.2	-31.1	32.4	-33.3	34.6	-35.7		
deć	1	100	10.8 -10.8		-12.1	14.9	-14.9	16.5	-16.5	18.1	-18.1	21.5	-21.5	23.3	-23.3	25.2	-25.2	29.3	-29.3	31.4	-31.4	33.6	-33.6		
45	2	10	11.9 -15.2		-17.0	16.5	-21.0	18.2	-23.2	19.9	-25.5	23.7	-30.3	25.7	-32.9	27.8	-35.6	32.3	-41.2	34.6	-44.2	37.0	-47.3		
30 to	2	20	11.6 -14.5		-16.3	16.0	-20.1	17.6	-22.2	19.4	-24.3	23.0	-29.0	25.0	-31.4	27.0	-34.0	31.4	-39.4	33.7	-42.3	36.0	-45.3		
Λ	2	50	11.1 -13.7		-15.3	15.4	-18.9	17.0	-20.8	18.6	-22.9	22.2	-27.2	24.1	-29.5	26.0	-32.0	30.2	-37.1	32.4	-39.8	34.6	-42.5		
Roof	3	100	10.8 -13.0 11.9 -15.2		-14.6	14.9 16.5	-18.0 -21.0	16.5 18.2	-19.8 -23.2	18.1 19.9	-21.8	21.5	-25.9 -30.3	23.3 25.7	-28.1 -32.9	25.2 27.8	-30.4 -35.6	29.3 32.3	-35.3 -41.2	31.4 34.6	-37.8 -44.2	33.6 37.0	-40.5 -47.3		
Ē	3	20	11.6 -14.5		-16.3	16.0	-20.1	17.6	-22.2	19.9	-24.3	23.0	-29.0	25.0	-31.4	27.0	-34.0	31.4	-39.4	33.7	-42.3	36.0	-45.3		-58.1
	3	50	11.0 -14.5		-15.3	15.4	-18.9	17.0	-22.2	19.4	-24.5	23.0	-29.0	23.0	-29.5	26.0	-32.0	30.2	-39.4	32.4	-42.5	34.6	-43.5		
	3	100	10.8 -13.0		-13.5	13.4	-18.0	16.5	-19.8	18.1	-22.9	22.2	-27.2	24.1	-29.5	25.2	-30.4	29.3	-35.3	31.4	-39.8	33.6			
	4	100	13.0 -14.1																						
	4	20	12.4 -13.5																						-54.1
	4	50	11.6 -12.7																		-37.1		-39.7		
=	4	100	11.0 -12.7								-20.4				-26.3						-35.4		-37.8		
Wall	5	100	13.0 -17.4								-29.1		-34.7		-37.6				-47.2						
	5	20	12.4 -16.2		-18.2		-22.5		-24.8			24.7			-35.1				-44.0		-47.2				-64.9
	5	50	11.6 -14.7				-20.3								-31.8										-58.7
	5	100	11.1 -13.5			1									-29.2										-54.1
L	5	100	11.1 -13.3	12.4	-13.1	13.3	-10./	10.9	1-20.0	10.5	-22.0	22.0	-20.9	23.9	-29.2	23.9	-51.0	50.0	-50.7	32.2	-39.3	.94.4	-42.1	++.2	-54.1

#### TABLE R301.2(2) COMPONENT AND CLADDING LOADS FOR A BUILDING WITH A MEAN ROOF HEIGHT OF 30 FEET LOCATED IN EXPOSURE B (psf)

For SI: 1 foot = 304.8 mm, 1 square foot =  $0.0929 \text{ m}^2$ , 1 mile per hour = 1.609 km/h.

**NOTES:** For effective areas between those given above the load may be interpolated, otherwise use the load associated with the lower effective area. Table values shall be adjusted for height and exposure by multiplying by the adjustment coefficient in Table R301.2(3).

See Figure R301.2(8) for location of zones.

Plus and minus signs signify pressures acting toward and away from the building surfaces.

MEAN	EXPOSURE							
ROOF HEIGHT	В	с	D					
15	1.00	1.21	1.47					
20	1.00	1.29	1.55					
25	1.00	1.35	1.61					
30	1.00	1.40	1.66					
35	1.05	1.45	1.70					
40	1.09	1.49	1.74					
45	1.12	1.53	1.78					
50	1.16	1.56	1.81					
55	1.19	1.59	1.84					
60	1.22	1.62	1.87					

 TABLE R301.2(3)

 HEIGHT AND EXPOSURE ADJUSTMENT COEFFICIENTS FOR TABLE R301.2(2)

TABLE R301.2(4) DESIGN PRESSURES FOR DOORS AND WINDOWS abc.d POSITIVE AND NEGATIVE IN PSF

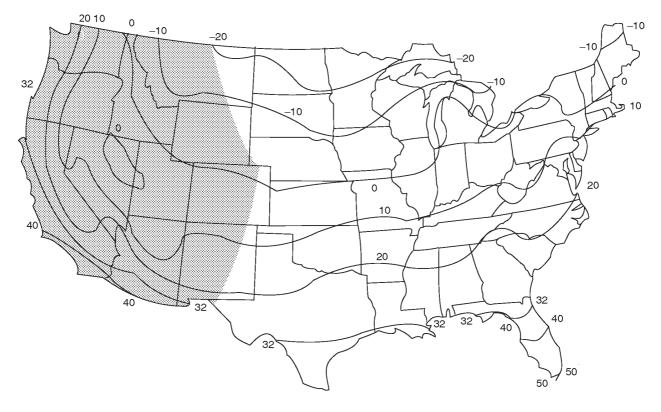
	MEAN ROOF HEIGHT (ft)					
VELOCITY (mph)	15	25	35			
90	15	17	19			
100	20	23	25			

a. Alternate design pressures may be determined by using North Carolina State Building Code, ASCE-7, DASMA Technical Data Sheet 155h (for garage doors), or the 2006 International Building Code.

b. If window or door is more than 4 feet (1219 mm) 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.

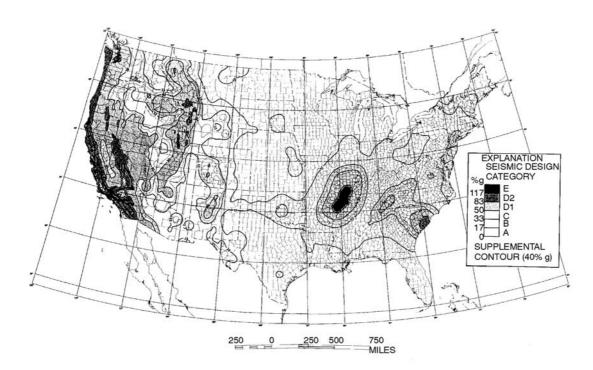




DESIGN TEMPERATURES IN THIS AREA MUST BE BASED ON ANALYSIS OF LOCAL CLIMATE AND TOPOGRAPHY

For SI:  $^{\circ}C = [(^{\circ}F)-32]/1.8$ .

FIGURE R301.2(1) ISOLINES OF THE 971/2 PERCENT WINTER (DECEMBER, JANUARY AND FEBRUARY) DESIGN TEMPERATURES (°F)



SCALE 1:15,000,000

#### REFERENCES

Digital data prepared with ARC/INFO 7.1.1 running under Solaris 2.5 on a UNIX workstation

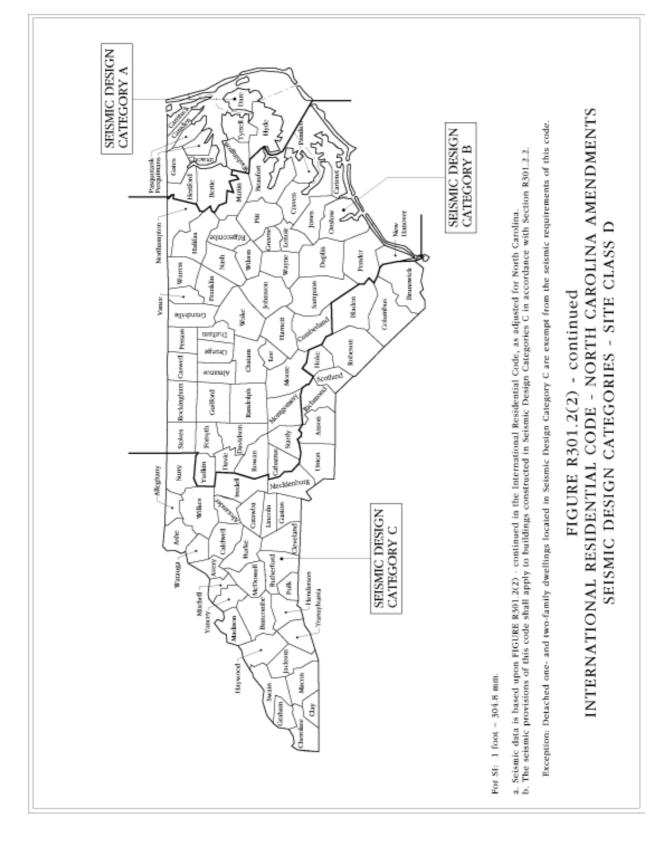
Albers Equal-Area Conic Projection Standard Parallels 29.5°N and 45.5°N Central Meridian 95°W

Prepared by U.S. Geological Survey

- Frankel, A. Mueller, C., Barnhard, T., Perkins, D., Leyendecker, E. V., Dickman, N., Hanson, S., and Hopper, M., 1996, National Seismic-Hazard Maps: Documentation June 1996: U.S. Geological Survey Open-File Report 96-532, 110 p.
- Hanson, S., and hopper, M., 1996, National Seismic-Hazard Waps: Documentation June 1996; U.S. Geological Survey Open-File Report 96-532, 110 p. Frankel, A., Mueller, C., Barnhard, T., Perkins, D., Leyendecker, E. V., Dickman, N., Hanson, S., and Spectral Response Acceleration for 0.2 Second Period with 2% Probability of Exceedance in 50 Years: U. S. Geological Survey Open-File Report 97-131-F, scale 1:7,000,000.
- Petersen, M., Bryant, W., Cramer, C., Cao, T., Reichle, M., Frankel, A., Lienkaemper, J., McCrory, P., and Schwartz, D., 1996, Probabilitic Seismic Hazard Assessment for the State of California: California Division of Mines and Geology Open-File Report 96-08, 66 p., and U.S. Geological Survey Open-File Report 96-706, 66 p.

For SI: 1 mile = 1.61 km.

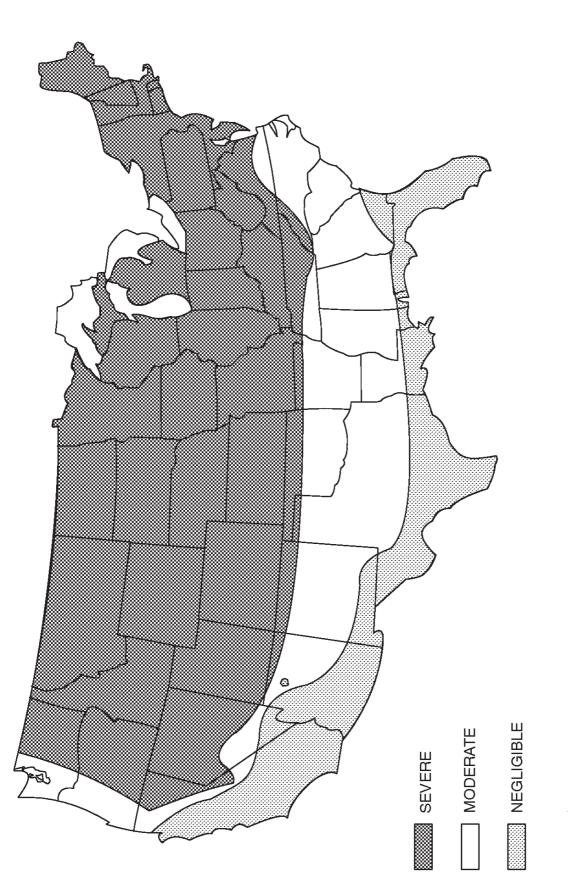
[B] FIGURE R301.2(2) SEISMIC DESIGN CATEGORIES—SITE CLASS D



#### COUNTIES IN SEISMIC DESIGN CATEGORY C

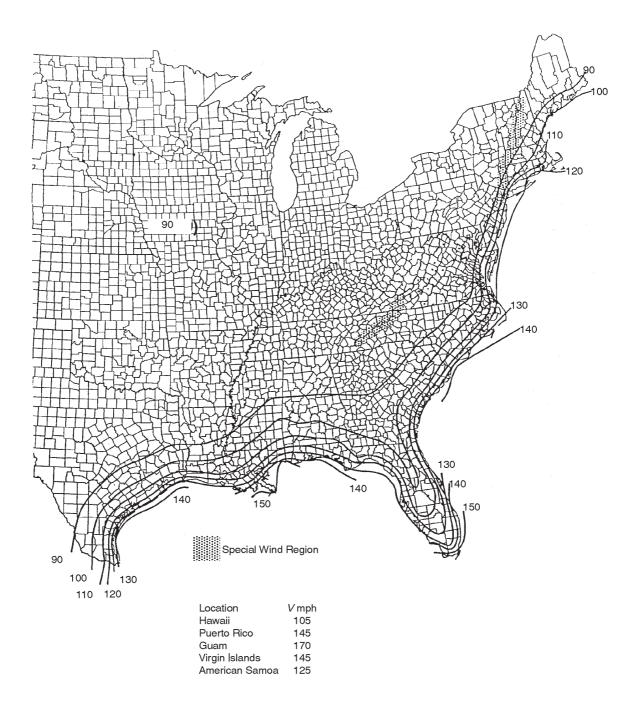
Alleghany Alexander Anson Ashe Avery Bladen Brunswick Buncombe Burke Caldwell Catawba Cherokee Clay Cleveland Columbus Gaston Graham Haywood Henderson Hoke Iredell Jackson Lincoln Macon Madison McDowell Mecklenburg Mitchell Polk Richmond Robeson Rutherford Scotland Surry Swain Transylvania Union Watauga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

FIGURE R301.2(2)



a. Alaska and Hawaii are classified as severe and negligible, respectively.
 b. Lines defining areas are approximate only. Local conditions may be more or less severe than indicated by region classification. A severe classification is where weather conditions result in significant snowfall combined with extended periods during which there is little or no natural thawing causing deticing salts to be used extensively.

[B] FIGURE R301.2(3) WEATHERING PROBABILITY MAP FOR CONCRETE

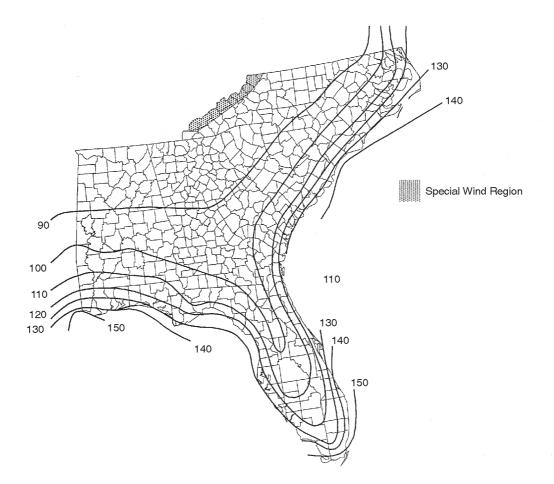


#### [B] FIGURE R301.2(4)—continued BASIC WIND SPEEDS FOR 50-YEAR MEAN RECURRENCE INTERVAL

(continued)

For SI: 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s.

- a. Values are nominal design 3-second gust wind speeds in miles per hour at 33 feet above ground for Exposure C category.
- b. Linear interpolation between wind contours is permitted.
- c. Islands and coastal areas outside the last contour shall use the last wind speed contour of the coastal area.
- d. Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.
- e. Enlarged view of Eastern and Southern seaboards are on the following pages.



#### [B] FIGURE R301.2(4)—continued BASIC WIND SPEEDS FOR 50-YEAR MEAN RECURRENCE INTERVAL

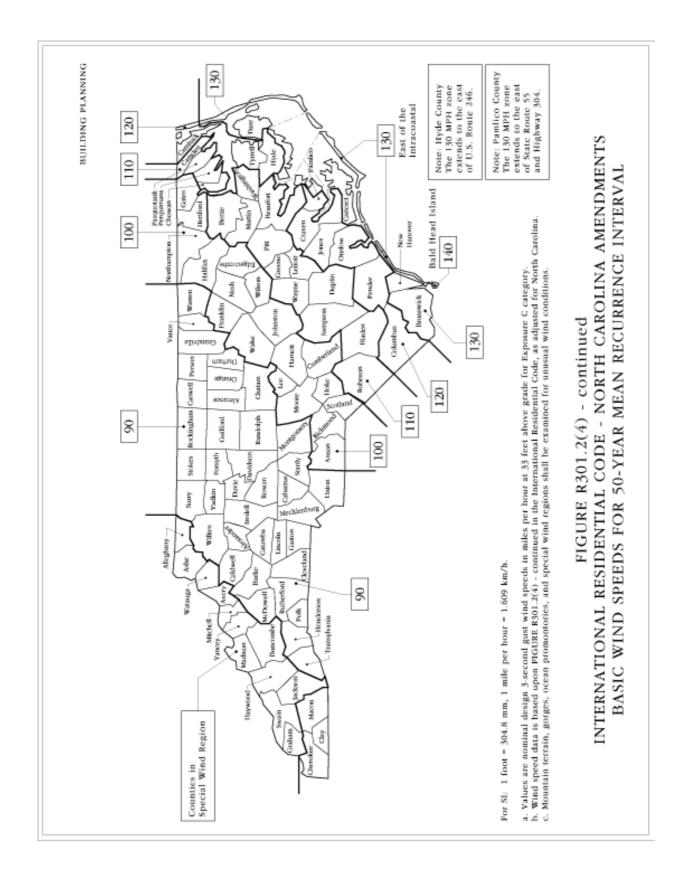
For SI: 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s.

a. Values are nominal design 3-second gust wind speeds in miles per hour at 33 feet above ground for Exposure C category.

b. Linear interpolation between wind contours is permitted.

c. Islands and coastal areas outside the last contour shall use the last wind speed contour of the coastal area.

d. Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.



Counties	МРН	Counties	МРН
Anson	100	Lee	100
Alleghany	special mountain region	Lenior	110
Ashe	special mountain 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 <sup>1</sup>	120/130	New Hanover <sup>3</sup>	120/130
Buncombe	special mountain region	Northampton	100
Camden	110	Onslow	120/130 east of ICW
Carteret	130	Pamlico <sup>5</sup>	120/130
Chowan	110	Pasquotank	110/
Columbus	120	Pender <sup>4</sup>	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
Harnett	100	Wayne	110
Haywood	special mountain region	Wilson	100
Hertford	100	Yancy	special mountain region
Hoke	100		
Hyde <sup>2</sup>	120/130	Counties not listed	90
Jackson	special mountain region		
Johnston	100		
Jones	120		

#### **BASIC DESIGN WIND SPEEDS**

#### 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 Topsail Township, and the remainder of the County is in the 110 mph zone.

5. Pamilico County - 130 mph zone east of SR 55 and Hwy304, 120 mph zone west of SR 55 and Hwy 304.

CONTROLLING ELEVATION IN FEET a, b, c, d, e	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

#### BASIC DESIGN WIND VELOCITIES FOR MOUNTAIN REGIONS

For SI: 1 foot = 304.8 mm, 1 mile per hour =  $0.0283 \text{ m}^3/\text{h}$ .

a. Wind velocities are to apply to all mountain tops, crests, knobs or peaks as named on the USGS Quadrangle maps.

b. Effect of the 130 mph wind is to extend downward from crest for 200 feet or to the controlling elevation for 120 mph wind, whichever is the lesser.

c. 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.

d. 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.

e. Effect of the 100 mph wind is to extend downward from crest for 50 feet or to the controlling elevation for 90 mph wind, whichever is the lesser.

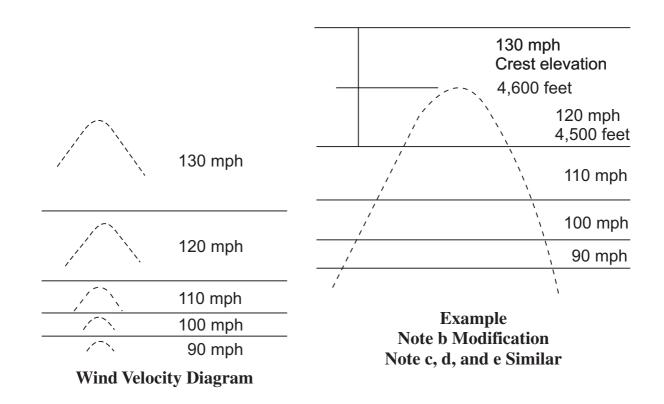


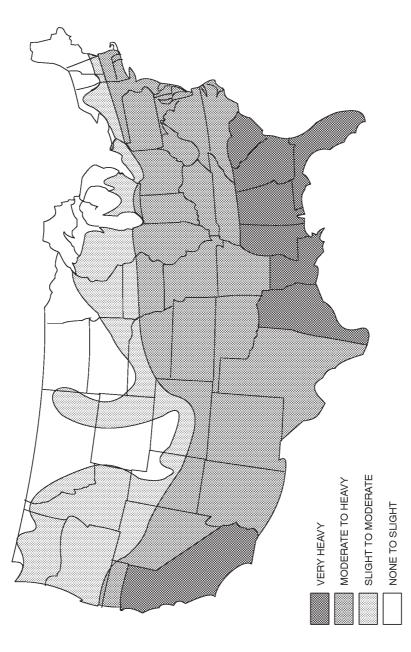
FIGURE R301.2(4)-continued



For SI: 1 foot = 304.8 mm, 1 pound per square foot =  $0.0479 \text{ kN/m}^2$ , 1 mile = 1.61 km

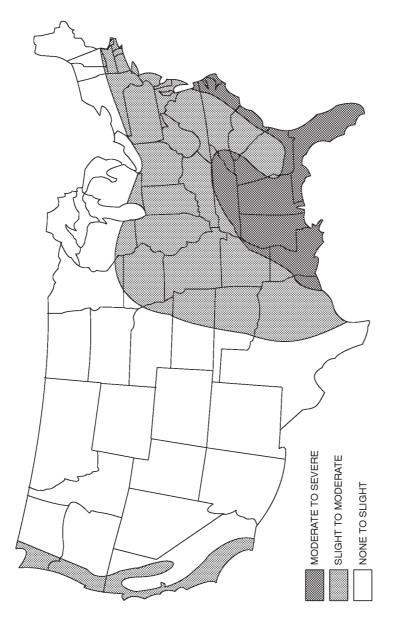
- a. In CS areas, site-specific Case Studies are required to establish ground snow loads. Extreme local variations in ground snow loads in these areas preclude mapping at this scale.
- b. Numbers in parentheses represent the upper elevation limits in feet for the ground snow load values presented below. Site-specific cases studies are required to establish ground snow loads at elevations not covered.

# [B] FIGURE R301.2(5) GROUND SNOW LOADS, $P_g$ , FOR THE UNITED STATES (lb/ft<sup>2</sup>)



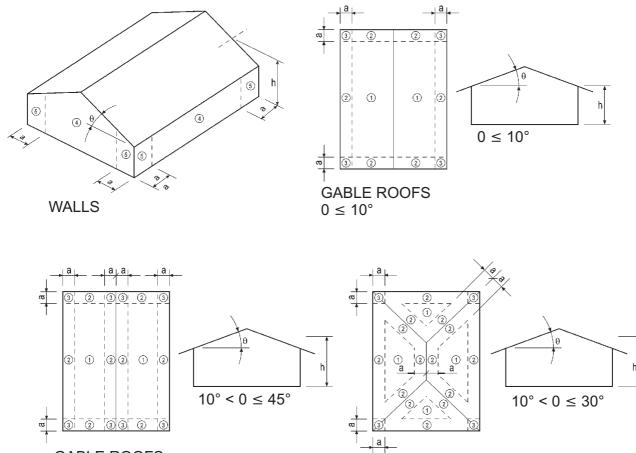
# FIGURE R301.2(6) TERMITE INFESTATION PROBABILITY MAP

NOTE: Lines defining areas are approximate only. Local conditions may be more or less severe than indicated by the region classification.



NOTES: Lines defining areas are approximate only. Local conditions may be more or less severe than indicated by the region classification.

FIGURE R301.2(7) DECAY PROBABILITY MAP



GABLE ROOFS  $10^{\circ} < 0 \le 45^{\circ}$ 

HIP ROOFS  $10^{\circ} < 0 \le 30^{\circ}$ 

For SI: 1 foot = 304.8 mm, 1 degree = 0.009 rad. NOTE: a = 4 feet in all cases

FIGURE R301.2(8) COMPONENT AND CLADDING PRESSURE ZONES

**R301.2.2 Seismic provisions.** The seismic provisions of this code shall apply to buildings constructed in Seismic Design Categories C,  $D_1$ , and  $D_2$ , as determined in accordance with this section. Buildings in Seismic Design Category E shall be designed in accordance with the North Carolina Building Code, except when the Seismic Design Category is reclassified to a lower Seismic Design Category in accordance with Section R301.2.2.1.

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

The weight and irregularity limitations of Section R301.2.2.2 shall apply to buildings in all Seismic Design Categories regulated by the seismic provision of this code. Buildings in Seismic Design Category C shall be constructed in accordance with the additional requirements of Sections R301.2.2.3. Buildings in Seismic Design Categories  $D_1$  and  $D_2$  shall be constructed in accordance with the additional requirements of Hamiltonian requirements of Section R301.2.2.4.

**R301.2.2.1 Determination of seismic design category.** Buildings shall be assigned a Seismic Design Category in accordance with Figure 301.2(2).

R301.2.2.1.1 Alternate determination of seismic design category. The Seismic Design Categories and corresponding Short Period Design Spectral Response Accelerations,  $S_{DS}$  shown in Figure R301.2(2) are based on soil Site Class D, as defined in Section 1615.1.1 of the North Carolina Building Code. If soil conditions are other than Site Class D, the Short Period Design Spectral Response Acceleration, S<sub>DS</sub>, for a site can be determined according to Section 1615.1 of the International Building Code. The value of  $S_{DS}$ determined according to Section 1615.1 of the Inter*national Building Code* is permitted to be used to set the Seismic Design Category according to Table R301.2.2.1.1, and to interpolate between values in Tables R602.10.1, R603.7, and other seismic design requirements of this code.

TABLE R301.2.2.1.1						
SEISMIC DESIGN CATEGORY DETERMINATION						

CALCULATED S <sub>DS</sub>	SEISMIC DESIGN CATEGORY
$S_{DS} \le 0.17 \mathrm{g}$	А
$0.17g < S_{DS} \le 0.33g$	В
$0.33g < S_{DS} \le 0.50g$	С
$0.50g < S_{DS} \le 0.83g$	D <sub>1</sub>
$0.83g < S_{DS} \le 1.17g$	D <sub>2</sub>
$1.17g < S_{Ds}$	Е

**R301.2.2.1.2 Alternative determination of Seismic Design Category E.** Buildings located in Seismic Design Category E in accordance with Figure R301.2(2) are permitted to be reclassified as being in Seismic Design Category  $D_2$  provided one of the following is done:

- A more detailed evaluation of the Seismic Design Category is made in accordance with the provisions and maps of the <u>North Carolina</u> Building Code. Buildings located in Seismic Design Category E per Table R301.2.2.1.1, but located in Seismic Design Category D per the *International Building Code*, may be designed using the Seismic Design Category D<sub>2</sub> requirements of this code.
- Buildings located in Seismic Design Category E that conform to the following additional restrictions are permitted to be constructed in accordance with the provisions for Seismic Design Category D<sub>2</sub> of this code:
  - 2.1. All exterior shear wall lines or braced wall panels are in one plane vertically from the foundation to the uppermost story.
  - 2.2. Floors shall not cantilever past the exterior walls.
  - 2.3. The building is within all of the requirements of Section R301.2.2.2.2 for being considered as regular.

**R301.2.2.2 Seismic limitations.** The following limitations apply to buildings in all Seismic Design Categories regulated by the seismic provisions of this code.

**R301.2.2.2.1 Weights of materials.** Average dead loads shall not exceed 15 psf  $(0.72 \text{ kN/m}^2)$  for roofs/ceiling assemblies or 10 psf  $(0.48 \text{ kN/m}^2)$  for floor assemblies, except as further limited by Section R301.2.2. Dead loads for walls above grade shall not exceed:

- 1. Fifteen psf (0.72 kN/m<sup>2</sup>) for exterior light-frame wood walls.
- 2. Fourteen psf (0.67 kN/m<sup>2</sup>) for exterior light-frame cold-formed steel walls.
- 3. Ten psf (0.48 kN/m<sup>2</sup>) for interior light-frame wood walls.
- Five psf (0.24 kN/m<sup>2</sup>) for interior light-frame cold-formed steel walls.
- 5. Eighty psf (3.83 kN/m<sup>2</sup>) for 8-inch-thick (203 mm) masonry walls.
- 6. Eighty-five psf (4.07 kN/m<sup>2</sup>) for 6-inch-thick (152 mm) concrete walls.

**Exception:** Roof/ceiling dead loads not exceeding 25 psf (1.19 kN/m<sup>2</sup>) shall be permitted provided the wall bracing amounts in Chapter 6 are increased in accordance with Table R301.2.2.2.1.

	ROOF/CEILING DEAD LOAD	ROOF/CEILING DEAD LOAD
WALL SUPPORTING	15 psf or less	25 psf
Roof only	1.0	1.2
Roof plus one story	1.0	1.1

#### TABLE R301.2.2.2.1 WALL BRACING ADJUSTMENT FACTORS BY ROOF COVERING DEAD LOAD<sup>a</sup>

For SI: 1 pound per square foot =  $0.049 \text{ kN/m}^2$ .

a. Linear interpolation shall be permitted.

**R301.2.2.2.2 Irregular buildings.** Concrete construction complying with Section R611 or R612 and conventional light-frame construction shall not be used in irregular portions of structures in Seismic Design Categories C,  $D_1$  and  $D_2$ . Only such irregular portions of structures shall be designed in accordance with accepted engineering practice to the extent such irregular features affect the performance of the conventional framing system. A portion of a building shall be considered to be irregular when one or more of the following conditions occur:

1. When exterior shear wall lines or braced wall panels are not in one plane vertically from the foundation to the uppermost story in which they are required.

> **Exception:** For wood light-frame construction, floors with cantilevers or setbacks not exceeding four times the nominal depth of the wood floor joists are permitted to support braced wall panels that are out of plane with braced wall panels below provided that:

- 1. Floor joists are nominal 2 inches by 10 inches (51 mm by 254 mm) or larger and spaced not more than 16 inches (406 mm) on center.
- 2. The ratio of the back span to the cantilever is at least 2 to 1.
- 3. Floor joists at ends of braced wall panels are doubled.
- 4. For wood-frame construction, a continuous rim joist is connected to ends of all cantilever joists. When spliced, the rim joists shall be spliced using a galvanized metal tie not less than 0.058 inch (1.47 mm) (16 gage) and  $1^{1/2}$  inches (38 mm) wide fastened with six 16d nails on each side of the splice or a block of the same size as the rim joist of sufficient length to fit securely between the joist space at which the splice occurs fastened with eight 16d nails on each side of the splice; and
- 5. Gravity loads carried at the end of cantilevered joists are limited to uniform wall and roof load and the reactions

from headers having span of 8 feet (2438 mm) or less.

2. When a section of floor or roof is not laterally supported by shear walls or braced wall lines on all edges.

**Exception:** Portions of floors that do not support shear walls or braced wall panels above, or roofs, shall be permitted to extend no more than 6 feet (1829 mm) beyond a shear wall or braced wall line.

3. When the end of a braced wall panel occurs over an opening in the wall below and ends at a horizontal distance greater than 1 foot (305 mm) from the edge of the opening. This provision is applicable to shear walls and braced wall panels offset in plane and to braced wall panels offset out of plane as permitted by the exception to Item 1 above.

**Exception:** For wood light-frame wall construction, one end of a braced wall panel shall be permitted to extend more than 1 foot (305 mm) over an opening of not more than eight feet (2438 mm) in width in the wall below provided that the opening includes a header in accordance with the following:

- 1. The building width, loading condition, and member species limitations of Table R502.5(1) shall apply and
- 2. Not less than 1-2x12 or 2-2x10 for an opening not more than 6 feet in width or
- 3. Not less than 2-2x12 or 3-2x10 for an opening not more than 6 feet in width or
- 4. Not less than 3-2x12 or 4-2x10 for an opening not more than 8 feet in width and
- 5. The entire length of the braced wall panel shall not occur over an opening in the wall below.
- 4. When an opening in a floor or roof exceeds the lesser of 12 feet (3657 mm) or 50 percent of the least floor or roof dimension.
- 5. When portions of a floor level are vertically offset.

#### **Exceptions:**

- 1. Framing supported directly by continuous foundations at the perimeter of the building.
- 2. For wood light-frame construction, floors shall be permitted to be vertically offset when the floor framing is lapped or tied together as required by Section R502.6.1.
- 6. When shear walls and braced wall lines do not occur in two perpendicular directions.

 When stories above grade partially or completely braced by wood wall framing in accordance with Section R602 or steel wall framing in accordance with Section R603 include masonry or concrete construction.

L

**Exception:** Fireplaces, chimneys, and masonry veneer as permitted by this code.

When this irregularity applies, the entire story shall be designed in accordance with accepted engineering practice.

**R301.2.2.3 Seismic Design Category C.** Structures assigned to Seismic Design Category C shall conform to the requirements of this section.

**R301.2.2.3.1 Anchored stone and masonry veneer.** Anchored stone and masonry veneer shall be limited to the first story above grade and shall not exceed 5 inches (127 mm) in thickness.

**Exception:** In Seismic Design Category C, anchored stone and masonry veneer not exceeding 5 inches (127 mm) in thickness shall be permitted to the height allowed in Section R703.7. In other than the topmost story, the length of wall bracing shall be 1.5 times the length otherwise required in Table R602.10.1.

**R301.2.2.3.2 Masonry construction.** Masonry construction shall comply with the requirements of Section R606.11.2.

**R301.2.2.3.3 Concrete construction.** Concrete construction shall comply with the requirements of Section R611 or R612.

**R301.2.2.4 Seismic Design Categories D**<sub>1</sub> and D<sub>2</sub>. Structures assigned to Seismic Design Categories D<sub>1</sub> and D<sub>2</sub> shall conform to the requirements for Seismic Design Category C and the additional requirements of this section.

**R301.2.2.4.1 Height limitations.** Wood framed buildings shall be limited to three stories above grade or the limits given in Table R602.10.1. Cold-formed steel framed buildings shall be limited to two stories above grade in accordance with COFS/PM. Mezzanines as defined in Section 202 shall not be considered as stories.

**R301.2.2.4.2 Anchored stone and masonry veneer.** Buildings with anchored stone and masonry veneer shall be designed in accordance with accepted engineering practice.

#### **Exceptions:**

- 1. In Seismic Design Category D<sub>1</sub>, exterior masonry veneer with a maximum nominal thickness of 4 inches (102 mm) is permitted in accordance with Section R703.7, Exception 3.
- In Seismic Design Category D<sub>2</sub>, exterior masonry veneer with a maximum actual thick-

ness of 3 inches (76 mm) is permitted in accordance with Section R703.7, Exception 4.

**R301.2.2.4.3 Masonry construction.** Masonry construction in Seismic Design Category  $D_1$  shall comply with the requirements of Section R606.11.3. Masonry construction in Seismic Design Category  $D_2$  shall comply with the requirements of Section R606.11.4.

**R301.2.2.4.4 Concrete construction.** Buildings with above-grade concrete walls shall be in accordance with Section R611, R612, or designed in accordance with accepted engineering practice.

**R301.2.2.4.5 Cold-formed steel framing in Seismic Design Category D<sub>1</sub> and D<sub>2</sub>.** In Seismic Design Category D<sub>1</sub> and D<sub>2</sub> in addition to the requirements of this code, cold-formed steel framing shall comply with the requirements of COFS/PM.

**R301.2.3 Snow loads.** Wood framed construction, cold-formed steel framed construction and masonry and concrete construction in regions with ground snow loads 70 psf  $(3.35 \text{ kN/m}^2)$  or less, shall be in accordance with Chapters 5, 6 and 8. Buildings in regions with ground snow loads greater than 70 psf  $(3.35 \text{ kN/m}^2)$  shall be designed in accordance with accepted engineering practice.

**R301.2.4 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 R323.

**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 North Carolina Building Code shall apply.

**R301.3 Story height.** Buildings constructed in accordance with these provisions shall be limited to story heights of not more than the following:

1. For wood wall framing, the laterally unsupported bearing wall stud height permitted by Table R602.3(5) plus a height of floor framing not to exceed sixteen inches.

**Exception:** For wood framed wall buildings with bracing in accordance with Table R602.10.1, the wall stud clear height used to determine the maximum permitted story height may be increased to 12 feet without requiring an engineered design for the building wind and seismic force resisting systems provided that the length of bracing required by Table R602.10.1 is increased by multiplying by a factor of 1.20. Wall studs are still subject to the requirements of this section.

- 2. For steel wall framing, a stud height of 10 feet, plus a height of floor framing not to exceed 16 inches.
- 3. For masonry walls, a maximum bearing wall clear height of 12 feet plus a height of floor framing not to exceed 16 inches.

**Exception:** An additional 8 feet is permitted for gable end walls.

4. For insulating concrete form walls, the maximum bearing wall height per story as permitted by Section 611 tables plus a height of floor framing not to exceed 16 inches.

Individual walls or walls studs shall be permitted to exceed these limits as permitted by Chapter 6 provisions, provided story heights are not exceeded. An engineered design shall be provided for the wall or wall framing members when they exceed the limits of Chapter 6. Where the story height limits are exceeded, an engineered design shall be provided in accordance with the <u>North Carolina</u> Building Code the overall wind and seismic force resisting systems.

**R301.4 Dead load.** The actual weights of materials and construction shall be used for determining dead load with consideration for the dead load of fixed service equipment.

**R301.5 Live load.** The minimum uniformly distributed live load shall be as provided in Table R301.5.

**R301.6 Roof load.** Roof shall be designed for the live load indicated in Table R301.6 or the snow load indicated in Table R301.2(1), whichever is greater.

**R301.7 Deflection.** The allowable deflection of any structural member under the live load listed in Sections R301.5 and R301.6 shall not exceed the values in Table R301.7.

TABLE R301.5 MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS (in pounds per square foot)

	USE	LIVE LOAD
	Attics with storage <sup>b</sup>	20
L	Attics without storage <sup>b</sup>	10
L	Decks <sup>e</sup>	40
	Exterior balconies	60
	Fire escapes	40
	Guardrails and handrails <sup>d</sup>	200
L	Guardrails in-fill components <sup>f</sup>	50
	Passenger vehicle garages <sup>a</sup>	50 <sup>a</sup>
	Rooms other than sleeping rooms	40
	Sleeping rooms	30
	Stairs	40°

For SI: 1 pound per square foot =  $0.0479 \text{ kN/m}^2$ , 1 square inch =  $645 \text{ mm}^2$ , 1 pound = 4.45 N.

- a. Elevated garage floors shall be capable of supporting a 2,000-pound load applied over a 20-square-inch area.
- b. No storage with roof slope not over 3 units in 12 units.
- c. Individual stair treads shall be designed for the uniformly distributed live load or a 300–pound concentrated load acting over an area of 4 square inches, whichever produces the greater stresses.
- d. A single concentrated load applied in any direction at any point along the top.
- e. See Section R502.2.1 for decks attached to exterior walls.
- f. Guard in-fill components (all those except the handrail), balusters and panel fillers shall be designed to withstand a horizontally applied normal load of 50 pounds on an area equal to 1 square foot. This load need not be assumed to act concurrently with any other live load requirement.

TABLE R301.6 MINIMUM ROOF LIVE LOADS IN POUNDS-FORCE PER SQUARE FOOT OF HORIZONTAL PROJECTION

	TRIBUTARY LOADED AREA IN SQUARE FEET FOR ANY STRUCTURAL MEMBER		
ROOF SLOPE	0 to 200	201 to 600	Over 600
Flat or rise less than 4 inches per foot (1:3)	20	16	12
Rise 4 inches per foot (1:3) to less than 12 inches per foot (1:1)	16	14	12
Rise 12 inches per foot (1:1) and greater	12	12	12

For SI: 1 square foot =  $0.0929 \text{ m}^2$ , 1 pound per square foot =  $0.0479 \text{ kN/m}^2$ , 1 inch per foot = 0.0833 mm/m.

TABLE R301.7 ALLOWABLE DEFLECTION OF STRUCTURAL MEMBERS<sup>a,b</sup>

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 <sup>b</sup>	
All other structural members	L/240	
Exterior walls with plaster or stucco finish	H/360	
Exterior walls-wind loads <sup>a</sup> with brittle finishes	L/240	
Exterior walls-wind loads <sup>a</sup> with flexible finishes	L/120	
Masonry-vertical support	L/600	

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

a. The wind load shall be permitted to be taken as 0.7 times the Component and Cladding loads for the purpose of the determining deflection limits herein.

b. 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.

**R301.8** Nominal sizes. For the purposes of this code, where dimensions of lumber are specified, they shall be deemed to be nominal dimensions unless specifically designated as actual dimensions.

#### SECTION R302 LOCATION ON LOT

**R302.1 Exterior walls.** Exterior walls with a fire separation distance less than 3 feet (914 mm) 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 of a lot line shall be permitted to have roof eave projections not exceeding 4 inches.

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.

**Exception:** 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.

**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.

#### SECTION R303 LIGHT, VENTILATION AND HEATING

**R303.1 Habitable rooms.** All habitable rooms shall be pro-vided with aggregate glazing area of not less than 8 percent of the floor area of such rooms. Natural ventilation shall be through windows, doors, louvers or other approved openings to the outdoor air. Such openings shall be provided with ready access or shall otherwise be readily controllable by the building occupants. The minimum openable area to the outdoors shall be 4 percent of the floor area being ventilated.

#### **Exceptions:**

- 1. The glazed areas need not be openable where the opening is not required by Section R310 and an approved mechanical ventilation system is provided capable of producing 0.35 air change per hour in the room or a whole-house mechanical ventilation system is installed capable of supplying outdoor ventilation air of 15 cubic feet per minute (cfm) (7.08 L/s) per occupant computed on the basis of two occupants for the first bedroom and one occupant for each additional bedroom.
- 2. The glazed areas need not be provided in rooms where Exception 1 above is satisfied and artificial light is provided capable of producing an average illumination of 6 footcandles (6.46 lux) over the area of the

room at a height of 30 inches (762 mm) above the floor level.

**R303.2** Adjoining rooms. For the purpose of determining light and ventilation requirements, any room shall be considered as a portion of an adjoining room when at least one-half of the area of the common wall is open and unobstructed and provides an opening of not less than one-tenth of the floor area of the interior room but not less than 25 square feet (2.32 m<sup>2</sup>).

**Exception:** Openings required for light and/or ventilation shall be permitted to open into a thermally isolated sunroom addition or patio cover, provided that there is an openable area between the adjoining room and the sunroom addition or patio cover of not less than one-tenth of the floor area of the interior room but not less than 20 square feet (1.86 m<sup>2</sup>). The minimum openable area to the outdoors shall be based upon the total floor area being ventilated.

**R303.3 Bathrooms.** Bathrooms, water closet compartments and other similar rooms shall be provided with aggregate glazing area in windows of not less than 3 square feet (0.279 m<sup>2</sup>), one-half of which must be openable.

**Exception:** The glazed areas shall not be required where artificial light and a mechanical ventilation system are provided. The minimum ventilation rates shall be 50 cfm (23.6 L/s) for intermittent ventilation or 20 cfm (9.4 L/s) for continuous ventilation. Ventilation air from the space shall be exhausted directly to the outside.

**R303.4 Opening location.** Outdoor intake and exhaust openings shall be located in accordance with Sections R303.4.1 and R303.4.2.

**R303.4.1 Intake openings.** Mechanical and gravity outdoor air intake openings shall be located <u>in accordance with</u> the North Carolina Mechanical Code.

For the purpose of this section, the exhaust from dwelling unit toilet rooms, bathrooms and kitchens shall not be considered as hazardous or noxious.

**R303.4.2 Exhaust openings.** Outside exhaust openings shall be located in accordance with the North Carolina Mechanical Code.

**R303.5 Outside opening protection.** Air exhaust and intake openings that terminate outdoors shall be protected with corrosion-resistant screens, louvers or grilles having a minimum opening size of 1/4 inch (6.4 mm) and a maximum opening size of 1/2 inch (12.7 mm), in any dimension. Openings shall be protected against local weather conditions. Outdoor air exhaust and intake openings shall meet the provisions for exterior wall opening protectives in accordance with this code.

**R303.6 Stairway illumination.** All interior and exterior stairways shall be provided with <u>a means to illuminate the stairs in accordance with the North Carolina Electrical Code.</u>

**R303.6.1 Light activation.** The control for activation of the required interior stairway lighting shall be accessible at the top and bottom of each stairway without traversing any

steps. The illumination of exterior stairways shall be controlled from inside the dwelling unit.

**Exception:** Lights that are continuously illuminated or automatically controlled.

**R303.7 Required glazed openings.** Required glazed openings shall open directly onto a street or public alley, or a yard or court located on the same lot as the building.

**R303.7.1 Roofed porches.** Required glazed openings may face into a roofed porch where the porch abuts a street, yard or court and the longer side of the porch is at least 65 percent open and unobstructed and the ceiling height is not less than 7 feet (2134 mm).

**R303.8 Required heating.** When the winter design temperature in Table R301.2(1) is below  $60^{\circ}$ F ( $16^{\circ}$ C), every dwelling unit shall be provided with heating facilities capable of maintaining a minimum room temperature of  $68^{\circ}$ F ( $20^{\circ}$ C) at a point 3 feet (914 mm) above the floor and 2 feet (610 mm) from exterior walls in all habitable rooms at the design temperature. The installation of one or more portable space heaters shall not be used to achieve compliance with this section.

# SECTION R304 MINIMUM ROOM AREAS

**R304.1 Minimum area.** Every dwelling unit shall have at least one habitable room that shall have not less than 120 square feet  $(11.2 \text{ m}^2)$  of gross floor area.

**R304.2 Other rooms.** Other habitable rooms shall have a floor area of not less than 70 square feet  $(6.5 \text{ m}^2)$ .

**Exception:** Kitchens.

**R304.3 Minimum dimensions.** Habitable rooms shall not be less than 7 feet (2134 mm) in any horizontal dimension.

Exception: Kitchens.

**R304.4 Height effect on room area.** Portions of a room with a sloping ceiling measuring less than 5 feet (1524 mm) or a furred ceiling measuring less than 7 feet (2134 mm) from the finished floor to the finished ceiling shall not be considered as contributing to the minimum required habitable area for that room.

#### SECTION R305 CEILING HEIGHT

**R305.1 Minimum height.** Habitable rooms, hallways, corridors, bathrooms, toilet rooms <u>and laundry rooms</u> 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 shall 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. Not more than 50 percent of the required floor area of a room or space is permitted to have a sloped ceiling less than 7 feet (2134 mm) in height with no portion of the required floor area less than 5 feet (1524 mm) in height.
- 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 showerhead 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 showerhead.

# SECTION R306 SANITATION

**R306.1 Toilet facilities.** Every dwelling unit shall be provided with a water closet, lavatory, and a bathtub or shower.

**R306.2 Kitchen.** Each dwelling unit shall be provided with a kitchen area and every kitchen area shall be provided with a sink.

**R306.3 Sewage disposal.** All plumbing fixtures shall be connected to a sanitary sewer or to an approved private sewage disposal system.

**R306.4 Water supply to fixtures.** All plumbing fixtures shall be connected to an approved water supply. Kitchen sinks, lavatories, bathtubs, showers, bidets, laundry tubs and washing machine outlets shall be provided with hot and cold water.

#### SECTION R307 TOILET, BATH AND SHOWER SPACES

**R307.1 Space required.** Fixtures shall be spaced as per Figure R307.2.

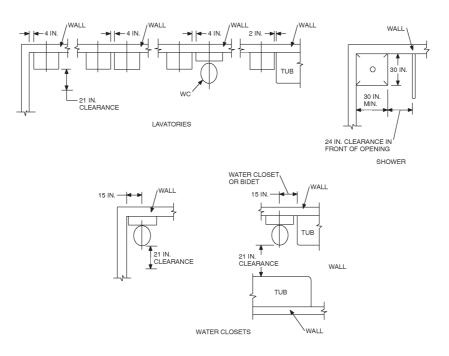
**R307.2 Bathtub and shower spaces.** Bathtub and shower floors and walls above bathtubs with installed shower heads and in shower compartments shall be finished with a nonabsorbent surface. Such wall surfaces shall extend to a height of not less than 6 feet (1829 mm) above the floor.

#### SECTION R308 GLAZING

**[B] 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 or installer's label, designating the type and thickness of glass and the safety glazing standard with which it complies, which is visible in the final installation. The label shall be acid etched, sandblasted, ceramic-fired, embossed mark, or shall be of a type which once applied cannot be removed without being destroyed.

## **Exceptions:**

1. For other than tempered glass, labels may be omitted provided the building official approves the use of a



For SI: 1 inch = 25.4 mm

#### FIGURE R307.2 MINIMUM FIXTURE CLEARANCES

certificate, affidavit or other evidence confirming compliance with this code.

2. Tempered spandrel glass may be identified by the manufacturer with a removable paper label.

**R308.1.1 Identification of multipane assemblies.** Multi-pane assemblies having individual panes not exceeding 1 square foot (0.09 m<sup>2</sup>) in exposed area shall have at least one pane in the assembly identified in accordance with Section R308.1. All other panes in the assembly shall be labeled "16 CFR 1201."

**R308.2 Louvered windows or jalousies.** Regular, float, wired or patterned glass in jalousies and louvered windows shall be no thinner than nominal  $\frac{3}{16}$  inch (4.76 mm) and no longer than 48 inches (1219 mm). Exposed glass edges shall be smooth.

**R308.2.1 Wired glass prohibited.** Wired glass with wire exposed on longitudinal edges shall not be used in jalousies or louvered windows.

**[B] R308.3 Human impact loads.** Individual glazed areas including glass mirrors in hazardous locations such as those indicated as defined in Section R308.4 shall pass the test requirements of CPSC 16 CFR, Part 1201. Glazing shall com-

ply with the CPSC 16 CFR, Part 1201 criteria for Category I or Category II as indicated in Table R308.3.

#### **Exceptions:**

- 1. Polished wired glass for use in fire doors and other fire resistant locations shall comply with ANSI Z97.1.
- 2. Louvered windows and jalousies shall comply with Section R308.2.

**[B] R308.4 Hazardous locations.** The following shall be considered specific hazardous locations for the purposes of glazing:

- 1. Glazing in side hinged 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. Glazing in doors and enclosures for hot tubs, whirlpools, saunas, steam rooms, bathtubs and showers. <u>Glazing enclosing</u> these compartments where the bottom exposed edge of the glazing is less than 60 inches

EXPOSED SURFACE AREA OF ONE SIDE OF ONE LITE		GLAZING IN DOORS (Category Class)	GLAZED PANELS REGULATED BY ITEM 7 OF SECTION R308.4 (Category Class)	GLAZED PANELS REGULATED BY ITEM 6 OF SECTION R308.4 (Category Class)	GLAZING IN DOORS AND ENCLOSURES REGULATED BY ITEM 5 OF SECTION R308.4 (Category Class)	SLIDING GLASS DOORS PATIO TYPE (Category Class)
9 sq. ft. or less	Ι	Ι	NR <sup>a</sup>	Ι	II	II
More than 9 sq. ft	II	II	II	II	II	Π

TABLE R308.3 MINIMUM CATEGORY CLASSIFICATION OF GLAZING

For SI: 1 square foot =  $0.0929 \text{ m}^2$ .

<sup>a</sup>NR means "No Requirement."

(1524 mm) measured vertically above any standing or walking surface.

- 5. 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.
- 6. Glazing in an individual fixed or operable panel, other than those locations described in Items 4 and 5 above, that meets all of the following conditions:
  - <u>6.1.</u> Exposed area of an individual pane greater than 9 square feet  $(0.836 \text{ m}^2)$ .
  - <u>6.2.</u> Bottom edge less than 18 inches (457 mm) above the floor.
  - 6.3. Top edge greater than 36 inches (914 mm) above the floor.
  - <u>6.4.</u> One or more walking surfaces within 36 inches (914 mm) horizontally of the glazing.
- <u>7.</u> All glazing in railings regardless of an area or height above a walking surface. Included are structural baluster panels and nonstructural in-fill panels.
- 8. 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.
- <u>9.</u> 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..

**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, 5 or 6.
- 3. Glazing in Section R308.4, Item <u>5</u>, when there is an intervening wall or other permanent barrier between the door and the glazing.
- 4. Glazing in Section R308.4, <u>Item 5 where</u> access through the door is to a closet or storage area 3 feet (914 mm) or less in <u>depth</u>.

- 5. Glazing in Section R308.4, Item 5, when a protective bar is installed on the accessible side(s) of the glazing 36 inches  $\pm$  2 inches (914 mm  $\pm$  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 <u>6</u>, 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.

**[B] R308.5 Site built windows.** Site built windows shall comply with Section 2404 of the <u>North Carolina</u> Building Code.

**[B] R308.6 Skylights and sloped glazing.** Skylights and sloped glazing shall comply with the following sections.

#### R308.6.1 Definitions.

**SKYLIGHTS AND SLOPED GLAZING.** Glass or other transparent or translucent glazing material installed at a slope of more than 15 degrees (0.26 rad) from vertical. Glazing materials in skylights, including unit skylights, solariums, sunrooms, roofs and sloped walls are included in this definition.

**UNIT SKYLIGHT.** A factory assembled, glazed fenestration unit, containing one panel of glazing material, that allows for natural daylighting through an opening in the roof assembly while preserving the weather resistant barrier of the roof.

**R308.6.2 Permitted materials.** The following types of glazing may be used:

1. Laminated glass with a minimum 0.015-inch (0.38 mm) polyvinyl butyral interlayer for glass panes 16 square feet (1.5 m<sup>2</sup>) or less in area located such that the highest point of the glass is not more than 12 feet (3658 mm) above a walking surface or other accessible area; for higher or larger sizes, the minimum interlayer thickness shall be 0.030 inch (0.76 mm).

- 2. Fully tempered glass.
- 3. Heat-strengthened glass.
- 4. Wired glass.
- 5. Approved rigid plastics.

**R308.6.3 Screens, general.** For fully tempered or heat-strengthened glass, a retaining screen meeting the requirements of Section R308.6.7 shall be installed below the glass, except for fully tempered glass that meets either condition listed in Section R308.6.5.

**R308.6.4 Screens with multiple glazing.** When the inboard pane is fully tempered, heat-strengthened, or wired glass, a retaining screen meeting the requirements of Section R308.6.7 shall be installed below the glass, except for either condition listed in Section R308.6.5. All other panes in the multiple glazing may be of any type listed in Section R308.6.2.

**R308.6.5 Screens not required.** Screens shall not be required when fully tempered glass is used as single glazing or the inboard pane in multiple glazing and either of the following conditions are met:

- 1. Glass area 16 square feet  $(1.49 \text{ m}^2)$  or less. Highest point of glass not more than 12 feet (3658 mm) above a walking surface or other accessible area, nominal glass thickness not more than  $3/_{16}$  inch (4.76 mm), and (for multiple glazing only) the other pane or panes fully tempered, laminated or wired glass.
- 2. Glass area greater than 16 square feet (1.49 m<sup>2</sup>). Glass sloped 30 degrees (0.52 rad) or less from vertical, and highest point of glass not more than 10 feet (3048 mm) above a walking surface or other accessible area.

**R308.6.6 Glass in greenhouses.** Any glazing material is permitted to be installed without screening in the sloped areas of greenhouses, provided the greenhouse height at the ridge does not exceed 20 feet (6096 mm) above grade.

**R308.6.7 Screen characteristics.** The screen and its fastenings shall be capable of supporting twice the weight of the glazing, be firmly and substantially fastened to the framing members, and have a mesh opening of no more than 1 inch by 1 inch (25.4 mm by 25.4 mm).

**R308.6.8 Curbs for skylights.** All unit skylights installed in a roof with a pitch flatter than three units vertical in 12 units horizontal (25-percent slope) shall be mounted on a curb extending at least 4 inches (102 mm) above the plane of the roof unless otherwise specified in the manufacturer's installation instructions.

**R308.6.9 Testing and labeling.** Unit skylights shall be tested by an approved independent laboratory, and bear a label identifying manufacturer, performance grade rating, and approved inspection agency to indicate compliance with the requirements of AAMA/WDMA 101/I.S.2/NAFS.

#### SECTION R309 GARAGES AND CARPORTS

**R309.1 Opening protection.** Openings from a private garage directly into a room used for sleeping purposes shall not be per-

mitted. Other openings between the garage and residence shall be equipped with solid wood doors not less than  $1^{3}/_{8}$  inches (35 mm) in thickness, solid or honeycomb core steel doors not less than  $1^{3}/_{8}$  inches (35 mm) thick, or 20-minute fire-rated doors.

**R309.1.1 Duct penetration.** Ducts in the garage and ducts penetrating the walls or ceilings separating the dwelling from the garage shall be constructed of a minimum No. 26 gage (0.48 mm) sheet steel or other approved material and shall have no openings into the garage.

**R309.2 Separation required.** The garage shall be separated from the residence and its attic area by not less than  $\frac{1}{2}$ -inch (12.7 mm) gypsum board applied to the garage side.

**R309.3 Floor surface.** Garage floor surfaces shall be of approved noncombustible material.

The area of floor used for parking of automobiles or other vehicles shall be sloped to facilitate the movement of liquids to a drain or toward the main vehicle entry doorway.

**R309.4 Carports.** Carports shall be open on at least two sides. Carport floor surfaces shall be of approved noncombustible material. Carports not open on at least two sides shall be considered a garage and shall comply with the provisions of this section for garages.

**Exception:** Asphalt surfaces shall be permitted at ground level in carports.

The area of floor used for parking of automobiles or other vehicles shall be sloped to facilitate the movement of liquids to a drain or toward the main vehicle entry doorway.

**R309.5 Flood hazard areas.** For buildings located in flood hazard areas as established by Table R301.2(1), garage floors shall be:

- 1. Elevated to or above the design flood elevation as determined in Section R323; or
- 2. Located below the design flood elevation provided they are at or above grade on all sides, are used solely for parking, building access, or storage, meet the requirements of Section R323, and are otherwise constructed in accordance with this code.

**R309.6 Automatic garage door openers.** Automatic garage door openers, if provided, shall be listed in accordance with UL 325.

# SECTION 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 openable emergency escape and rescue opening. 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 310.3. 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.

**R310.1.1 Minimum opening area.** All emergency escape and rescue openings shall have a minimum net clear openable area of 4 square feet ( $.372 \text{ m}^2$ ). 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 and rescue openings must have a minimum total glazing area of not less than 5 square feet (0.465 m<sup>2</sup>) in the case of a ground window and not less than 5.7 square feet (0.530 m<sup>2</sup>) in the case of an upper story window.

Exception: Deleted.

R310.1.2 Minimum opening height. Deleted.

R310.1.3 Minimum opening width. Deleted.

**R310.1.4 Operational constraints.** Emergency escape and rescue openings shall be operational from the inside of the room without the use of keys or tools.

**R310.2 Window wells.** The minimum horizontal area of the window well shall be 9 square feet (0.84 m<sup>2</sup>), with a minimum horizontal projection and width of 36 inches (914 mm). The area of the window well shall allow the emergency escape and rescue opening to be fully opened.

**Exception:** The ladder or steps required by Section R310.2.1 shall be permitted to encroach a maximum of 6 inches (152 mm) into the required dimensions of the window well.

**R310.2.1 Ladder and steps.** Window wells with a vertical depth greater than 44 inches (1118 mm) shall be equipped with a permanently affixed ladder or steps usable with the window in the fully open position. Ladders or steps required by this section shall not be required to comply with Sections R311.5 and R311.6. Ladders or rungs shall have an inside width of at least 12 inches (305 mm), shall project at least 3 inches (76 mm) from the wall and shall be spaced not more than 18 inches (457 mm) on center vertically for the full height of the window well.

**R310.3 Bulkhead enclosures.** Bulkhead enclosures shall provide direct access to the basement. The bulkhead enclosure with the door panels in the fully open position shall provide the minimum net clear opening required by Section R310.1.1. Bulkhead enclosures shall also comply with Section R311.5.8.2.

**R310.4 Bars, grills, covers and screens.** Bars, grills, 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 or force greater than that which is required for normal operation of the escape and rescue opening.

# SECTION R311 MEANS OF EGRESS

**R311.1 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 Section R310.2.1.

**R311.2** <u>Type of lock or latch.</u> All interior egress doors and a minimum of one exterior egress door shall be readily openable from the side from which egress is to be made without the use of a key or special knowledge or effort.

R311.2.1 Attachment. Deleted.

R311.2.2 Under stair protection. Deleted.

**R311.3 Hallways and interior doors.** The minimum width of a hallway shall be not less than 3 feet (914 mm).

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

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#### R311.4 Doors.

**R311.4.1 Exit door required.** Not less than one exit door conforming to this section shall be provided for each dwelling unit. The required exit door shall provide for direct access from the habitable portions of the dwelling to the exterior without requiring travel through a garage. Access to habitable levels not having an exit in accordance with this section shall be by a ramp in accordance with Section R311.6 or a stairway in accordance with Section R311.5.

**R311.4.2 Door type and size.** The required exit door shall be a side-hinged door not less than 3 feet (914 mm) in width and 6 feet 8 inches (2032 mm) in height. Other doors shall not be required to comply with these minimum dimensions.

**R311.4.3 Landings at doors.** A minimum of 3 foot by 3 foot (914 mm by 914 mm) landing shall be required on each side of an egress door. The floor or landing shall not be more than  $1\frac{1}{2}$  inches (38 mm) lower than the top of the threshold.

## **Exceptions:**

- 1. At the top of a flight of stairs, provided the door does not swing over the stairs.
- 2. The landing at the exterior doorway shall not be more than  $8 \frac{1}{4}$  inches (210 mm) below the top of the threshold, provided the door does not swing over the landing.

- <u>3. Exterior storm and screen doors are exempt from the requirements for landings.</u>
- 4. At the bottom of an interior flight of stairs, there may be a door between the landing and stair.

# R311.4.4 Type of lock or latch. Deleted.

# R311.5 Stairways.

**R311.5.1 Width.** Stairways shall not be less than 36 inches (914 mm) in clear width at all points above the permitted handrail height and below the required headroom height. Handrails shall not project more than 4.5 inches (114 mm) on either side of the stairway and the minimum clear width of the stairway at and below the handrail height, including treads and landings, shall not be less than 31.5 inches (787 mm) where a handrail is installed on one side and 27 inches (698 mm) where handrails are provided on both sides.

**Exception:** The width of spiral stairways shall be in accordance with Section R311.5.8.

**R311.5.2 Headroom.** The minimum headroom in all parts of the stairway shall not be less than 6 feet 8 inches (2036 mm) measured vertically from the sloped plane adjoining the tread nosing or from the floor surface of the landing or platform.

## R311.5.3 Stair treads and risers.

**R311.5.3.1 Riser height.** The maximum riser height shall be  $\frac{8^{1}}{4}$  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  $\frac{3}{8}$  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  $\frac{3}{4}$  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 floors or finished grade, the height of the riser may be less than the height of the adjacent risers.

**R311.5.3.2 Tread depth.** The minimum tread depth shall be <u>9 inches (229 mm</u>). 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 <u>9 inches (229 mm</u>) 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 <u>4 inches (102 mm</u>) 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).

**R311.5.3.3 Profile.** The radius of curvature at the leading edge of the tread shall be no greater than  $\frac{9}{16}$  inch (14.3 mm). A nosing not less than  $\frac{3}{4}$  inch (19 mm) but not more than  $1\frac{1}{4}$  inch (32 mm) shall be provided on stairways with solid risers. The greatest nosing projection shall not exceed the smallest nosing projection by more than  ${}^{3}/{}_{8}$  inch (9.5 mm) between two stories, including the nosing at the level of floors and landings. Beveling of nosing shall not exceed  ${}^{1}/{}_{2}$  inch (12.7 mm). Risers shall be vertical or sloped from the underside of the leading edge of the tread above at an angle not more than 30 (0.51 rad) degrees from the vertical. Open risers are permitted, provided that the opening between treads does not permit the passage of a 4-inch diameter (102 mm) sphere.

#### **Exceptions:**

- 1. A nosing is not required where the tread depth is a minimum of 11 inches (279 mm).
- 2. The opening between adjacent treads is not limited on stairs with a total rise of 30 inches (762 mm) or less.

**R311.5.4 Landings for stairways.** There shall be a floor or landing at the top and bottom of each stairway.

**Exception:** A floor or landing is not required at the top of an interior flight of stairs, provided a door does not swing over the stairs.

A flight of stairs shall not have a vertical rise greater than 12 feet (3658 mm) between floor levels or landings.

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

**R311.5.5 Stairway walking surface.** The walking surface of treads and landings of stairways shall be sloped no steeper than one <u>inch</u> vertical in 48 inches horizontal (2-percent slope).

**R311.5.6 Handrails.** Handrails shall be provided on at least one side of each continuous run of treads or flight with four or more risers.

**R311.5.6.1 Height.** Handrail height, measured vertically from the sloped plane adjoining the tread nosing, or finish surface of ramp slope, shall be not less than <u>30</u> inches (762 mm) and not more than 38 inches (965 mm).

**R311.5.6.2 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 <u>post.</u>
- 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  $1^{1}/_{4}$  inches (32 mm) 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  $6^{1}/_{4}$  inches (160 mm) with a maximum cross section of dimension of  $2^{1}/_{4}$  inches(57 mm).
- 2. Type II. Handrails with a perimeter greater than  $6^{1}/_{4}$  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  $3^{1}/_{4}$  inch (19 mm) measured vertically from the tallest portion of the profile and achieve a depth of at least  $5^{1}/_{16}$  inch (8 mm) within  $7^{1}/_{8}$  inch (22 mm) below the widest portion of the profile. This required depth shall continue for at least  $3^{1}/_{8}$  inch (10 mm) to a level that is not less than  $1^{3}/_{4}$  inches (45 mm) below the tallest portion of the profile. The minimum width of the handrail above the recess shall be  $1^{1}/_{4}$  inches (32 mm) to a maximum of  $2^{3}/_{4}$  inches (70 mm). Edges shall have a minimum radius of 0.01 inches (0.25 mm).

**R311.5.7 Illumination.** All stairs shall be provided with illumination in accordance with Section R303.6.

**R311.5.8 Special stairways.** Circular stairways, spiral stairways, winders and bulkhead enclosure stairways shall comply with all requirements of Section R311.5 except as specified below.

**R311.5.8.1 Spiral stairways.** Spiral stairways are permitted, provided the minimum width shall be 26 inches (660 mm) with each tread having a  $7^{1}/_{2}$ -inches (190 mm) minimum tread depth at 12 inches from the narrower edge. All treads shall be identical, and the rise shall be no more than  $9^{1}/_{2}$  inches (241 mm). A minimum headroom of 6 feet 6 inches (1982 mm) shall be provided.

**R311.5.8.2 Bulkhead enclosure stairways.** Stairways serving bulkhead enclosures, not part of the required building egress, providing access from the outside grade level to the basement shall be exempt from the requirements of Sections R311.4.3 and R311.5 where the maximum height from the basement finished floor level to grade adjacent to the stairway does not exceed 8 feet (2438 mm), and the grade level opening to the stairway is covered by a bulkhead enclosure with hinged doors or other approved means.

# R311.6 Ramps.

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

**R311.6.2 Landings required.** A minimum 3-foot-by-3-foot (914 mm by 914 mm) landing shall be provided:

1. At the top and bottom of ramps,

- 2. Where doors open onto ramps,
- 3. Where ramps change direction.

**R311.6.3 Handrails required.** Handrails shall be provided on at least one side of all ramps exceeding a slope of one unit vertical in 12 units horizontal (8.33-percent slope).

**R311.6.3.1 Height.** Handrail height, measured above the finished surface of the ramp slope, shall be not less than  $\underline{30}$  inches ( $\underline{762}$  mm) and not more than 38 inches (965 mm).

**R311.6.3.2 Handrail grip size.** Handrails on ramps shall comply with Section R311.5.6.3.

**R311.6.3.3 Continuity.** Handrails where required on ramps shall be continuous for the full length of the ramp. 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 1.5 inches (38 mm) between the wall and the handrails.

#### SECTION R312 GUARDS

**R312.1 Guards required.** Porches, balconies 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 34 inches (864 mm) in height measured vertically from the nosing of the treads.

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

**R312.2 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 <u>an object 6 inches (152 mm)</u> or more in diameter. <u>Horizontal spacing between the vertical members in required guardrails shall be a maximum of 4 inches (102 mm) at the nearest point between members.</u>

#### **Exceptions:**

- 1. The triangular openings formed by the riser, tread and bottom rail of a guard at the open side of a stairway <u>may</u> 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  $4\frac{3}{8}$  inches (107 mm) to pass through.

#### SECTION R313 SMOKE ALARMS

**[F] R313.1 Smoke alarms.** Smoke alarms shall be installed in the following locations:

- 1. In each sleeping room.
- 2. Outside each separate sleeping area in the immediate vicinity of the bedrooms.

3. On each additional story of the dwelling, including basements but not including crawl spaces and uninhabitable attics. In dwellings or dwelling units with split levels and without an intervening door between the adjacent levels, a smoke alarm installed on the upper level shall suffice for the adjacent lower level provided that the lower level is less than one full story below the upper level.

When more than one smoke alarm is required to be installed within an individual dwelling unit the alarm devices shall be interconnected in such a manner that the actuation of one alarm will activate all of the alarms in the individual unit. The alarm shall be clearly audible in all bedrooms over background noise levels with all intervening doors closed.

All smoke alarms shall be listed and installed in accordance with the provisions of this code and the household fire warning equipment provisions of NFPA 72.

**[EB] R313.1.1 Alterations, repairs and additions.** When interior alterations, repairs or additions requiring a permit occur, or when one or more sleeping rooms are added or created in existing dwellings, the individual dwelling unit shall be provided with smoke alarms located as required for new dwellings; the smoke alarms shall be interconnected and hard wired.

#### **Exceptions:**

- 1. Smoke alarms in existing areas shall not be required to be interconnected and hard wired where the alterations or repairs do not result in the removal of interior wall or ceiling finishes exposing the structure, unless there is an attic, crawl space, or basement available which could provide access for hard wiring and interconnection without the removal of interior finishes.
- 2. Repairs to the exterior surfaces of dwellings are exempt from the requirements of this section.

**[F] R313.2 Power source.** In new construction, the required smoke alarms shall receive their primary power from the building wiring when such wiring is served from a commercial source, and when primary power is interrupted, shall receive power from a battery. Wiring shall be permanent and without a disconnecting switch other than those required for overcurrent protection. Smoke alarms shall be permitted to be battery operated when installed in buildings without commercial power or in buildings that undergo alterations, repairs or additions regulated by Section R313.1.1.

#### SECTION R314 FOAM PLASTIC

**R314.1 General.** The provisions of this section shall govern the requirements and uses of foam plastic insulation.

**R314.1.1 Surface burning characteristics.** Except where otherwise noted in Section R314.2, all foam plastic or foam plastic cores in manufactured assemblies used in building construction shall have a flame-spread rating of not more

than 75 and shall have a smoke-developed rating of not more than 450 when tested in the maximum thickness intended for use in accordance with ASTM E 84.

**R314.1.2 Thermal barrier.** Foam plastic, except where otherwise noted, shall be separated from the interior of a building by minimum  $\frac{1}{2}$ -inch (12.7 mm) gypsum board or an approved finish material equivalent to a thermal barrier to limit the average temperature rise of the unexposed surface to no more than 250°F (121°C) after 15 minutes of fire exposure to the ASTM E 119 standard time temperature curve. The gypsum board shall be installed using a mechanical fastening system in accordance with Section R702.3.5. Reliance on adhesives to ensure that the gypsum board will remain in place when exposed to fire shall be prohibited.

**R314.2 Specific requirements.** The following requirements shall apply to all uses of foam plastic unless specifically approved in accordance with Section R314.3 or by other sections of the code.

**R314.2.1 Masonry or concrete construction.** Foam plastics may be used without the thermal barrier described in Section R314.1 when the foam plastic is protected by a minimum 1-inch (25.4 mm) thickness of masonry or concrete.

**R314.2.2 Roofing.** Foam plastic may be used in a roof-covering assembly without the thermal barrier when the foam is separated from the interior of the building by wood structural panel sheathing in accordance with Section R803, not less than  ${}^{15}/_{32}$  inch (11.9 mm) in thickness bonded with exterior glue and identified as Exposure 1, with edge supported by blocking or tongue-and-groove joints. The smoke-developed rating shall not be limited.

**R314.2.3** Attics and crawlspaces. Within attics where entry is made only for service of utilities, foam plastics shall be protected against ignition by  $1^{1}/_{2}$ -inch-thick (38 mm) mineral fiber insulation,  $1_{4}$ -inch- thick (6.4 mm) wood structural panels,  $3_{8}$ -inch (9.5 mm) particleboard,  $1_{4}$ -inch (6.4 mm) hardboard,  $3_{8}$ -inch (9.5 mm) gypsum board, or corrosion-resistant steel having a base metal thickness of 0.016 inch (0.406 mm). Within crawl spaces, foam plastic use is governed by Section R409.8.2.

**R314.2.4 Foam-filled doors.** Foam-filled doors are exempt from the requirements of Section R314.1.

**R314.2.5 Siding backer board.** Foam plastic board of not more than 1/2-inch (12.7 mm) thickness may be used as siding backer board when separated from interior spaces by not less than 2 inches (51 mm) of mineral fiber insulation or 1/2-inch (12.7 mm) gypsum wallboard or installed over existing exterior wall finish in conjunction with re-siding, providing the plastic board does not have a potential heat of more than 2,000 Btu per square foot (22 720 kJ/m<sup>2</sup>) when tested in accordance with NFPA 259.

**R314.2.6 Interior trim.** Foam plastic trim defined as picture molds, chair rails, baseboards, handrails, ceiling beams, door trim and window trim may be installed, provided:

- 1. The minimum density is 20 pounds per cubic foot  $(3.14 \text{ kg/m}^3)$ .
- 2. The maximum thickness of the trim is 0.5 inch (12.7 mm) and the maximum width is 4 inches (102 mm).
- 3. The trim constitutes no more than 10 percent of the area of any wall or ceiling.
- 4. The flame-spread rating does not exceed 75 when tested per ASTM E 84. The smoke-developed rating is not limited.

**R314.2.7 Sill plates and headers.** Foam plastic shall be permitted to be spray applied to a sill plate and header without thermal barrier subject to all of the following:

- 1. The maximum thickness of the foam plastic shall be  $3^{1}/_{4}$  inches (82.6 mm).
- 2. The density of the foam plastic shall be in the range of 1.5 to 2.0 pcf (24 to 32 kg/m<sup>3</sup>).
- 3. The foam plastic shall have a flame spread index of 25 or less and an accompanying smoke developed index of 450 or less when tested in accordance with <u>any applicable test(s) listed in Section R314.3.</u>

**R314.3 Specific approval.** Plastic foam not meeting the requirements of Sections R314.1 and R314.2 may be specifically approved on the basis of one of the following approved tests:

FM 4880, UL 1040, NFPA 286, ASTM E 152, or UL 1715, or fire tests related to actual end-use configurations. The specific approval may be based on the end use, quantity, location and similar considerations where such tests would not be applicable or practical.

**R314.4 Interior finish.** Foam plastics that are used as interior finish shall also meet the flame-spread requirements for interior finish.

**R314.5 Termite damage.** The use of foam <u>plastics shall</u> be in accordance with Section R320.4.

# [B] SECTION R315 FLAME SPREAD AND SMOKE DENSITY

**R315.1 Wall and ceiling.** Wall and ceiling finishes shall have a flame-spread classification of not greater than 200.

**Exception:** Flame-spread requirements for finishes shall not apply to trim defined as picture molds, chair rails, baseboards and handrails; to doors and windows or their frames; or to materials that are less than  $1/_{28}$  inch (0.907 mm) in thickness cemented to the surface of walls or ceilings if these materials have a flame-spread characteristic no greater than paper of this thickness cemented to a noncombustible backing.

**R315.2 Smoke-developed index.** Wall and ceiling finishes shall have a smoke-developed index of not greater than 450.

**R315.3 Testing.** Tests shall be made in accordance with ASTM E 84.

**R315.4 Alternate test method.** As an alternate to having a flame-spread classification of not greater than 200 and a smoke developed index of not greater than 450 when tested in accordance with ASTM E 84, wall and ceiling finishes, other than textiles, shall be permitted to be tested in accordance with NFPA 286. Materials tested in accordance with NFPA 286 shall meet the following criteria:

During the 40 kW exposure, the interior finish shall comply with Item 1. During the 160 kW exposure, the interior finish shall comply with Item 2. During the entire test, the interior finish shall comply with Item 3.

- 1. During the 40 kW exposure, flames shall not spread to the ceiling.
- 2. During the 160 kW exposure, the interior finish shall comply with the following:
  - 2.1. Flame shall not spread to the outer extremity of the sample on any wall or ceiling.
  - 2.2. Flashover, as defined in NFPA 286, shall not occur.
- 3. The total smoke released throughout the NFPA 286 test shall not exceed 1,000  $m^2$ .

# [B] SECTION R316 INSULATION

**R316.1 Insulation.** Insulation materials, including facings, such as vapor retarders or vapor permeable membranes installed within floor-ceiling assemblies, roof-ceiling assemblies, wall assemblies, crawl spaces and attics shall have a flame-spread index not to exceed 25 with an accompanying smoke-developed index not to exceed 450 when tested in accordance with ASTM E 84.

#### **Exceptions:**

- 1. When such materials are installed in concealed spaces, the flame-spread and smoke-developed limitations do not apply to the facings, provided that the facing is installed in substantial contact with the unexposed surface of the ceiling, floor or wall finish.
- 2. Cellulose loose-fill insulation, which is not spray applied, complying with the requirements of Section R316.3, shall only be required to meet the smoke-developed index of not more than 450.

**R316.2 Loose-fill insulation.** Loose-fill insulation materials that cannot be mounted in the ASTM E 84 apparatus without a screen or artificial supports shall have a flame-spread rating not to exceed 25 with an accompanying smoke-developed factor not to exceed 450 when tested in accordance with CAN/ ULC-S102.2.

**Exception:** Cellulose loose-fill insulation shall not be required to comply with this test method provided that such

insulation complies with the requirements of Section R316.3.

**R316.3 Cellulose loose-fill insulation.** Cellulose loose-fill insulation shall comply with CPSC 16 CFR, Parts 1209 and 1404. Each package of such insulating material shall be clearly labeled in accordance with CPSC 16 CFR, Parts 1209 and 1404.

**R316.4 Exposed attic insulation.** All exposed insulation materials installed on attic floors shall have a critical radiant flux not less than 0.12 watt per square centimeter.

**R316.5 Testing.** Tests for critical radiant flux shall be made in accordance with ASTM E 970.

#### SECTION R317 DWELLING UNIT SEPARATION

R317.1 Two-family dwellings. Dwelling units in two-family dwellings shall be separated from each other by wall and/or
floor assemblies having not less than 1-hour fire-resistance rating when tested in accordance with ASTM E 119. Fire-resistance-rated floor-ceiling and wall assemblies shall extend to and be tight against the exterior wall, and wall assemblies shall extend to the underside of the roof sheathing.

**Exception:** A fire resistance rating of  $\frac{1}{2}$  hour shall be permitted in buildings equipped throughout with an automatic sprinkler system installed in accordance with NFPA 13.

**R317.1.1 Supporting construction.** When floor assemblies are required to be fire-resistance-rated by Section R317.1, the supporting construction of such assemblies shall have an equal or greater fire-resistive rating.

**R317.2 Townhouses.** Each townhouse shall be considered a separate building and shall be separated by fire-resistance-rated wall assemblies meeting the requirements of Section R302 for exterior walls.

**Exception:** A common 2-hour fire-resistance-rated wall is permitted for townhouses if such walls do not contain plumbing or mechanical equipment, ducts or vents in the cavity of the common wall. Electrical installations shall be installed in accordance with the <u>North Carolina Electrical</u> <u>Code</u>. Penetrations of electrical outlet boxes shall be in accordance with Section R317.3.

**R317.2.1 Continuity.** The common wall for townhouses shall be continuous from the foundation to the underside of the roof sheathing, deck or slab and shall extend the full length of the common wall including walls extending through and separating attached accessory structures.

**R317.2.2 Parapets.** Parapets constructed in accordance with Section R317.2.3 shall be provided for townhouses as an extension of exterior walls or common walls in accordance with the following:

- 1. Where roof surfaces adjacent to the wall or walls are at the same elevation, the parapet shall extend not less than 30 inches (762 mm) above the roof surfaces.
- 2. Where roof surfaces adjacent to the wall or walls are at different elevations and the higher roof is not more than 30 inches (762 mm) above the lower roof, the

parapet shall extend not less than 30 inches (762 mm) above the lower roof surface.

**Exception:** A parapet is not required in the two cases above when the roof is covered with a minimum class C roof covering, and the roof decking or sheathing is of noncombustible materials or approved fire-retardant-treated wood for a distance of 4 feet (1219 mm) on each side of the wall or walls, or one layer of  $\frac{5}{8}$ -inch (15.9 mm) Type X gypsum board is installed directly beneath the roof decking or sheathing for a distance of 4 feet (1219 mm) on each side of the wall or walls.

3. A parapet is not required where roof surfaces adjacent to the wall or walls are at different elevations and the higher roof is more than 30 inches (762 mm) above the lower roof. The common wall construction from the lower roof to the underside of the higher roof deck shall not have less than a 1-hour fire-resistive rating. The wall shall be rated for exposure from both sides.

**R317.2.3 Parapet construction.** Parapets shall have the same fire-resistance rating as that required for the supporting wall or walls. On any side adjacent to a roof surface, the parapet shall have noncombustible faces for the uppermost 18 inches (457 mm), to include counterflashing and coping materials. Where the roof slopes toward a parapet at slopes greater than two units vertical in 12 units horizontal (16.7-percent slope), the parapet shall extend to the same height as any portion of the roof within a distance of 3 feet (914 mm), but in no case shall the height be less than 30 inches (762 mm).

**R317.2.4 Structural independence.** Each individual townhouse shall be structurally independent.

#### **Exceptions:**

- 1. Foundations supporting exterior walls or common walls.
- 2. Structural roof and wall sheathing from each unit may fasten to the common wall framing.
- 3. Nonstructural wall coverings.
- 4. Flashing at termination of roof covering over common wall.
- 5. Townhouses separated by a common 2-hour fire-resistance-rated wall as provided in Section R317.2.

**R317.3 Rated penetrations.** Penetrations of wall or floor/ceiling assemblies required to be fire-resistance-rated in accordance with Section R317.1 or R317.2 shall be protected in accordance with this section.

**R317.3.1 Through penetrations.** Through penetrations of fire-resistance-rated wall or floor assemblies shall comply with Section R317.3.1.1 or R317.3.1.2.

**Exception:** Where the penetrating items are steel, ferrous or copper pipes or steel conduits, the annular space shall be permitted to be protected as follows:

1. In concrete or masonry wall or floor assemblies where the penetrating item is a maximum 6 inches (152 mm) nominal diameter and the opening is a maximum 144 square inches (92 900 mm<sup>2</sup>), concrete, grout or mortar shall be permitted where installed to the full thickness of the wall or floor assembly or the thickness required to maintain the fire-resistance rating.

2. The material used to fill the annular space shall prevent the passage of flame and hot gases sufficient to ignite cotton waste where subjected to ASTM E 119 time temperature fire conditions under a minimum positive pressure differential of 0.01 inch of water (3 Pa) at the location of the penetration for the time period equivalent to the fire-resistance rating of the construction penetrated.

**R317.3.1.1 Fire-resistance-rated assembly.** Penetrations shall be installed as tested in the approved fire-resistance-rated assembly.

**R317.3.1.2 Penetration firestop system.** Penetrations shall be protected by an approved penetration firestop system installed as tested in accordance with ASTM E 814 or UL 1479, with a minimum positive pressure differential of 0.01 inch of water (3 Pa) and shall have an F rating of not less than the required fire-resistance rating of the wall or floor/ceiling assembly penetrated.

**R317.3.2 Membrane penetrations.** Membrane penetrations shall comply with Section R317.3.1. Where walls are required to have a minimum 1-hour fire resistance rating, recessed fixtures shall be so installed such that the required fire resistance will not be reduced.

#### **Exceptions**:

- Steel electrical boxes that do not exceed 16 square inches (0.0103m<sup>2</sup>) in area provided the total area of such openings does not exceed 100 square inches (0.0645 m<sup>2</sup> for any 100 square feet (9.29 m<sup>2</sup>) of wall area. Outlet boxes on opposite sides of the wall shall be separated as follows:
  - 1.1. By a horizontal distance of not less than 24 inches (610 mm);
  - 1.2. By a horizontal distance of not less than the depth of the wall cavity when the wall cavity is filled with cellulose loose-fill, rockwool or slag mineral wool insulation;
  - 1.3. By solid fire blocking in accordance with Section R602.8.1;
  - 1.4. By protecting both outlet boxes by listed putty pads; or
  - 1.5. By other listed materials and methods.
- 2. Membrane penetrations for listed electrical outlet boxes of any materials are permitted provided such boxes have been tested for use in fire resistance-rated assemblies and are installed in accordance with the instructions included in the listing. Outlet boxes on opposite sides of the wall shall be separated as follows:

- 2.1. By a horizontal distance of not less than 24 inches (610 mm);
- 2.2. By solid fire-blocking in accordance with Section R602.8;
- 2.3. By protecting both outlet boxes by listed putty pads; or
- 2.4. By other listed materials and methods.
- 3. The annular space created by the penetration of a fire sprinkler provided it is covered by a metal escutcheon plate.

# R317.4 Sound transmission. See Appendix K.

# SECTION R318 MOISTURE VAPOR RETARDERS

**R318.1 Moisture control.** Only in Zone 11 counties identified in Table N1101.2 shall above grade 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.

#### SECTION R319 PROTECTION AGAINST DECAY

**R319.1 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 AWPA C1, C2, C3, C4, C9, C15, C18, C22, C23, C24, C28, C31, C33, P1, P2 and **I** 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 <u>sills and plates</u> that rest on concrete or masonry exterior foundation walls and are less than 8 inches (203 mm) from the exposed ground.
- 3. Sills and sleepers on a concrete or masonry slab, <u>unless</u> the slab that is in direct contact with the ground is <u>separated from the ground</u> by an <u>approved</u> 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 <u>and</u> 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.

**R319.1.1 Ground contact.** All wood in contact with the ground and that supports permanent structures intended for human occupancy shall be approved pressure preservative treated wood suitable for ground contact use, except untreated wood may be used where entirely below groundwater level or continuously submerged in fresh water.

**R319.1.2 Geographical areas.** In geographical areas where experience has demonstrated a specific need, approved naturally durable or pressure preservatively treated wood shall be used for those portions of wood members that form the structural supports of buildings, balconies, porches or similar permanent building appurtenances when such members are exposed to the weather without adequate protection from a roof, eave, overhang or other covering that would prevent moisture or water accumulation on the surface or at joints between members. Depending on local experience, such members may include:

- 1. Horizontal members such as girders, joists and decking.
- 2. Vertical members such as posts, poles and columns.
- 3. Both horizontal and vertical members.

**R319.1.3 Posts, poles and columns.** Posts, poles and columns supporting permanent structures that are embedded in concrete in direct contact with the ground or embedded in concrete exposed to the weather shall be approved pressure preservatively treated wood suitable for ground contact use.

**R319.1.4 Wood columns.** Wood columns shall be approved wood of natural decay resistance or approved pressure preservatively treated wood.

#### **Exceptions:**

- 1. Posts or columns which are either exposed to the weather or located in basements or cellars, supported by piers or metal pedestals projecting 1 inch (25.4 mm) above the floor or finished grade and 6 inches (152 mm) above exposed earth, and are separated there from by an approved impervious moisture barrier.
- 2. Posts or columns in enclosed crawl spaces or unexcavated areas located within the periphery of the building, supported by a concrete pier or metal pedestal at a height greater than 8 inches (203mm) from exposed ground, and are separated there from by an impervious moisture barrier.

**R319.2 Quality mark.** Lumber and plywood required to be pressure preservatively treated in accordance with Section R319.1 shall bear the quality mark of an approved inspection agency that maintains continuing supervision, testing and inspection over the quality of the product and that has been approved by an accreditation body that complies with the requirements of the American Lumber Standard Committee treated wood program.

**R319.2.1 Required information.** The required quality mark on each piece of pressure preservatively treated lumber or plywood shall contain the following information:

- 1. Identification of the treating plant.
- 2. Type of preservative.
- 3. The minimum preservative retention.
- 4. End use for which the product was treated.
- 5. Standard to which the product was treated.
- 6. Identity of the approved inspection agency.
- 7. The designation "Dry," if applicable.

**Exception:** Quality marks on lumber less than 1 inch (25.4 mm) nominal thickness, or lumber less than nominal 1 inch by 5 inches (25.4 mm by 127 mm) or 2 inches by 4 inches (51 mm by 102 mm) or lumber 36 inches (914 mm) or less in length shall be applied by stamping the faces of exterior pieces or by end labeling not less than 25 percent of the pieces of a bundled unit.

#### <u>\*TABLE R319.3</u> ACCEPTABLE FASTENERS PER CHEMICALS USED IN PRESSURE-PRESERVATIVELY TREATED WOOD

ACCEL TABLE FACTEMENT EN CHEMICAES COED IN THEOCOMET MEDELINATIVEET MEATED 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			
Wolman E (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.				

**R319.3 Fasteners.** Fasteners for pressure preservative and fire-retardant-treated wood shall be <u>in accordance with Table R319.3.</u>

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

#### SECTION R320 PROTECTION AGAINST TERMITES

**R320.1 Subterranean termite control.** In areas favorable to termite damage as established by Table R301.2(1), methods of protection shall be by chemical soil treatment, pressure preservatively treated wood in accordance with the AWPA standards listed in Section R319.1, naturally termite-resistant wood or physical barriers (such as metal or plastic termite shields), or any combination of these methods.

**R320.1.1 Quality mark.** Lumber and plywood required to be pressure preservatively treated in accordance with Section R320.1 shall bear the quality mark of an approved inspection agency which maintains continuing supervision, testing and inspection over the quality of the product and which has been approved by an accreditation body which complies with the requirements of the American Lumber Standard Committee treated wood program.

**R320.2 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 <u>and applied according to the standards of the North Carolina Department of Agriculture.</u>

**R320.3 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.

R320.3.1 Field treatment. Deleted.

**R320.4 Foam plastic, general.** This section shall apply to both treated and untreated foam plastic.

**R320.4.1 Foundation walls.** All foam plastic shall be a minimum of 8 inches (203 mm) above grade (see Appendix O).

**Exception:** Foam plastic less than 8 inches (203 mm) above or in contact with grade shall be installed in accordance with Section R320.4.5 and Appendix O.

**R320.4.2 Termite control.** When foam plastic is in contact with the ground, subterranean termite control shall be in accordance with Section R320.1.

**R320.4.3 Slab-on-grade (nonstructural).** Foam plastic shall be installed along the vertical edge and underneath the slab as specified in Section R320.4.5.

**R320.4.4 Slab-on-grade (structural).** All slabs which distribute the wall loads to the foundation shall be insulated as specified in Section R320.4 and Appendix 0. Foam plastic shall be installed along the vertical edge and underneath the slab as specified in Section R320.4.

#### **<u>R320.4.5 Foam plastic in contact with ground.</u>**

**R320.4.5.1 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 (0.79 rad) (see Appendix O).

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

**R320.4.5.2** 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).

**R320.4.5.3 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.

**R320.4.5.4 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).

**R320.5 Crawl spaces.** The use of foam plastic insulation inside of crawl spaces is governed by Section R409.8.1.1.

# [F] SECTION R321 SITE ADDRESS

**R321.1 Premises identification.** Approved numbers or addresses shall be provided for all new buildings in such a position as to be plainly visible and legible from the street or road fronting the property.

## [B] SECTION R322 ACCESSIBILITY

R322.1 Scope. Deleted.

#### SECTION R323 FLOOD-RESISTANT CONSTRUCTION

**R323.1 General.** 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 the provisions contained in this section (see additional provisions in Chapter 45).

**Exception:** All buildings and structures in identified floodways as established in Table R301.2 (1) shall be designed and constructed as stipulated in the <u>North Carolina</u> Building Code.

**R323.1.1 Structural systems.** All structural systems of all buildings and structures shall be designed, connected and anchored to resist flotation, collapse or permanent lateral movement due to structural loads and stresses from flooding equal to the design flood elevation.

**R323.1.2 Flood-resistant construction.** All buildings and structures erected in areas prone to flooding shall be constructed by methods and practices that minimize flood damage.

**R323.1.3 Establishing the design flood elevation.** The design flood elevation shall be used to define areas prone to flooding, and shall describe, at a minimum, the base flood elevation at the depth of peak elevation of flooding (including wave height) which has a 1 percent (100-year flood) or greater chance of being equaled or exceeded in any given year.

**R323.1.4 Lowest floor.** The lowest floor shall be the floor of the lowest enclosed area, including basement, but excluding any unfinished flood-resistant enclosure that is useable solely for vehicle parking, building access or limited storage provided that such enclosure is not built so as to render the building or structure in violation of this section.

**R323.1.5** Protection of mechanical and electrical systems. Electrical systems, equipment and components, and heating, ventilating, air conditioning and plumbing appliances, plumbing fixtures, duct systems, and other service equipment shall be located at or above the design flood elevation. If replaced as part of a substantial improvement, electrical systems, equipment and components, and heating, ventilating, air conditioning, and plumbing appliances, plumbing fixtures, duct systems, and other service equipment shall meet the requirements of this section. Systems, fixtures, and equipment and components shall not be mounted on or penetrate through walls intended to break away under flood loads.

**Exception:** Electrical systems, equipment and components, and heating, ventilating, air conditioning and plumbing appliances, plumbing fixtures, duct systems, and other service equipment are permitted to be located below the design flood elevation provided that they are designed and installed to prevent water from entering or accumulating within the components and to resist hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding to the design flood elevation in compliance with the flood-resistant construction requirements of the North Carolina Building Code. Electrical wiring systems are permitted to be located below the design flood elevation provided they conform to the provisions of the electrical part of this code for wet locations.

**R323.1.6 Protection of water supply and sanitary sewage systems.** New and replacement water supply systems shall be designed to minimize or eliminate infiltration of flood waters into the systems in accordance with the plumbing provisions of this code. New and replacement sanitary sewage systems shall be designed to minimize or eliminate infiltration of floodwaters into systems and discharges from systems into floodwaters in accordance with the plumbing provisions of this code and the North Carolina Plumbing Code.

**R323.1.7 Flood-resistant materials.** Building materials used below the design flood elevation shall comply with the following:

- 1. All wood, including floor sheathing, shall be pressure preservatively treated in accordance with AWPA C1, C2, C3, C4, C9, C15, C18, C22, C23, C24, C28, P1, P2 and P3 or decay-resistant heartwood or redwood, black locust, or cedars.
- 2. Materials and installation methods used for flooring and interior and exterior walls and wall coverings shall conform to the provisions of FEMA/FIA-TB-2.

**R323.1.8 Manufactured housing.** New or replacement manufactured housing shall be elevated in accordance with Section R323.2 and the anchor and tie-down requirements of Sections AE604 and AE605 of Appendix E shall apply. The foundation and anchorage of manufactured housing to be located in identified flood ways as established in Table R301.2(1) shall be designed and constructed in accordance with the applicable provisions in the North Carolina Building Code.

**R323.1.9** As-built elevation documentation. A registered design professional shall prepare and seal documentation of the elevations specified in Section R323.2 or R323.3.

**R323.2 Flood hazard areas (including A Zones).** All areas that have been determined to be prone to flooding but not subject to high velocity wave action shall be designated as flood hazard areas. All buildings and structures erected in flood hazard areas shall be designed and constructed in accordance with Sections R323.2.1 through R323.2.3.

#### **R323.2.1** Elevation requirements.

- 1. Buildings and structures shall have the lowest floors elevated to or above the design flood elevation.
- 2. In areas of shallow flooding (AO Zones), buildings and structures shall have the lowest floor (including basement) elevated at least as high above the highest adjacent grade as the depth number specified in feet (mm) on the FIRM, or at least 2 feet (610 mm) if a depth number is not specified.
- 3. Basement floors that are below grade on all sides shall be elevated to or above the design flood elevation.

**Exception:** Enclosed areas below the design flood elevation, including basements whose floors are not below grade on all sides, shall meet the requirements of Section R323.2.2.

**R323.2.2 Enclosed area below design flood elevation.** Enclosed areas, including crawl spaces, that are below the design flood elevation shall:

- 1. Be used solely for parking of vehicles, building access or storage.
- 2. Be provided with flood openings which shall meet the following criteria:
  - 2.1. There shall be a minimum of two openings on different sides of each enclosed area; if a building has more than one enclosed area below the design flood elevation, each area shall have openings on exterior walls.
  - 2.2. The total net area of all openings shall be at least 1 square inch for each square foot (275 mm for each square meter) of enclosed area.
  - 2.3. The bottom of each opening shall be 1 foot (305 mm) or less above the adjacent ground-level.
  - 2.4. Openings shall be at least 3 inches (76 mm) in diameter.
  - 2.5. Any louvers, screens or other opening covers shall allow the automatic flow of floodwaters into and out of the enclosed area.
  - 2.6. Openings installed in doors and windows, that meet requirements 2.1 through 2.5, are acceptable; however, doors and windows without installed openings do not meet the requirements of this section.

**R323.2.3 Foundation design and construction.** Foundation walls for all buildings and structures erected in flood hazard areas shall meet the requirements of Chapter 4.

**Exception:** Unless designed in accordance with Section 404:

- 1. The unsupported height of 6 inches (152 mm) plain masonry walls shall be no greater than 3 feet (914 mm).
- 2. The unsupported height of 8 inches (203 mm) plain masonry walls shall be no greater than 4 feet (1219 mm).
- 3. The unsupported height of 8 inches (203 mm) reinforced masonry walls shall be no greater than 8 feet (2438 mm).

For the purpose of this exception, unsupported height is the distance from the finished grade of the under-floor space and the top of the wall.

**R323.3 Coastal high-hazard areas (including V Zones).** Areas that have been determined to be subject to wave heights in excess of 3 feet (914 mm) or subject to high velocity wave action or wave-induced erosion shall be designated as coastal high-hazard areas. All buildings and structures erected in coastal high-hazard areas shall be designed and constructed in accordance with Sections R323.3.1 through R323.3.6.

## R323.3.1 Location and site preparation. Deleted.

**R323.3.2** Elevation requirements.

- 1. All buildings and structures erected within coastal high hazard areas shall be elevated so that the lowest portion of all structural members supporting the lowest floor, with the exception of mat or raft foundations, piling, pile caps, columns, grade beams and bracing, is located at or above the design flood elevation.
- 2. Basement floors that are below grade on all sides are prohibited.
- 3. The use of fill for structural support is prohibited.
- 4. The placement of fill beneath buildings and structures is prohibited.

**Exception:** Walls and partitions enclosing areas below the design flood elevation shall meet the requirements of Sections R323.3.4 and R323.3.5.

R323.3.3 Foundations. All buildings and structures erected in coastal high hazard areas shall be supported on pilings or columns and shall be adequately anchored to such pilings or columns. Piling shall have adequate soil penetrations to resist the combined wave and wind loads (lateral and uplift). Water loading values used shall be those associated with the design flood. Wind loading values shall be those required by this code. Pile embedment shall include consideration of decreased resistance capacity caused by scour of soil strata surrounding the piling. Pile systems design and installation shall be certified in accordance with Section R323.3.6. Mat, raft or other foundations that support columns shall not be permitted where soil investigations that are required in accordance with Section R401.4 indicate that soil material under the mat, raft or other foundation is subject to scour or erosion from wave-velocity flow conditions.

**R323.3.4 Walls below design flood elevation.** Walls and partitions are permitted below the elevated floor, provided that such walls and partitions are not part of the structural support of the building or structure and:

- 1. Electrical, mechanical, and plumbing system components are not to be mounted on or penetrate through walls that are designed to break away under flood loads, and
- 2. Are constructed with insect screening or open lattice, or;
- 3. Are designed to break away or collapse without causing collapse, displacement or other structural damage to the elevated portion of the building or supporting foundation system. Such walls, framing and connections shall have a design safe loading resistance of not less than 10 (0.48 kN/m<sup>2</sup>) and no more than 20 pounds per square foot (0.96 kN/m<sup>2</sup>); or
- 4. Where wind loading values of this code exceed 20 pounds per square foot (0.96 kN/m<sup>2</sup>), the construction documents shall include documentation prepared and sealed by a registered design professional that:
  - 4.1. The walls and partitions below the design flood elevation have been designed to collapse

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from a water load less than that which would occur during the design flood.

4.2. The elevated portion of the building and supporting foundation system have been designed to withstand the effects of wind and flood loads acting simultaneously on all building components (structural and nonstructural). Water loading values used shall be those associated with the design flood. Wind loading values shall be those required by this code.

**R323.3.5 Enclosed areas below design flood elevation.** Enclosed areas below the design flood elevation shall be used solely for parking of vehicles, building access or storage.

**R323.3.6 Construction documents.** The construction documents shall include documentation that is prepared and sealed by a registered design professional that the design and methods of construction to be used meet the applicable criteria of this section.