

**2010 Oregon Structural Specialty Code
Special Amendment
Section 1812 Radon Mitigation
*R-2 and R-3***

Effective Date: April 1, 2011

New code section 1812 has been adopted by the State of Oregon.

The over-all purpose of the proposed amendments to the 2010 OSSC is to implement Senate Bill 1025 approved by the 2010 Legislature. The bill required the Building Codes Structures Board to adopt radon mitigation standards for certain types of new residential buildings and new public buildings. Radon mitigation standards adopted by these rules amend the 2010 OSSC. These requirements are applicable in Baker, Clackamas, Hood River, Multnomah, Polk, Washington and Yamhill Counties.

These proposed rules would become effective April 1, 2011 for new R-2 and R-3 occupancies.

These changes have been prepared in the following pages as an insert for the 2010 Oregon Structural Specialty Code and are formatted for insertion in loose leave binders.

SECTION 1812
Radon Control Methods
R-2 and R-3 Occupancies

1812.1 Scope. The provisions of this section apply to new R-2 and R-3 occupancies constructed in Baker, Clackamas, Hood River, Multnomah, Polk, Washington and Yamhill Counties for which initial building permits are issued on or after April 1, 2011.

1812.2 DEFINITIONS. For the purpose of these requirements, the terms used shall be defined as follows:

SUBSLAB DEPRESSURIZATION SYSTEM (Passive). A system designed to achieve lower sub-slab air pressure relative to indoor air pressure by use of a vent pipe routed through the conditioned space of a building and connecting the sub-slab area with outdoor air, thereby relying on the convective flow of air upward in the vent to draw air from beneath the slab.

SUBSLAB DEPRESSURIZATION SYSTEM (Active). A system designed to achieve lower sub-slab air pressure relative to indoor air pressure by use of a fan-powered vent drawing air from beneath the slab.

DRAIN TILE LOOP. A continuous length of drain tile or perforated pipe extending around all or part of the internal or external perimeter of a basement or crawl space footing.

RADON GAS. A naturally-occurring, chemically inert, radioactive gas that is not detectable by human senses. As a gas, it can move readily through particles of soil and rock and can accumulate under the slabs and foundations of homes where it can easily enter into the living space through construction cracks and openings.

SOIL-GAS-RETARDER. A continuous membrane of 6-mil (0.15 mm) polyethylene or other equivalent material used to retard the flow of soil gases into a building.

SUBMEMBRANE DEPRESSURIZATION SYSTEM. A system designed to achieve lower-sub-membrane air pressure relative to crawl space air pressure by use of a vent drawing air from beneath the soil-gas-retarder membrane.

1812.3 REQUIREMENTS

1812.3.1 General. The following construction techniques are intended to resist radon entry and prepare the building for post-construction radon mitigation. (see Figure 1812).

1812.3.2 Subfloor preparation. A layer of gas-permeable material shall be placed under all concrete

slabs and other floor systems that directly contact the ground and are within the walls of the living spaces of the building, to facilitate future installation of a sub-slab depressurization system, if needed. The gas-permeable layer shall consist of one of the following:

1. A uniform layer of clean aggregate, a minimum of 4 inches (102mm)thick. The aggregate shall consist of material that will pass through a 2-inch (51mm)sieve and be retained by a 1/4-inch (6.4 mm) sieve.
2. A uniform layer of sand (native or fill), a minimum of 4 inches (102 mm) thick, overlain by a layer or strips of geotextile drainage matting designed to allow the lateral flow of soil gases.
3. Other materials, systems or floor designs with demonstrated capability to permit depressurization across the entire sub-floor area.

1812.3.3 Soil-gas-retarder. A minimum 6-mil (0.15 mm) [or 3-mil (0.075 mm) cross-laminated] polyethylene or equivalent flexible sheeting material shall be placed on top of the gas-permeable layer prior to casting the slab or placing the floor assembly to serve as a soil-gas-retarder by bridging any cracks that develop in the slab or floor assembly and to prevent concrete from entering the void spaces in the aggregate base material. The sheeting shall cover the entire floor area with separate sections of sheeting lapped at least 12 inches (305 mm). The sheeting shall fit closely around any pipe, wire or other penetrations of the material. All punctures or tears in the material shall be sealed or covered with additional sheeting.

1812.3.4 Entry routes. Potential radon entry routes shall be closed in accordance with Sections 1812.3.4.1 through 1812.4.10.

1812.3.4.1 Floor openings. Openings around bathtubs, showers, water closets, pipes, wires or other objects that penetrate concrete slabs or other floor assemblies shall be filled with a polyurethane caulk or equivalent sealant applied in accordance with the manufacturer's recommendations.

1812.3.4.2 Concrete joints. All control joints, isolation joints, construction joints and any other joints in concrete slabs or between slabs and foundation walls shall be sealed with a caulk or sealant. Gaps and joints shall be cleared of loose material and filled with polyurethane caulk or other elastomeric sealant applied in accordance with the manufacturer's recommendations.

1812.3.4.3 Condensate drains. Condensate drains shall be trapped or routed through non perforated pipe to daylight.

1812.3.4.4 Sumps. Sump pits open to soil or serving as the termination point for sub-slab or exterior drain tile loops shall be covered with a gasketed or otherwise sealed lid. Sumps used as the suction point in a sub-slab depressurization system shall have a lid designed to accommodate the vent pipe. Sumps used as a floor drain shall have a lid equipped with a trapped inlet.

1812.3.4.5 Foundation walls. Hollow block masonry foundation walls shall be constructed with either a continuous course of solid masonry, one course of masonry grouted solid, or a solid concrete beam at or above finished ground surface to prevent passage of air from the interior of the wall into the living space. Where a brick veneer or other masonry ledge is installed, the course immediately below that ledge shall be sealed. Joints, cracks or other openings around all penetrations of both exterior and interior surfaces of masonry block or wood foundation walls below the ground surface shall be filled with polyurethane caulk or equivalent sealant. Penetrations of concrete walls shall be filled.

1812.3.4.6 Dampproofing. The exterior surfaces of portions of concrete and masonry block walls below the ground surface shall be dampproofed in accordance with Section 1805.2 of this code.

1812.3.4.7 Air-handling units. Air-handling units in crawl spaces shall be sealed to prevent air from being drawn into the unit.

Exception: Units with gasketed seams or units that are otherwise sealed by the manufacturer to prevent leakage.

1812.3.4.8 Ducts. Ductwork passing through or beneath a slab shall be of seamless material unless the air-handling system is designed to maintain continuous positive pressure within such ducting. Joints in such ductwork shall be sealed to prevent air leakage.

Ductwork located in crawl spaces shall have all seams and joints sealed by closure systems in accordance with Section 603.9 of the Oregon Mechanical Specialty Code.

1812.3.4.9 Crawl space floors. Openings around all penetrations through floors above crawl spaces shall be caulked or otherwise filled to prevent air leakage.

1812.3.4.10 Crawl space access. Access doors and other openings or penetrations between basements and adjoining crawl spaces shall be closed, gasketed or otherwise filled to prevent air leakage.

1812.3.5 Passive sub membrane depressurization system (crawl spaces). In buildings with crawl space foundations, the following components of a passive sub-membrane depressurization system shall be installed during construction.

Exception: Buildings in which an approved mechanical crawl space ventilation system or other equivalent system is installed.

1812.3.5.1 Ventilation. Crawl spaces shall be provided with vents to the exterior of the building. The minimum net area of ventilation openings shall comply with Section 1203.3 of this code.

1812.3.5.2 Soil-gas-retarder. The soil in crawl spaces shall be covered with a continuous soil-gas-retarder in conformance with Section 1812.3.3. The soil-gas-retarder shall extend to all foundation walls enclosing the crawl space area.

1812.3.5.3 Vent pipe. A vent pip complying with the requirements of section 1812.3.7 for subslab soil exhaust system ducts.

1812.3.6 Passive subslab depressurization system (basement or slab-on-grade). In basement or slab-on-grade buildings, subslab soil exhaust system ducts complying with Section 1812.3.7 shall be installed during construction.

1812.3.7 Subslab soil exhaust system ducts (SSESD). SSESD's shall be provided in accordance with this section and shall run continuous from below the soil-gas-retarder to the termination point described in section 1812.3.7.5. SSESD's shall consist of one three- or four inch diameter solid pipe or multiple pipes providing the same cross-sectional area. All annular openings between the SSESD and floor slabs or soil-gas-retarders shall be sealed airtight. In addition, all SSESD joints shall be sealed airtight. Penetrations of SSESDs through fire resistive construction shall comply with the applicable sections of Chapter 7 of this code. SSESDs shall be located within the building's insulated envelope and may be combined above the slab where the cross-sectional area of all combined SSESDs is maintained to the required termination point.

1812.3.7.1 Location. One SSESD shall be installed for every 2,000 square feet or portion thereof of building subslab or crawl space area served. Subslab areas

isolated by subslab walls shall be provided with separate SSESs in the number noted above.

1812.3.7.2 Materials. SSES material shall be air duct material listed and labeled to the requirements of UL 181 for Class 0 air ducts, or any of the following piping materials that comply with the Plumbing Code as building sanitary drainage and vent pipe: cast iron; galvanized steel; brass or copper pipe; copper tube of a weight not less than that of copper drainage tube, Type DWV; and plastic piping.

1812.3.7.3 Grade. SSESs shall not be trapped and shall have a minimum slope of one-eighth unit vertical in 12 units horizontal (1-percent slope).

1812.3.7.4 Subslab aperture. SSES's shall be embedded vertically into the sub-slab aggregate or other permeable material prior to casting a slab. A "T" fitting or equivalent method shall be used to ensure that the SSES opening remains within the gas permeable material. Alternatively, the SSES shall be inserted directly into an interior perimeter drain tile loop or through a sealed sump cover where the sump is exposed to the sub-slab aggregate or connected to it through a drainage system.

1812.3.7.5 Termination. SSESs shall extend through the roof and terminate at least 6 inches (152 mm) above the roof and at least 10 feet (3048 mm) from any operable openings or air intake.

1812.3.7.6 Identification. All exposed and visible interior SSESs shall be permanently identified with at least one label on each floor and in accessible attics. The label shall be by means of a tag, stencil or other approved marking which states: "Radon Reduction System."

1812.3.7.8 SSES accessibility. SSES's shall be accessible for future fan installation through an attic or other area outside the habitable space.

Exception: The SSES need not be accessible in an attic space where an approved roof-top electrical supply is provided for future use.

1812.3.7.9 Combination foundations. Combination basement/crawl space or slab-on-grade/crawl space foundations shall have separate radon vent pipes installed in each type of foundation area. Each radon vent pipe shall terminate above the roof or shall be connected to a single vent that terminates above the roof.

1812.3.8 Building depressurization. Joints in air ducts and plenums in unconditioned spaces shall meet the requirements of Section 603 of the Oregon Mechanical Specialty Code. Thermal envelope air infiltration requirements shall comply with the Oregon Energy Efficiency Specialty Code. Fireblocking shall meet the requirements contained in Section 717.2 of this code.

1812.3.9 Power source. To provide for future installation of an active sub-membrane or sub-slab depressurization system, an electrical circuit terminated in an approved box shall be installed during construction in the attic or other anticipated location of vent pipe fans. An electrical supply shall also be accessible in anticipated locations of system failure alarms.

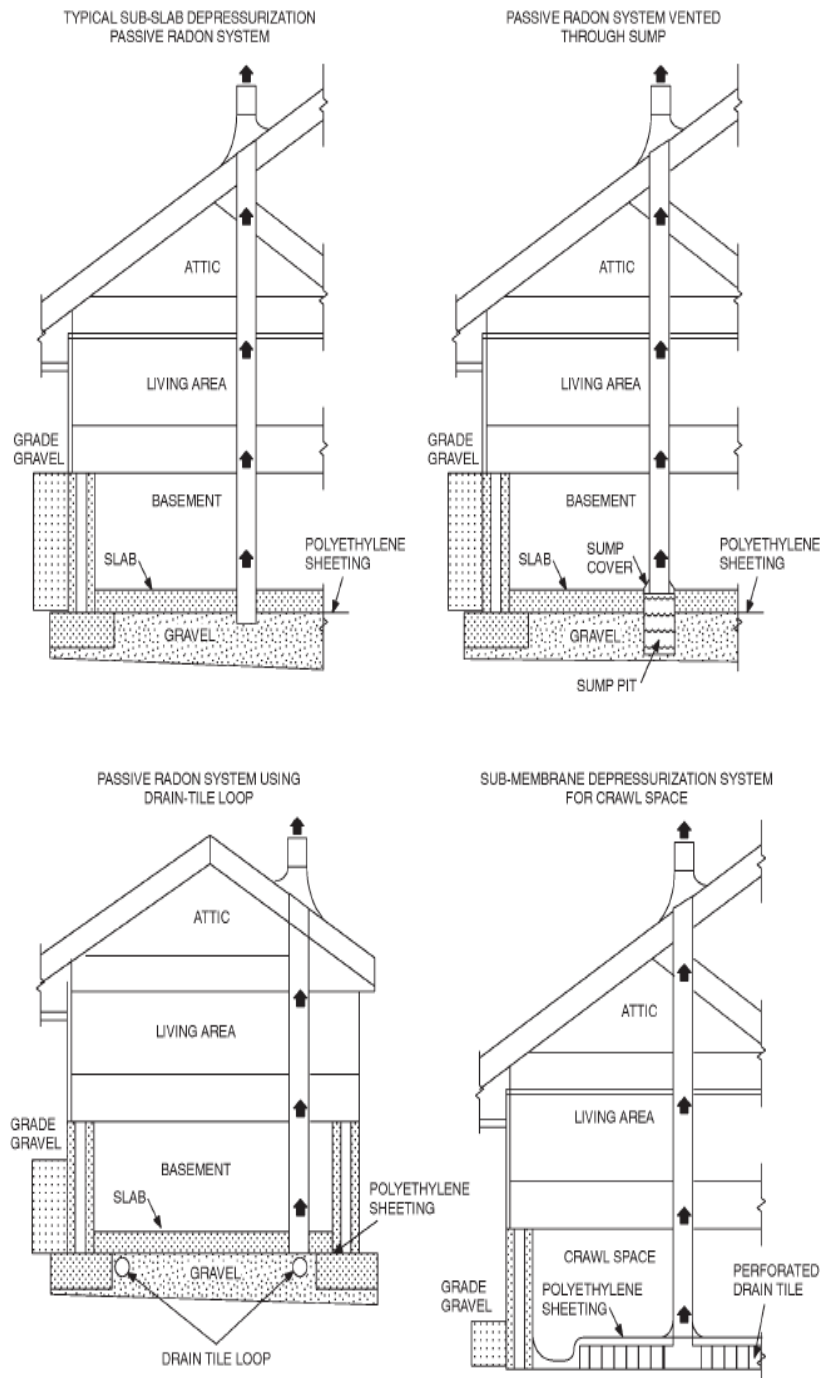


FIGURE 1812
RADON-RESISTANT CONSTRUCTION DETAILS FOR FOUR FOUNDATION TYPES

**Oregon Low Rise Code
(Appendix N)
Special Amendment
Section AN115 Radon Mitigation**

Effective Date: April 1, 2011

New code section AN 115 has been adopted by the State of Oregon.

The over-all purpose of the proposed amendments to the Oregon Low Rise Code is to implement Senate Bill 1025 approved by the 2010 Legislature. The bill required the Residential & Manufactured Structures Board to adopt radon mitigation standards for new apartment buildings covered under the scope of Appendix N. These requirements are applicable in Baker, Clackamas, Hood River, Multnomah, Polk, Washington and Yamhill Counties.

These proposed rules would become effective April 1, 2011 for new R-2 occupancies.

This item has been prepared as an insert page for the 2010 OSSC. Pages are formatted so that when inserted, the amendments will face the page containing the existing code language.

**SECTION AN 115
RADON MITIGATION**

AN115.1 Scope. Low-rise residential structures shall be provided with radon control methods in accordance with Section 1812 of this code. The provisions of this section apply to new low-rise residential buildings constructed in *Baker, Clackamas, Hood River, Multnomah, Polk, Washington and Yamhill Counties* for which initial building permits are issued on or after April 1, 2011.

**Oregon Structural Specialty Code
Special Amendment
Section 908.7 Carbon Monoxide**

Effective Date: April 1, 2011

New code section 908.7 has been adopted by the State of Oregon.

*With the passage of House Bill 3450, the Lofgren and Zander Memorial Act, carbon monoxide alarms will now be required in all newly constructed Group R occupancies as identified in Section 310 of the Oregon Structural Specialty Code (OSSC) which is based on the 2009 International Building Code (IBC). Examples of these uses may be characterized as; hotels, motels, apartments, dormitories, fraternities, sororities and residential care/assisted living facilities. In addition, SR-3 and SR-4 occupancies as defined in OSSC Appendix SR are included as they are principally built to “residential” standards. **Per the terms of the bill, these requirements are applicable to affected structures submitted for plan review as of April 1, 2011.***

This code has been prepared as an insert page for the 2010 OSSC. Pages are formatted so that when inserted, the amendments will face the page containing the existing code language.

908.7 Carbon monoxide alarms. For new construction, approved single station carbon monoxide alarms or a household carbon monoxide detection system shall be installed in each of the following occupancies:

1. Group R Occupancies identified in Section 310 of this code, and
2. Groups SR-3 and SR-4 Occupancies indentified in Appendix SR of this code.

908.7.1 Installation Location. Carbon monoxide alarms shall be located in each bedroom or within 15 feet outside of each bedroom door. Bedrooms on separate floor levels in a structure consisting of two or more stories shall have separate carbon monoxide alarms serving each story.

908.7.1.2 Three or More Dwelling Units. In addition to the locations required by section 908.7.1, a carbon monoxide alarm shall be installed in any enclosed common areas within buildings containing three or more dwelling units.

908.7.2 Alarm requirements.

908.7.2.1 Single station alarm requirements. Single station carbon monoxide alarms shall be listed as complying with ANSI/UL 2034 and shall be installed in accordance with this code and the manufacturer’s installation instructions.

908.7.2.2 Household carbon monoxide detection systems. Household carbon monoxide detection systems, that include carbon monoxide detectors and audible notification appliances, installed and maintained in accordance with this section for carbon monoxide alarms and NFPA 720 shall be permitted. The carbon monoxide detectors shall be listed as complying with ANSI/UL 2075.

908.7.2.3 Combination smoke/carbon monoxide alarm/detector requirements. Combination smoke/carbon monoxide alarms shall be listed as complying with ANSI/UL 2034 and ANSI/UL 217. Combination smoke/carbon monoxide detectors shall be listed as complying with ANSI/UL 2075 and ANSI/UL 268. See section 907.2.11 of this code for additional requirements specific to the installation of smoke alarms.

908.7.3 Power Source.

908.7.3.1 Carbon Monoxide Alarms. Single station carbon monoxide alarms shall be battery operated, or may receive their primary power from the building wiring system. Plug in devices securely fastened to the structure and installed in accordance with the manufacturer’s installation instructions are deemed to satisfy this requirement. Hard wired and plug in carbon monoxide alarms shall be equipped with battery back up.

908.7.3.2 Household carbon monoxide detection systems. Required power supply sources for household carbon monoxide detection systems shall be in accordance with NFPA 720.

908.7.3.3 Combination smoke/carbon monoxide alarms/detectors. Combination smoke/carbon monoxide alarms/detectors shall receive their power source in accordance with Section 907.2.11.4 and NFPA 72. Smoke

alarm features of combination smoke/carbon monoxide alarms shall be interconnected.

Exception: Interconnection and hard-wiring of combination smoke/carbon monoxide alarms/detectors in existing areas shall not be required where the alterations or repairs do not result in the removal of interior wall or ceiling finishes exposing the structure.

908.7.4 Where required in existing affected occupancies. Where a new carbon monoxide source is introduced or work requiring a structural permit occurs in existing occupancies as identified in Section ~~908.4~~ **908.7**¹, carbon monoxide alarms shall be provided in accordance with **Sections 908.7 908.7.1 through 908.7.3**¹ of this code.

Exception: Work involving the exterior surfaces of affected occupancies, such as the replacement of roofing or siding, or the *addition* or replacement of windows or doors, or the *addition* of a porch or deck, are exempt from the requirements of this section.

¹ Errata issued May 16, 2011

ANSI

Standard
reference
number

American National Standards Institute
25 West 43rd Street, Fourth Floor
New York, NY 10036

Referenced
in code
section number

ANSI/UL 2034-08

ANSI/UL 2075-04

Standard for single and Multiple Station Carbon Monoxide Alarms, with revisions through February 20, 2009

First Edition - Standard for Gas and Vapor Detectors and Sensors, with revisions through September 28, 2007

908.7.2.3

..... 908.7.2.3

REFERENCED STANDARDS

Oregon Amendments ~ Effective April 1, 2011

REFERENCED STANDARDS

Oregon Amendments ~ Effective April 1, 2011



National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169-7471

Standard reference number		Referenced in code section number
720-09	Standard for the Installation of Carbon Monoxide (CO) Detection and Warning Equipment	908.7.2.3

**Oregon Structural Specialty Code
Special Amendments
Section 2308.9.3.2 Portal Frame**

Effective Date: May 13, 2011

Amendments to OSSC section 2308.9.3.2 have been adopted by the State of Oregon.

The 2010 OSSC Section 2308.9.3.2 requires an alternate braced wall panel adjacent to a door or window opening have tie-down devices rated at 4,200 pounds of uplift.

It was recently brought to the attention of the division that tie-down devices for this application are not capable of meeting the 4,200-pound rating. This rating is necessary to comply with seismic requirements in Oregon.

The division, after vetting this issue with industry representatives, prepared amendments to the 2010 OSSC for consideration by the Building Codes Structures Board. The Board approved the code changes at their regularly scheduled May 4, 2011 meeting.

These code changes have been prepared as insert pages for the 2010 OSSC. Pages are formatted so that when inserted, the amendments will face the page containing the existing code language.

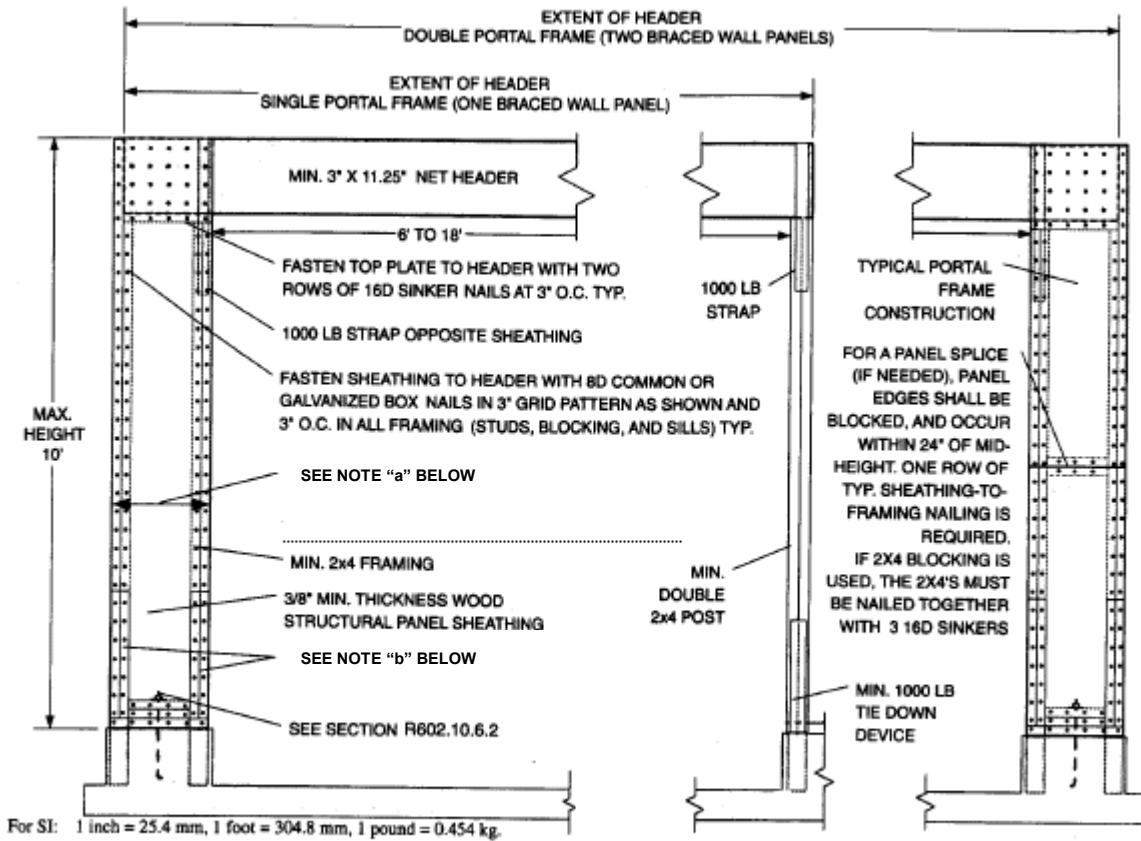
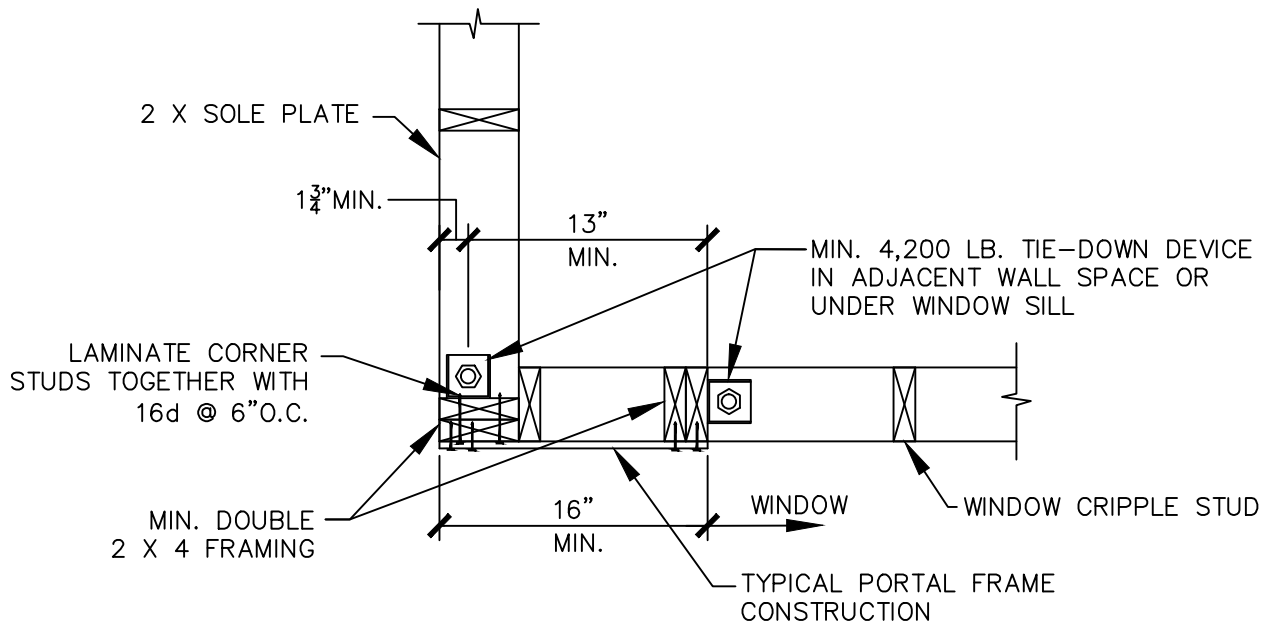
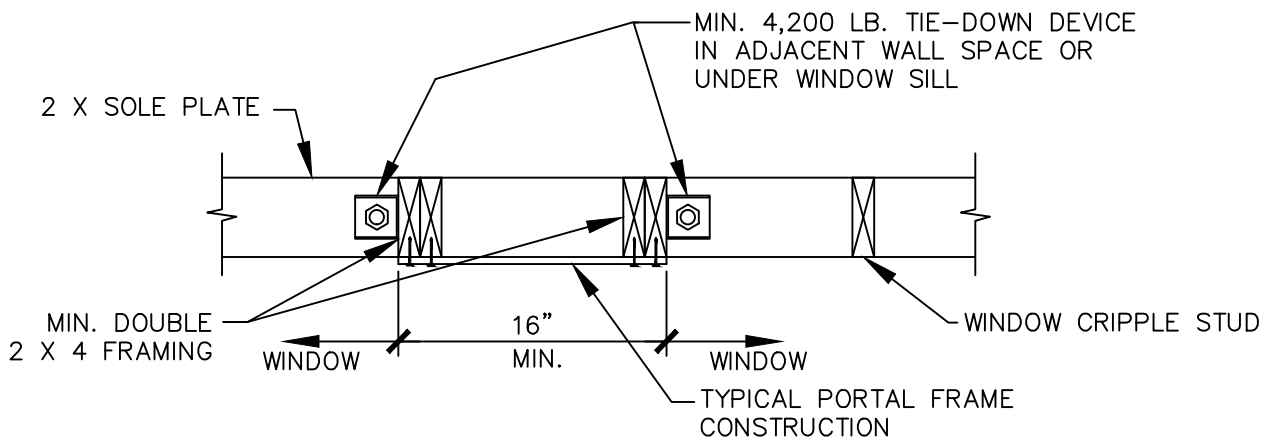


FIGURE R602.10.6.2
 ALTERNATE BRACED WALL PANEL ADJACENT TO A DOOR OR WINDOW OPENING

- a. Min. width – 20 inches for a one-story structure with 10 feet plate height, 18 inches for a one-story structure with 9 feet plate height and 16 inches for a one-story structure with 8 feet plate height. Min. width – 30 inches for use in the first story of a two-story structure with a 10 feet plate height, 26 inches for use in the first story of a two-story structure with a 9 feet plate height and 24 inches for use in the first story of a two-story structure with a 8 feet plate height.
- b. Min. 3500 lb tie-down device (embedded into concrete and nailed into framing).



ALTERNATE BRACE WALL PANEL AT CORNER CONDITION



ALTERNATE BRACE WALL PANEL AT INTERIOR CONDITION

**FIGURE 2308.9.3.2(1)
ALTERNATE BRACED WALL PANEL ADJACENT TO A WINDOW OPENING**



Code Changes/Errata

July 1, 2011

Oregon Structural Specialty Code Appendix N - "Low-Rise Residential Multifamily Dwelling Construction"

Oregon's Low Rise Residential Dwelling Code (Low-Rise Code) was created by passage of Senate Bill 906 in the 2003 Oregon Legislature and was codified in Oregon Revised Statute 545.610.

The Residential and Mechanical Structures Board (RMSB) has statutory authority for the promulgation of the Low-Rise Code including *Appendix N* as located in the *Oregon Structural Specialty Code* (OSSC). The RMSB recently adopted code changes to *Appendix N* as part of the 2011 Low-Rise Code adoption process. In addition, *Appendix N* has been updated to capture certain errata.

A history/overview of the *Low-Rise Code* is available at the following URL:
http://www.cbs.state.or.us/external/bcd/programs/residential/20081007_lowrise_history.pdf (No longer available)

The complete, revised *Appendix N* is attached and has been prepared as an insert for the *2010 OSSC*.

APPENDIX N
LOW-RISE RESIDENTIAL
MULTIFAMILY DWELLING CONSTRUCTION

(Adopted by the State of Oregon)

Code Changes/Errata

Issued by Oregon Building Codes Division

July 1, 2011

Underline text denotes addition

~~Strikethrough text~~ denotes deletion

AN101.1 Scope. The provisions of this appendix, and other applicable provisions of this code, shall apply to the construction, alteration, enlargement, replacement, repair, equipment, use and occupancy and location of low-rise residential multifamily dwellings and their accessory structures.

Low-rise multifamily dwellings and their accessory structures may also be designed and constructed in accordance with the provisions of the Oregon Structural Specialty Code.

The requirements of this appendix apply to:

1. Structures containing more than two dwelling units and classified as Group R-2, non transient apartment house occupancies as defined in this code, and in Section AN102.2, that comply with the following:

- 1.1. Structures that are three stories or less above grade;
- 1.2. Structures that have an exterior door for each dwelling unit;
- 1.3. Structures that contain at least three, but not more than 24 dwelling units;
- 1.4. Structures that are 36,000 SF or less in area;
- 1.5. Covered Multifamily dwellings as defined in ORS 447.210(5) in which there is no elevator; and
- 1.6. Structures or portions of structures that are used exclusively as dwellings and are not mixed occupancies as defined in Section 508 of this code.

Exceptions:

1. A low-rise residential multifamily dwelling may contain communal laundry rooms, storage rooms and similar incidental use areas.
2. Low-rise residential multifamily dwellings may have attached Group U private residential parking garages and attached carports. The area of a single garage and/or carport, or the cumulative area of multiple attached garages and/or carports is limited to 3,000 SF or less. Detached private residential parking garages with either a single or cumulative area of 3,000 SF or less and classified as a Group U

occupancy as defined in this code may be designed and constructed using this appendix.

2. The requirements of this appendix also apply to conventional light-frame structures designed and constructed using the prescriptive provisions of the *Oregon Residential Specialty Code*; or the *American Forest and Paper Association (AF&PA) Wood Frame Construction Manual for One- and Two-Family Dwellings* (WCFM); ~~or the design provisions of Appendix S of the Oregon Residential Specialty Code;~~ or the design provisions of the this code.

Exception: Structures of conventional light-frame wood construction may also contain structural design elements. ~~or may be designed entirely using Appendix S of the Oregon Residential Specialty Code.~~

AN101.2 Duties and powers of the building official. See the *Residential Code* Section 104.

AN101.2.1 Alternative materials, design and methods of construction and equipment. See the *Residential Code* Section R104.11.

AN101.3 Permits. Permits shall be applied for and issued according to the requirements of this section. See the *Residential Code* Section R105.2 for work exempt from permit.

AN101.4 Construction Documents. Construction documents shall comply with the requirements of Section R106 of the *Residential Code* and this appendix.

AN101.4.1 Plans for apartments, condominiums and attached private residential garages, carports or sheds shall indicate how required structural and fire resistive integrity will be maintained where penetrations into or through fire-resistive rated construction will be made for electrical, mechanical, plumbing, communication conduits, pipes and similar systems.

Plans for buildings designed and constructed using the provisions of this appendix shall contain a statement on the cover sheet clearly identifying that the

structure has been designed and constructed using the provision of this appendix. This statement shall be maintained as a permanent record in the files of the code enforcement agency.

AN101.4.2 State fire and life safety plan review. State fire and life safety plan review shall be conducted in accordance with Section ~~107.3.5~~ of this code.

AN101.4.3 Design professional in responsible charge.

AN101.4.3.1 General. Requirements for the design professional in responsible charge shall be as set forth in Section ~~106.3.4.1~~ 107.3.4 of this code and this section.

In addition to the requirements of Section ~~1709~~ 1710 of this code, where structural observation is required by Section AN101.6.1 the inspection program shall name the individual or firms who are to perform structural observation and describe the stages of construction at which structural observation is to occur (see also duties specified in Section 1704 of this code).

AN101.4.3.2 Deferred submittals. Deferred submittals shall meet the provisions of Section ~~106.3.4.2~~ 107.3.4.2 of this code.

AN101.5 Fees. Fees shall be calculated and assessed in accordance with Section R108 of the *Residential Code* or the jurisdiction's adopted fee schedule.

AN101.6 Inspections. Inspections shall be performed in accordance with Section R109 of the *Residential Code* and this section.

1. **Foundation inspections.** Inspection of the foundation shall be made after poles or piers are set or trenches or basement areas are excavated and any required forms erected and any required reinforcing steel is in place and prior to the placing of concrete.

The foundation inspection shall include excavations for thickened slabs intended for the support of bearing walls, partitions, structural supports, or equipment and special requirements for wood foundations.

2. **Floodplain inspections.** For construction in areas prone to flooding as established by the local jurisdiction having authority upon placement of the lowest floor, including basement, and prior to further vertical construction, the building official shall require submission of documentation, prepared and sealed by a registered design professional, of the elevation of the lowest floor, including basement, required in the *Residential Code*, Section ~~R323~~ R322.

3. **Frame and masonry inspection.** Inspection of framing and masonry construction shall be made after the roof, masonry, all framing, firestopping, draftstopping and bracing are in place and after the plumbing, mechanical and electrical rough inspections are approved.

4. **Fire-resistance-rated construction inspection.** Where fire-resistance-rated construction is required between dwelling units or due to location on property, the building official shall require an inspection of such construction after all lathing and/or wallboard is in place, but before any plaster is applied, or before wallboard joints and fasteners are taped and finished.

5. **Insulation and vapor barrier inspection.** Inspection shall be made after all insulation and required vapor barriers are in place but before any lath or gypsum board interior wall cover is applied.

Exceptions:

1. Ceiling and floor insulation visible during final inspection.

2. The building official may allow the frame insulation and vapor barrier inspections to be preformed simultaneously.

6. **Special inspections.** For special inspections, see Section AN101.6.1.

AN101.6.1 Special inspections and structural observations. When required by this section and Chapter 17 of this code special inspections and structural observations shall meet the requirements of Section AN101.4.3.1 and Chapter 17 of the this code.

Special inspections shall be required for:

1. Fabricated steel structural components.

2. Welding of fabricated steel components, structural steel and reinforcing steel.

3. Verification of structural steel details.

4. High-strength bolting.

5. Concrete with a structural design based on f'_{c} greater than 2,500 pounds per square inch.

6. Masonry construction in accordance with Section 1704.5.

7. Open construction prefabricated wooden structural elements and assemblies. See Section 1704.6.

8. Soils when required by Sections 1704.7 and ~~1802~~ 1803.

9. Exterior and interior architectural wall panels and the anchoring of masonry veneers in accordance with Sections ~~1704.5~~ ~~1707.7~~ and ~~1613.5.6~~ of this code.

10. Sprayed fire-resistant materials. See Section ~~1704.10~~ 1704.12.

AN101.7 Certificate of occupancy. See Section ~~110~~ 111.

SECTION AN102 DEFINITIONS

AN102.1 General. The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. The definitions provided in Section 202 shall also be applicable to this appendix.

AN102.2 Definitions.

ACCESSIBLE MEANS OF EGRESS. A continuous and unobstructed way of egress travel from any point in a building or facility that provides an accessible route to an area of refuge, a horizontal exit or a public way.

APARTMENT HOUSE. Any dwelling, or portion thereof, located on a single lot in which that contains three or more dwelling units and the units are rented, leased, let or hired out to be occupied on a nontransient basis and not defined as a townhouse.

CONDOMINIUM. A residential multifamily dwelling, or portion thereof, located on a single lot that contains dwelling units, which are owner-occupied or rented, leased, let or hired out to be occupied on a nontransient basis. A condominium association typically owns the multifamily dwelling but the dwelling units are individually owned. Property maintenance and liability requirements are mandated by use of a condominium agreement or similar legal instrument in accordance with ORS 100.

DOOR, EXTERIOR. A door located on an exterior perimeter wall or in an alcove opening onto a yard or court and is located directly at grade or is served by an exterior stair if located on a floor above grade.

FIRE PROTECTION RATING. The period of time that an opening protective assembly will maintain the ability to confine a fire as determined by tests prescribed in Section AN104.8. Ratings are stated in hours or minutes.

FLOOR FIRE-DOOR ASSEMBLY. A combination of a fire door, a frame, hardware and other accessories installed in a horizontal plane, which together provide a specific degree of fire protection to a through opening in a fire-resistance-rated floor. Floor fire-doors used to

protect openings in fire-resistance-rated floors shall be tested in the horizontal position in accordance with ASTM E 119, and shall achieve a fire-resistance rating of not less than the assembly being penetrated. Floor fire-doors shall be labeled by an approved agency.

MULTIFAMILY DWELLING. A building or structure that contains three or more dwelling units used, intended, or designed to be built, used, rented, leased, let or hired out to be occupied, or that are occupied for living purposes apartment houses, condominiums, congregate residences, townhouses and similar nontransient dwellings.

SPECIAL INSPECTION. Inspection as herein required of the materials, installation, fabrication, erection or placement of components and connections requiring special expertise to ensure compliance with approved construction documents and referenced standards (see Section AN101.6.1).

STRUCTURAL OBSERVATION. The visual observation of the structural system by a registered design professional for general conformance to the approved construction documents at significant construction stages and at completion of the structural system. Structural observation does not include or waive the responsibility for the inspection required by Section AN101.6.1 or other sections of this code.

SUBSTANTIAL ALTERATION. Any alteration where the total costs of all alterations (including, but not limited to electrical, mechanical, plumbing and structural changes) for a building or facility within any 12-month period amounts to 25 percent or more of the assessed value of the structure before the alteration occurred. For the purposes of this appendix, standard building maintenance, residing or reroofing are not considered as alterations.

SUBSTANTIAL DAMAGE. Any damage of any origin to a structure whereby the cost of restoring the structure to its original condition would be equal to or exceed 25 percent of the assessed value of the structure before the alteration occurred.

THROUGH-PENETRATION FIRESTOP SYSTEM. An assemblage of specific materials or products that are designed, tested and fire-resistance rated to resist for a prescribed period of time the spread of fire through penetrations. The F and T rating criteria for penetration fire stop systems shall be in accordance with ASTM E 814. See definitions of "F rating" and "T rating." When materials, systems or devices that have not been tested as part of a fire-resistance-rated assembly are incorporated into the assembly, sufficient data shall be made available to the building official to show that the required fire-

resistance rating is not reduced. Materials and methods of construction used to protect joints and penetrations in fire-resistance-rated building elements shall not reduce the required fire-resistance rating.

SECTION AN103 BUILDING PLANNING

AN103.1 Design criteria. Buildings and structures, and all parts thereof, regulated by this appendix shall meet the design requirements of the *Residential Code*, Section R301.

AN103.2 Building height, number of stories, allowable area and maximum number of dwelling units. The provisions of this section control the building height, number of stories, allowable area, and the maximum number of dwelling units for structures hereafter erected and additions to existing structures constructed under the provisions of this appendix. Additions and or alterations to existing buildings constructed prior to the adoption of this appendix shall be in compliance with the provisions of this code.

AN103.2.1 Building height and number of stories. Low-rise residential multifamily dwellings shall be limited to a maximum of 40 feet in height and three stories.

AN103.2.1.1 Height modifications. No height modifications shall be allowed. Structures greater than three stories above grade in height fall out of the scope of this appendix and must be designed and constructed in accordance with the primary provisions of this code.

AN103.2.2 Building Area and dwelling units. Low-rise residential multifamily dwellings shall be limited to a maximum of 24 dwelling units and 36,000 square feet (3344 m²) in cumulative area inclusive of attached carports and garages.

AN103.2.3 Automatic sprinkler systems. An automatic sprinkler system shall be provided in all low-rise multiple-family dwellings in accordance with Section AN109.

~~**AN103.2.3 Fire sprinkler systems.** Low-rise residential multifamily dwellings shall be limited to a maximum of three stories above grade, 36,000 square feet (3344 m²) in cumulative area inclusive of attached carports and garages and 24 dwelling units.~~

AN103.2.4 Mezzanines. A mezzanine or mezzanines in compliance with this section shall be considered a portion of the floor below. Such mezzanines shall not contribute to either the building area or number of stories as regulated by this section. The area of the

mezzanine shall be included in determining the fire area defined in Section AN102. The clear height above and below the mezzanine floor construction shall not be less than 7 feet (2134 mm).

AN103.2.4.1 Area limitation. The aggregate area of a mezzanine or mezzanines within a room shall not exceed one-third of the area of that room or space in which they are located. The enclosed portions of rooms shall not be included in a determination of the size of the room in which the mezzanine is located. In determining the allowable mezzanine area, the area of the mezzanine shall not be included in the area of the room.

AN103.2.5 Modifications to number of dwelling units and area. No area modifications shall be allowed under this appendix. Structures with more dwelling units or an area greater than allowed by Section AN103.2.2 shall be designed and constructed in accordance with the provisions of this code.

AN103.3 Building construction and fire-resistance rated separation requirements. Building construction and fire-resistance rated separation requirements for low-rise residential dwellings shall be separated by fire partitions and horizontal assemblies constructed in accordance with Section AN104.

AN103.3.3 Attached private residential parking garages and attached carports. Low-rise residential multifamily dwellings may contain private residential parking garages and have attached carports. The area of a single garage or carport or the cumulative area of multiple garages or carports on any or all levels is limited to a maximum of 3,000 square feet (279 m²) in area. Private residential parking garages or carports shall be separated as follows:

1. Private residential parking garages, dwelling units and incidental use areas shall be separated by fire barriers required by Table AN104.1 and constructed in accordance with Section AN104. Fire barrier membrane and through penetrations shall be in accordance with *Residential Code*, Section ~~R317.3~~ R302.4 and Section AN101.4.1.
2. Openings in fire barriers separating private residential parking garages, dwelling units and incidental use areas shall be protected as required in Section AN104.
3. Openings from a private residential parking garage directly into a room used for sleeping purposes shall not be permitted.
4. Parking garages used for multiple unit parking shall be provided with outdoor ventilation air at a

rate of 1.5 cfm/ft² (0.00762 m³/s _ m²). The ventilation systems shall be provided with manual or automatic controls that will operate such systems whenever the space is occupied. Such ventilation systems shall be installed in accordance with the *Mechanical Code*.

AN103.3.4 Incidental uses. A low-rise residential multifamily dwelling may contain non-separated communal laundry rooms, storage rooms and similar incidental use rooms.

AN103.3.4.1 Communal laundry room ventilation.

When multifamily dwelling units share a communal laundry room, which houses more than one washing machine or more than one dryer, natural ventilation shall be provided through windows, louvers or other openings to the outdoors equal to 4 percent of the floor area being ventilated. The operating mechanisms for such openings shall be provided with ready access so the openings are readily controllable by the building occupants.

Exception: A mechanical ventilation system, designed in accordance with the *Mechanical Code*, capable of providing a minimum of 15 cfm of outside air for every 50 square feet of floor space or fraction thereof may be installed in lieu of natural ventilation.

AN103.3.5 Shafts. The provisions of this section shall apply to vertical shafts where such shafts are required to protect openings and penetrations through floor/ceiling and roof/ceiling assemblies.

AN103.3.5.1 Shaft enclosure required. Openings through a floor/ceiling assembly shall be protected by a shaft enclosure complying with this section.

Exceptions:

1. A shaft enclosure is not required for openings totally within an individual residential dwelling unit.
2. A shaft enclosure is not required for penetrations by pipe, tube, conduit, wire, cable, and vents protected in accordance with Section AN104.
3. A shaft enclosure is not required for penetrations by ducts protected in accordance with Section AN104.
4. A shaft enclosure is not required for approved masonry chimneys, where annular space protection is provided at each floor level in accordance with Section AN104.

5. A shaft enclosure is not required for a floor opening that complies with the following:

- 5.1. Does not connect more than two stories.
- 5.2. Is not concealed within the building construction.
- 5.3. Is separated from floor openings serving other floors by construction conforming to required shaft enclosures.

6. A shaft enclosure is not required for joints protected by a fire-resistant joint system in accordance with Section AN104.

AN103.3.5.2 Shaft construction. The shaft enclosure shall be of materials permitted by the building type of construction.

AN103.3.5.3 Fire-resistance rating. The number of stories connected by the shaft enclosure shall include any basements but not any mezzanines. Shaft enclosures shall be constructed as fire barriers in accordance with Section AN104. Shaft enclosures shall have a fire-resistance rating not less than the floor assembly penetrated.

AN103.3.5.4 Continuity. Shaft enclosure walls shall extend from the top of the floor/ceiling assembly below to the underside of the floor or roof slab or deck above and shall be securely attached thereto. These walls shall be continuous through concealed spaces, such as the space above a suspended ceiling. The supporting construction shall be protected to afford the required fire-resistance rating of the element supported. Hollow vertical spaces within the shaft enclosure construction wall shall be fire stopped at every floor level.

AN103.3.5.5 Exterior walls. Where exterior walls serve as a part of a required shaft enclosure, such walls shall comply with the requirements of Section AN104 for exterior walls and the fire-resistance-rated enclosure requirements shall not apply.

AN103.3.5.6 Openings. Openings in a shaft enclosure shall be protected in accordance with Section AN104 as required for fire barriers. Such openings shall be self-closing or automatic-closing by smoke detection.

AN103.3.5.6.1 Prohibited openings. Openings other than those necessary for the purpose of the shaft shall not be permitted in shaft enclosures.

AN103.3.5.7 Penetrations. Penetrations in a shaft enclosure shall be protected in accordance with Section AN104 as required for fire barriers.

AN103.3.5.7.1 Prohibited penetrations.

Penetrations other than those necessary for the purpose of the shaft shall not be permitted in shaft enclosures.

AN103.3.5.8 Joints. Joints in a shaft enclosure shall comply with Section AN104.

AN103.3.5.9 Ducts and air transfer openings.

Penetrations of a shaft enclosure by ducts and air transfer openings shall comply with Section AN104.

AN103.3.5.10 Enclosure at the bottom. Shafts that do not extend to the bottom of the building or structure shall:

1. Be enclosed at the lowest level with construction of the same fire-resistance rating as the lowest floor through which the shaft passes, but not less than the rating required for the shaft enclosure;
2. Terminate in a room having a use related to the purpose of the shaft. The room shall be separated from the remainder of the building by construction having a fire-resistance rating and opening protectives at least equal to the protection required for the shaft enclosure; or
3. Be protected by approved fire dampers installed in accordance with their listing at the lowest floor level within the shaft enclosure.

Exceptions:

1. The fire-resistance-rated room separation is not required provided there are no openings in or penetrations of the shaft enclosure to the interior of the building except at the bottom. The bottom of the shaft shall be closed off around the penetrating items with materials permitted by Section AN104 for draftstopping, or the room shall be provided with an approved automatic fire suppression system.

2. The fire-resistance-rated room separation and the protection at the bottom of the shaft are not required provided there are no combustibles in the shaft and there are no openings or other penetrations through the shaft enclosure to the interior of the building.

AN103.3.5.11 Enclosure at the top. A shaft enclosure that does not extend to the underside of the roof deck of the building shall be enclosed at the top with construction of the same fire-resistance rating as the topmost floor penetrated by the shaft, but not less than the fire-resistance rating required for the shaft enclosure.

AN103.4 Location on lot. The provisions of this section control the location on lot of structures hereafter erected and additions to existing structures.

AN103.4.1 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.

AN103.4.2 Access. Buildings shall adjoin or have access to a yard, street, alley, or public way on not less than one side. The centerline of an adjoining public way shall be considered an adjacent property line.

AN103.4.3 Fire-resistive construction due to location on property. Exterior wall shall be fire-resistance rated and have opening protection as required by this section.

AN103.4.3.1 Fire resistance of walls. Exterior walls located less than 5 feet from a property line shall be constructed as firewalls in accordance with Section AN104. The fire-resistive rating of the walls shall be as required by Table AN104.1 when tested in accordance with ASTM E 119. Distances shall be measured at right angles from the property line. These provisions shall not apply to walls at right angles to the property line.

Exception: Exterior walls of detached accessory private residential parking garages and carports located 3 feet (914 mm) or more from a property line may be of non fire-rated construction.

AN103.4.3.2 Allowable openings. Openings in exterior walls are not permitted less than 5 feet (1524 mm) from a property line.

Exception: Exterior walls of detached accessory private residential parking garages and carports located 3 feet (914 mm) or more from a property line may have unprotected openings.

AN103.4.3.3 Projections. Cornices, eave overhangs, exterior balconies and similar architectural appendages extending beyond the floor area shall conform to the requirements of this section. Exterior egress balconies and exterior exit stairways shall also comply with Section AN110.11. Projections beyond the exterior wall shall not extend more than 12 inches (305 mm) into areas where openings are prohibited and be of not less than one-hour fire-resistive construction. Projections extending into areas where openings are prohibited shall have sufficient structural stability such that it will remain in place for the duration of time indicated.

AN103.4.3.4 Parapets. Parapets shall be provided on exterior walls of buildings.

Exceptions: A parapet need not be provided on an exterior wall where any of the following conditions exist:

1. The wall is not required to be fire-resistance rated construction.
2. The building has an area of not more than 1,000 square feet (93 m²) on any floor.

3. One-hour fire-resistance-rated exterior walls that terminate at the underside of the roof sheathing, deck or slab, provided:

3.1. Where the roof/ceiling framing elements are parallel to the walls, such framing and elements supporting such framing shall not be of less than 1-hour fire-resistance-rated construction for a width of 4 feet (1220 mm) measured from the interior side of the wall.

3.2. Where roof/ceiling framing elements are not parallel to the wall, the entire span of such framing and elements supporting such framing shall not be of less than 1-hour fire-resistance-rated construction.

3.3. Openings in the roof shall not be located within 5 feet (1524 mm) of the 1-hour fire-resistance-rated exterior wall.

3.4. The entire building shall be provided with not less than a Class B roof covering.

4. When a structure is provided with a Class C roof covering, the exterior wall shall be permitted to terminate at the roof sheathing or deck provided:

4.1. The roof sheathing or deck is constructed of approved noncombustible materials or of fire-retardant-treated wood, for a distance of 4 feet (1220 mm); or

4.2. The roof is protected with 0.625-inch (15.88 mm) Type X gypsum board directly beneath the underside of the roof sheathing or deck, supported by a minimum of nominal 2-inch (51 mm) ledgers attached to the sides of the roof framing members, for a minimum distance of 4 feet (1220 mm).

AN103.4.3.5 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 counter flashing 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).

AN103.4.3.6 Membrane and through penetrations. Fire barrier membrane and through penetrations shall be in accordance with *Residential Code*, Section ~~R317.3~~ R302.4, and AN101.4.1 and AN104.

AN103.4.4 Buildings on the same lot. For the purposes of determining the required exterior wall fire-rating, allowable opening and roof-covering requirements, buildings on the same lot shall be assumed to have an imaginary property line between them. Where a new building is to be erected on the same lot as an existing building, the location of the assumed imaginary property line with relation to the existing building shall be such that the exterior wall and opening protection of the existing building meet the criteria as set forth in Section AN103.4.

Two or more buildings on the same lot shall either be regulated as separate buildings or shall be considered as portions of one building if the buildings combined number of dwelling units and combined area do not exceed that allowed in Section AN103.2 for a single building.

AN103.5 Smoke alarms. Smoke alarms shall be installed in dwelling units of buildings regulated by this appendix in accordance with *Residential Code*, Section ~~R313~~ R314.

AN103.6 Carbon Monoxide alarms. Carbon Monoxide alarms shall be installed in dwelling units of buildings regulated by this appendix in accordance with *Residential Code*, Section R315.

SECTION AN104

FIRE-RESISTANCE-RATED CONSTRUCTION

AN104.1 General. Wall and floor ceiling assemblies required to be of fire-resistance rated construction shall be constructed in accordance with this section and Table AN104.1.

AN104.2 Vertical dwelling unit separation. Walls separating dwelling units in the same building shall be constructed as fire partitions and comply with this section. The fire-resistance rating of the walls shall be as required by Table AN104.1.

~~**Exceptions:** Dwelling unit separations may have fire resistance ratings of not less than ½ hour in~~

~~buildings equipped throughout with an NFPA 13 or 13R sprinkler system installed in accordance with this code.~~

TABLE AN104.1
 FIRE-RESISTIVE RATINGS^a

ASSEMBLY TYPE		SPRINKLED BUILDINGS
Firewalls ^b		NR ^c
Fire barriers ^b	Vertical	1/2-hour
	Horizontal	1/2-hour
Fire partitions		1/2-hour
Shafts		1-hour
Exterior walls		NR ^c
Exterior walls < 5 feet from a property line.		1-hour ^a

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

a. When tested in accordance with ASTM E 119.

b. For additional requirements, see Sections AN104.4.

c. Not required.

d. Exterior walls shall be protected on the interior side with a minimum of 5/8-inch Type "X" gypsum board installed as required for one hour fire-resistive construction.

AN104.2.1 Continuity. Fire partitions shall extend from the top of the floor assembly below to the underside of the floor/ceiling assembly above and from the top of the floor assembly below to the underside of the roof sheathing above for the uppermost story and shall be securely attached thereto.

AN104.2.2 Openings. Openings in a fire partition shall be protected in accordance with Section AN104.8.

AN104.2.3 Penetrations. Penetrations through fire partitions shall comply with *Residential Code* Section [R317.3 R302.4](#).

AN104.2.4 Ducts and air transfer openings. Penetrations by ducts and air transfer openings shall comply with Sections AN104.6.

AN104.3 Horizontal dwelling unit separation. Floor-ceiling assemblies separating individual dwelling units shall comply with this section.

AN104.3.1 Fire-resistance rating of floor/ceilings assemblies. Floor/ceiling assemblies separating dwelling units in the same building shall be constructed as fire barriers. The fire resistance rating of the assembly shall be as required by Table AN104.1.

~~**Exceptions:** Dwelling unit separations may have fire resistance ratings of not less than 1/2 hour in buildings equipped throughout with an NFPA 13 or 13R automatic sprinkler system installed in accordance with this code.~~

AN104.3.2 Access doors. Access doors shall be permitted in ceilings of fire-resistance-rated floor/ceiling and roof/ceiling assemblies provided such

doors are tested in accordance with ASTM E 119 as horizontal assemblies and labeled by an approved agency for such purpose.

AN104.3.3 Unusable space. In 1-hour fire-resistance-rated floor construction, the ceiling membrane is not required to be installed over unusable crawl spaces.

AN104.3.4 Continuity. Assemblies shall be continuous without openings, penetrations or joints except as permitted by this section and Section AN103.3.5. The supporting construction shall be protected to afford the required fire-resistance rating of the horizontal assembly supported.

AN104.3.5 Penetrations. Penetrations through fire-resistance-rated horizontal assemblies shall comply with *Residential Code*, Section [R317.3 R302.4](#).

AN104.3.6 Ducts and air transfer openings. Penetrations by ducts and air transfer openings shall comply with Sections AN104.6.

AN104.3.7 Other penetrations. Gas vents, factory-built chimneys and other penetrations that are prohibited from being provided with fire or smoke dampers, shall be provided with shafts in accordance with Section AN103.3.5.

AN104.4 Fire barriers for occupancy separation. Incidental uses, garages and carports shall be separated from dwelling units with fire barriers in accordance with Section AN103.3.3 and Section AN103.3.4. The fire-resistance rating of the assembly shall be as required by Table AN104.1.

AN104.4.1 Continuity of fire barrier walls. Fire barrier walls shall extend from the top of the floor/ceiling assembly below to the underside of the floor or deck above and from the top of the floor assembly below to the underside of the roof sheathing above for the uppermost story and shall be securely attached thereto. These walls shall be continuous through concealed spaces such as the space above a suspended ceiling. The supporting construction for fire barrier walls shall be protected to afford the required fire-resistance rating of the fire barrier supported except for 1-hour fire-resistance-rated incidental use area separations as required by Table AN103.2.1. Hollow vertical spaces within the fire barrier wall shall be fire stopped at every floor level.

Exception: Shaft enclosure shall be permitted to terminate at a top enclosure complying with Section AN103.3.5.11.

AN104.4.2 Openings. Openings in a fire barrier wall shall be protected in accordance with Section

AN104.8. Openings shall be limited to a maximum aggregate width of 25 percent of the length of the wall, and the maximum area of any single opening shall not exceed 120 square feet (11m²).

AN104.4.3 Horizontal fire barriers. Horizontal fire barriers separating incidental uses, garages and carports shall comply with Section AN104.3.

AN104.6 Duct and transfer openings in fire-resistance rated assemblies. The provisions of this section shall govern the protection of ducts and air transfer openings in fire-resistance- rated assemblies.

AN104.6.1 Ducts and air transfer openings without dampers. Ducts and air transfer openings that penetrate fire-resistance-rated assemblies and are not required by this section to have dampers shall comply with the requirements of *Residential Code*, Section ~~R317.3~~ R302.4 for membrane and through penetration fire-stops.

Where penetration of a fire-resistive assembly is beyond the scope of *Residential Code*, Section ~~R317.3~~ R302.4, the provisions of this section and Section 607 in the *Mechanical Code* shall govern the protection of duct penetrations and air transfer openings in fire-resistance-rated assemblies.

AN104.6.2 Installation. Fire dampers, smoke dampers, combination fire/smoke dampers and ceiling dampers located within air distribution and smoke control systems shall be installed in accordance with the requirements of this section, the manufacturer's installation instructions and listing.

AN104.6.3 Damper testing and ratings. Dampers shall be listed and bear the label of an approved testing agency indicating compliance with the standards in this section. Fire dampers shall comply with the requirements of UL555. Only fire dampers labeled for use in dynamic systems shall be installed in heating, ventilation and air-conditioning systems designed to operate with fans on during a fire. Smoke dampers shall comply with the requirements of UL 555S. Combination fire/smoke dampers shall comply with the requirements of both UL 555 and UL 555S. Ceiling radiation dampers shall comply with the requirements of UL 555C.

AN104.6.4 Fire protection rating. Fire dampers shall have the minimum fire protection rating of not less than 1½-hours.

AN104.6.4.1 Fire damper actuating device. The fire damper actuating device shall have an operating temperature which shall be approximately 50°F

(10°C) above the normal temperature within the duct system, but not less than 160°F (71°C).

AN104.6.5 Smoke damper ratings. Smoke damper leakage ratings shall not be less than Class II. Elevated temperature ratings shall not be less than 250°F (121°C).

AN104.6.5.1 Smoke damper actuation methods.

The smoke damper shall close upon actuation of a listed smoke detector or detectors installed in accordance with Section 907.10 of this code and one of the following methods, as applicable:

1. Where a damper is installed within a duct, a smoke detector shall be installed in the duct within 5 feet (1524 mm) of the damper with no air outlets or inlets between the detector and the damper. The detector shall be listed for the air velocity, temperature and humidity anticipated at the point where it is installed. Other than in mechanical smoke control systems, dampers shall be closed upon fan shutdown where local smoke detectors require a minimum velocity to operate.
2. Where a damper is installed above smoke barrier doors in a smoke barrier, a spot-type detector listed for releasing service shall be installed on either side of the smoke barrier door opening.
3. Where a damper is installed within an unducted opening in a wall, a spot-type detector listed for releasing service shall be installed within 5 feet (1524 mm) horizontally of the damper.
4. Where a total-coverage smoke detector system is provided within areas served by a heating, ventilation and air-conditioning (HVAC) system, dampers shall be permitted to be controlled by the smoke detection system.

AN104.6.6 Access and identification. Fire and smoke dampers shall be provided with an approved means of access, large enough to permit inspection and maintenance of the damper and its operating parts. The access shall not affect the integrity of fire-resistance-rated assemblies. The access openings shall not reduce the fire-resistance rating of the assembly. Access points shall be permanently identified on the exterior by a label having letters not less than 0.5 inch (12.7 mm) in height reading: SMOKE DAMPER or FIRE DAMPER. Access doors in ducts shall be tight fitting and suitable for the required duct construction.

AN104.6.7 Where required. Fire dampers, smoke dampers, combination fire/smoke dampers and ceiling radiation dampers shall be provided at the locations prescribed in this section. Where an assembly is

required to have both fire dampers and smoke dampers, combination fire/smoke dampers or a fire damper and a smoke damper shall be required.

AN104.6.7.1 Fire barriers. Duct and air transfer openings of fire barriers shall be protected with approved fire dampers installed in accordance with their listing.

Exception: Fire dampers are not required at penetrations of fire barriers where any of the following apply:

1. Penetrations are tested in accordance with ASTM E119 as part of the fire-resistance-rated assembly.
2. Such walls are penetrated by ducted HVAC systems, have a required fire-resistance rating of 1 hour or less, ~~are in buildings equipped throughout with an automatic sprinkler system in accordance with Section AN109.~~ For the purposes of this exception, a ducted HVAC system shall be a duct system for conveying supply, return or exhaust air as part of the structure's HVAC system. Such a duct system shall be constructed of sheet steel not less than 26 gage [0.0187 inch (0.4712 mm)] thickness and shall be continuous from the air-handling appliance or equipment to the air outlet and inlet terminals.

AN104.6.7.2 Penetrations of shaft enclosures. Shaft enclosures that are permitted to be penetrated by ducts and air transfer openings shall be protected with approved fire and smoke dampers installed in accordance with their listing.

Exceptions: Fire dampers are not required at penetrations of shafts where:

1. Steel exhaust subducts extended at least 22 inches (559 mm) vertically in exhaust shafts provided there is a continuous airflow upward to the outside;
2. Penetrations are tested in accordance with ASTM E 119 as part of the rated assembly; or
3. The penetrations are in parking garage exhaust or supply shafts that are separated from other building shafts by not less than 2-hour fire-resistance-rated construction.

AN104.6.7.3 Fire partitions. Duct penetrations in fire partitions shall be protected with approved fire dampers installed in accordance with their listing.

Exceptions: Fire dampers are not required where the duct system is constructed of approved

materials in accordance with the *Mechanical Code* and the duct penetrating the wall meets all of the following minimum requirements:

1. The duct shall not exceed 100 square inches (0.06 m²);
2. The duct shall be constructed of steel a minimum of 26 gage [0.0187 inch (0.4712 mm)] in thickness;
3. The duct shall not have openings that communicate the corridor with adjacent spaces or rooms;
4. The duct shall be installed above a ceiling;
5. The duct shall not terminate at a wall register in the fire-resistance-rated wall; and
6. A minimum 12-inch-long (0.30 m) by 0.060-inch-thick (1.52 mm) steel sleeve shall be centered in each duct opening. The sleeve shall be secured to both sides of the wall and all four sides of the sleeve with minimum 1½-inch by 1½-inch by 0.060-inch (0.038 m by 0.038m by 1.52 mm) steel retaining angles. The retaining angles shall be secured to the sleeve and the wall with No. 10 (M5) screws. The annular space between the steel sleeve and wall opening shall be filled with rock (mineral) wool batting on all sides.

AN104.6.7.4 Horizontal assemblies. Penetrations by ducts and air transfer openings of a floor, floor/ceiling assembly or the ceiling membrane of a roof/ceiling assembly shall be protected by a shaft enclosure that complies with Section AN103.3.5 or shall comply with this section.

AN104.6.7.4.1 Through penetrations. A duct and air transfer opening system constructed of approved materials in accordance with the *Mechanical Code* that penetrates a fire-resistance-rated floor/ceiling assembly that connects not more than two stories is permitted without shaft enclosure protection provided a fire damper is installed at the floor line.

Exception: A duct is permitted to penetrate three floors or less without a fire damper at each floor provided it meets all of the following requirements:

1. The duct shall be contained and located within the cavity of a wall and shall be constructed of steel not less than 26 gage [0.0187 inch (0.4712 mm)] in thickness;
2. The duct shall open into only one dwelling unit or sleeping unit and the duct system shall be

continuous from the unit to the exterior of the building;

3. The duct shall not exceed 4-inch (102 mm) nominal diameter and the total area of such

ducts shall not exceed 100 square inches (0.065 m²) in any 100 square feet (9.3 m²) of floor area;

4. The annular space around the duct is protected with materials that prevent the passage of flame and hot gases sufficient to ignite cotton waste where subjected to ASTM E119 time-temperature conditions under a minimum positive pressure differential of 0.01 inch (2.49 Pa) of water at the location of the penetration for the time period equivalent to the fire-resistance rating of the construction penetrated; and

5. Grille openings located in a ceiling of a fire-resistance-rated floor/ceiling or roof/ceiling assembly shall be protected with a ceiling radiation damper in accordance with Section AN105.9.12.

AN104.6.7.4.2 Membrane penetrations. Where duct systems constructed of approved materials in accordance with the *Mechanical Code* penetrate a ceiling of a fire-resistance-rated floor/ceiling or roof/ceiling assembly, shaft enclosure protection is not required provided an approved ceiling radiation damper is installed at the ceiling line. Where a duct is not attached to a diffuser that penetrates a ceiling of a fire-resistance-rated floor/ceiling or roof/ceiling assembly, shaft enclosure protection is not required provided an approved ceiling radiation damper is installed at the ceiling line. Ceiling radiation dampers shall be tested in accordance with UL 555C and constructed in accordance with the details listed in a fire-resistance-rated assembly or shall be labeled to function as a heat barrier for air-handling outlet/inlet penetrations in the ceiling of a fire-resistance-rated assembly. Ceiling radiation dampers shall not be required where ASTM E119 fire tests have shown that ceiling radiation dampers are not necessary in order to maintain the fire-resistance rating of the assembly. Ceiling radiation dampers shall not be required where exhaust duct penetrations are protected in accordance with *Residential Code*, Section [R317.3](#) [R302.4](#) and the exhaust ducts are located within the cavity of a wall, and do not pass through another dwelling unit or tenant space.

AN104.6.7.4.3 Non fire-resistance-rated assemblies. Duct systems constructed of approved materials in accordance with the *Mechanical Code* that

penetrate non fire-resistance-rated floor assemblies and that connect not more than two stories are permitted without shaft enclosure protection provided that the annular space between the assembly and the penetrating duct is filled with an approved noncombustible material to resist the free passage of flame and the products of combustion. Duct systems constructed of approved materials in accordance with the *Mechanical Code* that penetrate non fire-resistance-rated floor assemblies and that connect not more than three stories are permitted without shaft enclosure protection provided that the annular space between the assembly and the penetrating duct is filled with an approved noncombustible material to resist the free passage of flame and the products of combustion, and a fire damper is installed at each floor line.

Exception: Fire dampers are not required in ducts within individual residential dwelling units.

AN104.6.8 Flexible ducts and air connectors.

Flexible ducts and air connectors shall not pass through any fire-resistance-rated assembly. Flexible air connectors shall not pass through any wall, floor or ceiling.

AN104.7 Fireblocking and draftstopping. Fireblocking and draftstopping for concealed spaces other than attics, shall be installed in combustible concealed locations in accordance with *Residential Code*, Sections [R502.12](#), [R502.13](#), and [R302.11](#) and [R302.12](#). Materials used for fireblocking and draftstopping shall be as described in *Residential Code*, Sections [R502.12.1](#) and [R302.11](#) and [R302.12](#).

AN104.7.1 Double stud walls. Batts or blankets of mineral or glass fiber or other approved non-rigid materials shall be allowed as fireblocking in walls constructed using parallel rows of studs or staggered studs.

AN104.7.2 Architectural trim. Fireblocking shall be installed within concealed spaces of exterior wall finish and other exterior architectural elements where permitted to be of combustible construction or where erected with combustible frames, at maximum intervals of 20 feet (6096 mm). If non-continuous, such elements shall have closed ends with at least 4 inches (102 mm) of separation between sections.

Exceptions: Fireblocking shall not be required where installed on noncombustible framing and the face of the exterior wall finish exposed to the concealed space is covered by one of the following materials:

1. Aluminum having a minimum thickness of 0.019 inch (0.5 mm).
2. Corrosion-resistant steel having a base metal thickness not less than 0.016 inch (0.4 mm) at any point.
3. Other approved noncombustible materials.

AN104.8 Opening protectives. Opening protectives required by other sections of this code shall comply with the provisions of this section.

AN104.8.1 Fire-resistance-rated glazing. Labeled fire-resistance-rated glazing tested as part of a fire-resistance-rated wall assembly in accordance with ASTM E 119 shall not be required to comply with this section.

AN104.8.2 Fire door and shutter assemblies. Approved fire door and fire shutter assemblies shall be constructed of any material, or assembly of component materials that conforms to the test requirements of Section AN104.8.2.1 ~~or AN104.8.2.2~~ and shall have a fire protection rating of ¾-hour. Fire door assemblies and shutters shall be installed in accordance with the provisions of this section and NFPA 80.

Exceptions:

1. Labeled protective assemblies that conform to the requirements of this section or UL 10A, UL 14B and UL 14C for tin-clad fire door assemblies.
2. Floor fire doors shall comply with Section AN104.4.2.

AN104.8.2.1 Side-hinged or pivoted swinging doors. Side-hinged and pivoted swinging doors shall be tested in accordance with NFPA 252 or UL 10C.

AN104.8.3 Labeled protective assemblies. Fire door assemblies shall be labeled by an approved agency. The labels shall comply with NFPA 80, and shall be permanently affixed to the door or frame.

AN104.8.4 Fire doors. Fire doors and frames shall be labeled showing the name of the manufacturer, the name of the third-party inspection agency and the fire protection rating. Smoke and draft control doors complying with UL 1784 shall be labeled as such. Labels shall be approved and permanently affixed. The label shall be applied at the factory or location where fabrication and assembly are performed.

AN104.9 Door closing. Fire doors shall be self-closing or automatic-closing in accordance with this section.

AN104.9.1 Latch required. Unless otherwise specifically permitted, single fire doors and both leaves

of pairs of side-hinged swinging fire doors shall be provided with an active latch bolt that will secure the door when it is closed.

AN104.9.2 Automatic-closing fire door assemblies. Automatic-closing fire door assemblies shall be self-closing in accordance with NFPA 80.

AN104.9.3 Smoke-activated doors. Automatic-closing fire doors installed in fire partitions shall be automatic-closing by the actuation of smoke detectors installed in accordance with Section 907.10 of this code or by loss of power to the smoke detector or hold-open device. Fire doors that are automatic-closing by smoke detection shall not have more than a 10-second delay before the door starts to close after the smoke detector is actuated.

AN104.10 Glazing material. Fire-protection-rated glazing, when required by Section AN110.11.5 shall comply with the following:

AN104.10.1 Labeling. Fire-protection-rated glazing shall bear a label or other identification showing the name of the manufacturer, the test standard and the fire protection rating. Such label or other identification shall be issued by an approved agency and shall be permanently affixed.

AN104.10.2 Safety glazing. Fire-protection-rated glazing installed in fire doors or fire window assemblies in areas subject to human impact in hazardous locations shall comply with Section 2406.1 of this code.

AN104.10.3 Fire-protection rated glazing. Glazing in fire window assemblies shall be fire protection rated in accordance with Table AN104.10.3 and this section. Fire-protection-rated glazing installed as an opening protective in fire partitions and fire barriers shall be tested in accordance with and shall meet the acceptance criteria of NFPA 257 for a fire protection rating of 45 minutes. Fire-protection-rated glazing shall also comply with NFPA 80. Fire-protection-rated glazing required in accordance with Section AN110.11.5 for exterior wall opening protection shall be tested in accordance with and shall meet the acceptance criteria of NFPA 257 for a fire protection rating of 45 minutes.

TABLE 104.10.3
FIRE WINDOW ASSEMBLY FIRE PROTECTION RATING

TYPE OF ASSEMBLY	REQUIRED ASSEMBLY RATING (hours)	MINIMUM FIRE WINDOW ASSEMBLY RATING (hours) ^b
Interior walls:		
Fire walls	2	NP ^a
Fire barriers and fire partitions	1	3/4
Rated glazing required by Section AN110.11.5	0	3/4

a. Not permitted

b. Fire-protection-rated glazing in 0.5-hour fire-resistance-rated partitions is permitted to have an 1/3-hour fire protection rating.

AN104.10.4 Wired glass. Steel window frame assemblies of 1/8-inch (3.2 mm) minimum solid section or of not less than nominal 0.048-inch-thick (1.2 mm) formed sheet steel members fabricated by pressing, mitering, riveting, interlocking or welding and having provision for glazing with 1/4-inch (6.4 mm) wired glass where securely installed in the building construction and glazed with 1/4-inch (6.4 mm) labeled wired glass shall be deemed to meet the requirements for a 3/4-hour fire window assembly. Wired glass panels shall conform to the size limitations set forth in Table ~~715.5.3~~ 715.5.4 of this code.

AN104.10.5 Nonwired glass. Glazing other than wired glass in fire window assemblies shall be fire-protection-rated glazing installed in accordance with and complying with the size limitations set forth in NFPA 80.

AN104.10.6 Installation. Fire-protection-rated glazing shall be in the fixed position or be automatic-closing and shall be installed in approved frames.

AN104.10.7 Window mullions. Metal mullions that exceed a nominal height of 12 feet (3658 mm) shall be protected with materials to afford the same fire-resistance rating as required for the wall construction in which the protective is located.

AN104.10.8 Size limitations. The total area of windows shall not exceed 25 percent of the area of a common wall within any room.

AN104.10.9 Labeling requirements. Fire-protection rated glazing shall bear a label or other identification showing the name of the manufacturer, the test standard, and the fire protection rating. Such label or identification shall be issued by an approved agency and shall be permanently affixed.

SECTION AN105 INTERIOR FINISHES

AN105.1 Interior finishes. Interior finishes and materials shall comply with this section.

AN105.1.1 Wall and ceiling finishes. Wall and ceiling finishes in low-rise residential multifamily dwellings shall comply with *Residential Code*, Sections R702 and R805.

AN105.1.2 Flame spread and smoke density. Wall and ceiling finishes shall have flame spread and smoke density classifications in accordance with Class C finishes.

AN105.1.3 Plastics. Plastics used in buildings shall comply with *Residential Code*, Section ~~R314~~ R316.

AN105.1.4 Insulation. Insulation materials, including facings, such as vapor barriers or breather papers installed within floor/ceiling assemblies, roof/ceiling assemblies, wall assemblies, crawl spaces and attics, shall comply with ~~this~~ Section ~~R316~~ R302.10 of the *Residential Code*.

AN105.1.4.1 General. 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 AN105.1.4.3, shall only be required to meet the smoke-developed index of not more than 450.

AN105.1.4.2 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 AN105.1.4.3.

AN105.1.4.3 Cellulose loose-fill insulation.

Cellulose loose-fill insulation shall comply with CPSC16 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.

AN105.1.4.4 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.

AN105.1.4.5 Testing. Tests for critical radiant flux shall be made in accordance with ASTM E 970.

AN105.3 Gypsum board. Gypsum board and plaster shall comply with *Residential Code*, Sections R701 and R702.

AN105.4 General Glass and glazing. Glass and glazing shall comply with Chapter 24 of this code except as follows:

Site built windows. Site built windows shall ~~be permitted to~~ comply with ~~*Residential Code*, Section NF1112.6.~~ Section 2404 of this code.

Skylights and sloped glazing. Testing and labeling. Unit skylights shall be permitted to be in accordance with *Residential Code*, Section ~~NF1112.6.~~ R308.6.9.

**SECTION AN106
INTERIOR ENVIRONMENT**

AN106.1 Scope. The provisions of this chapter shall govern ventilation, temperature control, lighting, yards and courts, sound transmission, room dimensions, surrounding materials and rodent proofing associated with the interior spaces of buildings.

AN106.1.1 Ventilation. Buildings shall be provided with natural ventilation in accordance with *Residential Code*, Section R303.1 for habitable spaces. Section R408 for under-floor spaces and R806 for attic spaces. Alternatively, approved mechanical ventilation may be provided in accordance with the *Mechanical Code*.

AN106.1.2 Natural ventilation. Natural ventilation of an occupied space shall be through windows, doors, louvers or other openings to the outdoors in accordance with *Residential Code*, Section R303. The operating mechanism for such openings shall be provided with ready access so that the openings are readily controllable by the building occupants.

AN106.1.3 Openings below grade. Where openings below grade provide required natural ventilation, the outside horizontal clear space measured perpendicular to the opening shall be one and one-half times the

depth of the opening. The depth of the opening shall be measured from the average adjoining ground level to the bottom of the opening.

AN106.1.4 Openings on yards or courts. Where natural ventilation is to be provided by openings onto yards or courts, such yards or courts shall comply with Section AN106.6.

AN106.2 Required heating. Every dwelling unit shall be provided with heating facilities capable of maintaining a minimum room temperature of 68°F (20°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.

AN106.3 Sound transmission.

AN106.3.1 General. Wall and floor/ceiling assemblies separating dwelling units shall provided airborne sound insulation for walls, and both airborne and impact sound insulation for floor/ceiling assemblies.

AN106.3.2 Airborne sound. Airborne sound insulation for wall and floor/ceiling assemblies shall meet a Sound Transmission Class (STC) rating of 45 when tested in accordance with ASTM E 90.

AN106.3.3 Structural-borne sound. Floor/ceiling assemblies between dwelling units or between a dwelling unit and a public or service area within a structure shall have an Impact Insulation Class (IIC) rating of not less than 45 when tested in accordance with ASTM E 492.

AN106.4 Energy efficiency. Buildings designed and constructed under this appendix shall meet the energy efficiency related requirements of the *Residential Code*, Chapter 11.

AN106.5 Lighting. Every space intended for human occupancy shall be provided with natural light by means of exterior glazed openings in accordance with *Residential Code*, Section R303 or shall be provided with artificial light.

AN106.5.1 Exterior openings. Exterior openings required by the *Residential Code*, Section R303 for natural light shall open directly onto a public way, yard or court.

Exceptions:

1. Required exterior openings are permitted to open into a roofed porch where the porch:

1.1. Abuts a public way, yard or court.

1.2. Has a ceiling height of not less than 7 feet (2134 mm).

1.3. Has a longer side at least 65 percent open and unobstructed.

2. Skylights are not required to open directly onto a public way, yard or court.

AN106.5.2 Artificial light. Artificial light shall be provided that is adequate to provide an average illumination of 10 foot-candles (107 lux) over the area of the room at a height of 30 inches (762 mm) above the floor level.

AN106.5.3 Stairway illumination. Stairways within dwelling units and exterior stairways serving a dwelling unit shall have an illumination level on tread runs of not less than 1 foot-candle (11 lux).

AN106.5.4 Controls. The control for activation of the required stairway lighting shall be in accordance with the *Electrical Code*.

AN106.5.5 Emergency egress lighting. The means of egress shall be illuminated in accordance with Section AN110.8.

AN106.6 Yards and courts. This section shall apply to yards and courts adjacent to exterior openings that provide natural light or ventilation. Such yards and courts shall be on the same property as the building.

AN106.6.1 Yards. Yards shall not be less than 5 feet (914 mm) in width.

AN106.6.2 Courts. Courts shall not be less than 10 feet (914 mm) in width.

AN106.6.3 Air intake. Courts more than two stories in height shall be provided with a horizontal air intake at the bottom not less than 10 square feet (0.93 m²) in area and leading to the exterior of the building unless abutting a yard or public way.

AN106.6.4 Court drainage. The bottom of every court shall be properly graded and drained to a public sewer or other approved disposal system complying with the *Plumbing Code*.

AN106.7 Minimum room areas, ceiling heights and sanitation. Minimum room areas, ceiling heights and sanitation shall be in accordance with this section.

AN106.7.1 Minimum requirements.

AN106.7.1.1 Minimum room area.

AN106.7.1.1.1 Minimum area. Every dwelling unit shall have at least one habitable room that shall

have not less than 120 square feet (11.2 m²) of gross floor area.

AN106.7.1.1.2 Other rooms. Other habitable rooms shall have a floor area of not less than 70 square feet (6.5 m²).

Exception: Kitchens.

AN106.7.1.1.3 Minimum dimensions. Habitable rooms shall not be less than 7 feet (2134 mm) in any horizontal dimension.

Exception: Kitchens.

AN106.7.1.1.4 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.

AN106.7.1.2 Ceiling height.

AN106.7.1.2.1 Minimum height. Habitable rooms, hallways, corridors, bathrooms, toilet rooms, laundry rooms and basements shall have a ceiling height of not less than 7 feet 6 inches (2286mm). 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 without habitable spaces may project to within 6 feet, 8 inches (2032 mm) of the finished floor; and beams, girders, ducts or other obstructions may project to within 6 feet, 4 inches (1931 mm) of the finished floor.

3. 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. Not more than 75 percent of the floor area of a bathroom or toilet room is permitted to have a sloped ceiling less than 7 feet (2134 mm) in height, provided an area of 21 inches by 24 inches (534 mm by 610 mm) in front of toilets and lavatories has a minimum of 6 feet, 4 inches (1931 mm) in height, measured from the finished floor. An area of 24 inches by 30 inches (610 mm

by 762 mm) in front of and inside a tub or shower shall have a minimum of 6 feet, 4 inches (1931 mm) in height, measured from the standing surface of the fixture.

AN106.7.1.3 Sanitation.

AN106.7.1.3.1 Toilet facilities. Every dwelling unit shall be provided with a water closet, lavatory, and a bathtub or shower.

AN106.7.1.3.2 Kitchen. Each dwelling unit shall be provided with a kitchen area and every kitchen area shall be provided with a sink.

AN106.7.1.3.3 Sewage disposal. All plumbing fixtures shall be connected to a sanitary sewer or to an approved private sewage disposal system.

AN106.7.1.3.4 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.

AN106.7.2 Efficiency dwelling units. An efficiency living unit shall conform to the requirements of the code except as modified herein:

1. The unit shall have a living room of not less than 220 square feet (20.4 m²) of floor area. An additional 100 square feet (9.3 m²) of floor area shall be provided for each occupant of such unit in excess of two.
2. The unit shall be provided with a separate closet.
3. The unit shall be provided with a kitchen sink, cooking appliance and refrigeration facilities, each having a clear working space of not less than 30 inches (762 mm) in front. Light and ventilation conforming to this code shall be provided.
4. The unit shall be provided with a separate bathroom containing a water closet, lavatory and bathtub or shower.

AN106.7.3 Crawl spaces and attics. Crawl spaces and attic spaces shall be provided with a minimum of one access opening each as follows:

AN106.7.3.1 Access to under floor spaces. Access shall be provided to all under-floor spaces. Access openings through the floor shall be a minimum of 18 inches by 24 inches (457mm by 610 mm). Openings through a perimeter wall shall be 16 inches by 24 inches (407mm by 610 mm). When any portion of the through wall access is below grade, an areaway of not less than 16 inches by 24 inches (407mm by

610 mm) shall be provided. The bottom of the areaway shall be below the threshold of the access opening. Through wall access openings shall not be located under a door to the residence. See *Residential Code*, Section M1305.1.4 for access requirements where mechanical equipment is located under floors.

AN106.7.3.2 Attic access. In buildings with combustible ceiling or roof construction, an attic access opening shall be provided to attic areas that exceed 30 square feet (2.8 m²) and have a vertical height of 30 inches (762 mm) or greater. The rough-framed opening shall not be less than 22 inches by 30 inches (559 mm by 762 mm) and shall be located in a hallway or other readily accessible location. A 30-inch (762 mm) minimum unobstructed headroom in the attic space shall be provided at some point above the access opening. See *Residential Code*, Section M1305.1.3 for access requirements where mechanical equipment is located in attics.

AN106.7.4 Mechanical appliances. Access to mechanical appliances installed in under-floor areas, in attic spaces and on roofs or elevated structures shall be in accordance with the *Residential Code*, Chapter 13.

SECTION AN107 FLOORS, FLOOR/CEILINGS, ROOF/CEILINGS AND ROOF COVERINGS

AN107.1 General. Floors, floor/ceilings, roof/ceilings and roof coverings shall comply with this section.

AN107.1.1 Floors and floor/ceilings. Floors and floor/ceilings, when not required to be designed in accordance with accepted engineering practice, may be constructed in accordance with *Residential Code*, Chapter 5.

AN107.1.2 Roof/ceilings. Roof/ceilings, when not required to be designed, in accordance with accepted engineering practice, may be constructed in accordance with *Residential Code*, Chapter 8.

AN107.1.3 Roof coverings. Roof coverings shall be in accordance with *Residential Code*, Chapter 9.

Exceptions:

1. Buildings closer than 10 feet (3048 mm) to a property line shall have a minimum Class B roof.
2. Buildings with a separation of less than 10 feet between them shall have a minimum Class B roof installed on each building.

SECTION AN108 EXTERIOR WALLS

AN108.1 Exterior Coverings. Notwithstanding the requirements set forth in section AN104 of this document, exterior coverings shall be constructed and installed in accordance with the *Residential Code*, Chapter 7.

AN108.2 Exterior Windows and Doors. Exterior windows and doors shall comply with section R612 of the *Residential Code*.

SECTION AN109 FIRE PROTECTION SYSTEMS

AN109.1 General. Fire department access, fire-fighting water supply, and fire hydrants for structures regulated by this appendix shall be installed as specified in the *Fire Code*.

AN109.2 Fire sprinkler systems. An automatic sprinkler system shall be installed throughout all buildings designed and constructed to the provisions of this Appendix.

AN109.2.1 Installation requirements. Automatic sprinkler systems shall be installed in accordance with the standards listed in *Residential Code* Chapter ~~43~~ 44 and the following:

1. Quick-response and residential sprinklers.

Where automatic sprinkler systems are required,

quick-response or residential automatic sprinklers shall be installed in the dwelling units.

2. Water supplies. Potable water supplies shall be protected against backflow in accordance with the requirements of the *Plumbing Code* and the standards referenced in *Residential Code*, Chapter ~~43~~ 44.

3. Common domestic/fire mains. A single common water supply main shall be permitted to service both the domestic use and fire sprinklers. Domestic demand shall be included as part of the overall system demand for systems with common domestic/fire mains where no provisions are made to prevent the domestic water flow upon sprinkler system activation.

4. Hose threads. Fire hose threads used to provide connection with automatic sprinkler systems shall be approved and compatible with fire department hose threads.

5. Fire department connections. The location of the fire department connection shall be approved by the authority having jurisdiction.

6. Sprinkler system monitoring and alarms. All valves controlling the water supply for automatic sprinkler systems, pumps, tanks, water levels and

temperatures, critical air pressures and water-flow switches on all sprinkler systems serving 20 or more heads, shall be electrically supervised.

An approved audible sprinkler flow alarm shall be provided on the exterior of the building in an approved location. An approved audible sprinkler flow alarm to alert the occupants shall be provided in the interior of each dwelling unit in a normally occupied location. Actuation of the alarm shall be in accordance with NFPA 72.

7. Balconies, decks and patios. Sprinkler protection shall be provided for exterior balconies, decks and ground-floor patios serving dwelling units in buildings regulated by this appendix chapter. Sidewall sprinklers that are used to protect such areas shall be permitted to be located such that their deflectors are within 1 inch (25 mm) to 6 inches (152 mm) below the structural members, and a maximum distance of 14 inches (356 mm) below the deck of the exterior balconies that are constructed of open wood joist construction.

Exception: The sprinkler protection may be omitted if the balcony, deck or patio is constructed of noncombustible materials and there are no vents or other openings into enclosed soffits or attics located directly over the balcony, deck or patio.

8. Protection of a single means of egress. Sprinkler protection shall be provided for combustible exterior porches, exit balconies, and exit stairs that provide exclusive means of egress from dwelling units above grade.

AN109.3 Access roads and fire hydrants. See the *Fire Code* for distance requirements for access roads and fire hydrants.

AN109.4. Alteration or damage of existing non sprinkled low-rise residential dwellings. Where substantial alterations are made or substantial damage occurs to an existing non sprinkled building designed and constructed under the provisions of this appendix, an approved automatic sprinkler system complying with NFPA 13R shall be installed only in the altered or damaged dwelling units. When more than 50 percent of the dwelling units within a building are substantially altered or damaged, the entire building shall be provided with a NFPA 13R sprinkler system.

For the purposes of Section AN109.4, when an NFPA 13R sprinkler system is installed, a fire department connection shall not be required.

SECTION AN110 MEANS OF EGRESS

AN110.1 General. Every building, or portion thereof, shall be provided with a means of egress complying with this section and such other sections as applicable. A means of egress is an exit system that provides a continuous, unobstructed and undiminished path of exit travel from any occupied point in a building or structure to a public way. A means of egress system may include such elements as stairways, ramps, exterior exit balconies, hallways and doors.

Means of egress shall be maintained in accordance with the *Fire Code*.

AN110.2 Building accessibility. In addition to the requirements of this chapter, means of egress which provides access to, or egress from buildings for persons with disabilities, shall comply with the requirements of Chapter 11 of this code.

AN110.3 Occupant load. The basis for the design of the means of egress system is the occupant load served by the various components of such system. Occupant loads shall be determined in accordance with the provisions of this section and Table AN110.3. In determining the occupant load, all portions of a building shall be presumed to be occupied at the same time.

Exception: Incidental use areas that ordinarily are used only by the persons who occupy the main areas of an occupancy shall be provided with means of egress as though they are completely occupied, but their occupant load need not be included when computing the occupant load of the building.

The occupant load of yards, patios, courts and similar outdoor areas shall be assigned by the building official in accordance with the anticipated use of such areas. Such outdoor areas accessible and usable by the building occupants shall be provided with a means of egress as required by this chapter. Where an outdoor area exits only through a building, the occupant load of such outdoor area shall be considered in the design of the means of egress system of the building.

Exceptions:

1. Outdoor areas used exclusively for the service of the building need only have one means of egress.
2. Outdoor areas associated with and only accessible through an individual dwelling unit.

TABLE AN110.3
 MAXIMUM FLOOR AREA ALLOWANCES PER OCCUPANT

OCCUPANCY/USE	FLOOR AREA IN SQ. FT. PER OCCUPANT	MINIMUM OF TWO MEANS OF EGRESS WHEN THE OCCUPANT LOAD REACHES:
Common use areas such as roof decks, courtyards, exterior exit balconies, etc.	15 net	30
Residential dwelling units	200 gross	10

For SI: 1 square foot = 0.0929m².

AN110.4 Means of egress components. The requirements specified in this section shall apply to all three elements of the means of egress system.

AN110.4.1 Exit access. Exits shall be provided from each building level. Additionally, access to such exits shall be provided from all occupied areas within the building levels. The maximum number of exits required from any story, basement or individual space shall be maintained until arrival at grade or the public way.

AN110.4.1.1 From individual floors. For the purpose of this section, floors, stories, occupied roofs and similar designation of building levels other than basements shall be considered synonymous.

Every occupant on the first story shall have access to not less than one exit and not less than two exits when required by Table AN110.3. Every occupant in a basement and on stories other than the first story shall have access to not less than two exits.

Access to an exit shall not be permitted through either a private residential parking garage, carport, incidental use area or swimming pool area.

Exceptions:

1. Second stories having an occupant load less than 10 may be provided with access to only one exit.
2. Two or more dwelling units on the second story or in a basement may have access to only one exit where the total occupant load served by the exit does not exceed 10.
3. Except as provided in Table AN110.3 access to only one exit need be provided from the second floor or a basement within an individual dwelling unit.
4. Where the third floor within an individual dwelling unit does not exceed 500 square feet (46.45 m²), access to only one exit need be provided from that floor level.

5. Occupied roofs serving only one individual dwelling unit and having access only through such dwelling unit may have access to only one exit where such occupied areas are less than 500 square feet (46.45 m²) and are located no higher than immediately above the second story.

6. Floors and basements used exclusively for the service of the building and incidental uses allowed by Section AN103.3.4 ~~and Table AN103.2.1~~ may have access to only one exit.

AN110.4.1.2 From individual spaces. All occupied portions of the building shall have access to not less than one exit or exit access doorway. Access to not less than two exits or exit access doorways or combination thereof shall be provided when the individual or cumulative occupant load served by a portion of the exit access is equal to or greater than that listed in Table AN110.3.

Exception: Storage rooms, laundry rooms and other incidental use areas allowed by Section AN103.2.1 may be provided with access to only one exit doorway.

AN110.4.2 The exit. The exit is that portion of the means of egress system between the exit access and the exit discharge or the public way.

Doors of exit components that open directly to the exterior of a building shall not be located in areas where openings are required to be protected due to location on property. Exterior exit doors shall lead directly to the exit discharge or the public way.

AN110.4.2.1 Separation of exits. Where two or more exits are required from any level or portion of the building, at least two of the exits shall be placed a distance apart equal to not less than one third of the length of the maximum overall diagonal dimension of the area served measured in a straight line between the center of such exits. Additional exits or exit-access doorways shall be arranged a reasonable distance apart so that if one becomes blocked, the others will be available. Where more than one exit is required from the exterior exit balcony, the exit access shall be arranged such that there are no dead ends more than 20 feet (6096 mm) in length.

AN110.4.3 The exit discharge. The exit discharge is that portion of the means of egress system between the exit and the public way. Components that may be selectively included in the exit discharge include exterior exit balconies, exterior exit stairways, exterior exit ramps, exit courts and yards.

Exception: When approved by the building official, the exit discharge may lead to a safe dispersal area on the same property as the building being exited.

Grade level areas designated as an exit discharge component shall be permanently maintained. Such areas shall not be developed or otherwise altered in their capacity to provide for a continuous, unobstructed and undiminished means of egress for building occupants.

The exit discharge shall be at grade or shall provide direct access to grade. The exit discharge shall not reenter the building. Exterior exit balconies, exterior exit stairways and exterior exit ramps shall not be located in areas where openings are prohibited or required to be protected due to location on the property.

The travel distance in the exit discharge at grade shall not be limited.

Where the exit from a building discharges at other than grade level, there shall be not less than two separate paths of exit travel to grade level. Such paths of exit travel shall be arranged so there are no dead ends more than 20 feet (6096 mm) in length.

AN110.5 Egress Width. The minimum egress width shall not be less than 36 inches (914 mm).

Doors opening into the path of egress shall not reduce the required width to less than one-half during the course of the swing. When fully open the door shall not project more than 7 inches (178 mm) into the required width.

Exception: The restriction on a door swing shall not apply to doors within individual dwelling units.

AN110.6 Means of egress height. Except as may be specified elsewhere in this code and where sloped ceilings are allowed by other provision of this code, the means of egress system shall have a clear height of not less than 7 feet (2134 mm) measured vertically from the walking surface to the lowest projection from the ceiling or overhead structure. Protruding objects are permitted to extend below the minimum ceiling height required by this section provided a minimum headroom of 80 inches (2032 mm) shall be provided for any walking surface, including walks, and exit balconies. Not more than 50 percent of the ceiling area of a means of egress shall be reduced by protruding objects.

Exception: Door closers and stops shall not reduce headroom to less than 78 inches (1981 mm)

AN110.7 Means of egress continuity. The path of exit travel along a means of egress shall not be interrupted by any building element other than a means of egress

component. Obstructions shall not be placed in the required width of the means of egress except projections permitted by this chapter. The required capacity of a means of egress shall not be diminished along the path of exit travel.

All exterior elevation changes and interior elevation changes of 12 inches (305 mm) or more along the path of exit travel shall be made by steps conforming with the requirements of Section AN110.16.3 or by ramps complying with Section AN110.22.

AN110.8 Means of egress illumination. The means of egress system including the exit discharge, shall be illuminated at all times the building space served by the means of egress is occupied.

Exceptions:

1. Within individual dwelling units;
2. Within attached or detached private residential parking garages.

The means of egress illumination level shall be not less than 1 foot-candle (11 lux) at the floor level. The power supply for the means of egress illumination shall normally be provided by the premise's electrical supply. In the event of power failure, an emergency electrical system shall automatically illuminate the following areas:

1. Exterior exit balconies and exit stairways located in buildings required to have two or more exits.
2. Exterior egress components at other than the level of exit discharge until exit discharge is accomplished for buildings required to have two or more exits.
3. The portion of the exterior exit discharge immediately adjacent to exit discharge doorways in buildings required to have two or more exits.

The emergency power system shall provide for a duration of not less than 90 minutes and shall consist of storage batteries, unit equipment or an on-site generator. The installation of the emergency power system shall be in accordance with the *Electrical Code*.

AN110.9 Exit signs. Except as listed below, exits and exit access doors shall be marked by an approved exit sign readily visible from any direction of egress travel. Access to exits shall be marked by readily visible exit signs in cases where the exit or the path of egress is not immediately visible to the occupants. Exit sign placement shall be such that no point along the egress path is more than 100 feet (30 480 mm) or the listed viewing distance for the sign, whichever is less, from the nearest exit sign.

Exceptions: Exits signs shall not be required in the following locations:

1. Within individual dwelling units.
2. Within attached or detached private residential parking garages.
3. In rooms or areas which require only one exit or exit access.
4. At main exterior exit doors or gates which are obviously and clearly identifiable as exits when approved by the building official.

AN110.10 Emergency escape and rescue openings. Basements with habitable space and every sleeping room shall have at least one openable emergency escape and rescue window or exterior door opening complying with the requirements of *Residential Code*, Section R310.

AN110.11 Exterior exit balconies, exit stairways and exit ramps. Exterior exit balconies, stairways and ramps shall meet the requirement of this section.

AN110.11.1 Exterior exit balconies. An exterior exit balcony is a balcony, landing or porch projecting from the wall of a building and serves as an exit discharge component in a means of egress system.

AN110.11.2 Width. The width of exterior exit balconies shall be not less than 36 inches (914 mm).

AN110.11.3 Openness. The long side of an exterior exit balcony shall be at least 50 percent open, and the open area above the guardrail shall be distributed to prevent the accumulation of smoke or toxic gases.

AN110.11.4 Fire-resistive-rated construction. Walls of exterior exit balconies serving an occupant load of 10 or more shall be of 1-hour fire-resistive construction and ceilings shall be of not less than that required for 1-hour fire-resistive floor or roof system.

Exceptions:

1. Exterior sides of exterior exit balconies.
2. The exterior exit balcony roof may be of heavy-timber construction without concealed spaces.
3. Balconies and similar structures or appendages of Types III, IV and V construction shall be permitted to be of Type V nonrated construction where fire sprinkler protection is extended to protect the entire area under consideration.

AN110.11.5 Exterior exit stairways. An exterior exit stairway serves as an exit discharge component in a means of egress system and is open on at least one side as defined in Section AN102. Any stairway not

meeting the definition of an exterior stairway shall comply with the requirements for interior stairways. Exterior exit stairways shall comply with the applicable requirements for stairways as specified in Section AN110.16.

AN110.11.6 Exterior exit ramps. An exterior exit ramp serves as a exit discharge component in a means of egress system and is open on at least one side. Exterior exit ramps shall comply with the applicable requirements for ramps as specified in Section AN110.22.

AN110.11.7 Space under exit balconies, exit stairways and exit ramps. There shall be no enclosed usable space under exterior exit stairways and exit ramps. The open space under such stairways shall not be used for any purpose.

AN110.11.8 Proximity to openings. All openings in the exterior wall below and within 10 feet (3048 mm), measured horizontally, of an exterior exit stairway or exit ramp serving a building over two stories in height or a floor level having such openings in two or more floors below shall be protected by fixed or self-closing fire assemblies having a ¾-hour fire protection rating.

Exception: Openings may be unprotected when two separated exterior stairways or ramps are served by a common exterior exit balcony.

AN110.11.9 Attachment. Required exterior exit balconies, stairs and similar exit facilities shall be positively anchored to the primary structure to resist both vertical and lateral forces. Such attachment shall not be accomplished by use of toenails or nails subject to withdrawal.

AN110.12 Egress courts. An egress court is a court or yard that provides access to a public way for one or more required exits.

AN110.12.1 Width. The width of exit courts shall be as determined by the occupant load served but such width shall be not less than 44 inches (1118 mm).

Exception: An exit court serving only one individual dwelling unit or a private residential parking garage may be 36 inches (914 mm) in width.

The required width of exit courts shall be unobstructed to a height of 7 feet (2134 mm).

Exception: Doors when fully opened, and handrails shall not reduce the required width by more than 7 inches (178 mm). Doors in any position shall not reduce the required width by more than one half. Other non-structural

projections such as trim and similar decorative features may project into the required width 1½ inches (38 mm) from each side.

When an exit court exceeds the required width and the width of such exit court is then reduced along the path of exit travel, the reduction in width shall be gradual. The transition shall be affected by a guardrail not less than 36 inches (914 mm) in height and shall not create an angle of more than 30 degrees with respect to the axis of the exit court along the path of exit travel. In no case shall the width of the exit court be less than the required minimum width.

When an exit court serving a building or portion thereof having an occupant load of 10 or more is less than 10 feet (3048 mm) in width, the exit court walls shall be not less than 1-hour fire-resistive construction for a distance of 10 feet (3048 mm) above the floor of the court. All openings therein shall be protected by fixed or self-closing fire assemblies having a ¾-hour fire-protection rating.

AN110.13 Exit doors. 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 or carport. Where additional doors are installed for egress purposes, they shall conform to all the requirements of this section.

AN110.13.1 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. Where installed, exit doors shall be capable of opening such that the clear width of the exit is not less than 32 inches (813 mm) measured between the face of the door and the stop when the door is open 90 degrees (1.57 rad).

Exceptions:

1. The minimum and maximum width shall not apply to door openings that are not a part of the required means of egress from or within individual dwelling units.
2. Door openings within a dwelling unit shall be not less than 78 inches (1981 mm) in height.
3. Exterior door openings in dwelling units other than the required exit door, shall be not less than 76 inches (1930 mm) in height.
4. Interior egress doors within a dwelling unit which is not required to be adaptable or accessible.

5. Door openings required by Chapter 11 of the of this code to be accessible within dwelling units shall comply with Chapter 11.

AN110.13.2 Glazing. Glass doors and glazed panels in proximity of doors shall conform to the requirements of Chapter 24 of this code.

AN110.13.3 Type of lock or latch. All egress doors 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.

AN110.14 Gates. Gates used as a component in a means of egress system shall conform to the applicable requirements for doors.

AN110.15 Floor elevation. There shall be a floor or landing on each side of a door. Such floor or landing shall be at the same elevation on each side of the door. Landings shall be level except for exterior landings, which are permitted to have a slope not to exceed 0.25 unit vertical in 12 units horizontal (2-percent slope).

Exceptions:

1. Within individual dwelling units, a door is permitted to open at the top step of an interior flight of stairs, provided the door does not swing over the top step.
2. Screen doors and storm doors are permitted to swing over stairs or landings.

AN110.15.1 Landings at doors. Landings shall have a width not less than the width of the stairway or the door, whichever is the greatest. Doors in the fully open position shall not reduce a required dimension by more than 7 inches (178 mm). Landings shall have a length measured in the direction of travel of not less than 44 inches (1118 mm).

Exception: Landings within individual dwelling units need not exceed 36 inches (914 mm) in the direction of travel.

AN110.15.2 Thresholds. Except where otherwise required to be accessible, the floor or landing at a door serving an individual dwelling unit shall not be more than 1.5 inches (38 mm) lower than the top of the threshold.

Exception: Exterior doors that are not part of the required means of egress and are not on an accessible route may have the exterior landing not more than 7/4 inches (197 mm) below the threshold of the door.

AN110.16 Stairways. Every stairway having two or more risers shall comply with the requirements of this

section. The term “stairway” shall include stairs, landings, handrails and guardrails as applicable. The term “step” shall mean those portions of the means of egress achieving a change in elevation by means of a single riser. Individual steps shall comply with the detailed requirements of this section that specify applicability to steps.

Exception: Stairs or ladders used only to attend equipment or window wells are exempt from this section.

AN110.16.1 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 3½ inches (88.6 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 32.5 inches (823.3 mm) where a handrail is installed on one side and 29 (734.6 mm) where handrails are provided on both sides.

Exceptions:

1. The width of spiral stairways shall be in accordance with Section AN110.20.
2. Where a floor within an individual dwelling unit is served by more than one stairway, stairways other than the first stairway may have a clear width of not less than 30 inches (762 mm). Any handrail may encroach a maximum of 3½ inches (88.6 mm) into the clear width.
3. Stairways serving an occupant load of 50 or more shall have a width as determined by calculated occupant load but shall be not less than 44 inches (1118 mm) in width.

AN110.16.2 Headroom. The minimum headroom in all parts of the stairway shall not be less than 6 feet, 8 inches (2036 mm) measured vertically from a plane parallel and tangent to the stairway tread nosing to the soffit or other construction above at all points and shall be continuous for the full width of the stair to the point where the line intersects the landing below, one tread depth below the bottom riser.

AN110.16.3 Treads and risers. The maximum riser height shall be 7 inches (203 mm) and the minimum tread depth shall be 11 inches (229 mm). The riser height shall be measured vertically between leading edges of the adjacent treads. The tread depth shall be measured horizontally between the vertical planes of the foremost projection of the adjacent treads and at right angle to the tread’s leading edge. The walking surface of treads and landings of stairways shall be

sloped no steeper than one unit vertical in 48 units horizontal (2-percent slope). The greatest riser height within any flight of stairs shall not exceed the smallest by more than $\frac{3}{8}$ inch (9.5 mm). Stair treads shall be of uniform size and shape, except the largest tread run within any flight of stairs shall not exceed the smallest by more than $\frac{3}{8}$ inch (9.5 mm). Winder treads shall have a minimum tread depth of 11 inches (279 mm) measured at a right angle from the side where the treads are narrower and a minimum tread depth of 10 inches (254 mm). The greatest winder tread depth at the 12-inch (305 mm) walk-line within any flight of stairs shall not exceed the smallest by more than $\frac{3}{8}$ inch (9.5 mm).

Exceptions:

1. Circular stairs within individual dwelling units constructed in accordance with Section AN110.20.
2. Spiral stairs within individual dwelling units constructed in accordance with Section AN110.20.
3. Winders within individual dwelling units constructed in accordance with Section AN110.20.
4. Riser height for interior and exterior egress stairs serving only one dwelling unit, stairs within individual dwelling units, and stairs associated with either attached or detached private residential parking garages is allowed to be 8 inches (197 mm) maximum and the tread depth is allowed to be 9 inches (254 mm) minimum;
5. Where the bottom or top riser adjoins a sloping public way, sidewalk, garage floor or driveway having an established grade and serving as a landing, the bottom or top riser may be reduced to less than 4 inches (102 mm) in height with the variation in the height of the bottom or top riser not to exceed 1 unit vertical in 12 units horizontal (8.33-percent slope) of stairway width.

AN110.16.4 Profile. The radius of curvature at the leading edge of the tread shall be not greater than 0.5 inch (12.7 mm). Beveling of nosings shall not exceed 0.5 inch (12.7 mm). Risers shall be solid and vertical or sloped from the underside of the leading edge of the tread above at an angle not more than 30 degrees (0.52 rad) from the vertical. The leading edge (nosings) of treads shall project not more than 1.25 inches (32 mm) beyond the tread below and all projections of the leading edges shall be of uniform size, including the leading edge of the floor at the top of a flight.

Exceptions:

1. Solid risers are not required for stairways, provided that the opening between treads does not permit the passage of a sphere with a diameter of 4 inches (102 mm).
2. The opening between adjacent treads is not limited on stairs with a total rise of 30 inches (762 mm) or less.
3. Interior and exterior egress stairs serving only one dwelling unit, stairs within individual dwelling units, and stairs associated with either attached or detached Group U occupancies may have profiles as follows:
 - 3.1. The radius of curvature at the leading edge of the tread shall be no greater than $\frac{9}{16}$ inch (14.3 mm).
 - 3.2. 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 where the tread depth is less than 11 inches (279 mm) and the stairway is provided with solid risers.
 - 3.3. The greatest nosing projection shall not exceed the smallest nosing projection by more than $\frac{3}{8}$ inch (9.5 mm) between two stories, including the nosing at the level of floors and landings.
 - 3.4. Beveling of nosing shall not exceed $\frac{1}{2}$ inch (12.7 mm).
 - 3.5. 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.
 - 3.5.1. Open risers are permitted, provided that the opening between treads does not permit the passage of a 4-inch diameter (102 mm) sphere.
 - 3.5.2. The opening between adjacent treads is not limited on stairs with a total rise of 30 inches (762 mm) or less.

AN110.17 Landings for stairways. There shall be a floor or landing at the top and bottom of each stairway or stair run.

AN110.17.1 Width. Every landing shall have a dimension measured in the direction of exit travel not less than the width of the stairway. Such dimension need not exceed 44 inches (1118 mm) where the stair has a straight run. Landings shall be level except that exterior landings may have a slope not to exceed 0.25 unit vertical in 12 units horizontal (2-percent slope).

Exceptions:

1. In individual dwelling units and in either attached or detached private residential parking garages, such length need not exceed 36 inches (914 mm) where the stairs have a straight run.
2. At the top of an interior flight of stairs, provided a door does not swing over the stairs.
3. Stairways serving an unoccupied roof are exempt from these requirements.

AN110.17.2 Vertical rise. A flight of stairs shall not have a vertical rise greater than 12 feet (3658 mm) between floor levels or landings.

AN110.17.3 Walking surface. The walking surface of treads and landings of stairways shall be sloped no steeper than one unit vertical in 48 inches horizontal (2-percent slope) in any direction and shall have a solid surface. Finish floor materials shall be securely attached.

AN110.18 Handrails. Handrails shall be provided on both sides of each continuous run of treads or flights with two or more risers.

Exceptions:

1. Stairways having less than four risers that are within individual dwelling units or in private residential parking garages attached to individual dwelling units need not be provided with handrails.
2. Stairways serving only one dwelling unit may have a handrail on only one side.

AN110.18.1 Installation height. Handrails shall be installed at a height of 34 inches (864 mm) minimum and 38 inches (965 mm) maximum, measured vertically from the nosing of the treads. All required handrails shall be continuous the full length of the stairs and at least one handrail shall extend in the direction of the stair run not less than 12 inches (305 mm) beyond the top riser nor less than 12 inches (305 mm) beyond the bottom riser.

Exceptions:

1. Stairways within individual dwelling units and in residential garages accessory to individual dwelling units and stairways serving only one dwelling shall be installed at a height of 30 inches (762 mm) minimum and 38 inches (965 mm) maximum.
2. Handrails shall be permitted to be interrupted by a newel post at a turn.
3. Stairways within individual dwelling units and in residential garages accessory to individual dwelling

units and private stairways do not require handrails extensions.

AN110.18.2 Termination. Ends shall be returned or shall terminate in newel post 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 handrail.

Exception: The use of a volute, turnout or starting easing shall be allowed over the lowest tread at stairways within individual dwelling units.

AN110.18.3 Cross section. The handgrip portion of the handrails shall have a circular cross section of 1¼ inches (32 mm) minimum to a 2 inches (67 mm) maximum. Other handrail shapes that provide an equivalent grasping surface are permissible. The handgrip portion of handrails shall have a smooth surface with no sharp comers.

AN110.19 Stairway illumination. All stairs shall be provided with illumination in accordance with Section AN110.8 and this section.

AN110.19.1 Stairway illumination. All interior and exterior stairways shall be provided with a means to illuminate the stairs, including the landings and treads. Interior stairways shall be provided with an artificial light source located in the immediate vicinity of each landing of the stairway. Exterior stairways shall be provided with an artificial light source located in the immediate vicinity of the top landing of the stairway. Exterior stairways providing access to a basement from the outside grade level shall be provided with an artificial light source located in the immediate vicinity of the bottom landing of the stairway.

Exception: An artificial light source is not required at the top and bottom landing, provided an artificial light source is located directly over each stairway section.

AN110.19.1.1 Light activation. Where one or more lighting outlet(s) are installed for interior stairways, there shall be a wall switch at each floor level, and landing level that includes an entryway, to control the lighting outlet(s) where the stairway between floor level has six or more risers.

Exception: In hallways, stairways and at outdoor entrances, remote, central, or automatic control of lighting shall be permitted.

AN110.20 Special stairways. Circular stairways, spiral stairways, winders and bulkhead enclosure stairways shall comply with all requirements of Section AN110.16 except as specified in this section.

AN110.20.1 Spiral stairways. Spiral stairways are permitted as a means of egress within individual dwelling units and in other occupancies where the area served is limited to 250 square feet (23 m) in area and an occupant load of not more than five occupants. The tread shall provide a clear walking area measuring at least 26 inches (660 mm) from the outer edge of the supporting column to the inner edge of the handrail. The effective tread is delineated by the nosing radius line, the exterior arc (inner edge of railing) and the overlap radius line (nosing radius line of tread above). Effective tread dimensions are taken along a line perpendicular to the center line of the tread. A run of at least 7½ inches (191 mm) measured at a point 12 inches (305 mm) from where the tread is narrowest. The rise shall be sufficient to provide a headroom clearance of not less than 6 feet, 6 inches (1981 mm); however, such rise shall not exceed 9½ inches (241 mm).

AN110.20.2 Winders. Winders are permitted as a means of egress within individual dwelling units, provided that the width of the tread at a point not more than 12 inches (305 mm) from the side where the treads are narrower is not less than 10 inches (254 mm) and the minimum width of any tread is not less than 6 inches (152 mm). The continuous handrail required by Section AN110.16 shall be located on the side where the tread is narrower.

AN110.20.3 Circular stairways. Circular stairways conforming to the requirements of this section may be used as a means of egress component in any occupancy. The minimum width of run shall not be less than 11 inches (279 mm), or 10 inches (254 mm) within individual dwelling units, measured at a point 12 inches (305 mm) from the narrow end of the tread. The smaller stairway radius shall not be less than twice the width of the stairway. The minimum tread depth shall be not less than 10 inches (254 mm), or 9 inches (229 mm) within individual dwelling units.

AN110.21 Under stair protection. Enclosed accessible space under stairs within individual dwelling units shall have walls, under stair surface and any soffits protected on the enclosed side with 5/8-inch (12.7 mm) Type “X” gypsum board. Exterior exit stairs shall not have enclosed, accessible space under the stair.

AN110.22 Ramps. Ramps used as a component in a means of egress system shall conform to the requirements of this section and where applicable Chapter 11 of this code.

AN110.22.1 Width. The width of ramps shall not be less than 36 inches (912 mm) in width. Handrails may project into the required width a distance of 3½ inches

(89 mm) from each side of a ramp. Other projections such as trim and similar decorative features, may project into the required width 1½ inches (38 mm) from each side.

AN110.22.2 Slope.

AN110.22.2.1 Maximum slope. Ramps shall have a maximum slope of one unit vertical in eight units horizontal (12.5-percent slope).

AN110.22.2.2 Cross slope. The cross slope of ramps, measured perpendicular to the direction of travel, shall not be steeper than one unit vertical in 48 units horizontal (2-percent slope).

AN110.22.3 Landings. Ramps having slope steeper than one unit vertical in 20 units horizontal (5 percent slope) shall have landings at the top and bottom, and at least one intermediate landing shall be provided for each 5 feet (1524 mm) of vertical rise measured between the horizontal planes of adjacent landings. In addition, landings shall be provided where doors open onto ramps and in locations where ramps change direction. Landings shall be a minimum of 3 feet by 3 feet (914 mm by 914 mm) in size and shall have a dimension measured in the direction of ramp run of not less than 5 feet (1524 mm).

Doors in any position shall not reduce the minimum dimension of the landing to less than 42 inches (1067 mm) and shall not reduce the required width by more than 7 inches (178 mm) when fully open. Where ramp access is provided to comply with the requirements of Chapter 11 of this code and a door swings over a landing, the landing shall extend at least 24 inches (610 mm) beyond the latch edge of the door, measured parallel to the door in the closed position, and shall have a length measured in the direction of travel through the doorway of not less than 5 feet (1524 mm).

AN110.22.4 Handrails. Ramps having slopes steeper than one unit vertical in 20 units horizontal (5-percent slope) shall have rails as required for stairways.

Exception: For buildings that are not required to be accessible, handrails are required only on portions of exterior ramps that extend from the exit to the exterior grade.

AN110.22.5 Guards. Ramps and landings at ramps open on one or both sides shall have guards as required by AN110.23.

AN110.22.6 Surface. The surface of ramps shall be roughened or shall be of slip resistant materials and

where outdoors shall be designed so that water will not accumulate on walking surfaces.

AN110.23 Guards required. Unenclosed floor or roof openings, open and glazed sides of stairways, landings and ramps, balconies or porches more than 30 inches (762 mm) above grade or floor below, and roofs used for other than service of the building shall be protected by a guardrail.

AN110.23.1 Height. The top of guardrails shall be not less than 42 inches (1067 mm) in height.

Exceptions:

1. The top of guardrails within individual dwelling unit may be 36 inches (914 mm) in height.
2. The top of guardrails for stairways, exclusive of landings, may have a height as specified for handrails.

AN110.23.2 Intermediate rails. Open guardrails shall have intermediate rails or an ornamental closure that does not allow the passage of a sphere 4 inches (102 mm) in diameter.

Exceptions:

1. The triangular openings formed by the riser, tread and bottom rail of a guardrail at the open side of a stairway are permitted to be such that a sphere 6 inches (152 mm) cannot pass through.
2. Required guardrails on open sides of stairways within an individual dwelling unit shall have intermediate rails or ornamental closure which do not allow the passage of an object 5 inches (127 mm) or more in diameter. Opening limitations for required guardrails on open sides of stairways are applicable above the second riser of the stair.

**SECTION AN111
ACCESSIBILITY**

AN111.1 General. Buildings that meet the definition of a covered multifamily dwelling as defined in Chapter 2 of this code that do not require an elevator are required to be constructed in accordance with Chapter 11 of this code. Buildings ~~regulated by this appendix~~ that require an elevator in accordance with ORS 447.210(5) are beyond the scope of this appendix and shall be constructed in accordance with the building ~~primary~~ requirements of this code.

**SECTION AN112
FOUNDATIONS, CONCRETE AND SOILS**

AN112.2.1 Soil liquefaction. The potential for seismically induced liquefaction, soil instability and

other applicable factors shall be evaluated as provided in this code.

AN112.2 Concrete. The placement, forming, curing shall be in accordance with this code.

**SECTION AN113
CHIMNEYS AND FIREPLACES**

AN113.1 Chimneys and fireplaces. Chimneys and fireplaces shall be constructed and installed in accordance with *Residential Code*, Chapter 10.

**SECTION AN114
WOOD**

AN114.1 General. Wood shall conform to the referenced standards in the *Residential Code*, Chapter ~~43~~ 44 or Chapter 35 of this code. Buildings designed and constructed according to the conventional light frame requirements of this code shall be permitted.

**SECTION AN 115
RADON MITIGATION**

AN115.1 General. Low-rise residential structures shall be provided with radon control methods in accordance with Section 1812 of this code. The provisions of this section apply to new low-rise residential buildings constructed in Baker, Clackamas, Hood River, Multnomah, Polk, Washington and Yamhill Counties for which initial building permits are issued on or after April 1, 2011.

**SECTION AN201
MECHANICAL**

AN201.1 General. Mechanical installations shall be in accordance with this appendix and the *Residential Code*, Chapters 12 through 24.

AN201.2 Construction Documents. Construction documents for buildings more than two stories in height shall indicate where penetrations will be made for mechanical systems.

AN201.3 Private residential parking garage ventilation requirements. Parking garages used for multiple unit parking shall be provided with outdoor ventilation air at a rate of 1.5 cfm/ft². The ventilation systems shall be provided with manual or automatic controls that will operate such systems whenever the space is occupied.

AN201.4 Roof top mechanical installations. Where equipment and appliances requiring access are installed on roofs or elevated structures at a height exceeding 16 feet (4877 mm), or where appliances, equipment, fans or other components requiring service are located within 10

feet (3048 mm) of a roof edge, or where appliances are installed on a roof having a slope of three units vertical in 12 units horizontal (25-percent slope) or greater, they shall meet the requirements found in Sections ~~304.10~~ 304.11, 306.5 and ~~306.6~~ 306.5.1 of the *Mechanical Code*.

AN201.5 Duct penetrations. Where penetration of a fire-resistive assembly is beyond the scope of Section AN104.6, the provisions of Section 607 in the *Mechanical Code* shall govern the protection of duct penetrations and air transfer openings in fire-resistance-rated assemblies.

SECTION AN301 PLUMBING SYSTEMS

AN301.1 General. Plumbing systems and fixtures shall be provided in accordance with ~~provisions contained in the Oregon Residential Specialty Code, Chapters 25 through 32~~ the Plumbing Code.

SECTION AN401 ELECTRICAL

AN401.1 General. Electrical systems and fixtures shall be provided in accordance with ~~provisions contained in the Oregon Residential Specialty Code, Chapters 33 through 42~~ the Electrical Code.

SECTION AN501 SPECIAL CONSTRUCTION

AN501.1 General. The following items, when used, are to be constructed under the applicable portions of this code.

1. Pedestrian walkways and tunnels.
2. Awnings and canopies.
3. Marquees.
4. Signs.
- ~~5. Swimming pool enclosures and safety devices.~~

SECTION AN601 SPECIAL PROVISIONS

AN601.1 General. When applicable to structures designed and constructed using this appendix, see the applicable portions of this code:

1. Patio covers. See Appendix I.
2. Grading. See Appendix J (provisions adopted for optional use in municipalities).

3. Wildfire hazard mitigation. See Appendix L (provisions adopted for optional use in municipalities).

4. Reroofing. See Section 1511 of this code.

5. Waterproofing and dampproofing foundations. See Section ~~1807~~ 1805 of this code.

6. Protection of residential concrete exposed to freezing and thawing. See Section 1905.12 of this code.

SPECIAL DETAILED REQUIREMENTS BASED ON USE AND OCCUPANCY

2010 Oregon Mid Cycle Amendments

Effective February 1, 2012

R-3 Residential occupancies where the occupants are primarily permanent in nature and not classified as R-1, R-2, R-4 or I, including:

Buildings that do not contain more than two dwelling units.

Adult care facilities that provide accommodations for six or fewer persons of any age for less than 24 hours.

Child care facilities that provided accommodations for six or fewer persons of any age for less than 24 hours.

Congregate living facilities with 16 or fewer persons.

Adult foster homes as defined in ORS Chapter 443, or family child care homes (located in a private residence) as defined in Section 310.2.

Adult foster homes and family child care homes that are within a single-family dwelling are permitted to comply with the *Residential Code* in accordance with Section 101.2.

~~A Group R-3 residential occupancy, subject to licensure by the state, where personal care is administered for five or fewer persons, whose occupants may require assisted self-preservation shall be classified as a Group SR-3 occupancy and shall comply with the provisions of Appendix SR.~~

Lodging houses as defined in this section are permitted to comply with the *Residential Code* in accordance with Section 101.2.

**2010 Oregon Structural Specialty Code
Special Amendment
Section 1811 Radon Mitigation
*Slab on Grade***

Effective Date: April 1, 2013

New code section 1811 has been adopted by the State of Oregon.

The over-all purpose of the proposed amendments to the 2010 OSSC is to implement Senate Bill 1025 approved by the 2010 Legislature. The bill required the Building Codes Structures Board to adopt radon mitigation standards for certain types of new residential buildings and new public buildings. Radon mitigation standards adopted by these rules amend the 2010 OSSC. These requirements are applicable in Baker, Clackamas, Hood River, Multnomah, Polk, Washington and Yamhill Counties.

These proposed rules would become effective April 1, 2013 for new public buildings.

NOTE: Oregon Building Codes Division anticipates adoption of significant additional amendments to Section 1811 prior to implementation in April of 2013.

These changes have been prepared in the following pages as an insert for the 2010 Oregon Structural Specialty Code and are formatted for insertion in loose leave binders.

SECTION 1811
Radon Control Methods
Public Buildings

1811 Scope. The provisions of this section apply to new public buildings as defined in section 1811.1 which are built in Baker, Clackamas, Hood River, Multnomah, Polk, Washington and Yamhill Counties for which initial building permits are issued on or after April 1, 2013.

Exception: Public buildings of R-2 or R-3 occupancy classifications shall comply with section 1812.

Public buildings shall, at a minimum, incorporate a Passive Soil Depressurization (PSD) radon gas mitigation system complying with section 1811. PSD slab on grade construction shall comply with Section 1811.2. Active Soil Depressurization Systems (ASD) shall comply with section 1811.2 as modified by Section 1811.3. Public buildings using crawl space construction shall comply with Section 1812 except that radon vent pipes shall not be less than 6 inches in diameter.

Exceptions: Public buildings described below in items (1) through (5) are exempt from compliance with this standard. Elevated buildings that comply with all provisions of item (6) are exempt from compliance with other portions of this standard.

1. Temporary Structures
2. Free-standing greenhouses used exclusively for the cultivation of live plants
3. Open-air reviewing stands, grandstands and bleachers
4. Farm structures used only for storage or to shelter animals
5. Buildings of occupancy classification S, Storage, or H, Hazardous
6. Elevated buildings that satisfy all the following conditions:
 - a. The structure shall be separated from the ground by a vertical separation, measured between the final grade and the lower surface of the floor, of at least 18 inches,
 - b. All pilings, posts, piers or other supports shall be solid, or if hollow, shall be capped by a solid masonry unit or sealed at the surface of the soil with a construction complying with all applicable portions of section 1811.2.3.7,

- c. Enclosures of any kind, including but not limited to chases, storage rooms, elevator shafts and stairwells, that connect between the soil and the structure, shall comply with all applicable provisions of section 1811.2 and shall have a soil contact area of less than five percent (5%) of the projected building floor area,
- d. The perimeter of the structure, from the ground plane to the lower surface of the lowest floor shall be totally open for ventilation.

1811.1 Definitions: The following words and terms shall, for the purposes of this section have the meanings shown herein.

BUTT JOINT. A non-bonded plain, square joint a keyed joint or a doveled joint between two members, where primarily movement is at right angles to the plane of the joint. Sealant in a butt joint will generally be in tension or compression, but not shear.

CONTRACTION JOINT. A formed or sawed groove in a concrete structure, extending normal to the surface and to a depth of at least one-fourth the thickness of a concrete element, for the purpose of creating a weakened plane that induces a crack as internal stresses develop due to drying shrinkage.

CONSTRUCTION JOINT. The surface where two successive placements of concrete meet and are to be bonded; reinforcement is not interrupted and tie bars are used as required.

CURING. For concrete, the maintenance of a satisfactory moisture content and temperature during its early stages so that desired properties may develop. For sealants, the maintenance of a satisfactory moisture content and temperature while the physical properties of the sealant are changed by chemical reaction.

CURING COMPOUND. A liquid that can be applied as a coating to the surface of newly placed concrete to retard the loss of water, or in the case of pigmented compounds, also to reflect heat so as to provide an opportunity for the concrete to develop its properties in a favorable temperature and moisture environment.

DETERIORATION. The physical manifestation of failure of a material or assembly (e.g. cracking, delamination, flaking, pitting, scaling) caused by

environmental or internal autogenous influences during testing or service.

ELASTOMERIC SEALANT. A sealant whose macromolecular material returns rapidly to approximately its initial dimensions and shape after substantial deformation by a weak stress and release of the stress.

FIELD-MOLDED SEALANT. A liquid or semi-solid material molded into the desired shape in the joint into which it is installed.

HIGH-RANGE WATER REDUCER. A chemical admixture capable of reducing the water content of concrete at least 12%. This admixture shall conform to ASTM C494 Type F and/or Type 0.

HONEYCOMB. Voids left in concrete due to failure of the mortar to effectively fill the spaces among coarse aggregate particles.

ISOLATION JOINT. A non-bonded separation between adjoining parts of a structure, usually in a vertical plane, designed to allow relative movement in three directions in order to accommodate differential horizontal or vertical movement without the development of cracks elsewhere in the structure. May be either a butt joint or a lap joint, used to structurally separate the floor slab from other building elements.

LAITANCE. A layer of weak and nondurable material containing cement and fines from aggregates, brought by bleeding water to the outer surface of concrete.

LAP. The length by which one material overlays another at a lap joint.

LAP JOINT. A non-bonded joint in which the materials being joined override each other so that any movement of the materials is primarily parallel to the plane of the joint, putting sealants in shear rather than tension or compression. Formed slab joints that are not attached with a keyway are considered to be lap joints.

MEMBRANE-FORMING CURING COMPOUND. A liquid material that, when applied over the surface of freshly placed concrete, forms a solid, impervious layer which holds the mixing water in the concrete.

MANUFACTURED SANDS. Sands resulting from the crushing of rock, gravel or slag.

MASTIC. A sealant with putty-like properties.

MEMBRANE. A flexible, continuous sheet. See also: membrane-forming curing compound; soil-gas-retarder membrane; waterproofing membrane.

MID-RANGE WATER REDUCER. A chemical admixture capable of reducing the water content of concrete from 6 - 15%. This admixture shall conform to ASTM C494 Type A and/or Type F.

NATURAL SANDS. Sands resulting from the natural disintegration and abrasion of rock.

POLYETHYLENE. A thermo-plastic high-molecular-weight organic compound often used in sheet form as a water-vapor retarder.

POLYVINYL CHLORIDE. A synthetic resin used in the manufacture of pipes and nonmetallic waterstops.

PREFORMED SEALANT. A sealant functionally preshaped by the manufacturer so that only a minimum of field fabrication is required prior to installation.

PRESSURE SENSITIVE. Capable of adhering to a surface without the application of additional adhesives, when pressed against it.

PUBLIC BUILDING. Any building or structure constructed using public funds.

RADON GAS. A naturally-occurring, chemically inert, radioactive gas that is not detectable by human senses. As a gas, it can move readily through particles of soil and rock and can accumulate under the slabs and foundations of homes where it can easily enter into the living space through construction cracks and openings.

SEALANT. Any material used to seal joints or openings against passage of solids, liquids, or gases.

SOIL-GAS-RETARDER MEMBRANE. A durable, flexible and non-deteriorating material, installed in a continuous sheet to retard the pressure-driven flow of soil gas through elements of a structure.

1811.2 Slab on Grade. The design and installation of slab on grade PSD systems shall incorporate the five requirements as listed below. The design and construction requirements for each are detailed in the respective sections that follow.

1. **Subfloor Preparation:** Place a layer of gas-permeable material under all concrete slabs.
2. **Soil-Gas-Retarder Membrane:** The membrane shall be placed to minimize seams and to cover all

of the soil below the building floor. Seal major radon entry routes including slab and foundation joints and cracks and utility and pipe penetrations.

3. **Concrete Placement.** Follow specifications to limit the uncontrolled cracking of floor slabs including; mix design, placing practices, and curing practices.
4. **Subslab Barriers:** Eliminate barriers to subslab airflow such as sub-slab walls or provide subslab soil exhaust systems for each area.
5. **Subslab soil exhaust system ducts** (vent pipes): Run a 6-inch diameter or equivalent area subslab soil exhaust system duct from the radon suction pit to the outdoors.

1811.2.1 Subfloor Preparation. To ensure the proper extension of the pressure field under the entire building, a layer of gas-permeable material shall be placed under all concrete slabs. The gas-permeable layer shall consist of one of the following:

1. A layer of aggregate complying with section 1811.2.1
2. A uniform layer of sand (native or fill) a minimum of 4 inches thick, overlain by a layer or strips of geo-textile drainage matting designed to allow the lateral flow of soil gases.
3. Other materials, systems or floor designs with demonstrated capability to permit depressurization across the entire sub-floor area.

1811.2.1.1 Aggregate. A 4- to 6-inch layer of clean, coarse aggregate shall be placed beneath the slab. Where approved by the building official, pressure field extension may be accomplished through the use of mats or perforated pipe.

1811.2.1.1.1 Aggregate Specifications. Crushed aggregate shall meet Size #5 specifications as defined in ASTM C-33-90, "Standard Specification for Concrete Aggregates." Such aggregate is in the range of 1/2 to 1 in. diameter with less than 10 percent passing through a 1/2-inch sieve and has a free void space of approximately 50 percent.

1811.2.1.1.2 Aggregate Placement. Place a minimum of 4 to 6 inches of aggregate evenly under the entire slab, taking care not to introduce any fine material. If the aggregate is placed on top of a material with excessive fines and compaction of the aggregate is required for structural or other code

considerations, a geo textile fabric or an additional reinforced vapor retarder may be placed beneath the aggregate.

1811.2.2 Soil-Gas-Retarder Membrane. A soil-gas-retarder membrane shall be placed over the aggregate or other permeable material prior to placement of the slab in accordance with section 1811.2.2.

1811.2.2.1 Materials. Acceptable soil-gas-retarder membranes shall consist of a single layer of polyethylene, not less than 0.006-inch (6 mils) thick with a maximum perm rating of 0.3. Polyvinyl chloride (PVC), ethylene propylene diene monomer (EPDM), neoprene or other non-deteriorating, non-porous material may be used instead of polyethylene, provided the installed thickness of the alternate material has greater or equal tensile strength, resistance to water-vapor transmission, resistance to puncture, and resistance to deterioration determined in accordance with ASTM E 154 . The membrane shall be placed to minimize seams and to cover all of the soil below the building floor.

1811.2.2.2 Tape. Tape used to install the soil-gas retarder shall have a minimum width of 2 inches and shall be pressure sensitive vinyl or other non-deteriorating pressure sensitive tape compatible with the surfaces being joined. Paper tape and/or cloth tape shall not be used for these purposes.

1811.2.2.3 Mastic. Mastic used to install the soil-gas retarder shall be compatible with the surfaces being joined, and shall be installed in accordance with the manufacturer's recommendations for the materials, surface conditions and temperatures involved. Mastic may be used to join sections of membrane to one another or to elements of the building foundation, or to seal penetrations in the membrane.

1811.2.2.4 Installation. The soil-gas retarder shall be placed under the entire soil-contact area of the floor in a manner that minimizes the required number of joints and seams. Care shall be taken to prevent damage to the membrane during the construction process. In buildings incorporating the sub-slab portions of an active soil-depressurization system, the soil-gas retarder serves an important second purpose: to prevent mastic, cement or other materials from blocking the pressure distribution manifolds or pits.

1811.2.2.5 Seams. Seams between portions of the soil-gas retarder shall maintain a minimum of 12 inches of lap when concrete is placed. This may be

accomplished by securing the lapped edges of the membrane with tape or mastic or using larger unsecured overlaps prior to placing concrete.

1811.2.2.6 Slab Edges and Joints. The soil-gas retarder shall fully cover the soil beneath the building floor. Where the slab edge is cast against a foundation wall or grade beam, the soil-gas retarder shall contact the foundation element, and shall not extend vertically into the slab more than one half the slab thickness.

1811.2.2.7 Penetrations. At all points where pipes, conduits, reinforcing bars or other objects pass through the soil-gas-retarder membrane, the membrane shall be fitted to within ½ inch of the penetration and sealed with tape or mastic to the penetration. When penetrations occur within 24 inches of a soil-depressurization-system mat or pit, the gap between the penetrating object and the soil-gas-retarder shall be taped closed. When necessary to meet this requirement a second layer of the membrane, cut so as to provide a minimum 12-inch lap on all sides, shall be placed over the object and shall be sealed to the soil-gas retarder with a continuous band of tape.

1811.2.2.8 Punctures, Cuts and Tears. All damaged portions of the soil-gas-retarder membrane within 24 inches of any portion of a soil-depressurization-system mat or pit shall be sealed with tape or with a patch made from the same or compatible material, cut so as to provide a minimum 12-inch lap from any opening, and taped continuously about its perimeter.

1811.2.2.9 Mastics. Mastic may be used to join sections of soil-gas retarder to one another or to elements of the building foundation, or to seal penetrations in the soil-gas retarder, provided that mastic is kept at least 24 inches from any portion of a soil-depressurization-system mat or pit. Only tape may be used to seal the soil-gas-retarder membrane within 24 inches of a soil-depressurization-system mat or pit.

1811.2.2.10 Repairs. Where portions of an existing slab have been removed and are about to be replaced, a soil-gas-retarder membrane shall be carefully fitted to the opening, and all openings between the membrane and the soil closed with tape or mastic. Special care must be exercised to assure that mastic does not enter any portion of a soil-depressurization system located beneath the slab.

1811.2.3 Concrete Slabs - General. Concrete slabs shall be constructed in accordance with section 1811.2.3.

1811.2.3.1 Compressive Strength. Design strength for all concrete mixes used in the construction of slab-on-grade floors shall be a minimum of 3,000 psi at 28 days and shall be designed, delivered and placed in accordance with ASTM C 94.

1811.2.3.2 Shrinkage Control. In order to limit the uncontrolled cracking of floor slabs, the concrete mix design, placing practices, and curing practices prescribed in this section shall be followed. All concrete slabs-on-grade or slabs spanning above exposed soil shall be designed, placed, finished, and cured in accordance with local governing codes and applicable portions of ACI 318, "Building Code Requirements for Reinforced Concrete"; ACI 302, "Guide for Concrete Floor and Slab Construction"; and if fiber-reinforced concrete is used, the recommendations of the ACI Committee 544, "State of the Art Report on Fiber Reinforced Concrete".

1811.2.3.3 Mix Design. Mix design for all concrete used in the construction of slab on grade floors shall specify a maximum design slump not to exceed four (4) inches. On-site slumps shall not exceed five (5) inches, provided that the total water added to the mix, including plant, transit, and site added water does not exceed the total following parameters:

1. For mixes using only natural sands, water content shall not exceed 275 pounds per cubic yard of concrete.
2. For mixes using manufactured sands, water content shall not exceed 292 pounds per cubic yard of concrete.

1811.2.3.4 Slump and Workability. For concretes that do not contain mid-range or high-range water-reducers, concrete slump measured at the point of placement in accordance with ASTM C 172, shall not exceed 5-inches. For concretes designed and mixed containing mid-range or high-range water-reducers conforming with ASTM C 494, slump measured at the point of placement in accordance with ASTM C 172, shall not exceed 7-inches for mid-range and 8-inches for high-range water reducers.

1811.2.3.5 Hot Weather Placing and Finishing. All concrete shall be placed and finished in accordance with the provisions of ACI 301, Specifications for Structural Concrete for Buildings. When necessary,

provision for wind breaks, shading, fog spraying, sprinkling, ponding or wet covering with a light colored material shall be made in advance of placement, and such protective measures shall be taken as quickly as concrete hardening and finishing operations will allow.

1811.2.3.6 Curing. Concrete floors shall be cured by one of the means described below and shall not be subjected to loading until the architect or engineer has determined the slab to be structurally adequate for the loads imposed.

1. Concrete floor slabs shall be cured by covering the entire slab surface for a period of 7 days with clean, ponded water.
2. Concrete floor slabs shall be cured by covering the entire slab surface for a period of 7 days with a continuous mist or spray of clean, potable water.
3. Concrete floor slabs shall be cured by covering the entire slab surface for a period of 7 days with an impermeable sheet material conforming to ASTM C 171.
4. Concrete floor slabs shall be cured by covering the entire slab surface with a liquid membrane-forming compound that conforms with ASTM C 309. Curing compounds shall be compatible with materials specified in Section 303.3.1.

1811.2.3.7 Sealing of Construction Joints, Penetrations, Cracks, and Other Connections

1811.2.3.7.1 Sealants. Sealants shall be selected and installed in compliance with ASTM C 920 "Standard Specification for Elastomeric Joint Sealants" and ASTM C 1193 "Standard Guide for Use of Joint Sealants."

1. Sealant materials shall be compatible with the materials they join, including curing compounds and admixtures, and with materials that will be applied over them, including floor finishing materials.
2. Field-molded sealants shall be installed in sealant reservoirs proportioned, cleaned of laitance and prepared in accordance with the manufacturer's recommendations. For elastomeric sealants, this generally requires the installation of a bond breaker or backer rod.

3. When the installed sealant is not protected by a finished floor or other protective surface, it shall be suitable to withstand the traffic to which it will be exposed.
4. Waterstops shall be preformed from Polyvinyl chloride or other non-corrosive material and shall be selected and installed in compliance with ACI 504R.

1811.2.3.7.2 Joints. All joints between sections of concrete floor slabs, between the floor slab and a wall or other vertical surface, or between a section of floor and another object that passes through the slab, shall be sealed to prevent soil-gas entry in accordance with the provisions of this section. Joint design depends upon the amount and type of movement that the joint must withstand. No portion of any joint shall be covered or rendered inaccessible unless the seal has first been inspected and approved by the building official. All such joints shall be sealed prior to the issuance of a certificate of occupancy.

1. Butt joints. All non-bonded butt joints shall be sealed to prevent radon entry using an elastomeric sealant or a waterstop as specified above. The sealant reservoir shall be sufficiently large to prevent failure of the sealant or waterstop, but in no case shall the sealant reservoir be less than ¼-inch by ¼-inch in cross-section.
2. Lap joints. All non-bonded lap joints shall be sealed with either a field-molded or preformed elastomeric sealant or with a flexible waterstop as specified above. The lap joint shall be sufficiently large to prevent failure of the sealant or waterstop, but in no case shall the sealant reservoir be less than ½-inch by ½-inch in cross-section.
3. Isolation joints. All non-bonded isolation joints shall be sealed with either a field-molded or preformed elastomeric sealant or with a flexible waterstop as specified above. Isolation joints shall be sufficiently large to prevent failure of the sealant or waterstop, but in no case shall the sealant reservoir be less than ½-inch by ½-inch in cross-section. Control or contraction joints. Control or contraction joints may be used to limit unplanned cracking of floor slabs. In locations where continued movement of the slab portions can be reasonably expected, flexible sealants must be installed in reservoirs

4. complying with the requirements of above section on Butt Joints, or a flexible waterstop must be used.
5. Construction joints. All bonded construction joints shall be sealed to prevent radon entry using either a rigid or an elastomeric sealant or a waterstop as specified above. Where movement of the joint is not prevented by continuous reinforcing and tie bars, flexible sealants must be installed in reservoirs complying with the requirements of above section on Lap Joints, or a flexible waterstop must be used.

1811.2.3.7.3 Cracks. All cracks in concrete slabs supported on soil or spanning over exposed soil, that are used as floors for conditioned space or enclosed spaces adjacent to or connected to conditioned spaces, shall be sealed against radon entry in accordance with the provisions of this section and Section 1811.2.3.7.1. Ideally, sealing should occur as late in the construction process as possible.

1. Cracks greater than ¼-inch wide; all cracks that exhibit vertical displacement; all cracks that connect weakened zones in the slab such as vertical penetrations or re-entrant corners; and, all cracks that cross changes in materials or planes in the structure, shall be sealed with a flexible field-molded elastomeric sealant installed in accordance with above section on Isolation Joints.
2. Cracks greater than 1/16 inch in width, that do not meet any of the conditions described in Item (1) above, shall be enlarged to contain a sealant reservoir not less than ¼-inch x ¼-inch in cross-section along the entire length of the crack; and shall be sealed with a flexible, field-molded elastomeric sealant installed in accordance with above section on Butt Joints.
3. Cracks less than 1/16 inch in width, that do not meet any of the conditions described in item 1 above, may be left unsealed.

1811.2.3.7.4 Stakes, Pipe Penetrations and Other Small Objects. All objects that pass through the slab shall be sealed gas tight. A sealant reservoir, appropriately dimensioned to accommodate any differential movement between the object and the concrete, shall be formed continuously around the object, and the joint shall be sealed with a field molded elastomeric sealant

as prescribed for Isolation Joints and in accordance with the provisions of Section 1811.2.3.7.1. Where pipes or other penetrations are separated from the concrete by flexible sleeves, the sleeve shall be removed to provide bonding of the sealant to the object. Where stakes are used to support plumbing, electrical conduits or other objects that will penetrate the slab, the stakes shall be solid, non-porous and resistant to decay, corrosion and rust. Special care must be taken to avoid honeycombing between multiple or ganged penetrations.

1. Large utility service openings through the slab shall be sealed gas-tight. For slab-on-grade construction, this can be accomplished by fully covering the exposed soil with a vapor-retarder membrane, covered to a minimum depth of 1 inch with an elastomeric sealant. Alternatively, the opening may be closed with an expansive concrete or hydraulic cement to within ½ inch of the top of the slab, and the remaining ½ inch filled with an elastomeric sealant. When the opening connects to a crawlspace, the opening shall be closed with sheet metal or other rigid impermeable materials and sealed with an elastomeric sealant compatible with the materials and conditions.
2. For openings made through existing slabs, they must be sealed to meet the appropriate provisions of this Section. If the opening is partially repaired with concrete, any resulting crack shall be sealed in accordance with the Section 1811.2.3.7.3.
3. Any sump located in a habitable portion of a building and connecting to the soil, either directly or through drainage piping, shall be fitted with a gasketed lid. The lid shall be attached so as to provide a gas-tight seal between the sump and the access space above. Where interior footing drainage systems extend out beneath the footing, the drain must be sealed airtight where it passes beneath the footing.

1811.2.4 Walls in Contact with Soil-Gas. Walls separating below-grade conditioned space from the surrounding earth or from a crawlspace or other enclosed volume with an exposed earth floor, shall be isolated from the soil as required by this section. Foundation walls consisting of cavity walls, or constructed of hollow masonry products or of any material in such a way as to create an air-space within the wall, shall be capped at the floor-level of the first

finished floor they intersect. The cap shall be either at least 8 inches of solid concrete or concrete filled block, or a cap that provides air-flow resistance at least equal to the adjacent floor. No crack, honeycomb, joint duct, pipe, conduit chase or other opening in the wall shall be allowed to connect soil-gas to a conditioned space or to an enclosed space adjacent to or connected to a conditioned space.

1811.2.4.1 Materials. Walls governed by the provisions of this section shall be constructed of reinforced concrete, or solid reinforced masonry construction.

1811.2.4.2 Waterproofing. Walls governed by the provisions of this section shall be constructed with a continuous waterproofing membrane applied in accordance with Section 1805.3.2 of this code.

1811.2.4.2.1 Utility Penetrations. All below-grade utility penetrations through walls in partial or full contact with the soil shall be closed and sealed with an approved sealant material (see Section 1811.2.3.7.1). This seal shall be made on both faces of the wall. Where conduits or ducts do not provide a continuous and gas-tight separation from the soil, the end of the conduit or duct must be sealed in accordance with the provisions of Section 1811.2.3.7.1 to prevent soil-gas entry.

1811.2.4.3 Doors and Service Openings. Doors, hatches, or removable closures of any kind that can create an opening between the interior and a crawlspace should be avoided, but when required, shall be gasketed and installed with a latch or other permanent fastening device.

1811.2.5 Subslab soil exhaust system ducts (SSED). SSED's shall be provided in accordance with this section and shall run continuous from below the slab to the termination point described in section 1811.2.5.4. SSED's shall consist of one 6 inch diameter solid pipe or multiple pipes providing the same cross-sectional area. All annular openings between the SSED and the floor slab shall be sealed airtight. In addition, all SSED joints shall be sealed airtight. Penetrations of SSEDs through fire resistive construction shall comply with the applicable sections of Chapter 7 of this code. SSEDs shall be located within the building's insulated envelope and may be combined above the slab where the cross-sectional area of all combined SSEDs is maintained to the required termination point.

1811.2.5.1 Location. One SSED shall be installed for every 2,000 square feet or portion thereof of

building subslab area served. Subslab areas isolated by subslab walls shall be provided with separate SSEDs in the number noted above.

1811.2.5.2 Materials. SSED material shall be air duct material listed and labeled to the requirements of UL 181 for Class 0 air ducts, or any of the following piping materials that comply with the Plumbing Code as building sanitary drainage and vent pipe: cast iron; galvanized steel; brass or copper pipe; copper tube of a weight not less than that of copper drainage tube, Type DWV; and plastic piping.

1811.2.5.3 Grade. SSEDs shall not be trapped and shall have a minimum slope of one-eighth unit vertical in 12 units horizontal (1-percent slope).

1811.2.5.4 Subslab aperture. SSED's shall be embedded vertically into the sub-slab aggregate or other permeable material before the slab is cast. A "T" fitting or equivalent method shall be used to ensure that the SSED opening remains within the sub-slab permeable material. Alternatively, the SSED shall be inserted directly into an interior perimeter drain tile loop or through a sealed sump cover where the sump is exposed to the sub-slab aggregate or connected to it through a drainage system.

1811.2.5.5 Termination. SSEDs shall extend through the roof and terminate at least 6 inches (152 mm) above the roof and at least 10 feet (3048 mm) from any operable openings or air intake.

1811.2.5.6 Identification. All exposed and visible interior SSEDs shall be permanently identified with at least one label on each floor and in accessible attics. The label shall be by means of a tag, stencil or other approved marking which states: "Radon Reduction System."

1811.2.5.7 Combination foundations. Combination basement/crawl space or slab-on-grade/crawl space foundations shall have separate SSEDs installed in each type of foundation area. Each SSED shall terminate above the roof or shall be connected to a single SSED that terminates above the roof.

1811.3 Active Soil Depressurization (ASD). ASD systems shall comply with section 1811.2 as modified by this section.

1811.3.1 Design. ADS systems may comply with this section or be designed in accordance with accepted engineering practices for the mitigation of radon.

1811.3.2 Subslab soil exhaust system ducts (SSESD)

Location. One SSESD shall be installed for every 15,000 square feet or portion thereof of building subslab area served. Subslab areas isolated by subslab walls shall be provided with separate SSESDs in the number noted above.

1811.3.2.1 SSESD Sizing (Reserved). Air flow is a function of blower capacity, piping size, fittings and layout, sub slab aggregate resistance, soil permeability and slab and foundation leakage.

Editorial Note: Design criteria is under development.