the footing for well-drained sites, or one-half the total backfill height for poorly drained sites. The porous fill shall be covered with strips of 30-pound (13.6 kg) asphalt paper or 6-mil (0.15 mm) polyethylene to permit water seepage while avoiding infiltration of fine soils.

R406.3.4 Backfill. The remainder of the excavated area shall be backfilled with the same type of soil as was removed during the excavation.

SECTION R407
COLUMNS

R407.1 Wood column protection. Wood columns shall be protected against decay as set forth in Section R323.

R407.2 Steel column protection. All surfaces (inside and outside) of steel columns shall be given a shop coat of rust-inhibitive paint, except for corrosion-resistant steel and steel treated with coatings to provide corrosion resistance.

R407.3 Structural requirements. The columns shall be restrained to prevent lateral displacement at the bottom end. Wood columns shall not be less in nominal size than 4 inches by 4 inches (102 mm by 102 mm) and steel columns shall not be less than 3-inch-diameter (76 mm) standard pipe or approved equivalent.

Exception: In Seismic Design Categories A, B and C columns no more than 48 inches (1219 mm) in height on a pier or footing are exempt from the bottom end lateral displacement requirement within underfloor areas enclosed by a continuous foundation.

SECTION R408
UNDER-FLOOR SPACE

R408.1 Ventilation. The under-floor space between the bottom of the floor joists and the earth under any building (except space occupied by a basement or cellar) shall be provided with ventilation openings through foundation walls or exterior walls. The minimum net area of ventilation openings shall not be less than 1 square foot for each 150 square feet (0.67 m^2 for each 100 m^2) of under-floor space area. One such ventilating opening shall be within 3 feet (914 mm) of each corner of said building.

R408.2 Openings for under-floor ventilation. The minimum net area of ventilation openings shall not be less than 1 square foot (0.0929 m^2) for each 150 square feet (100 m^2) of underfloor space area. One such ventilating opening shall be within 3 feet (914 mm) of each corner of the building. Ventilation openings shall be covered for their height and width with any of the following materials provided that the least dimension of the covering shall not exceed 1/4 inch (6.4 mm):

1. Perforated sheet metal plates not less than 0.070 inch (1.8 mm) thick.
2. Expanded sheet metal plates not less than 0.047 inch (1.2 mm) thick.
3. Cast iron grills or grating.
4. Extruded load-bearing brick vents.
5. Hardware cloth of 0.035 inch (0.89 mm) wire or heavier.
6. Corrosion-resistant wire mesh, with the least dimension being 1/8 inch (3.2 mm).

Exceptions:

1. Where warranted by climatic conditions, ventilation openings to the outdoors are not required if ventilation openings to the interior are provided.
2. The total area of ventilation openings may be reduced to 1/1,500 of the under-floor area where the ground surface is treated with an approved vapor retarder material and the required openings are placed so as to provide cross-ventilation of the space. The installation of operable louvers shall not be prohibited.
3. Under-floor spaces used as supply plenums for distribution of heated and cooled air shall comply with the requirements of *the North Carolina Mechanical Code*.
4. Ventilation openings are not required where continuously operated mechanical ventilation is provided at a rate of 1.0 cfm (10 m^2) for each 50 square feet (1.02 L/s) of underfloor space floor area and ground surface is covered with an approved vapor retarder material.
5. Ventilation openings are not required when the ground surface is covered with an approved vapor retarder material, the space is supplied with conditioned air and the perimeter walls are insulated in accordance with Section N1102.1.7.

R408.3 Access. An access opening 18 inches by 24 inches (457 mm by 610 mm) shall be provided to the under-floor space. See *the North Carolina Mechanical Code* for access requirements where mechanical equipment is located under floors.

R408.4 Removal of debris. The under-floor grade shall be cleaned of all vegetation and organic material. All wood forms used for placing concrete shall be removed before a building is occupied or used for any purpose. All construction materials shall be removed before a building is occupied or used for any purpose.

R408.5 Finished grade. The finished grade of under-floor surface may be located at the bottom of the footings; however, where there is evidence that the groundwater table can rise to within 6 inches (152 mm) of the finished *grade of under-floor space* at the building perimeter or where there is evidence that the surface water does not readily drain from the building site, the grade in the under-floor space shall be as high as the outside finished grade, unless an approved drainage system is provided.

R408.6 Flood resistance. For buildings located in areas prone to flooding as established in Table R301.2(1), the walls enclosing the underfloor space shall be provided with flood openings in accordance with Section R327.2.2.

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TABLE N1102.1.1.2
STEEL-FRAME WALL MINIMUM PERFORMANCE REQUIREMENTS (R-VALUE)

CLIMATE ZONES	HDD	EQUIVALENT STEEL-FRAME WALL CAVITY AND SHEATHING R-VALUE[a] (hr·ft²·°F) / Btu
1-4	0-1999	R-11+R-5, R-15+R-4, R-21+R-3
5-8	2,000-3,999	R-11+R-5, R-15+R-4, R-21+R-3
9-12	4,000-5,999	R-11+R-9, R-15+R-8, R-21+R-7
13-15	6,000-8,499	R-13+R-10, R-19+R-9, R-25+R-8
16 and 17	8,500-12,999	R-13+R-10, R-19+R-9, R-25+R-8

For SI: 1 (hr·ft²·°F)/Btu = 0.176 m²·K/W.
a. The cavity insulation *R*-value requirement is listed first, followed by the sheathing *R*-value requirement.

N1102.1.2 Ceilings. The required "Ceiling R-value" in Table N1102.1 assumes standard truss or rafter construction and shall apply to all roof/ceiling portions of the building thermal envelope, including cathedral ceilings. Where the construction technique allows the required *R*-value of ceiling insulation to be obtained over the wall top plate, R-30 shall be permitted to be used where R-38 is required and R-38 shall be permitted to be used where R-49 is required.

N1102.1.3 Opaque doors. Opaque doors separating conditioned and unconditioned space shall have a maximum U-factor of 0.35. One opaque door shall be permitted to be exempt from this *U*-factor requirement.

N1102.1.4 Floors. The required *R*-value in Table N1102.1 shall apply to all floors, except any individual floor assembly with over 25 percent of its conditioned floor area exposed directly to outside air shall meet the *R*-value requirement in Table N1102.1 for "Ceilings."

N1102.1.5 Basement walls. When the basement is a conditioned space, the basement walls shall be insulated in accordance with Table N1102.1. When the basement is not a conditioned space, either the basement walls or the ceilings separating the basement from conditioned space shall be insulated in accordance with Table N1102.1. When insulating basement walls, the required *R*-value shall be applied from the top of the basement wall to a depth of 10 feet (3048 mm) below grade or to the top of the basement floor, whichever is less.

N1102.1.6 Slab-on-grade floors. For slabs with a top edge above finished grade or 12 inches (305 mm) or less below finished grade, the required *R*-value in Table N1102.1 shall be applied to the outside of the foundation or the inside of the foundation wall. The insulation shall extend downward from the top of the slab, or downward to the bottom of the slab and then horizontally in either direction, until the distance listed in Table N1102.1 is reached. When installed between the exterior wall and the edge of the interior slab, the top edge of the insulation shall be permitted to be cut at a 45-degree (0.79 rad) angle away from the exterior wall. Insulation extending horizontally away from the building shall be protected by pavement or by a minimum of 10 inches (254 mm) of soil.

In locations of 500 HDD or greater, R-2 shall be added to the values in Table N1102.1 where uninsulated hot water pipes, air distribution ducts or electric heating cables are installed within or under the slab.

Exception: Slab perimeter insulation is not required for unheated slabs in areas of *moderate to* very heavy termite infestation probability as shown in Figure R301.2(6). Where this exception is used, building envelope compliance shall be demonstrated by (a) using *International Energy Conservation Code* Section 502.2.2 or *International Energy Conservation Code* Chapter 4 with the actual slab insulation *R*-value in Table N1102.1, or (b) using *International Energy Conservation Code* Section 502.2.4.

N1102.1.7 Crawl space walls. Where the floor above the crawl space is uninsulated, insulation shall be installed on crawl space walls when the crawl space is not vented to outside air. The required *R*-value in Table N1102.1 shall be applied inside of the crawl space wall, downward from the sill plate to the exterior finished grade level and then vertically and/or horizontally for at least an additional 24 inches (610 mm). The exposed earth in all crawl space foundations shall be covered with a continuous vapor retarder having a maximum permeance rating of 1.0 perm[(57 mg)/(s·m²·Pa)], when tested in accordance with ASTM E 96.

N1102.1.8 Masonry veneer. For exterior foundation insulation, that horizontal portion of the foundation that supports a masonry veneer shall not be required to be insulated.

N1102.1.9 Protection. Exposed insulating materials applied to the exterior of foundation walls shall be protected. The protection shall extend at least 6 inches (152 mm) below finished grade level.

N1102.1.10 Air leakage. All joints, seams, penetrations; site-built windows, doors, and skylights; openings between window and door assemblies and their respective jambs and framing; and other sources of air leakage (infiltration and exfiltration) through the building thermal envelope shall be caulked, gasketed, weatherstripped, wrapped, or otherwise sealed to limit uncontrolled air movement.

N1102.2 Maximum solar heat gain coefficient for fenestration products. *Deleted.*

N1102.3 Fenestration exemption. Up to 1 percent of the total glazing area shall be exempt from *U*-factor requirements.