APPENDIX C
CODE CHANGE PROPOSAL
NORTH CAROLINA
BUILDING CODE COUNCIL

B-4

325 North Salisbury Street, Room 5_44
Raleigh, North Carolina 27603
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Petition for Rule Making — Item Number ________

Granted by BCC	________	**Adopted by BCC**	________	**Approved by RRC**	________
Denied by BCC	________	**Disapproved by BCC**	________	**Objection by RRC**	________

PROPONENT: BCC Residential Standing Committee PHONE: (919) 888-0284
REPRESENTING: BCC Residential Standing Committee
ADDRESS: Mail Service Center 1202
CITY: Raleigh STATE: NC ZIP: 27699-1202
E-MAIL: **carl.martin@ncdoi.gov** FAX: ( ) -

North Carolina State Building Code, Volume: 2024 NC Residential Code Section: Chapters 1-10, 25-33, 45, 46 and Appendices

CHECK ONE:
[ ] Revise section to read as follows:
[X] Add new section to read as follows:
[ ] Delete section and substitute the following:
[ ] Delete section without substitution:

~~LINE THROUGH MATERIAL TO BE DELETED~~ UNDERLINE MATERIAL TO BE ADDED

Please type. Continue proposal or reason on plain paper attached to this form. See reverse side for instructions.

The 2024 NCRC Chapters 1-10, 25-33, 45, 46 and Appendices is based on the 2021 IRC Chapters 1-10, 25-33, 45, 46 and Appendices which can be viewed at: **Digital Codes (iccsafe.org)**
The NC amendments to the 2021 IRC Chapters 1-10, 25-33, 45, 46 and Appendices that make up 2024 NCRC Chapters 1-10, 25-33, 45, 46 and Appendices are shown in ATTACHMENT A below.

Will this proposal change the cost of construction?	Decrease [ ]	Increase [ ]	No [X]
Will this proposal increase to the cost of a dwelling by $80 or more?		Yes [ ]	No [X]
Will this proposal affect the Local or State funds?	Local [ ]	State [ ]	No [X]
Will this proposal cause a substantial economic impact (≥$1,000,000)?		Yes [ ]	No [X]

- Non-Substantial – Provide an economic analysis including benefit/cost estimates.
- Substantial – The economic analysis must also include 2-alternatives, time value of money and risk analysis.
- Pursuant to §143-138(a1)(2) a cost-benefit analysis is required for all proposed amendments to the NC Energy Conservation Code. The Building Code Council shall also require same for the NC Residential Code, Chapter 11.

REASON: This amendment is proposed to protect the public by updating the code to current standards of practice.

Signature: CARL MARTIN Date: Febraury 1, 2023 FORM 11/26/19

ATTACHMENT A

THIS DOCUMENT CONTAINS PROPOSED NORTH CAROLINA AMENDMENTS TO THE 2021 EDITION OF THE INTERNTATIONAL RESIDENTIAL CODE (IRC) CHAPTERS 1-10, 25-33, 45, 46 AND APPENDICES FOR THE PURPOSE OF ESTABLISHING THE 2024 EDITION OF THE NORTH CAROLINA RESIDENTIAL CODE CHAPTERS 1-10, 25-33, 45, 46 AND APPENDICES.

UNDERLINED TEXT INDICATE NORTH CAROLINA PROPOSED AMENDMENTS TO THE 2021 INTERNATIONAL RESIDENTIAL CODE CHAPTERS 1-10, 25-33, 45, 46 AND APPENDICES FOR THE 2024 NORTH CAROLINA RESIDENTIAL CODE CHAPTERS 1-10, 25-33, 45, 46 AND APPENDICES.

S~~TRUCKTHROUGH~~ TEXT INDICATES IRC TEXT THAT IS PROPOSED TO BE REMOVED FROM THE 2024 NORTH CAROLINA RESIDENTIAL CODE CHAPTERS 1-10, 25-33, 45, 46 AND APPENDICES.

TEXT THAT IS HIGHLIGHTED IN YELLOW INDICATES PROPOSED NORTH CAROLINA AMENDMENTS THAT ARE NEW OR DIFFERRENT THAN THE 2018 NORTH CAROLINA RESIDENTIAL CODE CHAPTERS 1-10, 25-33, 45, 46 AND APPENDICES.

CHAPTER 1
SCOPE AND ADMINISTRATION

~~**User note:**~~

~~***About this chapter:** Chapter 1 establishes the limits of applicability of this code and describes how the code is to be applied and enforced. Chapter 1 is in two parts: Part 1—Scope and Application (Sections R101–R102) and Part 2—Administration and Enforcement (Sections R103–R114). Section R101 identifies which buildings and structures come under its purview and references other I-Codes as applicable. Standards and codes are scoped to the extent referenced (see Section R102.4).*~~

~~*The one- and two-family dwelling code is intended to be adopted as a legally enforceable document, and it cannot be effective without adequate provisions for its administration and enforcement. The provisions of Chapter 1 establish the authority and duties of the building official appointed by the authority having jurisdiction and also establish the rights and privileges of the design professional, contractor and property owner.*~~

SECTION R101
SCOPE AND GENERAL REQUIREMENTS

R101.1 Title. These provisions shall be known as the North Carolina *Residential Code for One- and Two-family Dwellings* ~~of~~ ~~**[NAME OF JURISDICTION]**~~, and shall be cited as such and will be referred to herein as "this code." These regulations were adopted by the North Carolina Building Code Council on June 13, 2024 to be effective January 1, 2025. References to the *International Codes* shall mean the *North Carolina Codes*. The North Carolina Amendments to the *International Codes* are underlined.

R101.2 Scope. The provisions of this code shall apply to the construction, *alteration*, movement, enlargement, replacement, *repair*, equipment, use and occupancy, location, removal, and demolition of one or more detached one- and two-family dwellings and *townhouses* located on a parcel not more than three stories above *grade plane* in height with a separate means of egress and their *accessory structures* not more than three stories above *grade plane* in height. Single family dwellings otherwise permitted by this Code shall include *bed and breakfast* homes.

Exception: ~~The following shall be permitted to be constructed in accordance with this code where provided with an automatic sprinkler system complying with Section P2904:~~

1. *Live/work units* ~~located in townhouses and~~ complying with the requirements of Section 508.5 of the *International Building Code*~~.~~ shall be permitted to be built as one- and two- family dwellings or townhouses. Fire suppression required by Section 508.5.7 of the International Building Code where constructed under the *International Residential Code for One- and Two-family Dwellings* shall conform to Section P2904.
2. ~~Owner-occupied *lodging houses* with five or fewer guestrooms.~~
3. ~~A care facility with five or fewer persons receiving custodial care within a *dwelling unit*.~~
4. ~~A care facility with five or fewer persons receiving medical care within a *dwelling unit*.~~
5. ~~A care facility for five or fewer persons receiving care that are within a single-family dwelling.~~

R101.2.1 Accessory buildings. *Accessory buildings* with any dimension greater than 12 feet (3658 mm) shall meet the provisions of this code. *Accessory buildings* are permitted to be constructed without a masonry or concrete foundation, except in *coastal high hazard* or *ocean hazard areas*, provided all of the following conditions are met:

1. The *accessory building* shall not exceed 400 square feet (37 m^2) or one story in height;
2. The building is supported on a wood foundation of minimum 2-inch by 6-inch (51-mm by 152-mm) or 3-inch by 4-inch (76-mm by 102-mm) mudsill of approved wood in accordance with Section R317;
3. The building is anchored to resist overturning and sliding by installing a minimum of one ground anchor at each corner of the building. The total resisting force of the anchors shall be equal to 20 psf (958 Pa) times the plan area of the building.

R101.2.2 Accessory structures. Only the following *accessory structures* shall meet the provisions of this code.

1. Decks, see Appendix M,
2. Gazebos,
3. Retaining walls, see Section R404.4,
4. Detached masonry chimneys located less than 10 feet (3048 mm) from other buildings or lot lines,
5. Swimming pools and spas, see Appendix NC-A,

6. Detached carports,
   Exception: Portable, lightweight carports not exceeding 400 square feet (37 m^2) or 12 feet (3658 mm) mean roof height.
7. *Docks, piers, bulkheads*, and waterway structures, see Section R331
8. Ground mounted photovoltaic system, see Section R324.7

R101.3 Purpose. The purpose of this code is to establish minimum requirements to provide a reasonable level of safety, health and general welfare through affordability, structural strength, means of egress, stability, sanitation, light and ventilation, energy conservation and safety to life and property from fire and other hazards attributed to the built environment. ~~and to provide a reasonable level of safety to fire fighters and emergency responders during emergency operations.~~

R102.5 Appendices. Provisions in the appendices shall not apply unless specifically referenced in the ~~adopting ordinance~~ code text.

R102.6 Partial invalidity. In the event any part or provision of this code is held to be illegal or void, this shall not have the effect of making void or illegal any of the other parts or provisions.

R102.7 Existing structures. ~~The legal occupancy of any structure existing on the date of adoption of this code shall be permitted to continue without change, except as is specifically covered in this code, the *International Property Maintenance Code* or the *International Fire Code*, or as is deemed necessary by the *building official* for the general safety and welfare of the occupants and the public.~~ For requirements of existing structures, refer to the *North Carolina Administrative Code and Policies* and the *North Carolina Existing Building Code*.

R102.7.1 Additions, alterations or repairs. *Additions*, *alterations* or repairs to any structure shall conform to the requirements for a new structure without requiring the existing structure to comply with the requirements of this code, unless otherwise stated. *Additions*, *alterations,* repairs and relocations shall not cause an existing structure to become less compliant with the provisions of this code than the existing building or structure was prior to the *addition*, *alteration* or *repair*. ~~An existing building together with its *additions* shall comply with the height limits of this code.~~ Where the *alteration* causes the use or occupancy to be changed to one not within the scope of this code, the provisions of the *International Existing Building Code* shall apply.

SECTION R103
DEPARTMENT OF BUILDING SAFETY

Deleted. See the *North Carolina Administrative Code and Policies*.

~~**R103.1 Creation of enforcement agency.** The department of building safety is hereby created and the official in charge thereof shall be known as the *building official*.~~

~~**R103.2 Appointment.** The *building official* shall be appointed by the *jurisdiction*.~~

~~**R103.3 Deputies.** In accordance with the prescribed procedures of this *jurisdiction* and with the concurrence of the appointing authority, the *building official* shall have the authority to appoint a deputy *building official*, the related technical officers, inspectors, plan examiners and other employees. Such employees shall have powers as delegated by the *building official*.~~

SECTION R104
DUTIES AND POWERS OF
THE BUILDING OFFICIAL

Deleted. See the *North Carolina Administrative Code and Policies*.

~~**R104.1 General.** The *building official* is hereby authorized and directed to enforce the provisions of this code. The *building official* shall have the authority to render interpretations of this code and to adopt policies and procedures in order to clarify the application of its provisions. Such interpretations, policies and procedures shall be in compliance with the intent and purpose of this code. Such policies and procedures shall not have the effect of waiving requirements specifically provided for in this code.~~

~~**R104.2 Applications and permits.** The *building official* shall receive applications, review *construction documents* and issue *permits* for the erection and *alteration* of buildings and structures, inspect the premises for which such permits have been issued and enforce compliance with the provisions of this code.~~

~~**R104.3 Notices and orders.** The *building official* shall issue necessary notices or orders to ensure compliance with this code.~~

~~**R104.4 Inspections.** The *building official* shall make the required inspections, or the *building official* shall have the authority to accept reports of inspection by *approved agencies* or individuals. Reports of such inspections shall be in writing and be certified by a responsible officer of such *approved agency* or by the responsible individual. The *building official* is authorized to engage such expert opinion as deemed necessary to report on unusual technical issues that arise, subject to the approval of the appointing authority.~~

~~**R104.5 Identification.** The *building official* shall carry proper identification when inspecting structures or premises in the performance of duties under this code.~~

~~**R104.6 Right of entry.** Where it is necessary to make an inspection to enforce the provisions of this code, or where the *building official* has reasonable cause to believe that there exists in a structure or upon a premises a condition that is contrary to or in violation of this code that makes the structure or premises unsafe, dangerous or hazardous, the *building official* or designee is authorized to enter the structure or premises at reasonable times to inspect or to perform the duties imposed by this code, provided that if such structure or premises be occupied that credentials be presented to the occupant and entry requested. If such structure or premises is unoccupied, the *building official* shall first make a reasonable effort to locate the *owner*, the owner's authorized agent, or other *person* having charge or control of the structure or premises and request entry. If entry is refused, the *building official* shall have recourse to the remedies provided by law to secure entry.~~

~~**R104.7 Department records.** The *building official* shall keep official records of applications received, *permits* and certificates issued, fees collected, reports of inspections, and notices and orders issued. Such records shall be retained in the official records for the period required for the retention of public records.~~

~~**R104.8 Liability.** The *building official*, member of the board of appeals or employee charged with the enforcement of this code, while acting for the *jurisdiction* in good faith and without malice in the discharge of the duties required by this code or other pertinent law or ordinance, shall not thereby be rendered civilly or criminally liable personally and is hereby relieved from personal liability for any damage accruing to persons or property as a result of any act or by reason of an act or omission in the discharge of official duties.~~

~~**R104.8.1 Legal defense.** Any suit or criminal complaint instituted against an officer or employee because of an act performed by that officer or employee in the lawful discharge of duties and under the provisions of this code shall be defended by legal representatives of the *jurisdiction* until the final termination of the proceedings. The *building official* or any subordinate shall not be liable for cost in any action, suit or proceeding that is instituted in pursuance of the provisions of this code.~~

~~**R104.9 Approved materials and equipment.** Materials, *equipment* and devices *approved* by the *building official* shall be constructed and installed in accordance with such approval.~~

~~**R104.9.1 Used materials and equipment.** Used materials, *equipment* and devices shall not be reused unless *approved* by the *building official*.~~

~~**R104.10 Modifications.** Where there are practical difficulties involved in carrying out the provisions of this code, the *building official* shall have the authority to grant modifications for individual cases, provided the *building official* shall first find that special individual reason makes the strict letter of this code impractical and the modification is in compliance with the intent and purpose of this code and that such modification does not lessen health, life and fire safety or structural requirements. The details of action granting modifications shall be recorded and entered in the files of the department of building safety.~~

~~**R104.10.1 Flood hazard areas.** The *building official* shall not grant modifications to any provisions required in flood hazard areas as established by Table R301.2 unless a determination has been made that:~~

1. ~~There is good and sufficient cause showing that the unique characteristics of the size, configuration or topography of the site render the elevation standards of Section R322 inappropriate.~~
2. ~~Failure to grant the modification would result in exceptional hardship by rendering the lot undevelopable.~~
3. ~~The granting of modification will not result in increased flood heights, additional threats to public safety, extraordinary public expense, cause fraud on or victimization of the public, or conflict with existing laws or ordinances.~~
4. ~~The modification is the minimum necessary to afford relief, considering the flood hazard.~~
5. ~~Written notice specifying the difference between the design flood elevation and the elevation to which the building is to be built, stating that the cost of flood insurance will be commensurate with the increased risk resulting from the reduced floor elevation and stating that construction below the design flood elevation increases risks to life and property, has been submitted to the applicant.~~

~~**R104.11 Alternative materials, design and methods of construction and equipment.** The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code. The *building official* shall have the authority to approve an alternative material, design or method of construction upon application of the *owner* or the owner's authorized agent. The *building official* shall first find that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the~~

~~purpose intended, not less than the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety. Compliance with the specific performance-based provisions of the International Codes shall be an alternative to the specific requirements of this code. Where the alternative material, design or method of construction is not *approved*, the *building official* shall respond in writing, stating the reasons why the alternative was not *approved*.~~

~~**R104.11.1 Tests.** Where there is insufficient evidence of compliance with the provisions of this code, or evidence that a material or method does not conform to the requirements of this code, or in order to substantiate claims for alternative materials or methods, the *building official* shall have the authority to require tests as evidence of compliance to be made at no expense to the *jurisdiction*. Test methods shall be as specified in this code or by other recognized test standards. In the absence of recognized and accepted test methods, the *building official* shall approve the testing procedures. Tests shall be performed by an *approved* agency. Reports of such tests shall be retained by the *building official* for the period required for retention of public records.~~

SECTION R105
PERMITS

Deleted. See the *North Carolina Administrative Code and Policies*.

~~**R105.1 Required.** Any *owner* or owner's authorized agent who intends to construct, enlarge, alter, *repair*, move, demolish or change the occupancy of a building or structure, or to erect, install, enlarge, alter, *repair*, remove, convert or replace any electrical, gas, mechanical or plumbing system, the installation of which is regulated by this code, or to cause any such work to be performed, shall first make application to the *building official* and obtain the required *permit*.~~

~~**R105.2 Work exempt from permit.** Exemption from *permit* requirements of this code shall not be deemed to grant authorization for any work to be done in any manner in violation of the provisions of this code or any other laws or ordinances of this *jurisdiction*. *Permits* shall not be required for the following:~~

~~**Building:**~~

1. ~~Other than *storm shelters*, one *story* detached *accessory structures,* provided that the floor area does not exceed 200 square feet (18.58 m²).~~
2. ~~Fences not over 7 feet (2134 mm) high.~~
3. ~~Retaining walls that are not over 4 feet (1219 mm) in height measured from the bottom of the footing to the top of the wall, unless supporting a surcharge.~~
4. ~~Water tanks supported directly upon *grade* if the capacity does not exceed 5,000 gallons (18 927 L) and the ratio of height to diameter or width does not exceed 2 to 1.~~
5. ~~Sidewalks and driveways.~~
6. ~~Painting, papering, tiling, carpeting, cabinets, counter tops and similar finish work.~~
7. ~~Prefabricated swimming pools that are less than 24 inches (610 mm) deep.~~
8. ~~Swings and other playground equipment.~~
9. ~~Window awnings supported by an exterior wall that do not project more than 54 inches (1372 mm) from the exterior wall and do not require additional support.~~
10. ~~Decks not exceeding 200 square feet (18.58 m²) in area, that are not more than 30 inches (762 mm) above *grade* at any point, are not attached to a dwelling and do not serve the exit door required by Section R311.4.~~

~~**Electrical:**~~

1. ~~*Listed* cord-and-plug connected temporary decorative lighting.~~
2. ~~Reinstallation of attachment plug receptacles but not the outlets therefor.~~
3. ~~Replacement of branch circuit overcurrent devices of the required capacity in the same location.~~
4. ~~Electrical wiring, devices, *appliances,* apparatus or *equipment* operating at less than 25 volts and not capable of supplying more than 50 watts of energy.~~
5. ~~Minor repair work, including the replacement of lamps or the connection of *approved* portable electrical equipment to *approved* permanently installed receptacles.~~

~~**Gas:**~~

1. ~~Portable heating, cooking or clothes drying *appliances*.~~
2. ~~Replacement of any minor part that does not alter approval of *equipment* or make such *equipment* unsafe.~~

3. ~~Portable fuel cell *appliances* that are not connected to a fixed piping system and are not interconnected to a power grid.~~

~~**Mechanical:**~~

1. ~~Portable heating *appliances*.~~
2. ~~Portable ventilation *appliances*.~~
3. ~~Portable cooling units.~~
4. ~~Steam, hot- or chilled-water piping within any heating or cooling *equipment* regulated by this code.~~
5. ~~Replacement of any minor part that does not alter approval of *equipment* or make such *equipment* unsafe.~~
6. ~~Portable evaporative coolers.~~
7. ~~Self-contained refrigeration systems containing 10 pounds (4.54 kg) or less of refrigerant or that are actuated by motors of 1 horsepower (746 W) or less.~~
8. ~~Portable fuel cell *appliances* that are not connected to a fixed piping system and are not interconnected to a power grid.~~

~~**Plumbing:**~~

1. ~~The stopping of leaks in drains, water, soil, waste or vent pipe; provided, however, that if any concealed trap, drainpipe, water, soil, waste or vent pipe becomes defective and it becomes necessary to remove and replace the same with new material, such work shall be considered as new work and a *permit* shall be obtained and inspection made as provided in this code.~~
2. ~~The clearing of stoppages or the repairing of leaks in pipes, valves or fixtures, and the removal and reinstallation of water closets, provided such repairs do not involve or require the replacement or rearrangement of valves, pipes or fixtures.~~

~~**R105.2.1 Emergency repairs.** Where *equipment* replacements and repairs must be performed in an emergency situation, the *permit* application shall be submitted within the next working business day to the *building official*.~~

~~**R105.2.2 Repairs.** Application or notice to the *building official* is not required for ordinary repairs to structures, replacement of lamps or the connection of *approved* portable electrical equipment to *approved* permanently installed receptacles. Such repairs shall not include the cutting away of any wall, partition or portion thereof, the removal or cutting of any structural beam or load bearing support, or the removal or change of any required means of egress, or rearrangement of parts of a structure affecting the egress requirements; nor shall ordinary repairs include *addition* to, *alteration* of, replacement or relocation of any water supply, sewer, drainage, drain leader, gas, soil, waste, vent or similar piping, electric wiring or mechanical or other work affecting public health or general safety.~~

~~**R105.2.3 Public service agencies.** A *permit* shall not be required for the installation, *alteration* or *repair* of generation, transmission, distribution, metering or other related equipment that is under the ownership and control of public service agencies by established right.~~

~~**R105.3 Application for permit.** To obtain a *permit*, the applicant shall first file an application therefor in writing on a form furnished by the department of building safety for that purpose. Such application shall:~~

1. ~~Identify and describe the work to be covered by the *permit* for which application is made.~~
2. ~~Describe the land on which the proposed work is to be done by legal description, street address or similar description that will readily identify and definitely locate the proposed building or work.~~
3. ~~Indicate the use and occupancy for which the proposed work is intended.~~
4. ~~Be accompanied by *construction documents* and other information as required in Section R106.1.~~
5. ~~State the valuation of the proposed work.~~
6. ~~Be signed by the applicant or the applicant's authorized agent.~~
7. ~~Give such other data and information as required by the *building official*.~~

~~**R105.3.1 Action on application.** The *building official* shall examine or cause to be examined applications for *permits* and amendments thereto within a reasonable time after filing. If the application or the *construction documents* do not conform to the requirements of pertinent laws, the *building official* shall reject such application in writing stating the reasons therefor. If the *building official* is satisfied that the proposed work conforms to the requirements of this code and laws and ordinances applicable thereto, the *building official* shall issue a *permit* therefor as soon as practicable.~~

~~**R105.3.1.1 Determination of substantially improved or substantially damaged existing buildings in flood hazard areas.** For applications for reconstruction, rehabilitation, *addition, alteration*, *repair* or other improvement of existing~~

~~buildings or structures located in a flood hazard area as established by Table R301.2, the *building official* shall examine or cause to be examined the *construction documents* and shall make a determination with regard to the value of the proposed work. For buildings that have sustained damage of any origin, the value of the proposed work shall include the cost to repair the building or structure to its predamaged condition. If the *building official* finds that the value of proposed work equals or exceeds 50 percent of the market value of the building or structure before the damage has occurred or the improvement is started, the proposed work is a substantial improvement or *repair* of substantial damage and the building official shall require existing portions of the entire building or structure to meet the requirements of Section R322.~~

~~For the purpose of this determination, a substantial improvement shall mean any *repair*, reconstruction, rehabilitation, addition or improvement of a building or structure, the cost of which equals or exceeds 50 percent of the market value of the building or structure before the improvement or *repair* is started. Where the building or structure has sustained substantial damage, repairs necessary to restore the building or structure to its predamaged condition shall be considered substantial improvements regardless of the actual repair work performed. The term shall not include either of the following:~~

1. ~~Improvements to a building or structure that are required to correct existing health, sanitary or safety code violations identified by the building official and that are the minimum necessary to ensure safe living conditions.~~
2. ~~Any *alteration* of a *historic building* or structure, provided that the *alteration* will not preclude the continued designation as a *historic building* or structure. For the purposes of this exclusion, a *historic building* shall be any of the following:~~
   - ~~2.1. Listed or preliminarily determined to be eligible for listing in the National Register of Historic Places.~~
   - ~~2.2. Determined by the Secretary of the US Department of Interior as contributing to the historical significance of a registered historic district or a district preliminarily determined to qualify as an historic district.~~
   - ~~2.3. Designated as historic under a state or local historic preservation program that is approved by the Department of Interior.~~

~~**R105.3.2 Time limitation of application.** An application for a *permit* for any proposed work shall be deemed to have been abandoned 180 days after the date of filing unless such application has been pursued in good faith or a *permit* has been issued; except that the *building official* is authorized to grant one or more extensions of time for additional periods not exceeding 180 days each. The extension shall be requested in writing and justifiable cause demonstrated.~~

~~**R105.4 Validity of permit.** The issuance or granting of a *permit* shall not be construed to be a *permit* for, or an *approval* of, any violation of any of the provisions of this code or of any other ordinance of the *jurisdiction*. *Permits* presuming to give authority to violate or cancel the provisions of this code or other ordinances of the *jurisdiction* shall not be valid. The issuance of a *permit* based on *construction documents* and other data shall not prevent the *building official* from requiring the correction of errors in the *construction documents* and other data. The *building official* is authorized to prevent occupancy or use of a structure where in violation of this code or of any other ordinances of this *jurisdiction*.~~

~~**R105.5 Expiration.** Every *permit* issued shall become invalid unless the work authorized by such *permit* is commenced within 180 days after its issuance or after commencement of work if more than 180 days pass between inspections. The building official is authorized to grant, in writing, one or more extensions of time, for periods not more than 180 days each. The extension shall be requested in writing and justifiable cause demonstrated.~~

~~**R105.6 Suspension or revocation.** The *building official* is authorized to suspend or revoke a *permit* issued under the provisions of this code wherever the *permit* is issued in error or on the basis of incorrect, inaccurate or incomplete information, or in violation of any ordinance or regulation or any of the provisions of this code.~~

~~**R105.7 Placement of permit.** The building *permit* or a copy shall be kept on the site of the work until the completion of the project.~~

~~**R105.8 Responsibility.** It shall be the duty of every *person* who performs work for the installation or *repair* of building, structure, electrical, gas, mechanical or plumbing systems, for which this code is applicable, to comply with this code.~~

~~**R105.9 Preliminary inspection.** Before issuing a *permit,* the *building official* is authorized to examine or cause to be examined buildings, structures and sites for which an application has been filed.~~

SECTION R106
CONSTRUCTION DOCUMENTS

Deleted. See the *North Carolina Administrative Code and Policies*.

~~**R106.1 Submittal documents.** Submittal documents consisting of *construction documents*, and other data shall be submitted in two or more sets, or in a digital format where allowed by the *building official*, with each application for a *permit.* The *construction documents* shall be prepared by a *registered design professional* where required by the statutes of the *jurisdiction* in which the~~

~~project is to be constructed. Where special conditions exist, the *building official* is authorized to require additional *construction documents* to be prepared by a *registered design professional*.~~

~~**Exception:** The *building official* is authorized to waive the submission of *construction documents* and other data not required to be prepared by a *registered design professional* if it is found that the nature of the work applied for is such that reviewing of *construction documents* is not necessary to obtain compliance with this code.~~

~~**R106.1.1 Information on construction documents.** *Construction documents* shall be drawn upon suitable material. Electronic media documents are permitted to be submitted where *approved* by the *building official*. *Construction documents* shall be of sufficient clarity to indicate the location, nature and extent of the work proposed and show in detail that it will conform to the provisions of this code and relevant laws, ordinances, rules and regulations, as determined by the *building official*.~~

~~**R106.1.2 Manufacturer's installation instructions.** Manufacturer's installation instructions, as required by this code, shall be available on the job site at the time of inspection.~~

~~**R106.1.3 Information on braced wall design.** For buildings and structures utilizing braced wall design, and where required by the *building official*, *braced wall lines* shall be identified on the *construction documents*. Pertinent information including, but not limited to, bracing methods, location and length of *braced wall panels* and foundation requirements of *braced wall panels* at top and bottom shall be provided.~~

~~**R106.1.4 Information for construction in flood hazard areas.** For buildings and structures located in whole or in part in flood hazard areas as established by Table R301.2, *construction documents* shall include:~~

1. ~~Delineation of flood hazard areas, floodway boundaries and flood zones and the design flood elevation, as appropriate.~~
2. ~~The elevation of the proposed lowest floor, including *basement*; in areas of shallow flooding (AO Zones), the height of the proposed lowest floor, including *basement*, above the highest adjacent *grade*.~~
3. ~~The elevation of the bottom of the lowest horizontal structural member in coastal high hazard areas (V Zone) and in Coastal A Zones where such zones are delineated on flood hazard maps identified in Table R301.2 or otherwise delineated by the *jurisdiction*.~~
4. ~~If design flood elevations are not included on the community's Flood Insurance Rate Map (FIRM), the *building official* and the applicant shall obtain and reasonably utilize any design flood elevation and floodway data available from other sources.~~

~~**R106.1.5 Information on storm shelters.** *Construction documents* for *storm shelters* shall include the information required in ICC 500.~~

~~**R106.2 Site plan or plot plan.** The *construction documents* submitted with the application for *permit* shall be accompanied by a site plan showing the size and location of new construction and existing structures on the site and distances from *lot lines*. In the case of demolition, the site plan shall show construction to be demolished and the location and size of existing structures and construction that are to remain on the site or plot. The *building official* is authorized to waive or modify the requirement for a site plan where the application for *permit* is for *alteration* or *repair* or where otherwise warranted.~~

~~**R106.3 Examination of documents.** The *building official* shall examine or cause to be examined *construction documents* for code compliance.~~

~~**R106.3.1 Approval of construction documents.** Where the *building official* issues a *permit*, the *construction documents* shall be *approved* in writing or by a stamp that states "REVIEWED FOR CODE COMPLIANCE." One set of *construction documents* so reviewed shall be retained by the *building official*. The other set shall be returned to the applicant, shall be kept at the site of work and shall be open to inspection by the *building official* or a duly authorized representative.~~

~~**R106.3.2 Previous approvals.** This code shall not require changes in the *construction documents*, construction or designated occupancy of a structure for which a lawful *permit* has been heretofore issued or otherwise lawfully authorized, and the construction of which has been pursued in good faith within 180 days after the effective date of this code and has not been abandoned.~~

~~**R106.3.3 Phased approval.** The *building official* is authorized to issue a *permit* for the construction of foundations or any other part of a building or structure before the *construction documents* for the whole building or structure have been submitted, provided that adequate information and detailed statements have been filed complying with pertinent requirements of this code. The holder of such *permit* for the foundation or other parts of a building or structure shall proceed at the holder's own risk with the building operation and without assurance that a *permit* for the entire structure will be granted.~~

~~**R106.4 Amended construction documents.** Work shall be installed in accordance with the *approved construction documents*, and any changes made during construction that are not in compliance with the *approved construction documents* shall be resubmitted for approval as an amended set of *construction documents*.~~

~~**R106.5 Retention of construction documents.** One set of *approved construction documents* shall be retained by the *building official* for a period of not less than 180 days from date of completion of the permitted work, or as required by state or local laws.~~

SECTION R107
TEMPORARY STRUCTURES AND USES

Deleted. See the *North Carolina Administrative Code and Policies*.

~~**R107.1 General.** The *building official* is authorized to issue a *permit* for temporary structures and temporary uses. Such *permits* shall be limited as to time of service, but shall not be permitted for more than 180 days. The *building official* is authorized to grant extensions for demonstrated cause.~~

~~**R107.2 Conformance.** Temporary structures and uses shall conform to the structural strength, fire safety, means of egress, light, *ventilation* and sanitary requirements of this code as necessary to ensure the public health, safety and general welfare.~~

~~**R107.3 Temporary power.** The *building official* is authorized to give permission to temporarily supply and use power in part of an electric installation before such installation has been fully completed and the final certificate of completion has been issued. The part covered by the temporary certificate shall comply with the requirements specified for temporary lighting, heat or power in NFPA 70.~~

~~**R107.4 Termination of approval.** The *building official* is authorized to terminate such *permit* for a temporary structure or use and to order the temporary structure or use to be discontinued.~~

SECTION R108
FEES

Deleted. See the *North Carolina Administrative Code and Policies*.

~~**R108.1 Payment of fees.** A *permit* shall not be valid until the fees prescribed by law have been paid, nor shall an amendment to a *permit* be released until the additional fee, if any, has been paid.~~

~~**R108.2 Schedule of permit fees.** On buildings, structures, electrical, gas, mechanical and plumbing systems or *alterations* requiring a *permit*, a fee for each *permit* shall be paid as required, in accordance with the schedule as established by the applicable governing authority.~~

~~**R108.3 Building permit valuations.** Building *permit* valuation shall include total value of the work for which a *permit* is being issued, such as electrical, gas, mechanical, plumbing equipment and other permanent systems, including materials and labor.~~

~~**R108.4 Related fees.** The payment of the fee for the construction, *alteration*, removal or demolition for work done in connection to or concurrently with the work authorized by a building *permit* shall not relieve the applicant or holder of the *permit* from the payment of other fees that are prescribed by law.~~

~~**R108.5 Refunds.** The *building official* is authorized to establish a refund policy.~~

~~**R108.6 Work commencing before permit issuance.** Any *person* who commences work requiring a *permit* on a building, structure, electrical, gas, mechanical or plumbing system before obtaining the necessary *permits* shall be subject to a fee established by the applicable governing authority that shall be in addition to the required *permit* fees.~~

SECTION R109
INSPECTIONS

Deleted. See the *North Carolina Administrative Code and Policies*.

~~**R109.1 Types of inspections.** For on-site construction, from time to time the *building official*, upon notification from the *permit* holder or his agent, shall make or cause to be made any necessary inspections and shall either approve that portion of the construction as completed or shall notify the *permit* holder or his or her agent wherein the same fails to comply with this code.~~

~~**R109.1.1 Foundation inspection.** 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 supported 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.~~

~~**R109.1.2 Plumbing, mechanical, gas and electrical systems inspection.** Rough inspection of plumbing, mechanical, gas and electrical systems shall be made prior to covering or concealment, before fixtures or *appliances* are set or installed, and prior to framing inspection.~~

~~**Exception:** Backfilling of ground source heat pump loop systems tested in accordance with Section M2105.28 prior to inspection shall be permitted.~~

~~**R109.1.3 Floodplain inspections.** For construction in flood hazard areas as established by Table R301.2, 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 Section R322.~~

~~**R109.1.4 Frame and masonry inspection.** Inspection of framing and masonry construction shall be made after the roof, masonry, framing, firestopping, draftstopping and bracing are in place and after the plumbing, mechanical and electrical rough inspections are *approved*.~~

~~**R109.1.5 Other inspections.** In addition to inspections in Sections R109.1.1 through R109.1.4, the *building official* shall have the authority to make or require any other inspections to ascertain compliance with this code and other laws enforced by the *building official*.~~

~~**R109.1.5.1 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 lathing or gypsum board or gypsum panel products are in place, but before any plaster is applied, or before board or panel joints and fasteners are taped and finished.~~

~~**R109.1.6 Final inspection.** Final inspection shall be made after the permitted work is complete and prior to occupancy.~~

~~**R109.1.6.1 Elevation documentation.** If located in a flood hazard area, the documentation of elevations required in Section R322.1.10 shall be submitted to the *building official* prior to the final inspection.~~

~~**R109.2 Inspection agencies.** The *building official* is authorized to accept reports of *approved* agencies, provided such agencies satisfy the requirements as to qualifications and reliability.~~

~~**R109.3 Inspection requests.** It shall be the duty of the *permit* holder or their agent to notify the *building official* that such work is ready for inspection. It shall be the duty of the *person* requesting any inspections required by this code to provide access to and means for inspection of such work.~~

~~**R109.4 Approval required.** Work shall not be done beyond the point indicated in each successive inspection without first obtaining the approval of the *building official*. The *building official*, upon notification, shall make the requested inspections and shall either indicate the portion of the construction that is satisfactory as completed, or shall notify the *permit* holder or an agent of the *permit* holder wherein the same fails to comply with this code. Any portions that do not comply shall be corrected and such portion shall not be covered or concealed until authorized by the *building official*.~~

SECTION R110
CERTIFICATE OF OCCUPANCY

Deleted. See the *North Carolina Administrative Code and Policies*.

~~**R110.1 Use and change of occupancy.** A building or structure shall not be used or occupied in whole or in part, and a *change of occupancy* of a building or structure or portion thereof shall not be made, until the *building official* has issued a certificate of occupancy therefor as provided herein. Issuance of a certificate of occupancy shall not be construed as an approval of a violation of the provisions of this code or of other ordinances of the *jurisdiction*. Certificates presuming to give authority to violate or cancel the provisions of this code or other ordinances of the *jurisdiction* shall not be valid.~~

~~**Exceptions:**~~

1. ~~Certificates of occupancy are not required for work exempt from *permits* under Section R105.2.~~
2. ~~Accessory buildings or structures.~~

~~**R110.2 Change in use.** Changes in the character or use of an existing structure shall not be made except as specified in Sections 506 and 507 of the *International Existing Building Code*.~~

~~**R110.3 Certificate issued.** After the *building official* inspects the building or structure and does not find violations of the provisions of this code or other laws that are enforced by the department, the *building official* shall issue a certificate of occupancy containing the following:~~

1. ~~The *permit* number.~~
2. ~~The address of the structure.~~
3. ~~The name and address of the *owner* or the owner's authorized agent.~~
4. ~~A description of that portion of the structure for which the certificate is issued.~~

5. ~~A statement that the described portion of the structure has been inspected for compliance with the requirements of this code.~~
6. ~~The name of the *building official*.~~
7. ~~The edition of the code under which the *permit* was issued.~~
8. ~~Where an automatic sprinkler system is provided and whether the sprinkler system is required.~~
9. ~~Any special stipulations and conditions of the building *permit*.~~

~~**R110.4 Temporary occupancy.** The *building official* is authorized to issue a temporary certificate of occupancy before the completion of the entire work covered by the *permit*, provided that such portion or portions shall be occupied safely. The *building official* shall set a time period during which the temporary certificate of occupancy is valid.~~

~~**R110.5 Revocation.** The *building official* is authorized to suspend or revoke a certificate of occupancy issued under the provisions of this code, in writing, wherever the certificate is issued in error, or on the basis of incorrect information supplied, or where it is determined that the building or structure or portion thereof is in violation of the provisions of this code or other ordinance of the *jurisdiction*.~~

SECTION R111
SERVICE UTILITIES

Deleted. See the *North Carolina Administrative Code and Policies*.

~~**R111.1 Connection of service utilities.** A *person* shall not make connections from a utility, a source of energy, fuel, or power to any building or system that is regulated by this code for which a *permit* is required, until *approved* by the *building official*.~~

~~**R111.2 Temporary connection.** The *building official* shall have the authority to authorize the temporary connection of the building or system to the utility, source of energy, fuel or power.~~

~~**R111.3 Authority to disconnect service utilities.** The *building official* shall have the authority to authorize disconnection of utility service to the building, structure or system regulated by this code and the referenced codes and standards set forth in Section R102.4 in case of emergency where necessary to eliminate an immediate hazard to life or property or where such utility connection has been made without the approval required by Section R111.1 or R111.2. The *building official* shall notify the serving utility and where possible the *owner* or the owner's authorized agent and occupant of the building, structure or service system of the decision to disconnect prior to taking such action. If not notified prior to disconnection, the *owner*, the owner's authorized agent or occupant of the building, structure or service system shall be notified in writing as soon as practical thereafter.~~

SECTION R112
BOARD OF APPEALS

Deleted. See the *North Carolina Administrative Code and Policies*.

~~**R112.1 General.** In order to hear and decide appeals of orders, decisions or determinations made by the *building official* relative to the application and interpretation of this code, there shall be and is hereby created a board of appeals. The *building official* shall be an ex officio member of said board but shall not have a vote on any matter before the board. The board of appeals shall be appointed by the governing body and shall hold office at its pleasure. The board shall adopt rules of procedure for conducting its business, and shall render decisions and findings in writing to the appellant with a duplicate copy to the *building official*.~~

~~**R112.2 Limitations on authority.** An application for appeal shall be based on a claim that the true intent of this code or the rules legally adopted thereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an equally good or better form of construction is proposed. The board shall not have authority to waive requirements of this code.~~

~~**R112.3 Qualifications.** The board of appeals shall consist of members who are qualified by experience and training to pass judgment on matters pertaining to building construction and are not employees of the *jurisdiction*.~~

~~**R112.4 Administration.** The *building official* shall take immediate action in accordance with the decision of the board.~~

SECTION R113
VIOLATIONS

Deleted. See the *North Carolina Administrative Code and Policies*.

~~**R113.1 Unlawful acts.** It shall be unlawful for any *person*, firm or corporation to erect, construct, alter, extend, *repair*, move, remove, demolish or occupy any building, structure or equipment regulated by this code, or cause same to be done, in conflict with or in violation of any of the provisions of this code.~~

~~**R113.2 Notice of violation.** The *building official* is authorized to serve a notice of violation or order on the *person* responsible for the erection, construction, *alteration*, extension, *repair*, moving, removal, demolition or occupancy of a building or structure in violation of the provisions of this code, or in violation of a detail statement or a plan *approved* thereunder, or in violation of a *permit* or certificate issued under the provisions of this code. Such order shall direct the discontinuance of the illegal action or condition and the abatement of the violation.~~

~~**R113.3 Prosecution of violation.** If the notice of violation is not complied with in the time prescribed by such notice, the *building official* is authorized to request the legal counsel of the *jurisdiction* to institute the appropriate proceeding at law or in equity to restrain, correct or abate such violation, or to require the removal or termination of the unlawful occupancy of the building or structure in violation of the provisions of this code or of the order or direction made pursuant thereto.~~

~~**R113.4 Violation penalties.** Any *person* who violates a provision of this code or fails to comply with any of the requirements thereof or who erects, constructs, alters or repairs a building or structure in violation of the *approved construction documents* or directive of the *building official,* or of a *permit* or certificate issued under the provisions of this code, shall be subject to penalties as prescribed by law.~~

SECTION R114
STOP WORK ORDER

Deleted. See the *North Carolina Administrative Code and Policies*.

~~**R114.1 Authority.** Where the *building official* finds any work regulated by this code being performed in a manner contrary to the provisions of this code or in a dangerous or unsafe manner, the *building official* is authorized to issue a stop work order.~~

~~**R114.2 Issuance.** The stop work order shall be in writing and shall be given to the *owner* of the property, the owner's authorized agent or the *person* performing the work. Upon issuance of a stop work order, the cited work shall immediately cease. The stop work order shall state the reason for the order and the conditions under which the cited work is authorized to resume.~~

~~**R114.3 Emergencies.** Where an emergency exists, the building official shall not be required to give a written notice prior to stopping the work.~~

~~**R114.4 Failure to comply.** Any *person* who shall continue any work after having been served with a stop work order, except such work as that *person* is directed to perform to remove a violation or unsafe condition, shall be subject to fines established by the authority having jurisdiction.~~

CHAPTER 2
DEFINITIONS

~~**User notes:**~~

~~***About this chapter:*** Codes, by their very nature, are technical documents. Every word, term and punctuation mark can add to or change the meaning of a technical requirement. It is necessary to maintain a consensus on the specific meaning of each term contained in the code. Chapter 2 performs this function by stating clearly what specific terms mean for the purpose of the code.~~

~~***Code development reminder:*** Code change proposals to definitions in this chapter preceded by a bracketed letter are considered by the IRC—Building Code Development Committee [RB], the IRC—Mechanical/Plumbing Code Development Committee [MP] or the IECC—Residential Code Development Committee [RE] during the Group B (2022) Code Development Cycle.~~

[RP] ACCEPTED ENGINEERING PRACTICE. Practice that conforms to accepted principles, tests or standards of nationally recognized technical or scientific authorities.

[RP] ACCESS COVER. A removable plate, usually secured by bolts or screws, to permit access to a pipe or pipe fitting for the purposes of inspection, repair or cleaning.

[RE] ACCESSIBLE. Signifies access that requires the removal of an access panel or similar removable obstruction. For energy purposes, *accessible* means admitting close approach as a result of not being guarded by locked doors, elevation or other effective means (see "*accessible, readily*").

ACCESSORY BUILDING. A building that does not contain a sleeping room, the use of which is accessory to that of the dwelling, that is detached and located on the same lot as the dwelling and is roofed over with more than 50 percent of its exterior walls enclosed.

[RB] ACCESSORY STRUCTURE. A detached structure that is accessory to ~~and incidental to that of the *dwelling(s)* and that is located on the same *lot*.~~ the dwelling and not defined as an accessory building. Examples of accessory structures are fencing, decks, gazebos, arbors, retaining walls, barbecue pits, detached chimneys, playground equipment, yard art, docks, piers, etc.

[RP] ADAPTER FITTING. An *approved* connecting device that suitably and properly joins or adjusts pipes and fittings that do not otherwise fit together**.**

[MP] AIR ADMITTANCE VALVE. A one-way valve designed to allow air into the plumbing drainage system where a negative pressure develops in the piping. This device shall close by gravity and seal the terminal under conditions of zero differential pressure (no flow conditions) and under positive internal pressure. The purpose of an air admittance valve is to provide a method of allowing air to enter the plumbing drainage system without the use of a vent extended to open air and to prevent *sewer* gases from escaping into a building.

[RG] AIR CONDITIONER, GAS-FIRED. A gas-burning, automatically operated *appliance* for supplying cooled air, dehumidified air, or both, or chilled liquid.

[RG] AIR CONDITIONING. The treatment of air so as to control simultaneously the temperature, humidity, cleanness and distribution of the air to meet the requirements of a *conditioned space*.

[RG] AIR, EXHAUST. Air being removed from any space or piece of *equipment* or *appliance* and conveyed directly to the atmosphere by means of openings or ducts. Relief air is classified as *exhaust air*.

[RG] AIR-HANDLING UNIT. A blower or fan used for the purpose of distributing supply air to a room, space or area.

[RB] AIR-IMPERMEABLE INSULATION. An insulation having an air permanence equal to or less than 0.02 L/s-m^2 at 75 Pa pressure differential ~~as~~ tested ~~in accordance~~ according to ~~with~~ ASTM E283 or E2178 at the thickness applied.

[RG] AIR, MAKEUP. Any combination of outdoor and transfer air intended to replace exhaust air and exfiltration.

[RM] AIR, OUTDOOR. Ambient air that enters a building through a ventilation system, through intentional openings for natural ventilation, or by infiltration.

[RM] AIR, TRANSFER. Air moved from one indoor space to another.

[RP] ALTERNATE ON-SITE NON-POTABLE WATER. Non-potable water from other than public utilities, on-site surface sources and subsurface natural freshwater sources. Examples of such water are gray water, on-site reclaimed water, collected rainwater, captured condensate and rejected water from reverse osmosis systems.

[RP] ALTERNATIVE ENGINEERED DESIGN. A plumbing system that performs in accordance with the intent of Chapters 29 through 33 and provides an equivalent level of performance for the protection of public health, safety and welfare. The system design is not specifically regulated by Chapters 29 through 33.

[RG] ANODELESS RISER. A transition assembly in which plastic *piping* is installed and terminated above ground outside of a building.

[RG] APPLIANCE, AUTOMATICALLY CONTROLLED. *Appliances* equipped with an automatic *burner* ignition and safety shut-off device and other automatic devices, that accomplish complete turn-on and shut-off of the gas to the *main burner* or *burners*, and graduate the gas supply to the *burner* or *burners*, but do not affect complete shut-off of the gas.

[RG] APPLIANCE, FAN-ASSISTED COMBUSTION. An *appliance* equipped with an integral mechanical means to either draw or force products of combustion through the combustion chamber or heat exchanger.

[RG] APPLIANCE, UNVENTED. An *appliance* designed or installed in such a manner that the products of combustion are not conveyed by a vent or *chimney* directly to the outside atmosphere.

[RG] APPLIANCE, VENTED. An *appliance* designed and installed in such a manner that all of the products of combustion are conveyed directly from the *appliance* to the outside atmosphere through an *approved chimney* or vent system.

[RP] AREA DRAIN. A receptacle designed to collect surface or storm water from an open area.

[RP] ASPIRATOR. A fitting or device supplied with water or other fluid under positive pressure that passes through an integral orifice or constriction, causing a vacuum. Aspirators are also referred to as suction apparatus, and are similar in operation to an ejector.

[RG] ATMOSPHERIC PRESSURE. The pressure of the weight of air and water vapor on the surface of the earth, approximately 14.7 pounds per square inch (psia) (101 kPa absolute) at sea level.

ATTIC STORAGE. A floored area, regardless of size, within an attic space that is served by an attic access.

Exception: A floor walkway not less than 24 inches (610 mm) wide or greater than 48 inches (1219 mm) wide that serves as an access for the service of utilities or equipment, and a level service space not less than 30 inches (762 mm) deep or greater than 48 inches (1219 mm) deep and not less than 30 inches (762 mm) wide or greater than 48 inches (1219 mm) wide at the front or service side of the appliance, shall not be considered as attic storage. Such floored area shall be labeled at the attic access opening, "NOT FOR STORAGE." The lettering shall be a minimum of 2 inches (51 mm) in height.

[RG] AUTOMATIC IGNITION. Ignition of gas at the *burner(s)* when the gas controlling device is turned on, including reignition if the flames on the *burner(s)* have been extinguished by means other than by the closing of the gas controlling device.

[RP] BACKFLOW CONNECTION. Any arrangement whereby backflow is possible.

[MP] BACKWATER VALVE. ~~A device installed in a drain or pipe to prevent backflow of sewage.~~ A device or valve installed in the *building drain* or *sewer* pipe where a *sewer* is subject to backflow, and that prevents drainage or waste from backing up into a lower level or fixtures and causing a flooding condition.

BALCONY, EXTERIOR. An exterior floor projecting from and supported by a structure without additional independent supports.

[RG] BAROMETRIC DRAFT REGULATOR. A balanced *damper* device attached to a *chimney*, vent *connector*, breeching or flue gas manifold to protect combustion *appliances* by controlling *chimney draft*. A double-acting *barometric draft regulator* is one whose balancing *damper* is free to move in either direction to protect combustion *appliances* from both excessive *draft* and backdraft.

BASE FLOOD ELEVATION (BFE) The elevation of surface water resulting from a flood that has a 1% chance of equaling or exceeding that level in any given year.

[RB] BASIC WIND SPEED. Three-second gust speed at 33 feet (10 058 mm) above the ground in Exposure C (see Section R301.2.1) as given in ~~Figure~~ Table R301.2(4) and R301.2(5).

[RM] BATHROOM. A room containing a bathtub, shower, spa or similar bathing fixture (see also "Toilet room.").

[RP] BATTERY OF FIXTURES. Any group of two or more similar adjacent fixtures that discharge into a common horizontal waste or soil branch.

BED AND BREAKFAST HOME. A detached single-family *dwelling* occupied by the *dwelling* owner and containing eight or fewer guest rooms for rent for a period of less than one week.
BEDROOM. *Sleeping room*.
BOAT SLIP. A berthing place for one or two watercraft where the watercraft can be securely moored to cleats, piling, or other devices while the boats are in the water. Boat slips are commonly configured as "side-ties" or as single- or double-loaded "U" shaped berths.

[RG] BOILER, LOW-PRESSURE. A self-contained *appliance* for supplying steam or hot water.

Hot water heating boiler. A boiler in which no steam is generated, from which hot water is circulated for heating purposes and then returned to the boiler, and that operates at water pressures not exceeding 160 pounds per square inch gauge (psig) (1100 kPa gauge) and at water temperatures not exceeding 250°F (121°C) at or near the boiler outlet.

Hot water supply boiler. A boiler, completely filled with water, which furnishes hot water to be used externally to itself, and that operates at water pressures not exceeding 160 psig (1100 kPa gauge) and at water temperatures not exceeding 250°F (121°C) at or near the boiler outlet.

Steam heating boiler. A boiler in which steam is generated and that operates at a steam pressure not exceeding 15 psig (100 kPa gauge).

[RG] BONDING JUMPER. A conductor installed to electrically connect metallic gas *piping* to the grounding electrode system.

[MP] BRANCH INTERVAL. ~~A vertical measurement of distance, 8 feet (2438 mm) or more in *developed length*, between the connections of *horizontal* branches to a drainage stack. Measurements are taken down the stack from the highest *horizontal* branch connection.~~ A distance along a soil or waste stack corresponding, in general, to a story height, but not less than 8 feet (2438 mm) within which the horizontal branches from one floor or story of a structure are connected to the stack. Measurements are taken down the stack from the highest horizontal branch connection.

[RM] BRAZED JOINT. A gas-tight joint obtained by the joining of metal parts with metallic mixtures or alloys that melt at a temperature above 1,000ºF (538ºC), but lower than the melting temperature of the parts to be joined.

[RG] BRAZING. A metal-joining process wherein coalescence is produced by the use of a nonferrous filler metal having a melting point above 1,000°F (538°C), but lower than that of the base metal being joined. The filler material is distributed between the closely fitted surfaces of the joint by capillary action.

BREAKAWAY WALL A wall that is not part of the structural support of the building and is intended through its design and construction to collapse under specific lateral loading forces, without causing damage to the elevated portion of the building or supporting foundation system. Any walls below the lowest floor in a building in a V Zone should give way under wind and water loads without causing collapse, displacement, or other damage to the elevated portion of the building or the supporting pilings or columns.

[RG] BROILER. A general term including salamanders, barbecues and other appliances cooking primarily by radiated heat, excepting toasters.

[RG] BTU. Abbreviation for British thermal unit, which is the quantity of heat required to raise the temperature of 1 pound (454 g) of water 1°F (0.56°C) (1 *Btu* = 1055 J).

[RB] BUILDING. Any one- or two-family dwelling or *townhouse*, or portion thereof, used or intended to be used for human habitation, for living, sleeping, cooking or eating purposes, or any combination thereof, or any *accessory* ~~structure~~ *building*. For the definition applicable in Chapter 11, see Section N1101.6.

[MP] BUILDING DRAIN. The lowest piping that collects the discharge from all other drainage piping inside the house and extends ~~30 inches (762 mm) in *developed length* of pipe, beyond the~~ to 10 feet (3048 mm) beyond the exterior walls of the building and conveys the drainage to the *building sewer*.

Exception: Drain lines connecting to septic tanks within 25 feet (7620 mm) of the building foundation wall for one- and two-family dwellings with 4 water closets or less shall be considered to be building drain with a minimum size of 3 inches (76.2 mm).

[MP] BUILDING SEWER. That part of the drainage system that extends from the end of the *building drain* and conveys its discharge to a public sewer, private sewer, individual sewage-disposal system or other point of disposal.

Sanitary. A *building sewer* that conveys sewage only.
Storm. A *building sewer* that conveys storm water or other drainage, but not sewage.
[RP] BUILDING SUBDRAIN. That portion of a drainage system that does not drain by gravity into the *building sewer*.

[RG] BURNER. A device for the final conveyance of the gas, or a mixture of gas and air, to the combustion zone.

Induced-draft. A *burner* that depends on *draft* induced by a fan that is an integral part of the *appliance* and is located downstream from the *burner*.

Power. A *burner* in which gas, air or both are supplied at pressures exceeding, for gas, the line pressure, and for air, atmospheric pressure, with this added pressure being applied at the *burner*.

[RG] CHIMNEY. A primary vertical structure containing one or more flues, for the purpose of carrying gaseous products of combustion and air from a fuel-burning *appliance* to the outside atmosphere.

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

Masonry chimney. A field-constructed chimney composed of solid masonry units, bricks, stones or concrete.

[RP] CISTERN. A small covered tank for storing water for a home or farm. Generally, this tank stores rainwater to be utilized for purposes other than in the potable water supply, and such tank is placed underground in most cases.

[RG] CLEARANCE. The minimum distance through air measured between the heat-producing surface of the mechanical *appliance*, device or *equipment* and the surface of the *combustible material* or assembly.

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

[RG] CLOTHES DRYER. An *appliance* used to dry wet laundry by means of heated air.

Type 1. Factory-built package, multiple production. Primarily used in the family living environment. Usually the smallest unit physically and in function output.

COASTAL HIGH HAZARD AREA. An area of special flood hazard extending from offshore to the inland limit of a primary frontal dune along an open coast and any other area subject to high velocity wave action from storms or seismic sources. The coastal high hazard area is identified as either V Zone or Coastal A Zone on Flood Insurance Rate Maps (FIRMs).

[RG] CODE. These regulations, subsequent amendments thereto, or any emergency rule or regulation that the administrative authority having *jurisdiction* has lawfully adopted.

CODE OFFICIAL. The officer or other designated authority charged with the administration and enforcement of this code, or a duly authorized representative.

[RP] COMBINATION FIXTURE. A fixture combining one sink and laundry tray or a two- or three-compartment sink or laundry tray in one unit.

[RG] COMBUSTIBLE ASSEMBLY. Wall, floor, ceiling or other assembly constructed of one or more component materials that are not defined as noncombustible.

[RG] COMBUSTION. In the context of this code, refers to the rapid oxidation of fuel accompanied by the production of heat or heat and light.

[RG] COMBUSTION AIR. Air necessary for complete combustion of a fuel, including theoretical air and excess air.

[RG] COMBUSTION CHAMBER. The portion of an *appliance* within which combustion occurs.

[RG] COMBUSTION PRODUCTS. Constituents resulting from the combustion of a fuel with the oxygen of the air, including the inert gases, but excluding excess air.

[MP] COMMON VENT. ~~A single pipe venting two trap arms within the same *branch interval*, either back-to-back or one above the other.~~ A vent connecting at the junction of two *fixture drains* or to a fixture *branch* and serving as a vent for both fixtures.

[RG] CONCEALED LOCATION. A location that cannot be accessed without damaging permanent parts of the building structure or finish surface. Spaces above, below or behind readily removable panels or doors shall not be considered as concealed.

[RG] CONCEALED PIPING. *Piping* that is located in a *concealed location* (see "*Concealed location*").

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

[RG] CONNECTOR, APPLIANCE (Fuel). Rigid metallic *pipe* and fittings, semirigid metallic *tubing* and fittings or a *listed* and *labeled* device that connects an *appliance* to the *gas piping system*.

[RG] CONNECTOR, CHIMNEY OR VENT. The *pipe* that connects an *appliance* to a chimney or vent.

[MP] CONTAMINATION. A ~~high-hazard or health~~ hazard impairment of the quality of the potable water that creates an actual hazard to the public health through poisoning or through the spread of disease by sewage, industrial fluids or waste.

[RG] CONTROL. A manual or automatic device designed to regulate the gas, air, water or electrical supply to, or operation of, a mechanical system.

[RG] CONVERSION BURNER. A unit consisting of a *burner* and its *controls* for installation in an *appliance* originally utilizing another fuel.

[RG] COPPER ALLOY. A homogeneous mixture of not less than two metals where not less than 50 percent of the finished metal is copper.

CORROSION RESISTANCE AREA. Areas within hurricane prone regions defined as that area east of the Intracoastal Waterway from the NC/SC state line north to Beaufort Inlet and from that point to include the barrier islands to the NC/VA state line.

[RP] CRITICAL LEVEL (C-L). An elevation (height) reference point that determines the minimum height at which a backflow preventer or vacuum breaker is installed above the *flood level rim* of the fixture or receptor served by the device. The critical level is the elevation level below which there is a potential for backflow to occur. If the critical level marking is not indicated on the device, the bottom of the device shall constitute the critical level.

[MP] CROSS CONNECTION. ~~Any connection between two otherwise separate piping systems that allows a flow from one system to the other.~~ Any physical connection or arrangement between two otherwise separate piping systems, one of which contains potable water and the other either water of unknown or questionable safety or steam, gas or chemical, whereby there exists the possibility for flow from one system to the other, with the direction of flow depending on the pressure differential between the two systems (see "Backflow").

[RG] CUBIC FOOT. The amount of gas that occupies 1 cubic foot (0.02832 m^3) when at a temperature of 60°F (16°C), saturated with water vapor and under a pressure equivalent to that of 30 inches of mercury (101 kPa).

[RG] DAMPER. A manually or automatically controlled device to regulate *draft* or the rate of flow of air or combustion gases.

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

DEAD END. A *branch* leading from a soil, waste or vent pipe; a *building drain*; or a *building sewer*, and terminating at a *developed length* of 2 feet (610 mm) or more by means of a plug, cap or other closed fitting.

DECK. An exterior floor system supported on at least two opposing sides by an adjoining structure or posts, piers, or other independent supports.

[RG] DECORATIVE APPLIANCE, VENTED. A *vented appliance* wherein the primary function lies in the aesthetic effect of the flames.

[RG] DECORATIVE APPLIANCES FOR INSTALLATION IN VENTED FIREPLACES. A *vented appliance* designed for installation within the fire chamber of a vented *fireplace*, wherein the primary function lies in the aesthetic effect of the flames.

[RG] DEMAND. The maximum amount of gas input required per unit of time, usually expressed in cubic feet per hour, or *Btu*/h (1 *Btu*/h = 0.2931 W).

[RG] DESIGN FLOOD ELEVATION. The elevation of the "design flood," including wave height, relative to the datum specified on the community's legally designated flood hazard map. In areas designated as Zone AO, the *design flood elevation* shall be the elevation of the highest existing grade of the *building's* perimeter plus the depth number (in feet) specified on the flood hazard map. In areas designated as Zone AO where a depth number is not specified on the map, the depth number shall be taken as being equal to 2 feet (610 mm).

[RM] DESIGN WORKING PRESSURE. The maximum allowable working pressure for which a specific part of a system is designed.

[RP] DISCHARGE PIPE. A pipe that conveys the discharge from plumbing fixtures or appliances.

[RM] DISCRETE PRODUCT. Products that are noncontinuous, individual, distinct pieces such as, but not limited to, electrical, plumbing and mechanical products and duct straps, duct fittings, duct registers and pipe hangers.

DOCK. A structure extending alongshore or out from the shore into a body of water, usually accommodating multiple boat slips, to which boats may be moored in order to load or unload people or cargo.

[MP] DRAINAGE FITTING. ~~A pipe fitting designed to provide connections in the drainage system that have provisions for establishing the desired slope in the system. These fittings are made from a variety of both metals and plastics. The methods of coupling provide for required slope in the system.~~ The type of fitting or fittings utilized in the drainage system. Drainage fittings are similar to cast-iron fittings, except that instead of having a bell and spigot, drainage fittings are recessed and tapped to eliminate ridges on the inside of the installed pipe.

[RP] DRAINAGE SYSTEM. Piping within a *public* or *private* premise that conveys sewage, rainwater or other liquid waste to a point of disposal. A drainage system does not include the mains of a *public sewer* system or a private or public sewage treatment or disposal plant.

Building gravity. A drainage system that drains by gravity into the *building sewer*.

Sanitary. A drainage system that carries sewage and excludes storm, surface and ground water.

Storm. A drainage system that carries rainwater, surface water, subsurface water and similar liquid waste.

[RG] DRIP. The container placed at a low point in a system of *piping* to collect *condensate* and from which the *condensate* is removable.

[RG] DUCT FURNACE. A warm-air *furnace* normally installed in an air distribution duct to supply warm air for heating. This definition shall apply only to a warm-air heating *appliance* that depends for air circulation on a blower not furnished as part of the *furnace*.

[RM] DUCTLESS MINI-SPLIT SYSTEM. A heating and cooling system that is comprised of one or multiple indoor evaporator/air-handling units and an outdoor condensing unit that is connected by refrigerant piping and electrical wiring. A ductless mini-split system is capable of cooling or heating one or more rooms without the use of a traditional ductwork system.

DURHAM FITTING. A special type of drainage fitting for use in the durham systems installations in which the joints are made with recessed and tapered threaded fittings, as opposed to bell and spigot lead/oakum or solvent/cemented or soldered joints. The tapping is at an angle (not 90 degrees) to provide for proper slope in otherwise rigid connections.

DURHAM SYSTEM. A term used to describe soil or waste systems where all piping is of threaded pipe, tube or other such rigid construction using recessed drainage fittings to correspond to the types of piping.

[RB] DWELLING. Any building that contains one or two *dwelling units* (duplex) on the same parcel of land, used, intended, or designed to be built, used, rented, leased, let or hired out to be occupied, or that are occupied for living purposes.

[RB] DWELLING UNIT. A single unit providing complete independent living facilities for ~~one or more persons~~ a single family, including permanent provisions for living, sleeping, eating, cooking and sanitation. For the definition applicable in Chapter 11, see Section N1101.6.

EGRESS ROOF ACCESS WINDOW. A skylight or roof window designed and installed to satisfy the emergency escape and rescue opening requirements in Section R310.2.

[RM] ELECTRIC HEATING APPLIANCE. An *appliance* that produces heat energy to create a warm environment by the application of electric power to resistance elements, refrigerant compressors or dissimilar material junctions.

[RM] ENERGY RECOVERY VENTILATION SYSTEM. Systems that employ air-to-air heat exchangers to recover energy from or reject energy to *exhaust air* for the purpose of preheating, pre-cooling, humidifying or dehumidifying outdoor *ventilation air* prior to supplying such air to a space, either directly or as part of an HVAC system.

[RM] ENVIRONMENTAL AIR. Air that is conveyed to or from occupied areas through ducts that are not part of the heating or air-conditioning system, such as ventilation for human usage, domestic kitchen range exhaust, bathroom exhaust, domestic clothes dryer exhaust and parking garage exhaust.

[RM]EQUIPMENT, EXISTING. Any *equipment* regulated by this code which was legally installed prior to the effective date of this code, or for which a permit to install has been issued.

[RG] EXCESS FLOW VALVE (EFV). A valve designed to activate when the fuel gas passing through it exceeds a prescribed flow rate.

[RM] EXFILTRATION. Uncontrolled outward air leakage from conditioned spaces through unintentional openings in ceilings, floors and walls to unconditioned spaces or the outdoors caused by pressure differences across these openings resulting from wind, the stack effect created by temperature differences between indoors and outdoors, and imbalances between supply and exhaust airflow rates.

[RM] EXHAUST SYSTEM. An assembly of connected ducts, *plenums*, fittings, registers, grilles and hoods through which air is conducted from the space or spaces and exhausted to the outdoor atmosphere.

[RG] EXTERIOR MASONRY CHIMNEYS. Masonry chimneys exposed to the outdoors on one or more sides below the roof line.

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

FARM BUILDING. Any building not used for sleeping purposes that is not accessed by the general public and is used primarily for a farm purpose. Farm purposes includes structures or buildings for equipment, storage and processing of agricultural products or commodities such as: crops, fruits, vegetables, ornamental or flowering plants, dairy, timber, livestock, poultry and all other such forms of agricultural products by the specific farm on which the structure or building is located. Farm purposes do not include structures or buildings for uses such as education facilities, research facilities, or aircraft hangers.

[RP] FAUCET. A valve end of a water pipe through which water is drawn from or held within the pipe.

[RP] FILL VALVE. A water supply valve, opened or closed by means of a float or similar device, utilized to supply water to a tank. An antisiphon fill valve contains an antisiphon device in the form of an *approved air gap* or vacuum breaker that is an integral part of the fill valve unit and that is positioned on the discharge side of the water supply control valve.

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

[MP] FIXTURE BRANCH, DRAINAGE. A drain serving two or more fixtures that discharges into another ~~portion of the drainage system.~~ drain or to a *stack*.

[MP] FIXTURE SUPPLY. The water-supply pipe connecting a fixture or fixture fitting to a ~~fixture branch.~~ *branch* water supply pipe or directly to a main water supply pipe branch.

[RG] FLAME SAFEGUARD. A device that will automatically shut off the fuel supply to a *main burner* or group of *burners* when the means of ignition of such *burners* becomes inoperative, and when flame failure occurs on the *burner* or group of *burners*.

[RG] FLASHBACK ARRESTOR CHECK VALVE. A device that will prevent the backflow of one gas into the supply system of another gas and prevent the passage of flame into the gas supply system.

FLOOD HAZARD AREA. For definition, see Section R322.

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

[RG] FLOOR FURNACE. A completely self-contained *furnace* suspended from the floor of the space being heated, taking air for combustion from outside such space and with means for observing flames and lighting the *appliance* from such space.

Fan type. A floor furnace equipped with a fan that provides the primary means for circulating air.

Gravity type. A floor furnace depending primarily on circulation of air by gravity. This classification shall also include floor furnaces equipped with booster-type fans that do not materially restrict free circulation of air by gravity flow when such fans are not in operation.

[RM] FLUE CONNECTION (BREECHING). A passage for conducting the products of *combustion* from a fuel-fired *appliance* to the vent or *chimney* (see also *Chimney connector* and *Vent connector*).

[RG] FLUE LINER (LINING). A system or material used to form the inside surface of a flue in a *chimney* or vent, for the purpose of protecting the surrounding structure from the effects of *combustion products* and for conveying *combustion products* without leakage to the atmosphere.

[MP] FLUSHOMETER VALVE. ~~A flushometer valve is a device that discharges a predetermined quantity of water to fixtures for flushing purposes and is actuated by direct water pressure.~~ A valve attached to a pressurized water supply pipe and so designed that when activated it opens the line for direct flow into the fixture at a rate and quantity to operate the fixture properly, and then gradually closes to reseal fixture traps and avoid water hammer.

[RG] FUEL GAS. A natural gas, manufactured gas, *liquefied petroleum gas* or mixtures of these gases.

[RM] FUEL OIL. Kerosene or any hydrocarbon oil having a flash point not less than 100ºF (38ºC).

[RM] FUEL-OIL PIPING SYSTEM. A closed piping system that connects a combustible liquid from a source of supply to a fuel-oil-burning *appliance*.

[RG] FURNACE, CENTRAL. A self-contained *appliance* for heating air by transfer of heat of *combustion* through metal to the air, and designed to supply heated air through ducts to spaces remote from or adjacent to the *appliance* location.

[RG] FURNACE, ENCLOSED. A specific heating, or heating and ventilating, furnace incorporating an integral total enclosure and using only outside air for combustion.

[RG] FURNACE PLENUM. An air compartment or chamber to which one or more ducts are connected and that forms part of an air distribution system.

[RM] FURNACE ROOM. A room primarily utilized for the installation of fuel-burning, space-heating and water-heating *appliances* other than boilers (see also *Boiler room*).

[RM] FUSIBLE PLUG. A device arranged to relieve pressure by operation of a fusible member at a predetermined temperature.

[RG] GAS CONVENIENCE OUTLET. A permanently mounted, manually operated device that provides the means for connecting an *appliance* to, and disconnecting an *appliance* from, the supply *piping*. The device includes an integral, manually operated valve with a nondisplaceable valve member and is designed so that disconnection of an *appliance* only occurs when the manually operated valve is in the closed position.

[RG] GAS PIPING. An installation of pipe, valves or fittings installed on a premises or in a building and utilized to convey fuel gas.

HAZARDOUS LOCATION, GLAZING. See Section R308.4.

[RM] HEAT TRANSFER LIQUID. The operating or thermal storage liquid in a mechanical system, including water or other liquid base, and additives at the concentration present under operating conditions used to move heat from one location to another. Refrigerants are not included as heat transfer liquids.

[RM] HOOD, FULL OPENING. An exhaust hood with an opening not less than the diameter of the connecting vent.

[MP] HORIZONTAL BRANCH, DRAINAGE. ~~A drain pipe extending laterally from a soil or waste stack or *building drain*, that receives the discharge from one or more *fixture drains*.~~ A drainage *branch* pipe extending laterally from a soil or waste *stack* or *building drain*, with or without vertical sections or *branches*, that receives the discharge from two or more *fixture drains* or *branches* and conducts the discharge to the soil or waste *stack* or to the *building drain*.

[RG] HOUSE PIPING. See *"Piping system."*

HUMIDISTAT. A regulatory device, actuated by changes in humidity, used for automatic control of relative humidity.

[RG] IGNITION PILOT. A *pilot* that operates during the lighting cycle and discontinues during *main burner* operation.

[RP] INDIRECT WASTE RECEPTOR. A plumbing fixture designed to collect and dispose of liquid waste from other plumbing fixtures, plumbing equipment or appliances that are required to discharge to the drainage system through an air gap. The following types of fixtures fall within the classification of indirect liquid waste receptors: floor sinks, mop receptors, service sinks and standpipe drains with integral air gaps.

[MP] INDIVIDUAL VENT. A pipe installed to vent a single *fixture* ~~*drain*~~ trap that connects with the vent system above ~~or terminates independently outside the building.~~ the fixture served or terminates in the open air.

[MP] INDIVIDUAL WATER SUPPLY. ~~A supply other than an *approved* public water supply that serves one or more families.~~ A water supply that serves one or more families, and that is not an *approved* public water supply.

[RG] INFRARED RADIANT HEATER. A heater that directs a substantial amount of its energy output in the form of infrared radiant energy into the area to be heated. Such heaters are of either the vented or unvented type.

[RM] INTERLOCK. A device actuated by another device with which it is directly associated, to govern succeeding operations of the same or allied devices. A circuit in which a given action cannot occur until after one or more other actions have taken place.

[RP] JOINT.

Expansion. A loop, return bend or return offset that provides for the expansion and contraction in a piping system and is utilized in tall buildings or where there is a rapid change of temperature, as in power plants, steam rooms and similar occupancies.

Flexible. Any joint between two pipes that permits one pipe to be deflected or moved without movement or deflection of the other pipe.

Mechanical. See "Mechanical joint."

Slip. A type of joint made by means of a washer or a special type of packing compound in which one pipe is slipped into the end of an adjacent pipe.

[RM] JOINT, FLANGED. A joint made by bolting together a pair of flanged ends.

[RG] JOINT, FLARED. A metal-to-metal compression joint in which a conical spread is made on the end of a tube that is compressed by a flare nut against a mating flare.

[RG] JOINT, MECHANICAL. A general form of gastight joints obtained by the joining of metal parts through a positive-holding mechanical construction, such as a press-connect joint, flanged joint, threaded joint, flared joint or compression joint.

[RG] JOINT, PLASTIC ADHESIVE. A joint made in thermoset plastic *piping* by the use of an adhesive substance that forms a continuous bond between the mating surfaces without dissolving either one of them.

[RM] JOINT, PLASTIC HEAT FUSION. A joint made in thermoplastic piping by heating the parts sufficiently to permit fusion of the materials when the parts are pressed together.

[RM] JOINT, PLASTIC SOLVENT CEMENT. A joint made in thermoplastic piping by the use of a solvent or solvent cement that forms a continuous bond between the mating surfaces.

[RM] JOINT, SOLDERED. A gas-tight joint obtained by the joining of metal parts with metallic mixtures of alloys that melt at temperatures between 400ºF (204ºC) and 1,000ºF (538ºC).

[RM] JOINT, WELDED. A gas-tight joint obtained by the joining of metal parts in molten state.

[RB] LABELED. Equipment, appliances, materials or products to which have been affixed a *label*, seal, symbol or other identifying *mark* of a nationally recognized testing laboratory, *approved* inspection agency or other organization as approved by the North Carolina Building Code Council concerned with product evaluation that maintains periodic inspection of the production of such *labeled* items and whose labeling indicates either that the *equipment*, appliances, material or product meets identified standards or has been tested and found suitable for a specified purpose. For the definition applicable in Chapter 11, see Section N1101.6.

LAUNDRY TRAY. a fixed tub with running water and drainpipe for washing clothes and other household linens, also called set tub.

LAVATORY. A hand-washing plumbing fixture located in a bathroom, or toilet room.

[RP] LEAD-FREE PIPE AND FITTINGS. Containing not more than a weighted average of ~~8.0~~ 0.25-percent lead when used with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures.

[RP] LEAD-FREE SOLDER AND FLUX. Containing not more than 0.2-percent lead**.**

[RP] LEADER. An exterior drainage pipe for conveying storm water from roof or gutter drains to an *approved* means of disposal.

[RG] LIQUEFIED PETROLEUM GAS or LPG (LP-GAS). *Liquefied petroleum gas* composed predominately of propane, propylene, butanes or butylenes, or mixtures thereof that is gaseous under normal atmospheric conditions, but is capable of being liquefied under moderate pressure at normal temperatures.

[RG] LEAK CHECK. An operation performed on a gas *piping system* to verify that the system does not leak.

[RB] LISTED. Equipment, appliances, materials, products or services included in a list published by an organization acceptable to the code official and concerned with evaluation of products or services that maintains periodic inspection of production of *listed equipment* or materials or periodic evaluation of services and whose listing states either that the *equipment*, appliances, material, product or service meets identified standards or has been tested and found suitable for a specified purpose. For the definition applicable in Chapter 11, see Section N1101.6

[RB] LIVE/WORK UNIT. A *dwelling unit* ~~or sleeping unit in which a significant portion of the space includes a non-residential use that is operated by the tenant.~~ in which more than 10 percent and less than 50 percent of the space includes a nonresidential use that is operated by the tenant.

[RG] LOG LIGHTER. A manually operated solid-fuel ignition *appliance* for installation in a vented solid-fuel-burning *fireplace*.

[RM] LOW-PRESSURE HOT-WATER-HEATING BOILER. A boiler furnishing hot water at pressures not exceeding 160 psi (1103 kPa) and at temperatures not exceeding 250ºF (121ºC).

[RM] LOW-PRESSURE STEAM-HEATING BOILER. A boiler furnishing steam at pressures not exceeding 15 psi (103 kPa).

LOWEST FLOOR. The lowest floor of the lowest enclosed area (including basement). An unfinished or flood-resistant enclosure, usable solely for parking of vehicles, building access or storage in an area other than a basement area is not considered a building's lowest floor, provided that unenclosed areas below the lowest floor of elevated buildings be free of obstructions and that enclosed areas be enclosed by open lattice-work, insect screening or non-supporting breakaway walls in accordance with the National Flood Insurance Program located in *coastal high hazard areas*.

[RG] MAIN BURNER. A device or group of devices essentially forming an integral unit for the final conveyance of gas or a mixture of gas and air to the combustion zone, and on which combustion takes place to accomplish the function for which the *appliance* is designed.

[RE] MANUAL. Capable of being operated by personal intervention For the definition applicable in Chapter 11, see Section N1101.6.

METER. The instrument installed to measure the volume of gas delivered through it or a measuring device used to collect data and indicate water usage.

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

[RG] MODULATING. Modulating or throttling is the action of a *control* from its maximum to minimum position in either predetermined steps or increments of movement as caused by its actuating medium.

[RM] NATURAL VENTILATION. The movement of air into and out of a space through intentionally provided openings, such as windows and doors, or through nonpowered ventilators.

[RM] OCCUPIABLE SPACE. An enclosed space intended for human activities, excluding those spaces intended primarily for other purposes, such as storage rooms and *equipment* rooms, that are only intended to be occupied occasionally and for short periods of time.

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

[RG] OFFSET (VENT). A combination of *approved* bends that make two changes in direction bringing one section of the vent out of line, but into a line parallel with the other section.

[RM] OUTDOOR AIR. Air taken from the outdoors, and therefore not previously circulated through the system.

[RM] OUTDOOR OPENING. A door, window, louver or skylight openable to the outdoor atmosphere.

[RG] OUTLET. The point at which a gas-fired *appliance* connects to the gas *piping system*.

[RG] OXYGEN DEPLETION SAFETY SHUTOFF SYSTEM (ODS). A system designed to act to shut off the gas supply to the main and *pilot burners* if the oxygen in the surrounding atmosphere is reduced below a predetermined level.

[RM] PANEL HEATING. A method of radiant space heating in which heat is supplied by large heated areas of room surfaces. The heating element usually consists of warm water piping, warm air ducts, or electrical resistance elements embedded in or located behind ceiling, wall or floor surfaces.

PIER. An elevated deck structure, usually pile supported, extending out into the water from the shore.

[RG] PILOT. A small flame that is utilized to ignite the gas at the *main burner* or *burners*.

PIPE SIZES. For the purposes of determining the minimum size of pipe required, cross-sectional areas are the essential characteristic, not the pipe diameter. When the Code instructs to "increase by one pipe size," some pipe sizes may not be commercially available. The following pipe sizes are presumed to be commercially available: 1/2, 3/4, 1, 1-1/4, 1-1/2, 2, 2-1/2, 3, 3-1/2, 4, 4-1/2, 5, 6, 7, 8, 9, 10.

[RG] PIPING. Where used in this code, *"piping"* refers to either *pipe* or *tubing*, or both.

Pipe. A rigid conduit of iron, steel, copper, copper-alloy or plastic.

Tubing. Semirigid conduit of copper, copper-alloy, aluminum, plastic or steel.

[RG] PIPING SYSTEM. The fuel *piping*, valves and fittings from the outlet of the *point of delivery* to the outlets of the *appliance* shutoff valves.

PLANS. Construction documents.

[RG] PLASTIC, THERMOPLASTIC. A plastic that is capable of being repeatedly softened by increase of temperature and hardened by decrease of temperature.

[RM] PLENUM. An enclosed portion of the building structure, other than an *occupiable space* being conditioned, that is designed to allow air movement, and thereby serve as part of an air distribution system.

[MP] PLUMBING. The practice, materials and fixtures utilized in the installation, maintenance, extension and alteration of all piping, fixtures, plumbing appliances and plumbing appurtenances, within or adjacent to any structure, in connection with sanitary drainage or storm drainage facilities; venting systems; and public or private water supply systems. For the purpose of this code, plumbing refers to those installations, repairs, maintenance and *alterations* regulated by Chapters 25 through 33.

[MP] PLUMBING APPLIANCE. An energized household *appliance* with plumbing connections, such as a dishwasher, food waste disposer, clothes washer or water heater. These devices have their operation or control dependent on one or more energized components, such as motors, controls or heating elements. Such devices are manually adjusted or controlled by the owner or operator, or are operated automatically through one or more of the following actions: a time cycle, a temperature range, a pressure range, a measured volume or weight.

[MP] PLUMBING APPURTENANCE. ~~A device or assembly that is an adjunct to the basic plumbing system and does not demand additional water supply or add any discharge load to the system. It is presumed that it performs some useful function in the operation, maintenance, servicing, economy or safety of the plumbing system.~~ A manufactured device, prefabricated assembly or on-the-job assembly of component parts that is an adjunct to the basic piping system and plumbing fixtures. An appurtenance demands no additional water supply and does not add any discharge load to a fixture or to the drainage system. Examples include filters, relief valves and aerators.

[MP] PLUMBING FIXTURE. ~~A receptacle or device that is connected to a water supply system or discharges to a drainage system or both. Such receptacles or devices require a supply of water; or discharge liquid waste or liquid borne solid waste; or require a supply of water and discharge waste to a drainage system~~. A receptacle or device that is either permanently or temporarily connected to the water distribution system of the premises and demands a supply of water therefrom; or discharges wastewater, liquid-borne waste materials or sewage either directly or indirectly to a drainage system of the premises; or requires both a water supply connection and a discharge to the drainage system of the premises.

[RG] POINT OF DELIVERY. For natural gas systems, the *point of delivery* is the outlet of the service meter assembly or the outlet of the service regulator or service shutoff valve where a meter is not provided. Where a system shutoff valve is provided after the outlet of the service meter assembly, such valve shall be considered to be downstream of the *point of delivery*. For undiluted liquefied petroleum gas systems, the *point of delivery* shall be considered to be the outlet of the first regulator that reduces pressure.

[MP] POLLUTION. ~~A low-hazard or nonhealth-hazard~~ An impairment of the quality of the potable water to a degree that does not create a hazard to the public health and that does adversely and unreasonably affect the aesthetic qualities of such potable water for domestic use.

[MP] POTABLE WATER. Water free from impurities present in amounts sufficient to cause disease or harmful physiological effects and conforming in bacteriological and chemical quality of the Public Health Service Drinking Water Standards or to the ~~requirements~~ regulations of the public health authority having *jurisdiction*.

[RG] PRESSURE DROP. The loss in pressure due to friction or obstruction in pipes, valves, fittings, *regulators* and *burners*.

[RM] PRESSURE RELIEF DEVICE. A pressure-actuated valve or rupture member designed to relieve excessive pressure automatically.

[RG] PRESSURE TEST. An operation performed to verify the gastight integrity of *gas piping* following its installation or modification.

PRIMARY STRUCTURAL FRAME. The primary structural frame shall include all of the following structural members:

1. The columns.
2. Structural members having direct connections to the columns, including girders, beams, trusses and spandrels.
3. Members of the floor construction and roof construction having direct connections to the columns.
4. Members that are essential to the vertical stability of the *primary structural frame* under gravity loading.

PRIVATE POND. A body of water owned entirely by a single property owner and located on the same parcel of land as a detached single-family dwelling.

[RM] PROTECTIVE ASSEMBLY (REDUCED CLEARANCE). Any noncombustible assembly that is *labeled* or constructed in accordance with Table M1306.2 and is placed between combustible materials or assemblies and mechanical *appliances*, devices or *equipment*, for the purpose of reducing required airspace *clearances*. Protective assemblies attached directly to a combustible assembly shall not be considered as part of that combustible assembly.

[MP] PUSH-FIT ~~FITTING~~ JOINTS. ~~A mechanical fitting that joins pipes or tubes and achieves a seal by mating the pipe or tube into the fitting.~~ A type of mechanical joint consisting of elastomeric seals and corrosion-resistant tube grippers. Such joints are permanent or removable depending on the design.

[RM] RADIANT HEATER. A heater designed to transfer heat primarily by direct radiation.

[RP] RAINWATER. Water from natural precipitation.

[RP] REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTION ASSEMBLY. A backflow prevention device consisting of two independently acting check valves, internally force-loaded to a normally closed position and separated by an intermediate chamber (or zone) in which there is an automatic relief means of venting to the atmosphere, internally loaded to a normally open position between two tightly closing shutoff valves and with a means for testing for tightness of the checks and opening of the relief means.

[RB] REGISTERED DESIGN PROFESSIONAL. An individual who is registered or licensed to practice their respective design profession as defined by the statutory requirements of the professional registration laws of the state or *jurisdiction* in which the project is to be constructed. Design by a registered design professional is not required where exempt under North Carolina general statutes or licensure laws.

[RG] REGULATOR, LINE GAS PRESSURE. A device placed in a gas line between the *service pressure regulator* and the *appliance* for controlling, maintaining or reducing the pressure in that portion of the *piping system* downstream of the device.

[RG] REGULATOR, MEDIUM-PRESSURE (MP Regulator). A line *pressure regulator* that reduces gas pressure from the range of greater than 0.5 psig (3.4 kPa) and less than or equal to 5 psig (34.5 kPa) to a lower pressure.

[RG] REGULATOR, MONITORING. A pressure regulator set in series with another pressure regulator for the purpose of preventing an overpressure in the downstream piping system.

[RG] REGULATOR, PRESSURE. A device placed in a gas line for reducing, controlling and maintaining the pressure in that portion of the *piping system* downstream of the device.

[RG] REGULATOR, SERVICE PRESSURE. For natural gas systems, a device installed by the serving gas supplier to reduce and limit the service line pressure to delivery pressure. For undiluted liquefied petroleum gas systems, the regulator located upstream from all line gas pressure regulators, where installed, and downstream from any first stage or a high pressure regulator in the system.

[RG] RELIEF OPENING. The opening provided in a *draft hood* to permit the ready escape to the atmosphere of the flue products from the *draft hood* in the event of no *draft*, backdraft or stoppage beyond the *draft hood*, and to permit air into the *draft hood* in the event of a strong chimney updraft.

[RG] RELIEF VALVE (DEVICE). A safety valve designed to forestall the development of a dangerous condition by relieving either pressure, temperature or vacuum in the hot water supply system.

[RG] RELIEF VALVE, PRESSURE. An *automatic valve* that opens and closes a relief vent, depending on whether the pressure is above or below a predetermined value.

[RG] RELIEF VALVE, TEMPERATURE.

Manual reset type. A valve that automatically opens a *relief* vent at a predetermined temperature and that must be manually returned to the closed position.

Reseating or self-closing type. An *automatic valve* that opens and closes a relief vent, depending on whether the temperature is above or below a predetermined value.

[RP] RELIEF VENT. A vent whose primary function is to provide circulation of air between drainage and vent systems.

[RM] RETURN AIR SYSTEM. An assembly of connected ducts, *plenums*, fittings, registers and grilles through which air from the space or spaces to be heated or cooled is conducted back to the supply unit (see also *Supply air system*).

[RP] RIM. An unobstructed open edge of a fixture.

[RG] RISER, GAS. A vertical *pipe* supplying fuel gas.

[RG] ROOM HEATER, UNVENTED. See "*Unvented room heater*."

[RG] ROOM HEATER, VENTED. A free-standing heating unit used for direct heating of the space in and adjacent to that in which the unit is located. (See "*Vented room heater*.")

[RG] SAFETY SHUTOFF DEVICE. See "*Flame safeguard*."

SCREEN ENCLOSURE. A building or part thereof, in whole or in part self-supporting, and having walls of insect screening with or without removable vinyl or acrylic wind break panels 10 mil or less with a Class A Flame Spread, and a roof.

[RM] SELF-CONTAINED EQUIPMENT. Complete, factory-assembled and tested, heating, air-conditioning or refrigeration *equipment* installed as a single unit, and having all working parts, complete with motive power, in an enclosed unit of said machinery.

[RG] SERVICE METER ASSEMBLY. The meter, valve, regulator, piping, fittings and equipment installed by the service gas supplier before the *point of delivery*.

[MP] SEWAGE. Any liquid waste containing animal matter, vegetable matter or other impurity in suspension or solution. Any liquid waste containing animal or vegetable matter in suspension or solution, including liquids containing chemicals in solution.

[RP] SEWAGE EJECTOR. A device for lifting sewage by entraining the sewage in a high-velocity jet of steam, air or water.

[RP] SEWER.

Building sewer. See "Building sewer."

Public sewer. That part of the drainage system of pipes, installed and maintained by a city, township, county, public utility company or other public entity, and located on public property, in the street or in an approved dedicated easement of public or community use.

Sanitary sewer. A *sewer* that carries sewage and excludes storm, surface and ground water.

Storm sewer. A *sewer* that conveys rainwater, surface water, subsurface water and similar liquid wastes**.**

SHAFT. An enclosed space extending through one or more stories of a building, connecting vertical openings in successive floors, or floors and the roof.

SHAFT ENCLOSURE. The walls or construction forming the boundaries of a shaft.

SIDE VENT. A vent connecting to the drain pipe through a fitting at an angle less than 45 degrees (0.79 rad) to the horizontal.

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

[MP] SOIL STACK OR PIPE. A pipe that conveys sewage containing fecal material to the *building drain* or *building sewer*.

[RG] SPECIFIC GRAVITY. As applied to gas, *specific gravity* is the ratio of the weight of a given volume to that of the same volume of air, both measured under the same condition.

[MP] STACK. ~~Any main vertical DWV line, including offsets, that extends one or more stories~~ A general term for any vertical line of soil, waste, vent or inside conductor piping that extends through at least one story with or without offsets as directly as possible to its vent terminal.

[RP] STACK VENTING. A method of venting a fixture or fixtures through the soil or waste *stack*.

[RM] STEAM-HEATING BOILER. A boiler operated at pressures not exceeding 15 psi (103 kPa) for steam.

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

[RB] STORY ABOVE GRADE PLANE. Any *story* having its finished floor surface entirely above *grade plane*, ~~or in which the finished surface of the floor next above is either~~ except that a *basement* shall be considered as a *story above grade plane* where the finished surface of the floor above the *basement* meets any one of the following:

1. More than 6 feet (1829 mm) *above grade plane.*
2. More than 12 feet (3658 mm) above the finished ground level at any point.
3. More than 6 feet (1829 mm) above the finished ground level for more than 50 percent of the total building perimeter.

[MP] SUMP PUMP. ~~A pump installed to empty a sump. These pumps are used for removing storm water only.~~ An automatic water pump powered by an electric motor for the removal of drainage, except raw sewage, from a sump, pit or low point. The pump is selected for the specific head and volume of the load and is usually operated by level controllers.

[RP] SUMP VENT. A vent from pneumatic sewage ejectors, or similar equipment, that terminates separately to the open air.

[RM] SUPPLY AIR. That air delivered to each or any space supplied by the air distribution system or the total air delivered to all spaces supplied by the air distribution system, which is provided for ventilating, heating, cooling, humidification, dehumidification and other similar purposes.

[RM] SUPPLY AIR SYSTEM. An assembly of connected ducts, *plenums*, fittings, registers and grilles through which air, heated or cooled, is conducted from the supply unit to the space or spaces to be heated or cooled (see also *Return air system*).

[MP] SWEEP. A drainage fitting designed to provide a change in direction of a drain pipe of less than the angle specified by the amount necessary to establish the desired slope of the line. Sweeps provide a longer turning radius than bends and a less turbulent flow pattern (see "*Bend*" and "*Elbow*"). Sweeps can be plastic or metal.

[RG] SYSTEM SHUTOFF. A valve installed after the *point of delivery* to shut off the entire piping system.

[RP] TEMPERED WATER. Water having a temperature range between 85°F (29°C) and 110°F (43°C).

[RG] THERMOSTAT. (See types that follow.)

Electric switch type. A device that senses changes in temperature and controls electrically, by means of separate components, the flow of gas to the *burner(s)* to maintain selected temperatures.

Integral gas valve type. An automatic device, actuated by temperature changes, designed to control the gas supply to the *burner(s)* in order to maintain temperatures between predetermined limits, and in which the thermal actuating element is an integral part of the device.

1. Graduating thermostat. A thermostat in which the motion of the valve is approximately in direct proportion to the effective motion of the thermal element induced by temperature change.
2. Snap-acting thermostat. A thermostat in which the thermostatic valve travels instantly from the closed to the open position, and vice versa.

[RG] TOILET, GAS-FIRED. A packaged and completely assembled *appliance* containing a toilet that incinerates refuse instead of flushing it away with water.

[RB] TOWNHOUSE. ~~A *building* that contains three or more attached *townhouse units*~~. A single-family dwelling unit constructed in a group of two or more attached units separated by property lines, or three or more attached units separated by assumed property lines based on the location of the double wall or common wall in which each unit extends from foundation to roof and with a yard or public way on not less than two sides.

[RG] TRANSITION FITTINGS, PLASTIC TO STEEL. An adapter for joining plastic *pipe* to steel *pipe*. The purpose of this fitting is to provide a permanent, pressure-tight connection between two materials that cannot be joined directly one to another.

[RG] UNIT HEATER. A self-contained, automatically controlled, vented, fuel-gas-burning, space-heating *appliance*, intended for installation in the space to be heated without the use of ducts, and having integral means for circulation of air.

[RM] UNIT HEATER. A self-contained *appliance* of the fan type, designed for the delivery of warm air directly into the space in which the *appliance* is located.

[RG] UNVENTED ROOM HEATER. An unvented heating *appliance* designed for stationary installation and utilized to provide comfort heating. Such *appliances* provide radiant heat or convection heat by gravity or fan circulation directly from the heater and do not utilize ducts.

[RP] VACUUM. Any pressure less than that exerted by the atmosphere.

[RG] VALVE. A device used in *piping* to control the gas supply to any section of a system of *piping* or to an *appliance*.

Appliance shutoff. A *valve* located in the *piping system*, used to isolate individual *appliances* for purposes such as service or replacement.

Automatic. An automatic or semiautomatic device consisting essentially of a *valve* and an operator that control the gas supply to the *burner(s)* during operation of an *appliance*. The operator shall be actuated by application of gas pressure on a flexible diaphragm, by electrical means, by mechanical means or by other *approved* means.

Automatic gas shutoff. A *valve* used in conjunction with an automatic gas shutoff device to shut off the gas supply to a water-heating system. It shall be constructed integrally with the gas shutoff device or shall be a separate assembly.

Individual main burner. A *valve* that controls the gas supply to an individual *main burner*.

Main burner control. A *valve* that controls the gas supply to the *main burner* manifold.

Manual main gas-control. A manually operated *valve* in the gas line for the purpose of completely turning on or shutting off the gas supply to the *appliance*, except to *pilot* or pilots that are provided with independent shutoff.

Manual reset. An automatic shutoff valve installed in the gas supply *piping* and set to shut off when unsafe conditions occur. The device remains closed until manually reopened.

Service shutoff. A valve, installed by the serving gas supplier between the source of supply and the *point of delivery*, to shut off the entire *piping system*.

[RG] VENT. A *pipe* or other conduit composed of factory-made components, containing a passageway for conveying *combustion products* and air to the atmosphere, *listed* and *labeled* for use with a specific type or class of *appliance*.

Special gas vent. A vent *listed* and *labeled* for use with *listed* Category II, III and IV gas *appliances*.

Type B vent. A vent *listed* and *labeled* for use with *appliances* with *draft hoods* and other Category I *appliances* that are *listed* for use with Type B vents.

Type BW vent. A vent *listed* and *labeled* for use with wall *furnaces*.

Type L vent. A vent *listed* and *labeled* for use with *appliances* that are *listed* for use with Type L or Type B vents.

[RG] VENT PIPING.

Breather. *Piping* run from a pressure-regulating device to the outdoors, designed to provide a reference to *atmospheric pressure*. If the device incorporates an integral pressure *relief* mechanism, a breather vent can also serve as a *relief* vent.

Relief. *Piping* run from a pressure-regulating or pressure-limiting device to the outdoors, designed to provide for the safe venting of gas in the event of excessive pressure in the *gas piping system*.

[RP] VENT PIPE. See "Vent system."

[MP] VENT SYSTEM. ~~Piping installed to equalize pneumatic pressure in a drainage system to prevent trap seal loss or blowback due to siphonage or back pressure.~~ A pipe or pipes installed to provide a flow of air to or from a plumbing drainage system, or to provide a circulation of air within such system to protect trap seals from siphonage and backpressure.

[RG] VENTED APPLIANCE CATEGORIES. *Appliances* that are categorized for the purpose of vent selection are classified into the following four categories:

Category I. An *appliance* that operates with a nonpositive vent static pressure and with a vent gas temperature that avoids excessive *condensate* production in the vent.

Category II. An *appliance* that operates with a nonpositive *vent* static pressure and with a vent gas temperature that is capable of causing excessive *condensate* production in the vent.

Category III. An *appliance* that operates with a positive vent static pressure and with a vent gas temperature that avoids excessive *condensate* production in the vent.

Category IV. An *appliance* that operates with a positive vent static pressure and with a vent gas temperature that is capable of causing excessive *condensate* production in the vent.

[RG] VENTED ROOM HEATER. A vented self-contained, free-standing, nonrecessed *appliance* for furnishing warm air to the space in which it is installed, directly from the heater without duct connections.

[RG] VENTED WALL FURNACE. A self-contained vented *appliance* complete with grilles or equivalent, designed for incorporation in or permanent attachment to the structure of a building, mobile home or travel trailer, and furnishing heated air circulated by gravity or by a fan directly into the space to be heated through openings in the casing. This definition shall exclude *floor furnaces, unit heaters* and *central furnaces* as herein defined.

[RM] VENTILATION AIR. That portion of supply air that comes from the outside (outdoors), plus any recirculated air that has been treated to maintain the desired quality of air within a designated space.

[RG] VENTING SYSTEM. A continuous open passageway from the *flue collar* or *draft hood* of an *appliance* to the outdoor atmosphere for the purpose of removing flue or vent gases. A venting system is usually composed of a vent or a chimney and *vent connector*, if used, assembled to form the open passageway.

Forced draft venting system. A portion of a venting system using a fan or other mechanical means to cause the removal of flue or vent gases under positive static vent pressure.

Induced draft venting system. A portion of a venting system using a fan or other mechanical means to cause the removal of flue or vent gases under nonpositive static vent pressure.

Mechanical draft venting system. A venting system designed to remove flue or vent gases by mechanical means, that consists of an induced draft portion under non-positive static pressure or a forced draft portion under positive static pressure.

Natural draft venting system. A venting system designed to remove flue or vent gases under nonpositive static vent pressure entirely by natural draft.

WALL, ABOVE-GRADE. A wall more than 50 percent above-grade and enclosing *conditioned space*. This includes between-floor spandrels, peripheral edges of floors, roof and basement knee walls, dormer walls, gable end walls, walls enclosing a mansard roof and skylight shafts.

WALL, CRAWLSPACE. The opaque portion of a wall that encloses a crawl space and is partially or totally below grade.

[RG] WALL HEATER, UNVENTED TYPE. A room heater of the type designed for insertion in or attachment to a wall or partition. Such heater does not incorporate concealed venting arrangements in its construction and discharges all products of *combustion* through the front into the room being heated.

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

[MP] WASTE. Liquidborne waste ~~that is free of~~ does not contain fecal matter.

WATER-HAMMER ARRESTOR. A device utilized to absorb the pressure surge (water hammer) that occurs when water flow is suddenly stopped in a water supply system

[MP] WATER MAIN. ~~A water supply pipe for public use.~~ A water supply pipe or system of pipes, installed and maintained by a city, township, county, public utility company or other public entity, on public property, in the street or in an approved dedicated easement of public or community use.

[MP] WATER OUTLET. ~~A valved discharge opening, including a hose bibb, through which water is removed from the potable water system supplying water to a plumbing fixture or plumbing *appliance* that requires either an *air gap* or backflow prevention device for protection of the supply system.~~ A discharge opening through which water is supplied to a fixture, into the atmosphere, such as a hose bibb, (except into an open tank that is part of the water supply system), to a boiler or heating system, or to any devices or equipment requiring water to operate but which are not part of the plumbing system.

[RP] WATER PIPE.

Riser. A water supply pipe that extends one full story or more to convey water to *branches* or to a group of fixtures.

Water distribution pipe. A pipe within the structure or on the premises that conveys water from the water service pipe, or from the meter when the meter is at the structure, to the points of utilization.

Water service pipe. The pipe from the water main or other source of potable water supply, or from the meter when the meter is at the public right of way, to the water distribution system of the building served. Water service pipe shall terminate 5 feet (1524 mm) outside the foundation wall.

~~**[MP] WATER SERVICE PIPE.** The outside pipe from the water main or other source of potable water supply to the water distribution system inside the building, terminating at the service valve. Water service pipe shall terminate 5 feet (1524 mm) outside the foundation wall.~~

[RP] WEIGHTED AVERAGE LEAD CONTENT. The weighted average lead content of a pipe, pipe fitting, plumbing fitting, or fixture shall be calculated by using the following formula: For each wetted component, the percentage of lead in the component shall be multiplied by the ratio of the wetted surface area of that component to the total wetted surface area of the entire product to arrive at the weighted percentage of lead of the component. The weighted percentage of lead of each wetted component shall be added together, and the sum of these wetted percentages shall constitute the weighted average lead content of the product. For lead content of materials that are provided as a range, the maximum content of the range shall be used.

[RP] WHIRLPOOL BATHTUB. A plumbing appliance consisting of a bathtub fixture that is equipped and fitted with a circulating piping system designed to accept, circulate and discharge bathtub water upon each use.

[RB] WINDBORNE DEBRIS REGION. Areas within *hurricane-prone regions* ~~located in accordance with one of the following:~~ defined as that area east of the Intracoastal Waterway from the North Carolina/South Carolina state line north to Beaufort Inlet and from that point to include the barrier islands to the North Carolina/Virginia state line.

1. ~~Within 1 mile (1.61 km) of the coastal mean high-water line where the ultimate design wind speed, V_{ult}, is 130 mph (58 m/s) or greater.~~

~~2. In areas where an Exposure D condition exists upwind at the waterline and the ultimate design wind speed, V_{ult}, is 140 mph (63 m/s) or greater; or Hawaii.~~

YARD HYDRANT. A freeze proof yard hydrant is an outdoor water supply outlet that has a valve and outlet above ground and a drain opening below the frost level.

[RE] ZONE. A space or group of spaces within a building with heating or cooling requirements that are sufficiently similar so that desired conditions can be maintained throughout using a single controlling device. For the definition applicable in Chapter 11, see Section N1101.6.

CHAPTER 3
BUILDING PLANNING

~~*User note:*~~

~~***About this chapter:** Chapter 3 contains a wide array of building planning requirements that are critical to designing a safe and usable building. This includes, but is not limited to, requirements related to general structural design, fire-resistant construction, light, ventilation, sanitation, plumbing fixture clearances, minimum room area and ceiling height, safety glazing, means of egress, automatic fire sprinkler systems, smoke and carbon monoxide alarm systems, accessibility,*~~ solar energy systems~~*, swimming pools, spas and hot tubs.*~~

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

1. AWC *Wood Frame Construction Manual* (WFCM).
2. AISI *Standard for Cold-Formed Steel Framing—Prescriptive Method for One- and Two-Family Dwellings* (AISI S230).
3. ICC *Standard on the Design and Construction of Log Structures* (ICC 400).
4. Sunrooms complying with AAMA/NPEA/NSA 2100.

R301.2.1 Wind design criteria. Buildings and portions thereof shall be constructed in accordance with the wind provisions of this code using the ultimate design wind speed in ~~Table R301.2~~ Tables R301.2 as determined from ~~Figure R301.2(2).~~ Tables R301.2(4) and R301.2(5). ~~The structural provisions of this code for wind loads are not permitted where wind design is required as specified in Section R301.2.1.1.~~ Where different construction methods and structural materials are used for various portions of a building, the applicable requirements of this section for each portion shall apply. Where not otherwise specified, the wind loads listed in ~~Table~~ Tables ~~R301.2.1(1)~~ R301.2(2) and R301.2(6) adjusted for height and exposure using Table R301.2.1(2) shall be used to determine design load performance requirements for wall coverings, curtain walls, roof coverings, exterior windows, skylights, garage doors and exterior doors. Asphalt shingles shall be designed for wind speeds in accordance with Section R905.2.4. *Metal roof shingles* shall be designed for wind speeds in accordance with Section R905.4.4. A continuous load path shall be provided to transmit the applicable uplift forces in Section R802.11 from the *roof assembly* to the foundation. Where ultimate design wind speeds in Figure R301.2(2) are less than the lowest wind speed indicated in the prescriptive provisions of this code, the lowest wind speed indicated in the prescriptive provisions of this code shall be used.

Exception: Openings for exterior balconies, decks, or porches under roofs enclosed with screen or removable vinyl or acrylic wind break panels shall be exempt from the loads listed in Table R301.2(2) and the height and exposure factors listed in Table R301.2(3). Vinyl and acrylic glazed panels shall be removable. Removable panels shall be identified as removable by a decal. The identification decal shall state "Removable panel SHALL be removed when wind speeds exceed 75 mph (34 m/s)." Decals shall be placed such that the decal is visible when the panel is installed.

TABLE R301.2
CLIMATIC AND GEOGRAPHIC DESIGN CRITERIA

ROOF LOAD (psf)	WIND SPEED (mph)	SEISMIC DESIGN CATEGORY	SUBJECT TO DAMAGE FROM			WINTER DESIGN TEMP	ICE BARRIER UNDERLAYMENT REQUIRED	FLOOD HAZARDS[b]	AIR FREEZING INDEX	MEAN ANNUAL TEMP
			Weathering[a]	Frost line depth[d]	Termite[c]					
20	Tables R301.2(4) & (5)	Table R301.2(7)	Moderate	Minimum 12 inches	Moderate-Heavy	Local	Local	Local	Local	Local

For SI: 1 pound per square foot = 0.0479 kPa, 1 mile per hour = 0.447 m/s.

a) Weathering may require a higher strength concrete or grade of masonry than necessary to satisfy the structural requirements of this code. The grade of masonry units shall be determined from ASTM C34, C55, C62, C73, C90, C129, C145, C216 or C652.
b) The jurisdiction shall fill in this part of the table with (a) the date of the jurisdiction's entry into the National Flood Insurance Program (date of adoption of the first code or ordinance for management of flood hazard areas), (b) the date(s) of the currently effective FIRM and FBFM or other flood hazard map adopted by the community, as may amended.
c) Protection is required in all of North Carolina in accordance with Section R318
d) Check with local jurisdiction for frost line depth.

e) TABLE R301.2.1(1)

f) COMPONENT AND CLADDING LOADS FOR A BUILDING WITH A MEAN ROOF HEIGHT OF 30 FEET LOCATED IN EXPOSURE B (ASD) (psf)[a, b, c, d, e, f, g, h]

	ZONE	EFFECTIVE WIND AREAS (square feet)	ULTIMATE DESIGN WIND SPEED, V_{ult}																									
			90.0		95.0		~~105.0~~ 100.0		~~115.0~~ 105.0		~~130.0~~ 110.0		~~150.0~~ 115.0		~~170.0~~ 120.0		~~95.0~~ 130.0		~~105.0~~ 140.0		~~115.0~~ 150.0		~~130.0~~ 160.0		~~150.0~~ 170.0		~~170.0~~ 180.0	
			Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg
Flat and gable roof 0 to 7 degrees	1	10.0	3.6	-13.9	4.0	-15.5	4.4	-17.2	4.8	-19.0	5.3	-20.8	5.8	-22.7	6.3	-24.8	7.4	-29.1	8.6	-33.7	9.9	-38.7	11.2	-44.0	12.7	-49.7	14.2	-55.7
	1	20.0	3.3	-13.0	3.7	-14.5	4.1	-16.0	4.5	-17.7	5.0	-19.4	5.4	-21.2	5.9	-23.1	7.0	-27.1	8.1	-31.4	9.3	-36.1	10.5	-41.1	11.9	-46.4	13.3	-52.0
	1	50.0	3.0	-11.8	3.4	-13.1	3.8	-14.5	4.1	-16.0	4.5	-17.6	5.0	-19.2	5.4	-20.9	6.3	-24.5	7.4	-28.4	8.4	-32.6	9.6	-37.1	10.8	-41.9	12.2	-47.0
	1	100.0	2.8	-10.8	3.1	-12.1	3.5	-13.4	3.8	-14.7	4.2	-16.2	4.6	-17.7	5.0	-19.2	5.9	-22.6	6.8	-26.2	7.8	-30.0	8.9	-34.2	10.0	-38.6	11.3	-43.3
	2	10.0	3.6	-18.4	4.0	-20.5	4.4	-22.7	4.8	-25.0	5.3	-27.4	5.8	-30.0	6.3	-32.7	7.4	-38.3	8.6	-44.5	9.9	-51.0	11.2	-28.1	12.7	-65.6	14.2	-73.5
	2	20.0	3.3	-17.2	3.7	-19.2	4.1	-21.2	4.5	-23.4	5.0	-25.7	5.4	-28.1	5.9	-30.6	7.0	-35.9	8.1	-41.6	9.3	-47.8	10.5	-54.3	11.9	-61.4	13.3	-68.8
	2	50.0	3.0	-15.6	3.4	-17.4	3.8	-19.3	4.1	-21.3	4.5	-23.3	5.0	-25.5	5.4	-27.8	6.3	-32.6	7.4	-37.8	8.4	-43.4	9.6	-49.4	10.8	-55.8	12.2	-62.5
	2	100.0	2.8	-14.4	3.1	-16.1	3.5	-17.8	3.8	-19.7	4.2	-21.6	4.6	-23.6	5.0	-25.7	5.9	-30.1	6.8	-35.0	7.8	-40.1	8.9	-45.7	10.0	-51.5	11.3	-57.8
	3	10.0	3.6	-25.0	4.0	-27.9	4.4	-30.9	4.8	-34.1	5.3	-37.4	5.8	-40.9	6.3	-44.5	7.4	-52.2	8.6	-60.6	9.9	-69.6	11.2	-79.1	12.7	-89.4	14.2	-100.2
	3	20.0	3.3	-22.6	3.7	-25.2	4.1	-28.0	4.5	-30.8	5.0	-33.8	5.4	-37.0	5.9	-40.3	7.0	-47.2	8.1	-54.8	9.3	-62.9	10.5	-71.6	11.9	-80.8	13.3	-90.6
	3	50.0	3.0	-19.4	3.4	-21.7	3.8	-24.0	4.1	-26.5	4.5	-29.0	5.0	-31.7	5.4	-34.6	6.3	-40.6	7.4	-47.0	8.4	-54.0	9.6	-61.4	10.8	-69.4	12.2	-77.8
	3	100.0	2.8	-17.4	3.1	-19.0	3.5	-21.0	3.8	-23.2	4.2	-25.5	4.6	-27.8	5.0	-30.3	5.9	-35.6	6.8	-41.2	7.8	-47.3	8.9	-53.9	10.0	-60.8	11.3	-68.2
Gable roof > 7 to 20 degrees	1, 2e	10.0	5.4	-16.2	6.0	-18.0	6.7	-19.9	7.4	-22.0	8.1	-24.1	8.8	-26.4	9.6	-28.7	11.3	-33.7	13.1	39.1	15.0	44.9	17.1	-51.0	19.3	-57.6	21.6	-64.6
	1, 2e	20.0	4.9	-16.2	5.4	-18.0	6.0	-19.9	6.6	-22.0	7.2	-24.1	7.9	-26.4	8.6	-28.7	10.1	-33.7	11.7	-39.1	13.5	-44.9	15.3	-51.0	17.3	-57.6	19.4	-64.6
	1, 2e	50.0	4.1	-9.9	4.6	-11.0	5.1	-12.2	5.6	-13.4	6.1	-14.7	6.7	-16.1	7.3	-17.5	8.6	-20.6	10.0	-23.8	11.4	-27.4	13.0	-31.1	14.7	-35.2	16.4	-39.4
	1, 2e	100.0	3.6	-5.0	4.0	-5.6	4.4	-6.2	4.8	-6.9	5.3	-7.5	5.8	-8.2	6.3	-9.0	7.4	-10.5	8.6	-12.2	9.9	-14.0	11.2	-15.9	12.7	-18.0	14.2	-20.2
	2n, 2r, 3e	10.0	5.4	-23.6	6.0	-26.3	6.7	-29.1	7.4	-32.1	8.1	-35.2	8.8	-38.5	9.6	-41.9	11.3	-49.2	13.1	-57.0	15.0	-65.4	17.1	-74.5	19.3	-84.1	21.6	-94.2
	2n, 2r, 3e	20.0	4.9	-20.3	5.4	-22.7	6.0	-25.1	6.6	-27.7	7.2	-30.4	7.9	-33.2	8.6	-36.2	10.1	-42.4	11.7	-49.2	13.5	-56.5	15.3	-64.3	17.3	-72.6	19.4	-81.4
	2n, 2r, 3e	50.0	4.1	-16.0	4.6	-17.9	5.1	-19.8	5.6	-21.8	6.1	-24.0	6.7	-26.2	7.3	-28.5	8.6	-33.5	10.0	-38.8	11.4	-44.6	13.0	-50.7	14.7	-57.2	16.4	-64.2
	2n, 2r, 3e	100.0	3.6	-12.8	4.0	-14.3	4.4	-15.8	4.8	-17.4	5.3	-19.1	5.8	-20.9	6.3	-22.8	7.4	-26.7	8.6	-31.0	9.9	-35.6	11.2	-40.5	12.7	-45.7	14.2	-51.3
	3r	10.0	5.4	-28.0	6.0	-30.2	6.7	-34.6	7.4	-38.1	8.1	-41.8	8.8	-45.7	9.6	-49.8	11.3	-58.4	13.1	-67.8	15.0	-77.8	17.1	-88.5	19.3	-99.9	21.6	-112.0
	3r	20.0	4.9	-24.0	5.4	-26.7	6.0	-29.6	6.6	-32.7	7.2	-35.9	7.9	-39.2	8.6	-42.7	10.1	-50.1	11.7	-58.1	13.5	-66.7	15.3	-75.9	17.3	-85.6	19.4	-96.0
	3r	50.0	4.1	-18.7	4.6	-20.8	5.1	-23.1	5.6	-25.4	6.1	-27.9	6.7	-30.5	7.3	-33.2	8.6	-39.0	10.0	-45.2	11.4	-51.9	13.0	-59.0	14.7	-66.6	16.4	-74.7

	3r	100.0	3.6	-14.7	4.0	-16.3	4.4	-18.1	4.8	-20.0	5.3	-21.9	5.8	-24.0	6.3	-26.1	7.4	-30.6	8.6	-35.5	9.9	-40.8	11.2	-46.4	12.7	-52.3	14.2	-58.7
Gable roof > 20 to 27 degrees	1, 2e	10.0	6.5	-12.4	7.3	-13.9	8.0	-15.4	8.9	-16.9	9.7	-18.6	10.6	-20.3	11.6	-22.1	13.6	-26.0	15.8	-30.1	18.1	-34.6	20.6	-39.3	23.3	-44.4	26.1	-49.9
	1, 2e	20.0	5.6	-12.4	6.3	-13.9	7.0	-15.4	7.7	-16.9	8.4	-18.6	9.2	-20.3	10.0	-22.1	11.7	-26.0	13.6	-30.1	15.6	-34.6	17.8	-39.3	20.1	-44.4	22.5	-49.8
	1, 2e	50.0	4.4	-10.6	5.0	-11.8	5.5	-3.1	6.1	-14.4	6.6	-15.8	7.3	-17.3	7.9	-18.8	9.3	-22.1	10.8	-25.6	12.3	-29.4	14.0	-33.5	15.9	-37.8	17.8	-42.4
	1, 2e	100.0	3.6	-9.1	4.0	-10.2	4.4	-11.3	4.8	-12.4	5.3	-13.6	5.8	-14.9	6.3	-16.2	7.4	-19.0	8.6	-22.1	9.9	-25.3	11.2	-28.8	12.7	-32.5	14.2	-36.5
	2n, 2r, 3e	10.0	6.5	-19.9	7.3	-22.1	8.0	-24.5	8.9	-27.0	9.7	-29.7	10.6	-32.4	11.6	-35.3	13.6	-41.4	15.8	-48.0	18.1	-55.2	20.6	-62.8	23.3	-70.8	26.1	-79.4
	2n, 2r, 3e	20.0	5.6	-17.4	6.3	-19.4	7.0	-21.5	7.7	-23.7	8.4	-26.0	9.2	-28.4	10.0	-31.0	11.7	-36.3	13.6	-42.1	15.6	-48.4	17.8	-55.0	20.1	-62.1	22.5	-69.6
	2n, 2r, 3e	50.0	4.4	-14.2	5.0	-15.8	5.5	-17.5	6.1	-19.3	6.6	-21.1	7.3	-23.1	7.9	-25.2	9.3	-29.5	10.8	-34.2	12.3	-39.3	14.0	-44.7	15.9	-50.5	17.8	-56.6
	2n, 2r, 3e	100.0	3.6	-11.7	4.0	-13.0	4.4	-14.5	4.8	-15.9	5.3	-17.5	5.8	-19.1	6.3	-20.8	7.4	-24.4	8.6	-28.3	9.9	-32.5	11.2	-37.0	12.7	-41.8	14.2	-46.8
	3r	10.0	6.5	-23.6	7.3	-26.3	8.0	-29.1	8.9	-32.1	9.7	-35.2	10.6	-38.5	11.6	-41.9	13.6	-49.2	15.8	-57.0	18.1	-65.4	20.6	-74.5	23.3	-84.1	26.1	-94.2
	3r	20.0	5.6	-19.9	6.3	-22.1	7.0	-24.5	7.7	-27.0	8.4	-29.7	9.2	-32.4	10.0	-35.3	11.7	-41.4	13.6	-48.0	15.6	-55.2	17.8	-62.8	20.1	-70.8	22.5	-79.4
	3r	50.0	4.4	-14.7	5.0	-16.3	5.5	-18.1	6.1	-20.0	6.6	-21.9	7.3	-24.0	7.9	-26.1	9.3	-30.6	10.8	-35.5	12.3	-40.8	14.0	-46.4	15.9	-52.3	17.8	-58.7
	3r	100.0	3.6	-14.7	4.0	-16.3	4.4	-18.1	4.8	-20.0	5.3	-21.9	5.8	-24.0	6.3	-26.1	7.4	-30.6	8.6	-35.5	9.9	-40.8	11.2	-46.4	12.7	-52.3	14.2	-58.7

g)

h) (continued)

i)

j) TABLE R301.2.1(1)—continued

k) COMPONENT AND CLADDING LOADS FOR A BUILDING WITH A MEAN ROOF HEIGHT OF 30 FEET LOCATED IN EXPOSURE B (ASD) (psf) [a, b, c, d, e, f, g, h]

	ZONE	EFFECTIVE WIND AREAS (square feet)	ULTIMATE DESIGN WIND SPEED, V_{ult}																									
			90.0		95.0		~~105.0~~ 100.0		~~115.0~~ 105.0		~~130.0~~ 110.0		~~150.0~~ 115.0		~~170.0~~ 120.0		~~95.0~~ 130.0		~~105.0~~ 140.0		~~115.0~~ 150.0		~~130.0~~ 160.0		~~150.0~~ 170.0		~~170.0~~ 180.0	
			Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg
Gable roof > 27 to 45 degrees	1, 2e, 2r	10.0	8.0	-14.7	8.9	-16.3	9.9	-18.1	10.9	-20.0	12.0	-21.9	13.1	-24.0	14.2	-26.1	16.7	-30.6	19.4	-35.5	22.2	-40.8	25.3	-16.4	28.5	-52.3	32.0	-58.7
	1, 2e, 2r	20.0	7.1	-12.4	7.9	-13.9	8.8	-15.4	9.7	-16.9	10.6	-18.6	11.6	-20.3	12.6	-22.1	14.8	-26.0	17.2	-30.1	19.8	-34.6	22.5	-39.3	25.4	-44.4	28.5	-49.8
	1, 2e, 2r	50.0	5.9	-9.5	6.6	-10.6	7.3	-11.7	8.1	-12.9	8.9	-14.2	9.7	-15.5	10.5	-16.9	12.4	-19.8	14.3	-22.9	16.5	-26.3	18.7	-30.0	21.1	-33.8	23.7	-37.9
	1, 2e, 2r	100.0	5.0	-7.3	5.6	-8.1	6.2	-9.0	6.9	-9.9	7.5	-10.8	8.2	-11.9	9.0	-12.9	10.5	-15.1	12.2	-17.6	14.0	-20.2	15.9	-22.9	18.0	-25.9	20.2	-29.0
	2n, 3r	10.0	8.0	-16.2	8.9	-18.0	9.9	-19.9	10.9	-22.0	12.0	-24.1	13.1	-26.4	-14.2	-28.7	16.7	-33.7	19.4	-39.1	22.2	-44.9	25.3	-51.0	28.5	-57.6	32.0	-64.6
	2n, 3r	20.0	7.1	-14.4	7.9	-16.1	8.8	-17.8	9.7	-19.7	10.6	-21.6	11.6	-23.6	12.6	-25.7	14.8	-30.1	17.2	-34.9	19.8	-40.1	22.5	-45.6	25.4	-51.5	28.5	-57.8
	2n, 3r	50.0	5.9	-12.2	6.6	-13.5	7.3	-15.0	8.1	-16.5	8.9	-18.2	9.7	-19.9	10.5	-21.6	12.4	-25.4	14.3	-29.4	16.5	-33.8	18.7	-38.4	21.1	-43.4	23.7	-48.6
	2n, 3r	100.0	5.0	-10.4	5.6	-11.6	6.2	-12.9	6.9	-14.2	7.5	-15.6	8.2	-17.1	9.0	-18.6	10.5	-21.8	12.2	-25.3	14.0	-29.0	15.9	-33.0	18.0	-37.3	20.0	-41.8
	3e	10.0	8.0	-19.9	8.9	-22.1	9.9	-24.5	10.9	-27.0	12.0	-29.7	13.1	-32.4	14.2	-35.3	16.7	-41.4	19.4	-48.0	22.2	-55.2	25.3	-62.8	28.8	-70.8	32.0	-79.4

	3e	20.0	7.1	-17.6	7.9	-19.6	8.8	-21.8	9.7	-24.0	10.6	-26.3	11.6	-28.8	12.6	-31.3	14.8	-36.8	17.2	-42.7	19.8	-49.0	22.5	-55.7	25.4	-62.9	28.5	-70.5
	3e	50.0	5.9	-14.7	6.6	-16.3	7.3	-18.1	8.1	-20.0	8.9	-21.9	9.7	-24.0	10.5	-26.1	12.4	-30.6	14.3	-35.5	16.6	-40.8	18.7	-46.4	21.1	-52.3	23.7	-58.7
	3e	100.0	5.0	-12.4	5.6	-13.9	6.2	-15.4	6.9	-16.9	7.5	-18.6	8.2	-20.3	9.0	-22.1	10.5	-26.0	12.2	-30.1	14.0	-34.6	15.9	-39.3	18.0	-44.4	20.2	-49.8
Hipped roof > 7 to 20 degrees[g]	1	10.0	6.5	-14.7	7.3	-16.3	8.0	-18.1	8.9	-20.0	9.7	-21.9	10.6	-24.0	11.6	-26.1	13.6	-30.6	15.8	-35.5	18.1	-40.8	20.6	-46.4	23.3	-52.3	26.1	-58.7
	1	20.0	5.6	-14.7	6.3	-16.3	7.0	-18.1	7.7	-20.0	8.4	-21.9	9.2	-24.0	10.0	-26.1	11.7	-30.6	13.6	-35.5	15.6	-40.8	17.8	-46.4	20.1	-52.3	22.5	-58.7
	1	50.0	4.4	-11.3	5.0	-12.6	5.5	-14.0	6.1	-15.4	6.6	-16.9	7.3	-18.5	7.9	-20.2	9.3	-23.7	10.8	-27.4	12.3	-31.5	14.0	-35.8	15.9	-40.4	17.8	-45.3
	1	100.0	3.6	-8.7	4.0	-9.7	4.4	-10.8	4.8	-11.9	5.3	-13.1	5.8	-14.3	6.3	-15.5	7.4	-18.2	8.6	-21.2	9.9	-24.3	11.2	-27.6	12.7	-31.2	14.2	-35.0
	2r	10.0	6.5	-19.1	7.3	-21.3	8.0	-23.6	8.9	-26.0	9.7	-28.6	10.6	-31.2	11.6	-34.0	13.6	-39.9	15.8	-46.3	18.1	-53.1	20.6	-60.4	23.3	-68.2	26.1	-76.5
	2r	20.0	5.6	-17.2	6.3	-19.2	7.0	-21.3	7.7	-23.4	8.4	-25.7	9.2	-28.1	10.0	-30.6	11.7	-35.9	13.6	-41.7	15.6	-47.9	17.8	-54.4	20.1	-61.5	22.5	-68.9
	2r	50.0	4.4	-14.7	5.0	-16.4	5.5	-18.2	6.1	-20.0	6.6	-22.0	7.3	-24.0	7.9	-26.1	9.3	-30.7	10.8	-35.6	12.3	-40.9	14.0	-46.5	15.9	-52.5	17.8	-58.8
	2r	100.0	3.6	-12.8	4.0	-14.3	4.4	-15.8	4.8	-17.4	5.3	-19.1	5.8	-20.9	6.3	-22.8	7.4	-26.7	8.6	-31.0	9.9	-35.6	11.2	-40.5	12.7	-45.7	14.2	-51.3
	2e, 3	10.0	6.5	-20.6	7.3	-22.9	8.0	-25.4	8.9	-28.0	9.7	-30.8	10.6	-33.6	11.6	-36.6	13.6	-43.0	15.8	-49.8	18.1	-57.2	20.6	-65.1	23.3	-73.5	26.1	-82.4
	2e, 3	20.0	5.6	-18.5	6.3	-20.6	7.0	-22.9	7.7	-25.2	8.4	-27.7	9.2	-30.3	10.0	-32.9	11.7	-38.7	13.6	-44.8	15.6	-51.5	17.8	-58.6	20.1	-66.1	22.5	-74.1
	2e, 3	50.0	4.4	-15.8	5.0	-17.6	5.5	-19.5	6.1	-21.5	6.6	-23.6	7.3	-25.8	7.9	-28.0	9.3	-32.9	10.8	-38.2	12.3	-43.8	14.0	-49.9	15.9	-56.3	17.8	-63.1
	2e, 3	100.0	3.6	-13.7	4.0	-15.3	4.0	-16.9	4.8	-18.7	5.3	-20.5	5.8	-22.4	6.3	-24.4	7.4	-28.6	8.6	-33.2	9.9	-38.1	11.2	-43.3	12.7	-48.9	14.2	-54.8
Hipped roof > 20 to 27 degrees	1	10.0	6.5	-11.7	7.3	-13.0	8.0	-14.5	8.9	-15.9	9.7	-17.5	10.6	-19.1	11.6	-20.8	13.6	-24.4	15.8	-28.3	18.1	-32.5	20.6	-37.0	23.3	-41.8	26.1	-46.8
	1	20.0	5.6	-10.4	6.3	-11.6	7.0	-12.8	7.7	-14.1	8.4	-15.5	9.2	-16.9	10.0	-18.4	11.7	-21.6	13.6	-25.1	15.6	-28.8	17.8	-32.8	20.1	-37.0	22.5	-41.5
	1	50.0	4.4	-8.6	5.0	-9.6	5.5	-10.6	6.1	-11.7	6.6	-12.8	7.3	-14.0	7.9	-15.3	9.3	-17.9	10.8	-20.8	12.3	-23.9	14.0	-27.2	15.9	-30.7	17.8	-34.4
	1	100.0	3.6	-7.3	4.0	-8.1	4.4	-9.0	4.8	-9.9	5.3	-10.8	5.8	-11.9	6.3	-12.9	7.4	-15.1	8.6	-17.6	9.9	-20.2	11.2	-22.9	12.7	-25.9	14.2	-29.0
	2e, 2r, 3	10.0	6.5	-16.2	7.3	-18.0	8.0	-19.9	8.9	-22.0	9.7	-24.1	10.6	-26.4	11.6	-28.7	13.6	-33.7	15.8	-39.1	18.1	-44.9	20.6	-51.0	23.3	-57.6	26.1	-64.6
	2e, 2r, 3	20.0	5.6	-14.4	6.3	-16.1	7.0	-17.8	7.7	-19.7	8.4	-21.6	9.2	-23.6	10.0	-25.7	11.7	-30.1	13.6	-34.9	15.6	-40.1	17.8	-45.6	20.1	-51.5	22.5	-57.8
	2e, 2r, 3	50.0	4.4	-12.2	5.0	-13.5	5.5	-15.0	6.1	-16.5	6.6	-18.2	7.3	-19.9	7.9	-21.6	9.3	-25.4	10.8	-29.4	12.3	-33.8	14.0	-38.4	15.9	-43.4	17.8	-48.6
	2e, 2r, 3	100.0	3.6	-10.4	4.0	-11.6	4.4	-12.9	4.8	-14.2	5.3	-15.6	5.8	-17.1	6.3	-18.6	7.4	-21.8	8.6	-25.3	9.9	-29.0	11.2	-33.0	12.7	-37.3	14.2	-41.8

l)

m) (continued)

n)

o) TABLE R301.2.1(1)—continued

p) COMPONENT AND CLADDING LOADS FOR A BUILDING WITH A MEAN ROOF HEIGHT OF 30 FEET LOCATED IN EXPOSURE B (ASD) (psf) [a, b, c, d, e, f, g, h]

	ZONE		ULTIMATE DESIGN WIND SPEED, V_{ult}

		EFFECTIVE WIND AREAS (square feet)	90.0		95.0		~~105.0~~ 100.0		~~115.0~~ 105.0		~~130.0~~ 110.0		~~150.0~~ 115.0		~~170.0~~ 120.0		~~95.0~~ 130.0		~~105.0~~ 140.0		~~115.0~~ 150.0		~~130.0~~ 160.0		~~150.0~~ 170.0		~~170.0~~ 180.0	
			Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg
Hipped roof > 27 to 45 degrees	1	10.0	6.2	-12.4	6.9	-13.9	7.7	-15.4	8.5	-16.9	9.3	-18.6	10.2	-20.3	11.1	-22.1	13.0	-26.0	15.1	-30.1	17.3	-34.6	19.7	-39.3	22.2	-44.4	24.9	-49.8
	1	20.0	5.4	-11.0	6.0	-12.3	6.7	-13.6	7.4	-15.0	8.1	-16.5	8.9	-18.0	9.6	-19.6	11.3	-23.0	13.1	-26.7	15.1	-30.7	17.1	-34.9	19.4	-39.4	21.7	-44.2
	1	50.0	4.4	-9.2	4.9	-10.2	5.4	-11.3	5.9	-12.5	6.5	-13.7	7.1	-15.0	7.7	-16.3	9.1	-19.2	10.5	-22.2	12.1	-25.5	13.8	-29.0	15.5	-32.8	17.4	-36.7
	1	100.0	3.6	-7.8	4.0	-8.7	4.4	-9.6	4.8	-10.6	5.3	-11.6	5.8	-12.7	6.3	-13.8	7.4	-16.2	8.6	-18.8	9.9	-21.6	11.2	-24.6	12.7	-27.8	14.2	-31.1
	2e	10.0	6.2	-14.8	6.9	-16.5	7.7	-18.3	8.5	-20.2	9.3	-22.1	10.2	-24.2	11.1	-26.3	13.0	-30.9	15.1	-35.9	17.3	-41.2	19.7	-46.8	22.2	-52.9	24.9	-59.3
	2e	20.0	5.4	-11.7	6.0	-13.0	6.7	-14.5	7.4	-15.9	8.1	-17.5	8.9	-19.1	9.6	-20.8	11.3	-24.4	13.1	-28.3	15.1	-32.5	17.1	-37.0	19.4	-41.8	21.7	-46.8
	2e	50.0	4.4	-7.3	4.9	-8.1	5.4	-9.0	5.9	-9.9	6.5	-10.8	7.1	-11.9	7.7	-12.9	9.1	-15.1	10.5	-17.6	12.1	-20.2	13.8	-22.9	15.5	-25.9	17.4	-29.0
	2e	100.0	3.6	-7.3	4.0	-8.1	4.4	-9.0	4.8	-9.9	5.3	-10.8	5.8	-11.9	6.3	-12.9	7.4	-15.1	8.6	-17.6	9.9	-20.2	11.2	-22.9	12.7	-25.9	14.2	-29.0
	2r	10.0	6.2	-18.7	6.9	-20.9	7.7	-23.1	8.5	-25.5	9.3	-28.0	10.2	-30.6	11.1	-33.3	13.0	-39.1	15.1	-45.4	17.3	-52.1	19.7	-59.2	22.2	-66.9	24.9	-75.0
	2r	20.0	5.4	-15.7	6.0	-17.5	6.7	-19.4	7.4	-21.4	8.1	-23.5	8.9	-25.7	9.6	-28.0	11.3	-32.8	13.1	-38.1	15.1	-43.7	17.1	-49.8	19.4	-56.2	21.7	-63.0
	2r	50.0	4.4	-11.7	4.9	-13.1	5.4	-14.5	5.9	-16.0	6.5	-17.5	7.1	-19.2	7.7	-20.9	9.1	-24.5	10.5	-28.4	12.1	-32.6	13.8	-37.1	15.5	-41.9	17.4	-47.0
	2r	100.0	3.6	-8.7	4.0	-9.7	4.4	-10.8	4.8	-11.9	5.3	-13.1	5.8	-14.3	6.3	-15.5	7.4	-18.2	8.6	-21.2	9.9	-24.3	11.2	-27.6	12.7	-31.2	14.2	-35.0
	3	10.0	6.2	-20.0	6.9	-22.3	7.7	-24.7	8.5	-27.2	9.3	-29.9	10.2	-32.7	11.1	-35.6	13.0	-41.7	15.1	-48.4	17.3	-55.6	19.7	-63.2	22.2	-71.4	24.9	-80.0
	3	20.0	5.4	-15.0	6.0	-16.8	6.7	-18.6	7.4	-20.5	8.1	-22.5	8.9	-24.6	9.6	-26.7	11.3	-31.4	13.1	-36.4	15.1	-41.8	17.1	-47.5	19.4	-53.7	21.7	-60.2
	3	50.0	4.4	-8.7	4.9	-9.7	5.4	-10.8	5.9	-11.9	6.5	-13.1	7.1	-14.3	7.7	-15.5	9.1	-18.2	10.5	-21.2	12.1	-24.3	13.8	-27.6	15.5	-31.2	17.4	-35.0
	3	100.0	3.6	-8.7	4.0	-9.7	4.4	-10.8	4.8	-11.9	5.3	-13.1	5.8	-14.3	6.3	-15.5	7.4	-18.2	8.6	-21.2	9.9	-24.3	11.2	-27.6	12.7	-31.2	14.2	-35.0
Wall	4	10.0	8.7	-9.5	9.7	-10.6	10.8	-11.7	11.9	-12.9	13.1	-14.2	14.3	-15.5	15.5	-16.9	18.2	-19.8	21.2	-22.9	24.3	-26.3	27.6	-30.0	31.2	-33.8	35.0	-37.9
	4	20.0	8.3	-9.1	9.3	-10.1	10.3	-11.2	11.4	-12.4	12.5	-13.6	13.6	-14.8	14.8	-16.2	17.4	-19.0	20.2	-22.0	23.2	-25.3	26.4	-28.7	29.8	-32.4	33.4	-36.4
	4	50.0	7.8	-8.6	8.7	-9.5	9.7	-10.6	10.7	-11.7	11.7	-12.8	12.8	-14.0	13.9	-15.2	16.3	-17.9	18.9	-20.7	21.7	-23.8	24.7	-27.1	27.9	-30.6	31.3	-34.3
	4	100.0	7.4	-8.2	8.3	-9.1	9.2	-10.1	10.1	-11.1	11.1	-12.2	12.1	-13.3	13.2	-14.5	15.5	-17.1	18.0	-19.8	20.6	-22.7	23.5	-25.8	26.5	-29.2	29.7	-32.7
	4	500.0	6.5	-7.3	7.3	-8.1	8.0	-9.0	8.9	-9.9	9.7	-10.8	10.6	-11.9	11.6	-12.9	13.5	-15.1	15.8	-17.6	18.1	-20.2	20.6	-22.9	23.3	-25.9	26.1	-29.0
	5	10.0	8.7	-11.7	9.7	-13.0	10.8	-14.5	11.9	-15.9	13.1	-17.5	14.3	-19.1	15.5	-20.8	18.2	-24.4	21.2	-28.3	24.3	-32.5	27.6	-37.0	31.2	-41.8	35.0	-46.8
	5	20.0	8.3	-10.9	9.3	-12.2	10.3	-13.5	11.4	-14.9	12.5	-16.3	13.6	-17.8	14.8	-19.4	17.4	-22.8	20.2	-26.4	23.2	-30.3	26.4	-34.5	29.8	-39.0	33.4	-43.7
	5	50.0	7.8	-9.9	8.7	-11.0	9.7	-12.2	10.7	-13.4	11.7	-14.7	12.8	-16.1	13.9	-17.5	16.3	-20.6	18.9	-23.9	21.7	-27.4	24.7	-31.2	27.9	-35.2	31.3	-39.5
	5	100.0	7.4	-9.1	8.3	-10.1	9.2	-11.2	10.1	-12.4	11.1	-13.6	12.1	-14.8	13.2	-16.1	15.5	-19.0	18.0	-22.0	20.6	-25.2	23.5	-28.7	26.5	-32.4	29.7	-36.3
	5	500.0	6.5	-7.3	7.3	-8.1	8.0	-9.0	8.9	-9.9	9.7	-10.8	10.6	-11.9	11.6	-12.9	13.6	-15.1	15.8	-17.6	18.1	-20.2	20.6	-22.9	23.3	-25.9	26.1	-29.0

q)

r) For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m^2, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa.

s) a. The effective wind area shall be equal to the span length multiplied by an effective width. This width shall be not less than one-third the span length. For cladding fasteners, the effective wind areas shall not be greater than the area that is tributary to an individual fastener.

t) b. For effective areas between those given, the load shall be interpolated or the load associated with the lower effective areas shall be used.

u) c. Table values shall be adjusted for height and exposure by multiplying by the adjustment coefficient in Table R301.2.1(2).

v) d. See Figure R318.4 for locations of termite infestation probability zones.

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

x) f. Positive and negative design wind pressures shall not be less than 10 psf.

y) g. Where the ratio of the building mean roof height to the building length or width is less than 0.8, uplift loads shall be permitted to be calculated in accordance with ASCE 7.

z) h. Openings for exterior balconies, decks, or porches under roofs enclosed with screen or removable vinyl or acrylic wind break panels shall be exempt from the loads listed in Table R301.2(2) and the height and exposure factors listed in Table R301.2(3). Vinyl and acrylic glazed panels shall be removable. Removable panels shall be identified as removable by a decal. The identification decal shall state "Removable panel SHALL be removed when wind speeds exceed 75 mph (34 m/s)." Decals shall be placed such that the decal is visible when the panel is installed.

TABLE R301.2(4)
ULTIMATE DESIGN WIND SPEEDS BY COUNTY (mph)

Counties not listed	115		
Alleghany	special mountain region	Johnston	120
Ashe	special mountain region	Jones	140
Avery	special mountain region	Lenoir	130
Beaufort	130	Madison	special mountain region
Bertie	120	Martin[f]	120/130
Bladen[a]	130/140	Mitchell	special mountain region
Brunswick	150	New Hanover	150
Buncombe	special mountain region	Onslow[g]	140/150
Camden	130	Pamlico	140
Carteret	150	Pasquotank	130
Chowan	130	Pender[h]	140/150
Columbus	140	Perquimans	130
Craven	140	Pitt	130
Cumberland[b]	120/130	Richmond	120
Currituck	130	Robeson	130
Dare[c]	130/140	Sampson	130
Duplin[d]	130/140	Scotland	120
Gates	120	Swain	special mountain region
Graham	special mountain region	Tyrell	130
Greene	130	Washington	130
Harnett	120	Watauga	special mountain region
Haywood	special mountain region	Wayne	130
Hoke	120	Wilson	120
Hyde[e]	130/140	Yancey	special mountain region
Jackson	special mountain region		

For SI: 1 foot = 304.8, 1 mile per hour = 0.44 m/s.

a) Bladen County – 130 mph zone west of Hwy. 701, 140 mph zone east of Hwy. 701.
b) Cumberland County – 120 mph zone west of I-95, 130 mph zone east of I-95.
c) Dare County - 130 mph zone west of U.S. Route 264, 140 mph zone east of U.S. Route 264.
d) Duplin County - 130 mph zone west of U.S. Route 41, 140 mph zone east of U.S. Route 41
e) Hyde County – 130 mph zone west of U.S. Route 264, 140 mph zone east of U.S. Route 264.
f) Martin County – 120 mph zone west of Hwy. 17, 130 mph zone east of Hwy 17.
g) Onslow County – 150 mph zone in the Township of Swansboro and Stump Sound, 150 mph zone east of the Intracoastal Waterway, 140 mph zone in the remainder of the county
h) Pender County – 150 mph zone in the Township of Topsail, 140 mph zone in the remainder of the county.

TABLE R301.2(5)
ULTIMATE DESIGN WIND SPEED FOR MOUNTAIN REGIONS

FIRST FLOOR FINISH ELEVATION (feet)	ULTIMATE DESIGN WIND SPEED (mph)
Less than 2,700	115
2,700 to less than 3,000	120
3,000 to less than 3,500	130
3,500 to less than 4,500	140
4,500 or greater	150

For SI: 1 foot = 304.8, 1 mile per hour = 0.44 m/s.

TABLE R301.2(6)
DESIGN PRESSURES FOR DOORS AND WINDOWS [a,b,c,d,e]
POSITIVE AND NEGATIVE (psf)

VELOCITY (mph)	MEAN ROOF HEIGHT (feet)		
	15	25	35
115	16	18	20
120	17	20	22

For SI: 1 foot = 304.8, 1 mile per hour = 0.44 m/s.
a. Alternative design pressures may be determined by using *North Carolina Building Code*, ASCE-7, or the *International Building Code*.
b. If window or door is more than 4 feet (1219 mm) from a corner, the pressure from this table shall be permitted to be multiplied by 0.87. This adjustment does not apply to garage doors.
c. For windows and doors in structures with a roof slope of 10 degrees (0.0745 rad) or less (2:12) from the table may be multiplied by 0.90.
d. Design pressure ratings based on standards listed in Section R609 are adequate documentation of capacity to resist pressures from the table.
e. Design pressures are for windows and doors located in Exposure Category B.

TABLE R301.2(7)
COUNTIES IN SEISMIC DESIGN CATEGORY C

Transylvania	Jackson
Madison	Macon
Cherokee	Henderson
Clay	Buncombe
Graham	Swain
Haywood	

Note: Counties not listed are in Seismic Design Category A or B.

R301.2.1.1 Wind limitations and wind design required. ~~The wind provisions of this code shall not apply to the design of buildings where wind design is required in accordance with Figure R301.2.1.1, or where the ultimate design wind speed, V_{ult}, in Figure R301.2(2) equals or exceeds 140 miles per hour (225 kph) in a special wind region.~~ Construction in regions where the ultimate wind speeds from Tables R301.2(4) and R301.2(5) equal or exceed 130 miles per hour (58 m/s) shall be designed in accordance with one of the following:

~~**Exceptions:**~~

~~1. For concrete construction, the wind provisions of this code shall apply in accordance with the limitations of Sections R404 and R608.~~

2. ~~For structural insulated panels, the wind provisions of this code shall apply in accordance with the limitations of Section R610.~~

3. ~~For cold-formed steel *light-frame construction*, the wind provisions of this code shall apply in accordance with the limitations of Sections R505, R603 and R804.~~

~~In regions where wind design is required in accordance with Figure R301.2.1.1 or where the ultimate design wind speed, V_{ult}, in Figure R301.2(2) equals or exceeds 140 miles per hour (225 kph) in a special wind region, the design of buildings for wind loads shall be in accordance with one or more of the following methods:~~

1. AWC *Wood Frame Construction Manual* (WFCM).
2. ICC *Standard for Residential Construction in High-Wind Regions* (ICC 600).
3. ASCE *Minimum Design Loads for Buildings and Other Structures* (ASCE 7).
4. Deleted. ~~AISI *Standard for Cold-Formed Steel Framing—Prescriptive Method for One- and Two-Family Dwellings* (AISI S230).~~
5. *International Building Code*.
6. Concrete construction shall be designed in accordance with the provisions of this code.
7. Structural insulated panel (SIP) walls shall be designed in accordance with the provisions of this code.
8. Chapters 45 and 46.

The elements of design not addressed by the methods in Items 1 through 5 shall be in accordance with the provisions of this code.

Where ASCE 7 or the *International Building Code* is used for the design of the building, the wind speed map and exposure category requirements as specified in ASCE 7 and the *International Building Code* shall be used.

R301.2.1.1.1 Sunrooms. Deleted. ~~*Sunrooms* shall comply with AAMA/NPEA/NSA 2100. For the purpose of applying the criteria of AAMA/NPEA/NSA 2100 based on the intended use, *sunrooms* shall be identified as one of the following categories by the permit applicant, *design professional* or the property *owner* or owner's agent in the *construction documents*. Component and cladding pressures shall be used for the design of elements that do not qualify as main windforce-resisting systems. Main windforce-resisting system pressures shall be used for the design of elements assigned to provide support and stability for the overall *sunroom*.~~

~~**Category I:** A thermally isolated *sunroom* with walls that are open or enclosed with insect screening or 0.5 mm (20 mil) maximum thickness plastic film. The space is nonhabitable and unconditioned.~~

~~**Category II:** A thermally isolated *sunroom* with enclosed walls. The openings are enclosed with translucent or transparent plastic or glass. The space is nonhabitable and unconditioned.~~

~~**Category III:** A thermally isolated *sunroom* with enclosed walls. The openings are enclosed with translucent or transparent plastic or glass. The *sunroom* fenestration complies with additional requirements for air infiltration resistance and water penetration resistance. The space is nonhabitable and unconditioned.~~

~~**Category IV:** A thermally isolated *sunroom* with enclosed walls. The *sunroom* is designed to be heated or cooled by a separate temperature control or system and is thermally isolated from the primary structure. The *sunroom* fenestration complies with additional requirements for water penetration resistance, air infiltration resistance and thermal performance. The space is nonhabitable and conditioned.~~

~~**Category V:** A *sunroom* with enclosed walls. The *sunroom* is designed to be heated or cooled and is open to the main structure. The *sunroom* fenestration complies with additional requirements for water penetration resistance, air infiltration resistance and thermal performance. The space is habitable and conditioned.~~

R301.2.1.2 Protection of openings. Exterior glazing in buildings located in *windborne debris regions* shall be protected from windborne debris. Glazed opening protection for windborne debris shall meet the requirements of the Large Missile Test of ASTM E1886 and ASTM E1996 as modified in Section 301.2.1.2.1. Garage door glazed opening protection for windborne debris shall meet the requirements of an *approved* impact-resisting standard or ANSI/DASMA 115.

Exception:

1. *Wood structural panels* with a thickness of not less than $^{7}/_{16}$ inch (11 mm) and a span of not more than 8 feet (2438 mm) shall be permitted for opening protection. Panels shall be precut and attached to the framing surrounding the opening containing the product with the glazed opening. Panels shall be predrilled as required for the anchorage method and shall be secured with the attachment hardware provided. Attachments shall be designed to resist the component and cladding loads determined in accordance with either Table R301.2.1(1) or ASCE 7, with the permanent corrosion-resistant attachment hardware provided and anchors permanently installed on the building. Attachment in accordance with Table R301.2.1.2 is permitted for buildings with a mean roof height of 45 feet (13 728 mm) or less where the ultimate design wind speed, V_{ult}, is 180 mph (290 kph) or less.
2. Openings for exterior balconies, decks, or porches under roofs enclosed with screen or removable vinyl or acrylic wind break panels shall not be required to be protected, provided the spaces are separated from the building interior by a wall and all openings in the wall separating the unit from the balcony, deck or porch are protected in accordance with this section. Vinyl and acrylic glazed panels shall be removable. Removable panels shall be identified as removable by a decal. The identification decal shall state “Removable panel SHALL be removed when wind speeds exceed 75 mph (34 m/s).” Decals shall be placed such that the decal is visible when the panel is installed.

TABLE R301.2.1.2

WINDBORNE DEBRIS PROTECTION FASTENING SCHEDULE FOR WOOD STRUCTURAL PANELS[a, b, c, d]

FASTENER TYPE	FASTENER SPACING (inches)[a, b]		
	Panel span ≤ 4 feet	4 feet < panel span ≤ 6 feet	6 feet < panel span ≤ 8 feet
No. 8 ~~wood-screw-based anchor with 2-inch embedment length~~ wood screws	16	10	8
No. 10 ~~wood-screw-based anchor with 2-inch embedment length~~ wood screws	16	12	9
$^{1}/_{4}$-inch ~~lag-screw-based anchor with 2-inch embedment length~~ lag screws	16	16	16

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound = 4.448 N, 1 mile per hour = 0.447 m/s.

a. This table is based on 180 mph ultimate design wind speeds, V_{ult}, and a 45-foot mean roof height.

b. Fasteners shall be installed at opposing ends of the *wood structural panel*. Fasteners shall be located not less than 1 inch from the edge of the panel.

c. ~~Anchors~~ Fasteners shall penetrate through the exterior wall covering with an embedment length of not less than 2 inches into the building frame. Fasteners shall be located not less than $2^{1}/_{2}$ inches from the edge of concrete block or concrete.

d. Panels attached to masonry or masonry/stucco shall be attached using vibration-resistant anchors having an ultimate withdrawal capacity of not less than 1,500 pounds.

R301.2.1.5 Topographic wind effects. Deleted. ~~In areas designated in Table R301.2 as having local historical data documenting structural damage to buildings caused by wind speed-up at isolated *hills*, ridges and escarpments that are abrupt changes from the general topography of the area, topographic wind effects shall be considered in the design of the building in accordance with Section R301.2.1.5.1 or in accordance with the provisions of ASCE 7. See Figure R301.2.1.5.1(1) for topographic features for wind speed-up effect.~~

~~In these designated areas, topographic wind effects shall apply only to buildings sited on the top half of an isolated *hill*, *ridge* or escarpment where all of the following conditions exist:~~

1. ~~The average slope of the top half of the *hill*, *ridge* or escarpment is 10 percent or greater.~~
2. ~~The *hill*, *ridge* or escarpment is 60 feet (18 288 mm) or greater in height for Exposure B, 30 feet (9144 mm) or greater in height for Exposure C, and 15 feet (4572 mm) or greater in height for Exposure D.~~
3. ~~The *hill*, *ridge* or escarpment is isolated or unobstructed by other topographic features of similar height in the upwind direction for a distance measured from its high point of 100 times its height or 2 miles (3.2 km), whichever is less. See Figure R301.2.1.5.1(3) for upwind obstruction.~~

4. ~~The *hill*, *ridge* or escarpment protrudes by a factor of two or more above the height of other upwind topographic features located in any quadrant within a radius of 2 miles (3.2 km) measured from its high point.~~

R301.2.1.5.1 Simplified topographic wind speed-up method. <u>Deleted.</u> ~~As an alternative to the ASCE 7 topographic wind provisions, the provisions of Section R301.2.1.5.1 shall be permitted to be used to design for wind speed-up effects, where required by Section R301.2.1.5.~~

~~Structures located on the top half of isolated *hills*, ridges or escarpments meeting the conditions of Section R301.2.1.5 shall be designed for an increased basic wind speed as determined by Table R301.2.1.5.1. On the high side of an escarpment, the increased basic wind speed shall extend horizontally downwind from the edge of the escarpment 1.5 times the horizontal length of the upwind slope (1.5L) or 6 times the height of the escarpment (6H), whichever is greater. See Figure R301.2.1.5.1(2) for where wind speed increase is applied.~~

~~TABLE R301.2.1.5.1~~

~~ULTIMATE DESIGN WIND SPEED MODIFICATION FOR TOPOGRAPHIC WIND EFFECT~~[a, b]

~~ULTIMATE DESIGN WIND SPEED FROM FIGURE R301.2(2) (mph)~~	~~AVERAGE SLOPE OF THE TOP HALF OF HILL, RIDGE OR ESCARPMENT (percent)~~						
	~~0.10~~	~~0.125~~	~~0.15~~	~~0.175~~	~~0.20~~	~~0.23~~	~~0.25~~
	~~Required ultimate design wind speed-up, modified for topographic wind speed-up (mph)~~						
~~95~~	~~114~~	~~119~~	~~123~~	~~127~~	~~131~~	~~137~~	~~140~~
~~100~~	~~120~~	~~125~~	~~129~~	~~134~~	~~138~~	~~144~~	~~147~~
~~105~~	~~126~~	~~131~~	~~135~~	~~141~~	~~145~~	~~151~~	~~154~~
~~110~~	~~132~~	~~137~~	~~142~~	~~147~~	~~152~~	~~158~~	~~162~~
~~115~~	~~138~~	~~143~~	~~148~~	~~154~~	~~159~~	~~165~~	~~169~~
~~120~~	~~144~~	~~149~~	~~155~~	~~160~~	~~166~~	~~172~~	~~176~~
~~130~~	~~156~~	~~162~~	~~168~~	~~174~~	~~179~~	~~NA~~	~~NA~~
~~140~~	~~168~~	~~174~~	~~181~~	~~NA~~	~~NA~~	~~NA~~	~~NA~~
~~150~~	~~180~~	~~NA~~	~~NA~~	~~NA~~	~~NA~~	~~NA~~	~~NA~~

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

~~NA = Not Applicable.~~

~~a. Table applies to a feature height of 500 feet or less and dwellings sited a distance equal or greater than half the feature height.~~

~~b. Where the ultimate design wind speed as modified by Table R301.2.1.5.1 equals or exceeds 140 miles per hour, the building shall be considered as "wind design required" in accordance with Section R301.2.1.1.~~

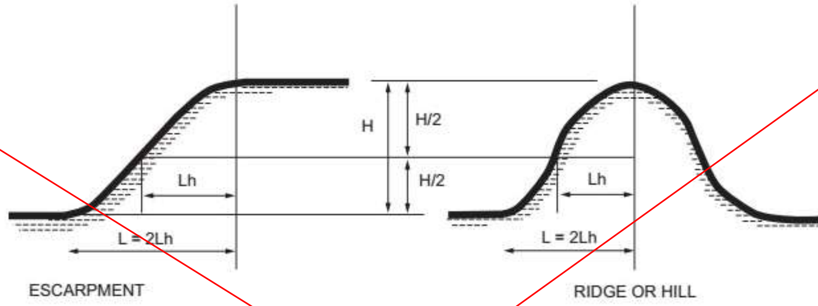
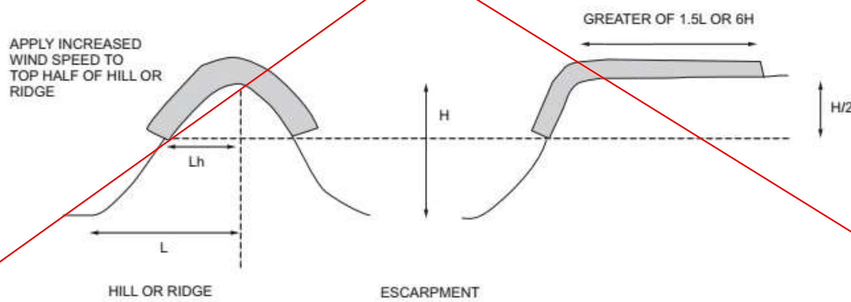


FIGURE R301.2.1.5.1(1)TOPOGRAPHIC FEATURES FOR WIND SPEED-UP EFFECT



~~FIGURE R301.2.1.5.1(2)ILLUSTRATION OF WHERE ON A TOPOGRAPHIC FEATURE, WIND SPEED INCREASE IS APPLIED~~

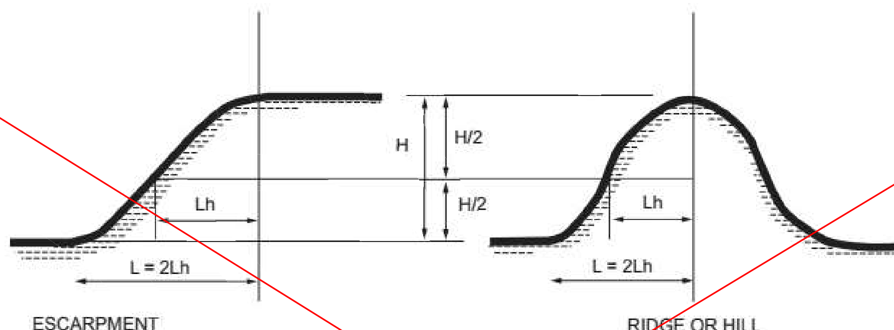
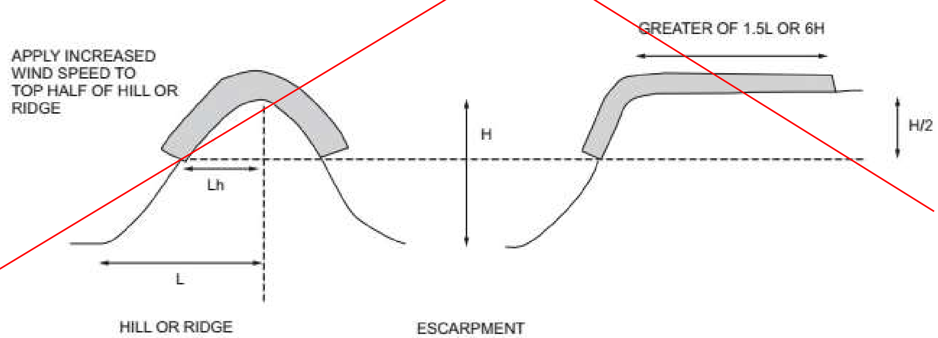
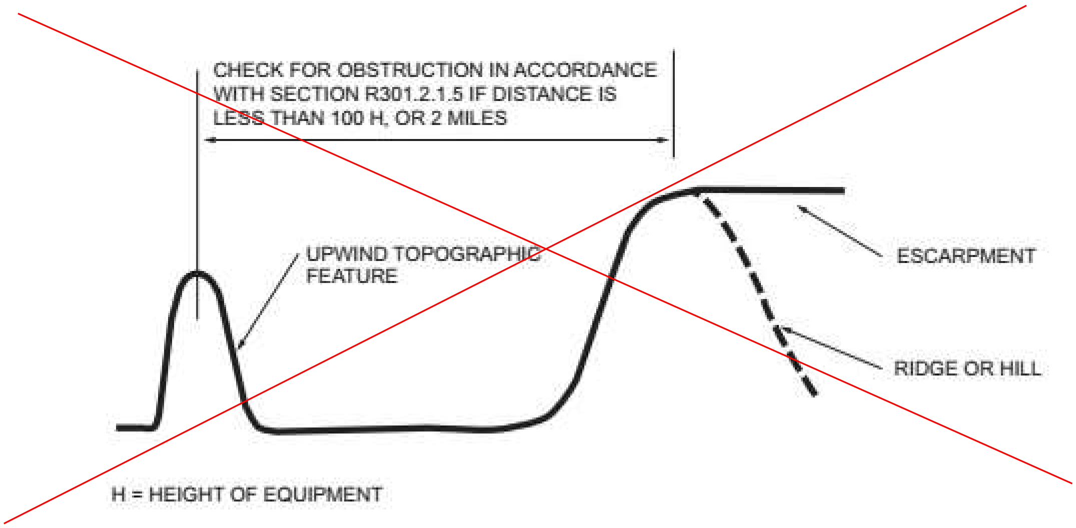


FIGURE R301.2.1.5.1(1)TOPOGRAPHIC FEATURES FOR WIND SPEED-UP EFFECT



~~FIGURE R301.2.1.5.1(2)ILLUSTRATION OF WHERE ON A TOPOGRAPHIC FEATURE, WIND SPEED INCREASE IS APPLIED~~



~~FIGURE R301.2.1.5.1(3)UPWIND OBSTRUCTION~~

R301.2.2 Townhouses seismic provisions. ~~Buildings~~ *Townhouses* in *Seismic Design* ~~*Categories*~~ *Category* C, ~~D_0, D_1 and D_2~~ shall be constructed in accordance with the requirements of this section and other seismic requirements of this code. ~~The seismic provisions of this code shall apply as follows:~~

1. ~~*Townhouses* in *Seismic Design Categories* C, D_0, D_1 and D_2.~~
2. ~~Detached one- and two-family *dwellings* in *Seismic Design Categories*, D_0, D_1 and D_2.~~

~~Buildings in Seismic Design Category E shall be designed to resist seismic loads in accordance with the *International Building Code*, except where the seismic design category is reclassified to a lower seismic design category in accordance with Section R301.2.2.1. Components of buildings not required to be designed to resist seismic loads shall be constructed in accordance with the provisions of this code.~~

R301.2.2.1 Determination of seismic design category. Buildings shall be assigned a seismic design category in accordance with ~~Figures R301.2.2.1(1) through R301.2.2.1(6).~~ Table R301.2(7).

~~**R301.2.2.1.1 Alternate determination of seismic design category.** If soil conditions are determined by the building official to be Site Class A, B, or D, the seismic design category and short-period design spectral response accelerations, S_{DS}, for a site shall be allowed to be determined in accordance with Figures R301.2.2.1.1(1) through R301.2.2.1.1(6), or Section 1613.2 of the *International Building Code*. The value of S_{DS} determined in accordance with Section 1613.2 of the *International Building Code* is permitted to be used to set the seismic design category in accordance with Table R301.2.2.1.1, and to interpolate between values in Tables R602.10.3(3) and R603.9.2(1) and other seismic design requirements of this code.~~

~~**TABLE R301.2.2.1.1**~~

~~**SEISMIC DESIGN CATEGORY DETERMINATION**~~

~~CALCULATED S_{DS}~~	~~SEISMIC DESIGN CATEGORY~~
~~$S_{DS} \le 0.17g$~~	~~A~~
~~$0.17g < S_{DS} \le 0.33g$~~	~~B~~
~~$0.33g < S_{DS} \le 0.50g$~~	~~C~~
~~$0.50g < S_{DS} \le 0.67g$~~	~~D_0~~
~~$0.67g < S_{DS} \le 0.83g$~~	~~D_1~~
~~$0.83g < S_{DS} \le 1.25g$~~	~~D_2~~
~~$1.25g < S_{DS}$~~	~~E~~

~~**R301.2.2.1.2 Alternative determination of Seismic Design Category E.** Buildings located in Seismic Design Category E in accordance with Figures R301.2.2.1(1) through R301.2.2.1(6), or Figures R301.2.2.1.1(1) through R301.2.2.1.1(6) where applicable, are permitted to be reclassified as being in Seismic Design Category D_2 provided that one of the following is done:~~

1. ~~A more detailed evaluation of the seismic design category is made in accordance with the provisions and maps of the *International Building Code*. Buildings located in Seismic Design Category E in accordance with Table R301.2.2.1.1, but located in Seismic Design Category D in accordance with the *International Building Code*, shall be permitted to be designed using the Seismic Design Category D_2 requirements of this code.~~
2. ~~Buildings located in Seismic Design Category E that conform to the following additional restrictions are permitted to be constructed in accordance with the provisions for Seismic Design Category D_2 of this code:~~
    - ~~2.1. All exterior shear wall lines or *braced wall panels* are in one plane vertically from the foundation to the uppermost *story*.~~
    - ~~2.2. Floors shall not cantilever past the *exterior walls*.~~
    - ~~2.3. The building is within the requirements of Section R301.2.2.6 for being considered as regular.~~

R301.2.2.2 Weights of materials. Average dead loads shall not exceed 15 pounds per square foot (720 Pa) for the combined roof and ceiling assemblies (on a horizontal projection) or 10 pounds per square foot (480 Pa) for floor assemblies, except as further limited by Section R301.2.2. Dead loads for walls above *grade* shall not exceed:

1. Fifteen pounds per square foot (720 Pa) for exterior light-frame wood walls.
2. Deleted. ~~Fourteen pounds per square foot (670 Pa) for exterior light-frame cold-formed steel walls.~~
3. Ten pounds per square foot (480 Pa) for interior light-frame wood walls.
4. Deleted. ~~Five pounds per square foot (240 Pa) for interior light-frame cold-formed steel walls.~~
5. Eighty pounds per square foot (3830 Pa) for 8-inch-thick (203 mm) masonry walls.
6. Eighty-five pounds per square foot (4070 Pa) for 6-inch-thick (152 mm) concrete walls.
7. Ten pounds per square foot (480 Pa) for SIP walls.

Exceptions:

1. Deleted. ~~Roof and ceiling dead loads not exceeding 25 pounds per square foot (1190 Pa) shall be permitted provided that the wall bracing amounts in Section R602.10.3 are increased in accordance with Table R602.10.3(4).~~
2. Light-frame walls with stone or masonry veneer shall be permitted in accordance with the provisions of Sections R702.1 and R703.
3. Fireplaces and chimneys shall be permitted in accordance with Chapter 10.

R301.2.2.3 Stone and masonry veneer. Anchored stone and masonry veneer shall comply with the requirements of Sections R702.1 and R703.

R301.2.2.4 Masonry construction. Masonry construction ~~in *Seismic Design Categories* D_0 and D_1 shall comply with the requirements of Section R606.12.1. Masonry construction in Seismic Design Category D_2~~ shall comply with the requirements of Section R606.12~~.4~~.

R301.2.2.5 Concrete construction. ~~Buildings~~ *Townhouses* with exterior above-*grade* concrete walls shall comply with PCA 100 or shall be designed in accordance with ACI 318.

Exception: Deleted. ~~Detached one- and two-family dwellings in Seismic Design Category C with exterior above-*grade* concrete walls are allowed to comply with the requirements of Section R608.~~

R301.2.2.6 Irregular ~~buildings~~ Townhouses. The seismic provisions of this code shall not be used for structures, or portions thereof, located in *Seismic Design* ~~*Categories*~~ *Category* C~~, D_0, D_1 and D_2~~ and considered to be irregular in accordance with this section. A building or portion of a building shall be considered to be irregular where one or more of the conditions defined in Items 1 through 8 occur. Irregular structures, or irregular portions of structures, shall be designed in accordance with accepted engineering practice to the extent the irregular features affect the performance of the remaining structural system. Where the forces associated with the irregularity are resisted by a structural system designed in accordance with accepted engineering practice, the remainder of the building shall be permitted to be designed using the provisions of this code.

1. ***Shear wall* or braced wall offsets out of plane.** Conditions where exterior *shear wall* lines or *braced wall panels* are not in one plane vertically from the foundation to the uppermost story in which they are required.

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

   1. Floor joists are nominal 2 inches by 10 inches (51 mm by 254 mm) or larger and spaced not more than 16 inches (406 mm) on center.
   2. The ratio of the back span to the cantilever is not less than 2 to 1.
   3. Floor joists at ends of *braced wall panels* are doubled.
   4. For wood-frame construction, a continuous rim joist is connected to ends of cantilever joists. Where spliced, the rim joists shall be spliced using a galvanized metal tie not less than 0.058 inch (1.5 mm) (16 gage) and $1^1/_2$ inches (38 mm) wide fastened with six 16d nails on each side of the splice; or a block of the same size as the rim joist and of sufficient length to fit securely between the joist space at which the splice occurs, fastened with eight 16d nails on each side of the splice.
   5. Gravity loads carried at the end of cantilevered joists are limited to uniform wall and roof loads and the reactions from headers having a span of 8 feet (2438 mm) or less.

R301.2.2.7 Height limitations. Wood-framed buildings shall be limited to three *stories* above *grade plane* or the limits given in Table R602.10.3(3). ~~Wood-framed buildings in Seismic Design Category D_2 exceeding two *stories* shall be designed for wind and seismic loads in accordance with accepted engineering practice.~~ ~~Cold-formed steel framed buildings shall be limited to less than or equal to three *stories* above *grade plane* in accordance with AISI S230.~~ *Mezzanines* as defined in Section R202 that comply with Section R325 shall not be considered as *stories*. *Structural insulated panel* buildings shall be limited to two *stories* above *grade plane*.

R301.2.2.8 Cold-formed steel framing in Seismic Design Categories D_0, D_1 and D_2. Deleted. ~~In *Seismic Design Categories* D_0, D_1 and D_2 in addition to the requirements of this code, cold-formed steel framing shall comply with the requirements of AISI S230.~~

R301.2.2.9 Masonry chimneys. Deleted. ~~In *Seismic Design Categories* D_0, D_1 and D_2, masonry chimneys shall be reinforced and anchored to the building in accordance with Sections R1003.3 and R1003.4.~~

R301.2.2.10 Anchorage of water heaters. Deleted. ~~In *Seismic Design Categories* D_0, D_1 and D_2, and in *townhouses* in Seismic Design Category C, water heaters and thermal storage units shall be anchored against movement and overturning in accordance with Section M1307.2 or P2801.8.~~

R301.2.3 Snow loads. Deleted. ~~Wood-framed construction, cold-formed, steel-framed construction and masonry and concrete construction, and *structural insulated panel* construction in regions with ground snow loads 70 pounds per square foot (3.35 kPa) or less, shall be in accordance with Chapters 5, 6 and 8. Buildings in regions with ground snow loads greater than 70 pounds per square foot (3.35 kPa) shall be designed in accordance with accepted engineering practice.~~

R301.3 Story height. The wind and seismic provisions of this code shall apply to buildings with *story heights* not exceeding the following:

1. For wood wall framing, the *story height* shall not exceed 11 feet 7 inches (3531 mm) and the laterally unsupported bearing wall stud height permitted by Table R602.3(5).

   Exception: A story height not exceeding 13 feet 7 inches (4140 mm) is permitted provided that the maximum wall stud clear height does not exceed 12 feet (3658 mm), the wall studs are in accordance with Exception 2 or 3 of Section R602.3.1 or an engineered design is provided for the wall framing members, and wall bracing for the building is in accordance with Section R602.10. Studs shall be laterally supported at the top and bottom plate in accordance with Section R602.3.

2. Deleted. ~~For cold-formed steel wall framing, the *story height* shall be not more than 11 feet 7 inches (3531 mm) and the unsupported bearing wall stud height shall be not more than 10 feet (3048 mm).~~

3. For masonry walls, the *story height* shall be not more than 13 feet 7 inches (4140 mm) and the bearing wall clear height shall be not more than 12 feet (3658 mm).

   Exception: An additional 8 feet (2438 mm) of bearing wall clear height is permitted for gable end walls.

4. For insulating concrete form walls, the maximum *story height* shall not exceed 11 feet 7 inches (3531 mm) and the maximum unsupported wall height per *story* as permitted by Section R608 tables shall not exceed 10 feet (3048 mm).

5. For structural insulated panel (SIP) walls, the *story height* shall be not more than 11 feet 7 inches (3531 mm) and the bearing wall height per *story* as permitted by Section R610 tables shall not exceed 10 feet (3048 mm).

For walls other than wood-framed walls, individual walls or wall studs shall be permitted to exceed these limits as permitted by Chapter 6, provided that the *story heights* of this section are not exceeded. An engineered design shall be provided for the wall or wall framing members where the limits of Chapter 6 are exceeded. Where the *story height* limits of this section are exceeded, the design of the building, or the noncompliant portions thereof, to resist wind and seismic loads shall be in accordance with the *International Building Code*.

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

USE	**UNIFORM** LOAD **(psf)**	**CONCENTRATED LOAD (lb)**
Uninhabitable attics without storage[b]	10	—
Uninhabitable attics with limited storage[b, g]	20	—
Habitable attics and attics served with fixed stairs	30	—
Balconies (exterior) and decks[e]	40	—
Fire escapes	40	—
Guards	—	200[h, i]
Guard in-fill components[f]	—	50[h]
Handrail[d]	200[h]	—
Passenger vehicle garages[a]	50[a]	2,000[a]
Areas other than sleeping areas	40	—
Sleeping areas	30	—
Stairs	40[c]	300[c]

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kPa, 1 square inch = 645 mm^2, 1 pound = 4.45 N.

a. Elevated garage floors shall be capable of supporting the uniformly distributed live load or a 2,000-pound concentrated load applied on an area of $4^1/_2$ inches by $4^1/_2$ inches, whichever produces the greater stresses.

b. Uninhabitable attics without storage are those where the clear height between joists and rafters is not more than 42 inches, or where there are not two or more adjacent trusses with web configurations capable of accommodating an assumed rectangle 42 inches in height by 24 inches in width, or greater, within the plane of the trusses. This *live load* need not be assumed to act concurrently with any other live load requirements.

c. Individual stair treads shall be capable of supporting the uniformly distributed live load or a 300-pound concentrated load applied on an area of 2 inches by 2 inches, whichever produces the greater stresses.

d. A single concentrated load applied in any direction at any point along the top. For a guard not required to serve as a handrail, the load need not be applied to the top element of the guard in a direction parallel to such element.

e. See ~~Section R507.1~~ Appendix NC-A for decks attached to exterior walls.

f. Guard in-fill components (all those except the handrail), balusters and panel fillers shall be designed to withstand a horizontally applied normal load of 50 pounds on an area equal to 1 square foot. This load need not be assumed to act concurrently with any other live load requirement.

g. Uninhabitable attics with limited storage are those where the clear height between joists and rafters is 42 inches or greater, or where there are two or more adjacent trusses with web configurations capable of accommodating an assumed rectangle 42 inches in height by 24 inches in width, or greater, within the plane of the trusses.

The live load need only be applied to those portions of the joists or truss bottom chords where all of the following conditions are met:

1. The attic area is accessed from an opening not less than 20 inches in width by 30 inches in length that is located where the clear height in the attic is not less than 30 inches.
2. The slopes of the joists or truss bottom chords are not greater than 2 units vertical in 12 units horizontal.
3. Required insulation depth is less than the joist or truss bottom chord member depth.

The remaining portions of the joists or truss bottom chords shall be designed for a uniformly distributed concurrent live load of not less than 10 pounds per square foot.

h. Glazing used in handrail assemblies and guards shall be designed with a load adjustment factor of 4. The load adjustment factor shall be applied to each of the concentrated loads applied to the top of the rail, and to the load on the in-fill components. These loads shall be determined independent of one another, and loads are assumed not to occur with any other live load.

i. Where the top of a guard system is not required to serve as a handrail, the single concentrated load shall be applied at any point along the top, in the vertical downward direction and in the horizontal direction away from the walking surface. Where the top of a guard is also serving as the handrail, a single concentrated load shall be applied in any direction at any point along the top. Concentrated loads shall not be applied concurrently.

R301.6 Roof load. The roof shall be designed for the *live load* indicated ~~in Table R301.6 or the ground snow load indicated in~~ Table R301.2, whichever is greater.

~~TABLE R301.6~~

~~MINIMUM ROOF LIVE LOADS IN POUNDS-FORCE PER SQUARE FOOT OF HORIZONTAL PROJECTION~~

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

~~For SI: 1 square foot = 0.0929 m^2, 1 pound per square foot = 0.0479 kPa, 1 inch per foot = 83.3 mm/m.~~

R301.7 Deflection. The allowable deflection of any structural member under the *live load* listed in Sections R301.5 and R301.6 or wind loads determined by Section R301.2.1 shall not exceed the values in Table R301.7.

TABLE R301.7

ALLOWABLE DEFLECTION OF STRUCTURAL MEMBERS[b, c]

STRUCTURAL MEMBER	ALLOWABLE DEFLECTION
Rafters having slopes greater than 3:12 with finished ceiling not attached to rafters	*L*/180
Interior walls and partitions	*H*/180
Floors	*L*/360[f]
Ceilings with brittle finishes (including plaster and stucco)	*L*/360
Ceilings with flexible finishes (including gypsum board)	*L*/240
All other structural members	*L*/240
Exterior walls—wind loads[a] with plaster or stucco finish	*H*/360
Exterior walls—wind loads[a] with other brittle finishes	*H*/240
Exterior walls—wind loads[a] with flexible finishes	*H*/120[d]
Lintels supporting masonry veneer walls[e]	*L*/600

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

a. For the purpose of the determining deflection limits herein, the wind load shall be permitted to be taken as 0.7 times the component and cladding (ASD) loads obtained from Table R301.2.1(1).

b. For cantilever members, *L* shall be taken as twice the length of the cantilever.

c. For aluminum structural members or panels used in roofs or walls of sunroom additions or patio covers, not supporting edge of glass or sandwich panels, the total load deflection shall not exceed *L*/60. For continuous aluminum structural members supporting edge of glass, the total load deflection shall not exceed *L*/175 for each glass lite or *L*/60 for the entire length of the member, whichever is more stringent. For sandwich panels used in roofs or walls of sunroom additions or patio covers, the total load deflection shall not exceed *L*/120.

d. Deflection for exterior walls with interior gypsum board finish shall be limited to an allowable deflection of *H*/180.

e. Refer to Section R703.8.2. The dead load of supported materials shall be included when calculating the deflection of these members.

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

SECTION R302
FIRE-RESISTANT CONSTRUCTION

R302.1 Exterior walls. Construction, projections, openings and penetrations of exterior walls of *dwellings* and accessory buildings shall comply with Table R302.1(1); or *dwellings* equipped throughout with an *automatic sprinkler system* installed in accordance with Section P2904 shall comply with Table R302.1(2).

Exceptions:

1. Walls, projections, openings or penetrations in walls perpendicular to the line used to determine the *fire separation distance*. *Townhouse* eave projections shall comply with Sections R302.2.7 and R302.2.8.
2. Walls of *individual dwelling units* and their *accessory structures* located on the same *lot*.
3. Detached tool sheds and storage sheds, playhouses and similar structures exempted from *permits* are not required to provide wall protection based on location on the *lot*. Projections beyond the exterior wall shall not extend over the *lot line*.
4. Detached garages accessory to a *dwelling* located within ~~2~~ 3 feet (~~610~~ 915 mm) of a *lot line* are permitted to have non-fire-resistance rated roof eave projections not exceeding 4 16 inches (~~102~~ 407 mm).
5. Foundation vents installed in compliance with this code are permitted.

R302.1.1 Soffit protection. In construction using vinyl or aluminum soffit material, the following application shall apply. Soffit assemblies located on buildings with less than a 5 feet (1524 mm) fire separation distance shall be securely attached to framing members and applied over fire-retardant-treated wood, 23/32-inch (18.3 mm) wood sheathing or 5/8-inch (15.9 mm) exterior grade or moisture resistant gypsum board. Venting requirements shall be provided in both soffit and underlayments. Vents shall be either nominal 2-inch (51 mm) continuous or equivalent intermittent and shall not exceed the minimum net free air requirements established in Section R806.2 by more than 50 percent. *Townhouse* construction shall meet the additional requirements of Sections R302.2.7 and R302.2.8.

Exceptions:

1. Any portion of soffits having 5 feet (1524 mm) or more *fire separation distance*.
2. Roof rake lines where the soffit does not communicate to the attic are not required to be protected per this section.
3. Soffits with less than 3 feet (914 mm) *fire separation distance* shall meet the projection fire rating requirements of Table R302.1.
4. Soffits between buildings located on the same lot.

R302.1.2 Flame spread. Vinyl siding and vinyl soffit materials shall have a flame spread index of 25 or less as tested in accordance with ASTM E84.

TABLE R302.1~~(1)~~
EXTERIOR WALLS

EXTERIOR WALL ELEMENT	MINIMUM FIRE-RESISTANCE RATING	MINIMUM FIRE SEPARATION DISTANCE

Walls	Fire-resistance rated	1 hour—tested in accordance with ASTM E119, UL 263 ~~or Section 703.3 of the *International Building Code*~~ with exposure from both sides	~~0~~ < 3 feet < 5 feet[c]
	Not fire-resistance rated	0 hours	≥ ~~5~~ 3 feet > 5 feet[c]
Projections	~~Not allowed~~	~~NA~~	~~< 2 feet~~
	Fire-resistance rated	1 hour on the underside, or heavy timber, or fire-retardant-treated wood[a, b]	~~≥ 2 feet to < 5 feet~~ < 3 feet < 5 feet[c]
	Not fire-resistance rated	0 hours	~~≥ 5~~ > 3feet > 5 feet[c]
Openings in walls	Not allowed	NA	< 3 feet < 5 feet[c]
	~~25% maximum of wall area~~	~~0 hours~~	~~3 feet~~
	Unlimited	0 hours	~~5~~ 3 feet > 5 feet[c]
Penetrations	All	Comply with Section R302.4	< 3 feet < 5 feet[c]
		None required	3 feet > 5 feet[c]

For SI: 1 foot = 304.8 mm.
NA = Not Applicable.
a. The fire-resistance rating shall be permitted to be reduced to 0 hours on the underside of the eave overhang if fireblocking is provided from the wall top plate to the underside of the roof sheathing.
b. The fire-resistance rating shall be permitted to be reduced to 0 hours on the underside of the rake overhang where gable vent openings are not installed.
c. Fire separation distance requirement for multiple dwellings on a single parcel.

~~**TABLE R302.1(2)**~~

~~**EXTERIOR WALLS—DWELLINGS WITH FIRE SPRINKLERS**~~

~~EXTERIOR WALL ELEMENT~~		~~MINIMUM FIRE-RESISTANCE RATING~~	~~MINIMUM FIRE SEPARATION DISTANCE~~
~~Walls~~	~~Fire-resistance rated~~	~~1 hour—tested in accordance with ASTM E119, UL 263 or Section 703.2.2 of the *International Building Code* with exposure from the outside~~	~~0 feet~~
	~~Not fire-resistance rated~~	~~0 hours~~	~~3 feet[a]~~
~~Projections~~	~~Not allowed~~	~~NA~~	~~< 2 feet~~
	~~Fire-resistance rated~~	~~1 hour on the underside, or heavy timber, or fire-retardant-treated wood[b, c]~~	~~2 feet[a]~~
	~~Not fire-resistance rated~~	~~0 hours~~	~~3 feet~~
~~Openings in walls~~	~~Not allowed~~	~~NA~~	~~< 3 feet~~
	~~Unlimited~~	~~0 hours~~	~~3 feet[a]~~
~~Penetrations~~	~~All~~	~~Comply with Section R302.4~~	~~< 3 feet~~
		~~None required~~	~~3 feet[a]~~

~~For SI: 1 foot = 304.8 mm.~~

~~NA = Not Applicable.~~

a. ~~For residential subdivisions where all dwellings are equipped throughout with an automatic sprinkler system installed in accordance with Section P2904, the *fire separation distance* for exterior walls not fire-resistance rated and for fire-resistance-rated projections shall be permitted to be reduced to 0 feet, and unlimited unprotected openings and penetrations shall be permitted, where the adjoining lot provides an open setback yard that is 6 feet or more in width on the opposite side of the property line.~~

b. ~~The fire-resistance rating shall be permitted to be reduced to 0 hours on the underside of the eave overhang if fireblocking is provided from the wall top plate to the underside of the roof sheathing.~~

c. ~~The fire-resistance rating shall be permitted to be reduced to 0 hours on the underside of the rake overhang where gable vent openings are not installed.~~

R302.2 Townhouses. Walls separating *townhouse units* shall be constructed in accordance with Section R302.2.1 or R302.2.2 and shall comply with Sections 302.2.3 through 302.2.5.

R302.2.1 Double walls. Each *townhouse unit* shall be separated from other *townhouse units* by two 1-hour fire-resistance-rated wall assemblies tested in accordance with ASTM E119, UL 263 or Section 703.2.2 of the ~~*International*~~ *2024 North Carolina* *Building Code.*

R302.2.2 Common walls. Common walls separating *townhouse units* shall be assigned a fire-resistance rating in accordance with Item 1 or 2 and shall be rated for fire exposure from both sides. Common walls shall extend to and be tight against the exterior sheathing of the exterior walls, or the inside face of exterior walls without stud cavities, and the underside of the roof sheathing. The common wall shared by two *townhouse units* shall be constructed without plumbing or mechanical equipment, ducts or vents, other than water-filled fire sprinkler piping in the cavity of the common wall. ~~Electrical installations shall be in accordance with Chapters 34 through 43.~~ Penetrations of the membrane of common walls for electrical outlet boxes shall be in accordance with Section R302.4.

1. Where an automatic sprinkler system in accordance with Section P2904 is provided, the common wall shall be not less than a 1-hour fire-resistance-rated wall assembly tested in accordance with ASTM E119, UL 263 or Section 703.2.2 of the *International Building Code*.
2. Where an automatic sprinkler system in accordance with Section P2904 is not provided, the common wall shall be not less than a 2-hour fire-resistance-rated wall assembly tested in accordance with ASTM E119, UL 263 or Section 703.2.2 of the *International Building Code*.

Exception: Common walls are permitted to extend to and be tight against the inside of the exterior walls if the cavity between the end of the common wall and the exterior sheathing is filled with a minimum of two 2-inch nominal thickness wood studs.

R302.2.3 Continuity. The fire-resistance-rated wall or assembly separating *townhouse units* shall be continuous from the foundation to the underside of the roof sheathing, deck or slab. The fire-resistance rating shall extend the full length of the wall or assembly from exterior sheathing to exterior sheathing, including wall extensions through and separating attached enclosed *accessory structures*.

R302.2.7 Townhouse eave protection. In *townhouse* construction projections extending into the fire separation distance shall have not less than 1-hour fire-resistive-construction on the underside. Soffit material beyond the fire separation distance shall be securely attached to framing members and shall be constructed using either noncombustible soffit material; fire-retardant-treated soffit material; vinyl soffit installed over 3/4-inch (19 mm) wood sheathing or 5/8-inch (15.9 mm) gypsum board; or aluminum soffit installed over 3/4-inch (19 mm) wood sheathing or 5/8-inch (15.9 mm) gypsum board. Venting requirements shall be provided in both soffit and underlayments. Vents shall be either nominal 2-inch (51 mm) continuous or equivalent intermittent and shall not exceed the minimum net free air requirements established in Section R806.2 by more than 50 percent. Vents in soffit are not allowed within 4 feet (1219 mm) of fire walls or property lines.

R302.2.8 Townhouse eave projections. Overhang projections not exceeding 12 inches (305 mm) shall be allowed to extend beyond the property line in townhouse buildings provided all the following conditions are met:

1. Required fire-resistant-rated wall assembly is tight to roof deck;
2. Eaves shall be protected with roof decking and fascia of noncombustible materials or approved fire retardant- treated wood; and
3. Eaves shall have not less than one layer of 5/8-inch (15.9 mm) Type X gypsum board or equivalent fire resistive construction on the underside.

R302.2.9 Sound transmission. See Appendix K.

R302.5 Dwelling-garage opening and penetration protection. Openings and penetrations through the walls or ceilings separating the *dwelling* from the garage shall be in accordance with Sections R302.5.1 through R302.5.3.

R302.5.1 Opening protection. Openings from a private garage directly into a room used for sleeping purposes shall not be permitted. Other openings between the garage and residence shall be equipped with solid wood doors not less than 1$^{3}/_{8}$ inches (35 mm) in thickness, solid or honeycomb-core steel doors not less than 1$^{3}/_{8}$ inches (35 mm) thick, or 20-minute fire-rated doors. ~~Doors shall be self-latching and equipped with a self-closing or automatic-closing device.~~

Exception: A disappearing/pull-down stairway to uninhabited attic space with minimum 3/8-inch (9.53 mm) (nominal) fire-retardant-treated structural panel is equivalent to the separation requirement from attics in Table R302.6.

TABLE R302.6
DWELLING-GARAGE SEPARATION[b]

SEPARATION	MATERIAL
From the residence and attics	Not less than $^{1}/_{2}$-inch gypsum board or equivalent applied to the garage side
From habitable rooms above the garage[a]	Not less than $^{5}/_{8}$-inch Type X gypsum board or equivalent
Structure(s) supporting floor/ceiling assemblies used for separation required by this section	Not less than $^{1}/_{2}$-inch gypsum board or equivalent
Garages located less than 3 feet from a dwelling unit on the same lot	Not less than $^{1}/_{2}$-inch gypsum board or equivalent applied to the interior side of exterior walls that are within this area

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

a. For dwelling units constructed prior to the 2012 *North Carolina Residential Code* edition, 1/2 inch or greater existing gypsum board on the bottom side of the garage ceiling shall be acceptable. Joints shall be taped.

b. Residential aircraft hangar shall comply with North Carolina Building Code section 412.5.

R302.7 Under-stair protection. Enclosed ~~space under stairs that is *accessed* by a door or access panel~~ accessible space under stairs shall have walls, under-stair surface and any soffits protected on the enclosed side with $^{1}/_{2}$-inch (12.7 mm) gypsum board.

R302.11 Fireblocking. In combustible construction, fireblocking shall be provided to cut off both vertical and horizontal concealed draft openings and to form an effective fire barrier between stories, and between a top story and the roof space.

Fireblocking shall be provided in wood-framed construction in the following locations:

1. In concealed spaces of stud walls and partitions, including furred spaces and parallel rows of studs or staggered studs, as follows:
   1.1. Vertically at the ceiling and floor levels.
   1.2. Horizontally at intervals not exceeding 10 feet (3048 mm)~~.~~ in furred spaces, parallel rows of studs, or staggered studs.
2. At interconnections between concealed vertical and horizontal spaces such as occur at soffits, drop ceilings and cove ceilings.
3. In concealed spaces between stair stringers at the top and bottom of the run. Enclosed spaces under stairs shall comply with Section R302.7.
4. At openings around vents, pipes, ducts, cables and wires at ceiling and floor level, with an *approved* material to resist the free passage of flame and products of combustion. The material filling this annular space shall not be required to meet the ASTM E136 requirements.

5. For the fireblocking of chimneys and fireplaces, see Section R1003.19.
6. Fireblocking of cornices of a two-family *dwelling* is required at the line of *dwelling unit* separation.

R302.13 Fire protection of floors. Deleted ~~Floor assemblies that are not required elsewhere in this code to be fire-resistance rated, shall be provided with a 1/2-inch (12.7 mm) gypsum wallboard membrane, 5/8-inch (16 mm) *wood structural panel* membrane, or equivalent on the underside of the floor framing member. Penetrations or openings for ducts, vents, electrical outlets, lighting, devices, luminaires, wires, speakers, drainage, piping and similar openings or penetrations shall be permitted.~~

~~**Exceptions:**~~

1. ~~Floor assemblies located directly over a space protected by an automatic sprinkler system in accordance with Section P2904, NFPA 13D, or other *approved* equivalent sprinkler system.~~
2. ~~Floor assemblies located directly over a *crawl space* not intended for storage or for the installation of fuel-fired or electric-powered heating *appliances*.~~
3. ~~Portions of floor assemblies shall be permitted to be unprotected where complying with the following:~~
   - ~~3.1. The aggregate area of the unprotected portions does not exceed 80 square feet (7.4 m^2) per story.~~
   - ~~3.2. Fireblocking in accordance with Section R302.11.1 is installed along the perimeter of the unprotected portion to separate the unprotected portion from the remainder of the floor assembly.~~
4. ~~Wood floor assemblies using dimension lumber or *structural composite lumber* equal to or greater than 2-inch by 10-inch (50.8 mm by 254 mm) nominal dimension, or other *approved* floor assemblies demonstrating equivalent fire performance.~~

SECTION R303
LIGHT, VENTILATION AND HEATING

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

Exceptions:

1. For habitable rooms ~~other than kitchens~~, the glazed areas need not be openable where the opening is not required by Section R310 and a whole-house mechanical *ventilation* system ~~or a mechanical ventilation system capable of producing 0.35 air changes per hour in the habitable rooms~~ is installed in accordance with Section M1505.
2. For kitchens, the glazed areas need not be openable where the opening is not required by Section R310 and a local exhaust system is installed in accordance with Section M1505.
3. The glazed areas need not be installed in rooms where Exception 1 is satisfied and artificial light is provided that is capable of producing an average illumination of 6 footcandles (65 lux) over the area of the room at a height of 30 inches (762 mm) above the floor level.
4. Use of *sunroom* and patio covers, as defined in Section R202, shall be permitted for natural *ventilation* if in excess of 40 percent of the exterior *sunroom* walls are open, or are enclosed only by insect screening.

R303.10 Required heating. Where the winter design temperature in Table R301.2 is below 60°F (16°C), every *dwelling unit* shall be provided with heating facilities capable of maintaining a room temperature of not less than 68°F (20°C) at a point 3 feet (914 mm) above the floor and 2 feet (610 mm) from exterior walls in 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.

Exception: Unconditioned *sunrooms* that are thermally isolated from the dwelling.

R308.4.2 Glazing adjacent to doors. Glazing in an individual fixed or operable panel ~~adjacent to a~~ in the same plane as the door shall be considered to be a hazardous location where the bottom exposed edge of the glazing is less than 60 inches (1524 mm) above the floor or walking surface and it meets either of the following conditions:

1. Where the glazing is within 24 inches (610 mm) of either side of the door in the plane of the door in a closed position.

2. Deleted. ~~Where the glazing is on a wall less than 180 degrees (3.14 rad) from the plane of the door in a closed position and within 24 inches (610 mm) of the hinge side of an in-swinging door.~~

R308.4.5 Glazing and wet surfaces. Glazing in walls, enclosures or fences containing ~~or adjacent to facing the direction of exit from~~ hot tubs, spas, whirlpools, saunas, steam rooms, bathtubs, showers and indoor or outdoor swimming pools where the bottom exposed edge of the glazing is less than 60 inches (1524 mm) measured vertically above any standing or walking surface shall be considered to be a hazardous location. This shall apply to single glazing and each pane in multiple glazing.

Exception: Glazing that is more than 60 inches (1524 mm), measured horizontally, ~~and in a straight line~~ from the water's edge. ~~of a bathtub, hot tub, spa, whirlpool or swimming pool or from the edge of a shower, sauna or steam room.~~

R308.4.6 Glazing adjacent to stairs and ramps. Glazing where the bottom exposed edge of the glazing is less than 36 inches (914 mm) above the plane of the adjacent walking surface of *stairways*, landings between flights of stairs and *ramps* shall be considered to be a hazardous location.

Exceptions:

1. Where glazing is adjacent to a walking surface and a horizontal rail is installed at 34 to 38 inches (864 to 965 mm) above the walking surface. The rail shall be capable of withstanding a horizontal load of 50 pounds per linear foot (730 N/m) without contacting the glass and have a cross-sectional height of not less than $1^1/_2$ inches (38 mm).
2. Glazing 36 inches (914 mm) or more measured horizontally from the walking surface.
3. Where a change in elevation is 8¼ inches (210 mm) or less at an exterior door.

R308.6.3 Screens, general. For fully tempered or heat-strengthened glass, a ~~broken glass retention~~ retaining screen meeting the requirements of Section R308.6.7 shall be installed below the ~~full area of the~~ glass, except for fully tempered glass that meets Condition 1 or 2 listed in Section R308.6.5.

R308.6.4 Screens with multiple glazing. Where the inboard pane is fully tempered, heat-strengthened or wired glass, a ~~broken glass retention~~ retaining screen meeting the requirements of Section R308.6.7 shall be installed below ~~the full area of~~ the glass, except for Condition 1 or 2 listed in Section R308.6.5. Other panes in the multiple glazing shall be of any type listed in Section R308.6.2.

R309.5 Fire sprinklers. Deleted. ~~Private garages shall be protected by fire sprinklers where the garage wall has been designed based on Table R302.1(2), Note a. Sprinklers in garages shall be connected to an automatic sprinkler system that complies with Section P2904. Garage sprinklers shall be residential sprinklers or quick-response sprinklers, designed to provide a density of 0.05 gpm/ft². Garage doors shall not be considered obstructions with respect to sprinkler placement.~~

R310.1.1 Operational constraints and opening control devices. *Emergency escape and rescue openings* shall be operational from the inside of the room without the use of keys, tools or special knowledge. Window opening control devices and fall prevention devices complying with ASTM F2090 shall be permitted for use on windows serving as a required *emergency escape and rescue opening*. ~~and shall be not more than 70 inches (178 cm) above the finished floor.~~

R310.2.1 Minimum size. *Emergency escape and rescue openings* shall have a ~~net clear opening of not less than 5.7 square feet (0.530 m²)~~ minimum net clear openable area of 4 square feet (0.372 m²) and must have a minimum total glazing area of not less than 5 square feet (0.465 m2) in the case of a ground floor level window and not less than 5.7 square feet (0.530 m2) in the case of an upper story window.

~~**Exception:** The minimum net clear opening for *grade floor emergency escape and rescue openings* shall be 5 square feet (0.465 m²).~~

R310.2.2 Minimum dimensions. The minimum net clear opening height dimension shall be ~~24~~ 22 inches (~~610~~ 559 mm). The minimum net clear opening width dimension shall be 20 inches (508 mm). The net clear opening dimensions shall be the result of normal operation of the opening.

R310.2.3 Maximum height from floor. Emergency escape and rescue openings shall have the bottom of the clear opening not greater than 44 inches (1118 mm) above the finished floor.

R310.2.5 Egress roof access window. Egress roof access windows shall be deemed to meet the requirements of Section R310 where installed such that the bottom of the opening is not more than 44 inches (1118 mm) above the floor, provided the egress roof access window complies with the minimum opening area requirements of Section R310.2.1.

R310.3.1 Minimum door opening size. The minimum net clear height opening for any door that serves as an emergency and escape rescue opening shall be ~~24~~ 22 inches (~~610~~ 559 mm). The minimum net clear opening width dimension shall be 20 inches (508 mm).

R310.4.3 Drainage. Area wells shall be designed for proper drainage. ~~by connecting to the building's foundation drainage system required by Section R405.1.~~

Exception: A drainage system for area wells is not required where the foundation is on well-drained soil or sand-gravel mixture soils in accordance with the United Soil Classification System, Group I Soils, as detailed in Table R405.1.

R310.5 Replacement windows for emergency escape and rescue openings. Replacement windows installed in buildings meeting the scope of this code shall be exempt from Sections R310.2 and R310.4.4, provided that the replacement window meets the following conditions:

~~1. The replacement window is the manufacturer's largest standard size window that will fit within the existing frame or existing rough opening. The replacement window is of the same operating style as the existing window or a style that provides for an equal or greater window opening area than the existing window.~~

~~2. The replacement window is not part of a change of occupancy.~~

1. The replacement window is the manufacturer's largest standard size window that will fit within the existing frame or existing rough opening.
2. The replacement window is of the same operating style as the existing window or a style that provides for an equal or greater window opening area than the existing window.
3. The rough opening has not been reconstructed or modified in any manner. If the opening is reconstructed or modified in any manner, then the opening must comply with the current code requirements for emergency escape and rescue openings.

R310.6 Dwelling additions. Where *dwelling additions* contain sleeping rooms, an *emergency escape and rescue opening* shall be provided in each new sleeping room. Where *dwelling additions* have *basements*, an *emergency escape and rescue opening* shall be provided in the new *basement*.

Exceptions:

1. An *emergency escape and rescue opening* is not required in a new *basement* that contains a sleeping room with an *emergency escape and rescue opening*.
2. An *emergency escape and rescue opening* is not required in a new *basement* where there is an *emergency escape and rescue opening* in an existing *basement* that is *accessed* from the new *basement*.
3. ~~An operable window complying with Section 310.7.1 shall be acceptable as an *emergency escape and rescue opening*.~~

R310.7 Alterations or repairs of existing basements. New sleeping rooms created in an existing *basement* shall be provided with *emergency escape and rescue openings* in accordance with Section R310.1. Other than new sleeping rooms, where existing basements undergo alterations or repairs, an *emergency escape and rescue opening* is not required.

~~**Exception:** An operable window complying with Section 310.7.1 shall be acceptable as an *emergency escape and rescue opening*.~~

~~**R310.7.1 Existing emergency escape and rescue openings.** Where a *change of occupancy* would require an *emergency escape and rescue opening* in accordance with Section 310.1, operable windows serving as the *emergency escape and rescue opening* shall comply with the following:~~

1. ~~**An existing operable window shall provide a minimum net clear opening of 4 square feet (0.38 m^2) with a minimum net clear opening height of 22 inches (559 mm) and a minimum net clear opening width of 20 inches (508 mm).**~~
2. ~~A replacement window where such window complies with both of the following:~~
   - ~~2.1. The replacement window meets the size requirements in Item 1.~~

~~2.2. The replacement window is the manufacturer's largest standard-size window that will fit within the existing frame or existing rough opening. The replacement window shall be permitted to be of the same operating style as the existing window or a style that provides for an equal or greater window opening area than the existing window.~~

SECTION R311
MEANS OF EGRESS

R311.1 Means of egress. *Dwellings* *and accessory buildings* shall be provided with a means of egress in accordance with this section. The means of egress shall provide a continuous and unobstructed path of vertical and horizontal egress travel from all portions of the *dwelling* *and accessory buildings* to the required egress door without requiring travel through a garage. The required egress door shall open directly into a *public way* or to a *yard* or court that opens to a *public way*.

Exceptions:

1. Equipment service platforms may be served by ladders constructed in accordance with Section R310.4.2.1
2. Detached garages and storage buildings

R311.2 Egress door. Not less than one egress door shall be provided for each *dwelling unit*. The egress door shall be side-hinged, and shall provide a clear width of not less than 32 inches (813 mm) where measured between the face of the door and the stop, with the door open 90 degrees (1.57 rad). The clear height of the door opening shall be not less than 78 inches (1981 mm) in height measured from the top of the threshold to the bottom of the stop. Other doors shall not be required to comply with these minimum dimensions. ~~Egress doors shall be readily openable from inside the *dwelling*~~ All interior egress doors and a minimum of one exterior egress door shall be readily openable from the side from which egress is to be made without the use of a key or special knowledge or effort.

R311.6 Hallways. The width of a hallway shall be not less than 3 feet (914 mm). measured from the finished surface of the walls.

R311.6.1 Interior egress doors. All doors providing egress from habitable rooms shall have nominal dimensions of 2 feet 6 inches (782 mm) width by 6 feet 8 inches (2032 mm) height. Interior 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.

R311.7.1 Width. *Stairways* shall be not less than 36 inches (914 mm) in clear width at all points above the permitted *handrail* height and below the required headroom height. The clear width of *stairways* at and below the *handrail* height, including treads and landings, shall be not less than 31$^{1}/_{2}$ inches (787 mm) where a *handrail* is installed on one side and 27 inches (698 mm) where *handrails* are installed on both sides.

Exception:

1. The width of *spiral stairways* shall be in accordance with Section R311.7.10.1.
2. Stairways not required for egress shall be permitted to be a minimum width of 26 inches (660 mm).

R311.7.4 Walkline. ~~The walkline across *winder* treads and landings shall be concentric to the turn and parallel to the direction of travel entering and exiting the turn. The walkline shall be located 12 inches (305 mm) from the inside of the turn. The 12 inch (305 mm) dimension shall be measured from the widest point of the clear stair width at the walking surface. Where *winders* are adjacent within a flight, the point of the widest clear stair width of the adjacent *winders* shall be used.~~

The walkline across winder treads shall be concentric to the curved direction of travel through the turn and located 12 inches (305 mm) from the side where the winders are narrower. The 12 inch (305 mm) dimension shall be measured from the widest point of the clear stair width at the walking surface of the winder. If winders are adjacent within the flight, the point of the widest clear stair width of the adjacent winders shall be used.

R311.7.5 Stair treads and risers. *Stair* treads and *risers* shall meet the requirements of this section. For the purposes of this section, dimensions and dimensioned surfaces shall be exclusive of carpets, rugs or runners.

R311.7.5.1 Risers. The *riser* height shall be not more than ~~7 3/4~~ 8 ¼ inches (~~196~~ 210 mm). The *riser* height shall be measured vertically between leading edges of the adjacent treads. The greatest *riser* height within any flight of stairs shall not exceed the smallest by more than 3/8 inch (9.5 mm). ~~*Risers* shall be vertical or sloped from the underside of the *nosing* of the tread above at an angle not more than 30 degrees (0.51 rad) from the vertical.~~ At open *risers*, openings located more than 30 inches (762 mm), as measured vertically, to the floor or *grade* below shall not permit the passage of a 4-inch-diameter (102 mm) sphere. The top and bottom riser of interior stairs shall not exceed the smallest riser within that stair run by more than 3/4 inch (19 mm). The height of the top and bottom riser of the interior stairs shall be measured from the permanent finished surface (carpet excluded). Where the bottom riser of an exterior stair adjoins an exterior walk, porch, driveway, patio, garage floor, or finish grade, the height of the riser may be less than the height of the adjacent risers.

Exceptions:

1. The opening between adjacent treads is not limited on *spiral stairways*.
2. The *riser* height of *spiral stairways* shall be in accordance with Section R311.7.10.1.

R311.7.5.2 Treads. The tread depth shall be not less than ~~10~~ 9 inches (~~254~~ 229 mm). The tread depth shall be measured horizontally between the vertical planes of the foremost projection of adjacent treads and at a right angle to the tread's leading edge. The greatest tread depth within any flight of stairs shall not exceed the smallest by more than 3/8 inch (9.5 mm).

R311.7.5.2.1 Winder treads. Winder treads shall have a tread depth of not less than ~~10~~ 9 inches (~~254~~ 229 mm) measured ~~between the vertical planes of the foremost projection of adjacent treads at the intersections with the walkline~~ as above a point 12 inches (305 mm) from the side where the treads are narrower. Winder treads shall have a tread depth of not less than ~~6~~ 4 inches (~~152~~ 102 mm) at any point. ~~within the clear width of the stair.~~ Within any flight of stairs, the ~~largest~~ greatest winder tread depth at the 12 inch (305 mm) walkline shall not exceed the smallest ~~winder tread~~ by more than 3/8 inch (9.5 mm). Consistently shaped winders at the walkline shall be allowed within the same flight of stairs as rectangular treads and shall not be required to be within 3/8 inch (9.5 mm) of the rectangular tread depth.

Exception: The tread depth at *spiral stairways* shall be in accordance with Section R311.7.10.1.

R311.7.5.4 Exterior plastic composite stair treads. *Plastic composite* exterior stair treads shall comply with the provisions of this section and ~~Section R507.2.2.~~ the requirements of ASTM D7032 -2017.

R311.7.6 Landings for stairways. ~~There shall be a floor or landing at the top and bottom of each *stairway*. The width perpendicular to the direction of travel shall be not less than the width of the flight served. For landings of shapes other than square or rectangular, the depth at the walk line and the total area shall be not less than that of a quarter circle with a radius equal to the required landing width. Where the *stairway* has a straight run, the depth in the direction of travel shall be not less than 36 inches (914 mm).~~ There shall be a floor or landing at the top and bottom of each stairway. A flight of stairs shall not have a vertical rise larger than 12 feet 7 inches (3734 mm) between floor levels or landings. The width of each landing shall not be less than the width of the stairway served. Every landing shall have a minimum dimension of 36 inches (914 mm) measured in the direction of travel.

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

R311.7.7 Stairway walking surface. The walking surface of treads and landings of *stairways* shall be sloped not steeper than 1 unit vertical in 48 units horizontal (2-percent slope).

~~**Exception:** Where the surface of a landing is required elsewhere in the code to drain surface water, the walking surface of the landing shall be sloped not steeper than 1 unit vertical in 20 units horizontal (5-percent slope) in the direction of travel.~~

R311.7.8 Handrails. *Handrails* shall be provided on not less than one side of each flight of stairs with four or more *risers*.

R311.7.8.1 Height. *Handrail* height, measured vertically from the sloped plane adjoining the tread *nosing*, or finish surface of ramp slope, shall be not less than 34 inches (864 mm) and not more than 38 inches (965 mm).

Exceptions:

1. The use of a volute, turnout, ~~or~~ starting easing or starting newel shall be allowed over the lowest tread.

2. Where *handrail* fittings or bendings are used to provide continuous transition between flights, transitions at *winder* treads, the transition from *handrail* to *guard*, or used at the start of a flight, the *handrail* height at the fittings or bendings shall be permitted to exceed 38 inches (965 mm).

R311.7.8.4 Continuity. *Handrails* shall be continuous for the full length of the flight, from a point directly above the top riser of the flight to a point directly above the lowest riser of the flight. *Handrail* ends shall be returned toward a wall, guard walking surface continuous to itself, or terminate to a post.

Exceptions:

1. *Handrail* continuity shall be permitted to be interrupted by a newel post at a turn in a flight with winders, at a landing, or over the lowest tread.
2. A volute, turnout or starting easing shall be allowed to terminate over the lowest tread and over the top landing.
3. Two or more separate rails shall be considered continuous if the termination of the rails occurs within 6 inches (152 mm) of each other. If transitioning between a wall-mounted handrail and a guardrail/handrail, the wall-mounted rail shall return into the wall.

R311.7.8.5 Grip size. Required *handrails* shall be of one of the following types or provide equivalent graspability.

1. Type I. *Handrails* with a circular cross section shall have an outside diameter of not less than $1^{1}/_{4}$ inches (32 mm) and not greater than 2 inches (51 mm). If the *handrail* is not circular, it shall have a perimeter of not less than 4 inches (102 mm) and not greater than $6^{1}/_{4}$ inches (160 mm) and a cross section of not more than $2^{1}/_{4}$ inches (57 mm). Edges shall have a radius of not less than 0.01 inch (0.25 mm).
2. Type II. *Handrails* with a perimeter greater than $6^{1}/_{4}$ inches (160 mm) shall have a graspable finger recess area on both sides of the profile. The finger recess shall begin within $^{3}/_{4}$ inch (19 mm) measured vertically from the tallest portion of the profile and have a depth of not less than $^{5}/_{16}$ inch (8 mm) within $^{7}/_{8}$ inch (22 mm) below the widest portion of the profile. This required depth shall continue for not less than $^{3}/_{8}$ inch (10 mm) to a level that is not less than $1^{3}/_{4}$ inches (45 mm) below the tallest portion of the profile. The width of the *handrail* above the recess shall be not less than $1^{1}/_{4}$ inches (32 mm) and not more than $2^{3}/_{4}$ inches (70 mm). Edges shall have a radius of not less than 0.01 inch (0.25 mm).

Exception: Exterior handrails (garages and areas exposed to the weather) shall not be more than 31/2 inches (89 mm) in cross-section dimension.

R311.7.8.6 Exterior plastic composite handrails. *Plastic composite* exterior *handrails* shall comply with the requirements of ~~Section R507.2.2~~ ASTM D7032.

R311.7.10 Special stairways. *Spiral stairways* and bulkhead enclosure *stairways* and bowed tread stairways shall comply with the requirements of Section R311.7 except as specified in Sections R311.7.10.1 and ~~R311.7.10.2.~~ R311.7.10.3.

R311.7.10.3 Bowed tread stairways. Bowed tread stairways are permitted provided they are uniform in bowed tread depth along the entire width of the tread with not more than $^{3}/_{8}$-inch (9.5 mm) variance from greatest to smallest tread in the stairway flight. At no point shall the tread be less than 9 inches (229 mm) with a nosing as listed in Sections R311.7.5.2 and R311.7.5.3, respectively.

R311.7.10.3.1 Standard stairway application. The bottom three treads in a standard straight run stairway application as listed under Section R311.7.5.2 are permitted to bow provided that, at no point along the width of the tread, they are less than 9 inches (229 mm) as measured under Section R311.7.5.2 and each bowed tread is uniform with other bowed treads with no more than $^{3}/_{8}$-inch (9.5 mm) variance from greatest to least. Nosing is required as listed in Section R311.7.5.3.

R311.7.10.3.2 Bowed tread circular stairways.
Bowed treads in a circular stairway are permitted provided they are uniform, as per winder treads as listed in Section 311.7.5.2.1, measured at a point 12 inches (305 mm) from the side where the treads are narrower. At this walk line, bowed treads must be uniform with other circular stairway treads with the greatest tread not to exceed the smallest by more than $^{3}/_{8}$ inch (9.5 mm). Nosing is required as listed in Section R311.7.5.3.

R311.7.11 Alternating tread devices. Deleted. ~~Alternating tread devices shall not be used as an element of a means of egress. Alternating tread devices shall be permitted provided that a required means of egress *stairway* or~~

~~*ramp* serves the same space at each adjoining level or where a means of egress is not required. The clear width at and below the *handrails* shall be not less than 20 inches (508 mm).~~

~~**Exception:** Alternating tread devices are allowed to be used as an element of a means of egress for lofts, *mezzanines* and similar areas of 200 gross square feet (18.6 m^2) or less where such devices do not provide exclusive access to a kitchen or bathroom.~~

~~**R311.7.11.1 Treads of alternating tread devices.** Alternating tread devices shall have a tread depth of not less than 5 inches (127 mm), a projected tread depth of not less than $8^{1}/_{2}$ inches (216 mm), a tread width of not less than 7 inches (178 mm) and a *riser* height of not more than $9^{1}/_{2}$ inches (241 mm). The tread depth shall be measured horizontally between the vertical planes of the foremost projections of adjacent treads. The *riser* height shall be measured vertically between the leading edges of adjacent treads. The *riser* height and tread depth provided shall result in an angle of ascent from the horizontal of between 50 and 70 degrees (0.87 and 1.22 rad). The initial tread of the device shall begin at the same elevation as the platform, landing or floor surface.~~

~~**R311.7.11.2 Handrails of alternating tread devices.** *Handrails* shall be provided on both sides of alternating tread devices and shall comply with Sections R311.7.8.2 through R311.7.8.6. *Handrail* height shall be uniform, not less than 30 inches (762 mm) and not more than 34 inches (864 mm).~~

SECTION R313
AUTOMATIC FIRE SPRINKLER SYSTEMS

<u>DELETED</u>

~~**R313.1 Townhouse automatic fire sprinkler systems.** An automatic sprinkler system shall be installed in *townhouses*.~~

~~**Exception:** An automatic sprinkler system shall not be required where *additions* or *alterations* are made to existing *townhouses* that do not have an automatic sprinkler system installed.~~

~~**R313.1.1 Design and installation.** Automatic sprinkler systems for *townhouses* shall be designed and installed in accordance with Section P2904 or NFPA 13D.~~

~~**R313.2 One- and two-family dwellings automatic sprinkler systems.** An automatic sprinkler system shall be installed in one- and two-family *dwellings*.~~

~~**Exception:** An automatic sprinkler system shall not be required for *additions* or *alterations* to existing buildings that are not already provided with a sprinkler system.~~

~~**R313.2.1 Design and installation.** Automatic sprinkler systems shall be designed and installed in accordance with Section P2904 or NFPA 13D.~~

R314.2.2 Alterations, repairs and additions. Where *alterations*, *repairs* or *additions* requiring a <u>building</u> *permit* occur, the individual *dwelling unit* shall be equipped with smoke alarms located as required for new *dwellings*.

Exceptions:

1. Work involving the exterior surfaces of *dwellings*, such as the replacement of roofing or siding, the addition or replacement of windows or doors, or the addition of a porch or deck.
2. Installation, *alteration* or repairs of plumbing or mechanical systems.

R314.3 Location. Smoke alarms shall be installed in the following locations:

1. In each sleeping room.
2. Outside each separate sleeping area in the immediate vicinity of the bedrooms.
3. On each additional story of the *dwelling*, including *basements* and *habitable attics* and not including crawl spaces and uninhabitable *attics*. In *dwellings* or *dwelling units* with split levels and without an intervening door between the adjacent levels, a smoke alarm installed on the upper level shall suffice for the adjacent lower level provided that the lower level is less than one full *story* below the upper level.
4. Not less than 3 feet (914 mm) horizontally from the door or opening of a bathroom that contains a bathtub or shower unless this would prevent placement of a smoke alarm required by this section.

5. Deleted. ~~In the hallway and in the room open to the hallway in *dwelling units* where the ceiling height of a room open to a hallway serving bedrooms exceeds that of the hallway by 24 inches (610 mm) or more.~~

R314.3.1 Installation near cooking appliances. Smoke alarms shall not be installed in the following locations unless this would prevent placement of a smoke alarm in a location required by Section R314.3.

1. Ionization smoke alarms shall not be installed less than 20 feet (6096 mm) horizontally from a permanently installed cooking *appliance*.
2. Ionization smoke alarms with an alarm-silencing switch shall not be installed less than 10 feet (3048 mm) horizontally from a permanently installed cooking *appliance*.
3. Photoelectric smoke alarms shall not be installed less than 6 feet (1828 mm) horizontally from a permanently installed cooking *appliance*.
4. Deleted. ~~Smoke alarms *listed* and marked "helps reduce cooking nuisance alarms" shall not be installed less than 6 feet (1828 mm) horizontally from a permanently installed cooking *appliance*.~~

R315.2.1 New construction. For new construction, carbon monoxide alarms shall be provided in *dwelling units* where either or both of the following conditions exist.

1. The *dwelling unit* contains a fuel-fired *appliance* or fireplace.
2. The *dwelling unit* has an attached garage with an opening that communicates with the *dwelling unit*.

R315.2.2 Alterations, repairs and additions. Where *alterations*, *repairs* or *additions* requiring a building *permit* occur, ~~the individual *dwelling unit*~~ ,*or where one or more sleeping rooms are added or created in existing dwellings,* or where fuel-fired appliances or fireplaces are added or replaced, shall be equipped with carbon monoxide alarms located as required for new *dwellings*.

Exceptions:

1. Work involving the exterior surfaces of *dwellings*, 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~~.~~ or the installation of a fuel-fired appliance that cannot introduce carbon monoxide to the interior of the dwelling.
2. Deleted. ~~Installation, *alteration* or repairs of plumbing systems.~~
3. Deleted. ~~Installation, alteration or repairs of mechanical systems that are not fuel fired.~~

R316.5.2 Roofing. The thermal barrier specified in Section R316.4 is not required where the foam plastic in a *roof assembly* or under a roof covering is installed in accordance with the code and the manufacturer's instructions and is separated from the interior of the building by one of the following:

1) Tongue-and-groove wood planks

2) *Wood structural panel* sheathing, in accordance with Section R803, that is not less than $^{15}/_{32}$ inch (11.9 mm) thick bonded with exterior glue, identified as Exposure 1 and with edges supported by blocking or tongue-and-groove joints or an equivalent material.

The *smoke-developed index* for roof applications shall not be limited.

R316.5.4 Crawl spaces. The thermal barrier specified in Section R316.4 is not required where all of the following apply:

1. *Crawl space* access is required by Section ~~R408.4~~. R408.8 and Section R409.1.2
2. Entry is made only for purposes of repairs or maintenance.
3. The foam plastic insulation has been tested in accordance with Section R316.6 or the foam plastic insulation is protected against ignition using one of the following ignition barrier materials:
   - 3.1. $1^{1}/_{2}$-inch-thick (38 mm) mineral fiber insulation.
   - 3.2. $^{1}/_{4}$-inch-thick (6.4 mm) *wood structural panels*.
   - 3.3. $^{3}/_{8}$-inch (9.5 mm) particleboard.
   - 3.4. $^{1}/_{4}$-inch (6.4 mm) hardboard.
   - 3.5. $^{3}/_{8}$-inch (9.5 mm) gypsum board.
   - 3.6. Corrosion-resistant steel having a base metal thickness of 0.016 inch (0.406 mm).
   - 3.7. $^{1}/_{4}$-inch (6.4 mm) fiber-cement panel, soffit or backer board.

R316.7 Termite damage. The use of foam plastics in areas of "~~very~~ moderate-heavy" termite infestation probability shall be in accordance with Section R318.4.

SECTION R317
PROTECTION OF WOOD AND
WOOD-BASED PRODUCTS AGAINST DECAY

R317.1 Location required. Protection of wood and wood-based products from decay shall be provided in the following locations by the use of *naturally durable wood* or wood that is preservative-treated in accordance with AWPA U1.

1. In crawl spaces or unexcavated areas located within the periphery of the building foundation, wood joists or the bottom of a wood structural floor where closer than 18 inches (457 mm) to exposed ground, wood girders where closer than 12 inches (305 mm) to exposed ground.~~, and wood columns where closer than 8 inches (204 mm) to exposed ground.~~
2. Wood framing members~~, including columns,~~ that rest ~~directly~~ on concrete or masonry exterior foundation walls and are less than 8 inches (203 mm) from the exposed ground.
3. Sills and sleepers on a concrete or masonry slab that is in direct contact with the ground unless separated from such slab by an impervious moisture barrier.
4. The ends of wood girders entering exterior masonry or concrete walls having clearances of less than $^1/_2$ inch (12.7 mm) on tops, sides and ends.
5. Wood siding, sheathing and wall framing on the exterior of a building having a clearance of less than 6 inches (152 mm) from the ground or less than 2 inches (51 mm) measured vertically from concrete steps, porch slabs, patio slabs and similar horizontal surfaces exposed to the weather.
6. Wood structural members supporting moisture-permeable floors or roofs that are exposed to the weather, such as concrete or masonry slabs, unless separated from such floors or roofs by an impervious moisture barrier.
7. Wood furring strips or other wood framing members attached directly to the interior of exterior masonry walls or concrete walls below *grade* except where an *approved* vapor retarder is applied between the wall and the furring strips or framing members.
8. ~~Portions of wood structural members that form the structural supports of buildings, balconies, porches or similar permanent building appurtenances where those members are exposed to the weather without adequate protection from a roof, eave, overhang or other covering that would prevent moisture or water accumulation on the surface or at joints between members.~~

   ~~Exception: Sawn lumber used in buildings located in a geographical region where experience has demonstrated that climatic conditions preclude the need to use naturally durable or preservative-treated wood where the structure is exposed to the weather.~~

8. All portions of a porch, screen porch or deck from the bottom of the header down, including posts, guardrails, pickets, steps, and floor structure. Coverings that would prevent moisture or water accumulation on the surface or at joints between members are allowed.

   Exception: Columns complying with Section R317.1.3, Exception 3.

~~9. Wood columns in contact with *basement* floor slabs unless supported by concrete piers or metal pedestals projecting not less than 1 inch (25 mm) above the concrete floor and separated from the concrete pier by an impervious moisture barrier.~~

R317.1.1 Field treatment. Deleted. ~~Field-cut ends, notches and drilled holes of preservative-treated wood shall be treated in the field in accordance with AWPA M4.~~

R317.1.3 Wood columns. Wood columns shall be *approved* wood of natural decay resistance or *approved* pressure-preservative-treated wood.

Exceptions:

1. Columns in basements when supported by a concrete floor with an approved impervious moisture barrier installed between the slab and earth.
2. Columns exposed to the weather when all of the following conditions are met:

a. The column is supported by piers or metal pedestals projecting 1 inch (25.4 mm) above a concrete floor or 6 inches (152 mm) above exposed earth and the earth is covered by an approved impervious moisture barrier;

b. There are no joints in or between structural members (from the header to the base of the column);

c. The column is protected from exposure to surface moisture at the top by a roof, eave, or overhang; and

d. The exterior surface of the column is full sealed (paint, sealer, etc.) against moisture intrusion.

3. Columns in enclosed crawl spaces or unexcavated areas located within the periphery of the building when supported by a concrete pier or metal pedestal at a height more than 8 inches (203 mm) from exposed earth and the earth is covered by an impervious moisture barrier.

R317.4 Plastic composites. *Plastic composite* exterior deck boards, stair treads, *guards* and *handrails* containing wood, cellulosic or other biodegradable materials shall comply with the requirements of ~~Section R507.2.2~~ ASTM D7032.

SECTION R318
PROTECTION AGAINST
SUBTERRANEAN TERMITES

R318.1 Subterranean termite control methods. In areas subject to damage from termites as indicated by Table R301.2, protection shall be by one, or a combination, of the following methods:

1. Chemical termiticide treatment in accordance with Section R318.2.
2. Termite-baiting system installed and maintained in accordance with the *label*~~.~~, and according to the rules adopted by the North Carolina Structural Pest Control Committee (02 NOAC 34).
3. Pressure-preservative-treated wood in accordance with ~~the provisions of Section R317.1.~~ AWPA U1.
4. *Naturally durable termite-resistant wood*.
5. Deleted. ~~Physical barriers in accordance with Section R318.3 and used in locations as specified in Section R317.1.~~
6. Deleted. ~~Cold-formed steel framing in accordance with Sections R505.2.1 and R603.2.1.~~

R318.1.2 Field treatment. Deleted. ~~Field-cut ends, notches and drilled holes of pressure-preservative-treated wood shall be retreated in the field in accordance with AWPA M4.~~

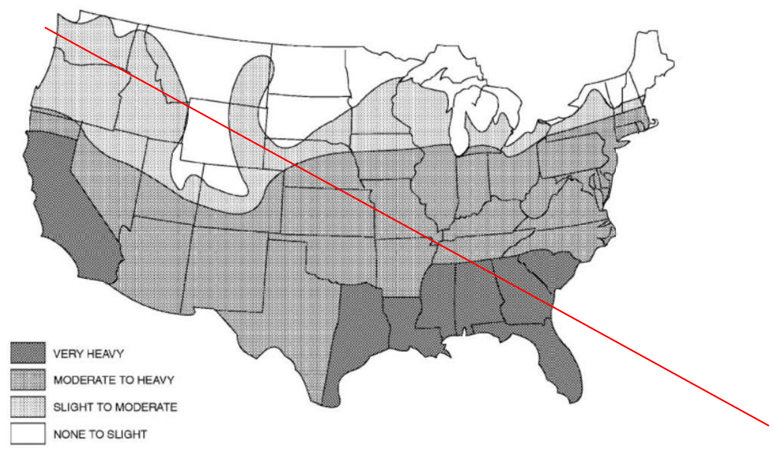
R318.2 Chemical termiticide treatment. Chemical termiticide treatment shall include soil treatment or field-applied wood treatment. The concentration, rate of application and method of treatment of the chemical termiticide shall be in strict accordance with the termiticide *label*. and applied according to the rules adopted by the North Carolina Structural Pest Control Committee (02 NOAC 34).

R318.3 Barriers. Deleted. ~~*Approved* physical barriers, such as metal or plastic sheeting or collars specifically designed for termite prevention, shall be installed in a manner to prevent termites from entering the structure. Shields placed on top of an exterior foundation wall shall be used only if in combination with another method of protection.~~

R318.4 Foam plastic protection. ~~In areas where the probability of termite infestation is "very heavy" as indicated in Figure R318.4, extruded and expanded polystyrene, polyisocyanurate and other foam plastics shall not be installed on the exterior face or under interior or exterior foundation walls or slab foundations located below *grade*. The clearance between foam plastics installed above *grade* and exposed earth shall be not less than 6 inches (152 mm).~~ This section shall apply to both treated and untreated foam plastic.

~~**Exceptions:**~~

1. ~~Buildings where the structural members of walls, floors, ceilings and roofs are entirely of *noncombustible materials* or pressure-preservative-treated wood.~~
2. ~~Where in addition to the requirements of Section R318.1, an *approved* method of protecting the foam plastic and structure from subterranean termite damage is used.~~
3. ~~On the interior side of basement *walls*.~~



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

~~FIGURE R318.4 TERMITE INFESTATION PROBABILITY MAP~~

R318.4.1 Foundation walls. All foam plastic shall be a minimum of 8 inches (203 mm) above grade. See Appendix NC-D.

Exception: Foam plastic less than 8 inches (203 mm) above or in contact with grade shall be installed in accordance with Section 318.4.5 and Appendix NC-D.

R318.4.2 Termite control. When foam plastic is in contact with the ground, subterranean termite control shall be in accordance with Section 318.1.

R318.4.3 Slab on grade (nonstructural). Foam plastic shall be installed along the vertical edge and underneath the slab as specified in Section R318.4.5.

R318.4.4 Slab on grade (structural). All slabs that distribute the wall loads to the foundation shall be insulated as specified in this section. Foam plastic shall be installed along the vertical edge and underneath grade as specified in Appendix NC-D, Figure NCD-3.

R318.4.5 Foam plastic in contact with ground. Foam plastic in contact with the ground shall comply with Sections R318.4.5.1 through R318.4.5.4.

R318.4.5.1 Inspection and treatment gaps. Foam plastic in contact with the ground shall not be continuous to the bottom of the weather-resistant siding. A clear and unobstructed 2-inch (51 mm) minimum inspection gap shall be maintained from the bottom of the weather-resistant siding to the top of any foam plastic. A minimum 4-inch (102 mm) treatment gap shall be provided beginning not more than 6 inches (152 mm) below grade. The top and bottom edges of the foam plastic installed between the inspection gap and the treatment gap shall be cut at a 45-degree (0.79 rad) angle. See Appendix NC-D.

Exception: For additional requirements for insulting concrete form (ICF) foundations see Section R404.1.3.3.6.1.

R318.4.5.2 Protection of exposed foam plastic. Exposed foam plastic shall be protected from physical damage. The required inspection gap foam plastic and treatment gap shall be on the exterior with a cementitious coating that extends at least 2 inches (51 mm) below the foam plastic onto the surface of the foundation wall. See Appendix NC-D.

R318.4.5.3 Waterproofing foam plastic between inspection gap and treatment gap. Waterproofing shall be installed over the required cementitious coating from 6 inches (152 mm) above grade to the treatment gap in accordance with manufacturer's installation instructions.

R318.4.5.4 Dampproofing of below grade walls. Any foam plastic applied below the treatment gap shall be installed after required foundation wall dampproofing is in place. See Section R406 and Appendix NC-D.

SECTION R320
ACCESSIBILITY

R320.1 Scope. Where there are four or more *dwelling units* or *sleeping units* in a single structure, the provisions of Chapter 11 of the *International Building Code* for Group R-3 shall apply.

Exception: Owner-occupied *lodging houses* with ~~five~~ eight or fewer guestrooms are not required to be accessible.

R321.1.1 Clearance Between Hoistways Doors and Car Doors or Gates The clearance between the hoistway doors or gates and the hoistway edge of the landing sill shall not exceed 3/4 inch (19 mm). The distance between the hoistway face of the landing door or gate and the car door or gate shall not exceed 4 inches (101.6 mm) as follows:

1. Horizontal sliding car doors and gates shall be designed and installed to withstand a force of 75 pounds applied horizontally on an area 4 inches by 4 inches at right angles to and at any location on the car door without permanent deformation. The deflection may not exceed 3/4 inch and may not displace the door from its guides or tracks. The force must be applied while the door is in the fully closed position.

2. Folding car doors shall be designed and installed to withstand a force of 75 pounds applied horizontally using a 4-inch-diameter sphere at any location within the folds on the car door without permanent deformation. The deflection may not exceed 3/4 inch and may not displace the door from its guides. The force must be applied while the door is in the fully closed position.

Exception: A permanent installation of a nonremovable, hoistway door space guard, a full height door baffle or door baffle that is at least 31.75" in height is allowed. The door space guard, full height door baffle or 31.75" door baffle must be designed and installed to withstand a force of 75 pounds applied horizontally using a 4-inch-diameter sphere at any location of the space guard without permanent deformation while allowing no more than 3/4"sill.

R321.2 Platform lifts. Where provided, platform lifts shall comply with ASME A18.1.

R321.3 Accessibility. Deleted. ~~Elevators or platform lifts that are part of an accessible route required by Chapter 11 of the *International Building Code*, shall comply with ICC A117.1.~~

R321.4 Certification The installer shall certify that the following conditions have been met.

1. The elevator or platform lift has been installed in accordance with the manufacturer's installation instructions.
2. The elevator meets the requirements of ASME A17.1/CSA B44.
3. The elevator or platform lift meets the requirements of the North Carolina Electrical Code. Before a Certificate of Occupancy is issued, the permit holder shall provide the code enforcement official a letter of certification from the installer, evidencing compliance with the above conditions. Any maintenance requirements required by the manufacturer must be stated and affixed to the component.

4. SECTION R322
FLOOD-RESISTANT CONSTRUCTION

5. **R322.1 General.** Buildings and structures constructed in whole or in part in flood hazard areas, including A or V Zones and Coastal A Zones, as established in Table R301.2, and substantial improvement and *repair* of substantial damage of buildings and structures in flood hazard areas, shall be designed and constructed in accordance with the provisions contained in this section. Buildings and structures that are located in more than one flood hazard area shall comply with the provisions associated with the most restrictive flood hazard area. Buildings and structures located in whole or in part in identified floodways shall be designed and constructed in accordance with ASCE 24. See additional provisions in Chapter 46.

6. **R322.1.9 Manufactured homes.** Deleted. ~~The bottom of the frame of new and replacement *manufactured homes* on foundations that conform to the requirements of Section R322.2 or R322.3, as applicable, shall be elevated to or above the elevations specified in Section R322.2 (flood hazard areas including A Zones) or R322.3 in coastal high-hazard areas (V Zones and Coastal A Zones). The anchor and tie-down requirements~~

~~of the applicable state or federal requirements shall apply. The foundation and anchorage of *manufactured homes* to be located in identified floodways shall be designed and constructed in accordance with ASCE 24.~~

7. **R322.2.4 Tanks.** Deleted. ~~Underground tanks shall be anchored to prevent flotation, collapse and lateral movement under conditions of the base flood. Above-ground tanks shall be installed at or above the elevation required in Section R322.2.1 or shall be anchored to prevent flotation, collapse and lateral movement under conditions of the base flood.~~

8. **R322.3 Coastal high-hazard areas (including V Zones and Coastal A Zones, where designated).** ~~Areas that have been determined to be subject to wave heights in excess of 3 feet (914 mm) or subject to high-velocity wave action or wave-induced erosion shall be designated as coastal high-hazard areas. Flood hazard areas that have been designated as subject to wave heights between $1\frac{1}{2}$ feet (457 mm) and 3 feet (914 mm) or otherwise designated by the *jurisdiction* shall be designated as Coastal A Zones. Buildings and structures constructed in whole or in part in coastal high-hazard areas and Coastal A Zones, where designated, shall be designed and constructed in accordance with Sections R322.3.1 through R322.3.10.~~ See Chapter 46.

9. **R322.3.1 Location and site preparation.** Deleted.

~~10. 1. New buildings and buildings that are determined to be substantially improved pursuant to Section R105.3.1.1 shall be located landward of the reach of mean high tide.~~

~~11. 2. For any alteration of sand dunes and mangrove stands, the *building official* shall require submission of an engineering analysis that demonstrates that the proposed alteration will not increase the potential for flood damage.~~

12. **R322.3.2 Elevation requirements.** Deleted.

~~13.~~ 1. ~~Buildings and structures erected within coastal high-hazard areas and Coastal A Zones, shall be elevated so that the bottom of the lowest horizontal structural members supporting the lowest floor, with the exception of piling, pile caps, columns, grade beams and bracing, is elevated to or above the base flood elevation plus 1 foot (305 mm) or the design flood elevation, whichever is higher.~~

~~14. 2. *Basement* floors that are below *grade* on all sides are prohibited.~~

~~15. 3. Garages used solely for parking, building access or storage, and carports shall comply with Item 1 or shall be at or above *grade* on not less than one side and, if enclosed with walls, such walls shall comply with Item 6.~~

~~16. 4. The use of fill for structural support is prohibited.~~

~~17. 5. Minor grading, and the placement of minor quantities of fill, shall be permitted for landscaping and for drainage purposes under and around buildings and for support of parking slabs, pool decks, patios and walkways.~~

~~18. 6. Walls and partitions enclosing areas below the elevation required in this section shall meet the requirements of Sections R322.3.5 and R322.3.6.~~

~~19.~~ **R322.3.3 Foundations.** Deleted. ~~Buildings and structures erected in coastal high-hazard areas and Coastal A Zones shall be supported on pilings or columns and shall be adequately anchored to such pilings or columns and shall comply with the following:~~

~~20. **1.** The space below the elevated building shall be either free of obstruction or, if enclosed with walls, the walls shall meet the requirements of Section R322.3.5.~~

~~21. 2. Pilings shall have adequate soil penetrations to resist the combined wave and wind loads (lateral and uplift) and pile embedment shall include consideration of decreased resistance capacity caused by scour of soil strata surrounding the piling.~~

~~22. 3. Columns and their supporting foundations shall be designed to resist combined wave and wind loads, lateral and uplift, and shall include consideration of decreased resistance capacity caused by scour of soil strata surrounding the columns. Spread footing, mat, raft or other foundations that support columns shall not be permitted where soil investigations that are required in accordance with Section R401.4 indicate that soil material under the spread footing, mat, raft or other foundation is subject to scour or erosion from wave-velocity flow conditions. If permitted, spread footing, mat, raft or other foundations that support columns shall be designed in accordance with ASCE 24.~~

~~23. 4. Flood and wave loads shall be those associated with the design flood. Wind loads shall be those required by this code.~~

24. ~~5. Foundation designs and *construction documents* shall be prepared and sealed in accordance with Section R322.3.9.~~

25. ~~**Exception:** In Coastal A Zones, stem wall foundations supporting a floor system above and backfilled with soil or gravel to the underside of the floor system shall be permitted provided that the foundations are designed to account for wave action, debris impact, erosion and local scour. Where soils are susceptible to erosion and local scour, stem wall foundations shall have deep footings to account for the loss of soil.~~

26. **R322.3.4 Concrete slabs.** Deleted. ~~Concrete slabs used for parking, floors of enclosures, landings, decks, walkways, patios and similar uses that are located beneath structures, or slabs that are located such that if undermined or displaced during base flood conditions could cause structural damage to the building foundation, shall be designed and constructed in accordance with one of the following:~~

27. ~~1. To be structurally independent of the foundation system of the structure, to not transfer flood loads to the main structure, and to be frangible and break away under flood conditions prior to base flood conditions. Slabs shall be a maximum of 4 inches (102 mm) thick, shall not have turned-down edges, shall not contain reinforcing, shall have isolation joints at pilings and columns, and shall have control or construction joints in both directions spaced not more than 4 feet (1219 mm) apart.~~

28. ~~2. To be self-supporting, structural slabs capable of remaining intact and functional under base flood conditions, including erosion and local scour, and the main structure shall be capable of resisting any added flood loads and effects of local scour caused by the presence of the slabs.~~

29. **R322.3.5 Walls below required elevation.** ~~Walls and partitions are permitted below the elevation required in Section R322.3.2, provided that such walls and partitions are not part of the structural support of the building or structure and:~~

30. ~~1. Electrical, mechanical and plumbing system components are not to be mounted on or penetrate through walls that are designed to break away under flood loads; and~~

31. ~~2. Are constructed with insect screening or open lattice; or~~

32. ~~3. Are designed to break away or collapse without causing collapse, displacement or other structural damage to the elevated portion of the building or supporting foundation system. Such walls, framing and connections shall have a resistance of not less than 10 (479 Pa) and not more than 20 pounds per square foot (958 Pa) as determined using allowable stress design; or~~

33. ~~4. Where wind loading values of this code exceed 20 pounds per square foot (958 Pa), as determined using allowable stress design, the *construction documents* shall include documentation prepared and sealed by a *registered design professional* that:~~

34. ~~4.1. The walls and partitions below the required elevation have been designed to collapse from a water load less than that which would occur during the base flood.~~

35. ~~4.2. The elevated portion of the building and supporting foundation system have been designed to withstand the effects of wind and flood loads acting simultaneously on structural and nonstructural building components. Water-loading values used shall be those associated with the design flood. Wind-loading values shall be those required by this code.~~

36. ~~5. Walls intended to break away under flood loads as specified in Item 3 or 4 have flood openings that meet the criteria in Section R322.2.2, Item 2.~~

37. ~~**R322.3.6 Enclosed areas below required elevation.** Enclosed areas below the elevation required in Section R322.3.2 shall be used solely for parking of vehicles, building access or storage.~~

38. ~~**R322.3.6.1 Protection of building envelope.** An exterior door that meets the requirements of Section R609 shall be installed at the top of stairs that provide access to the building and that are enclosed with walls designed to break away in accordance with Section R322.3.5.~~

39. ~~**R322.3.7 Stairways and ramps.** *Stairways* and *ramps* that are located below the lowest floor elevations specified in Section R322.3.2 shall comply with one or more of the following:~~

40. ~~1. Be designed and constructed with open or partially open *risers* and *guards*.~~

41. ~~2. *Stairways* and *ramps* not part of the required means of egress shall be designed and constructed to break away during design flood conditions without causing damage to the building or structure, including foundation.~~

42. ~~3. Be retractable, or able to be raised to or above the lowest floor elevation, provided that the ability to be retracted or raised prior to the onset of flooding is not contrary to the means of egress requirements of the code.~~

43. ~~4. Be designed and constructed to resist flood loads and minimize transfer of flood loads to the building or structure, including foundation.~~

44. ~~Areas below *stairways* and *ramps* shall not be enclosed with walls below the required in Section R322.3.2 elevation unless such walls are constructed in accordance with Section R322.3.5.~~

45. ~~**R322.3.8 Decks and porches.** Attached decks and porches shall meet the elevation requirements of Section R322.3.2 and shall either meet the foundation requirements of this section or shall be cantilevered from or knee braced to the building or structure. Self supporting decks and porches that are below the elevation required in Section R322.3.2 shall not be enclosed by solid, rigid walls, including walls designed to break away. Self-supporting decks and porches shall be designed and constructed to remain in place during base flood conditions or shall be frangible and break away under base flood conditions.~~

46. ~~**R322.3.9 Construction documents.** The *construction documents* shall include documentation that is prepared and sealed by a *registered design professional* that the design and methods of construction to be used meet the applicable criteria of this section.~~

47. ~~**R322.3.10 Tanks.** Underground tanks shall be anchored to prevent flotation, collapse and lateral movement under conditions of the base flood. Above-ground tanks shall be installed at or above the elevation required in Section R322.3.2. Where elevated on platforms, the platforms shall be cantilevered from or knee braced to the building or shall be supported on foundations that conform to the requirements of Section R322.3.~~

R324.4.1.1 Roof load. Portions of roof structures not covered with *photovoltaic panel systems* shall be designed for dead loads and roof loads in accordance with Sections R301.4 and R301.6. Portions of roof structures covered with *photovoltaic panel systems* shall be designed for the following load cases:

1. Dead load (including *photovoltaic panel* weight) plus ~~snow~~ roof load in accordance with Table R301.2.
2. Dead load (excluding *photovoltaic panel* weight) plus roof *live load* ~~or snow load~~, whichever is greater, in accordance with Section R301.6.

R326.3 Story above grade plane. A habitable attic shall be considered a story above *grade plane*.

Exceptions: A habitable attic shall not be considered to be a story above grade plane provided that the habitable attic meets all the following:

1. The aggregate area of the habitable attic is either of the following:
   1.1. Not greater than ~~one-third~~ 50 percent of the floor area of the story below.
   ~~1.2. Not greater than one half of the floor area of the story below where the habitable attic is located within a dwelling unit equipped with a fire sprinkler system in accordance with Section P2904.~~
2. The occupiable space is enclosed by the roof assembly above, knee walls, if applicable, on the sides and the floor-ceiling assembly below.
3. The floor of the habitable attic does not extend beyond the exterior walls of the story below.
4. ~~**Where a habitable attic is located above a third story, the dwelling unit or townhouse unit shall be equipped with a fire sprinkler system in accordance with Section P2904.**~~

SECTION R327
SWIMMING POOLS, SPAS AND HOT TUBS

R327.1 General. The design and construction of pools and spas shall comply with ~~the *International Swimming Pool and Spa Code*.~~ Appendix NC-A.

R328.3.1 Spacing. Individual units shall be separated from each other by not less than 3 feet (914 mm) except where smaller separation distances are documented to be adequate based on large-scale fire testing complying with ~~Section 1207.1.5 of the *International Fire Code*.~~ UL 9540A.

R328.5 Energy ratings. Individual *ESS* units shall have a maximum rating of 20 kWh. The aggregate rating of the *ESS* shall not exceed:

1. 40 kWh within utility closets, basements and storage or utility spaces.
2. 80 kWh in attached or detached garages and detached accessory structures.
3. 80 kWh on exterior walls.
4. 80 kWh outdoors on the ground.

~~*ESS* installations exceeding the permitted individual or aggregate ratings shall be installed in accordance with Section 1207 of the *International Fire Code*.~~

SECTION R330
STATIONARY FUEL CELL POWER SYSTEMS

Deleted.

~~**R330.1 General.** *Stationary fuel cell power systems* in new and existing buildings and structures shall comply with Section 1206 of the *International Fire Code*.~~

SECTION R331
DOCKS, PIERS, BULKHEADS AND WATERWAY STRUCTURES

R331.1 General. Docks, piers, bulkheads and waterway structures shall be constructed in accordance with Chapter 36 of the North Carolina Building Code.

Exceptions: Structures complying with the following are not required to meet the provisions of this code.

1. Docks and Piers built over private ponds.
2. Fixed in place walkways, docks, and piers not covered in Exception 1 and not exceeding 144 square feet for single family dwelling.
3. Minor repairs to existing docks, piers and waterway structures.

SECTION R332
LICENSED RESIDENTIAL CARE

R332.1 General. Buildings in which more than three people are harbored for medical, charitable or other care or treatment shall be classified as residential care facilities. The state agency having jurisdiction shall classify the facility as a residential care home, small residential care facility or small nonambulatory care facility.

R332.1.1 Fire extinguishers. Fire extinguishers shall be installed in licensed residential care facilities in accordance with the North Carolina Fire Prevention Code.

R332.1.2 Means of egress. Where two means of egress exits are required, the exits or exit access doors shall be so located and constructed to minimize the possibility that both may be blocked by any one fire or other emergency condition.

R332.2 Residential Care Facilities. Homes keeping no more than six adults or six unrestrained children who are able to respond and evacuate the facility without verbal or physical assistance, determined by the state agency having jurisdiction to be licensable, shall be classified as Single-Family Residential and comply with the requirements of this section.

R332.2.1 Means of egress. Each normally occupied story of the facility shall have two remotely located means of egress exits. The exits or exit access doors shall be so located and constructed to minimize the possibility that both may be blocked by any one fire or other emergency condition.

R332.2.2 Smoke Detection Systems. Smoke detectors shall be provided on all levels.

R332.2.3 Interior finishes. Interior wall and ceiling finishes shall be Class A, B or C.

R332.2.4 Heating appliances. Unvented fuel-fired heaters and portable electric heaters shall be prohibited.

R332.3 Licensed Small Residential Care Facilities. The following facilities when determined by the State Agency having jurisdiction to be licensable, shall be classified as Single-Family Residential and comply with the requirements of this section.

1. Residential Care Facilities keeping no more than six adults or six unrestrained children with no more than three who are unable to respond and evacuate without verbal or physical assistance.
2. Residential Care Facilities keeping no more than five adults or five children who are unable to respond and evacuate without verbal or physical assistance, when certifiable for Medicaid reimbursement, and when staffed 24-hours per day with at least two staff awake at all times.
3. Residential Care Facilities keeping no more than nine adults or nine children who are able to respond and evacuate without verbal or physical assistance.

R332.3.1 Fire Resistance Construction. The building shall be of one-hour fire resistant rated construction including all walls, partitions, floors and ceilings. Bedroom doors shall be 1.75 inches solid wood core.

Exception: No rating shall be required if the building is NFPA 13D sprinklered with a wet pipe system with a 30-minute water supply. Bathrooms, toilets, closets, pantries, storage spaces, attached garages, and utility spaces shall be sprinklered. The sprinkler system shall be monitored per North Carolina Fire Code, Section 903.4 (Section 903.4, Exception 1 is not applicable in this occupancy)

R332.3.2 Building height and area. Buildings shall not exceed two stories in height and shall not exceed 7,000 square feet (650 m^2) per story for dwellings applying the exception in Section R332.2.1 and 12,000 square feet (1114.8 m^2) per story for all other dwellings. For purposes of this section, attics and basements used as habitable spaces shall be considered as stories.

R332.3.3 Quantity of exits. Each normally occupied story of the facility shall have two remotely located exits. The exits doors shall be so located and constructed to minimize the possibility that both may be blocked by any one fire or other emergency condition.

R332.3.4 Egress stairs. Required facility egress stairways shall be either exterior unenclosed or interior enclosed on each level with one-hour fire-resistant rated construction and self-closing 20-minute labeled doors. Other interior stairways shall be enclosed on one floor level with one-hour fire resistant walls and self-closing 20-minute labeled doors.

R332.3.5 Smoke and heat detectors. Smoke detectors shall be provided on all levels. Heat detectors shall be installed in all attic spaces. The heat detectors shall be connected to the fire alarm and detection system.

R332.3.6 Incidental accessory occupancies. Any incidental use area, as defined by North Carolina Building Code, Table 508.2.5, shall be enclosed with one-hour fire-resistant rated construction and self-closing 20-minute labeled door or provided with an automatic sprinkler system and smoke resistant separation from other areas.

R332.3.7 Fire alarm systems. A building fire alarm system shall be provided in accordance with NFPA 72. Provisions shall be made to activate the internal evacuation alarm at all required exits.

R332.3.8 Interior finishes. Interior wall and ceiling membranes shall be gypsum wallboard, plaster or other non-combustible material.

R332.3.9 Heating appliances. Unvented fuel-fired heaters, floor furnaces, and portable electric heaters shall not be installed.

R332.3.10 Occupants. Occupants younger than six-years of age shall sleep on the level of exit discharge with adult supervision.

R332.4 Small Non-ambulatory Care Facilities. Facilities keeping no more than six adults or six children who are unable to respond and evacuate without verbal or physical assistance, when determined by the State Agency having jurisdiction to be licensable shall comply with the requirements of R332.3 for Licensed Small Residential Care Facilities.

R332.4.1 Automatic sprinkler systems. The building shall be sprinklered with a wet pipe system in accordance with NFPA 13D with a 30-minute water supply including bathrooms, toilets, closets, pantries, storage spaces, attached garages, and utility spaces. The sprinkler system shall be monitored per North Carolina Fire Code, Section 903.4. North Carolina Fire Code, Section 903.4, Exception 1 shall not apply to this section.

SECTION R333
LICENSED ADULT AND CHILD DAY CARE

R333.1 Means of egress.

R333.1.1 Location. Rooms where occupants receive care shall be on the level of exit discharge.

R333.1.2 Quantity of Exits. Adult and child day care facilities shall have two or more remote means of egress.

Exception: A room where occupants receive care and comply with all of the following:

a. Located on the level of exit discharge, and

b. Has an exit door directly to the exterior.

R333.1.3 Walls and Ceilings. All walls and ceilings in rooms which are used for day care purposes and are part of an egress (exiting) path shall have interior membranes of noncombustible construction such as but not limited to plaster or gypsum wallboard or shall comply with Section 803 of the North Carolina Building Code.

R333.2 Portable Fire Extinguishers. At least one 2-A:10-B:C fire extinguisher shall be provided per floor with a maximum of 40 feet travel distance to the extinguisher.

SECTION R334
DEMOLITION

R334.1 Demolition. Where a building or structure regulated by this code has been demolished or removed, the lot shall not create a new hazard to the site or to adjoining properties. All utilities shall be properly terminated.

CHAPTER 4
FOUNDATIONS

~~**User note:**~~

~~***About this chapter:*** Chapter 4 provides requirements for constructing footings and walls for foundations of wood, masonry, concrete and precast concrete. In addition to a foundation's ability to support the required design loads, this chapter addresses several other factors that can affect foundation performance. These include controlling surface water and subsurface drainage, requiring soil tests where conditions warrant and evaluating proximity to slopes and minimum depth requirements. This chapter also provides requirements to minimize adverse effects of moisture, decay and pests in basements and crawl spaces.~~

R401.4.1 Geotechnical evaluation. ~~In lieu of a complete geotechnical evaluation, the load-bearing values in Table R401.4.1 shall be assumed.~~ The load bearing values greater than 2000 psf (95.8 kPa) in Table R401.4.1 require an engineering evaluation.

TABLE R401.4.1
PRESUMPTIVE LOAD-BEARING VALUES OF FOUNDATION MATERIALS[a]

CLASS OF MATERIAL	LOAD-BEARING PRESSURE (pounds per square foot)
Crystalline bedrock	12,000
Sedimentary and foliated rock	~~4,000~~ 6000
Sandy gravel and/or gravel (GW and GP)	~~3,000~~ 5000
Sand, silty sand, clayey sand, silty gravel and clayey gravel (SW, SP, SM, SC, GM and GC)	~~2,000~~ 3000
Clay, sandy, silty clay, clayey silt, silt and sandy siltclay (CL, ML, MH and CH)	~~1,500~~[b] 2000b

For SI: 1 pound per square foot = 0.0479 kPa.

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

b. Where the building official determines that in-place soils with an allowable bearing capacity of less than ~~1,500~~ 2000 psf are likely to be present at the site, the allowable bearing capacity shall be determined by a soils investigation.

SECTION R403
FOOTINGS

R403.1 General. All exterior walls shall be supported on continuous solid or fully grouted masonry or concrete footings, crushed stone footings, wood foundations, or other *approved* structural systems that shall be of sufficient design to accommodate all loads according to Section R301 and to transmit the resulting loads to the soil within the limitations as determined from the character of the soil. Footings shall be supported on undisturbed natural soils or engineered fill. Concrete footing shall be designed and constructed in accordance with the provisions of Section R403 or in accordance with ACI 332. Discontinuous footings shall be permitted to be constructed in accordance with ACI 332 for concrete foundation walls and Appendix NC-C for masonry foundation walls.

TABLE R403.1(1)

~~**(TO BE replaced by new footing table)**~~

~~**MINIMUM WIDTH AND THICKNESS FOR CONCRETE FOOTINGS FOR LIGHT-FRAME CONSTRUCTION (inches)[a, b, c, d]**~~

		~~LOAD-BEARING VALUE OF SOIL (psf)~~

~~**GROUND** SNOW LOAD OR ROOF LIVE LOAD~~	~~STORY AND TYPE OF STRUCTURE WITH LIGHT FRAME~~	~~1,500~~	~~2,000~~	~~2,500~~	~~3,000~~	~~3,500~~	~~4,000~~
~~20 psf roof live load or 25 psf ground snow load~~	~~1 story—slab-on-grade~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~1 story—with crawl space~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~1 story—plus basement~~	~~16 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~2 story—slab-on-grade~~	~~13 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~2 story—with crawl space~~	~~15 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~2 story—plus basement~~	~~19 × 6~~	~~14 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~3 story—slab-on-grade~~	~~16 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~3 story—with crawl space~~	~~18 × 6~~	~~14 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~3 story—plus basement~~	~~22 × 7~~	~~16 × 6~~	~~13 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
~~30 psf~~	~~1 story—slab-on-grade~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~1 story—with crawl space~~	~~13 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~1 story—plus basement~~	~~16 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~2 story—slab-on-grade~~	~~13 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~2 story—with crawl space~~	~~16 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~2 story—plus basement~~	~~19 × 6~~	~~14 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~3 story—slab-on-grade~~	~~16 × 6~~	~~14 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~3 story—with crawl space~~	~~19 × 6~~	~~14 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~3 story—plus basement~~	~~22 × 7~~	~~16 × 6~~	~~13 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
~~50 psf~~	~~1 story—slab-on-grade~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~1 story—with crawl space~~	~~14 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~1 story—plus basement~~	~~18 × 6~~	~~13 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~2 story—slab-on-grade~~	~~15 × 6~~	~~13 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~2 story—with crawl space~~	~~17 × 6~~	~~13 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~2 story—plus basement~~	~~21 × 7~~	~~15 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~3 story—slab-on-grade~~	~~18 × 6~~	~~13 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~3 story—with crawl space~~	~~20 × 6~~	~~15 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~3 story—plus basement~~	~~24 × 8~~	~~18 × 6~~	~~14 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
~~70 psf~~	~~1 story—slab-on-grade~~	~~14 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~1 story—with crawl space~~	~~16 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~1 story—plus basement~~	~~19 × 6~~	~~14 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~2 story—slab-on-grade~~	~~17 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~2 story—with crawl space~~	~~19 × 6~~	~~14 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~2 story—plus basement~~	~~22 × 7~~	~~17 × 6~~	~~13 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~3 story—slab-on-grade~~	~~20 × 6~~	~~15 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~3 story—with crawl space~~	~~22 × 7~~	~~16 × 6~~	~~13 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~3 story—plus basement~~	~~24 × 8~~	~~19 × 6~~	~~15 × 6~~	~~13 × 6~~	~~12 × 6~~	~~12 × 6~~

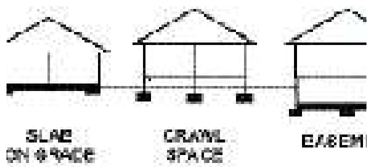
~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 47.9 N/m².~~

~~a. Linear interpolation of footing width is permitted between the soil bearing pressures in the table. Extrapolation is not permitted.~~

~~b. The table is based on the following conditions and loads: building width, 32 feet; wall height, 9 feet; basement wall height, 8 feet; dead loads, 15 psf roof and ceiling assembly, 10 psf floor assembly, 12 psf wall assembly; live loads, roof and ground snow loads as listed, 40 psf first floor, 30 psf second and third floors. Footing sizes are calculated assuming a clear span roof/ceiling assembly and an interior bearing wall or beam at each floor.~~

~~c. Where the building width perpendicular to the wall footing is greater than 32 feet, the footing width shall be increased by 2 inches and footing depth shall be increased by 1 inch for every 4 feet of increase in building width.~~

~~d. Where the building width perpendicular to the wall footing is less than 32 feet, a 2-inch decrease in footing width and 1-inch decrease in footing depth is permitted for every 4 feet of decrease in building width provided that the minimum width is 12 inches and minimum depth is 6 inches.~~



~~TABLE R403.1(2)~~

~~MINIMUM WIDTH AND THICKNESS FOR CONCRETE FOOTINGS FOR LIGHT-FRAME CONSTRUCTION WITH BRICK VENEER OR LATH AND PLASTER (inches)~~[~~a, b, c, d~~]

GROUND ~~SNOW LOAD OR ROOF LIVE LOAD~~	~~STORY AND TYPE OF STRUCTURE WITH BRICK VENEER~~	~~LOAD-BEARING VALUE OF SOIL (psf)~~					
		~~1,500~~	~~2,000~~	~~2,500~~	~~3,000~~	~~3,500~~	~~4,000~~
~~20 psf roof live load or 25 psf ground snow load~~	~~1 story—slab-on-grade~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~1 story—with crawl space~~	~~15 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~1 story—plus basement~~	~~18 × 6~~	~~14 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~2 story—slab-on-grade~~	~~18 × 6~~	~~13 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~2 story—with crawl space~~	~~20 × 6~~	~~15 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~2 story—plus basement~~	~~23 × 8~~	~~17 × 6~~	~~14 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~3 story—slab-on-grade~~	~~23 × 8~~	~~17 × 6~~	~~14 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~3 story—with crawl space~~	~~25 × 9~~	~~19 × 6~~	~~15 × 6~~	~~13 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~3 story—plus basement~~	~~29 × 11~~	~~21 × 7~~	~~17 × 6~~	~~14 × 6~~	~~12 × 6~~	~~12 × 6~~
~~30 psf~~	~~1 story—slab-on-grade~~	~~13 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~1 story—with crawl space~~	~~15 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~1 story—plus basement~~	~~18 × 6~~	~~14 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~2 story—slab-on-grade~~	~~18 × 6~~	~~14 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~2 story—with crawl space~~	~~20 × 6~~	~~15 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~2 story—plus basement~~	~~24 × 8~~	~~18 × 6~~	~~14 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~3 story—slab-on-grade~~	~~23 × 8~~	~~18 × 6~~	~~14 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~3 story—with crawl space~~	~~26 × 9~~	~~19 × 6~~	~~15 × 6~~	~~13 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~3 story—plus basement~~	~~29 × 11~~	~~22 × 7~~	~~17 × 6~~	~~14 × 6~~	~~12 × 6~~	~~12 × 6~~
~~50 psf~~	~~1 story—slab-on-grade~~	~~14 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~1 story—with crawl space~~	~~17 × 6~~	~~13 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~1 story—plus basement~~	~~20 × 60~~	~~15 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~2 story—slab-on-grade~~	~~20 × 6~~	~~15 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~2 story—with crawl space~~	~~22 × 7~~	~~17 × 6~~	~~13 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~2 story—plus basement~~	~~25 × 9~~	~~19 × 6~~	~~15 × 6~~	~~13 × 6~~	~~12 × 6~~	~~12 × 6~~

	3 story — slab-on-grade	25 × 9	19 × 6	15 × 6	13 × 6	12 × 6	12 × 6
	3 story — with crawl space	27 × 10	21 × 7	16 × 6	14 × 6	12 × 6	12 × 6
	3 story — plus basement	31 × 12	23 × 8	18 × 6	15 × 6	13 × 6	12 × 6
70 psf	1 story — slab-on-grade	14 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story — with crawl space	17 × 6	14 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story — plus basement	22 × 7	16 × 6	13 × 6	12 × 6	12 × 6	12 × 6
	2 story — slab-on-grade	21 × 7	16 × 6	13 × 6	12 × 6	12 × 6	12 × 6
	2 story — with crawl space	24 × 8	18 × 6	14 × 6	12 × 6	12 × 6	12 × 6
	2 story — plus basement	27 × 10	20 × 6	16 × 6	13 × 6	12 × 6	12 × 6
	3 story — slab-on-grade	27 × 10	20 × 6	16 × 6	13 × 6	12 × 6	12 × 6
	3 story — with crawl space	29 × 11	22 × 7	17 × 6	15 × 6	12 × 6	12 × 6
	3 story — plus basement	32 × 12	24 × 8	19 × 6	16 × 6	14 × 6	12 × 6

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 47.9 N/m^2.

a. Linear interpolation of footing width is permitted between the soil bearing pressures in the table. Extrapolation is not permitted.

b. The table is based on the following conditions and loads: building width, 32 feet; wall height, 9 feet; basement wall height, 8 feet; dead loads, 15 psf roof and ceiling assembly, 10 psf floor assembly, 12 psf wall assembly; live loads, roof and ground snow loads as listed, 40 psf first floor, 30 psf second and third floors. Footing sizes are calculated assuming a clear span roof/ceiling assembly and an interior bearing wall or beam at each floor.

c. Where the building width perpendicular to the wall footing is greater than 32 feet, the footing width shall be increased by 2 inches and footing depth shall be increased by 1 inch for every 4 feet of increase in building width.

d. Where the building width perpendicular to the wall footing is less than 32 feet, a 2-inch decrease in footing width and 1-inch decrease in footing depth is permitted for every 4 feet of decrease in building width provided that the minimum width is 12 inches and minimum depth is 6 inches.

TABLE R403.1(3)

MINIMUM WIDTH AND THICKNESS FOR CONCRETE FOOTINGS WITH CAST-IN-PLACE CONCRETE OR PARTIALLY GROUTED MASONRY WALL CONSTRUCTION (inches)[a, b, c, d]

GROUND SNOW LOAD OR ROOF LIVE LOAD	STORY AND TYPE OF STRUCTURE WITH CMU **OR CONCRETE**	LOAD-BEARING VALUE OF SOIL (psf)					
		1,500	2,000	2,500	3,000	3,500	4,000
20 psf roof live load or 25 psf ground snow load	1 story — slab-on-grade	13 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story — with crawl space	16 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story — plus basement	19 × 6	14 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story — slab-on-grade	19 × 6	14 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story — with crawl space	22 × 7	16 × 6	13 × 6	12 × 6	12 × 6	12 × 6
	2 story — plus basement	25 × 9	19 × 6	15 × 6	12 × 6	12 × 6	12 × 6
	3 story — slab-on-grade	25 × 9	19 × 6	15 × 6	13 × 6	12 × 6	12 × 6
	3 story — with crawl space	28 × 10	21 × 7	17 × 6	14 × 6	12 × 6	12 × 6
	3 story — plus basement	31 × 12	23 × 8	18 × 6	15 × 6	13 × 6	12 × 6
30 psf	1 story — slab-on-grade	13 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story — with crawl space	16 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story — plus basement	19 × 7	14 × 6	12 × 6	12 × 6	12 × 6	12 × 6

	~~2 story — slab-on-grade~~	~~19 × 6~~	~~15 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~2 story — with crawl space~~	~~22 × 7~~	~~16 × 6~~	~~13 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~2 story — plus basement~~	~~25 × 9~~	~~19 × 6~~	~~15 × 6~~	~~13 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~3 story — slab-on-grade~~	~~26 × 9~~	~~19 × 6~~	~~15 × 6~~	~~13 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~3 story — with crawl space~~	~~28 × 10~~	~~21 × 7~~	~~17 × 6~~	~~14 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~3 story — plus basement~~	~~31 × 12~~	~~23 × 8~~	~~19 × 6~~	~~16 × 6~~	~~13 × 6~~	~~12 × 6~~
~~50 psf~~	~~1 story — slab-on-grade~~	~~15 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~1 story — with crawl space~~	~~18 × 6~~	~~13 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~1 story — plus basement~~	~~21× 7~~	~~16 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~2 story — slab-on-grade~~	~~21 × 7~~	~~16 × 6~~	~~13 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~2 story — with crawl space~~	~~24 × 8~~	~~18 × 6~~	~~14 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~2 story — plus basement~~	~~27 × 10~~	~~20 × 6~~	~~16 × 6~~	~~13 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~3 story — slab-on-grade~~	~~27 × 10~~	~~20 × 6~~	~~16 × 6~~	~~14 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~3 story — with crawl space~~	~~30 × 11~~	~~22 × 7~~	~~18 × 6~~	~~15 × 6~~	~~13 × 6~~	~~12 × 6~~
	~~3 story — plus basement~~	~~33 × 13~~	~~25 × 9~~	~~20 × 6~~	~~16 × 6~~	~~14 × 6~~	~~12 × 6~~
~~70 psf~~	~~1 story — slab-on-grade~~	~~17 × 6~~	~~13 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~1 story — with crawl space~~	~~19 × 6~~	~~14 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~1 story — plus basement~~	~~22 × 7~~	~~17 × 6~~	~~13 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~2 story — slab-on-grade~~	~~23 × 8~~	~~17 × 6~~	~~14 × 6~~	~~12 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~2 story — with crawl space~~	~~25 × 9~~	~~19 × 6~~	~~15 × 6~~	~~12× 6~~	~~12 × 6~~	~~12 × 6~~
	~~2 story — plus basement~~	~~28 × 10~~	~~21 × 7~~	~~17 × 6~~	~~14 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~3 story — slab-on-grade~~	~~29 × 11~~	~~22 × 7~~	~~17 × 6~~	~~14 × 6~~	~~12 × 6~~	~~12 × 6~~
	~~3 story — with crawl space~~	~~31 × 12~~	~~23 × 8~~	~~19 × 6~~	~~16 × 6~~	~~13 × 6~~	~~12 × 6~~
	~~3 story — plus basement~~	~~34 × 13~~	~~26 × 9~~	~~21 × 7~~	~~17 × 6~~	~~15 × 6~~	~~13 × 6~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 47.9 N/m^2.~~

~~a. Linear interpolation of footing width is permitted between the soil bearing pressures in the table. Extrapolation is not permitted.~~

~~b. The table is based on the following conditions and loads: building width, 32 feet; wall height, 9 feet; basement wall height, 8 feet; dead loads, 15 psf roof and ceiling assembly, 10 psf floor assembly, 12 psf wall assembly; live loads, roof and ground snow loads as listed, 40 psf first floor, 30 psf second and third floors. Footing sizes are calculated assuming a clear span roof/ceiling assembly and an interior bearing wall or beam at each floor.~~

~~c. Where the building width perpendicular to the wall footing is greater than 32 feet, the footing width shall be increased by 2 inches and footing depth shall be increased by 1 inch for every 4 feet of increase in building width.~~

~~d. Where the building width perpendicular to the wall footing is less than 32 feet, a 2-inch decrease in footing width and 1-inch decrease in footing depth is permitted for every 4 feet of decrease in building width provided that the minimum width is 12 inches and minimum depth is 6 inches.~~

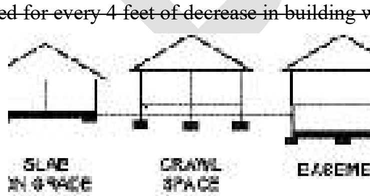


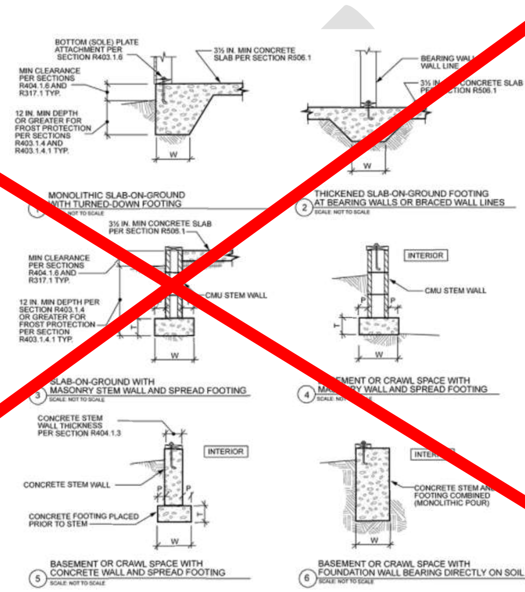
TABLE R403.1(1) [a,b,c,d]
MINIMUM WIDTH OF CONCRETE, PRECAST OR MASONRY FOOTINGS (INCHES)

	LOAD-BEARING VALUE OF SOIL (psf)			
	1500	**2000**	**3000**	**4000**
	Light-frame wood construction			
1-STORY - Slab-on-grade	12	12	12	12
1-STORY - Crawl space	14	12	12	12
1-STORY - plus basement wall	17	13	12	12
2-STORY - Slab-on-grade	13	12	12	12
2-STORY - Crawl space	18	13	12	12
2-STORY - plus basement wall	21	16	12	12
3-STORY - Slab-on-grade	16	12	12	12
3-STORY - Crawl space	21	16	12	12
3-STORY - plus basement wall	24	18	12	12
	Light-frame wood construction with brick veneer or 8-inch hollow concrete masonry			
1-STORY - Slab-on-grade	12	12	12	12
1-STORY - Crawl space	17	13	12	12
1-STORY - plus basement wall	20	15	12	12
2-STORY - Slab-on-grade	19	14	12	12
2-STORY - Crawl space	24	18	12	12
2-STORY - plus basement wall	27	20	14	12
3-STORY - Slab-on-grade	25	19	13	12
3-STORY - Crawl space	30	23	15	12
3-STORY - plus basement wall	33	25	17	13
	8 inch grout-filled concrete masonry			
1-STORY - Slab-on-grade	15	12	12	12
1-STORY - Crawl space	20	15	12	12
1-STORY - plus basement wall	23	17	12	12
2-STORY - Slab-on-grade	23	18	12	12
2-STORY - Crawl space	28	21	14	12
2-STORY - plus basement wall	31	24	16	12
3-STORY - Slab-on-grade	32	24	16	12
3-STORY - Crawl space	37	28	19	14
3-STORY - plus basement wall	40	30	20	15

The table is based on the following conditions and loads:
Building width: 36 feet; Wall height: 9 feet; Crawl space wall height: 10 feet; Basement wall height: 10 feet
Basement wall height: 8 feet

Dead loads: 20 psf roof and ceiling assembly, 10 psf floor assembly, 15 psf wall assembly
Roof Live load: 20 psf
Live Load: 40 psf first floor, 30 psf second and third floor each

a. The table assumed a clear-span roof, such as a truss
b. The table assumed a center-bearing wall carrying the load with floor tributary length no more than 9 feet
c. Linear interpolation of footing width is permitted between the soil bearing pressures in the table. Extrapolation is not permitted.
d. Table does not include habitable attic floor load.



For SI: 1 inch = 25.4 mm.
W = Width of footing, T = Thickness of footing and P = Projection per Section R403.1.1.

a. See Section R404.3 for sill requirements.
b. See Section R403.1.6 for sill attachment.
c. See Section R506.2.3 for vapor barrier requirements.
d. See Section R403.1 for base.
e. See Figure R403.1.3 for additional footing requirements for structures in Seismic Design Categories D_0, D_1 and D_2 and townhouses in Seismic Design Category C.
f. See Section R408 for under-floor ventilation and access requirements.

FIGURE R403.1(1)PLAIN CONCRETE FOOTINGS WITH MASONRY AND CONCRETE STEM WALLS IN SEISMIC DESIGN CATEGORIES A, B AND C[a, b, c, d, e, f]

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

AREA[e]	1 (ONE) STORY		2 (TWO) STORY		2½ (TWO & ONE HALF) STORY	
	Pier[c, d]	Footing	Pier[c, d]	Footing	Pier[c, d]	Footing
50	8″ × 16″	1′-4″ × 2′-0″ × 8″	8″ × 16″	1′-4″ × 2′-6″ × 8″	8″ × 16″	1′-4″ × 2′-6″ × 8″
100	8″ × 16″	1′-4″ × 2′-0″ × 8″	8″ × 16″	2′-0″ × 2′-0″ × 10″	16″ × 16"	2′-6″ × 2′-6″ × 10″
150	8″ × 16″	2′-0" × 2′-0″ × 8″	16″ × 16″	2′-8″ × 2′-8″ × 10″	16″ × 16″	3′-0″ × 3′-0″ × 10″
200	8″ × 16″	2′-4" × 2′-4″ × 10″	16″ × 16″	3′-0″ × 3′-0″ × 10″	16″ × 16″	4′-0″ × 4′-0″ × 1′-0″
250	—	—	16″ × 16″	3′-4″ × 3′-4″ × 1′-0"	16″ × 24″	4′-0″ × 4′-0″ × 1′-0″
300	—	—	16″ × 16″	3′-8″ × 3′-8″ × 1′-0"	16″ × 24″	4′-6″ × 4′-6″ × 1′-0″

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

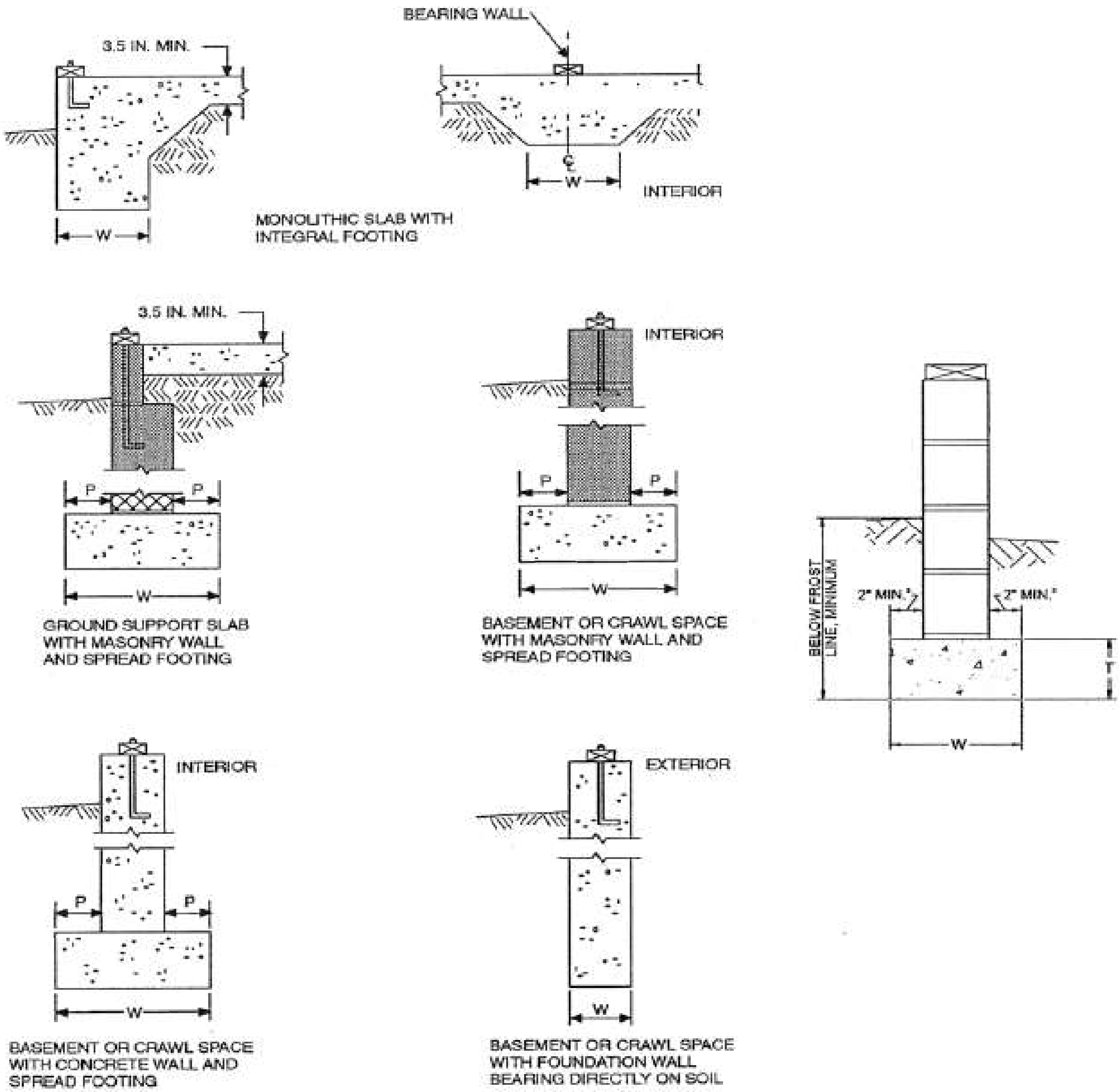
a. Pier sizes are based on hollow CMU capped with 4 inches of solid masonry or concrete for 1 (one) story and 8 inches of solid masonry or concrete for 2 (two), $2^1/_2$ (two and one half) or 3 (three) story houses or shall have cavities of the top course filled with concrete or grout or other approved methods. Mortar shall be Type S. A minimum footing width of 12 inches is acceptable for monolithic slab foundations.

b. Footing sizes are based on 2000 psf allowable soil bearing and 2500 psi concrete. This table is based on the limitations of a tributary area using dimensional framing lumber only.

c. Centers of piers shall bear in the middle one-third of the footings. Girders must have full bearing on piers. Footings shall be full thickness over the entire area of the footing.

d. Pier sizes given are minimum. For height/thickness limitations see Section R606.7.

e. Area at first level supported by pier and footing in square feet.



For SI: 1 inch = 25.4 mm.

W = Width of footing, T = Thickness of footing and P = Projection per Section R403.1.1.

Notes:

a. Foundations shall extend not less than 12 inches below finished grade and in no case less than the frost line depth.

b. Footing sizes are based on soil with an allowable soil pressure of 2,000 pounds per square foot. Footings on soil with a lower allowable soil pressure shall be designed in accordance with accepted engineering practice.

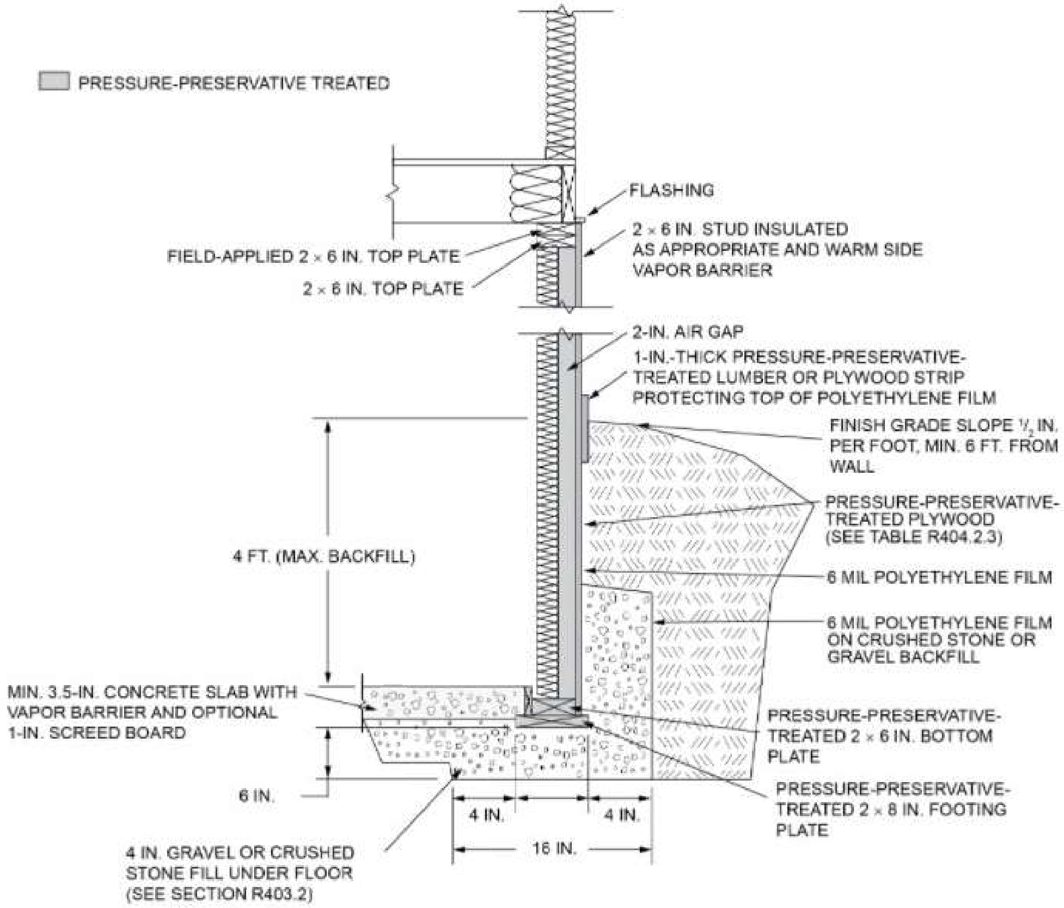
c. Footing projections shall not exceed the footing thickness.

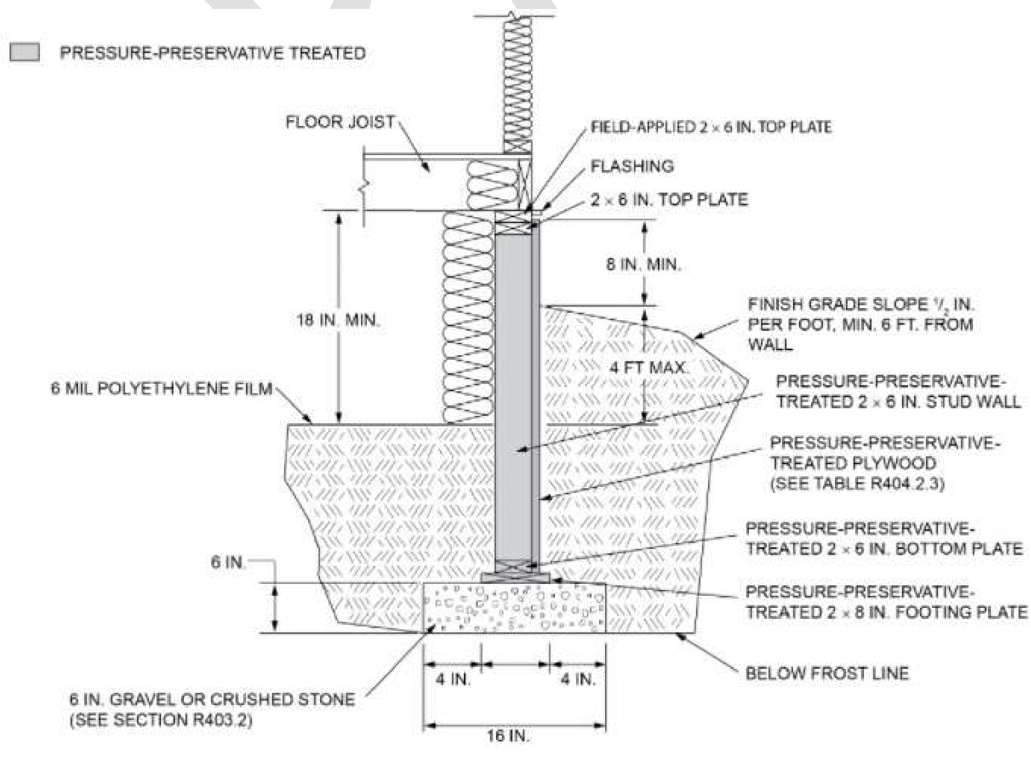
d. For minimum footing width (W) see Table R403.1(1).

e. Minimum footing thickness (T) is: 6" for 1 story, 8" for 2 story and 10" for 3 story.

f. Install anchor bolts per Section R403.1.6.

FIGURE R403.1(1)
CONCRETE AND MASONRY FOUNDATION DETAILS[a, b, c, d, e, f]


PRESSURE-PRESERVATIVE TREATED
FLASHING
2 × 6 IN. STUD INSULATED AS APPROPRIATE AND WARM SIDE VAPOR BARRIER
FIELD-APPLIED 2 × 6 IN. TOP PLATE
2 × 6 IN. TOP PLATE
2-IN. AIR GAP
1-IN.-THICK PRESSURE-PRESERVATIVE-TREATED LUMBER OR PLYWOOD STRIP PROTECTING TOP OF POLYETHYLENE FILM
FINISH GRADE SLOPE 1/2 IN. PER FOOT, MIN. 6 FT. FROM WALL
PRESSURE-PRESERVATIVE-TREATED PLYWOOD (SEE TABLE R404.2.3)
4 FT. (MAX. BACKFILL)
6 MIL POLYETHYLENE FILM
6 MIL POLYETHYLENE FILM ON CRUSHED STONE OR GRAVEL BACKFILL
MIN. 3.5-IN. CONCRETE SLAB WITH VAPOR BARRIER AND OPTIONAL 1-IN. SCREED BOARD
PRESSURE-PRESERVATIVE-TREATED 2 × 6 IN. BOTTOM PLATE
6 IN.
PRESSURE-PRESERVATIVE-TREATED 2 × 8 IN. FOOTING PLATE
4 IN.
4 IN.
16 IN.
4 IN. GRAVEL OR CRUSHED STONE FILL UNDER FLOOR (SEE SECTION R403.2)


PRESSURE-PRESERVATIVE TREATED
FLOOR JOIST
FIELD-APPLIED 2 × 6 IN. TOP PLATE
FLASHING
2 × 6 IN. TOP PLATE
8 IN. MIN.
18 IN. MIN.
FINISH GRADE SLOPE 1/2 IN. PER FOOT, MIN. 6 FT. FROM WALL
4 FT MAX.
6 MIL POLYETHYLENE FILM
PRESSURE-PRESERVATIVE-TREATED 2 × 6 IN. STUD WALL
PRESSURE-PRESERVATIVE-TREATED PLYWOOD (SEE TABLE R404.2.3)
6 IN.
PRESSURE-PRESERVATIVE-TREATED 2 × 6 IN. BOTTOM PLATE
PRESSURE-PRESERVATIVE-TREATED 2 × 8 IN. FOOTING PLATE
4 IN.
4 IN.
BELOW FROST LINE
6 IN. GRAVEL OR CRUSHED STONE (SEE SECTION R403.2)
16 IN.

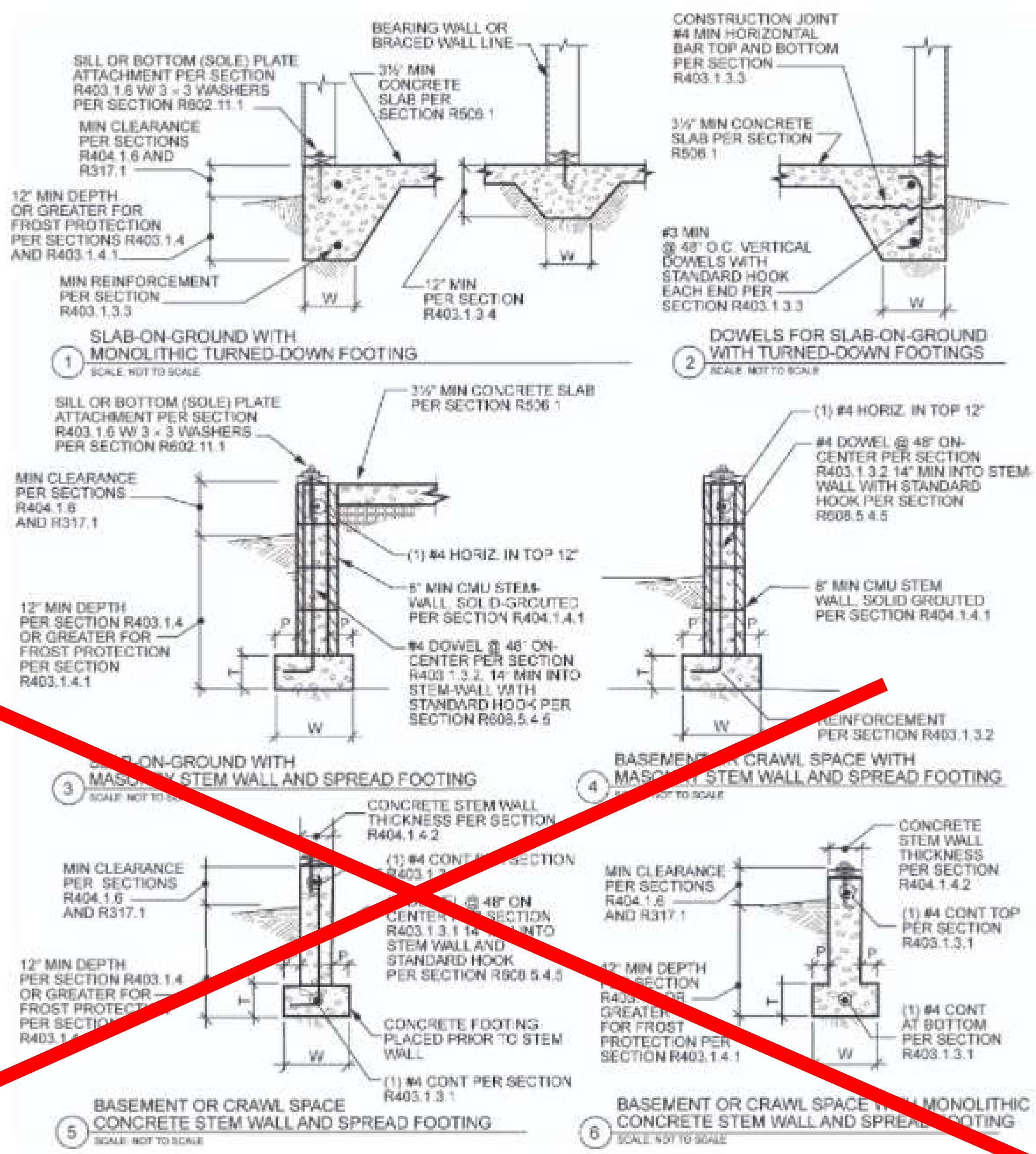
R403.1.1 Minimum size. The minimum width, W, and thickness, T, for concrete footings shall be in accordance with Tables R403.1(1) ~~through R403.1(3)~~ and Figure R403.1(1) or R403.1.3, ~~as applicable,~~ but not less than 12 inches (305 mm) in width and 6 inches (152 mm) in depth. The footing width shall be based on the load-bearing value of the soil in accordance with Table R401.4.1. Footing projections, P, shall be not less than 2 inches (51 mm) and shall not exceed the thickness of the footing. Footing thickness and projection for fireplaces shall be in accordance with Section R1001.2. The size of footings supporting piers and columns shall be based on the tributary load ~~and allowable soil pressure~~ in accordance with Table ~~R401.4.1~~ R403.1(2). Footings for wood foundations shall be in accordance with the details set forth in Section R403.2, and Figures R403.1(2) and R403.1(3). Footings for precast foundations shall be in accordance with the details set forth in Section R403.4, Table R403.4, and Figures R403.4(1) and R403.4(2).

R403.1.2 Continuous footing in Seismic Design Categories D_0, D_1 and D_2. Deleted. ~~Exterior walls of buildings located in *Seismic Design Categories* D_0, D_1 and D_2 shall be supported by continuous solid or fully grouted masonry or concrete footings. Other footing materials or systems shall be designed in accordance with accepted engineering practice. Required interior *braced wall panels* in buildings located in *Seismic Design Categories* D_0, D_1 and D_2 with plan dimensions greater than 50 feet (15 240 mm) shall be supported by continuous solid or fully grouted masonry or concrete footings in accordance with Section R403.1.3.4, except for two-story buildings in Seismic Design Category D_2, in which all *braced wall panels*, interior and exterior, shall be supported on continuous foundations.~~

~~**Exception:** Two-story buildings shall be permitted to have interior *braced wall panels* supported on continuous foundations at intervals not exceeding 50 feet (15 240 mm) provided that:~~

1. ~~The height of cripple walls does not exceed 4 feet (1219 mm).~~
2. ~~First-floor *braced wall panels* are supported on doubled floor joists, continuous blocking or floor beams.~~
3. ~~The distance between bracing lines does not exceed twice the building width measured parallel to the *braced wall line*.~~

R403.1.3 Footing and stem wall reinforcing in Seismic Design Categories D_0, D_1 and D_2. Deleted. ~~Concrete footings located in *Seismic Design Categories* D_0, D_1 and D_2, as established in Table R301.2, shall have minimum reinforcement in accordance with this section and Figure R403.1.3. Reinforcement shall be installed with support and cover in accordance with Section R403.1.3.5.~~



For SI: 1 inch = 25.4 mm.

W = Width of footing, T = Thickness of footing and P = Projection per Section R403.1.1. NOTES:

a. See Section R404.3 for sill requirements.

b. See Section R403.1.6 for sill attachment.

c. See Section R506.2.3 for vapor barrier requirements.

d. See Section R403.1 for base.

e. See Section R408 for under-floor ventilation and access requirements.

f. See Section R403.1.3.5 for reinforcement requirements.

~~FIGURE R403.1.3REINFORCED CONCRETE FOOTINGS AND MASONRY AND CONCRETE STEM WALLS IN SDC D_0, D_1 AND D_2~~ [a, b, c, d, e, f]

R403.1.3.1 Concrete stem walls with concrete footings. Deleted.~~In *Seismic Design Categories* D_0, D_1 and D_2 where a construction joint is created between a concrete footing and a concrete stem wall, not fewer than one~~

~~No. 4 vertical bar shall be installed at not more than 4 feet (1219 mm) on center. The vertical bar shall have a standard hook and extend to the bottom of the footing and shall have support and cover as specified in Section R403.1.3.5.3 and extend not less than 14 inches (357 mm) into the stem wall. Standard hooks shall comply with Section R608.5.4.5. Not fewer than one No. 4 horizontal bar shall be installed within 12 inches (305 mm) of the top of the stem wall and one No. 4 horizontal bar shall be located 3 to 4 inches (76 mm to 102 mm) from the bottom of the footing.~~

R403.1.3.2 Masonry stem walls with concrete footings. Deleted. ~~In *Seismic Design Categories* D_0, D_1 and D_2 where a masonry stem wall is supported on a concrete footing, not fewer than one No. 4 vertical bar shall be installed at not more than 4 feet (1219 mm) on center. The vertical bar shall have a standard hook and extend to the bottom of the footing and shall have support and cover as specified in Section R403.1.3.5.3 and extend not less than 14 inches (357 mm) into the stem wall. Standard hooks shall comply with Section R608.5.4.5. Not fewer than one No. 4 horizontal bar shall be installed within 12 inches (305 mm) of the top of the wall and one No. 4 horizontal bar shall be located 3 to 4 inches (76 mm to 102 mm) from the bottom of the footing. Masonry stem walls shall be solid grouted.~~

R403.1.3.3 Slabs-on-ground with turned-down footings. Deleted. ~~In *Seismic Design Categories* D_0, D_1 and D_2, slabs-on-ground cast monolithically with turned-down footings shall have not fewer than one No. 4 bar at the top and the bottom of the footing or one No. 5 bar or two No. 4 bars in the middle third of the footing depth.~~

~~Where the slab is not cast monolithically with the footing, No. 3 or larger vertical dowels with standard hooks on each end shall be installed at not more than 4 feet (1219 mm) on center in accordance with Figure R403.1.3, Detail 2. Standard hooks shall comply with Section R608.5.4.5.~~

R403.1.3.4 Interior bearing and *braced wall panel* footings in Seismic Design Categories D_0, D_1 and D_2. Deleted. ~~In *Seismic Design Categories* D_0, D_1 and D_2, interior footings supporting bearing walls or *braced wall panels*, and cast monolithically with a slab on *grade*, shall extend to a depth of not less than 12 inches (305 mm) below the top of the slab.~~

R403.1.3.5 Reinforcement. Deleted. ~~Footing and stem wall reinforcement shall comply with Sections R403.1.3.5.1 through R403.1.3.5.4.~~

R403.1.3.5.1 Steel reinforcement. Deleted. ~~Steel reinforcement shall comply with the requirements of ASTM A615, A706M or A996M. ASTM A996 bars produced from rail steel shall be Type R. The minimum yield strength of reinforcing steel shall be 40,000 psi (Grade 40) (276 MPa).~~

R403.1.3.5.2 Location of reinforcement in wall. Deleted. ~~The center of vertical reinforcement in stem walls shall be located at the centerline of the wall. Horizontal and vertical reinforcement shall be located in footings and stem walls to provide the minimum cover required by Section R403.1.3.5.3.~~

R403.1.3.5.3 Support and cover. Deleted. ~~Reinforcement shall be secured in the proper location in the forms with tie wire or other bar support system to prevent displacement during the concrete placement operation. Steel reinforcement in concrete cast against the earth shall have a minimum cover of 3 inches (75 mm). Minimum cover for reinforcement in concrete cast in removable forms that will be exposed to the earth or weather shall be $1^1/_2$ inches (38 mm) for No. 5 bars and smaller, and 2 inches (50 mm) for No. 6 bars and larger. For concrete cast in removable forms that will not be exposed to the earth or weather, and for concrete cast in stay-in-place forms, minimum cover shall be $^3/_4$ inch (19 mm).~~

R403.1.3.5.4 Lap splices. Deleted. ~~Vertical and horizontal reinforcement shall be the longest lengths practical. Where splices are necessary in reinforcement, the length of lap splice shall be in accordance with Table R608.5.4(1) and Figure R608.5.4(1). The maximum gap between noncontact parallel bars at a lap splice shall not exceed the smaller of one-fifth the required lap length and 6 inches (152 mm) [see Figure R608.5.4(1)].~~

R403.1.3.6 Isolated concrete footings. Deleted. ~~In detached one- and two-family dwellings that are three *stories* or less in height and constructed with stud bearing walls, isolated plain concrete footings supporting columns or pedestals are permitted.~~

R403.1.4 Minimum depth. ~~Exterior footings shall be placed not less than 12 inches (305 mm) below the undisturbed ground surface. Where applicable, the depth of footings shall also conform to Section R403.1.4.1. Deck footings shall be in accordance with Section R507.3.~~ All foundation systems and exterior footings shall extend below the frost line specified in Table R301.2(1). In no case shall the bottom of the exterior footings be less than 12 inches (305 mm) below the finished grade.

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

R403.1.4.1 Frost protection. See Section R403.1.4 ~~Except where otherwise protected from frost, foundation walls, piers and other permanent supports of buildings and structures shall be protected from frost by one or more of the following methods:~~

1. ~~Extended below the frost line specified in Table R301.2.~~
2. ~~Constructed in accordance with Section R403.3.~~
3. ~~Constructed in accordance with ASCE 32.~~
4. ~~Erected on solid rock.~~

~~Footings shall not bear on frozen soil unless the frozen condition is permanent.~~

~~**Exceptions:**~~

1. ~~Protection of free-standing *accessory structures* with an area of 600 square feet (56 m^2) or less, of *light-frame construction*, with an eave height of 10 feet (3048 mm) or less shall not be required.~~
2. ~~Protection of free-standing *accessory structures* with an area of 400 square feet (37 m^2) or less, of other than *light-frame construction*, with an eave height of 10 feet (3048 mm) or less shall not be required.~~

R403.1.5 Slope. The top surface of footings shall be level (1/2 inch in 10 feet) or shall be brought level, under the width of the wall, with masonry units with full mortar joints. The bottom surface of footings shall not have a slope exceeding 1 unit vertical in 10 units horizontal (10-percent slope). Footings shall be stepped where it is necessary to change the elevation of the top surface of the footings or where the slope of the bottom surface of the footings will exceed 1 unit vertical in 10 units horizontal (10-percent slope).

R403.1.6 Foundation anchorage. Wood sill plates and wood walls supported directly on continuous foundations shall be anchored to the foundation in accordance with this section.

~~Cold-formed steel framing shall be anchored directly to the foundation or fastened to wood sill plates in accordance with Section R505.3.1 or R603.3.1, as applicable. Wood sill plates supporting cold-formed steel framing shall be anchored to the foundation in accordance with this section.~~

Wood sole plates at all exterior walls on monolithic slabs, wood sole plates of *braced wall panels* at building interiors on monolithic slabs and all wood sill plates shall be anchored to the foundation with minimum $^{1}/_{2}$-inch-diameter (12.7 mm) anchor bolts spaced not greater than 6 feet (1829 mm) on center or *approved* anchors or anchor straps spaced as required to provide equivalent anchorage to $^{1}/_{2}$-inch-diameter (12.7 mm) anchor bolts. Bolts shall extend not less than 7 inches (178 mm) into concrete or grouted cells of *concrete masonry units*. The bolts shall be located in the middle third of the width of the plate. A nut and washer shall be tightened on each anchor bolt. There shall be not fewer than two bolts per plate section with one bolt located not more than 12 inches (305 mm) ~~or less than seven bolt diameters from each end of the plate section~~ from the corner. Interior bearing wall sole plates on monolithic slab foundation that are not part of a *braced wall panel* shall be positively anchored with *approved* fasteners. Sill plates and sole plates shall be protected against decay and termites where required by Sections R317 and R318. Anchor bolts shall be permitted to be located while concrete is still plastic and before it has set. Where anchor bolts resist placement or the consolidation of concrete around anchor bolts is impeded, the concrete shall be vibrated to ensure full contact between the anchor bolts and concrete.

Exceptions:

1. Walls 24 inches (610 mm) total length or shorter connecting offset *braced wall panels* shall be anchored to the foundation with not fewer than one anchor bolt located in the center third of the plate section and shall be attached to adjacent *braced wall panels* at corners as shown in Item 9 of Table R602.3(1).
2. Connection of walls 12 inches (305 mm) total length or shorter connecting offset *braced wall panels* to the foundation without anchor bolts shall be permitted. The wall shall be attached to adjacent *braced wall panels* at corners as shown in Item 9 of Table R602.3(1).

R403.1.6.1 Foundation anchorage in Seismic Design ~~Categories~~ Category C, ~~D_0, D_1 and D_2~~. In addition to the requirements of Section R403.1.6, the following requirements shall apply to ~~wood light-frame structures in *Seismic Design Categories* D_0, D_1 and D_2 and~~ wood light-frame *townhouses* in Seismic Design Category C.

1. Plate washers conforming to Section R602.11.1 shall be provided for all anchor bolts over the full length of required *braced wall lines* except where *approved* anchor straps are used. Properly sized cut washers shall be permitted for anchor bolts in wall lines not containing *braced wall panels*.
2. Interior braced wall plates shall have anchor bolts spaced at not more than 6 feet (1829 mm) on center and located ~~within~~ not more than 12 inches (305 mm) ~~of the ends of each plate section where supported on a continuous foundation~~ from the corner.
3. Interior bearing wall sole plates shall have anchor bolts spaced at not more than 6 feet (1829 mm) on center and located ~~within~~ not more than 12 inches (305 mm) ~~of the ends of each plate section where supported on a continuous foundation~~ from the corner.
4. The maximum anchor bolt spacing shall be 4 feet (1219 mm) for buildings over two *stories* in height.
5. Deleted. ~~Stepped cripple walls shall conform to Section R602.11.2.~~
6. Where continuous wood foundations in accordance with Section R404.2 are used, the force transfer shall have a capacity equal to or greater than the connections required by Section R602.11.1 or the *braced wall panel* shall be connected to the wood foundations in accordance with the *braced wall panel*-to-floor fastening requirements of Table R602.3(1).

R403.1.7 Footings on or adjacent to slopes. Deleted. ~~The placement of buildings and structures on or adjacent to slopes steeper than 1 unit vertical in 3 units horizontal (33.3 percent slope) shall conform to Sections R403.1.7.1 through R403.1.7.4.~~

~~**R403.1.7.1 Building clearances from ascending slopes.** In general, buildings below slopes shall be set a sufficient distance from the slope to provide protection from slope drainage, erosion and shallow failures. Except as provided in Section R403.1.7.4 and Figure R403.1.7.1, the following criteria will be assumed to provide this protection. Where the existing slope is steeper than 1 unit vertical in 1 unit horizontal (100-percent slope), the toe of the slope shall be assumed to be at the intersection of a horizontal plane drawn from the top of the foundation and a plane drawn tangent to the slope at an angle of 45 degrees (0.79 rad) to the horizontal. Where a retaining wall is constructed at the toe of the slope, the height of the slope shall be measured from the top of the wall to the top of the slope.~~

~~**R403.1.7.2 Footing setback from descending slope surfaces.** Footings on or adjacent to slope surfaces shall be founded in material with an embedment and setback from the slope surface sufficient to provide vertical and lateral support for the footing without detrimental settlement. Except as provided for in Section R403.1.7.4 and Figure R403.1.7.1, the following setback is deemed adequate to meet the criteria. Where the slope is steeper than 1 unit vertical in 1 unit horizontal (100-percent slope), the required setback shall be measured from an imaginary plane 45 degrees (0.79 rad) to the horizontal, projected upward from the toe of the slope.~~

~~**R403.1.7.3 Foundation elevation.** On graded sites, the top of any exterior foundation shall extend above the elevation of the street gutter at point of discharge or the inlet of an *approved* drainage device not less than 12 inches (305 mm) plus 2 percent. Alternate elevations are permitted subject to the approval of the *building official*, provided that it can be demonstrated that required drainage to the point of discharge and away from the structure is provided at all locations on the site.~~

~~**R403.1.7.4 Alternate setbacks and clearances.** Alternate setbacks and clearances are permitted, subject to the approval of the *building official*. The *building official* is permitted to require an investigation and recommendation of a qualified engineer to demonstrate that the intent of this section has been satisfied. Such an investigation shall include consideration of material, height of slope, slope gradient, load intensity and erosion characteristics of slope material.~~

R403.1.8 Foundations on expansive soils. Deleted. ~~Foundation and floor slabs for buildings located on *expansive soils* shall be designed in accordance with Section 1808.6 of the *International Building Code*.~~

~~**Exception:** Slab-on-ground and other foundation systems that have performed adequately in soil conditions similar to those encountered at the building site are permitted subject to the approval of the *building official*.~~

~~**R403.1.8.1 Expansive soils classifications.** Soils meeting all of the following provisions shall be considered to be expansive, except that tests to show compliance with Items 1, 2 and 3 shall not be required if the test prescribed in Item 4 is conducted:~~

1. ~~Plasticity Index (PI) of 15 or greater, determined in accordance with ASTM D4318.~~

2. ~~More than 10 percent of the soil particles pass a No. 200 sieve (75 µm), determined in accordance with ASTM D422.~~
3. ~~More than 10 percent of the soil particles are less than 5 micrometers in size, determined in accordance with ASTM D422.~~
4. ~~Expansion Index greater than 20, determined in accordance with ASTM D4829.~~

R403.1.9 Excavations near footings or foundations.
Excavations shall not remove lateral support from any footing or foundation without first shoring, underpinning or protecting the footing or foundation against settlement or lateral translation. Where footings of adjacent buildings or structures are undercut by excavations measured from the bottom of the adjacent existing footing at a 45 degree angle (0.79 rad) within 10 feet (3048 mm) as shown in Figure R403.1.9, the footings shall require evaluation by a *registered design professional.*

Exception: *Accessory buildings* not exceeding 400 square feet (37 m2) exempt from providing a masonry or concrete foundation in accordance with Section R101.2.1.

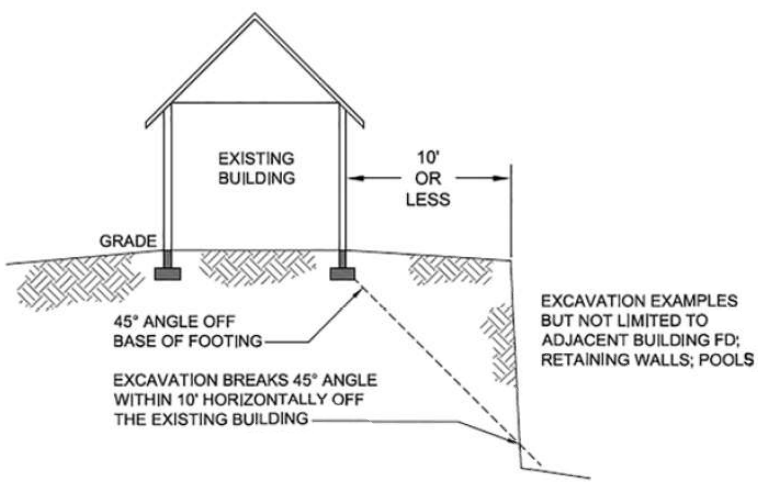


FIGURE R403.1.9
EXCAVATIONS NEAR FOOTINGS OR FOUNDATIONS

R403.2 Footings for wood foundations. Footings for wood foundations shall be in accordance with Figures R403.1(2) and R403.1(3). Gravel shall be washed and well graded. The maximum size stone shall not exceed $^3/_4$ inch (19.1 mm). Gravel shall be free from organic, clayey or silty soils. Sand shall be coarse, not smaller than $^1/_{16}$-inch (1.6 mm) grains and shall be free from organic, clayey or silty soils. Crushed stone shall have a maximum size of $^1/_2$ inch (12.7 mm).

R403.3 Frost-protected shallow foundations. Deleted. ~~For buildings where the monthly mean temperature of the building is maintained at not less than 64°F (18°C), footings are not required to extend below the frost line where protected from frost by insulation in accordance with Figure R403.3(1) and Table R403.3(1). Foundations protected from frost in accordance with Figure R403.3(1) and Table R403.3(1) shall not be used for unheated spaces such as porches, utility rooms, garages and carports, and shall not be attached to *basements* or *crawl spaces* that are not maintained at a minimum monthly mean temperature of 64°F (18°C).~~

~~Materials used below *grade* for the purpose of insulating footings against frost shall be *labeled* as complying with ASTM C578.~~

~~**TABLE R403.3(1)**~~

~~**MINIMUM FOOTING DEPTH AND INSULATION REQUIREMENTS FOR FROST-PROTECTED FOOTINGS IN HEATED BUILDINGS[a]**~~

~~AIR-FREEZING INDEX (°F days)[b]~~	~~MINIMUM FOOTING DEPTH, *D* (inches)~~	~~VERTICAL INSULATION *R*-VALUE[c, d]~~	~~HORIZONTAL INSULATION *R*-VALUE[c, e]~~		~~HORIZONTAL INSULATION DIMENSIONS PER Figure R403.3(1) (inches)~~		
			~~Along walls~~	~~At corners~~	~~A~~	~~B~~	~~C~~

1,500 or less	12	4.5	Not required	Not required	Not required	Not required	Not required
2,000	14	5.6	Not required	Not required	Not required	Not required	Not required
2,500	16	6.7	1.7	4.9	12	24	40
3,000	16	7.8	6.5	8.6	12	24	40
3,500	16	9.0	8.0	11.2	24	30	60
4,000	16	10.1	10.5	13.1	24	36	60

~~For SI: 1 inch = 25.4 mm, °C = [(°F) – 32]/1.8.~~

~~a. Insulation requirements are for protection against frost damage in heated buildings. Greater values could be required to meet energy conservation standards.~~

~~b. See Figure R403.3(2) or Table R403.3(2) for Air-Freezing Index values.~~

~~c. Insulation materials shall provide the stated minimum *R*-values under long-term exposure to moist, below-ground conditions in freezing climates. The following *R*-values shall be used to determine insulation thicknesses required for this application: Type II expanded polystyrene (EPS) 3.2 R per inch for vertical insulation and 2.6 R per inch for horizontal insulation; Type IX expanded polystyrene (EPS) 3.4 R per inch for vertical insulation and 2.8 R per inch for horizontal insulation; Types IV, V, VI, VII, and X extruded polystyrene (XPS) 4.5 R per inch for vertical insulation and 4.0 R per inch for horizontal insulation.~~

~~d. Vertical insulation shall be expanded polystyrene insulation or extruded polystyrene insulation.~~

~~e. Horizontal insulation shall be expanded polystyrene insulation or extruded polystyrene insulation.~~

~~TABLE R403.3(2)—continued~~

~~AIR-FREEZING INDEX FOR US LOCATIONS BY COUNTY~~

STATE	AIR-FREEZING INDEX					
	1,500 or less	2,000	2,500	3,000	3,500	4,000
Louisiana	All counties	—	—	—	—	—
Maine	York	Knox, Lincoln, Sagadahoc	Androscoggin, Cumberland, Hancock, Kennebec, Waldo, Washington	Aroostook, Franklin, Oxford, Penobscot, Piscataquis, Somerset	—	—
Maryland	All counties	—	—	—	—	—
Massachusetts	All counties not listed	Berkshire, Franklin, Hampden, Worcester	—	—	—	—
Michigan	Berrien, Branch, Cass, Kalamazoo, Macomb, Ottawa, St. Clair, St. Joseph	All counties not listed	Alger, Charlevoix, Cheboygan, Chippewa, Crawford, Delta, Emmet, Iosco, Kalkaska, Lake, Luce, Mackinac, Menominee, Missaukee, Montmorency, Ogemaw, Osceola, Otsego, Roscommon, Schoolcraft, Wexford	Baraga, Dickinson, Iron, Keweenaw, Marquette	Gogebic, Houghton, Ontonagon	—

~~Minnesota~~	—	—	~~Houston, Winona~~	~~All counties not listed~~	~~Aitkin, Big Stone, Carlton, Crow Wing, Douglas, Itasca, Kanabec, Lake, Morrison, Pine, Pope, Stearns, Stevens, Swift, Todd, Wadena~~	~~Becker, Beltrami, Cass, Clay, Clearwater, Grant, Hubbard, Kittson, Koochiching, Lake of the Woods, Mahnomen, Marshall, Norman, Otter Tail, Pennington, Polk, Red Lake, Roseau, St. Louis, Traverse, Wilkin~~
~~Mississippi~~	~~All counties~~	—	—	—	—	—
~~Missouri~~	~~All counties not listed~~	~~Atchison, Mercer, Nodaway, Putnam~~	—	—	—	—
~~Montana~~	~~Mineral~~	~~Broadwater, Golden Valley, Granite, Lake, Lincoln, Missoula, Ravalli, Sanders, Sweet Grass~~	~~Big Horn, Carbon, Jefferson, Judith Basin, Lewis and Clark, Meagher, Musselshell, Powder River, Powell, Silver Bow, Stillwater, Westland~~	~~Carter, Cascade, Deer Lodge, Falcon, Fergus, Flathead, Gallatin, Glacier, Madison, Park, Petroleum, Ponder, Rosebud, Teton, Treasure, Yellowstone~~	~~Beaverhead, Blaine, Chouteau, Custer, Dawson, Garfield, Liberty, McCone, Prairie, Toole, Wibaux~~	~~Daniels, Hill, Phillips, Richland, Roosevelt, Sheridan, Valley~~

~~TABLE R403.3(2)~~

~~AIR-FREEZING INDEX FOR US LOCATIONS BY COUNTY~~

~~STATE~~	~~AIR-FREEZING INDEX~~					
	~~1,500 or less~~	~~2,000~~	~~2,500~~	~~3,000~~	~~3,500~~	~~4,000~~
~~Alabama~~	~~All counties~~	—	—	—	—	—
~~Alaska~~	~~Ketchikan Gateway, Prince of Wales-Outer Ketchikan (CA), Sitka, Wrangell-Petersburg (CA)~~	—	~~Aleutians West (CA), Haines, Juneau, Skagway-Hoonah-Angoon (CA), Yakutat~~	—	—	~~All counties not listed~~
~~Arizona~~	~~All counties~~	—	—	—	—	—
~~Arkansas~~	~~All counties~~	—	—	—	—	—
~~California~~	~~All counties not listed~~	~~Nevada, Sierra~~	—	—	—	—
~~Colorado~~	~~All counties not listed~~	~~Archuleta, Custer, Fremont, Huerfano, Las Animas, Ouray, Pitkin, San Miguel~~	~~Clear Creek, Conejos, Costilla, Dolores, Eagle, La Plata, Park, Routt, San Juan, Summit~~	~~Alamosa, Grand, Jackson, Larimer, Moffat, Rio Blanco, Rio Grande~~	~~Chaffee, Gunnison, Lake, Saguache~~	~~Hinsdale, Mineral~~
~~Connecticut~~	~~All counties not listed~~	~~Hartford, Litchfield~~	—	—	—	—
~~Delaware~~	~~All counties~~	—	—	—	—	—

~~District of Columbia~~	~~All counties~~	—	—	—	—	—
~~Florida~~	~~All counties~~	—	—	—	—	—
~~Georgia~~	~~All counties~~	—	—	—	—	—
~~Hawaii~~	~~All counties~~	—	—	—	—	—
~~Idaho~~	~~All counties not listed~~	~~Adams, Bannock, Blaine, Clearwater, Idaho, Lincoln, Oneida, Power, Valley, Washington~~	~~Bingham, Bonneville, Camas, Caribou, Elmore, Franklin, Jefferson, Madison, Teton~~	~~Bear Lake, Butte, Custer, Fremont, Lemhi~~	~~Clark~~	—

~~*(continued)*~~
~~*(continued)*~~
~~*(continued)*~~

~~TABLE R403.3(2)—continued~~

~~AIR-FREEZING INDEX FOR US LOCATIONS BY COUNTY~~

~~STATE~~	~~AIR-FREEZING INDEX~~					
	~~1,500 or less~~	~~2,000~~	~~2,500~~	~~3,000~~	~~3,500~~	~~4,000~~
~~Illinois~~	~~All counties not listed~~	~~Boone, Bureau, Cook, Dekalb, DuPage, Fulton, Grundy, Henderson, Henry, Iroquois, Jo Daviess, Kane, Kankakee, Kendall, Knox, La Salle, Lake, Lee, Livingston, Marshall, Mason, McHenry, McLean, Mercer, Peoria, Putnam, Rock Island, Stark, Tazewell, Warren, Whiteside, Will, Woodford~~	~~Carroll, Ogle, Stephenson, Winnebago~~	—	—	—
~~Indiana~~	~~All counties not listed~~	~~Allen, Benton, Cass, Fountain, Fulton, Howard, Jasper, Kosciusko, La Porte, Lake, Marshall, Miami, Newton, Porter, Pulaski, Starke, Steuben, Tippecanoe, Tipton, Wabash, Warren, White~~	—	—	—	—

~~Iowa~~	~~Appanoose, Davis, Fremont, Lee, Van Buren~~	~~All counties not listed~~	~~Allamakee, Black Hawk, Boone, Bremer, Buchanan, Buena Vista, Butler, Calhoun, Cerro Gordo, Cherokee, Chickasaw, Clay, Clayton, Delaware, Dubuque, Fayette, Floyd, Franklin, Grundy, Hamilton, Hancock, Hardin, Humboldt, Ida, Jackson, Jasper, Jones, Linn, Marshall, Palo Alto, Plymouth, Pocahontas, Poweshiek, Sac, Sioux, Story, Tama, Webster, Winnebago, Woodbury, Worth, Wright~~	~~Dickinson, Emmet, Howard, Kossuth, Lyon, Mitchell, O'Brien, Osceola, Winneshiek~~	—	—
~~Kansas~~	~~All counties~~	—	—	—	—	—
~~Kentucky~~	~~All counties~~	—	—	—	—	—

~~*(continued)*~~

~~TABLE R403.3(2)—continued~~

~~AIR-FREEZING INDEX FOR US LOCATIONS BY COUNTY~~

~~STATE~~	~~AIR-FREEZING INDEX~~					
	~~1,500 or less~~	~~2,000~~	~~2,500~~	~~3,000~~	~~3,500~~	~~4,000~~
~~Nebraska~~	~~Adams, Banner, Chase, Cheyenne, Clay, Deuel, Dundy, Fillmore, Franklin, Frontier, Furnas, Gage, Garden, Gosper, Harlan, Hayes, Hitchcock, Jefferson, Kimball, Morrill, Nemaha, Nuckolls, Pawnee, Perkins, Phelps, Red Willow, Richardson, Saline, Scotts Bluff, Seward, Thayer, Webster~~	~~All counties not listed~~	~~Boyd, Burt, Cedar, Cuming, Dakota, Dixon, Dodge, Knox, Thurston~~	—	—	—
~~Nevada~~	~~All counties not listed~~	~~Elko, Eureka, Nye, Washoe, White Pine~~	—	—	—	—

~~New Hampshire~~	—	~~All counties not listed~~	—	—	—	~~Carroll, Coos, Grafton~~
~~New Jersey~~	~~All counties~~	—	—	—	—	—
~~New Mexico~~	~~All counties not listed~~	~~Rio Arriba~~	~~Colfax, Mora, Taos~~	—	—	—
~~New York~~	~~Albany, Bronx, Cayuga, Columbia, Cortland, Dutchess, Genessee, Kings, Livingston, Monroe, Nassau, New York, Niagara, Onondaga, Ontario, Orange, Orleans, Putnam, Queens, Richmond, Rockland, Seneca, Suffolk, Wayne, Westchester, Yates~~	~~All counties not listed~~	~~Clinton, Essex, Franklin, Hamilton, Herkimer, Jefferson, Lewis, St. Lawrence, Warren~~	—	—	—
~~North Carolina~~	~~All counties~~	—	—	—	—	—
~~North Dakota~~	—	—	—	~~Billings, Bowman~~	~~Adams, Dickey, Golden Valley, Hettinger, LaMoure, Oliver, Ransom, Sargent, Sioux, Slope, Stark~~	~~All counties not listed~~

~~*(continued)*~~

~~TABLE R403.3(2)—continued~~

~~AIR-FREEZING INDEX FOR US LOCATIONS BY COUNTY~~

~~STATE~~	~~AIR-FREEZING INDEX~~					
	~~1,500 or less~~	~~2,000~~	~~2,500~~	~~3,000~~	~~3,500~~	~~4,000~~
~~Ohio~~	~~All counties not listed~~	~~Ashland, Crawford, Defiance, Holmes, Huron, Knox, Licking, Morrow, Paulding, Putnam, Richland, Seneca, Williams~~	—	—	—	—
~~Oklahoma~~	~~All counties~~	—	—	—	—	—
~~Oregon~~	~~All counties not listed~~	~~Baker, Crook, Grant, Harney~~	—	—	—	—

~~Pennsylvania~~	~~All counties not listed~~	~~Berks, Blair, Bradford, Cambria, Cameron, Centre, Clarion, Clearfield, Clinton, Crawford, Elk, Forest, Huntingdon, Indiana, Jefferson, Lackawanna, Lycoming, McKean, Pike, Potter, Susquehanna, Tioga, Venango, Warren, Wayne, Wyoming~~	—	—	—	—
~~Rhode Island~~	~~All counties~~	—	—	—	—	—
~~South Carolina~~	~~All counties~~	—	—	—	—	—
~~South Dakota~~	—	~~Bennett, Custer, Fall River, Lawrence, Mellette, Shannon, Todd, Tripp~~	~~Bon Homme, Charles Mix, Davison, Douglas, Gregory, Jackson, Jones, Lyman~~	~~All counties not listed~~	~~Beadle, Brookings, Brown, Campbell, Codington, Corson, Day, Deuel, Edmunds, Faulk, Grant, Hamlin, Kingsbury, Marshall, McPherson, Perkins, Roberts, Spink, Walworth~~	—
~~Tennessee~~	~~All counties~~	—	—	—	—	—
~~Texas~~	~~All counties~~	—	—	—	—	—
~~Utah~~	~~All counties not listed~~	~~Box Elder, Morgan, Weber~~	~~Garfield, Salt Lake, Summit~~	~~Carbon, Daggett, Duchesne, Rich, Sanpete, Uintah, Wasatch~~	—	—
~~Vermont~~	—	~~Bennington, Grand Isle, Rutland, Windham~~	~~Addison, Chittenden, Franklin, Orange, Washington, Windsor~~	~~Caledonia, Essex, Lamoille, Orleans~~	—	—
~~Virginia~~	~~All counties~~	—	—	—	—	—

~~TABLE R403.3(2)—continued~~

~~AIR-FREEZING INDEX FOR US LOCATIONS BY COUNTY~~

~~STATE~~	~~AIR-FREEZING INDEX~~					
	~~1,500 or less~~	~~2,000~~	~~2,500~~	~~3,000~~	~~3,500~~	~~4,000~~
~~Washington~~	~~All counties not listed~~	~~Chelan, Douglas, Ferry, Okanogan~~	—	—	—	—

~~West Virginia~~	~~All counties~~	—	—	—	—	—
~~Wisconsin~~	—	~~Kenosha, Kewaunee, Racine, Sheboygan, Walworth~~	~~All counties not listed~~	~~Ashland, Barron, Burnett, Chippewa, Clark, Dunn, Eau Claire, Florence, Forest, Iron, Jackson, La Crosse, Langlade, Marathon, Monroe, Pepin, Polk, Portage, Price, Rust, St. Croix, Taylor, Trempealeau, Vilas, Wood~~	~~Bayfield, Douglas, Lincoln, Oneida, Sawyer, Washburn~~	—
~~Wyoming~~	~~Goshen, Platte~~	~~Converse, Crook, Laramie, Niobrara~~	~~Campbell, Carbon, Hot Springs, Johnson, Natrona, Sheridan, Uinta, Weston~~	~~Albany, Big Horn, Park, Washakie~~	~~Fremont, Teton~~	~~Lincoln, Sublette, Sweetwater~~

~~**R403.3.1 Foundations adjoining frost-protected shallow foundations.** Foundations that adjoin frost protected shallow foundations shall be protected from frost in accordance with Section R403.1.4.~~

~~**R403.3.1.1 Attachment to unheated slab-on-ground structure.** Vertical wall insulation and horizontal insulation of frost protected shallow foundations that adjoin a slab-on-ground foundation that does not have a monthly mean temperature maintained at not less than 64°F (18°C) shall be in accordance with Figure R403.3(3) and Table R403.3(1). Vertical wall insulation shall extend between the frost protected shallow foundation and the adjoining slab foundation. Required horizontal insulation shall be continuous under the adjoining slab foundation and through any foundation walls adjoining the frost- protected shallow foundation. Where insulation passes through a foundation wall, it shall be either of a type complying with this section and having bearing capacity equal to or greater than the structural loads imposed by the building, or the building shall be designed and constructed using beams, lintels, cantilevers or other means of transferring building loads such that the structural loads of the building do not bear on the insulation.~~

~~**R403.3.1.2 Attachment to heated structure.** Where a frost-protected shallow foundation abuts a structure that has a monthly mean temperature maintained at not less than 64°F (18°C), horizontal insulation and vertical wall~~

~~insulation shall not be required between the frost-protected shallow foundation and the adjoining structure. Where the frost-protected shallow foundation abuts the heated structure, the horizontal insulation and vertical wall insulation shall extend along the adjoining foundation in accordance with Figure R403.3(4) a distance of not less than Dimension A in Table R403.3(1).~~

~~**Exception:** Where the frost-protected shallow foundation abuts the heated structure to form an inside corner, vertical insulation extending along the adjoining foundation is not required.~~

~~**R403.3.2 Protection of horizontal insulation below ground.** Horizontal insulation placed less than 12 inches (305 mm) below the ground surface or that portion of horizontal insulation extending outward more than 24 inches (610 mm) from the foundation edge shall be protected against damage by use of a concrete slab or asphalt paving on the ground surface directly above the insulation or by cementitious board, plywood rated for below-ground use, or other *approved* materials placed below ground, directly above the top surface of the insulation.~~

~~**R403.3.3 Drainage.** Final *grade* shall be sloped in accordance with Section R401.3. In other than Group I Soils, as detailed in Table R405.1, gravel or crushed stone beneath horizontal insulation below ground shall drain to daylight or into an *approved* sewer system.~~

~~**R403.3.4 Termite protection.** The use of foam plastic in areas of "very heavy" termite infestation probability shall be in accordance with Section R318.4.~~

R403.4 Footings for precast concrete foundations. Footings for *precast concrete* foundations shall comply with Section R403.4.1 and R403.4.2

R404.1.2.1 Masonry foundation walls. *Concrete masonry* and *clay masonry* foundation walls shall be constructed as set forth in Table R404.1.1(1), R404.1.1(2), R404.1.1(3) or R404.1.1(4) and shall comply with applicable provisions of Section R606. ~~In buildings assigned to *Seismic Design Categories* D_0, D_1 and D_2, *concrete masonry* and *clay masonry* foundation walls shall also comply with Section R404.1.4.1.~~ Rubble stone masonry foundation walls shall be constructed in accordance with Sections R404.1.8 and R606.4.2. Rubble stone masonry walls shall not be used ~~in *Seismic Design Categories* D_0, D_1 and D_2, or~~ in *townhouses* in Seismic Design Category C.

R404.1.3.3.6.1 Stay-in-place forms. Stay-in-place concrete forms shall comply with this section.

1. Surface burning characteristics. The flame-spread index and *smoke-developed index* of forming material, other than foam plastic, left exposed on the interior shall comply with Section R302. The surface burning characteristics of foam plastic used in *insulating concrete forms* shall comply with Section R316.3.
2. Interior covering. Stay-in-place forms constructed of rigid foam plastic shall be protected on the interior of the building as required by Section R316. Where gypsum board is used to protect the foam plastic, it shall be installed with a mechanical fastening system. Use of adhesives in addition to mechanical fasteners is permitted.
3. Exterior wall covering. Stay-in-place forms constructed of rigid foam plastics shall be protected from sunlight and physical damage by the application of an *approved* exterior wall covering complying with this code. Exterior surfaces of other stay-in-place forming systems shall be protected in accordance with this code.
4. Termite protection. ~~In areas where the probability of termite infestation is "very heavy" as indicated by Table R301.2 or Figure R301.2.1, foam~~ Foam plastic insulation shall be permitted below grade on foundation walls in accordance with Section R318.4.
5. Flat ICF wall system forms shall conform to ASTM E2634.

R404.1.3.3.7.1 Steel reinforcement. Steel reinforcement shall comply with the requirements of ASTM A615, A706M or A996. ASTM A996 bars produced from rail steel shall be Type R. In buildings assigned to Seismic Design Category A, B or C, the minimum yield strength of reinforcing steel shall be 40,000 psi (Grade 40) (276 MPa). ~~In buildings assigned to Seismic Design Category D_0, D_1 or D_2, the minimum yield strength shall be 60,000 psi (Grade 60) (414 MPa).~~

R404.1.4 Seismic Design Category D_0, D_1 or D_2. **(Deleted)**

~~**R404.1.4.1 Masonry foundation walls.** In buildings assigned to Seismic Design Category D_0, D_1 or D_2, as established in Table R301.2, masonry foundation walls shall comply with this section. In addition to the requirements of Table R404.1.1(1), plain masonry foundation walls shall comply with the following:~~

~~1. Wall height shall not exceed 8 feet (2438 mm).~~

~~2. Unbalanced backfill height shall not exceed 4 feet (1219 mm).~~

~~3. Minimum nominal thickness for plain masonry foundation walls shall be 8 inches (203 mm).~~

~~4. Masonry stem walls shall have a minimum vertical reinforcement of one No. 4 (No. 13) bar located not greater than 4 feet (1219 mm) on center in grouted cells. Vertical reinforcement shall be tied to the horizontal reinforcement in the footings.~~

~~Foundation walls, supporting more than 4 feet (1219 mm) of unbalanced backfill or exceeding 8 feet (2438 mm) in height shall be constructed in accordance with Table R404.1.1(2), R404.1.1(3) or R404.1.1(4). Masonry foundation walls shall have two No. 4 (No. 13) horizontal bars located in the upper 12 inches (305 mm) of the wall.~~

~~**R404.1.4.2 Concrete foundation walls.** In buildings assigned to Seismic Design Category D_0, D_1 or D_2, as established in Table R301.2, concrete foundation walls that support light-frame walls shall comply with this section, and concrete foundation walls that support above-grade concrete walls shall comply with ACI 318, ACI 332 or PCA 100 (see Section R404.1.3). In addition to the horizontal reinforcement required by Table R404.1.2(1), plain concrete walls supporting light-frame walls shall comply with the following:~~

~~1. Wall height shall not exceed 8 feet (2438 mm).~~

~~2. Unbalanced backfill height shall not exceed 4 feet (1219 mm).~~

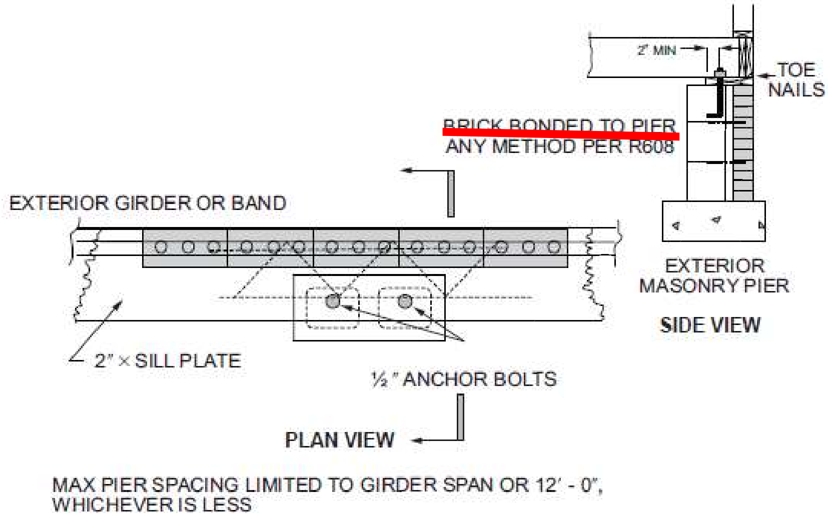
~~3. Minimum thickness for plain concrete foundation walls shall be 7.5 inches (191 mm) except that 6 inches (152 mm) is permitted where the maximum wall height is 4 feet, 6 inches (1372 mm).~~

~~Foundation walls less than 7.5 inches (191 mm) in thickness, supporting more than 4 feet (1219 mm) of unbalanced backfill or exceeding 8 feet (2438 mm) in height shall be provided with horizontal reinforcement in accordance with Table R404.1.2(1), and vertical reinforcement in accordance with Table R404.1.2(2), R404.1.2(3), R404.1.2(4), R404.1.2(5), R404.1.2(6), R404.1.2(7) or R404.1.2(8). Where Tables R404.1.2(2) through R404.1.2(8) permit plain concrete walls, not less than No. 4 (No. 13) vertical bars at a spacing not exceeding 48 inches (1219 mm) shall be provided.~~

R404.1.5.3 Pier and curtain wall foundations. Use of pier and curtain wall foundations shall be permitted to support *light-frame construction* not more than two *stories* in height, provided that the following requirements are met:

1. ~~All *load-bearing walls* shall be placed on continuous concrete footings placed integrally with the exterior wall footings.~~ Curtain walls shall be bonded into piers and supported on concrete footings poured integrally with pier footings.
2. The minimum actual thickness of a load-bearing masonry wall shall be not less than 4 inches (102 mm) nominal or $3^3/_8$ inches (92 mm) actual thickness, and shall be bonded integrally with piers spaced in accordance with Section R606.6.4.
3. Piers shall be constructed in accordance with Sections R606.7 and R606.7.1, and shall be bonded into the load-bearing masonry wall in accordance with Section R606.13.1 or R606.13.1.1.
4. The maximum height of a ~~4-inch (102 mm) load-bearing masonry foundation wall supporting wood-frame walls and floors~~ pier and curtain wall foundations shall be not more than ~~4 feet (1219 mm)~~ 6 feet (1829 mm).
5. Anchorage shall be in accordance with Section R403.1.6, Figure R404.1.5 (1), or as specified by engineered design accepted by the *building official*.
6. The unbalanced fill for 4-inch (102 mm) foundation walls shall not exceed 24 inches (610 mm) for *solid masonry* or ~~12 inches (305 mm)~~ 16 inches (406 mm) for *hollow masonry*.
7. ~~In *Seismic Design Categories* D_0, D_1 and D_2, prescriptive reinforcement shall be provided in the horizontal and vertical direction. Provide minimum horizontal joint reinforcement of two No. 9 gage wires spaced not less than 6 inches (152 mm) or one $^1/_4$-inch-diameter (6.4 mm) wire at 10 inches (254 mm) on center vertically. Provide minimum vertical reinforcement of one No. 4 bar at 48 inches (1220 mm) on center horizontally grouted in place.~~ Pier size shall be based on Table R403.1(2).
8. See Chapter 45 for special anchorage and reinforcement in high wind zones.

R404.1.5.4 Piers. The unsupported height of masonry piers shall not exceed 10 times their least dimension. When structural clay tile or hollow concrete masonry units are used for isolated piers to support beams and girders, the cellular spaces shall be filled solidly with concrete or Type M or S mortar, except that unfilled hollow piers may be used if their unsupported height is not more than four times their least dimension. When hollow masonry units are solidly filled with concrete or Type M or S mortar, the allowable compressive stress may be increased as provided in Table R606.9.



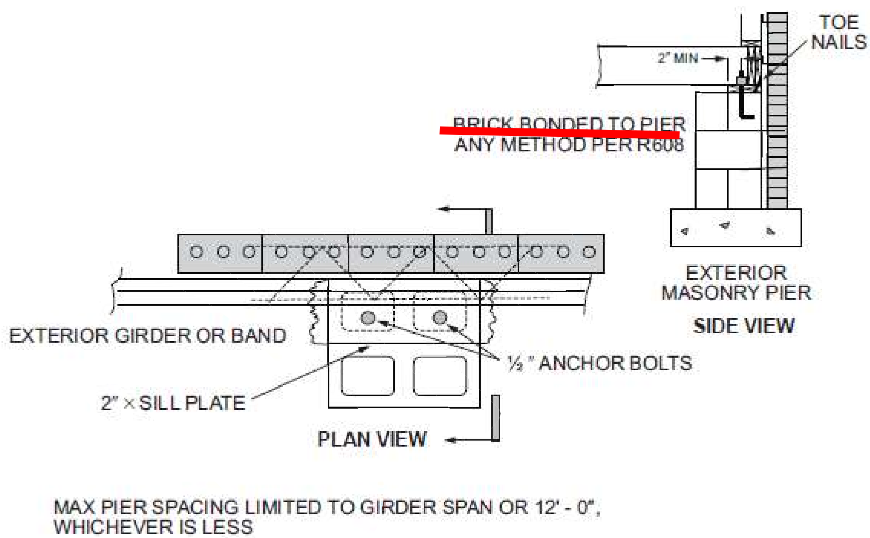


FIGURE R404.1.5(1)

ALTERNATIVE ANCHORAGE FOR MASONRY CURTAIN WALL WITH CONCRETE MASONRY PIERS

R404.1.9.1 Pier cap. *Hollow masonry* piers shall be capped with 4 inches (102 mm) of *solid masonry* or concrete for one story and 8 inches (203 mm) of solid masonry or concrete for two stories and two and one-half stories or shall have cavities of the top course filled with concrete or grout or Type M or S mortar.~~, a masonry cap block, or shall have cavities of the top course filled with concrete or grout.~~ Where required, termite protection for the pier cap shall be provided in accordance with Section R318.

R404.1.9.4 Seismic design of masonry piers. Masonry piers in ~~*dwellings* located in Seismic Design Category D_0, D_1 or D_2, and~~ *townhouses* in Seismic Design Category C, shall be designed in accordance with accepted engineering practice.

R404.4 Retaining walls. ~~Retaining walls that are not laterally supported at the top and that retain in excess of 48 inches (1219 mm) of unbalanced fill, or retaining walls exceeding 24 inches (610 mm) in height that resist lateral loads in addition to soil, shall be designed in accordance with accepted engineering practice to ensure stability against overturning, sliding, excessive foundation pressure and water uplift. Retaining walls shall be designed for a safety factor of 1.5 against lateral sliding and overturning. This section shall not apply to foundation walls supporting buildings.~~Retaining walls that meet the following shall be designed by a registered design professional.

1. Any retaining walls on a residential site that cross over adjacent property lines regardless of vertical height, or

2. Retaining walls that support buildings and their accessory structures, undercutting footings 10' or less per R403.1.9 and Figure 403.1.9, or

3. Individual retaining walls supporting unbalanced backfill exceeding 5 feet (1524 mm) in height within a horizontal distance of 15 feet (4572 mm) or less, or

4. Multiple retaining walls providing a cumulative vertical relief of unbalanced backfill heights greater than 5 Feet (1524 mm) within a horizontal distance of 15 feet (4572 mm) or less.

Retaining walls shall be designed for a safety factor of 1.5 against lateral sliding and overturning.

SECTION R405
FOUNDATION DRAINAGE

R405.1 Concrete or masonry foundations. Exterior ~~Drains~~ drains shall be provided around concrete or masonry foundations that retain 12 inches or more of earth on the exterior of the foundation wall. ~~and enclose habitable or usable spaces located below *grade*~~. Drainage tiles, gravel or crushed stone drains, perforated pipe or other *approved* systems or materials shall be installed at or below the top of the footing or below the bottom of the slab and shall discharge by gravity or mechanical means into an *approved* drainage system. Gravel or crushed stone drains shall extend not less than 1 foot (305 mm) beyond the outside edge of the footing and 6 inches (152 mm) above the top of the footing and be covered with an *approved* filter membrane material. The top of open joints of drain tiles shall be protected with strips of building paper. Except where otherwise recommended by the drain manufacturer, perforated drains shall be surrounded with an *approved* filter membrane or the filter membrane shall cover the washed gravel or crushed rock covering the drain. Drainage tiles or perforated pipe shall be placed on not less than 2 inches (51 mm) of washed gravel or crushed rock not less than one sieve size larger than the tile joint opening or perforation and covered with not less than 6 inches (152 mm) of the same material.

Exception: A drainage system is not required where the foundation is installed on well-drained ground or sand-gravel mixture soils according to the Unified Soil Classification System, Group I soils, as detailed in Table R405.1.

SECTION R406
FOUNDATION WATERPROOFING AND DAMPPROOFING

R406.1 Concrete and masonry foundation dampproofing. ~~Except where required by Section R406.2 to be waterproofed, foundation walls that retain earth and enclose interior spaces and floors below *grade* shall be dampproofed from the finished grade to the higher of the top of the footing or 6 inches (152 mm) below the top of the basement floor.~~ Foundation walls where the outside grade is higher than the inside grade shall be dampproofed from the top of the footing to the finished grade. Masonry walls shall ~~have not less than $^3/_8$-inch (9.5 mm) Portland cement parging applied to the exterior of the wall. The parging shall~~ be dampproofed in accordance with one of the following:

1. Bituminous coating.
2. Three pounds per square yard (1.63 kg/m^2) of acrylic modified cement.
3. One-eighth-inch (3.2 mm) coat of surface-bonding cement complying with ASTM C887.
4. Any material permitted for waterproofing in Section R406.2.
5. Portland cement parging applied to the exterior of the wall no less than 3/8-inch (9.5 mm)
6. Other *approved* methods or materials.

~~**Exception:** Parging of unit masonry walls is not required where a material is *approved* for direct application to the masonry.~~

Concrete walls shall be dampproofed by applying any one of the listed dampproofing materials or any one of the waterproofing materials listed in Section R406.2 to the exterior of the wall.

R406.2 Concrete and masonry foundation waterproofing. ~~In areas where a high water table or other severe soil-water conditions are known to exist,~~ ~~exterior~~ Exterior foundation walls that retain earth and enclose interior *occupiable spaces* ~~and floors~~ below *grade* shall be waterproofed from the finished *grade* to the higher of the top of the footing or 6 inches (152 mm) below the top of the basement floor. Walls shall be waterproofed in accordance with one of the following:

1. Two-ply hot-mopped felts.
2. Fifty-five-pound (25 kg) roll roofing.
3. Forty-mil (1 mm) polymer-modified asphalt.
4. Sixty-mil (1.5 mm) flexible polymer cement.
5. One-eighth-inch (3 mm) cement-based, fiber-reinforced, waterproof coating.
6. Sixty-mil (1.5 mm) solvent-free liquid-applied synthetic rubber.

All joints in membrane waterproofing shall be lapped and sealed with an adhesive compatible with the membrane.

Exception: Organic-solvent-based products such as hydrocarbons, chlorinated hydrocarbons, ketones and es-ters shall not be used for ICF walls with expanded polystyrene form material. Use of plastic roofing cements, acrylic coatings, latex coatings, mortars and pargings to seal ICF walls is permitted. Cold-setting asphalt or hot asphalt shall conform to Type C of ASTM D449. Hot asphalt shall be applied at a temperature of less than 200°F (93°C).

R407.3 Structural requirements. The columns shall be restrained to prevent lateral displacement at the top and bottom end. Wood columns shall be not less in nominal size than 4 inches by 4 inches (102 mm by 102 mm). Steel columns shall be not less than 3-inch-diameter (76 mm) Schedule 40 pipe manufactured in accordance with ASTM A53/A53M Grade B or *approved* equivalent.

SECTION R408
~~UNDER-FLOOR SPACE~~ WALL VENTED CRAWL SPACES

~~**R408.1 Moisture control.** The under-floor space between the bottom of the floor joists and the earth under any building (except space occupied by a *basement*) shall comply with Section R408.2 or R408.3.~~

~~**R408.2 Openings for under-floor ventilation.** Ventilation openings through foundation or exterior walls surrounding the under-floor space shall be provided in accordance with this section. The minimum net area of ventilation openings shall be not less than 1 square foot (0.0929 m^2) for each 150 square feet (14 m^2) of under-floor area. One ventilation opening shall be within 3 feet (915 mm) of each external corner of the under-floor space. Ventilation openings shall be covered for their height and width with any of the following materials provided that the least dimension of the covering shall not exceed $^1/_4$ inch (6.4 mm), and operational louvers are permitted:~~

1. ~~Perforated sheet metal plates not less than 0.070 inch (1.8 mm) thick.~~
2. ~~Expanded sheet metal plates not less than 0.047 inch (1.2 mm) thick.~~
3. ~~Cast-iron grill or grating.~~
4. ~~Extruded load-bearing brick vents.~~
5. ~~Hardware cloth of 0.035 inch (0.89 mm) wire or heavier.~~
6. ~~Corrosion-resistant wire mesh, with the least dimension being $^1/_8$ inch (3.2 mm) thick.~~

~~**Exceptions:**~~

1. ~~The total area of ventilation openings shall be permitted to be reduced to $^1/_{1,500}$ of the under-floor area where the ground surface is covered with an *approved* Class I vapor retarder material.~~
2. ~~Where the ground surface is covered with an *approved* Class 1 vapor retarder material, ventilation openings are not required to be within 3 feet (915 mm) of each external corner of the under-floor space provided that the openings are placed to provide cross ventilation of the space.~~

~~**R408.3 Unvented crawl space.** For unvented under-floor spaces, the following items shall be provided:~~

~~1. Exposed earth shall be covered with a continuous Class I vapor retarder. Joints of the vapor retarder shall overlap by 6 inches (152 mm) and shall be sealed or taped. The edges of the vapor retarder shall extend not less than 6 inches (152 mm) up the stem wall and shall be attached and sealed to the stem wall or insulation.~~

~~2. One of the following shall be provided for the under-floor space:~~

~~2.1. Continuously operated mechanical exhaust ventilation at a rate equal to 1 cubic foot per minute (0.47 L/s) for each 50 square feet (4.7 m^2) of *crawl space* floor area, including an air pathway to the common area (such as a duct or transfer grille), and perimeter walls insulated in accordance with Section N1102.2.10.1 of this code.~~

~~2.2. *Conditioned air* supply sized to deliver at a rate equal to 1 cubic foot per minute (0.47 L/s) for each 50 square feet (4.7 m^2) of under-floor area, including a return air pathway to the common area (such as a duct or transfer grille), and perimeter walls insulated in accordance with Section N1102.2.10.1 of this code.~~

~~2.3. Plenum in existing structures complying with Section M1601.5, if under-floor space is used as a plenum.~~

~~2.4. Dehumidification sized in accordance with manufacturer's specifications.~~

~~**R408.4 Access.** Access shall be provided to all under-floor spaces. Access openings through the floor shall be not smaller than 18 inches by 24 inches (457 mm by 610 mm). Openings through a perimeter wall shall be not less than 16 inches by 24 inches (407 mm by 610 mm). Where any portion of the through wall access is below *grade*, an areaway not less than 16 inches by 24 inches (407 mm 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 Section M1305.1.3 for access requirements where mechanical *equipment* is located under floors.~~

~~**R408.5 Removal of debris.** The under-floor *grade* shall be cleaned of all vegetation and organic material. Wood forms used for placing concrete shall be removed before a building is occupied or used for any purpose. Construction materials shall be removed before a building is occupied or used for any purpose.~~

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

~~**R408.7 Flood resistance.** For buildings located in flood hazard areas as established in Table R301.2:~~

~~1. Walls enclosing the under-floor space shall be provided with flood openings in accordance with Section R322.2.2.~~

~~2. The finished ground level of the under-floor space shall be equal to or higher than the outside finished ground level on at least one side.~~

~~**Exception:** Under-floor spaces that meet the requirements of FEMA TB 11-1.~~

~~**R408.8 Under-floor vapor retarder.** In Climate Zones 1A, 2A and 3A below the warm-humid line, a continuous Class I or II vapor retarder shall be provided on the exposed face of air-permeable insulation installed between the floor joists and exposed to the grade in the under-floor space. The vapor retarder shall have a maximum water vapor permeance of 1.5 perms when tested in accordance with Procedure B of ASTM E96.~~

~~**Exception:** The vapor retarder shall not be required in unvented *crawl spaces* constructed in accordance with Section R408.3.~~

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

R408.1.1 Foundation vent sizing. The minimum net area of ventilation openings shall be not less than 1 square foot (0.0929 m2) for each 150 square feet (13.9 m2) of crawl space ground area.

Exception: The total area of ventilation openings may be reduced to 1/1,500 of the under-floor area where the ground surface is treated with an approved vapor retarder material in accordance with Section R408.2 and the required openings are placed to provide cross ventilation of the crawl space. The installation of operable louvers shall not be prohibited.

R408.1.2 Foundation vent location. One foundation vent shall be within 3 feet (914 mm) of each corner of the building. To prevent rainwater entry when the crawlspace is built on a sloped site, the uphill foundation walls may be constructed without wall vent openings. Vent dams shall be provided when the bottom of the foundation vent opening is less than 4 inches (102 mm) above the finished exterior grade.

R408.1.3 Covering material. To prevent rodent entry, foundation vents shall be covered with any of the following materials provided that the ventilation holes through the covering material shall not exceed 1/4 inch (6.4 mm) in any direction:

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

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

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

R408.2 Ground vapor retarder. When required by Section R408.1.1 Exception, a minimum 6-mil (0.15 mm) polyethylene vapor retarder or equivalent shall be installed to nominally cover all exposed earth in the crawl space, with joints lapped not less than 12 inches (305 mm). Where there is no evidence that the groundwater table can rise to within 6 inches (152 mm) of the floor of the crawl space, it is acceptable to puncture the ground vapor retarder at low spots to prevent water puddles from forming on top of the vapor retarder due to condensation.

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

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

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

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

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

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

R408.9 Removal of debris. The crawl space floor shall be cleaned of all vegetation and organic material. All wood forms used for placing shall be removed before the building is occupied or used for any purpose. All construction materials shall be removed before the building is occupied or used for any purpose.

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

R408.11 Flood resistance. For buildings located in flood hazard areas as established in Table R301.2(1):

1. Walls enclosing the under-floor space shall be provided with flood openings in accordance with Section R322.2.2.
2. The finished ground level of the under-floor space shall be equal to or higher than the outside finished ground level on at least one side.

Exception: Under-floor spaces that meet the requirements of FEMA/FIA TB 11-1.

SECTION R409
CLOSED CRAWL SPACES

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

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

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

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

R409.2.1 Ground vapor retarder. A minimum 6-mil (0.15 mm) polyethylene vapor retarder or equivalent shall be installed to nominally cover all exposed earth in the crawl space, with joints lapped not less than 12 inches (305 mm). Minor pockets or wrinkles that prevent total drainage across the surface of the vapor retarder are allowed. The floor of the crawl space shall be graded so that it drains to one or more low spots. Install a drain to daylight or sump pump at each low spot. Crawl space drains shall be kept separate from roof gutter drain systems and foundation perimeter drains.

R409.2.2 Liner. The ground vapor retarder is permitted to be installed as a full interior liner by sealing the edges to the walls and beam columns and sealing the seams. Single piece liner systems are approved. The top edge of the wall liner shall terminate 3 inches (76 mm) below the top edge of the masonry foundation wall. The top edge of the liner shall be brought up the interior columns a minimum of 4 inches (102 mm) above the crawl space floor. The floor of the crawl space shall be graded so that it drains to one or more low spots. Install a drain to daylight or sump pump at each low spot. Crawl space drains shall be separate from roof gutter drain systems and foundation perimeter drains.

R409.2.2.1 Wall liner termite inspection gap. Provide a clear and unobstructed 3 inch (76 mm) minimum, 4 inch (102 mm) maximum inspection gap between the top of the wall liner and the bottom of the wood sill. This inspection gap may be ignored with regards to energy performance and is not intended to create an energy penalty.

R409.2.3 Concrete floor surfacing. (Deleted) ~~The ground vapor retarder may be protected against ripping and displacement by pouring an unreinforced, minimum 2 inch (51 mm) thick, concrete surface directly over the vapor barrier. A base course of gravel or other drainage material under the ground moisture barrier is not required. The floor of the crawl space shall be graded so that the concrete surface drains to one or more low spots. Install a drain to daylight or sump pump at each low spot. Crawl space drains shall be separate from roof gutter drain systems and foundation perimeter drains.~~

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

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

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

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

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

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

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

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

R409.5.5 Conditioned space. The crawl space shall be designed as a heated and cooled, conditioned space with wall insulation installed in accordance with the requirements of Section R409.8. Intentionally returning air from the crawl space to space-conditioning equipment that serves the dwelling shall be allowed. Foam plastic insulation located in a crawl space plenum shall be protected against ignition by an approved thermal barrier.

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

R409.7 Combustion air. The air sealing requirements of a closed crawl space may result in a foundation that cannot provide adequate combustion air for fuel-burning appliances; therefore, fuel-burning appliances located in the crawl space such as furnaces and water heaters shall obtain combustion air from outdoors as in accordance with the *North Carolina Mechanical Code*.

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

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

R409.8.1 Wall insulation. Where the floor above a crawl space is not insulated, the walls shall be insulated. Wall insulation is permitted to be located on any combination of the exterior and interior surfaces and within the structural cavities or materials of the exterior crawl space walls. Wall insulation systems require that the band joist area of the floor frame be insulated. Wall insulation shall begin 3 inches (76 mm) below the top of the masonry foundation wall and shall extend down to 3 inches (76 mm) above the top of the footing or concrete floor, 3 inches (76 mm) above the interior ground surface or 24 inches (610 mm) below the outside finished ground level, whichever is less. No insulation shall be required on masonry walls of 9 inches (229 mm) height or less.

R409.8.1.1 ~~Foam plastic~~ Inspection gap requirements for Insulation.
For outside walls, Section R318.4 governs applications. When expanded polystyrene, polyisocyanurate, other foam plastic insulation fiberglass, rockwool, cellulose or other porous insulation is installed on the inside surface of the exterior foundation walls, ~~provisions in Sections R409.8.1.1.1 through R409.8.1.1.2 apply.~~
~~**R409.8.1.1.1 Earth floored crawl spaces.**~~ **p**rovide a clear and unobstructed 3-inch (76 mm) minimum, 4-inch (102 mm) maximum termite inspection gap between the top of the foam plastic wall insulation and the bottom of the wood sill. ~~Because insulation ground contact is not allowed, provide a continuous 3-inch (76 mm) minimum clearance gap between the bottom edge of the foam plastic wall insulation and the earth floor surface. Refer to Section N1102.2.9 to determine maximum allowances for insulation gaps.~~

~~**R409.8.1.1.2 Concrete floor surfaced crawl spaces.** Provide a clear and unobstructed 3-inch (76 mm) minimum, 4-inch (102 mm) maximum termite inspection gap between the top of the foam plastic wall insulation and the bottom of the wood sill. Provide a continuous 3-inch (76 mm) minimum clearance gap between the bottom edge of the foam plastic wall insulation and the concrete floor surface. Refer to Section N1102.2.9 to determine maximum allowances for insulation gaps.~~

R409.8.1.2 Porous insulation material. ~~When fiberglass, rockwool, cellulose or other porous insulation materials are installed on the inside wall surface of a closed crawl space, provide a clear and unobstructed 3-inch (76 mm) minimum termite inspection gap between the top of the porous wall insulation and the bottom of the wood sill.~~
To reduce wicking potential, porous insulation ground contact is not allowed in earth floored or concrete surfaces crawl spaces. Provide a continuous 3- inch (76 mm) minimum wicking gap between the bottom edge of the porous wall insulation and the earth or concrete floor surface. Refer to Section N1102.1.7 to determine maximum allowances for insulation gaps.

R409.8.2 Foam plastic fire safety. Foam plastic insulation may be installed inside crawl spaces without a thermal cover when the insulation product has been tested in accordance with ASTM E84 to have a flame-spread rating of not more than 25 and a smoke developed rating of not more than 450. Foam plastics that have not been tested to meet these ratings shall be protected against ignition by covering them with a thermal barrier. Acceptable thermal barriers include 1/2-inch (13 mm) cement board, metal foil sheets, metal foil tape, steel or aluminum metal sheets or other approved materials installed in such a manner that the foam is not exposed.

Exception: Foam plastic insulation located in closed crawl spaces used as conditioned spaces or plenums shall be protected against ignition by an approved thermal barrier.

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

R409.10 Duct air leakage control. All heating and cooling ductwork located in the crawl space shall be sealed with mastic or other industry approved duct closure systems.

R409.11 Access. A minimum access opening measuring 18 inches by 24 inches (457 mm by 610 mm) shall be provided to the crawl space. See the *North Carolina Mechanical Code* for access requirements where mechanical equipment is located under floors.

R409.12 Removal of debris. The crawl space floor shall be cleaned of all vegetation and organic material. All wood forms used for placing shall be removed before the building is occupied or used for any purpose. All construction materials shall be removed before the building is occupied or used for any purpose.

R409.13 Finished grade. The finished grade of the crawlspace is permitted to be located at the bottom of the footings; however, where there is evidence that the groundwater table can rise to within 6 inches (152 mm) of the finished grade of the crawl space at the perimeter or where there is evidence that the surface water does not readily drain from the building site, the grade in the crawl space shall be as high as the outside finished grade, unless an approved drainage system is provided.

CHAPTER 5
FLOORS

~~**User note:**~~

~~***About this chapter:** Chapter 5 provides the requirements for the design and construction of floor systems that will be capable of supporting minimum required design loads. This chapter covers wood floor framing, wood floors on the ground, cold-formed steel floor framing and concrete slabs on the ground. Allowable span tables are provided that greatly simplify the determination of joist, girder and sheathing sizes for raised floor systems of wood framing and cold-formed steel framing. This chapter also contains prescriptive requirements for wood-framed exterior decks and their attachment to the main building.*~~

R502.7 Lateral restraint at supports. Joists shall be supported laterally at the ends by full-depth solid blocking not less than 2 inches (51 mm) nominal in thickness; or by attachment to a full-depth header, band or rim joist, or to an adjoining stud or shall be otherwise provided with lateral support to prevent rotation.

Exceptions:

1. Trusses, *structural composite lumber*, structural glued-laminated members and I-joists shall be supported laterally as required by the manufacturer's recommendations.
2. Deleted. ~~In *Seismic Design Categories* D_0, D_1 and D_2, lateral restraint shall be provided at each intermediate support.~~

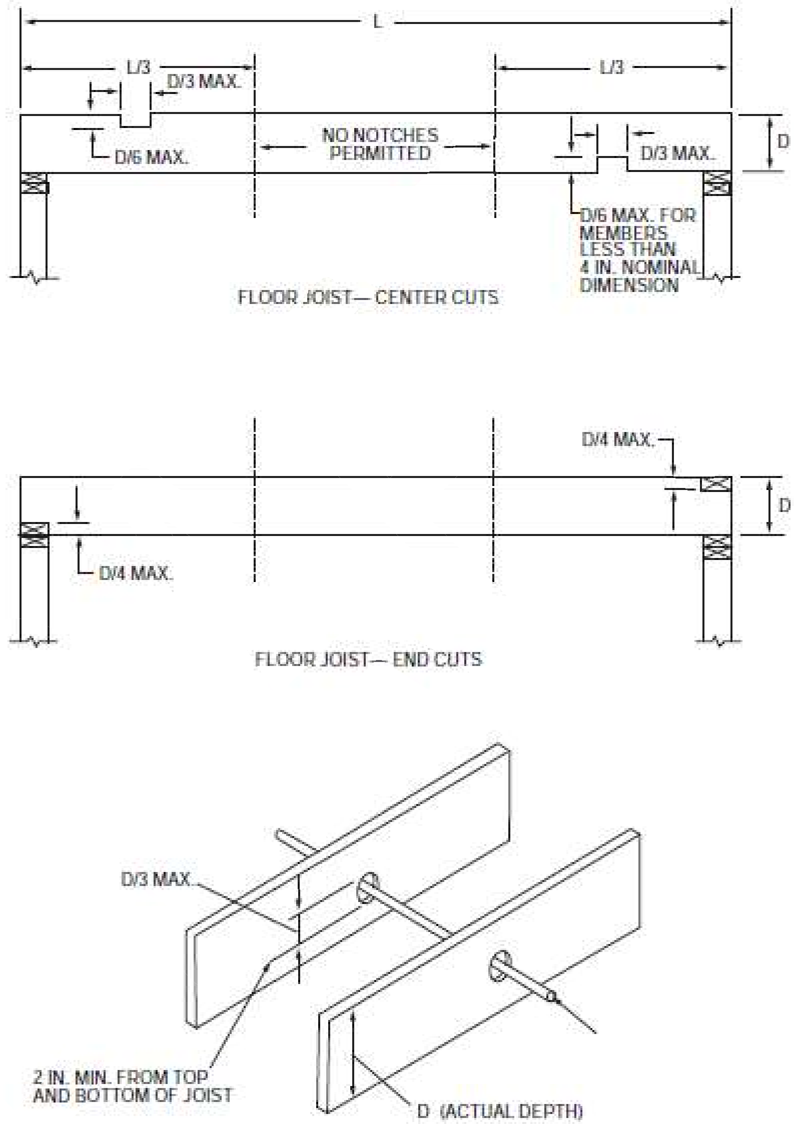
R502.8 Cutting, drilling and notching. Structural floor members shall not be cut, bored or notched in excess of the limitations specified in this section. See Figure ~~R502.8~~ R502.8 (1) and R502.8(2).

R502.11.1 Design. Wood trusses shall be designed in accordance with *approved* engineering practice. The design and manufacture of metal-plate-connected wood trusses shall comply with ANSI/TPI 1. The *truss design drawings* shall be prepared by a *registered design professional*. ~~where required by the statutes of the *jurisdiction* in which the project is to be constructed in accordance with Section R106.1.~~

R502.11.4 Truss design drawings. *Truss design drawings*, prepared in compliance with Section R502.11.1, shall be submitted to the *building official* ~~and *approved* prior to installation~~. *Truss design drawings* shall be provided with the shipment of trusses delivered to the job site. *Truss design drawings* shall include, at a minimum, the information specified as follows:

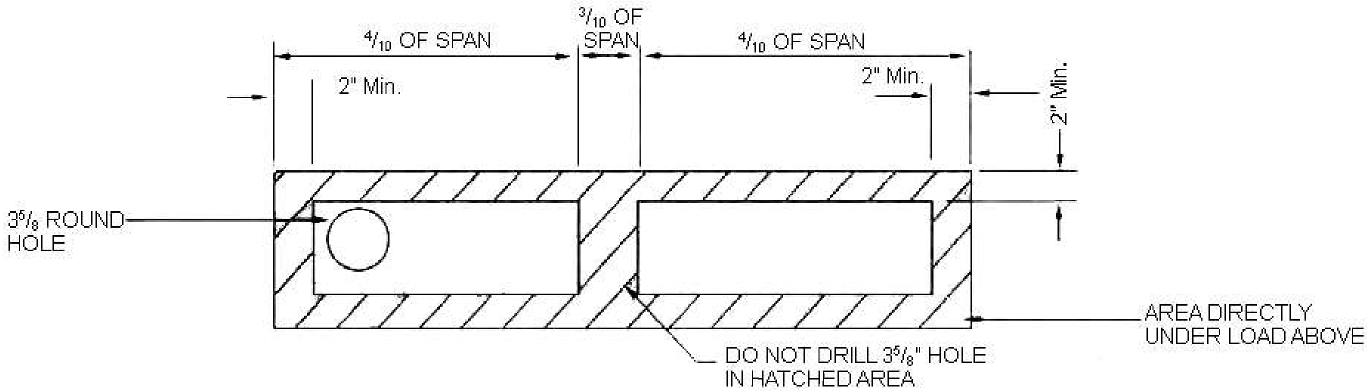
1. Slope or depth, span and spacing.
2. Location of all joints.
3. Required bearing widths.
4. Design loads as applicable:
   - 4.1. Top chord *live load*.
   - 4.2. Top chord dead load.
   - 4.3. Bottom chord *live load*.
   - 4.4. Bottom chord dead load.
   - 4.5. Concentrated loads and their points of application.
   - 4.6. Controlling wind and earthquake loads.
5. Adjustments to lumber and joint connector design values for conditions of use.
6. Each reaction force and direction.
7. Joint connector type and description, such as size, thickness or gage, and the dimensioned location of each joint connector except where symmetrically located relative to the joint interface.
8. Lumber size, species and grade for each member.
9. Connection requirements for:
   - 9.1. Truss-to-girder-truss.
   - 9.2. Truss ply-to-ply.
   - 9.3. Field splices.
10. Calculated deflection ratio, maximum description for live and total load, or both.

11. Maximum axial compression forces in the truss members to enable the building designer to design the size, connections and anchorage of the permanent continuous lateral bracing. Forces shall be shown on the truss drawing or on supplemental documents.
12. Required permanent truss member bracing location.



For SI: 1 inch = 25.4 mm.

FIGURE R502.8(1)
CUTTING, NOTCHING AND DRILLING



For SI: 1 inch = 24.5 mm, 1 foot = 304.8 mm
1. Do not drill in center 2/10's of joist span.
2. Do not drill directly under load bearing walls at end.
3. Do not drill closer than 2 inch to top or bottom edge.
4. Apply 4 feet joist width × 1/2 inch CDX plywood with face grain running with joist to both sides using 6d nails or 11/2 inch screws 1 inch from top and bottom
4 inches o.c.
5. Holes shall not be closer than 2 inches o.c. within unhatched area only.
6. Plywood shall be attached such that 2 feet minimum of plywood is centered on each side of the hole location, except when the hole is located within 2 feet of the end of joist.

FIGURE R502.8(2)
ACCEPTABLE LOCATION OF 35/8-inch DIAMETER HOLE IN 2 × 10 JOIST

SECTION R505
COLD-FORMED STEEL FLOOR FRAMING

Deleted.

~~**R505.1 Cold-formed steel floor framing.** Elements shall be straight and free of any defects that would significantly affect structural performance. Cold-formed steel floor framing members shall be in accordance with the requirements of this section.~~

~~**R505.1.1 Applicability limits.** The provisions of this section shall control the construction of cold-formed steel floor framing for buildings not greater than 60 feet (18 288 mm) in length perpendicular to the joist span, not greater than 40 feet (12 192 mm) in width parallel to the joist span and less than or equal to three *stories* above *grade plane*. Cold-formed steel floor framing constructed in accordance with the provisions of this section shall be limited to sites where the ultimate design wind speed is less than 140 miles per hour (63 m/s), Exposure Category B or C, and the ground snow load is less than or equal to 70 pounds per square foot (3.35 kPa).~~

~~*R505.1.1.1 Alternate applications.* **Cold-formed steel floor framing for buildings exceeding the applicability limits of Section R505.1.1 is permitted to be designed and constructed in accordance with AISI S230, subject to the limits therein.**~~

~~**R505.1.2 In-line framing.** Where supported by cold-formed steel-framed walls in accordance with Section R603, cold-formed steel floor framing shall be constructed with floor joists located in-line with load-bearing studs located below the joists in accordance with **the tolerances specified in AISI S240, Section B1.2.3.**~~

~~**R505.1.3 Floor trusses.** Cold-formed steel trusses shall be designed, braced and installed in accordance with AISI S230**, Section D8.** In the absence of specific bracing requirements, trusses shall be braced in accordance with accepted industry practices, such as the SBCA *Cold-Formed Steel Building Component Safety Information*~~

~~*(CFSBCSI), Guide to Good Practice for Handling, Installing & Bracing of Cold-Formed Steel Trusses.* Truss members shall not be notched, cut or altered in any manner without an *approved* design.~~

~~**R505.2 Structural framing.** Load-bearing cold-formed steel floor framing members shall be in accordance with this section.~~

~~**R505.2.1 Material.** Load-bearing cold-formed steel framing members shall be cold formed to shape from structural quality sheet steel complying with the requirements of **AISI S240, Section A3**.~~

~~**R505.2.2 Corrosion protection.** Load-bearing cold-formed steel framing shall have a metallic coating complying with **AISI S240, Section A4.**~~

~~**R505.2.3 Dimension, thickness and material grade.** Load-bearing cold-formed steel floor framing members shall comply with AISI S230, Section A4.3 and material grade requirements as specified in AISI S230, Section A4.4.~~

~~**R505.2.4 Identification.** Load-bearing cold-formed steel framing members shall meet the product identification requirements of AISI S240, Section A5.5.~~

~~**R505.2.5 Fastening.** Screws for steel-to-steel connections shall be installed with a minimum edge distance and center-to-center spacing of 1/2 inch (12.7 mm), shall be self-drilling tapping, and shall conform to ASTM C1513. Floor sheathing shall be attached to cold-formed steel joists with minimum No. 8 self-drilling tapping screws that conform to ASTM C1513. Screws attaching floor sheathing to cold-formed steel joists shall have a minimum head diameter of 0.292 inch (7.4 mm) with countersunk heads and shall be installed with a minimum edge distance of 3/8 inch (9.5 mm). Gypsum board ceilings shall be attached to cold-formed steel joists with minimum No. 6 screws conforming to ASTM C954 or ASTM C1513 with a bugle-head style and shall be installed in accordance with Section R702. For all connections, screws shall extend through the steel not fewer than three exposed threads. Fasteners shall have a rust inhibitive coating suitable for the installation in which they are being used, or be manufactured from material not susceptible to corrosion.~~

~~**R505.2.6 Web holes, web hole reinforcing and web hole patching.** Web holes **in floor framing members shall comply with the conditions as prescribed in AISI S230, Section A4.5. Web holes not in compliance with the conditions as prescribed in AISI S230, Section A4.5 shall be reinforced in accordance with the provisions of AISI S230, Section A4.6 or patched in accordance with the provisions of AISI S230, Section A4.7.**~~

~~**R505.3 Floor construction.** Cold-formed steel floors shall be constructed in accordance with this section.~~

~~**R505.3.1 Floor-to-foundation or load-bearing wall connections.** Cold-formed steel-framed floors shall be anchored to foundations, wood sills or *load-bearing walls* in accordance with Table R505.3.1(1) and Figure R505.3.1(1), R505.3.1(2), R505.3.1(3), R505.3.1(4), R505.3.1(5) or R505.3.1(6). Anchor bolts shall be located not more than 12 inches (305 mm) from corners or the termination of bottom tracks. Continuous cold-formed steel joists supported by interior *load-bearing walls* shall be constructed in accordance with Figure R505.3.1(7). Lapped cold-formed steel joists shall be constructed in accordance with Figure R505.3.1(8). End floor joists constructed on foundation walls parallel to the joist span shall be doubled unless a C-shaped bearing stiffener, sized in accordance with Section R505.3.4, is installed web-to-web with the floor joist beneath each supported wall stud, as shown in Figure R505.3.1(9). Fastening of cold-formed steel joists to other framing members shall be in accordance with Section R505.2.5 and Table R505.3.1(2).~~

~~TABLE R505.3.1(1)~~

~~FLOOR-TO-FOUNDATION OR BEARING WALL CONNECTION REQUIREMENTS[a, b]~~

~~FRAMING CONDITION~~	~~BASIC ULTIMATE WIND SPEED (mph) AND EXPOSURE~~	
	~~110 mph Exposure Category C or less than 139 mph Exposure Category B~~	~~Less than 139 mph Exposure Category C~~
~~Floor joist to wall track of exterior wall in accordance with Figure R505.3.1(1)~~	~~2-No. 8 screws~~	~~3-No. 8 screws~~
~~Rim track or end joist to *load-bearing wall* top track in accordance with Figure R505.3.1(1)~~	~~1-No. 8 screw at 24 inches o.c.~~	~~1-No. 8 screw at 24 inches o.c.~~

~~Rim track or end joist to wood sill in accordance with Figure R505.3.1(2)~~	~~Steel plate spaced at 4 feet o.c. with 4-No. 8 screws and 4-10d or 6-8d common nails~~	~~Steel plate spaced at 2 feet o.c. with 4-No. 8 screws and 4-10d or 6-8d common nails~~
~~Rim track or end joist to foundation in accordance with Figure R505.3.1(3)~~	~~1/2-inch minimum diameter anchor bolt and clip angle spaced at 6 feet o.c. with 8-No. 8 screws~~	~~1/2-inch minimum diameter anchor bolt and clip angle spaced at 4 feet o.c. with 8-No. 8 screws~~
~~Cantilevered joist to foundation in accordance with Figure R505.3.1(4)~~	~~1/2-inch minimum diameter anchor bolt and clip angle spaced at 6 feet o.c. with 8-No. 8 screws~~	~~1/2-inch minimum diameter anchor bolt and clip angle spaced at 4 feet o.c. with 8-No. 8 screws~~
~~Cantilevered joist to wood sill in accordance with Figure R505.3.1(5)~~	~~Steel plate spaced at 4 feet o.c. with 4-No. 8 screws and 4-10d or 6-8d common nails~~	~~Steel plate spaced at 2 feet o.c. with 4-No. 8 screws and 4-10d or 6-8d common nails~~
~~Cantilevered joist to exterior *load-bearing wall* track in accordance with Figure R505.3.1(6)~~	~~2-No. 8 screws~~	~~3-No. 8 screws~~

~~For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s, 1 foot = 304.8 mm.~~

~~a. Anchor bolts are to be located not more than 12 inches from corners or the termination of bottom tracks such as at door openings or corners. Bolts extend not less than 15 inches into masonry or 7 inches into concrete. Anchor bolts connecting cold-formed steel framing to the foundation structure are to be installed so that the distance from the center of the bolt hole to the edge of the connected member is not less than one and one-half bolt diameters.~~

~~b. All screw sizes shown are minimum.~~

~~TABLE R505.3.1(2)~~

~~FLOOR FASTENING SCHEDULE[a]~~

~~DESCRIPTION OF BUILDING ELEMENTS~~	~~NUMBER AND SIZE OF FASTENERS~~	~~SPACING OF FASTENERS~~
~~Floor joist to track of an interior *load-bearing wall* in accordance with Figures R505.3.1(7) and R505.3.1(8)~~	~~2-No. 8 screws~~	~~Each joist~~
~~Floor joist to track at end of joist~~	~~2-No. 8 screws~~	~~One per flange or two per bearing stiffener~~
~~Subfloor to floor joists~~	~~No. 8 screws~~	~~6 in. o.c. on edges and 12 in. o.c. at intermediate supports~~

~~For SI: 1 inch = 25.4 mm.~~

~~a. All screw sizes shown are minimum.~~

~~**R505.3.2 Minimum floor joist sizes.** Floor joist size and thickness shall be determined in accordance with the limits set forth in Table R505.3.2 for single or continuous spans. Where continuous joist members are used, the interior bearing supports shall be located within 2 feet (610 mm) of midspan of the cold-formed steel joists, and the individual spans shall not exceed the spans in Table R505.3.2. Floor joists shall have a bearing support length of not less than 1 1/2 inches (38 mm) for exterior wall supports and 3 1/2 inches (89 mm) for interior wall supports. Tracks shall be not less than 33 mils (0.84 mm) thick except where used as part of a floor header or trimmer in accordance with Section R505.3.8. Bearing stiffeners shall be installed in accordance with Section R505.3.4.~~

~~TABLE R505.3.2~~

~~ALLOWABLE SPANS FOR COLD-FORMED STEEL JOISTS—SINGLE OR CONTINUOUS SPANS[a, b, c, d, e, f]~~

~~JOIST DESIGNATION~~	~~30 PSF LIVE LOAD~~				~~40 PSF LIVE LOAD~~			
	~~Spacing (inches)~~				~~Spacing (inches)~~			
	~~12~~	~~16~~	~~19.2~~	~~24~~	~~12~~	~~16~~	~~19.2~~	~~24~~
~~550S162-33~~	~~11′-8″~~	~~10′-4″~~	~~9′-5″~~	~~8′-5″~~	~~10′-7″~~	~~9′-2″~~	~~8′-5″~~	~~7′-6″~~

~~550S162-43~~	~~12′-8″~~	~~11′-6″~~	~~10′-8″~~	~~10′-5″~~	~~11′-6″~~	~~10′-4″~~	~~9′-10″~~	~~9′-3″~~
~~550S162-54~~	~~13′-7″~~	~~12′-4″~~	~~11′-7″~~	~~10′-9″~~	~~12′-4″~~	~~11′-3″~~	~~10′-7″~~	~~9′-10″~~
~~550S162-68~~	~~14′-7″~~	~~13′-3″~~	~~12′-6″~~	~~11′-7″~~	~~13′-3″~~	~~12′-0″~~	~~11′-4″~~	~~10′-6″~~
~~800S162-33~~	~~14′-6″~~	~~12′-6″~~	~~11′-5″~~	~~10′-3″~~	~~12′-10″~~	~~11′-1″~~	~~10′-2″~~	~~9′-1″~~
~~800S162-43~~	~~17′-0″~~	~~15′-1″~~	~~13′-9″~~	~~12′-4″~~	~~15′-5″~~	~~13′-5″~~	~~12′-3″~~	~~10′-11″~~
~~800S162-54~~	~~18′-3″~~	~~16′-7″~~	~~15′-8″~~	~~14′-6″~~	~~16′-7″~~	~~15′-1″~~	~~14′-2″~~	~~13′-2″~~
~~800S162-68~~	~~19′-9″~~	~~17′-11″~~	~~16′-11″~~	~~15′-8″~~	~~17′-11″~~	~~16′-3″~~	~~15′-4″~~	~~14′-3″~~
~~1000S162-43~~	~~19′-4″~~	~~16′-9″~~	~~15′-3″~~	~~13′-8″~~	~~17′-2″~~	~~14′-10″~~	~~13′-7″~~	~~12′-2″~~
~~1000S162-54~~	~~21′-9″~~	~~19′-9″~~	~~18′-7″~~	~~17′-3″~~	~~19′-9″~~	~~18′-0″~~	~~16′-11″~~	~~15′-8″~~
~~1000S162-68~~	~~23′-7″~~	~~21′-5″~~	~~20′-2″~~	~~18′-9″~~	~~21′-5″~~	~~19′-6″~~	~~18′-4″~~	~~17′-0″~~
~~1200S162-54~~	~~25′-1″~~	~~22′-10″~~	~~21′-6″~~	~~19′-9″~~	~~22′-10″~~	~~20′-9″~~	~~19′-6″~~	~~17′-6″~~
~~1200S162-68~~	~~27′-3″~~	~~24′-9″~~	~~23′-4″~~	~~21′-8″~~	~~24′-9″~~	~~22′-6″~~	~~21′-2″~~	~~19′-8″~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 mil = 0.0254 mm.~~

~~a. Deflection criteria: *L*/480 for live loads, *L*/240 for total loads.~~

~~b. Floor dead load = 10 psf.~~

~~c. Table provides the maximum clear span in feet and inches.~~

~~d. Bearing stiffeners are to be installed at all support points and concentrated loads.~~

~~e. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thickness. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thickness.~~

~~f. Table R505.3.2 is not applicable for 800S162-33 and 1000S162-43 continuous joist members.~~

~~**R505.3.3 Joist bracing and blocking.** Joist bracing and blocking shall be in accordance with this section.~~

~~**R505.3.3.1 Joist top flange bracing.** The top flanges of cold-formed steel joists shall be laterally braced by the application of floor sheathing fastened to the joists in accordance with Section R505.2.5 and Table R505.3.1(2).~~

~~**R505.3.3.2 Joist bottom flange bracing/blocking.** Floor joists with spans that exceed 12 feet (3658 mm) shall have the bottom flanges laterally braced in accordance with one of the following:~~

1. ~~Gypsum board installed with minimum No. 6 screws in accordance with Section R702.~~
2. ~~Continuous steel straps installed in accordance with Figure R505.3.3.2(1). Steel straps shall be spaced at not greater than 12 feet (3658 mm) on center and shall be not less than $1^1/_2$ inches (38 mm) in width and 33 mils (0.84 mm) in thickness. Straps shall be fastened to the bottom flange of each joist with one No. 8 screw, fastened to blocking with two No. 8 screws, and fastened at each end (of strap) with two No. 8 screws. Blocking in accordance with Figure R505.3.3.2(1) or R505.3.3.2(2) shall be installed between joists at each end of the continuous strapping and at a maximum spacing of 12 feet (3658 mm) measured along the continuous strapping (perpendicular to the joist run). Blocking shall also be located at the termination of all straps. As an alternative to blocking at the ends, anchoring the strap to a stable building component with two No. 8 screws shall be permitted.~~

~~**R505.3.3.3 Blocking at interior bearing supports.** Blocking is not required for continuous back-to-back floor joists at bearing supports. Blocking shall be installed between every other joist for single continuous floor joists across bearing supports in accordance with Figure R505.3.1(7). Blocking shall consist of C-shaped or track section with a minimum thickness of 33 mils (0.84 mm). Blocking shall be fastened to each adjacent joist through a 33-mil (0.84 mm) clip angle, bent web of blocking or flanges of web stiffeners with two No. 8 screws on each side. The minimum depth of the blocking shall be equal to the depth of the joist minus 2 inches (51 mm). The minimum length of the angle shall be equal to the depth of the joist minus 2 inches (51 mm).~~

~~**R505.3.3.4 Blocking at cantilevers.** Blocking shall be installed between every other joist over cantilever bearing supports in accordance with Figure R505.3.1(4), R505.3.1(5) or R505.3.1(6). Blocking shall consist of C-shaped or track section with minimum thickness of 33 mils (0.84 mm). Blocking shall be fastened to each adjacent joist through bent web of blocking, 33-mil clip angle or flange of web stiffener with two No. 8 screws~~

~~at each end. The depth of the blocking shall be equal to the depth of the joist. The minimum length of the angle shall be equal to the depth of the joist minus 2 inches (51 mm). Blocking shall be fastened through the floor sheathing and to the support with three No. 8 screws (top and bottom).~~

~~**R505.3.4 Bearing stiffeners.** Bearing stiffeners shall be installed at each joist bearing location in accordance with this section, except for joists lapped over an interior support not carrying a *load-bearing wall* above. Floor joists supporting jamb studs with multiple members shall have two bearing stiffeners in accordance with Figure R505.3.4(1). Bearing stiffeners shall be fabricated from a C-shaped, track or clip angle member in accordance with one of the following:~~

1. ~~C-shaped bearing stiffeners:~~
   - 1.1. ~~Where the joist is not carrying a *load-bearing wall* above, the bearing stiffener shall be a minimum 33 mil (0.84 mm) thickness.~~
   - 1.2. ~~Where the joist is carrying a *load-bearing wall* above, the bearing stiffener shall be not less than the same designation thickness as the wall stud above.~~
2. ~~Track bearing stiffeners:~~
   - 2.1. ~~Where the joist is not carrying a *load-bearing wall* above, the bearing stiffener shall be a minimum 43 mil (1.09 mm) thickness.~~
   - 2.2. ~~Where the joist is carrying a *load-bearing wall* above, the bearing stiffener shall be not less than one designation thickness greater than the wall stud above.~~

~~The minimum length of a bearing stiffener shall be the depth of member being stiffened minus $^3/_8$ inch (9.5 mm). Each bearing stiffener shall be fastened to the web of the member it is stiffening as shown in Figure R505.3.4(2).~~

~~**R505.3.5 Cutting and notching.** Flanges and lips of load-bearing cold-formed steel floor framing members shall not be cut or notched.~~

~~**R505.3.6 Floor cantilevers.** Floor cantilevers for the top floor of a two- or three-story building or the first floor of a one-story building shall not exceed 24 inches (610 mm). Cantilevers, not exceeding 24 inches (610 mm) and supporting two stories and roof (first floor of a two-story building), shall be permitted provided that all cantilevered joists are doubled (nested or back-to-back). The doubled cantilevered joists shall extend not less than 6 feet (1829 mm) toward the inside and shall be fastened with not less than two No. 8 screws spaced at 24 inches (610 mm) on center through the webs (for back-to-back) or flanges (for nested joists).~~

~~**R505.3.7 Splicing.** Joists and other structural members shall not be spliced without an *approved* design. Splicing of tracks shall conform to Figure R505.3.7.~~

~~**R505.3.8 Framing of floor openings.** Openings in floors shall be framed with header and trimmer joists. Header joist spans shall not exceed 6 feet (1829 mm) or 8 feet (2438 mm) in length in accordance with Figure R505.3.8(1) or R505.3.8(2), respectively. Header and trimmer joists shall be fabricated from joist and track members, having a minimum size and thickness at least equivalent to the adjacent floor joists, and shall be installed in accordance with Figures R505.3.8(1), R505.3.8(2), R505.3.8(3) and R505.3.8(4). Each header joist shall be connected to trimmer joists with four 2-inch by 2-inch (51-mm by 51-mm) clip angles. Each clip angle shall be fastened to both the header and trimmer joists with four No. 8 screws, evenly spaced, through each leg of the clip angle. The clip angles shall have a thickness not less than that of the floor joist. Each track section for a built-up header or trimmer joist shall extend the full length of the joist (continuous).~~

R506.2.1 Fill. Fill material shall be free of vegetation and foreign material. The fill shall be compacted to ensure uniform support of the slab, and except where *approved*, the fill depths shall not exceed 24 inches (610 mm) for clean sand or gravel and 8 inches (203 mm) for earth.

Exception: #57 or #67 stone may be used as fill for a maximum depth of 4 feet without consolidation.

R506.2.3 Vapor retarder. A **minimum** ~~**10**~~ **6**-mil **(**~~**0.010**~~ 0.006 inch**;** ~~**0.254**~~ **152 mm)** vapor retarder **conforming to ASTM E1745 Class A requirements** with joints lapped not less than 6 inches (152 mm) shall be placed between the concrete floor slab and the base course or the prepared subgrade where a base course does not exist.

Exception: The vapor retarder is not required for the following:

1. Garages, utility buildings and other unheated *accessory structures*.
2. For unheated storage rooms having an area of less than 70 square feet (6.5 m^2) and carports.
3. Driveways, walks, patios and other flatwork not likely to be enclosed and heated at a later date.
4. Where *approved* by the *building official*, based on local site conditions.

SECTION R507
EXTERIOR DECKS

Deleted. See Chapter 47

~~**R507.1 Decks.** Wood-framed decks shall be in accordance with this section. **Decks shall be designed for the** *live load* **required in Section R301.5 or the ground snow load indicated in Table R301.2, whichever is greater.** For decks using materials and conditions not prescribed in this section, refer to Section R301.~~

~~**R507.2 Materials.** Materials used for the construction of decks shall comply with this section.~~

~~**R507.2.1 Wood materials.** Wood materials shall be No. 2 grade or better lumber, preservative-treated in accordance with Section R317, or *approved*, naturally durable lumber, and termite protected where required in accordance with Section R318. Where design in accordance with Section R301 is provided, wood structural members shall be designed using the wet service factor defined in AWC NDS. Cuts, notches and drilled holes of preservative treated wood members shall be treated in accordance with Section R317.1.1. All preservative treated wood products in contact with the ground shall be *labeled* for such usage.~~

~~**R507.2.1.1 Engineered wood products.** Engineered wood products shall be in accordance with Section R502.~~

~~**R507.2.2 Plastic composite deck boards, stair treads, guards or handrails.** *Plastic composite* exterior deck boards, stair treads, *guards* and *handrails* shall comply with the requirements of ASTM D7032 and this section.~~

~~**R507.2.2.1 Labeling.** *Plastic composite* deck boards and stair treads, or their packaging, shall bear a *label* that indicates compliance with ASTM D7032 and includes the allowable load and maximum allowable span determined in accordance with ASTM D7032. Plastic or composite *handrails* and *guards*, or their packaging, shall bear a *label* that indicates compliance with ASTM D7032 and includes the maximum allowable span determined in accordance with ASTM D7032.~~

~~**R507.2.2.2 Flame spread index.** *Plastic composite* deck boards, stair treads, *guards*, and *handrails* shall exhibit a flame spread index not exceeding 200 when tested in accordance with ASTM E84 or UL 723 with the test specimen remaining in place during the test.~~

~~**Exception:** *Plastic composites* determined to be noncombustible.~~

~~**R507.2.2.3 Decay resistance.** *Plastic composite* deck boards, stair treads, *guards* and *handrails* containing wood, cellulosic or other biodegradable materials shall be decay resistant in accordance with ASTM D7032.~~

~~**R507.2.2.4 Termite resistance.** Where required by Section 318, *plastic composite* deck boards, stair treads, *guards* and *handrails* containing wood, cellulosic or other biodegradable materials shall be termite resistant in accordance with ASTM D7032.~~

~~**R507.2.2.5 Installation of plastic composites.** *Plastic composite* deck boards, stair treads, *guards* and *handrails* shall be installed in accordance with this code and the manufacturer's instructions.~~

~~**R507.2.3 Fasteners and connectors.** Metal fasteners and connectors used for all decks shall be in accordance with Section R317.3 and Table R507.2.3.~~

~~**TABLE R507.2.3**~~

~~**FASTENER AND CONNECTOR SPECIFICATIONS FOR DECKS[a, b]**~~

~~ITEM~~	~~MATERIAL~~	~~MINIMUM FINISH/COATING~~	~~ALTERNATE FINISH/COATING[c]~~
~~Nails and **glulam** rivets~~	~~In accordance with ASTM F1667~~	~~Hot-dipped galvanized per ASTM A153**, Class D for** $^3/_8$**-inch diameter and less**~~	~~Stainless steel, silicon bronze or copper~~

~~Bolts~~[e]	~~In accordance with ASTM A307 (bolts), ASTM A563 (nuts), ASTM F844 (washers)~~	~~Hot-dipped galvanized per ASTM A153, Class C (Class D for $^3/_8$-inch diameter and less) or mechanically galvanized per ASTM B695, Class 55 or 410 stainless steel~~	~~Stainless steel, silicon bronze or copper~~
~~Lag screws~~[d] ~~(including nuts and washers)~~			
~~Metal connectors~~	~~Per manufacturer's specification~~	~~ASTM A653 type G185 zinc-coated galvanized steel or post hot-dipped galvanized per ASTM A123 providing a minimum average coating weight of 2.0 oz./ft² (total both sides)~~	~~Stainless steel~~

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

~~a. Equivalent materials, coatings and finishes shall be permitted.~~

~~b. Fasteners and connectors exposed to salt water or located within 300 feet of a salt water shoreline shall be stainless steel.~~

~~c. Holes for bolts shall be drilled a minimum $^1/_{32}$ inch and a maximum $^1/_{16}$ inch larger than the bolt.~~

~~d. Lag screws $^1/_2$ inch and larger shall be predrilled to avoid wood splitting per the *National Design Specification (NDS) for Wood Construction*.~~

~~e. Stainless-steel-driven fasteners shall be in accordance with ASTM F1667.~~

~~**R507.2.4 Flashing.** Flashing shall be corrosion-resistant metal of nominal thickness not less than 0.019 inch (0.48 mm) or *approved* nonmetallic material that is compatible with the substrate of the structure and the decking materials.~~

~~**R507.2.5 Alternate materials.** Alternative materials, including glass and metals, shall be permitted.~~

~~**R507.3 Footings.** Decks shall be supported on concrete footings or other *approved* structural systems designed to accommodate all loads in accordance with Section R301. Deck footings shall be sized to carry the imposed loads from the deck structure to the ground as shown in Figure R507.3.~~

~~**Exceptions:**~~

1. ~~**Footings shall not be required for free-standing** decks consisting of joists directly supported on grade over their entire length.~~
2. ~~**Footings shall not be required for free-standing decks that meet all of the following criteria:**~~

~~2.1. The joists bear directly on **precast concrete** pier blocks at grade without support by beams or posts.~~

~~2.2. The area of the deck does not exceed 200 square feet (18.6 m²).~~

~~**2.3. The walking surface is not more than 20 inches (508 mm) above grade at any point within 36 inches (914 mm) measured horizontally from the edge.**~~

~~**R507.3.1 Minimum size.** The minimum size of concrete footings shall be in accordance with Table R507.3.1, based on the tributary area and allowable soil-bearing pressure in accordance with Table R401.4.1.~~

~~TABLE R507.3.1~~

~~MINIMUM FOOTING SIZE FOR DECKS~~

~~LIVE OR GROUND SNOW LOAD~~[b] ~~(psf)~~	~~TRIBUTARY AREA (ft²)~~	~~LOAD-BEARING VALUE OF SOILS~~[a, c, d] ~~(psf)~~								
		~~1,500~~[e]			~~2,000~~[e]			~~≥ 3,000~~[e]		
		~~Side of a square footing (inches)~~	~~Diameter of a round footing (inches)~~	~~Thickness (inches)~~[f]	~~Side of a square footing (inches)~~	~~Diameter of a round footing (inches)~~	~~Thickness (inches)~~[f]	~~Side of a square footing (inches)~~	~~Diameter of a round footing (inches)~~	~~Thickness (inches)~~[f]
~~40~~	~~**5**~~	~~7~~	~~8~~	~~6~~	~~7~~	~~8~~	~~6~~	~~7~~	~~8~~	~~6~~
	~~20~~	~~**10**~~	~~12~~	~~6~~	~~9~~	~~9~~	~~6~~	~~7~~	~~8~~	~~6~~
	~~40~~	~~14~~	~~16~~	~~6~~	~~12~~	~~14~~	~~6~~	~~10~~	~~12~~	~~6~~
	~~60~~	~~17~~	~~19~~	~~6~~	~~15~~	~~17~~	~~6~~	~~12~~	~~14~~	~~6~~
	~~80~~	~~20~~	~~22~~	~~7~~	~~17~~	~~19~~	~~6~~	~~14~~	~~16~~	~~6~~

	~~100~~	~~22~~	~~25~~	~~8~~	~~19~~	~~21~~	~~6~~	~~15~~	~~17~~	~~6~~
	~~120~~	~~24~~	~~27~~	~~9~~	~~21~~	~~23~~	~~7~~	~~17~~	~~19~~	~~6~~
	~~140~~	~~26~~	~~29~~	~~10~~	~~22~~	~~25~~	~~8~~	~~18~~	~~21~~	~~6~~
	~~160~~	~~28~~	~~31~~	~~11~~	~~24~~	~~27~~	~~9~~	~~20~~	~~22~~	~~7~~
~~50~~	**~~5~~**	~~7~~	~~8~~	~~6~~	~~7~~	~~8~~	~~6~~	~~7~~	~~8~~	~~6~~
	~~20~~	**~~11~~**	~~13~~	~~6~~	~~10~~	~~11~~	~~6~~	~~8~~	~~9~~	~~6~~
	~~40~~	~~15~~	~~17~~	~~6~~	~~13~~	~~15~~	~~6~~	~~11~~	~~13~~	~~6~~
	~~60~~	~~19~~	~~21~~	~~6~~	~~16~~	~~18~~	~~6~~	~~13~~	~~15~~	~~6~~
	~~80~~	~~21~~	~~24~~	~~8~~	~~19~~	~~21~~	~~6~~	~~15~~	~~17~~	~~6~~
	~~100~~	~~24~~	~~27~~	~~9~~	~~21~~	~~23~~	~~7~~	~~17~~	~~19~~	~~6~~
	~~120~~	~~26~~	~~30~~	~~10~~	~~23~~	~~26~~	~~8~~	~~19~~	~~21~~	~~6~~
	~~140~~	~~28~~	~~32~~	~~11~~	~~25~~	~~28~~	~~9~~	~~20~~	~~23~~	~~7~~
	~~160~~	~~30~~	~~34~~	~~12~~	~~26~~	~~30~~	~~10~~	~~21~~	~~24~~	~~8~~
~~60~~	**~~5~~**	~~7~~	~~8~~	~~6~~	~~7~~	~~8~~	~~6~~	~~7~~	~~8~~	~~6~~
	~~20~~	~~12~~	~~14~~	~~6~~	**~~11~~**	~~12~~	~~6~~	~~9~~	~~10~~	~~6~~
	~~40~~	~~16~~	~~19~~	~~6~~	~~14~~	~~16~~	~~8~~	~~12~~	~~14~~	~~6~~
	~~60~~	~~20~~	~~23~~	~~7~~	~~17~~	~~20~~	~~6~~	~~14~~	~~16~~	~~6~~
	~~80~~	~~23~~	~~26~~	~~9~~	~~20~~	~~23~~	~~7~~	~~16~~	~~19~~	~~6~~
	~~100~~	~~26~~	~~29~~	~~10~~	~~22~~	~~25~~	~~8~~	~~18~~	~~21~~	~~6~~
	~~120~~	~~28~~	~~32~~	~~11~~	~~25~~	~~28~~	~~9~~	~~20~~	~~23~~	~~7~~
	~~140~~	~~31~~	~~35~~	~~12~~	~~27~~	~~30~~	~~10~~	~~22~~	~~24~~	~~8~~
	~~160~~	~~33~~	~~37~~	~~13~~	~~28~~	~~32~~	~~11~~	~~23~~	~~26~~	~~9~~
~~70~~	**~~5~~**	~~7~~	~~8~~	~~6~~	~~7~~	~~8~~	~~6~~	~~7~~	~~8~~	~~6~~
	~~20~~	~~12~~	~~14~~	~~6~~	~~11~~	~~13~~	~~6~~	~~9~~	~~10~~	~~6~~
	~~40~~	~~18~~	~~20~~	~~6~~	~~15~~	~~17~~	~~6~~	~~12~~	~~14~~	~~6~~
	~~60~~	~~21~~	~~24~~	~~8~~	~~19~~	~~21~~	~~6~~	~~15~~	~~17~~	~~6~~
	~~80~~	~~25~~	~~28~~	~~9~~	~~21~~	~~24~~	~~8~~	~~18~~	~~20~~	~~6~~
	~~100~~	~~28~~	~~31~~	~~11~~	~~24~~	~~27~~	~~9~~	~~20~~	~~22~~	~~7~~
	~~120~~	~~30~~	~~34~~	~~12~~	~~26~~	~~30~~	~~10~~	~~21~~	~~24~~	~~8~~
	~~140~~	~~33~~	~~37~~	~~13~~	~~28~~	~~32~~	~~11~~	~~23~~	~~26~~	~~9~~
	~~160~~	~~35~~	~~40~~	~~15~~	~~30~~	~~34~~	~~12~~	~~25~~	~~28~~	~~9~~

~~For SI: 1 inch = 25.4 mm, 1 square foot = 0.0929 m^2, 1 pound per square foot = 0.0479 kPa.~~

~~a. Interpolation permitted, extrapolation not permitted.~~

~~b. Based on highest load case: Dead + Live or Dead + Snow.~~

~~c. Footing dimensions shall allow complete bearing of the post.~~

~~d. If the support is a brick or CMU pier, the footing shall have a minimum 2-inch projection on all sides.~~
~~e. Area, in square feet, of deck surface supported by post and footings.~~
~~f. Minimum thickness shall only apply to plain concrete footings.~~

~~**R507.3.2 Minimum depth. Deck footings shall be placed not less than 12 inches (305 mm) below the undisturbed ground surface.**~~

~~*R507.3.3 Frost protection.* **Where decks are attached to a frost-protected structure, deck footings shall be protected from frost by one or more of the following methods:**~~

~~1. Extending below the frost line specified in Table R301.2.~~

~~2. Erecting on solid rock.~~

~~**3. Other *approved* methods of frost protection.**~~

~~**R507.4 Deck posts.** For single-level decks, **wood** post size shall be in accordance with Table R507.4.~~

~~***TABLE R507.4***~~
~~***DECK POST HEIGHT***~~

~~LOADS (psf)[b]~~	~~POST SPECIES[c]~~	~~POST SIZE[d]~~	~~TRIBUTARY AREA (ft^2)[g, h]~~							
			~~20~~	~~40~~	~~60~~	~~80~~	~~100~~	~~120~~	~~140~~	~~160~~
			~~MAXIMUM DECK POST HEIGHT[a] (feet-inches)~~							
~~40 live load~~	~~Southern pine~~	~~4 × 4~~	~~14-0~~	~~13-8~~	~~11-0~~	~~9-5~~	~~8-4~~	~~7-5~~	~~6-9~~	~~6-2~~
		~~4 × 6~~	~~14-0~~	~~14-0~~	~~13-11~~	~~12-0~~	~~10-8~~	~~9-8~~	~~8-10~~	~~8-2~~
		~~6 × 6~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~
		~~8 × 8~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~
	~~Douglas fir[e]~~ ~~Hem-fir[e]~~ ~~Spruce-pine-fir[e]~~	~~4 × 4~~	~~14-0~~	~~13-6~~	~~10-10~~	~~9-3~~	~~8-0~~	~~7-0~~	~~6-2~~	~~5-3~~
		~~4 × 6~~	~~14-0~~	~~14-0~~	~~13-10~~	~~11-10~~	~~10-6~~	~~9-5~~	~~8-7~~	~~7-10~~
		~~6 × 6~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~
		~~8 × 8~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~
	~~Redwood[f]~~ ~~Western cedars[f]~~ ~~Ponderosa pine[f]~~ ~~Red pine[f]~~	~~4 × 4~~	~~14-0~~	~~13-2~~	~~10-3~~	~~8-1~~	~~5-8~~	~~NP~~	~~NP~~	~~NP~~
		~~4 × 6~~	~~14-0~~	~~14-0~~	~~13-6~~	~~11-4~~	~~9-9~~	~~8-4~~	~~6-9~~	~~4-7~~
		~~6 × 6~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~13-7~~	~~9-7~~
		~~8 × 8~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~
~~50 ground snow load~~	~~Southern pine~~	~~4 × 4~~	~~14-0~~	~~12-2~~	~~9-10~~	~~8-5~~	~~7-5~~	~~6-7~~	~~5-11~~	~~5-4~~
		~~4 × 6~~	~~14-0~~	~~14-0~~	~~12-6~~	~~10-9~~	~~9-6~~	~~8-7~~	~~7-10~~	~~7-3~~
		~~6 × 6~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~13-4~~
		~~8 × 8~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~
	~~Douglas fir[e]~~ ~~Hem-fir[e]~~ ~~Spruce-pine-fir[e]~~	~~4 × 4~~	~~14-0~~	~~12-1~~	~~9-8~~	~~8-2~~	~~7-1~~	~~6-2~~	~~5-3~~	~~**4-2**~~
		~~4 × 6~~	~~14-0~~	~~14-0~~	~~12-4~~	~~10-7~~	~~9-4~~	~~8-4~~	~~7-7~~	~~6-11~~
		~~6 × 6~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~12-10~~
		~~8 × 8~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~

	~~Redwood~~[f] ~~Western cedars~~[f] ~~Ponderosa pine~~[f] ~~Red pine~~[f]	~~4 × 4~~	~~14-0~~	~~11-8~~	~~9-0~~	~~6-10~~	~~3-7~~	~~NP~~	~~NP~~	~~NP~~
		~~4 × 6~~	~~14-0~~	~~14-0~~	~~12-0~~	~~10-0~~	~~8-6~~	~~7-0~~	~~5-3~~	~~NP~~
		~~6 × 6~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~10-8~~	~~2-4~~
		~~8 × 8~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~
~~60 ground snow load~~	~~Southern pine~~	~~4 × 4~~	~~14-0~~	~~11-1~~	~~8-11~~	~~7-7~~	~~6-7~~	~~5-10~~	~~5-2~~	~~4-6~~
		~~4 × 6~~	~~14-0~~	~~14-0~~	~~11-4~~	~~9-9~~	~~8-7~~	~~7-9~~	~~7-1~~	~~6-6~~
		~~6 × 6~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~12-9~~	~~11-2~~
		~~8 × 8~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~
	~~Douglas fir~~[e] ~~Hem-fir~~[e] ~~Spruce-pine-fir~~[e]	~~4 × 4~~	~~14-0~~	~~10-11~~	~~8-8~~	~~7-3~~	~~6-2~~	~~5-0~~	~~3-7~~	~~NP~~
		~~4 × 6~~	~~14-0~~	~~13-11~~	~~11-2~~	~~9-7~~	~~8-4~~	~~7-5~~	~~6-8~~	~~5-11~~
		~~6 × 6~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~12-2~~	~~10-2~~
		~~8 × 8~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~
	~~Redwood~~[f] ~~Western cedars~~[f] ~~Ponderosa pine~~[f] ~~Red pine~~[f]	~~4 × 4~~	~~14-0~~	~~10-6~~	~~7-9~~	~~4-7~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~
		~~4 × 6~~	~~14-0~~	~~13-7~~	~~10-9~~	~~8-9~~	~~7-0~~	~~4-9~~	~~NP~~	~~NP~~
		~~6 × 6~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~9-9~~	~~NP~~	~~NP~~
		~~8 × 8~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~

~~*(continued)*~~

~~*TABLE R507.4—continued*~~

~~*DECK POST HEIGHT*~~

~~LOADS (psf)~~[b]	~~POST SPECIES~~[c]	~~POST SIZE~~[d]	~~TRIBUTARY AREA (ft²)~~[g, h]							
			~~20~~	~~40~~	~~60~~	~~80~~	~~100~~	~~120~~	~~140~~	~~160~~
			~~MAXIMUM DECK POST HEIGHT~~[a] ~~(feet-inches)~~							
~~70 ground snow load~~	~~Southern pine~~	~~4 × 4~~	~~14-0~~	~~10-2~~	~~8-2~~	~~6-11~~	~~5-11~~	~~5-2~~	~~4-4~~	~~3-4~~
		~~4 × 6~~	~~14-0~~	~~12-11~~	~~10-5~~	~~8-11~~	~~7-10~~	~~7-1~~	~~6-5~~	~~5-10~~
		~~6 × 6~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~12-9~~	~~10-11~~	~~8-7~~
		~~8 × 8~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~
	~~Douglas fir~~[e] ~~Hem-fir~~[e] ~~Spruce-pine-fir~~[e]	~~4 × 4~~	~~14-0~~	~~10-1~~	~~7-11~~	~~6-6~~	~~5-3~~	~~3-7~~	~~NP~~	~~NP~~
		~~4 × 6~~	~~14-0~~	~~12-10~~	~~10-3~~	~~8-9~~	~~7-7~~	~~6-8~~	~~5-10~~	~~4-11~~
		~~6 × 6~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~12-2~~	~~9-9~~	~~5-9~~
		~~8 × 8~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~	~~14-0~~
	~~Redwood~~[f] ~~Western cedars~~[f]	~~4 × 4~~	~~14-0~~	~~9-5~~	~~6-5~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~
		~~4 × 6~~	~~14-0~~	~~12-6~~	~~9-8~~	~~7-7~~	~~5-3~~	~~NP~~	~~NP~~	~~NP~~

	Ponderosa pine[f] Red pine[f]	6 × 6	14-0	14-0	14-0	14-0	10-8	NP	NP	NP
		8 × 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.~~
~~NP = Not Permitted.~~
~~a. Measured from the underside of the beam to the top of footing or pier.~~
~~b. 10 psf dead load. Snow load not assumed to be concurrent with live load.~~
~~c. No. 2 grade, wet service factor included.~~
~~d. Notched deck posts shall be sized to accommodate beam size in accordance with Section R507.5.2.~~
~~e. Includes incising factor.~~
~~f. Incising factor not included.~~
~~g. Area, in square feet, of deck surface supported by post and footings.~~
~~h. Interpolation permitted. Extrapolation not permitted.~~

~~**R507.4.1 Deck post to deck footing connection.** Where posts bear on concrete footings in accordance with Section R403 and Figure R507.3, lateral restraint shall be provided by manufactured connectors or a minimum post embedment of 12 inches (305 mm) in surrounding soils or concrete piers. Other footing systems shall be permitted.~~

~~**Exception:** Where expansive, compressible, shifting or other questionable soils are present, surrounding soils shall not be relied on for lateral support.~~

~~**R507.5 Deck beams.** Maximum allowable spans for wood deck beams, as shown in Figure R507.5, shall be in accordance with **Tables R507.5(1) through R507.5(4)**. Beam plies shall be fastened **together** with two rows of 10d (3-inch × 0.128-inch) nails minimum at 16 inches (406 mm) on center along each edge. Beams shall be permitted to cantilever at each end up to one fourth of the **actual** beam span. Deck beams of other materials shall be permitted where designed in accordance with accepted engineering practices.~~

~~TABLE R507.5(1)~~

~~*MAXIMUM* DECK BEAM SPAN—*40 PSF LIVE LOAD*[c]~~

BEAM SPECIES[d]	BEAM SIZE[e]	EFFECTIVE DECK JOIST SPAN LENGTH[a, i, j] (feet)						
		6	8	10	12	14	16	18
		MAXIMUM DECK BEAM SPAN LENGTH (feet-inches)[a, b, f]						
Southern pine	1-2 × 6	4-7	4-0	3-7	3-3	3-0	2-10	2-8
	1-2 × 8	5-11	5-1	4-7	4-2	3-10	3-7	3-5
	1-2 × 10	7-0	6-0	5-5	4-11	4-7	4-3	4-0
	1-2 × 12	8-3	7-1	6-4	5-10	5-5	5-0	4-9
	2-2 × 6	6-11	5-11	5-4	4-10	4-6	4-3	4-0
	2-2 × 8	8-9	7-7	6-9	6-2	5-9	5-4	5-0
	2-2 × 10	10-4	9-0	8-0	7-4	6-9	6-4	6-0
	2-2 × 12	12-2	10-7	9-5	8-7	8-0	7-5	7-0
	3-2 × 6	8-6	7-5	6-8	6-1	5-8	5-3	4-11
	3-2 × 8	10-11	9-6	8-6	7-9	7-2	6-8	6-4
	3-2 × 10	13-0	11-2	10-0	9-2	8-6	7-11	7-6
	3-2 × 12	15-3	13-3	11-10	10-9	10-0	9-4	8-10
Douglas fir-larch[g] Hem-fir[g] Spruce-pine-fir	1-2 x 6	4-1	3-6	3-0	2-8	2-5	2-3	2-1
	1-2 × 8	5-6	4-8	4-0	3-6	3-2	2-11	2-9
	1-2 × 10	6-8	5-10	5-1	4-6	4-1	3-9	3-6

	1-2 × 12	7-9	6-9	6-0	5-6	5-0	3-9	3-6
	2-2 × 6	6-1	5-3	4-9	4-4	3-11	3-7	3-3
	2-2 × 8	8-2	7-1	6-4	5-9	5-2	4-8	4-4
	2-2 × 10	10-0	8-7	7-9	7-0	6-6	6-0	5-6
	2-2 × 12	11-7	10-0	8-11	8-2	7-7	7-1	6-8
	3-2 × 6	7-8	6-8	6-0	5-6	5-1	4-9	4-6
	3-2 × 8	10-3	8-10	7-11	7-3	6-8	6-3	5-11
	3-2 × 10	12-6	10-10	9-8	8-10	8-2	7-8	7-2
	3-2 × 12	14-6	12-7	11-3	10-3	9-6	8-11	8-5
Redwood[h] Western cedars[h] Ponderosa pine[h] Red pine[h]	1-2 × 6	4-2	3-7	3-1	2-9	2-6	2-3	2-2
	1-2 × 8	5-4	4-7	4-1	3-7	3-3	3-0	2-10
	1-2 × 10	6-6	5-7	5-0	4-7	4-2	3-10	3-7
	1-2 × 12	7-6	6-6	5-10	5-4	4-11	4-7	4-4
	2-2 × 6	6-2	5-4	4-10	4-5	4-0	3-8	3-4
	2-2 × 8	7-10	6-10	6-1	5-7	5-2	4-10	4-5
	2-2 × 10	9-7	8-4	7-5	6-9	6-3	5-10	5-6
	2-2 × 12	11-1	9-8	8-7	7-10	7-3	6-10	6-5
	3-2 × 6	7-8	6-9	6-0	5-6	5-1	4-9	4-6
	3-2 × 8	9-10	8-6	7-7	6-11	6-5	6-0	5-8
	3-2 × 10	12-0	10-5	9-4	8-6	7-10	7-4	6-11
	3-2 × 12	13-11	12-1	10-9	9-10	9-1	8-6	8-1

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound = 0.454 kg.~~

~~**a. Interpolation permitted. Extrapolation not permitted.**~~

~~b. Beams supporting a single span of joists with or without cantilever.~~

~~c. Dead load = 10 psf, L/Δ = 360 at main span, L/Δ = 180 at cantilever. **Snow load is not assumed to be concurrent with live load.**~~

~~d. No. 2 grade, wet service factor **included**.~~

~~e. Beam depth shall be **equal to or** greater than **the depth of intersecting joist for** a flush beam **connection**.~~

~~f. Beam cantilevers are limited to the adjacent beam's span divided by 4.~~

~~g. Includes incising factor.~~

~~h. Incising factor not included.~~

~~i. **Deck joist span as shown in Figure R507.5.**~~

~~j. For calculation of effective deck joist span, the actual joist span length shall be multiplied by the joist span factor in accordance with Table R507.5(5).~~

~~TABLE R507.5(2)~~

~~MAXIMUM DECK BEAM SPAN—50 PSF GROUND SNOW LOAD[c]~~

BEAM SPECIES[d]	BEAM SIZE[e]	EFFECTIVE DECK JOIST SPAN LENGTH (feet)[a, i, j]						
		6	8	10	12	14	16	18
		MAXIMUM DECK BEAM SPAN LENGTH (feet-inches)[a, b, f]						
Southern pine	1-2 × 6	4-6	3-11	3-6	3-2	2-11	2-9	2-7
	1-2 × 8	5-9	4-11	4-5	4-0	3-9	3-6	3-3

	~~1 - 2 × 10~~	~~6-9~~	~~5-10~~	~~5-3~~	~~4-9~~	~~4-5~~	~~4-2~~	~~3-11~~
	~~1 - 2 × 12~~	~~8-0~~	~~6-11~~	~~6-2~~	~~5-8~~	~~5-3~~	~~4-11~~	~~4-7~~
	~~2 - 2 × 6~~	~~6-8~~	~~5-9~~	~~5-2~~	~~4-9~~	~~4-4~~	~~4-1~~	~~3-10~~
	~~2 - 2 × 8~~	~~8-6~~	~~7-4~~	~~6-7~~	~~6-0~~	~~5-7~~	~~5-2~~	~~4-11~~
	~~2 - 2 × 10~~	~~10-1~~	~~8-9~~	~~7-10~~	~~7-1~~	~~6-7~~	~~6-2~~	~~5-10~~
	~~2 - 2 × 12~~	~~11-11~~	~~10-3~~	~~9-2~~	~~8-5~~	~~7-9~~	~~7-3~~	~~6-10~~
	~~3 - 2 × 6~~	~~7-11~~	~~7-2~~	~~6-6~~	~~5-11~~	~~5-6~~	~~5-1~~	~~4-10~~
	~~3 - 2 × 8~~	~~10-5~~	~~9-3~~	~~8-3~~	~~7-6~~	~~6-11~~	~~6-6~~	~~6-2~~
	~~3 - 2 × 10~~	~~12-8~~	~~10-11~~	~~9-9~~	~~8-11~~	~~8-3~~	~~7-9~~	~~7-3~~
	~~3 - 2 × 12~~	~~14-11~~	~~12-11~~	~~11-6~~	~~10-6~~	~~9-9~~	~~9-1~~	~~8-7~~
~~Douglas fir-larch~~[g] ~~Hem-fir~~[g] ~~Spruce-pine-fir~~[g]	~~1 - 2 × 6~~	~~4-0~~	~~3-5~~	~~2-11~~	~~2-7~~	~~2-4~~	~~2-2~~	~~2-0~~
	~~1 - 2 × 8~~	~~5-4~~	~~4-7~~	~~3-11~~	~~3-5~~	~~3-1~~	~~2-10~~	~~2-8~~
	~~1 - 2 × 10~~	~~6-7~~	~~5-8~~	~~4-11~~	~~4-5~~	~~4-0~~	~~3-8~~	~~3-5~~
	~~1 - 2 × 12~~	~~7-7~~	~~6-7~~	~~5-11~~	~~5-4~~	~~4-10~~	~~4-6~~	~~4-2~~
	~~2 - 2 × 6~~	~~6-0~~	~~5-2~~	~~4-7~~	~~4-2~~	~~3-10~~	~~3-5~~	~~3-2~~
	~~2 - 2 × 8~~	~~8-0~~	~~6-11~~	~~6-2~~	~~5-8~~	~~5-0~~	~~4-7~~	~~4-2~~
	~~2 - 2 × 10~~	~~9-9~~	~~8-5~~	~~7-7~~	~~6-11~~	~~6-4~~	~~5-10~~	~~5-4~~
	~~2 - 2 × 12~~	~~11-4~~	~~9-10~~	~~8-9~~	~~8-0~~	~~7-5~~	~~6-11~~	~~6-6~~
	~~3 - 2 × 6~~	~~7-6~~	~~6-6~~	~~5-9~~	~~5-3~~	~~4-11~~	~~4-7~~	~~4-4~~
	~~3 - 2 × 8~~	~~10-0~~	~~8-8~~	~~7-9~~	~~7-1~~	~~6-6~~	~~6-1~~	~~5-8~~
	~~3 - 2 × 10~~	~~12-3~~	~~10-7~~	~~9-6~~	~~8-8~~	~~8-0~~	~~7-6~~	~~7-0~~
	~~3 - 2 × 12~~	~~14-3~~	~~12-4~~	~~11-0~~	~~10-1~~	~~9-4~~	~~8-9~~	~~8-3~~
~~Redwood~~[h] ~~Western cedars~~[h] ~~Ponderosa pine~~[h] ~~Red pine~~[h]	~~1 - 2 × 6~~	~~4-1~~	~~3-6~~	~~3-0~~	~~2-8~~	~~2-5~~	~~2-3~~	~~2-1~~
	~~1 - 2 × 8~~	~~5-2~~	~~4-6~~	~~4-0~~	~~3-6~~	~~3-2~~	~~2-11~~	~~2-9~~
	~~1 - 2 × 10~~	~~6-4~~	~~5-6~~	~~4-11~~	~~4-6~~	~~4-1~~	~~3-9~~	~~3-6~~
	~~1 - 2 × 12~~	~~7-4~~	~~6-4~~	~~5-8~~	~~5-2~~	~~4-10~~	~~4-6~~	~~4-3~~
	~~2 - 2 × 6~~	~~6-1~~	~~5-3~~	~~4-8~~	~~4-4~~	~~3-11~~	~~3-6~~	~~3-3~~
	~~2 - 2 × 8~~	~~7-8~~	~~6-8~~	~~5-11~~	~~5-5~~	~~5-0~~	~~4-8~~	~~4-3~~
	~~2 - 2 × 10~~	~~9-5~~	~~8-2~~	~~7-3~~	~~6-8~~	~~6-2~~	~~5-9~~	~~5-5~~
	~~2 - 2 × 12~~	~~10-11~~	~~9-5~~	~~8-5~~	~~7-8~~	~~7-2~~	~~6-8~~	~~6-3~~
	~~3 - 2 × 6~~	~~7-1~~	~~6-5~~	~~5-11~~	~~5-5~~	~~5-0~~	~~4-8~~	~~4-5~~
	~~3 - 2 × 8~~	~~9-4~~	~~8-4~~	~~7-5~~	~~6-10~~	~~604~~	~~5-11~~	~~5-7~~
	~~3 - 2 × 10~~	~~11-9~~	~~10-2~~	~~9-1~~	~~8-4~~	~~7-8~~	~~7-2~~	~~6-9~~
	~~3 - 2 × 12~~	~~13-8~~	~~11-10~~	~~10-7~~	~~9-8~~	~~8-11~~	~~8-4~~	~~7-10~~

~~For SI: 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound = 0.454 kg.~~

~~a. Interpolation allowed. Extrapolation is not allowed.~~

~~b. Beams supporting a single span of joists with or without cantilever.~~

~~c. Dead load = 10 psf, L/Δ = 360 at main span, L/Δ = 180 at cantilever. Snow load not assumed to be concurrent with live load.~~
~~d. No. 2 grade, wet service factor included.~~
~~e. Beam depth shall be equal to or greater than the depth of intersecting joist for a flush beam connection.~~
~~f. Beam cantilevers are limited to the adjacent beam's span divided by 4.~~
~~g. Includes incising factor.~~
~~h. Incising factor not included.~~
~~i. Deck joist span as shown in Figure R507.5.~~
~~j. For calculation of effective deck joist span, the actual joist span length shall be multiplied by the joist span factor in accordance with Table R507.5(5).~~

~~TABLE R507.5(3)~~

~~MAXIMUM DECK BEAM SPAN—60 PSF GROUND SNOW LOAD[c]~~

~~BEAM SPECIES[d]~~	~~BEAM SIZE[e]~~	~~EFFECTIVE DECK JOIST SPAN LENGTH[a, i, j] (feet)~~						
		~~6~~	~~8~~	~~10~~	~~12~~	~~14~~	~~16~~	~~18~~
		~~MAXIMUM DECK BEAM SPAN LENGTH (feet-inches)[a, b, f]~~						
~~Southern pine~~	~~1-2 × 6~~	~~4-2~~	~~3-7~~	~~3-3~~	~~2-11~~	~~2-9~~	~~2-6~~	~~2-5~~
	~~1-2 × 8~~	~~5-3~~	~~4-7~~	~~4-1~~	~~3-9~~	~~3-5~~	~~3-3~~	~~3-0~~
	~~1-2 × 10~~	~~6-3~~	~~5-5~~	~~4-10~~	~~4-5~~	~~4-1~~	~~3-10~~	~~3-7~~
	~~1-2 × 12~~	~~7-5~~	~~6-5~~	~~5-9~~	~~5-3~~	~~4-10~~	~~4-6~~	~~4-3~~
	~~2-2 × 6~~	~~6-2~~	~~5-4~~	~~4-9~~	~~4-4~~	~~4-0~~	~~3-9~~	~~3-7~~
	~~2-2 × 8~~	~~7-10~~	~~6-10~~	~~6-1~~	~~5-7~~	~~5-2~~	~~4-10~~	~~4-6~~
	~~2-2 × 10~~	~~9-4~~	~~8-1~~	~~7-3~~	~~6-7~~	~~6-1~~	~~5-8~~	~~5-4~~
	~~2-2 × 12~~	~~11-0~~	~~9-6~~	~~8-6~~	~~7-9~~	~~7-2~~	~~6-9~~	~~6-4~~
	~~3-2 × 6~~	~~7-5~~	~~6-9~~	~~6-0~~	~~5-6~~	~~5-1~~	~~4-9~~	~~4-6~~
	~~3-2 × 8~~	~~9-9~~	~~8-6~~	~~7-8~~	~~6-11~~	~~6-5~~	~~6-0~~	~~5-8~~
	~~3-2 × 10~~	~~11-8~~	~~10-2~~	~~9-1~~	~~8-3~~	~~7-8~~	~~7-2~~	~~6-9~~
	~~3-2 × 12~~	~~13-9~~	~~11-11~~	~~10-8~~	~~9-9~~	~~9-0~~	~~8-5~~	~~7-11~~
~~Douglas fir-larch[g]~~ ~~Hem-fir[g]~~ ~~Spuce-pine-fir[g]~~	~~1-2 × 6~~	~~3-8~~	~~3-1~~	~~2-8~~	~~2-4~~	~~2-2~~	~~2-0~~	~~1-10~~
	~~1-2 × 8~~	~~5-0~~	~~4-1~~	~~3-6~~	~~3-1~~	~~2-10~~	~~2-7~~	~~2-5~~
	~~1-2 × 10~~	~~6-1~~	~~5-2~~	~~4-6~~	~~4-0~~	~~3-7~~	~~3-4~~	~~3-2~~
	~~1-2 × 12~~	~~7-1~~	~~6-1~~	~~5-5~~	~~4-10~~	~~4-5~~	~~4-1~~	~~3-10~~
	~~2-2 × 6~~	~~5-6~~	~~4-9~~	~~4-3~~	~~3-10~~	~~3-5~~	~~3-1~~	~~2-10~~
	~~2-2 × 8~~	~~7-5~~	~~6-5~~	~~5-9~~	~~5-0~~	~~4-6~~	~~4-1~~	~~3-9~~
	~~2-2 × 10~~	~~9-0~~	~~7-10~~	~~7-0~~	~~6-4~~	~~5-9~~	~~5-2~~	~~4-10~~
	~~2-2 × 12~~	~~10-6~~	~~9-1~~	~~8-1~~	~~7-5~~	~~6-10~~	~~6-4~~	~~5-10~~
	~~3-2 × 6~~	~~6-11~~	~~6-0~~	~~5-4~~	~~4-11~~	~~4-6~~	~~4-2~~	~~3-10~~
	~~3-2 × 8~~	~~9-3~~	~~8-0~~	~~7-2~~	~~6-6~~	~~6-1~~	~~5-6~~	~~5-0~~
	~~3-2 × 10~~	~~11-4~~	~~9-10~~	~~8-9~~	~~8-0~~	~~7-5~~	~~6-11~~	~~6-5~~
	~~3-2 × 12~~	~~13-2~~	~~11-5~~	~~10-2~~	~~9-4~~	~~8-7~~	~~8-1~~	~~7-7~~
~~Redwood[h]~~ ~~Western cedars[h]~~ ~~Ponderosa pine[h]~~ ~~Red pine[h]~~	~~1-2 × 6~~	~~3-9~~	~~3-2~~	~~2-9~~	~~2-5~~	~~2-2~~	~~2-0~~	~~1-11~~
	~~1-2 × 8~~	~~4-10~~	~~4-2~~	~~3-7~~	~~3-2~~	~~2-11~~	~~2-8~~	~~2-6~~
	~~1-2 × 10~~	~~5-10~~	~~5-1~~	~~4-6~~	~~4-1~~	~~3-8~~	~~3-5~~	~~3-3~~

	~~1—2 × 12~~	~~6-10~~	~~5-11~~	~~5-3~~	~~4-10~~	~~4-5~~	~~4-2~~	~~3-11~~
	~~2—2 × 6~~	~~5-7~~	~~4-10~~	~~4-4~~	~~3-11~~	~~3-6~~	~~3-2~~	~~2-11~~
	~~2—2 × 8~~	~~7-1~~	~~6-2~~	~~5-6~~	~~5-0~~	~~4-7~~	~~4-2~~	~~3-10~~
	~~2—2 × 10~~	~~8-8~~	~~7-6~~	~~6-9~~	~~6-2~~	~~5-8~~	~~5-4~~	~~4-11~~
	~~2—2 × 12~~	~~10-1~~	~~8-9~~	~~7-10~~	~~7-2~~	~~6-7~~	~~6-2~~	~~5-10~~
	~~3—2 × 6~~	~~6-8~~	~~6-1~~	~~5-5~~	~~5-0~~	~~4-7~~	~~4-3~~	~~3-11~~
	~~3—2 × 8~~	~~8-9~~	~~7-9~~	~~6-22~~	~~6-4~~	~~5-20~~	~~5-5~~	~~5-3~~
	~~3—2 × 10~~	~~10-11~~	~~9-5~~	~~8-5~~	~~7-8~~	~~7-3~~	~~6-8~~	~~6-3~~
	~~3—2 × 12~~	~~12-8~~	~~10-11~~	~~9-9~~	~~8-11~~	~~8-3~~	~~7-9~~	~~7-3~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound = 0.454 kg.~~

~~a. Interpolation allowed. Extrapolation is not allowed.~~

~~b. Beams supporting a single span of joists with or without cantilever.~~

~~c. Dead load = 10 psf, L/Δ = 360 at main span, L/Δ = 180 at cantilever. Snow load not assumed to be concurrent with live load.~~

~~d. No. 2 grade, wet service factor included.~~

~~e. Beam depth shall be equal to or greater than the depth of intersecting joist for a flush beam connection.~~

~~f. Beam cantilevers are limited to the adjacent beam's span divided by 4.~~

~~g. Includes incising factor.~~

~~h. Incising factor not included.~~

~~i. Deck joist span as shown in Figure R507.5.~~

~~j. For calculation of effective deck joist span, the actual joist span length shall be multiplied by the joist span factor in accordance with Table R507.5(5).~~

~~TABLE R507.5(4)~~

~~MAXIMUM DECK BEAM SPAN—70 PSF GROUND SNOW LOAD[e]~~

~~BEAM SPECIES[d]~~	~~BEAM SIZE[e]~~	~~EFFECTIVE DECK JOIST SPAN LENGTH (feet)[a, i, j]~~						
		~~6~~	~~8~~	~~10~~	~~12~~	~~14~~	~~16~~	~~18~~
		~~MAXIMUM DECK BEAM SPAN LENGTH (feet-inches)[a, b, f]~~						
~~Southern pine~~	~~1—2 × 6~~	~~3-11~~	~~3-4~~	~~3-0~~	~~2-9~~	~~2-6~~	~~2-4~~	~~2-3~~
	~~1—2 × 8~~	~~4-11~~	~~4-3~~	~~3-10~~	~~3-6~~	~~3-3~~	~~3-0~~	~~2-10~~
	~~1—2 × 10~~	~~5-10~~	~~5-1~~	~~4-6~~	~~4-2~~	~~3-10~~	~~3-7~~	~~3-4~~
	~~1—2 × 12~~	~~6-11~~	~~6-0~~	~~5-4~~	~~4-11~~	~~4-6~~	~~4-3~~	~~4-0~~
	~~2—2 × 6~~	~~5-9~~	~~5-0~~	~~4-6~~	~~4-1~~	~~3-9~~	~~3-6~~	~~3-4~~
	~~2—2 × 8~~	~~7-4~~	~~6-4~~	~~5-8~~	~~5-2~~	~~4-10~~	~~4-6~~	~~4-3~~
	~~2—2 × 10~~	~~8-9~~	~~7-7~~	~~6-9~~	~~6-2~~	~~5-8~~	~~5-4~~	~~5-0~~
	~~2—2 × 12~~	~~10-3~~	~~8-11~~	~~8-0~~	~~7-3~~	~~6-9~~	~~6-3~~	~~5-11~~
	~~3—2 × 6~~	~~7-0~~	~~6-3~~	~~5-7~~	~~5-1~~	~~4-9~~	~~4-5~~	~~4-2~~
	~~3—2 × 8~~	~~9-3~~	~~8-0~~	~~7-2~~	~~6-6~~	~~6-0~~	~~5-8~~	~~5-4~~
	~~3—2 × 10~~	~~10-11~~	~~9-6~~	~~8-6~~	~~7-9~~	~~7-2~~	~~6-8~~	~~6-4~~
	~~3—2 × 12~~	~~12-11~~	~~11-2~~	~~10-0~~	~~9-1~~	~~8-5~~	~~7-11~~	~~7-5~~
~~Douglas fir-larch[g]~~ ~~Hem-fir[g]~~ ~~Spruce-pine-fir[g]~~	~~1—2 × 6~~	~~3-5~~	~~2-10~~	~~2-5~~	~~2-2~~	~~2-0~~	~~1-10~~	~~1-9~~
	~~1—2 × 8~~	~~4-7~~	~~3-8~~	~~3-2~~	~~2-10~~	~~2-7~~	~~2-5~~	~~2-4~~
	~~1—2 × 10~~	~~5-8~~	~~4-9~~	~~4-1~~	~~3-8~~	~~3-4~~	~~3-1~~	~~2-11~~

	~~1 - 2 × 12~~	~~6-7~~	~~5-8~~	~~5-0~~	~~4-6~~	~~4-1~~	~~3-10~~	~~3-7~~
	~~2 - 2 × 6~~	~~5-2~~	~~4-6~~	~~4-0~~	~~3-5~~	~~3-1~~	~~2-10~~	~~2-7~~
	~~2 - 2 × 8~~	~~6-11~~	~~6-0~~	~~5-3~~	~~4-7~~	~~4-1~~	~~3-8~~	~~3-5~~
	~~2 - 2 × 10~~	~~8-5~~	~~7-4~~	~~6-6~~	~~5-10~~	~~5-2~~	~~4-9~~	~~4-5~~
	~~2 - 2 × 12~~	~~9-10~~	~~8-6~~	~~7-7~~	~~6-11~~	~~6-4~~	~~5-9~~	~~5-4~~
	~~3 - 2 × 6~~	~~6-6~~	~~5-7~~	~~5-0~~	~~4-7~~	~~4-2~~	~~3-9~~	~~3-5~~
	~~3 - 2 × 8~~	~~8-8~~	~~7-6~~	~~6-8~~	~~6-1~~	~~5-6~~	~~5-0~~	~~4-7~~
	~~3 - 2 × 10~~	~~10-7~~	~~9-2~~	~~8-2~~	~~7-6~~	~~6-11~~	~~6-4~~	~~5-10~~
	~~3 - 2 × 12~~	~~12-4~~	~~10-8~~	~~9-7~~	~~8-9~~	~~8-1~~	~~7-7~~	~~7-1~~
~~Redwood[h]~~ ~~Western cedars[h]~~ ~~Ponderosa pine[h]~~ ~~Red pine[h]~~	~~1 - 2 × 6~~	~~3-6~~	~~2-11~~	~~2-6~~	~~2-3~~	~~2-0~~	~~1-11~~	~~1-9~~
	~~1 - 2 × 8~~	~~4-6~~	~~3-10~~	~~3-3~~	~~2-11~~	~~2-8~~	~~2-6~~	~~2-4~~
	~~1 - 2 × 10~~	~~5-6~~	~~4-9~~	~~4-2~~	~~3-9~~	~~3-5~~	~~3-2~~	~~3-0~~
	~~1 - 2 × 12~~	~~6-4~~	~~5-6~~	~~4-11~~	~~4-6~~	~~4-2~~	~~3-11~~	~~3-8~~
	~~2 - 2 × 6~~	~~5-3~~	~~4-7~~	~~4-1~~	~~3-6~~	~~3-2~~	~~2-11~~	~~2-8~~
	~~2 - 2 × 8~~	~~6-8~~	~~5-9~~	~~5-2~~	~~4-8~~	~~4-2~~	~~3-10~~	~~3-6~~
	~~2 - 2 × 10~~	~~8-2~~	~~7-1~~	~~6-4~~	~~5-9~~	~~5-4~~	~~4-10~~	~~4-6~~
	~~2 - 2 × 12~~	~~9-5~~	~~8-2~~	~~7-4~~	~~6-8~~	~~6-2~~	~~5-9~~	~~5-5~~
	~~3 - 2 × 6~~	~~6-4~~	~~5-8~~	~~5-1~~	~~4-8~~	~~4-3~~	~~3-10~~	~~3-6~~
	~~3 - 2 × 8~~	~~8-4~~	~~7-3~~	~~6-5~~	~~5-11~~	~~5-5~~	~~5-1~~	~~4-8~~
	~~3 - 2 × 10~~	~~10-2~~	~~8-10~~	~~7-11~~	~~7-2~~	~~6-8~~	~~6-3~~	~~5-11~~
	~~3 - 2 × 12~~	~~11-10~~	~~10-3~~	~~9-2~~	~~8-4~~	~~7-9~~	~~7-3~~	~~6-10~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound = 0.454 kg.~~

~~a. Interpolation allowed. Extrapolation is not allowed.~~

~~b. Beams supporting a single span of joists with or without cantilever.~~

~~c. Dead load = 10 psf, *L*/Δ = 360 at main span, *L*/Δ = 180 at cantilever. Snow load not assumed to be concurrent with live load.~~

~~d. No. 2 grade, wet service factor included.~~

~~e. Beam depth shall be equal to or greater than the depth of intersecting joist for a flush beam connection.~~

~~f. Beam cantilevers are limited to the adjacent beam's span divided by 4.~~

~~g. Includes incising factor.~~

~~h. Incising factor not included.~~

~~i. Deck joist span as shown in Figure R507.5.~~

~~j. For calculation of effective deck joist span, the actual joist span length shall be multiplied by the joist span factor in accordance with Table R507.5(5).~~

~~TABLE R507.5(5)~~

~~JOIST SPAN FACTORS FOR CALCULATING EFFECTIVE DECK JOIST SPAN~~

~~[for use with Note j in Tables R507.5(1), R507.5(2), R507.5(3) and R507.5(4)]~~

~~C/J[a]~~	~~JOIST SPAN FACTOR~~
~~0 (no cantilever)~~	~~0.66~~
~~1/12 (0.87)~~	~~0.72~~
~~1/10 (0.10)~~	~~0.80~~
~~1/8 (0.125)~~	~~0.84~~

1/6 (0.167)	0.90
1/4 (0.250)	1.00

For SI:1 foot = 304.8 mm.

a. C = actual joist cantilever length (feet); J = actual joist span length (feet).

R507.5.1 Deck beam bearing. The ends of beams shall have not less than $1^1/_2$ inches (38 mm) of bearing on wood or metal and not less than 3 inches (76 mm) of bearing on concrete or masonry for the entire width of the beam. Where multiple-span beams bear on intermediate posts, each ply must have full bearing on the post in accordance with Figures R507.5.1(1) and R507.5.1(2).

R507.5.2 Deck beam connection to supports. Deck beams shall be attached to supports in a manner capable of transferring vertical loads and resisting horizontal displacement. Deck beam connections to wood posts shall be in accordance with Figures R507.5.1(1) and R507.5.1(2). Manufactured post to beam connectors shall be sized for the post and beam sizes. Bolts shall have washers under the head and nut.

R507.6 Deck joists. Maximum allowable spans for wood deck joists, as shown in Figure R507.6, shall be in accordance with Table R507.6. The maximum joist spacing shall be limited by the decking materials in accordance with Table R507.7.

TABLE R507.6
MAXIMUM DECK JOIST SPANS

LOAD[a] **(psf)**	**JOIST** SPECIES[b]	**JOIST** SIZE	ALLOWABLE JOIST SPAN[b, c] **(feet-inches)**			MAXIMUM CANTILEVER[d,f] **(feet-inches)**							
			Joist spacing (inches)			**Joist back span**[g] **(feet)**							
			12	16	24	**4**	**6**	**8**	**10**	12	**14**	16	**18**
40 live load	Southern pine	2 × 6	9-11	9-0	7-7	1-0	1-6	1-5	NP	NP	NP	NP	NP
		2 × 8	13-1	11-10	9-8	1-0	1-6	2-0	2-6	2-3	NP	NP	NP
		2 × 10	16-2	14-0	11-5	1-0	1-6	2-0	2-6	3-0	3-4	3-4	NP
		2 × 12	18-0	16-6	13-6	1-0	1-6	2-0	2-6	3-0	3-6	4-0	4-1
	Douglas fir-larch[e] Hem-fir[e] Spruce-pine-fir[e]	2 × 6	9-6	8-4	6-10	1-0	1-6	1-4	NP	NP	NP	NP	NP
		2 × 8	12-6	11-1	9-1	1-0	1-6	2-0	2-3	2-0	NP	NP	NP
		2 × 10	15-8	13-7	11-1	1-0	1-6	2-0	2-6	3-0	3-3	NP	NP
		2 × 12	18-0	15-9	12-10	1-0	1-6	2-0	2-6	3-0	3-6	3-11	**3-11**
	Redwood[f] Western cedars[f] Ponderosa pine[f] Red pine[f]	2 × 6	8-10	8-0	6-10	1-0	1-4	1-1	NP	NP	NP	NP	NP
		2 × 8	11-8	10-7	8-8	1-0	1-6	2-0	1-11	NP	NP	NP	NP
		2 × 10	14-11	13-0	10-7	1-0	1-6	2-0	2-6	3-0	2-9	NP	NP
		2 × 12	17-5	15-1	12-4	1-0	1-6	2-0	2-6	3-0	3-6	3-8	NP
50 ground snow load	Southern pine	2 × 6	9-2	8-4	7-4	1-0	1-6	1-5	NP	NP	NP	NP	NP
		2 × 8	12-1	11-0	9-5	1-0	1-6	2-0	2-5	2-3	NP	NP	NP
		2 × 10	15-5	13-9	11-3	1-0	1-6	2-0	2-6	3-0	3-1	NP	NP
		2 × 12	18-0	16-2	13-2	1-0	1-6	2-0	2-6	3-0	3-6	3-10	3-10

LOAD[a] (psf)	JOIST SPECIES[b]	JOIST SIZE	ALLOWABLE JOIST SPAN[b, c] (feet-inches) Joist spacing (inches) 12	16	24	MAXIMUM CANTILEVER[d,f] (feet-inches) Joist back span[g] (feet) 4	6	8	10	12	14	16	18
	Douglas fir-larch[e] Hem-fir[e] Spruce-pine-fir[e]	2 × 6	8-10	8-0	6-8	1-0	1-6	1-4	NP	NP	NP	NP	NP
		2 × 8	**11-7**	10-7	8-11	1-0	1-6	2-0	2-3	NP	NP	NP	NP
		2 × 10	14-10	13-3	10-10	1-0	1-6	2-0	2-6	3-0	3-0	NP	NP
		2 × 12	17-9	15-5	12-7	1-0	1-6	2-0	2-6	3-0	3-6	3-8	NP
	Redwood[f] Western cedars[f] Ponderosa pine[f] Red pine[f]	2 × 6	8-3	7-6	6-6	1-0	1-4	1-1	NP	NP	NP	NP	NP
		2 × 8	10-10	9-10	8-6	1-0	1-6	2-0	1-11	NP	NP	NP	NP
		2 × 10	13-10	12-7	10-5	1-0	1-6	2-0	2-6	2-9	NP	NP	NP
		2 × 12	16-10	14-9	12-1	1-0	1-6	2-0	2-6	3-0	3-5	3-5	NP
60 ground snow load	Southern pine	2 × 6	8-8	7-10	6-10	1-0	1-6	1-5	NP	NP	NP	NP	NP
		2 × 8	11-5	10-4	8-9	1-0	1-6	2-0	2-4	NP	NP	NP	NP
		2 × 10	14-7	12-9	10-5	1-0	1-6	2-0	2-6	2-11	2-11	NP	NP
		2 × 12	17-3	15-0	12-3	1-0	1-6	2-0	2-6	3-0	3-6	3-7	NP
	Douglas fir-larch[e] Hem-fir[e] Spruce-pine-fir[e]	2 × 6	8-4	7-6	6-2	1-0	1-6	1-4	NP	NP	NP	NP	NP
		2 × 8	10-11	9-11	8-3	1-0	1-6	2-0	2-2	NP	NP	NP	NP
		2 × 10	13-11	12-4	10-0	1-0	1-6	2-0	2-6	2-10	NP	NP	NP
		2 × 12	16-6	14-3	11-8	1-0	1-6	2-0	2-6	3-0	3-5	3-5	NP
	Redwood[f] Western cedars[f] Ponderosa pine[f] Red pine[f]	2 × 6	7-9	7-0	6-2	1-0	1-4	NP	NP	NP	NP	NP	NP
		2 × 8	10-2	9-3	7-11	1-0	1-6	2-0	1-11	NP	NP	NP	NP
		2 × 10	13-0	11-9	9-7	1-0	1-6	2-0	2-6	2-7	NP	NP	NP
		2 × 12	15-9	13-8	11-2	1-0	1-6	2-0	2-6	3-0	3-2	NP	NP

(continued)

TABLE R507.6—continued

MAXIMUM DECK JOIST SPANS

LOAD[a] (psf)	JOIST SPECIES[b]	JOIST SIZE	ALLOWABLE JOIST SPAN[b, c] (feet-inches) Joist spacing (inches) 12	16	24	MAXIMUM CANTILEVER[d,f] (feet-inches) Joist back span[g] (feet) 4	6	8	10	12	14	16	18
70 ground snow load	Southern pine	2 × 6	8-3	7-6	6-5	1-0	1-6	1-5	NP	NP	NP	NP	NP
		2 × 8	10-10	9-10	8-2	1-0	1-6	2-0	2-2	NP	NP	NP	NP
		2 × 10	13-9	11-11	9-9	1-0	1-6	2-0	2-6	2-9	NP	NP	NP
		2 × 12	16-2	14-0	11-5	1-0	1-6	2-0	2-6	3-0	3-5	3-5	NP
	Douglas fir-larch[e] Hem-fir[e]	2 × 6	7-11	7-1	5-9	1-0	1-6	NP	NP	NP	NP	NP	NP
		2 × 8	10-5	9-5	7-8	1-0	1-6	2-0	2-1	NP	NP	NP	NP

	Spruce-pine-fir[e]	2 × 10	13-3	11-6	9-5	1-0	1-6	2-0	2-6	2-8	NP	NP	NP
		2 × 12	15-5	13-4	10-11	1-0	1-6	2-0	2-6	3-0	3-3	NP	NP
	Redwood[f] Western cedars[f] Ponderosa pine[f] Red pine[f]	2 × 6	7-4	6-8	5-10	1-0	1-4	NP	NP	NP	NP	NP	NP
		2 × 8	9-8	8-10	7-4	1-0	1-6	1-11	NP	NP	NP	NP	NP
		2 × 10	12-4	11-0	9-0	1-0	1-6	2-0	2-6	2-6	NP	NP	NP
		2 × 12	14-9	12-9	10-5	1-0	1-6	2-0	2-6	3-0	3-0	NP	NP

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound = 0.454 kg.
NP = Not Permitted.
a. Dead load = 10 psf. Snow load not assumed to be concurrent with live load.
b. No. 2 grade, wet service factor **included**.
c. *L*/Δ = 360 **at main span**.
d. *L*/Δ = 180 at cantilever with a 220-pound point load applied to end.
e. Includes incising factor.
f. Incising factor **not included**.
g. Interpolation allowed. Extrapolation is not allowed.

R507.6.1 Deck joist bearing. The ends of joists shall have not less than 1$^{1}/_{2}$ inches (38 mm) of bearing on wood or metal and not less than 3 inches (76 mm) of bearing on concrete or masonry over its entire width. Joists bearing on top of a multiple-ply beam or ledger shall be fastened in accordance with Table R602.3(1). Joists bearing on top of a single-ply beam or ledger shall be attached by a mechanical connector. Joist framing into the side of a beam or ledger board shall be supported by *approved* joist hangers.

R507.6.2 Deck joist lateral restraint. Joist ends and bearing locations shall be provided with lateral resistance to prevent rotation. Where lateral restraint is provided by joist hangers or blocking between joists, their depth shall equal not less than 60 percent of the joist depth. Where lateral restraint is provided by rim joists, they shall be secured to the end of each joist with not fewer than three 10d (3-inch by 0.128-inch) (76 mm by 3.3 mm) nails or three No. 10 x 3-inch-long (76 mm) wood screws.

R507.7 Decking. Maximum allowable spacing for joists supporting **wood** decking, **excluding *stairways*,** shall be in accordance with Table R507.7. Wood decking shall be attached to each supporting member with not less than two 8d threaded nails or two No. 8 wood screws. **Maximum allowable spacing for joists supporting *plastic composite* decking shall be in accordance with Section R507.2.** Other *approved* decking or fastener systems shall be installed in accordance with the manufacturer's installation requirements.

TABLE R507.7
MAXIMUM JOIST SPACING FOR *WOOD* DECKING

DECKING MATERIAL TYPE AND NOMINAL SIZE	DECKING PERPENDICULAR TO JOIST		DECKING DIAGONAL TO JOIST[a]	
	Single span[c]	**Multiple span[c]**	**Single span[c]**	**Multiple span[c]**
	Maximum on-center joist spacing (inches)			
1$^{1}/_{4}$-inch-thick wood[b]	12	16	8	12
2-inch-thick wood	24	24	18	24

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 degree = 0.01745 rad.
a. Maximum angle of 45 degrees from perpendicular for wood deck boards.
b. Other maximum span provided by an accredited lumber grading or inspection agency also allowed.
c. Individual wood deck boards supported by two joists shall be considered single span and three or more joists shall be considered multiple span.

R507.8 Vertical and lateral supports. Where supported by attachment to an exterior wall, decks shall be positively anchored to the primary structure and designed for both vertical and lateral loads. Such attachment shall not be

~~accomplished by the use of toenails or nails subject to withdrawal. For decks with cantilevered framing members, connection to exterior walls or other framing members shall be designed and constructed to resist uplift resulting from the full *live load* specified in Table R301.5 acting on the cantilevered portion of the deck. Where positive connection to the primary building structure cannot be verified during inspection, decks shall be self-supporting.~~

~~**R507.9 Vertical and lateral supports at band joist.** Vertical and lateral supports for decks shall comply with this section.~~

~~**R507.9.1 Vertical supports.** Vertical loads shall be transferred to band joists with ledgers in accordance with this section.~~

~~**R507.9.1.1 Ledger details.** Deck ledgers shall be a minimum 2-inch by 8-inch (51 mm by 203 mm) nominal, pressure-preservative-treated Southern pine, incised pressure-preservative-treated hem-fir, or *approved*, naturally durable, No. 2 grade or better lumber. Deck ledgers shall not support concentrated loads from beams or girders. Deck ledgers shall not be supported on stone or masonry veneer.~~

~~**R507.9.1.2 Band joist details.** Band joists supporting a ledger shall be a minimum 2-inch nominal (51 mm), solid-sawn, spruce-pine-fir or better lumber or a minimum 1-inch (25 mm) **nominal engineered wood rim boards in accordance with Section R502.1.7**. Band joists shall bear fully on the primary structure capable of supporting all required loads.~~

~~**R507.9.1.3 Ledger to band joist details.** Fasteners used in deck ledger connections in accordance with Table R507.9.1.3(1) shall be hot-dipped galvanized or stainless steel and shall be installed in accordance with Table R507.9.1.3(2) and Figures R507.9.1.3(1) and R507.9.1.3(2).~~

~~TABLE R507.9.1.3(1)~~

~~DECK LEDGER CONNECTION TO BAND JOIST~~

~~LOAD[c] (psf)~~	~~JOIST SPAN[a] (feet)~~	~~ON-CENTER SPACING OF FASTENERS[b] (inches)~~		
		~~1/2-inch diameter lag screw with 1/2-inch maximum sheathing[d, e]~~	~~1/2-inch diameter bolt with 1/2-inch maximum sheathing[e]~~	~~1/2-inch diameter bolt with 1-inch maximum sheathing[f]~~
~~40 live load~~	~~6~~	~~30~~	~~36~~	~~36~~
	~~8~~	~~23~~	~~36~~	~~36~~
	~~10~~	~~18~~	~~34~~	~~29~~
	~~12~~	~~15~~	~~29~~	~~24~~
	~~14~~	~~13~~	~~24~~	~~21~~
	~~16~~	~~11~~	~~21~~	~~18~~
	~~18~~	~~10~~	~~19~~	~~16~~
~~50 ground snow load~~	~~6~~	~~29~~	~~36~~	~~36~~
	~~8~~	~~22~~	~~36~~	~~35~~
	~~10~~	~~17~~	~~33~~	~~28~~
	~~12~~	~~14~~	~~27~~	~~23~~
	~~14~~	~~12~~	~~23~~	~~20~~
	~~16~~	~~11~~	~~20~~	~~17~~
	~~18~~	~~9~~	~~18~~	~~15~~

	~~6~~	~~25~~	~~36~~	~~36~~
	~~8~~	~~18~~	~~35~~	~~30~~
	~~10~~	~~15~~	~~28~~	~~24~~
~~60 ground snow load~~	~~12~~	~~12~~	~~23~~	~~20~~
	~~14~~	~~10~~	~~20~~	~~17~~
	~~16~~	~~9~~	~~17~~	~~15~~
	~~18~~	~~8~~	~~15~~	~~13~~
	~~6~~	~~22~~	~~36~~	~~35~~
	~~8~~	~~16~~	~~31~~	~~26~~
	~~10~~	~~13~~	~~25~~	~~21~~
~~70 ground snow load~~	~~12~~	~~11~~	~~20~~	~~17~~
	~~14~~	~~9~~	~~17~~	~~15~~
	~~16~~	~~8~~	~~15~~	~~13~~
	~~18~~	~~7~~	~~13~~	~~11~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.~~

~~a. Interpolation permitted. Extrapolation is not permitted.~~

~~b. Ledgers shall be flashed in accordance with Section R703.4 to prevent water from contacting the house band joist.~~

~~c. Dead Load = 10 psf. Snow load shall not be assumed to act concurrently with live load.~~

~~d. The tip of the lag screw shall fully extend beyond the inside face of the band joist.~~

~~e. Sheathing shall be wood structural panel or solid sawn lumber.~~

~~f. Sheathing shall be permitted to be wood structural panel, gypsum board, fiberboard, lumber or foam sheathing. Up to $^1/_2$-inch thickness of stacked washers shall be permitted to substitute for up to $^1/_2$ inch of allowable sheathing thickness where combined with wood structural panel or lumber sheathing.~~

~~TABLE R507.9.1.3(2)~~

~~PLACEMENT OF LAG SCREWS AND BOLTS IN DECK LEDGERS AND BAND JOISTS~~

~~MINIMUM END AND EDGE DISTANCES AND SPACING BETWEEN ROWS~~				
	~~TOP EDGE~~	~~BOTTOM EDGE~~	~~ENDS~~	~~ROW SPACING~~
~~Ledger[a]~~	~~2 inches[d]~~	~~$^3/_4$ inch~~	~~2 inches[b]~~	~~$1^5/_8$ inches[b]~~
~~Band Joist[c]~~	~~$^3/_4$ inch~~	~~2 inches~~	~~2 inches[b]~~	~~$1^5/_8$ inches[b]~~

~~For SI: 1 inch = 25.4 mm.~~

~~a. Lag screws or bolts shall be staggered from the top to the bottom along the horizontal run of the deck ledger in accordance with Figure R507.9.1.3(1).~~

~~b. Maximum 5 inches.~~

~~c. For engineered rim joists, the manufacturer's recommendations shall govern.~~

~~d. The minimum distance from bottom row of lag screws or bolts to the top edge of the ledger shall be in accordance with Figure R507.9.1.3(1).~~

~~**R507.9.1.4 Alternate ledger details.** Alternate framing configurations supporting a ledger constructed to meet the load requirements of Section R301.5 shall be permitted.~~

~~**R507.9.2 Lateral connection.** Lateral loads shall be transferred to the ground or to a structure capable of transmitting them to the ground. Where the lateral load connection is provided in accordance with Figure R507.9.2(1), hold-down tension devices shall be installed in not less than two locations per deck, within 24 inches (610 mm) of each end of the deck. Each device shall have an allowable stress design capacity of not less than 1,500 pounds (6672 N). Where the lateral load connections are provided in accordance with Figure R507.9.2(2), the hold-down tension devices shall be installed in not less than four locations per deck, and each device shall have an allowable stress design capacity of not less than 750 pounds (3336 N).~~

~~*R507.10 Exterior guards.* ***Guards*** **shall be constructed to meet the requirements of Sections R301.5 and R312, and this section.**~~

~~**R507.10.1 Support of guards.** Where **guards** are supported on deck framing, **guard** loads shall be transferred to the deck framing with a continuous load path to the deck joists.~~

~~**R507.10.1.1 Guards supported by side of deck framing.** Where **guards** are connected to the interior or exterior side of a deck joist or beam, the joist or beam shall be connected to the adjacent joists to prevent rotation of the joist or beam. Connections relying only on fasteners in end grain withdrawal are not permitted.~~

~~**R507.10.1.2 Guards supported on top of deck framing.** Where **guards** are mounted on top of the decking, the **guards** shall be connected to the deck framing or blocking and installed in accordance with manufacturer's instructions to transfer the **guard** loads to the adjacent joists.~~

~~**R507.10.2 Wood posts at deck guards.** Where 4-inch by 4-inch (102 mm by 102 mm) wood posts support guard loads applied to the top of the guard, such posts shall not be notched at the connection to the supporting structure.~~

~~**R507.10.3 Plastic composite guards. Plastic composite guards** shall comply with the provisions of Section R507.2.2.~~

~~*R507.10.4 Other guards.* **Other** ***guards*** **shall be in accordance with either manufacturer's instructions or accepted engineering principles.**~~

CHAPTER 6
WALL CONSTRUCTION

~~**User note:**~~

~~***About this chapter:** Chapter 6 contains prescriptive provisions for the design and construction of walls. The wall construction covered in Chapter 6 consists of five different types: wood framed, cold-formed steel framed, masonry, concrete and structural insulated panel (SIP). The primary concern of this chapter is the structural integrity of wall construction and transfer of all imposed loads to the supporting structure.*~~

R602.3.1 Stud size, height and spacing. The size, height and spacing of studs shall be in accordance with Table R602.3(5).

Exceptions:

1. Utility grade studs shall not be spaced more than 16 inches (406 mm) on center, shall not support more than a roof and ceiling, and shall not exceed 8 feet (2438 mm) in height for exterior walls and *load-bearing walls* or 10 feet (3048 mm) for interior nonload-bearing walls.
2. Where ~~ground snow~~ roof loads are less than or equal to ~~25~~ 20 pounds per square foot ~~(1.2 kPa),~~ and the ultimate design wind speed is less than or equal to 130 mph (58.1 m/s), 2-inch by 6-inch (38 mm by 140 mm) studs supporting a roof load with not more than 6 feet (1829 mm) of tributary length shall have a maximum height of 18 feet (5486 mm) where spaced at 16 inches (406 mm) on center, or 20 feet (6096 mm) where spaced at 12 inches (305 mm) on center. Studs shall be No. 2 grade lumber or better.
3. Exterior load-bearing studs not exceeding 12 feet (3658 mm) in height provided in accordance with Table R602.3(6). The minimum number of full-height studs adjacent to openings shall be in accordance with Section R602.7.5. The building shall be located in Exposure B, and the roof *live load* shall not exceed 20 psf (0.96 kPa), ~~and the ground snow load shall not exceed 30 psf (1.4 kPa).~~ Studs and plates shall be No. 2 grade lumber or better.

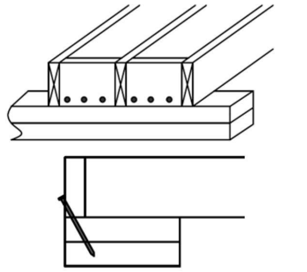
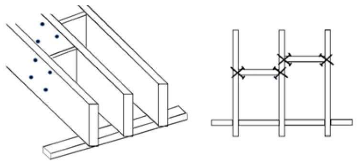
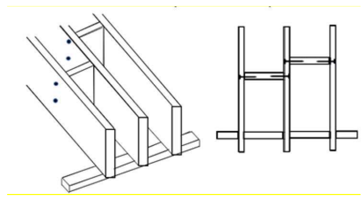
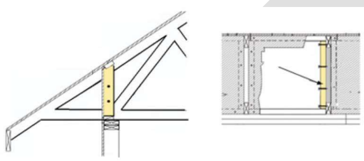
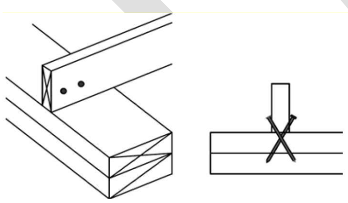
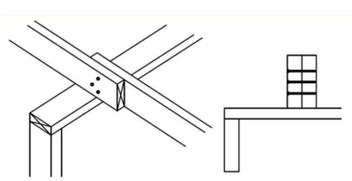
R602.3.2 Top plate for bearing and braced wall lines. Wood stud walls shall be capped with a double top plate installed to provide overlapping at corners and intersections with bearing partitions. End joints in top plates shall be offset not less than 24 inches (610 mm). Joints in plates need not occur over studs. Plates shall be not less than 2-inches (51 mm) nominal thickness and have a width not less than the width of the studs.

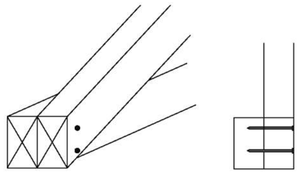
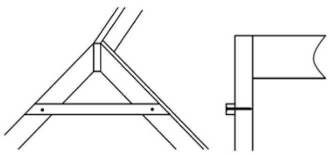
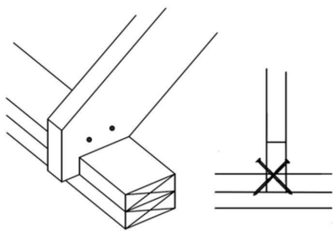
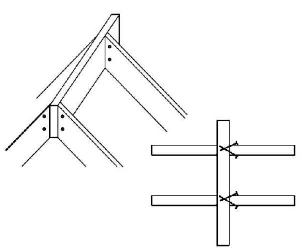
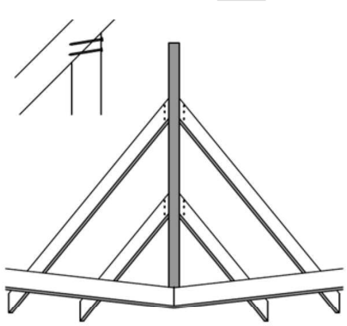
Exception: A single top plate used as an alternative to a double top plate shall comply with the following:

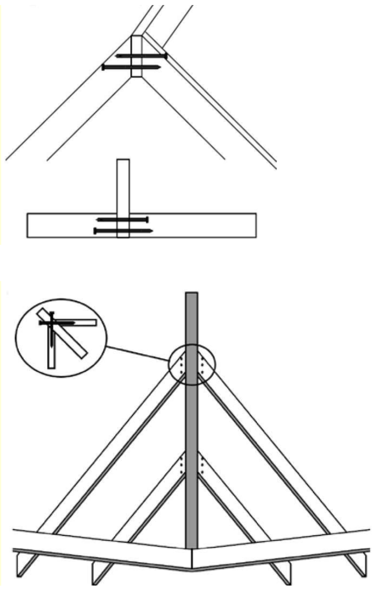
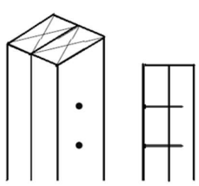
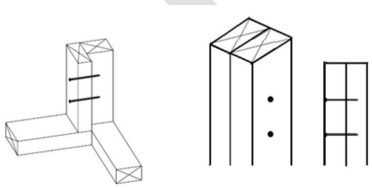
1. The single top plate shall be tied at corners, intersecting walls, and at in-line splices in straight wall lines in accordance with Table R602.3.2.
2. The rafters or joists shall be centered over the studs with a tolerance of not more than 1 inch (25 mm).
3. Omission of the top plate is permitted over headers where the headers are adequately tied to adjacent wall sections in accordance with Table R602.3.2.

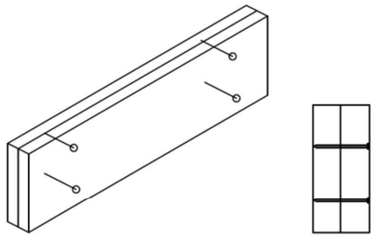
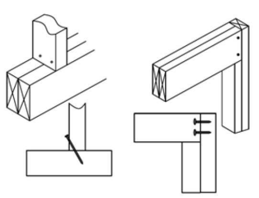
TABLE R602.3(1)
FASTENING SCHEDULE [k, l,m,n]

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER[a, b, c]	SPACING AND LOCATION
		Roof	
1	Blocking between ceiling joists, rafters or trusses to top plate or other framing below	4-8d box ($2^1/_2''$ × 0.113″); or 3-8d common ($2^1/_2''$ × 0.131″); or 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails	Toe nail

			
	Blocking between rafters or truss not at the wall top plates, to rafter or truss 	2-8d common (2$^1/_2$″ × 0.131″); or 2-3″ × 0.131″ nails	Each end toe nail
		2-16d common (3$^1/_2$″ × 0.162″); or 3-3″ × 0.131″ nails	End nail
	Flat blocking to truss and web filler 	16d common (3$^1/_2$″ × 0.162″); or 3″ × 0.131″ nails	6″ o.c. face nail
2	Ceiling joists to top plate 	4-8d box (2$^1/_2$″ × 0.113″); or 3-8d common (2$^1/_2$″ × 0.131″); or 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails	Per joist, toe nail
3	Ceiling joist not attached to parallel rafter, laps over partitions [see Section R802.5.2 and Table R802.5.2(1)] 	4-10d box (3″ × 0.128″); or 3-16d common (3$^1/_2$″ × 0.162″); or 4-3″ × 0.131″ nails	Face nail

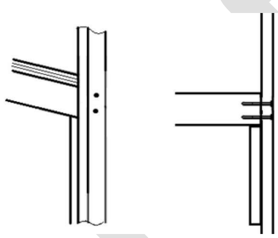
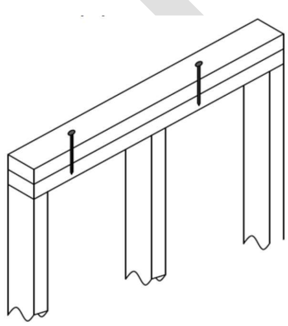
4	Ceiling joist attached to parallel rafter (heel joint) [see Section R802.5.2 and Table R802.5.2(1)] 	Table R802.5.2(1)	Face nail
5	Collar tie to rafter, face nail 	4-10d box (3″ × 0.128″); or 3-10d common (3″ × 0.148″); or 4-3″ × 0.131″ nails	Face nail each rafter
6	Rafter or roof truss to plate [o] 	3-16d box (3$^{1}/_{2}$″ × 0.135″); or 3-10d common (3″ × 0.148″); or 4-10d box (3″ × 0.128″); or 4-3″ × 0.131″ nails	2 toe nails on one side and 1 toe nail on opposite side of each rafter or truss[i]
7	Roof rafters to ridge, valley or hip rafters or roof rafter to minimum 2″ ridge beam  	4-16d box (3$^{1}/_{2}$″ × 0.135″); or 3-10d common (3″ × 0.148″); or 4-10d box (3″ × 0.128″); or 4-3″ × 0.131″ nails	Toe nail

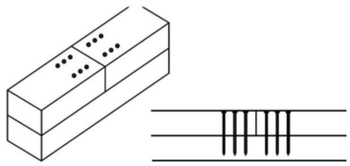
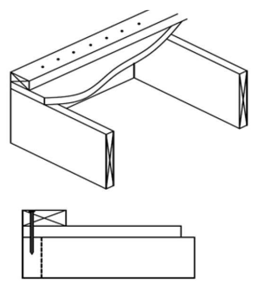
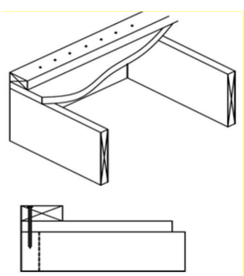
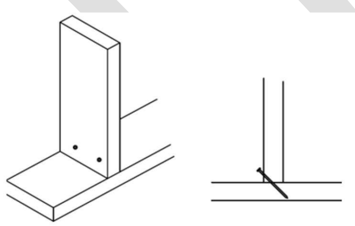
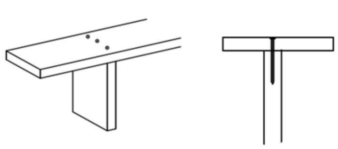
		3-16d box (3 1/2″ × 0.135″); or 2-16d common (3 1/2″ × 0.162″); or 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails	End nail
Wall			
8	Stud to stud (not at braced wall panels) 	16d common (3 1/2″ × 0.162″)	24″ o.c. face nail
		10d box (3″ × 0.128″); or 3″ × 0.131″ nails	16″ o.c. face nail
9	Stud to stud and abutting studs at intersecting wall corners (at braced wall panels) 	16d box (3 1/2″ × 0.135″); or 3″ × 0.131″ nails	12″ o.c. face nail
		16d common (3 1/2″ × 0.162″)	16″ o.c. face nail
10	Built-up header (2″ to 2″ header with 1/2″ spacer)	16d common (3 1/2″ × 0.162″)	16″ o.c. each edge face nail
		16d box (3 1/2″ × 0.135″)	12″ o.c. each edge face nail

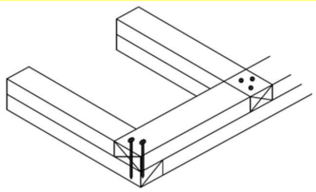
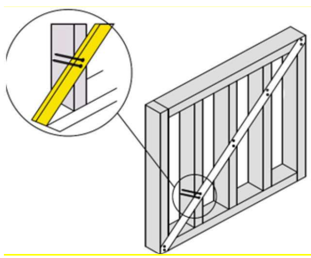
			
11	Continuous header to stud 	5-8d box ($2^{1}/_{2}''$ × 0.113″); or 4-8d common ($2^{1}/_{2}''$ × 0.131″); or 4-10d box (3″ × 0.128″)	Toe nail

(continued)

TABLE R602.3(1)—continued
FASTENING SCHEDULE

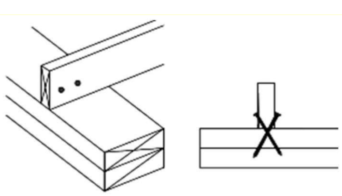
ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER[a, b, c]	SPACING AND LOCATION
		Wall	
12	Adjacent full-height stud to end of header 	4-16d box ($3^{1}/_{2}''$× 0.135″); or 3-16d common ($3^{1}/_{2}''$ × 0.162″); or 4-10d box (3″ × 0.128″); or 4-3″ × 0.131″ nails	End nail
13	Top plate to top plate 	16d common ($3^{1}/_{2}''$ × 0.162″)	16″ o.c. face nail
		10d box (3″ × 0.128″); or 3″ × 0.131″ nails	12″ o.c. face nail
14	Double top plate splice	8-16d common ($3^{1}/_{2}''$ × 0.162″); or 12-16d box ($3^{1}/_{2}''$ × 0.135″); or 12-10d box (3″ × 0.128″); or 12-3″ × 0.131″ nails	Face nail on each side of end joint (minimum 24″ lap splice length each side of end joint)

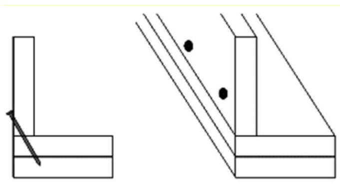
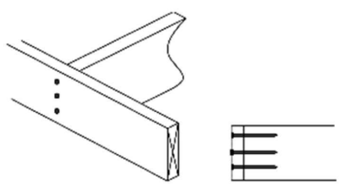
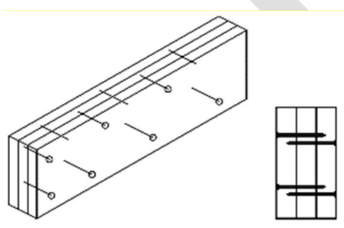
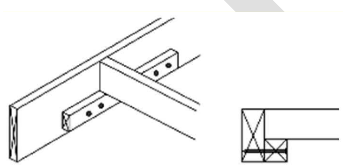
			
15	Bottom plate to joist, rim joist, band joist or blocking (not at braced wall panels) 	16d common (3$^1/_2$″ × 0.162″)	16″ o.c. face nail
		16d box (3$^1/_2$″ × 0.135″); or 3″ × 0.131″ nails	12″ o.c. face nail
		Roof	
16	Bottom plate to joist, rim joist, band joist or blocking (at braced wall panel) 	3-16d box (3$^1/_2$″ × 0.135″); or 2-16d common (3$^1/_2$″ × 0.162″); or 4-3″ × 0.131″ nails	16″ o.c. face nail
17	Top or bottom plate to stud [p] 	4-8d box (2$^1/_2$″ × 0.113″); or 3-16d box (3$^1/_2$″ × 0.135″); or 4-8d common (2$^1/_2$″ × 0.131″); or 4-10d box (3″ × 0.128″); or 4-3″ × 0.131″ nails	Toe nail
		3-16d box (3$^1/_2$″ × 0.135″); or 2-16d common (3$^1/_2$″ × 0.162″); or 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails	End nail
18	Top plates, laps at corners and intersections	3-10d box (3″ × 0.128″); or 2-16d common (3$^1/_2$″ × 0.162″); or 3-3″ × 0.131″ nails	Face nail

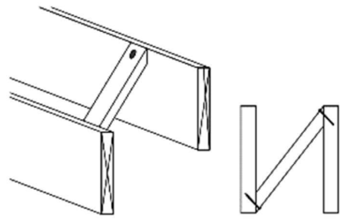
			
19	1″ brace to each stud and plate 	3-8d box (2$^{1}/_{2}$″ × 0.113″); or 2-8d common (2$^{1}/_{2}$″ × 0.131″); or 2-10d box (3″ × 0.128″); or 2 staples 1$^{3}/_{4}$″	Face nail
20	1″ × 6″ sheathing to each bearing	3-8d box (2$^{1}/_{2}$″ × 0.113″); or 2-8d common (2$^{1}/_{2}$″ × 0.131″); or 2-10d box (3″ × 0.128″); or 2 staples, 1″ crown, 16 ga., 1$^{3}/_{4}$″ long	Face nail
21	1″ × 8″ and wider sheathing to each bearing	3-8d box (2$^{1}/_{2}$″ × 0.113″); or 3-8d common (2$^{1}/_{2}$″ × 0.131″); or 3-10d box (3″ × 0.128″); or 3 staples, 1″ crown, 16 ga., 1$^{3}/_{4}$″ long	Face nail
		Wider than 1″ × 8″ 4-8d box (2$^{1}/_{2}$″ × 0.113″); or 3-8d common (2$^{1}/_{2}$″ × 0.131″); or 3-10d box (3″ × 0.128″); or 4 staples, 1″ crown, 16 ga., 1$^{3}/_{4}$″ long	

(continued)

TABLE R602.3(1)—continued
FASTENING SCHEDULE

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER[a, b, c]	SPACING AND LOCATION
		Floor	
22	Joist to sill, top plate or girder 	4-8d box (2$^{1}/_{2}$″ × 0.113″); or 3-8d common (2$^{1}/_{2}$″ × 0.131″); or 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails	Toe nail
23		8d box (2$^{1}/_{2}$″ × 0.113″)	4″ o.c. toe nail

	Rim joist, band joist or blocking to sill or top plate (roof applications also) 	8d common ($2\frac{1}{2}''$ × 0.131″); or 10d box (3″ × 0.128″); or 3″ × 0.131″ nails	6″ o.c. toe nail
24	1″ × 6″ subfloor or less to each joist	3-8d box ($2\frac{1}{2}''$ × 0.113″); or 2-8d common ($2\frac{1}{2}''$ × 0.131″); or 3-10d box (3″ × 0.128″); or 2 staples, 1″ crown, 16 ga., $1\frac{3}{4}''$ long	Face nail
25	2″ subfloor to joist or girder	3-16d box ($3\frac{1}{2}''$ × 0.135″); or 2-16d common ($3\frac{1}{2}''$ × 0.162″)	Blind and face nail
26	2″ planks (plank & beam—floor & roof)	3-16d box ($3\frac{1}{2}''$ × 0.135″); or 2-16d common ($3\frac{1}{2}''$ × 0.162″)	At each bearing, face nail
27	Band or rim joist to joist 	3-16d common ($3\frac{1}{2}''$ × 0.162″); or 4-10 box (3″ × 0.128″); or 4-3″ × 0.131″ nails; or 4-3″ × 14 ga. staples, $\frac{7}{16}''$ crown	End nail
28	Built-up girders and beams, 2-inch lumber layers 	20d common (4″ × 0.192″); or	Nail each layer as follows: 32″ o.c. at top and bottom and staggered.
		10d box (3″ × 0.128″); or 3″ × 0.131″ nails	24″ o.c. face nail at top and bottom staggered on opposite sides
		And: 2-20d common (4″ × 0.192″); or 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails	Face nail at ends and at each splice
29	Ledger strip supporting joists or rafters 	4-16d box ($3\frac{1}{2}''$ × 0.135″); or 3-16d common ($3\frac{1}{2}''$ × 0.162″); or 4-10d box (3″ × 0.128″); or 4-3″ × 0.131″ nails	At each joist or rafter, face nail
30	Bridging or blocking to joist, rafter or truss	2-10d box (3″ × 0.128″); or 2-8d common ($2\frac{1}{2}''$ × 0.131″); or 3″ × 0.131″ nails	Each end, toe nail

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER[a, b, c]	SPACING OF FASTENERS	
			Edges[h] (inches)	Intermediate supports[c, e] (inches)
				
Wood structural panels, subfloor, roof and interior wall sheathing to framing and particleboard wall sheathing to framing [see Table R602.3(3) for wood structural panel exterior wall sheathing to wall framing]				
31	3/8″ – 1/2″	6d common or deformed (2″ × 0.113″ × 0.266″ head); or 2 3/8″ × 0.113″ × 0.266″ head nail (subfloor, wall)[i]	6[j]	6[f,j]
		8d common (2 1/2″ × 0.131″) nail (roof); or RSRS-01 (2 3/8″ × 0.113″) nail (roof)[b]	6[j]	6[f,j]
32	19/32″ – 3/4″	8d common (2-2 1/2″ × 0.131″) nail (subfloor, wall)	6	12
		8d common (2 1/2″ × 0.131″) nail (roof); or RSRS-01; (2 3/8″ × 0.113″) nail (roof)[b]	6[j]	6[f,j]
		Deformed 2 3/8″ × 0.113″ × 0.266″ head (wall or subfloor)	6	12
33	7/8″ – 1 1/4″	10d common (3″ × 0.148″) nail; or (2 1/2″ × 0.131 × 0.281″ head) deformed nail	6	12

(continued)

TABLE R602.3(1)—continued
FASTENING SCHEDULE

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER[a, b, c]	SPACING AND LOCATION	
		Other wall sheathing[g]		
34	$^{1}/_{2}$″ structural cellulosic fiberboard sheathing	$1^{1}/_{2}$″ × 0.120″ galvanized roofing nail, $^{7}/_{16}$″ head diameter; or $1^{1}/_{4}$″ long 16 ga. staple with $^{7}/_{16}$″ or 1″ crown	3	6
35	$^{25}/_{32}$″ structural cellulosic fiberboard sheathing	$1^{3}/_{4}$″ × 0.120″ galvanized roofing nail, $^{7}/_{16}$″ head diameter; or $1^{1}/_{4}$″ long 16 ga. staple with $^{7}/_{16}$″ or 1″ crown	3	6
36	$^{1}/_{2}$″ gypsum sheathing[d]	$1^{1}/_{2}$″ × 0.120″ galvanized roofing nail, $^{7}/_{16}$″ head diameter, or $1^{1}/_{4}$″ long 16 ga.; staple galvanized, $1^{1}/_{2}$″ long; $^{7}/_{16}$″ or 1″ crown or $1^{1}/_{4}$″ screws, Type W or S	7	7
37	$^{5}/_{8}$″ gypsum sheathing[d]	$1^{3}/_{4}$″ × 0.120″ galvanized roofing nail, $^{7}/_{16}$″ head diameter, or $1^{1}/_{4}$″ long 16 ga.; staple galvanized, $1^{1}/_{2}$″ long; $^{7}/_{16}$″ or 1″ crown or $1^{1}/_{4}$″ screws, Type W or S	7	7
		Wood structural panels, combination subfloor underlayment to framing		
38	$^{3}/_{4}$″ and less	Deformed (2″ × 0.113″) or Deformed (2″ × 0.120″) nail; or 8d common ($2^{1}/_{2}$″ × 0.131″) nail	6	12
39	$^{7}/_{8}$″ – 1"	8d common ($2^{1}/_{2}$″ × 0.131″) nail; or Deformed (2″ × 0.113″); or Deformed ($2^{1}/_{2}$″ × 0.120″) nail	6	12
40	$1^{1}/_{8}$″ – $1^{1}/_{4}$″	10d common (3″ × 0.148″) nail; or Deformed (2″ × 0.113″); or Deformed ($2^{1}/_{2}$″ × 0.120″) nail	6	12

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s; 1 ksi = 6.895 MPa.

a. Nails are smooth-common, box or deformed shanks except where otherwise stated. Nails used for framing and sheathing connections are carbon steel and shall have minimum average bending yield strengths as shown: 80 ksi for shank diameter of 0.192 inch (20d common nail), 90 ksi for shank diameters larger than 0.142 inch but not larger than 0.177 inch, and 100 ksi for shank diameters of 0.142 inch or less. Connections using nails and staples of other materials, such as stainless steel, shall be designed by accepted engineering practice ~~or approved under Section R104.11.~~

b. RSRS-01 is a Roof Sheathing Ring Shank nail meeting the specifications in ASTM F1667.

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

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

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

f. For wood structural panel roof sheathing attached to gable end roof framing and to intermediate supports within 48 inches of roof edges and ridges, nails shall be spaced at 4 inches on center where the ultimate design wind speed is greater than 130 mph in Exposure B or greater than 115 mph in Exposure C.

g. Gypsum sheathing shall conform to ASTM C1396 and shall be installed in accordance with ASTM C1280 or GA 253. Fiberboard sheathing shall conform to ASTM C208.

h. Spacing of fasteners on floor sheathing panel edges applies to panel edges supported by framing members and required blocking and at floor perimeters only. Spacing of fasteners on roof sheathing panel edges applies to panel edges supported by framing members and required blocking. Blocking of roof or floor sheathing panel edges perpendicular to the framing members need not be provided except as required by other provisions of this code. Floor perimeter shall be supported by framing members or solid blocking. Roof sheathing 7/16-inch or greater in thickness does not require perimeter blocking.

i. Where a rafter is fastened to an adjacent parallel ceiling joist in accordance with this schedule, provide two toe nails on one side of the rafter and toe nails from the ceiling joist to top plate in accordance with this schedule. The toe nail on the opposite side of the rafter shall not be required.

~~j. For regions having ultimate wind speed of less than 130 mph, nails for attaching wood structural panel roof sheathing to gable end wall framing shall be spaced 6 inches on center. For regions having ultimate wind speed of 130 mph or greater, nails for attaching panel roof sheathing to edge and intermediate supports shall be spaced 4 inches on center for minimum 48-inch distance from ridges, eaves, and gable~~

~~end walls; and 4 inches on center to gable end wall framing.~~ For wood structural panel roof sheathing attached to gable end roof framing and to intermediate supports within 48 inches of roof edges and ridges, nails shall be spaced at 4 inches on center where the ultimate design wind speed is greater than 130 mph in Exposure C. Roof sheathing 19/32-inch or greater in thickness shall be attached to roof framing members spaced at 24-inches on center or shall be designed by accepted engineering practice where the ultimate design wind speed is greater than 130 mph in Exposure C.

~~k. This fastening schedule applies to framing members having an actual thickness of 1 1/2 inches (nominal "2-by" lumber).~~

k. Fastenings listed above may also be used for other connections that are not listed but that have the same configuration and the same code requirement for fastener quantity/spacing and fastener size (pennyweight and style, e.g., 8d common, "8-penny common nail").

~~l. This fastener, in the quantity or spacing shown in the rightmost column, comprises the most stringent fastening of the connection listed in the International Residential Code.~~

~~m. Fastening schedule only applies to buildings of conventional wood frame construction where wind or seismic analysis is not required by the applicable code. In areas where wind or seismic analysis is required, required fastening must be determined by structural analysis. The following are conditions for which codes require structural analysis:~~

~~i. For nominal dimensions of nails see Table R602.3(1a)~~

~~ii. North Carolina Residential Code – buildings located in areas where the design wind speed equals or exceeds 130 mph (58 m/s) or townhouses assigned to Seismic Design Category C.~~

l. For nominal dimensions of nails see Table R602.3(1a)

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n. Nails and staples shall conform to the requirements of ASTM F1667.

o. See Table 4508.3 in the 130, 140 and 150 mph (58 m/s, 63 m/s, 67 m/s)

p. See Table 4508.4 in the 130, 140 and 150 mph (58 m/s, 63 m/s, 67 m/s)

TABLE R602.3(1a)
NOMINAL DIMENSIONS OF NAILS LISTED IN TABLE R602.3(1)

NAILS DESCRIBED BY PENNYWEIGHT SYSTEM		
Pennyweight	Length (inches)	Shank diameter (inches)
Box		
6d	2	0.099
8d	2½	0.113
10d	3	0.128
Casing		
6d	2¼	0.099
8d	2½	0.113
10d	3	0.128
Common		
6d	2	0.113
8d	2½	0.131
10d	3	0.148
16d	3½	0.162
20d	4	0.192
Cooler		
5d	1⅝	0.086
6d	1⅞	0.092
8d	2⅜	0.113
Deformed[a]		
3d	1¼	0.099
4d	1½	0.099
6d	2	0.120
8d	2½	0.120
Finish		
8d	2½	0.099
10d	3	0.113
Siding		
6d	1⅞	0.106
8d	2⅜	0.128
Additional Recognized Nails		
Smooth shank nails	2¼	0.092
	2¼	0.105
	3	0.120
	3¼	
	1½	0.131
	3	
	3¼	
	1½	0.148
	2½	0.162
Deformed shank nails[a]	2¼	0.099
	2	0.113
	2⅜	
	2½	0.131

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s; 1ksi = 6.895 MPa.

a. A deformed shank nail must have either a helical (screw) shank or an annular (ring) shank.

TABLE R602.3(3)

REQUIREMENTS FOR WOOD STRUCTURAL PANEL WALL SHEATHING USED TO RESIST WIND PRESSURES[a, b, c]

MINIMUM NAIL	MINIMUM WOOD STRUCTURAL	~~MINIMUM NOMINAL~~	MAXIMUM WALL STUD	PANEL NAIL SPACING	ULTIMATE DESIGN WIND SPEED V_{ult} (mph)

Size	Penetration (inches)	PANEL SPAN RATING	PANEL THICKNESS (inches)	SPACING (inches)	Edges (inches o.c.)	Field (inches o.c.)	Wind exposure category		
							B	C	D
6d Common (2.0″ × 0.113″)	1.5	24/0	$^{3}/_{8}$	16	6	12	140	115	110
8d Common (2.5″ × 0.131″)	1.75	24/16	$^{7}/_{16}$	16	6	12	170	140	135
				24	6	12	140	115	110

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.

a. Panel strength axis parallel or perpendicular to supports. Three-ply plywood sheathing with studs spaced more than 16 inches on center shall be applied with panel strength axis perpendicular to supports.

b. Table is based on wind pressures acting toward and away from building surfaces in accordance with Section R301.2. Lateral bracing requirements shall be in accordance with Section R602.10.

c. Wood structural panels with span ratings of Wall-16 or Wall-24 shall be permitted as an alternate to panels with a 24/0 span rating. Plywood siding rated 16 o.c. or 24 o.c. shall be permitted as an alternate to panels with a 24/16 span rating. Wall-16 and Plywood siding 16 o.c. shall be used with studs spaced not more than 16 inches on center.

TABLE R602.3.2
SINGLE TOP-PLATE SPLICE CONNECTION DETAILS
<u>FOR BEARING WALLS AND BRACED WALL LINES</u>

~~CONDITION~~	TOP-PLATE SPLICE LOCATION			
	Corners and intersecting walls		Butt joints in straight walls	
	Splice plate size	Minimum nails each side of joint	Splice plate size	Minimum nails each side of joint
~~Structures in SDC A-C; and in SDC D_0, D_1 and D_2 with braced wall line spacing less than 25 feet~~	3″ × 6″ × 0.036″ galvanized steel plate or equivalent	(6) 8d box ($2^{1}/_{2}$″ × 0.113″) nails	3″× 12″ × 0.036″ galvanized steel plate or equivalent	(12) 8d box ($2^{1}/_{2}$″ × 0.113″) nails
~~Structures in SDC D_0, D_1 and D_2, with braced wall line spacing greater than or equal to 25 feet~~	~~3″ × 8″ × 0.036″ galvanized steel plate or equivalent~~	~~(9) 8d box ($2^{1}/_{2}$″ × 0.113″) nails~~	~~3″ × 16″ × 0.036″ galvanized steel plate or equivalent~~	~~(18) 8dbox ($2^{1}/_{2}$″ × 0.113″) nails~~

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

R602.6 Drilling and notching of studs. Drilling and notching of studs shall be in accordance with the following:

1. Notching. A stud in an exterior wall or bearing partition shall not be cut or notched to a depth exceeding 25 percent of its depth. Studs in nonbearing partitions shall not be notched to a depth exceeding 40 percent of a single stud depth. <u>Notching of bearing studs shall be on one edge only and not to exceed one-fourth the height of the stud. Notching shall not occur in the bottom or top 6 inches (152 mm) of bearing studs.</u>
2. Boring. The diameter of bored holes in studs shall not exceed 60 percent of the stud depth, the edge of the hole shall not be less than $^{5}/_{8}$ inch (16 mm) from the edge of the stud, and the hole <u>shall not be closer than 6 inches (152 mm) from an adjacent hole or notch. Holes not exceeding 3/4 inch (19 mm) diameter can be as close as 11/2 inches (38 mm) on center spacing.</u> ~~shall not be located in the same section as a cut or notch. Where the diameter of a bored hole in a stud~~ <u>Studs</u> located in exterior walls or bearing partitions is over 40 percent, such stud shall be doubled and not more than two successive doubled studs shall be so bored. See Figures R602.6(1) and R602.6(2).

   Exception: Where approved, stud shoes are installed in accordance with the manufacturer's instructions.

<u>3. Cutting and notching of studs shall be permitted to be increased to 65 percent of the width of the stud in exterior and interior walls and bearing partitions, provided that one of the following conditions are met:</u>

<u>(a) The wall section is reinforced with $^{1}/_{2}$-inch (13 mm) exterior grade plywood or equivalent reinforcement on the notched side of the wall. Plywood, if used, shall reach from the floor to ceiling and at least one stud further on each side of the section that has been notched or cut.</u>

(b) The exterior walls of a kitchen may be reinforced by placing 1/2-inch (13 mm) plywood or equivalent reinforcement on the notched side of the wall. Plywood, if used, shall reach from the floor to counter-top height and at least one stud further on each side of the section that has been notched or cut.

R602.7 Headers. For header spans, see Tables R602.7(1), and R602.7(2) ~~R602.7(3).~~

TABLE R602.7(1)

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

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

a. Spans are given in feet and inches.

b. Spans are based on minimum design properties for No. 2 grade lumber of Douglas fir-larch, hem-fir, Southern pine, and spruce-pine-fir.

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

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

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

~~f. Spans are calculated assuming the top of the header or girder is laterally braced by perpendicular framing. Where the top of the header or girder is not laterally braced (for example, cripple studs bearing on the header), tabulated spans for headers consisting of 2 × 8, 2 × 10, or 2 × 12 sizes shall be multiplied by 0.70 or the header or girder shall be designed.~~

TABLE R602.7(2)

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

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

a. Spans are given in feet and inches.

b. Spans are based on minimum design properties for No. 2 grade lumber of Douglas fir-larch, hem-fir, Southern pine, and spruce-pine-fir.

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

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

e. ~~Spans are calculated assuming the top of the header or girder is laterally braced by perpendicular framing. Where the top of the header or girder is not laterally braced (for example, cripple studs bearing on the header), tabulated spans for headers consisting of 2 × 8, 2 × 10, or 2 × 12 sizes shall be multiplied by 0.70 or the header or girder shall be designed.~~

~~**TABLE R602.7(3)**~~

~~**GIRDER AND HEADER SPANS[a] FOR OPEN PORCHES**~~
~~**(Maximum span for Douglas fir-larch, hem-fir, Southern pine and spruce-pine-fir[b])**~~

~~SIZE~~	~~SUPPORTING ROOF~~						~~SUPPORTING FLOOR~~	
	~~Ground Snow Load (psf)~~							
	~~30~~		~~50~~		~~70~~			
	~~Depth of Porch[c] (feet)~~							
	~~8~~	~~14~~	~~8~~	~~14~~	~~8~~	~~14~~	~~8~~	~~14~~
~~2-2 × 6~~	~~7-6~~	~~5-8~~	~~6-2~~	~~4-8~~	~~5-4~~	~~4-0~~	~~6-4~~	~~4-9~~
~~2-2 × 8~~	~~10-1~~	~~7-7~~	~~8-3~~	~~6-2~~	~~7-1~~	~~5-4~~	~~8-5~~	~~6-4~~
~~2-2 × 10~~	~~12-4~~	~~9-4~~	~~10-1~~	~~7-7~~	~~8-9~~	~~6-7~~	~~10-4~~	~~7-9~~
~~2-2 × 12~~	~~14-4~~	~~10-10~~	~~11-8~~	~~8-10~~	~~10-1~~	~~7-8~~	~~11-11~~	~~9-0~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.~~

~~a. Spans are given in feet and inches.~~

~~b. Tabulated values assume No. 2 grade lumber, wet service and incising for refractory species. Use 30 psf ground snow load for cases in which ground snow load is less than 30 psf and the roof live load is equal to or less than 20 psf.~~

~~c. Porch depth is measured horizontally from building face to centerline of the header. For depths between those shown, spans are permitted to be interpolated.~~

R602.10 Wall bracing. Buildings shall be braced in accordance with this section or, when applicable, Section R602.12. Where a building, or portion thereof, does not comply with one or more of the bracing requirements in this section, those portions shall be designed and constructed in accordance with Section R301.1.

R602.10.1 Braced wall lines. For the purpose of determining the amount and location of bracing required in each story level of a building, *braced wall lines* shall be designated as straight lines in the building plan placed in accordance with this section.

R602.10.1.1 Length of a braced wall line. The length of a *braced wall line* shall be the distance between its ends. The end of a *braced wall line* shall be the intersection with a perpendicular *braced wall line*, an angled *braced wall line* as permitted in Section R602.10.1.4 or an exterior wall as shown in Figure R602.10.1.1.

R602.10.1.2 Location of **braced wall** lines and permitted offsets**.** Each *braced wall line* shall be located such that no more than two-thirds of the required *braced wall panel* length is located to one side of the *braced wall line*. Braced wall panels shall be permitted to be offset up to 4 feet (1219 mm) from the designated *braced wall line*. Braced wall panels parallel to a *braced wall line* shall be offset not more than 4 feet (1219 mm) from the designated *braced wall line* location as shown in Figure R602.10.1.1.

Exterior walls parallel to a *braced wall line* shall be offset not more than 4 feet (1219 mm) from the designated *braced wall line* location as shown in Figure R602.10.1.1.

Interior walls used as bracing shall be offset not more than 4 feet (1219 mm) from a *braced wall line* through the interior of the building as shown in Figure R602.10.1.1.

R602.10.1.3 Spacing of braced wall lines. The spacing between parallel *braced wall lines* shall be in accordance with Table R602.10.1.3. Intermediate *braced wall lines* through the interior of the building shall be permitted.

R602.10.1.4 Angled walls. Any portion of a wall along a *braced wall line* shall be permitted to angle out of plane for a maximum diagonal length of 8 feet (2438 mm). Where the angled wall occurs at a corner, the length of the *braced wall line* shall be measured from the projected corner as shown in Figure R602.10.1.4. Where the diagonal length is greater than 8 feet (2438 mm), it shall be considered to be a separate *braced wall line* and shall be braced in accordance with Section R602.10.1.

R602.10.2 Braced wall panels. *Braced wall panel*s shall be full-height sections of wall that shall not have vertical or horizontal offsets. *Braced wall panel*s shall be constructed and placed along a *braced wall line* in accordance with this section and the bracing methods specified in Section R602.10.4.

R602.10.2.1 Braced wall panel uplift load path. The bracing lengths in Table R602.10.3(1) apply only when uplift loads are resisted in accordance with Section R602.3.5.

R602.10.2.2 Locations of braced wall panels. A *braced wall panel* shall begin within 10 feet (3810 mm) from each end of a *braced wall line* as determined in Section R602.10.1.1. The distance between adjacent edges of braced wall panels along a *braced wall line* shall be not greater than 20 feet (6096 mm) as shown in Figure R602.10.2.2.

Exceptions:

1. Deleted. ~~*Braced wall panels* in *Seismic Design Categories* D_0, D_1 and D_2 shall comply with Section R602.10.2.2.1.~~
2. *Braced wall panels* with continuous sheathing in *Seismic Design Categories* A, B and C shall comply with Section R602.10.7.

R602.10.2.2.1 Location of braced wall panels in Seismic Design Categories D_0, D_1 and D_2. Deleted. ~~Braced wall panels shall be located at each end of a *braced wall line*.~~

~~Exceptions:~~

~~1. Braced wall panels constructed of Method WSP or BV-WSP and continuous sheathing methods as specified in Section R602.10.4 shall be permitted to begin not more than 10 feet (3048 mm) from each end of a *braced wall line* provided that each end complies with one of the following:~~

~~1.1. A minimum 24 inch wide (610 mm) panel for Methods WSP, CS-WSP, CS-G and CS-PF is applied to each side of the building corner as shown in End Condition 4 of Figure R602.10.7.~~

~~1.2. The end of each *braced wall panel* closest to the end of the *braced wall line* shall have an 1,800-pound (8 kN) hold-down device fastened to the stud at the edge of the *braced wall panel* closest~~

~~to the corner and to the foundation or framing below as shown in End Condition 5 of Figure R602.10.7.~~

~~2. Braced wall panels constructed of Method PFH or ABW, or of Method BV-WSP where a hold-down is provided in accordance with Table R602.10.6.5.4, shall be permitted to begin not more than 10 feet (3048 mm) from each end of a *braced wall line*.~~

R602.10.2.3 Minimum number of braced wall panels. *Braced wall lines* with a length of 16 feet (4877 mm) or less shall have not less than two *braced wall panel*s of any length or one *braced wall panel* equal to 48 inches (1219 mm) or more. *Braced wall lines* greater than 16 feet (4877 mm) shall have not less than two *braced wall panel*s.

R602.10.3 Required length of bracing. The required length of bracing along each *braced wall line* shall be determined as follows:

1. All buildings in *Seismic Design Categories* A and B shall use Table R602.10.3(1) and the applicable adjustment factors in Table R602.10.3(2).
2. Detached buildings in *Seismic Design Category* C shall use Table R602.10.3(1) and the applicable adjustment factors in Table R602.10.3(2).
3. Townhouses in *Seismic Design Category* C shall use the greater value determined from Table R602.10.3(1) or R602.10.3(3) and the applicable adjustment factors in Table R602.10.3(2) or R602.10.3(4), respectively.
4. Deleted. ~~All buildings in *Seismic Design Categories* D_0, D_1 and D_2 shall use the greater value determined from Table R602.10.3(1) or R602.10.3(3) and the applicable adjustment factors in Table R602.10.3(2) or R602.10.3(4), respectively.~~

Only *braced wall panel*s parallel to the *braced wall line* shall contribute toward the required length of bracing of that *braced wall line*. *Braced wall panel*s along an angled wall meeting the minimum length requirements of Tables R602.10.5 and R602.10.5.2 shall be permitted to contribute its projected length toward the minimum required length of bracing for the *braced wall line* as shown in Figure R602.10.1.4. Any *braced wall panel* on an angled wall at the end of a *braced wall line* shall contribute its projected length for only one of the *braced wall lines* at the projected corner.

Exception: Deleted. ~~The length of wall bracing for dwellings in *Seismic Design Categories* D_0, D_1 and D_2 with stone or masonry veneer installed in accordance with Section R703.8 and exceeding the first-story height shall be in accordance with Section R602.10.6.5.~~

R602.10.4 Construction methods for braced wall panels. Intermittent and continuously sheathed *braced wall panel*s shall be constructed in accordance with this section and the methods listed in Table R602.10.4.

R602.10.4.1 Mixing methods. Mixing of bracing methods shall be permitted as follows:

1. Mixing intermittent bracing and continuous sheathing methods from story to story shall be permitted.
2. Mixing intermittent bracing methods from *braced wall line* to *braced wall line* within a story shall be permitted. In regions within *Seismic Design Categories* A, B and C where the ultimate design wind speed is less than or equal to 130 mph (58m/s), mixing of intermittent bracing and continuous sheathing methods from *braced wall line* to *braced wall line* within a story shall be permitted.
3. Mixing intermittent bracing methods along a *braced wall line* shall be permitted in *Seismic Design Categories* A and B, and detached dwellings in *Seismic Design Category* C, provided that the length of required bracing in accordance with Table R602.10.3(1) or R602.10.3(3) is the highest value of all intermittent bracing methods used.
4. Mixing of continuous sheathing methods CS-WSP, CS-G and CS-PF along a *braced wall line* shall be permitted. Intermittent methods ABW, PFH and PFG shall be permitted to be used along a *braced wall line* with continuous sheathed methods, provided that the length of required bracing for that *braced wall line* is determined in accordance with Table R602.10.3(1) or R602.10.3(3) using the highest value of the bracing methods used.
5. In *Seismic Design Categories* A and B, and for detached one- and two-family dwellings in *Seismic Design Category* C, mixing of intermittent bracing methods along the interior portion of a *braced wall line* with continuous sheathing methods CS-WSP, CS-G and CS-PF along the exterior portion of the same *braced wall line* shall be permitted. The length of required bracing shall be the highest value of all intermittent bracing methods used in accordance with Table R602.10.3(1) or R602.10.3(3) as adjusted by Tables

R602.10.3(2) and R602.10.3(4), respectively. The requirements of Section R602.10.7 shall apply to each end of the continuously sheathed portion of the *braced wall line*.

R602.10.4.2 Continuous sheathing methods. Continuous sheathing methods require structural panel sheathing to be used on all sheathable surfaces on one side of a *braced wall line* including areas above and below openings and gable end walls and shall meet the requirements of Section R602.10.7.

R602.10.4.3 Braced wall panel interior finish material. *Braced wall panel*s shall have gypsum wall board installed on the side of the wall opposite the bracing material. Gypsum wall board shall be not less than $^1/_2$ inch (12.7 mm) in thickness and be fastened with nails or screws in accordance with Table R602.3(1) for exterior sheathing or Table R702.3.5 for interior gypsum wall board. Spacing of fasteners at panel edges for gypsum wall board opposite Method LIB bracing shall not exceed 8 inches (203 mm). ~~Interior finish material shall not be glued in *Seismic Design Categories* D_0, D_1 and D_2.~~

Exceptions:

1. Interior finish material is not required opposite wall panels that are braced in accordance with Methods GB, BV-WSP, ABW, PFH, PFG and CS-PF, unless otherwise required by Section R302.6.
2. An *approved* interior finish material with an in-plane shear resistance equivalent to gypsum board shall be permitted to be substituted, unless otherwise required by Section R302.6.
3. Except for Method LIB, gypsum wall board is permitted to be omitted provided that the required length of bracing in Tables R602.10.3(1) and R602.10.3(3) is multiplied by the appropriate adjustment factor in Tables R602.10.3(2) and R602.10.3(4), respectively, unless otherwise required by Section R302.6.

TABLE R602.10.1.3
BRACED WALL LINE SPACING

APPLICATION	CONDITION	BUILDING TYPE	BRACED WALL LINE SPACING CRITERIA	
			Maximum Spacing	Exception to Maximum Spacing
Wind bracing	Ultimate design wind speed < 140 mph	Detached, townhouse	60 feet	None
Seismic bracing	SDC A – C	Detached	Use wind bracing	
	SDC A – B	Townhouse	Use wind bracing	
	SDC C	Townhouse	35 feet	Up to 50 feet when length of required bracing per Table R602.10.3(3) is adjusted in accordance with Table R602.10.3(4).
	~~SDC D_0, D_1, D_2~~	~~Detached, townhouses, one- and two-story only~~	~~25 feet~~	~~Up to 35 feet to allow for a single room not to exceed 900 square feet. Spacing of all other braced wall lines shall not exceed 25 feet.~~
	~~SDC D_0, D_1, D_2~~	~~Detached, townhouse~~	~~25 feet~~	~~Up to 35 feet when length of required bracing per Table R602.10.3(3) is adjusted in accordance with Table R602.10.3(4).~~

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m^2, 1 mile per hour = 0.447 m/s.

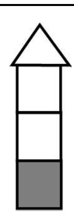
TABLE R602.10.3(1)
BRACING REQUIREMENTS BASED ON WIND SPEED

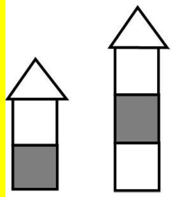
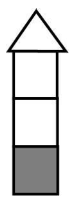
• EXPOSURE CATEGORY B • 30-FOOT MEAN ROOF HEIGHT • 10-FOOT WALL HEIGHT • 2 BRACED WALL LINES			MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE[a]			
Ultimate Design Wind Speed (mph)	Story Location	Braced Wall Line Spacing[c] (feet)	Method LIB[b]	Method GB	Methods DWB, WSP, SFB, PBS, PCP, HPS, BV-WSP, ABW, PFH, PFC, CS-SFB	Methods CS-WSP, CS-G, CS-PF
~~<95 mph~~		~~10~~	~~2.5~~	~~2.5~~	~~1.5~~	~~1.5~~
		~~20~~	~~4.5~~	~~4.5~~	~~2.5~~	~~2.5~~
		~~30~~	~~6.5~~	~~6.5~~	~~4.0~~	~~3.5~~
		~~40~~	~~8.5~~	~~8.5~~	~~5.0~~	~~4.0~~
		~~50~~	~~10.5~~	~~10.5~~	~~6.0~~	~~5.0~~
		~~60~~	~~12.5~~	~~12.5~~	~~7.0~~	~~6.0~~
		~~10~~	~~5.0~~	~~5.0~~	~~3.0~~	~~2.5~~
		~~20~~	~~8.5~~	~~8.5~~	~~5.0~~	~~4.5~~
		~~30~~	~~12.5~~	~~12.5~~	~~7.0~~	~~6.0~~
		~~40~~	~~16.0~~	~~16.0~~	~~9.5~~	~~8.0~~
		~~50~~	~~20.0~~	~~20.0~~	~~11.5~~	~~10.0~~
		~~60~~	~~23.5~~	~~23.5~~	~~13.5~~	~~11.5~~
		~~10~~	~~NP~~	~~7.0~~	~~4.0~~	~~3.5~~
		~~20~~	~~NP~~	~~13.0~~	~~7.5~~	~~6.5~~
		~~30~~	~~NP~~	~~18.5~~	~~10.5~~	~~9.0~~
		~~40~~	~~NP~~	~~24.0~~	~~13.5~~	~~11.5~~
		~~50~~	~~NP~~	~~29.5~~	~~17.0~~	~~14.5~~
		~~60~~	~~NP~~	~~35.0~~	~~20.0~~	~~17.0~~
~~≤ 110~~		~~10~~	~~3.5~~	~~3.5~~	~~2.0~~	~~1.5~~
		~~20~~	~~6.0~~	~~6.0~~	~~3.5~~	~~3.0~~
		~~30~~	~~8.5~~	~~8.5~~	~~5.0~~	~~4.5~~
		~~40~~	~~11.5~~	~~11.5~~	~~6.5~~	~~5.5~~
		~~50~~	~~14.0~~	~~14.0~~	~~8.0~~	~~7.0~~
		~~60~~	~~16.5~~	~~16.5~~	~~9.5~~	~~8.0~~
		~~10~~	~~6.5~~	~~6.5~~	~~3.5~~	~~3.0~~
		~~20~~	~~11.5~~	~~11.5~~	~~6.5~~	~~5.5~~
		~~30~~	~~16.5~~	~~16.5~~	~~9.5~~	~~8.0~~
		~~40~~	~~21.5~~	~~21.5~~	~~12.5~~	~~10.5~~
		~~50~~	~~26.5~~	~~26.5~~	~~15.5~~	~~13.0~~

		~~60~~	~~31.5~~	~~31.5~~	~~18.0~~	~~15.5~~
		~~10~~	~~NP~~	~~9.5~~	~~5.5~~	~~4.5~~
		~~20~~	~~NP~~	~~17.0~~	~~10.0~~	~~8.5~~
		~~30~~	~~NP~~	~~24.5~~	~~14.0~~	~~12.0~~
		~~40~~	~~NP~~	~~32.0~~	~~18.5~~	~~15.5~~
		~~50~~	~~NP~~	~~39.5~~	~~22.5~~	~~19.0~~
		~~60~~	~~NP~~	~~46.5~~	~~26.5~~	~~23.0~~

(continued)

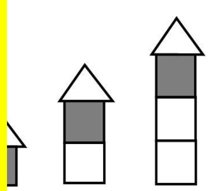
TABLE R602.10.3(1)—continued
BRACING REQUIREMENTS BASED ON WIND SPEED

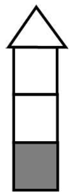
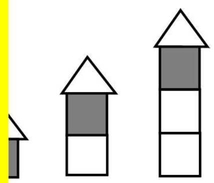
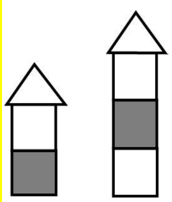
• EXPOSURE CATEGORY B • 30-FOOT MEAN ROOF HEIGHT • 10-FOOT WALL HEIGHT • 2 BRACED WALL LINES			MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE[a]			
Ultimate Design Wind Speed (mph)	**Story Location**	**Braced Wall Line Spacing[c] (feet)**	**Method LIB[b]**	**Method GB**	**Methods DWB, WSP, SFB, PBS, PCP, HPS, BV-WSP, ABW, PFH, PFC, CS-SFB**	**Methods CS-WSP, CS-G, CS-PF**
≤ 115		10	3.5	3.5	2.0	2.0
		20	6.5	6.5	3.5	3.5
		30	9.5	9.5	5.5	4.5
		40	12.5	12.5	7.0	6.0
		50	15.0	15.0	9.0	7.5
		60	18.0	18.0	10.5	9.0
		10	7.0	7.0	4.0	3.5
		20	12.5	12.5	7.5	6.5
		30	18.0	18.0	10.5	9.0
		40	23.5	23.5	13.5	11.5
		50	29.0	29.0	16.5	14.0
		60	34.5	34.5	20.0	17.0
		10	NP	10.0	6.0	5.0
		20	NP	18.5	11.0	9.0
		30	NP	27.0	15.5	13.0
		40	NP	35.0	20.0	17.0
		50	NP	43.0	24.5	21.0
		60	NP	51.0	29.0	25.0
≤ 120		10	4.0	4.0	2.5	2.0

		20	7.0	7.0	4.0	3.5
		30	10.5	10.5	6.0	5.0
		40	13.5	13.5	8.0	6.5
		50	16.5	16.5	9.5	8.0
		60	19.5	19.5	11.5	9.5
		10	7.5	7.5	4.5	3.5
		20	14.0	14.0	8.0	7.0
		30	20.0	20.0	11.5	9.5
		40	25.5	25.5	15.0	12.5
		50	31.5	31.5	18.0	15.5
		60	37.5	37.5	21.5	18.5
		10	NP	11.0	6.5	5.5
		20	NP	20.5	11.5	10.0
		30	NP	29.0	17.0	14.5
		40	NP	38.0	22.0	18.5
		50	NP	47.0	27.0	23.0
		60	NP	55.5	32.0	27.0

(continued)

TABLE R602.10.3(1)—continued
BRACING REQUIREMENTS BASED ON WIND SPEED

• EXPOSURE CATEGORY B • 30-FOOT MEAN ROOF HEIGHT • 10-FOOT WALL HEIGHT • 2 BRACED WALL LINES			MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE[a]			
Ultimate Design Wind Speed (mph)	**Story Location**	**Braced Wall Line Spacing[c] (feet)**	**Method LIB[b]**	**Method GB**	**Methods DWB, WSP, SFB, PBS, PCP, HPS, BV-WSP, ABW, PFH, PFC, CS-SFB**	**Methods CS-WSP, CS-G, CS-PF**
≤ 130		10	4.5	4.5	2.5	2.5
		20	8.5	8.5	5.0	4.0
		30	12.0	12.0	7.0	6.0
		40	15.5	15.5	9.0	7.5
		50	19.5	19.5	11.0	9.5
		60	23.0	23.0	13.0	11.0
		10	8.5	8.5	5.0	4.5
		20	16.0	16.0	9.5	8.0

		30	23.0	23.0	13.5	11.5
		40	30.0	30.0	17.5	15.0
		50	37.0	37.0	21.5	18.0
		60	44.0	44.0	25.0	21.5
		10	NP	13.0	7.5	6.5
		20	NP	24.0	13.5	11.5
		30	NP	34.5	19.5	17.0
		40	NP	44.5	25.5	22.0
		50	NP	55.0	31.5	26.5
		60	NP	65.0	37.5	31.5
< 140		10	5.5	5.5	3.0	2.5
		20	10.0	10.0	5.5	5.0
		30	14.0	14.0	8.0	7.0
		40	18.0	18.0	10.5	9.0
		50	22.5	22.5	13.0	11.0
		60	26.5	26.5	15.0	13.0
		10	10.0	10.0	6.0	5.0
		20	18.5	18.5	11.0	9.0
		30	27.0	27.0	15.5	13.0
		40	35.0	35.0	20.0	17.0
		50	43.0	43.0	24.5	21.0
		60	51.0	51.0	29.0	25.0
		10	NP	15.0	8.5	7.5
		20	NP	27.5	16.0	13.5
		30	NP	39.5	23.0	19.5
		40	NP	51.5	29.5	25.0
		50	NP	63.5	36.5	31.0
		60	NP	75.5	43.0	36.5

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s.
NP = Not Permitted.
a. Linear interpolation shall be permitted.
b. Method LIB shall have gypsum board fastened to not less than one side with nails or screws in accordance with Table R602.3(1) for exterior sheathing or Table R702.3.5 for interior gypsum board. Spacing of fasteners at panel edges shall not exceed 8 inches.
c. Where three or more parallel braced wall lines are present and the distances between adjacent braced wall lines are different, the average dimension shall be permitted to be used for braced wall line spacing.

TABLE R602.10.3(2)
WIND ADJUSTMENT FACTORS TO THE REQUIRED LENGTH OF WALL BRACING

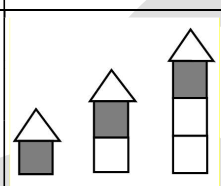
ITEM NUMBER	ADJUSTMENT BASED ON	STORY/SUPPORTING	CONDITION	ADJUSTMENT FACTOR[a, b] [multiply length from Table R602.10.3(1) by this factor]	APPLICABLE METHODS
1	Exposure category[d]	One-story structure	B	1.00	All methods
			C	1.20	
			D	1.50	
		Two-story structure	B	1.00	
			C	1.30	
			D	1.60	
		Three-story structure	B	1.00	
			C	1.40	
			D	1.70	
2	Roof eave-to-ridge height	Roof only	≤ 5 feet	0.70	
			10 feet	1.00	
			15 feet	1.30	
			20 feet	1.60	
		Roof + 1 floor	≤ 5 feet	0.85	
			10 feet	1.00	
			15 feet	1.15	
			20 feet	1.30	
		Roof + 2 floors	≤ 5 feet	0.90	
			10 feet	1.00	
			15 feet	1.10	
			20 feet	Not permitted	
3	Story height (Section R301.3)	Any story	8 feet	0.90	
			9 feet	0.95	
			10 feet	1.00	
			11 feet	1.05	
			12 feet	1.10	
4	Number of braced wall lines (per plan direction)[c]	Any story	2	1.00	
			3	1.30	
			4	1.45	
			≥ 5	1.60	
5	Additional 800-pound hold-down device	Top story only	Fastened to the end studs of each braced wall panel and to the foundation or framing below	0.80	DWB, WSP, SFB, PBS, PCP, HPS

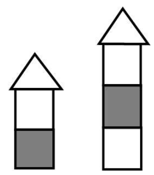
6	Interior gypsum board finish (or equivalent)	Any story	Omitted from inside face of braced wall panels	1.40	DWB, WSP, SFB, PBS, PCP, HPS, CS-WSP, CS-G, CS-SFB
7	Gypsum board fastening	Any story	4 inches o.c. at panel edges, including top and bottom plates, and all horizontal joints blocked	0.7	GB
8	Horizontal blocking	Any story	Horizontal block is omitted	2.0	WSP, PBS, CS-WSP

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound = 4.48 N.
a. Linear interpolation shall be permitted.
b. The total adjustment factor is the product of all applicable adjustment factors.
c. The adjustment factor is permitted to be 1.0 when determining bracing amounts for intermediate braced wall lines provided the bracing amounts on adjacent braced wall lines are based on a spacing and number that neglects the intermediate braced wall line.
d. The same adjustment factor shall be applied to all braced wall lines on all floors of the structure, based on the worst-case exposure category.

TABLE R602.10.3(3)

BRACING REQUIREMENTS BASED ON SEISMIC DESIGN CATEGORY

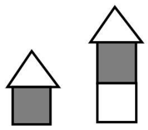
• WALL HEIGHT = 10 FEET • 10 PSF FLOOR DEAD LOAD • 15 PSF ROOF/CEILING DEAD LOAD • BRACED WALL LINE SPACING ≤ 25 FEET			MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE[a, g]				
Seismic Design Category[b]	**Story Location**	**Braced Wall Line Length (feet)[c]**	**Method LIB[d]**	**Method GB**	**Methods DWB, SFB, PBS, PCP, HPS, CS-SFB[e]**	Methods WSP, ABW[f], PFH[f] and PFG[e, f]	**Methods CS-WSP, CS-G, CS-PF**
C (townhouses only)		10	2.5	2.5	2.5	1.6	1.4
		20	5.0	5.0	5.0	3.2	2.7
		30	7.5	7.5	7.5	4.8	4.1
		40	10.0	10.0	10.0	6.4	5.4
		50	12.5	12.5	12.5	8.0	6.8
		10	NP	4.5	4.5	3.0	2.6
		20	NP	9.0	9.0	6.0	5.1
		30	NP	13.5	13.5	9.0	7.7
		40	NP	18.0	18.0	12.0	10.2
		50	NP	22.5	22.5	15.0	12.8
		10	NP	6.0	6.0	4.5	3.8
		20	NP	12.0	12.0	9.0	7.7
		30	NP	18.0	18.0	13.5	11.5
		40	NP	24.0	24.0	18.0	15.3
		50	NP	30.0	30.0	22.5	19.1
~~D0~~		~~10~~	~~NP~~	~~2.8~~	~~2.8~~	~~1.8~~	~~1.6~~

		~~20~~	~~NP~~	~~5.5~~	~~5.5~~	~~3.6~~	~~3.1~~
		~~30~~	~~NP~~	~~8.3~~	~~8.3~~	~~5.4~~	~~4.6~~
		~~40~~	~~NP~~	~~11.0~~	~~11.0~~	~~7.2~~	~~6.1~~
		~~50~~	~~NP~~	~~13.8~~	~~13.8~~	~~9.0~~	~~7.7~~
		~~10~~	~~NP~~	~~5.3~~	~~5.3~~	~~3.8~~	~~3.2~~
		~~20~~	~~NP~~	~~10.5~~	~~10.5~~	~~7.5~~	~~6.4~~
		~~30~~	~~NP~~	~~15.8~~	~~15.8~~	~~11.3~~	~~9.6~~
		~~40~~	~~NP~~	~~21.0~~	~~21.0~~	~~15.0~~	~~12.8~~
		~~50~~	~~NP~~	~~26.3~~	~~26.3~~	~~18.8~~	~~16.0~~
		~~10~~	~~NP~~	~~7.3~~	~~7.3~~	~~5.3~~	~~4.5~~
		~~20~~	~~NP~~	~~14.5~~	~~14.5~~	~~10.5~~	~~9.0~~
		~~30~~	~~NP~~	~~21.8~~	~~21.8~~	~~15.8~~	~~13.4~~
		~~40~~	~~NP~~	~~29.0~~	~~29.0~~	~~21.0~~	~~17.9~~
		~~50~~	~~NP~~	~~36.3~~	~~36.3~~	~~26.3~~	~~22.3~~

(continued)

TABLE R602.10.3(3)—continued
BRACING REQUIREMENTS BASED ON SEISMIC DESIGN CATEGORY

• WALL HEIGHT = 10 FEET • 10 PSF FLOOR DEAD LOAD • 15 PSF ROOF/CEILING DEAD LOAD • BRACED WALL LINE SPACING ≤ 25 FEET			MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE[a, g]				
Seismic Design Category[b]	**Story Location**	**Braced Wall Line Length (feet)[c]**	**Method LIB[d]**	**Method GB**	**Methods DWB, SFB, PBS, PCP, HPS, CS-SFB[e]**	Methods WSP, ABW[f], PFH[f] and PFG[e, f]	**Methods CS-WSP, CS-G, CS-PF**
		~~10~~	~~NP~~	~~3.0~~	~~3.0~~	~~2.0~~	~~1.7~~
		~~20~~	~~NP~~	~~6.0~~	~~6.0~~	~~4.0~~	~~3.4~~
		~~30~~	~~NP~~	~~9.0~~	~~9.0~~	~~6.0~~	~~5.1~~
		~~40~~	~~NP~~	~~12.0~~	~~12.0~~	~~8.0~~	~~6.8~~
		~~50~~	~~NP~~	~~15.0~~	~~15.0~~	~~10.0~~	~~8.5~~
~~D_1~~		~~10~~	~~NP~~	~~6.0~~	~~6.0~~	~~4.5~~	~~3.8~~
		~~20~~	~~NP~~	~~12.0~~	~~12.0~~	~~9.0~~	~~7.7~~
		~~30~~	~~NP~~	~~18.0~~	~~18.0~~	~~13.5~~	~~11.5~~
		~~40~~	~~NP~~	~~24.0~~	~~24.0~~	~~18.0~~	~~15.3~~
		~~50~~	~~NP~~	~~30.0~~	~~30.0~~	~~22.5~~	~~19.1~~
		~~10~~	~~NP~~	~~8.5~~	~~8.5~~	~~6.0~~	~~5.1~~

		~~20~~	~~NP~~	~~17.0~~	~~17.0~~	~~12.0~~	~~10.2~~
		~~30~~	~~NP~~	~~25.5~~	~~25.5~~	~~18.0~~	~~15.3~~
		~~40~~	~~NP~~	~~34.0~~	~~34.0~~	~~24.0~~	~~20.4~~
		~~50~~	~~NP~~	~~42.5~~	~~42.5~~	~~30.0~~	~~25.5~~
~~D_2[h]~~		~~10~~	~~NP~~	~~4.0~~	~~4.0~~	~~2.5~~	~~2.1~~
		~~20~~	~~NP~~	~~8.0~~	~~8.0~~	~~5.0~~	~~4.3~~
		~~30~~	~~NP~~	~~12.0~~	~~12.0~~	~~7.5~~	~~6.4~~
		~~40~~	~~NP~~	~~16.0~~	~~16.0~~	~~10.0~~	~~8.5~~
		~~50~~	~~NP~~	~~20.0~~	~~20.0~~	~~12.5~~	~~10.6~~
		~~10~~	~~NP~~	~~7.5~~	~~7.5~~	~~5.5~~	~~4.7~~
		~~20~~	~~NP~~	~~15.0~~	~~15.0~~	~~11.0~~	~~9.4~~
		~~30~~	~~NP~~	~~22.5~~	~~22.5~~	~~16.5~~	~~14.0~~
		~~40~~	~~NP~~	~~30.0~~	~~30.0~~	~~22.0~~	~~18.7~~
		~~50~~	~~NP~~	~~37.5~~	~~37.5~~	~~27.5~~	~~23.4~~
	~~Three-story dwelling~~	~~10~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~
		~~20~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~
		~~30~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~
		~~40~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~
		~~50~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~	~~NP~~
	~~Cripple wall below one- or two-story dwelling~~	~~10~~	~~NP~~	~~NP~~	~~NP~~	~~7.5~~	~~6.4~~
		~~20~~	~~NP~~	~~NP~~	~~NP~~	~~15.0~~	~~12.8~~
		~~30~~	~~NP~~	~~NP~~	~~NP~~	~~22.5~~	~~19.1~~
		~~40~~	~~NP~~	~~NP~~	~~NP~~	~~30.0~~	~~25.5~~
		~~50~~	~~NP~~	~~NP~~	~~NP~~	~~37.5~~	~~31.9~~

(continued)

TABLE R602.10.3(3)—continued

BRACING REQUIREMENTS BASED ON SEISMIC DESIGN CATEGORY

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

NP = Not Permitted.

a. Linear interpolation shall be permitted.

b. Interpolation of bracing length between the S_{ds} values associated with the seismic design categories shall be permitted when a site-specific S_{ds} value is determined in accordance with Section 1613.2 of the *International Building Code*.

c. Where the braced wall line length is greater than 50 feet, braced wall lines shall be permitted to be divided into shorter segments having lengths of 50 feet or less, and the amount of bracing within each segment shall be in accordance with this table.

d. Method LIB shall have gypsum board fastened to not less than one side with nails or screws in accordance with Table R602.3(1) for exterior sheathing or Table R702.3.5 for interior gypsum board. Spacing of fasteners at panel edges shall not exceed 8 inches.

e. Deleted. ~~Methods PFG and CS-SFB do not apply in Seismic Design Categories D_0, D_1 and D_2.~~

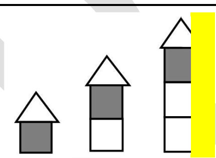
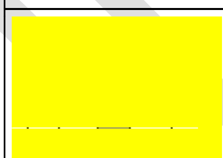
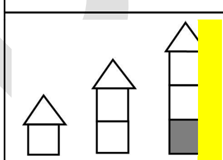
f. Methods PFH, PFG and ABW are only permitted on a single story or a first of two stories.

g. Where more than one bracing method is used, mixing methods shall be in accordance with Section R602.10.4.1.

h. Deleted. ~~One- and two-family dwellings in Seismic Design Category D_2 exceeding two stories shall be designed in accordance with accepted engineering practice.~~

TABLE R602.10.3(4)

SEISMIC ADJUSTMENT FACTORS TO THE REQUIRED LENGTH OF WALL BRACING

ITEM NUMBER	ADJUSTMENT BASED ON	STORY[g]	CONDITION	ADJUSTMENT FACTOR[a, b] [Multiply length from Table R602.10.3(3) by this factor]	APPLICABLE METHODS
1	Story height (Section 301.3)	Any story	≤ 10 feet	1.0	All methods
			> 10 feet and ≤ 12 feet	1.2	
2	Braced wall line spacing, townhouses in SDC C	Any story	≤ 35 feet	1.0	
			> 35 feet and ≤ 50 feet	1.43	
~~3~~	~~Braced wall line spacing, in SDC D_0, D_1, D_2[e]~~	~~Any story~~	~~> 25 feet and ≤ 30 feet~~	~~1.2~~	
			~~> 30 feet and ≤ 35 feet~~	~~1.4~~	
4	Wall dead load	Any story	> 8 psf and < 15 psf	1.0	
			< 8psf	0.85	
5	Roof/ceiling dead load for wall supporting	1-, 2- or 3-story building	≤15 psf	1.0	
		2- or 3-story building	> 15 psf and ≤ 25 psf	1.1	
		1-story building or top story	> 15 psf and ≤ 25 psf	1.2	
6	Walls with stone or masonry veneer, townhouses in SDC C[d, e]		1.0		All methods
			1.5		
			1.5		
~~7~~	~~Walls with stone or masonry veneer, detached one- and two-family dwellings in SDC D_0 – D_2[d, f]~~	~~Any story~~	~~See Section R602.10.6.5.4~~		~~BV-WSP~~

~~8~~	~~Walls with stone or masonry veneer, detached one- and two-family dwellings in SDC D_0 – D_2~~ [d, f]	~~First and second story of two-story dwelling~~	~~Limited brick veneer on second story. See Section R602.10.6.5.3.~~	~~1.2~~	~~WSP, CS-WSP~~
9	Interior gypsum board finish (or equivalent)	Any story	Omitted from inside face of braced wall panels	1.5	DWB, WSP, SFB, PBS, PCP, HPS, CS-WSP, CS-G, CS-SFB
10	Horizontal blocking	Any story	Horizontal blocking omitted	2.0	WSP, PBS, CS-WSP

For SI: 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

a. Linear interpolation shall be permitted.

b. The total length of bracing required for a given wall line is the product of all applicable adjustment factors.

c. The length-to-width ratio for the floor/roof diaphragm shall not exceed 3:1.

d. Applies to stone or masonry veneer exceeding the first story height.

e. The adjustment factor for stone or masonry veneer shall be applied to all exterior braced wall lines and all braced wall lines on the interior of the building, backing or perpendicular to and laterally supporting veneered walls.

f. See Section R602.10.6.5 for requirements where stone or masonry veneer does not exceed the first-story height.

g. ~~One- and two-family dwellings in Seismic Design Category D_2 exceeding two stories shall be designed in accordance with accepted engineering practice.~~

R602.10.4.4 Panel joints. Vertical joints of panel sheathing shall occur over and be fastened to common studs. Horizontal joints of panel sheathing in *braced wall panels* shall occur over and be fastened to common blocking of a thickness of $1^1/_2$ inches (38 mm) or greater.

Exceptions:

1. For methods WSP and CS-WSP, blocking of horizontal joints is permitted to be omitted when adjustment factor No. 8 of Table R602.10.3(2) or No. 9 of Table R602.10.3(4) is applied.
2. Vertical joints of panel sheathing shall be permitted to occur over double studs, where adjoining panel edges are attached to separate studs with the required panel edge fastening schedule, and the adjacent studs are attached together with two rows of 10d box nails [3 inches by 0.128 inch (76.2 mm by 3.25 mm)] at 10 inches o.c. (254 mm).
3. Blocking at horizontal joints shall not be required in wall segments that are not counted as *braced wall panels*.
4. Where Method GB panels are installed horizontally, blocking of horizontal joints is not required.

R602.10.5 Minimum length of a braced wall panel. The minimum length of a *braced wall panel* shall comply with Table R602.10.5. For Methods CS-WSP and CS-SFB, the minimum panel length shall be based on the adjacent clear opening height in accordance with Table R602.10.5 and Figure R602.10.5. Where a panel has an opening on either side of differing heights, the taller opening height shall be used to determine the panel length.

R602.10.5.1 Contributing length. For purposes of computing the required length of bracing in Tables R602.10.3(1) and R602.10.3(3), the contributing length of each *braced wall panel* shall be as specified in Table R602.10.5.

R602.10.5.2 Partial credit. For Methods DWB, WSP, SFB, PBS, PCP and HPS in *Seismic Design Categories* A, B and C, panels between 36 inches and 48 inches (914 mm and 1219 mm) in length shall be considered a *braced wall panel* and shall be permitted to partially contribute toward the required length of bracing in Tables R602.10.3(1) and R602.10.3(3), and the contributing length shall be determined from Table R602.10.5.2.

R602.10.6 Construction of Methods ABW, PFH, PFG, CS-PF and BV-WSP. Methods ABW, PFH, PFG, CS-PF and BV-WSP shall be constructed as specified in Sections R602.10.6.1 through R602.10.6.5.

R602.10.6.1 Method ABW: Alternate braced wall panels. Method ABW *braced wall panel*s shall be constructed in accordance with Figure R602.10.6.1. The hold-down force shall be in accordance with Table R602.10.6.1.

R602.10.6.2 Method PFH: Portal frame with hold-downs. Method PFH *braced wall panels* shall be constructed in accordance with Figure R602.10.6.2.

R602.10.6.3 Method PFG: Portal frame at garage door openings in Seismic Design Categories A, B and C. Where supporting a roof or one story and a roof, a Method PFG *braced wall panel* constructed in accordance with Figure R602.10.6.3 shall be permitted on either side of garage door openings.

R602.10.6.4 Method CS-PF: Continuously sheathed portal frame. Continuously sheathed portal frame *braced wall panel*s shall be constructed in accordance with Figure R602.10.6.4 and Table R602.10.6.4.

R602.10.6.5 Wall bracing for dwellings with stone and masonry veneer in Seismic Design Categories D_0, D_1 and D_2. Deleted. ~~Townhouses in *Seismic Design Categories* D_0, D_1 and D_2 with stone or masonry veneer exceeding the first story height shall be designed in accordance with accepted engineering practice.~~

~~One- and two-family dwellings in *Seismic Design Category* D_2 exceeding two stories and having stone or masonry veneer shall be designed in accordance with accepted engineering practice.~~

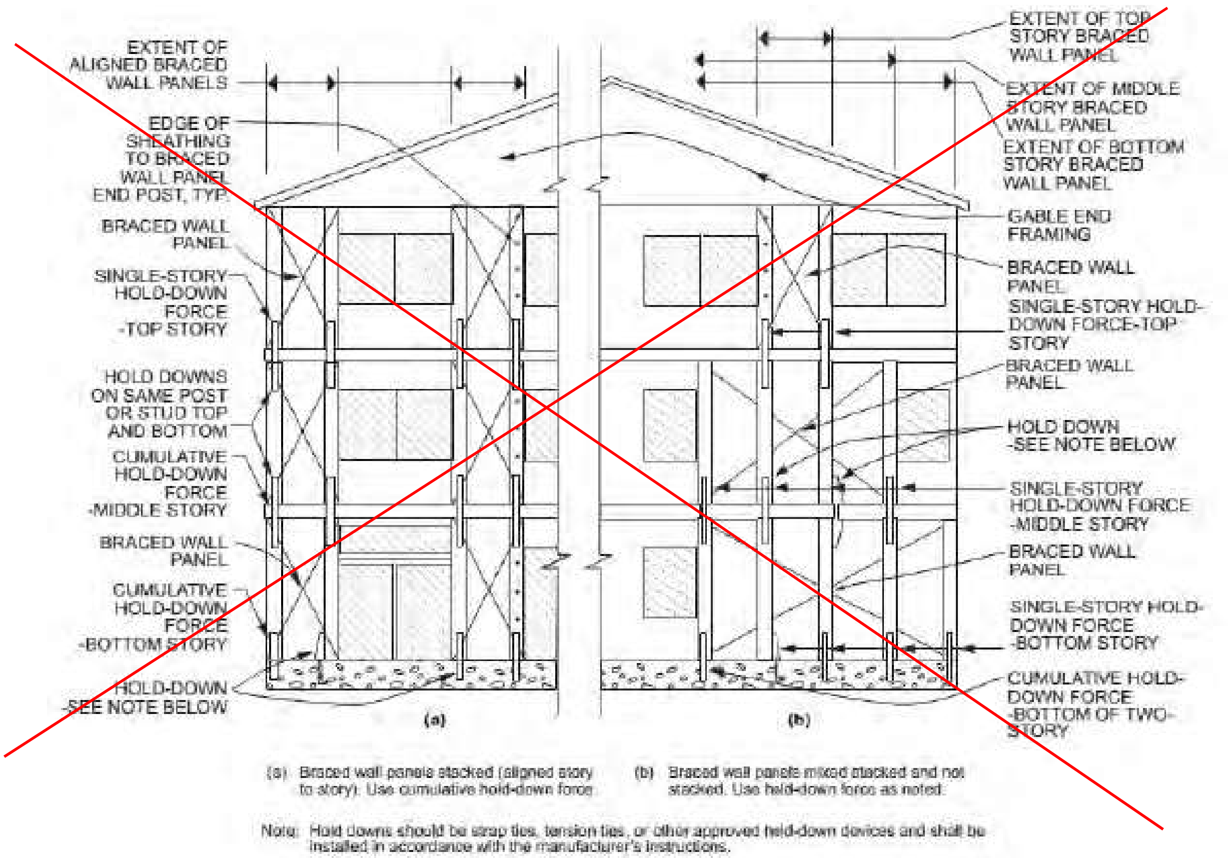
~~Where stone and masonry veneer are installed in accordance with Section R703.8, wall bracing on exterior *braced wall lines* and *braced wall lines* on the interior of the building, backing or perpendicular to and laterally supporting veneered walls shall comply with this section.~~

~~R602.10.6.5.1 Veneer on first story only. Where dwellings in *Seismic Design Categories* D_0, D_1 and D_2 have stone or masonry veneer installed in accordance with Section R703.8 and the veneer does not exceed the first-story height, wall bracing shall be in accordance with Section R602.10, exclusive of Section R602.10.6.5.~~

~~R602.10.6.5.2 Veneer exceeding first-story height. Where detached one- or two-family dwellings in *Seismic Design Categories* D_0, D_1 and D_2 have stone or masonry veneer installed in accordance with Section R703.8, and the veneer exceeds the first *story height*, wall bracing at exterior *braced wall lines* and *braced wall lines* on the interior of the building shall be constructed using Method BV-WSP in accordance with this section and Figure R602.10.6.5.2. Cripple walls shall not be permitted, and required interior *braced wall lines* shall be supported on continuous foundations.~~

~~R602.10.6.5.3 Limited veneer exceeding first-story height. Where detached one- or two-family dwellings in *Seismic Design Categories* D_0, D_1 and D_2 have exterior veneer installed in accordance with Section R703.8 and where brick veneer installed above the first story height meets the following limitations, bracing in accordance with Method WSP or CS-WSP shall be permitted provided that the total length of *braced wall panels* specified by Table R602.10.3(3) is multiplied by 1.2 for each first- and second-story *braced wall line*.~~

1. ~~The dwelling does not extend more than two stories above *grade plane*.~~
2. ~~The veneer does not exceed 5 inches (127 mm) in thickness.~~
3. ~~The height of veneer on gable end walls does not extend more than 8 feet (2438 mm) above the bearing wall top plate elevation.~~
4. ~~Where veneer is installed on multiple walls above the first story, the total area of the veneer on the second-story exterior walls shall not exceed 25 percent of the occupied second floor area.~~
5. ~~Where the veneer is installed on one entire second-story exterior wall, including walls on bay windows and similar appurtenances, brick veneer shall not be installed on any of the other walls on that floor.~~



~~FIGURE R602.10.6.5~~FIGURE R602.10.6.5.2

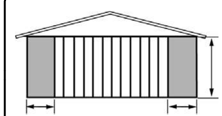
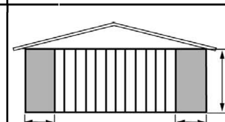
~~METHOD BV-WSP—WALL BRACING FOR DWELLINGS WITH STONE AND~~ MASONRY VENEER IN SEISMIC DESIGN CATEGORIES D_0, D_1 and D_2

~~R602.10.6.5.4 **Length of bracing.** The length of bracing along each *braced wall line* shall be the greater of that required by the ultimate design wind speed and *braced wall line* spacing in accordance with Table R602.10.3(1) as adjusted by the factors in Table R602.10.3(2) or the seismic design category and *braced wall line* length in accordance either with Table R602.10.6.5.4 when using Method BV-WSP, or Table R602.10.3(3) as adjusted by the factors in Table R602.10.3(4) when using Method WSP or CS-WSP. Angled walls shall be permitted to be counted in accordance with Section R602.10.1.4, and *braced wall panel* location shall be in accordance with Section R602.10.2.2. Spacing between *braced wall lines* shall be in accordance with Table R602.10.1.3. The seismic adjustment factors in Table R602.10.3(4) shall not be applied to the length of bracing determined using Table R602.10.6.5.4, except that the bracing amount increase for *braced wall line* spacing greater than 25 feet (7620 mm) in accordance with Table R602.10.1.3 shall be required. The minimum total length of bracing in a *braced wall line,* after all adjustments have been taken, shall be not less than 48 inches (1219 mm) total.~~

TABLE R602.10.4

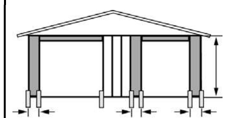
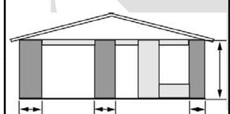
BRACING METHODS

METHODS, MATERIAL		MINIMUM THICKNESS	FIGURE	CONNECTION CRITERIA[a]	
				Fasteners	Spacing
Interm	**LIB** Let-in-bracing	1 × 4 wood or approved metal straps		Wood: 2-8d common nails or 3-8d ($2^1/_2$″ long × 0.113″ dia.) nails	Wood: per stud and top and bottom plates

		for maximum 16″ stud spacing		Metal strap: per manufacturer	Metal: per manufacturer
	DWB Diagonal wood boards	$^{3}/_{4}$″ (1″ nominal) for maximum 24″ stud spacing		2-8d ($2^{1}/_{2}$″ long × 0.113″ dia.) nails or 2-$1^{3}/_{4}$″ long staples	Per stud
	WSP Wood structural panel (See Section R604)	$^{3}/_{8}$″		Exterior sheath R602.3(3)	6″ edges 12″ field
				Interior sheathing per Table R602.3(1) or R602.3(2)	Varies by fastener
	Wood structural panels with stone or masonry veneer (See Section	$^{7}/_{16}$″	See Figure R602.10.6.5.2	8d common ($2^{1}/_{2}$″ × 0.131) nails	intermediate supports 4″ at braced wall panel end posts
	SFB Structural fiberboard sheathing	$^{1}/_{2}$″ or $^{25}/_{32}$″ for maximum 16″ stud spacing		$1^{1}/_{2}$″ long × 0.12″ dia. (for $^{1}/_{2}$″ thick sheathing) $1^{3}/_{4}$″ long × 0.12″ dia. (for $^{25}/_{32}$″ thick sheathing) galvanized roofing nails	3″ edges 6″ field
	GB Gypsum board	$^{1}/_{2}$″		Nails or screws per Table R602.3(1) for exterior locations	For all braced wall panel locations: 7″edges (including top and bottom plates) 7″ field
				Nails or screws per Table R702.3.5 for interior locations	
	PBS Particleboard sheathing (See Section R605)	$^{3}/_{8}$″ or $^{1}/_{2}$″ for maximum 16″stud spacing		For $^{3}/_{8}$″, 6d common (2″ long × 0.113″ dia.) nails; For $^{1}/_{2}$″, 8d common ($2^{1}/_{2}$″ long × 0.131″ dia.) nails	3″ edges 6″ field
	PCP Portland cement plaster	See Section R703.6 for maximum 16″ stud spacing		$1^{1}/_{2}$″ long, 11 gage, 0.120″ dia., $^{7}/_{16}$″ dia. head nails or $^{7}/_{8}$″ long, 16 gage staples	6″ o.c. on all framing members
	HPS Hardboard panel siding	$^{7}/_{16}$″ for maximum 16″ stud spacing		0.092″ dia., 0.225″ dia. head nails with length to accommodate $1^{1}/_{2}$″ penetration into studs	4″ edges 8″ field
	ABW Alternate braced wall	$^{3}/_{8}$″		See Section R602.10.6.1	See Section R602.10.6.1

(continued)

TABLE R602.10.4—continued
BRACING METHODS

	METHODS, MATERIAL	MINIMUM THICKNESS	FIGURE	[a]	
ermittent Bracing Methods	**PFH** Portal frame with hold-downs	$^{3}/_{8}''$		See Section R602.10.6.2	See Section R602.10.6.2
	PFG Portal frame at garage	$^{7}/_{16}''$		See Section R602.10.6.3	See Section R602.10.6.3
Continuous Sheathing Methods	**CS-WSP** Continuously sheathed wood structural panel	$^{3}/_{8}''$		Exterior sheathing per Table R602.3(3)	6″ edges 12″ field
				Interior sheathing per Table R602.3(1) or R602.3(2)	Varies by fastener
	CS-G[b, c] Continuously sheathed wood structural panel adjacent to garage openings	$^{3}/_{8}''$		See Method CS-WSP	See Method CS-WSP
	CS-PF Continuously sheathed portal frame	$^{7}/_{16}''$		See Section R602.10.6.4	See Section R602.10.6.4
	CS-SFB[d] Continuously sheathed structural fiberboard	$^{1}/_{2}''$ or $^{25}/_{32}''$ for maximum 16″ stud spacing		$1^{1}/_{2}''$ long × 0.12″ dia. (for $^{1}/_{2}''$ thick sheathing) $1^{3}/_{4}''$ long × 0.12″ dia. (for $^{25}/_{32}''$ thick sheathing) galvanized roofing nails	3″ edges 6″ field

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 degree = 0.0175 rad, 1 pound per square foot = 47.8 N/m^2, 1 mile per hour = 0.447 m/s.

a. Adhesive attachment of wall sheathing, including Method GB, shall not be permitted in Seismic Design Categories C, D_0, D_1 and D_2.

b. Applies to panels next to garage door opening where supporting gable end wall or roof load only. Shall only be used on one wall of the garage. ~~In Seismic Design Categories D_0, D_1 and D_2, roof covering dead load shall not exceed 3 psf.~~

c. Garage openings adjacent to a Method CS-G panel shall be provided with a header in accordance with Table R602.7(1). A full-height clear opening shall not be permitted adjacent to a Method CS-G panel.

d. Deleted. ~~Method CS-SFB does not apply in Seismic Design Categories D_0, D_1 and D_2.~~

e. Deleted. ~~Method applies to detached one- and two-family dwellings in Seismic Design Categories D_0 through D_2 only.~~

TABLE R602.10.5
MINIMUM LENGTH OF BRACED WALL PANELS

	[a]	

		Wall Height					CONTRIBUTING LENGTH (inches)
		8 feet	9 feet	10 feet	11 feet	12 feet	
DWB, WSP, SFB, PBS, PCP, HPS, BV-WSP		48	48	48	53	58	Actual[b]
GB		48	48	48	53	58	Double sided = Actual Single sided = 0.5 × Actual
LIB		55	62	69	NP	NP	Actual[b]
ABW	SDC A, B and C, ultimate design wind speed < 140 mph	28	32	34	38	42	48
ABW	~~SDC D_0, D_1 and D_2, ultimate design wind speed < 140 mph~~	~~32~~	~~32~~	~~34~~	~~NP~~	~~NP~~	48
CS-G		24	27	30	33	36	Actual[b]
CS-WSP, CS-SFB	Adjacent clear opening height (inches)						
CS-WSP, CS-SFB	≤ 64	24	27	30	33	36	Actual[b]
	68	26	27	30	33	36	
	72	27	27	30	33	36	
	76	30	29	30	33	36	
	80	32	30	30	33	36	
	84	35	32	32	33	36	
	88	38	35	33	33	36	
	92	43	37	35	35	36	
	96	48	41	38	36	36	
	100	—	44	40	38	38	
	104	—	49	43	40	39	
	108	—	54	46	43	41	
	112	—	—	50	45	43	
	116	—	—	55	48	45	
	120	—	—	60	52	48	
	124	—	—	—	56	51	
	128	—	—	—	61	54	
	132	—	—	—	66	58	
	136	—	—	—	—	62	
	140	—	—	—	—	66	
	144	—	—	—	—	72	
METHOD (See Table R602.10.4)		Portal header height					
		8 feet	9 feet	10 feet	11 feet	12 feet	

PFH	Supporting roof only	16	16	16	Note c	Note c	48
	Supporting one story and roof	24	24	24	Note c	Note c	
PFG		24	27	30	Note d	Note d	1.5 × Actual[b]
CS-PF	SDC A, B and C	16	18	20	Note e	Note e	1.5 × Actual[b]
	~~SDC D_0, D_1 and D_2~~	~~16~~	~~18~~	~~20~~	~~Note e~~	~~Note e~~	~~Actual[b]~~

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s.

NP = Not Permitted.

a. Linear interpolation shall be permitted.
b. Use the actual length where it is greater than or equal to the minimum length.
c. Maximum header height for PFH is 10 feet in accordance with Figure R602.10.6.2, but wall height shall be permitted to be increased to 12 feet with pony wall.
d. Maximum header height for PFG is 10 feet in accordance with Figure R602.10.6.3, but wall height shall be permitted to be increased to 12 feet with pony wall.
e. Maximum header height for CS-PF is 10 feet in accordance with Figure R602.10.6.4, but wall height shall be permitted to be increased to 12 feet with pony wall.

TABLE R602.10.5.2
PARTIAL CREDIT FOR BRACED WALL PANELS LESS THAN 48 INCHES IN ACTUAL LENGTH

ACTUAL LENGTH OF BRACED WALL PANEL (inches)	CONTRIBUTING LENGTH OF BRACED WALL PANEL (inches)[a]	
	8-foot Wall Height	9-foot Wall Height
48	48	48
42	36	36
36	27	NA

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

NA = Not Applicable.

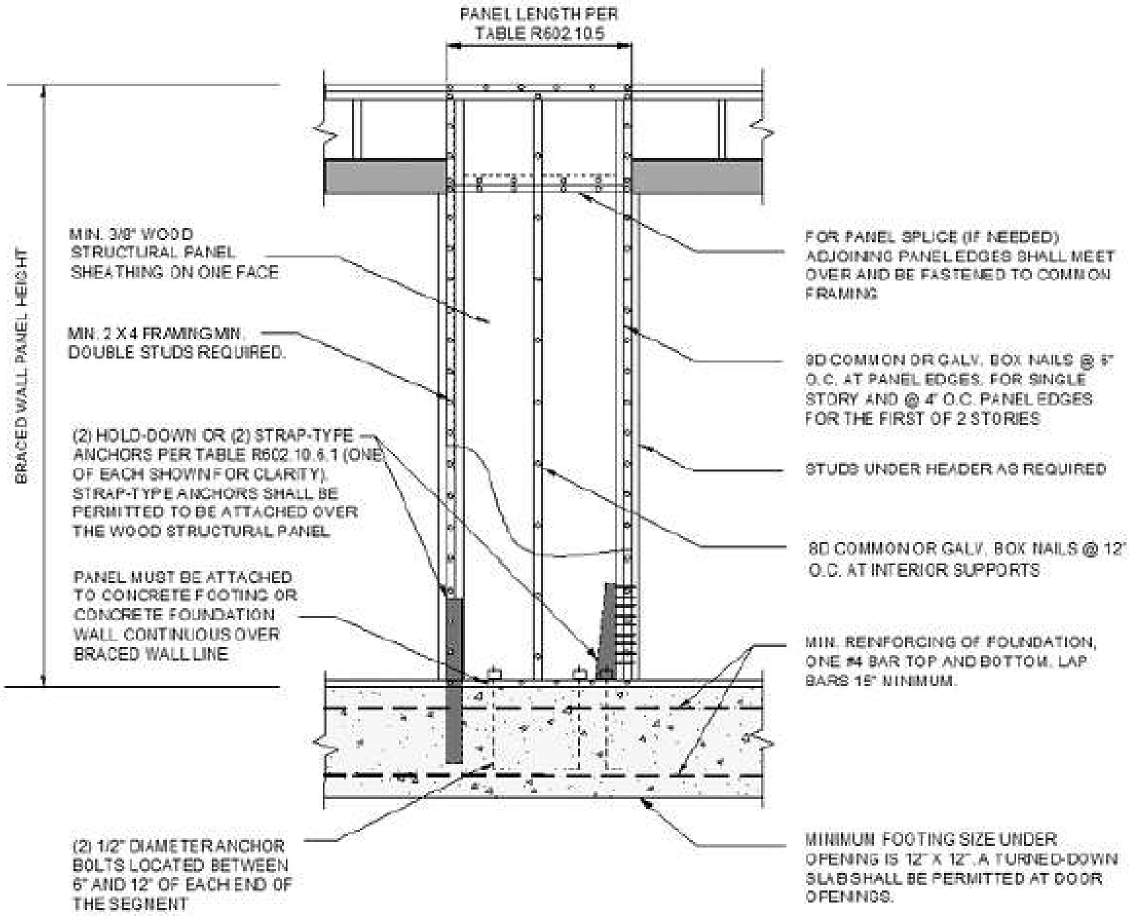
a. Linear interpolation shall be permitted.

TABLE R602.10.6.1
MINIMUM HOLD-DOWN FORCES FOR METHOD ABW BRACED WALL PANELS

SEISMIC DESIGN CATEGORY AND WIND SPEED	SUPPORTING/STORY	HOLD-DOWN FORCE (pounds)				
		Height of Braced Wall Panel				
		8 feet	9 feet	10 feet	11 feet	12 feet
SDC A, B and C Ultimate design wind speed < 140 mph	One story	1,800	1,800	1,800	2,000	2,200
	First of two stories	3,000	3,000	3,000	3,300	3,600
~~SDC D_0, D_1 and D_2~~ ~~Ultimate design wind speed <140 mph~~	~~One story~~	~~1,800~~	~~1,800~~	~~1,800~~	~~NP~~	~~NP~~
	~~First of two stories~~	~~3,000~~	~~3,000~~	~~3,000~~	~~NP~~	~~NP~~

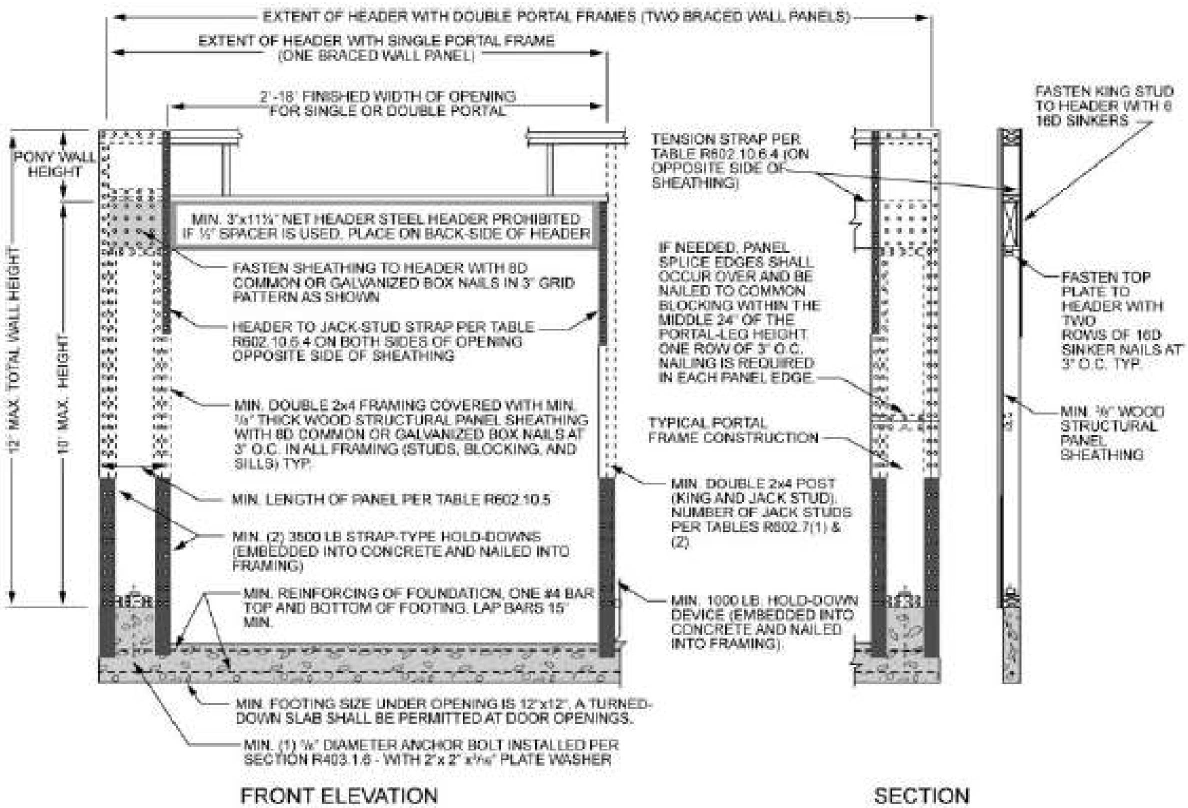
For SI: 1 foot = 304.8 mm, 1 pound = 4.45 N, 1 mile per hour = 0.447 m/s.

NP = Not Permitted.



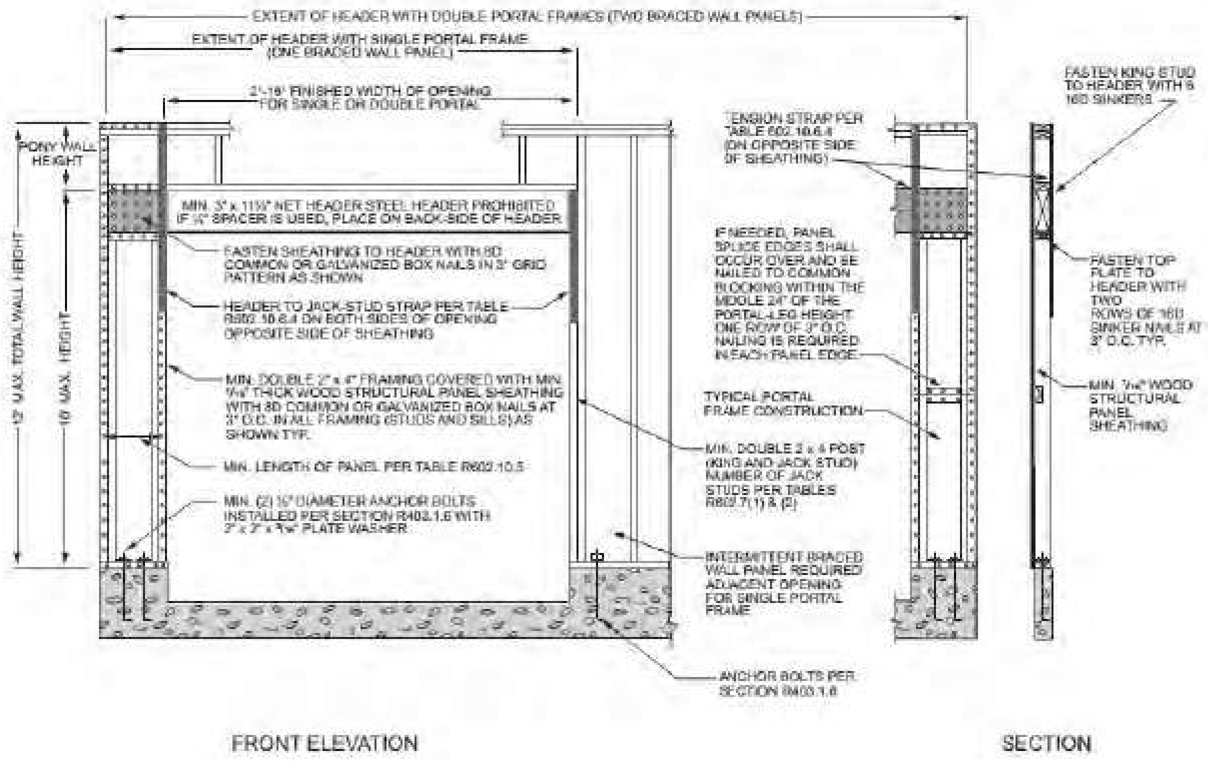
For SI: 1 inch = 25.4 mm.

FIGURE R602.10.6.1
METHOD ABW—ALTERNATE BRACED WALL PANEL



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

FIGURE R602.10.6.2
METHOD PFH—PORTAL FRAME WITH HOLD-DOWNS



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

FIGURE R602.10.6.3
METHOD PFG—PORTAL FRAME AT GARAGE DOOR OPENINGS IN SEISMIC DESIGN CATEGORIES A, B AND C

TABLE R602.10.6.4
TENSION STRAP CAPACITY FOR RESISTING WIND PRESSURES PERPENDICULAR TO METHODS PFH, PFG AND CS-PF BRACED WALL PANELS[a]

MINIMUM WALL STUD FRAMING NOMINAL SIZE AND GRADE	MAXIMUM PONY WALL HEIGHT (feet)	MAXIMUM TOTAL WALL HEIGHT (feet)	MAXIMUM OPENING WIDTH (feet)	TENSION STRAP CAPACITY REQUIRED (pounds)[a]					
				Ultimate Design Wind Speed V_{ult} (mph)					
				≤ 110	115	130	≤ 110	115	130
				Exposure B			Exposure C		
2 × 4 No. 2 Grade	0	10	18	1,000	1,000	1,000	1,000	1,000	1,050
	1	10	9	1,000	1,000	1,000	1,000	1,000	1,750
			16	1,000	1,025	2,050	2,075	2,500	3,950
			18	1,000	1,275	2,375	2,400	2,850	DR
	2	10	9	1,000	1,000	1,475	1,500	1,875	3,125
			16	1,775	2,175	3,525	3,550	4,125	DR

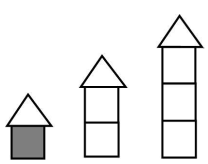
			18	2,075	2,500	3,950	3,975	DR	DR
	2	12	9	1,150	1,500	2,650	2,675	3,175	DR
			16	2,875	3,375	DR	DR	DR	DR
			18	3,425	3,975	DR	DR	DR	DR
	4	12	9	2,275	2,750	DR	DR	DR	DR
			12	3,225	3,775	DR	DR	DR	DR
2 × 6 Stud Grade	2	12	9	1,000	1,000	1,700	1,700	2,025	3,050
			16	1,825	2,150	3,225	3,225	3,675	DR
			18	2,200	2,550	3,725	3,750	DR	DR
	4	12	9	1,450	1,750	2,700	2,725	3,125	DR
			16	2,050	2,400	DR	DR	DR	DR
			18	3,350	3,800	DR	DR	DR	DR

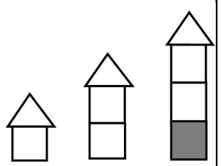
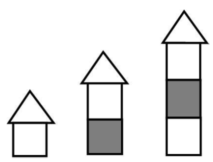
For SI: 1 foot = 304.8 mm, 1 pound = 4.45 N, 1 mile per hour = 0.447 m/s.
DR = Design Required.
a. Straps shall be installed in accordance with manufacturer's recommendations.

TABLE R602.10.6.5.4

METHOD BV-WSP WALL BRACING REQUIREMENTS[d]

Deleted.

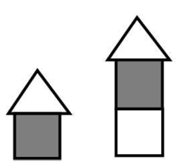
~~SEISMIC DESIGN CATEGORY~~	~~STORY~~	~~—~~	~~—~~	~~—~~	~~—~~	~~—~~	~~SINGLE-STORY HOLD-DOWN FORCE (pounds)[b]~~	~~CUMULATIVE HOLD-DOWN FORCE (pounds)[c]~~
		~~Braced Wall Panels Required Along each Braced Wall Line~~						
~~D0~~		~~4.0~~	~~7.0~~	~~10.5~~	~~14.0~~	~~17.5~~	~~NA~~	~~—~~
		~~4.0~~	~~7.0~~	~~10.5~~	~~14.0~~	~~17.5~~	~~1,900~~	~~—~~

		~~4.5~~	~~9.0~~	~~13.5~~	~~18.0~~	~~22.5~~	~~3,500~~	~~5,400~~
		~~6.0~~	~~12.0~~	~~18.0~~	~~24.0~~	~~30.0~~	~~3,500~~	~~8,900~~
		~~4.5~~	~~9.0~~	~~13.5~~	~~18.0~~	~~22.5~~	~~2,100~~	~~—~~
~~D_1~~		~~4.5~~	~~9.0~~	~~13.5~~	~~18.0~~	~~22.5~~	~~3,700~~	~~5,800~~
		~~6.0~~	~~12.0~~	~~18.0~~	~~24.0~~	~~30.0~~	~~3,700~~	~~9,500~~

(continued)

TABLE R602.10.6.5.4—continued

METHOD BV-WSP WALL BRACING REQUIREMENTS[d]

SEISMIC DESIGN CATEGORY	**STORY**						**SINGLE-STORY HOLD-DOWN FORCE (pounds)[b]**	**CUMULATIVE HOLD-DOWN FORCE (pounds)[c]**
~~D_2~~ [a]		~~5.5~~	~~11.0~~	~~16.5~~	~~22.0~~	~~27.5~~	~~2,300~~	~~—~~

		~~5.5~~	~~11.0~~	~~16.5~~	~~22.0~~	~~27.5~~	~~3,900~~	~~6,200~~
	~~—~~	~~—~~	~~—~~	~~—~~	~~—~~	~~—~~	~~—~~	~~—~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.479 kPa, 1 pound-force = 4.448 N.~~

~~NP = Not Permitted.~~

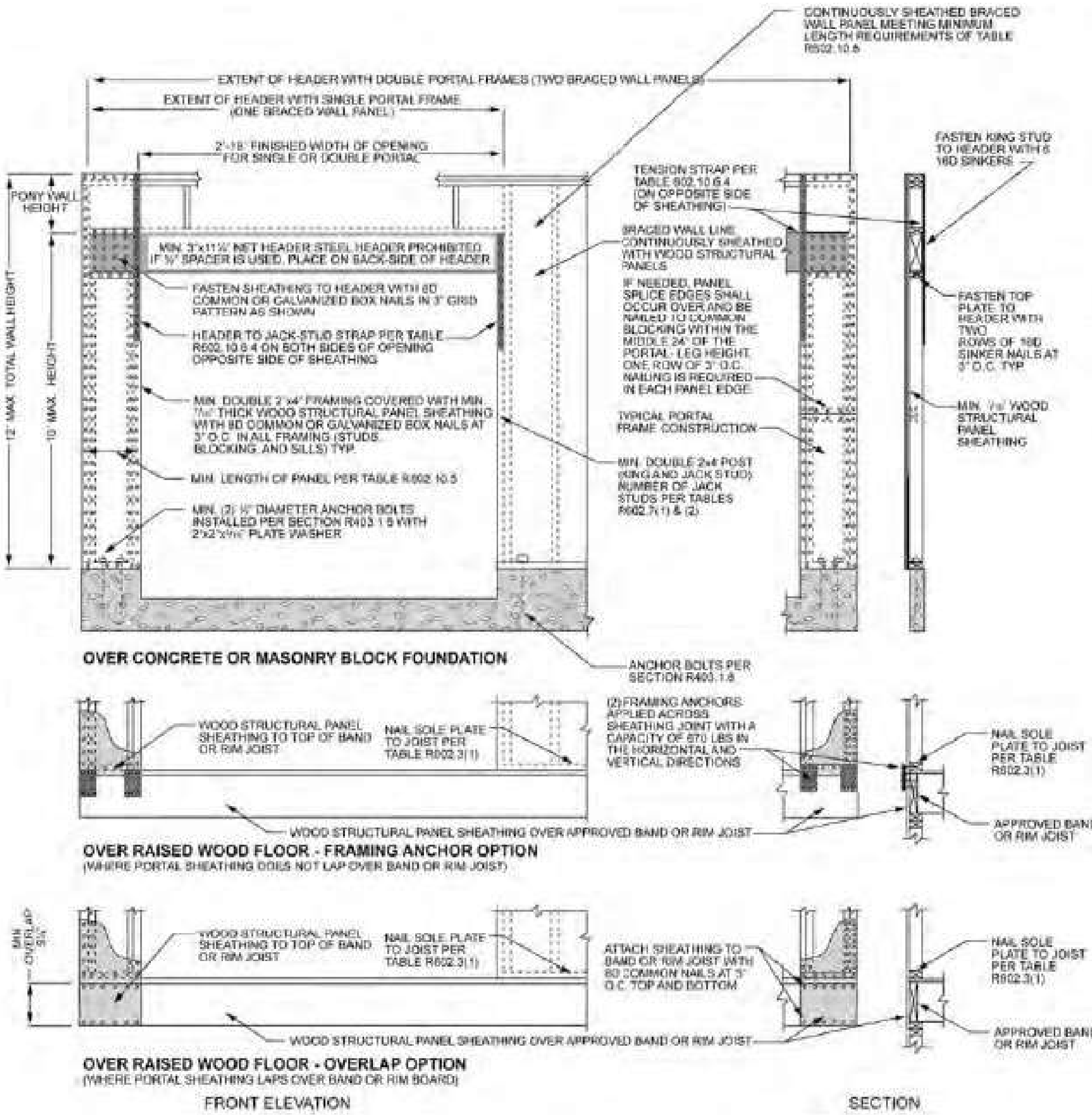
~~NA = Not Applicable.~~

~~a. One- and two-family dwellings in Seismic Design Category D_2 exceeding two stories shall be designed in accordance with accepted engineering practices.~~

~~b. Hold-down force is minimum allowable stress design load for connector providing uplift tie from wall framing at end of *braced wall panel* at the noted story to wall framing at end of *braced wall panel* at the story below, or to foundation or foundation wall. Use single-story hold-down force where edges of *braced wall panels* do not align; a continuous load path to the foundation shall be maintained.~~

~~c. Where hold-down connectors from stories above align with stories below, use cumulative hold-down force to size middle- and bottom-story hold-down connectors.~~

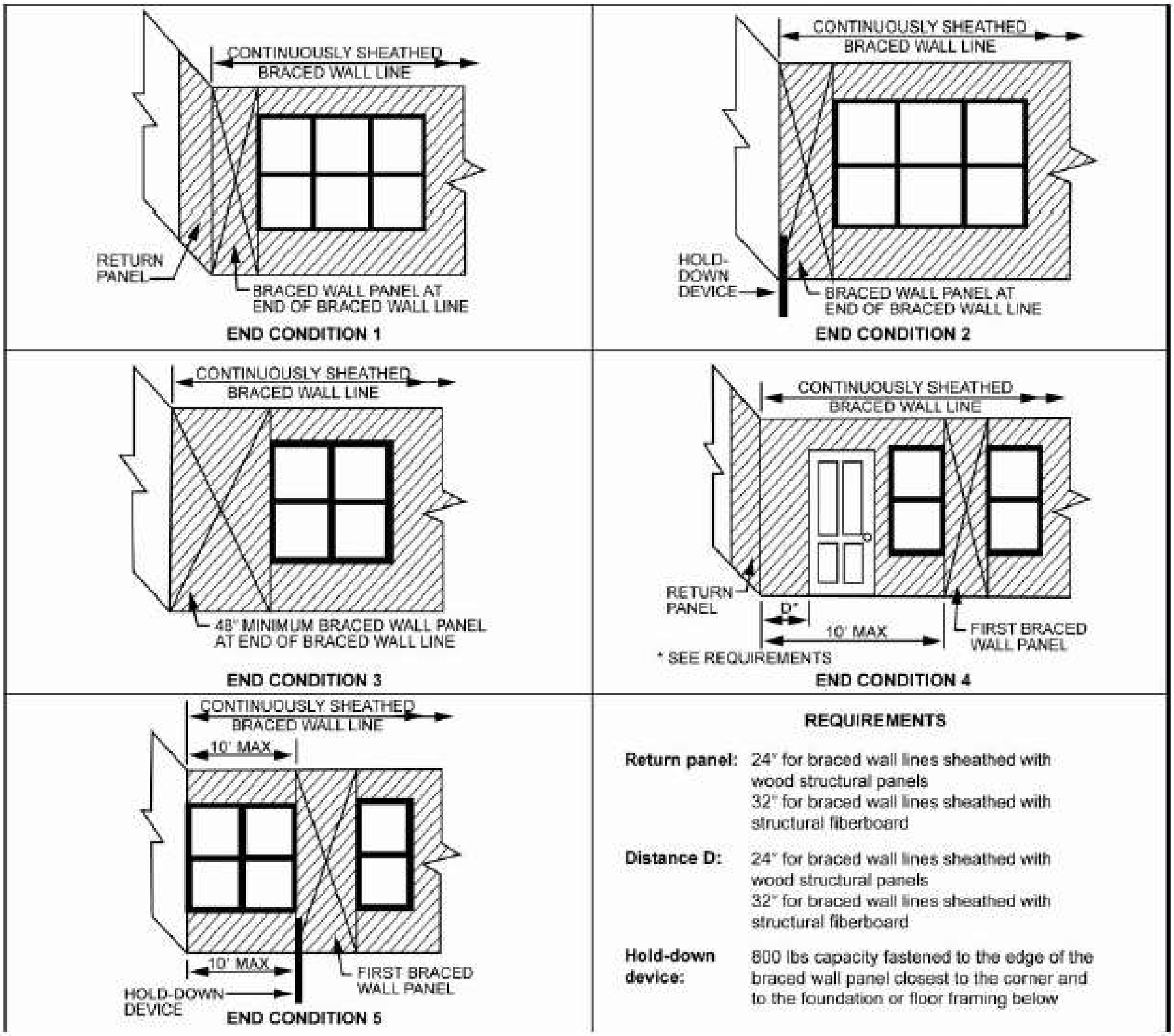
~~d. Interpolation between braced wall lengths is permitted.~~



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

FIGURE R602.10.6.4
METHOD CS-PF—CONTINUOUSLY SHEATHED PORTAL FRAME PANEL CONSTRUCTION

R602.10.7 Ends of braced wall lines with continuous sheathing. Each end of a *braced wall line* with continuous sheathing shall have one of the conditions shown in Figure R602.10.7.

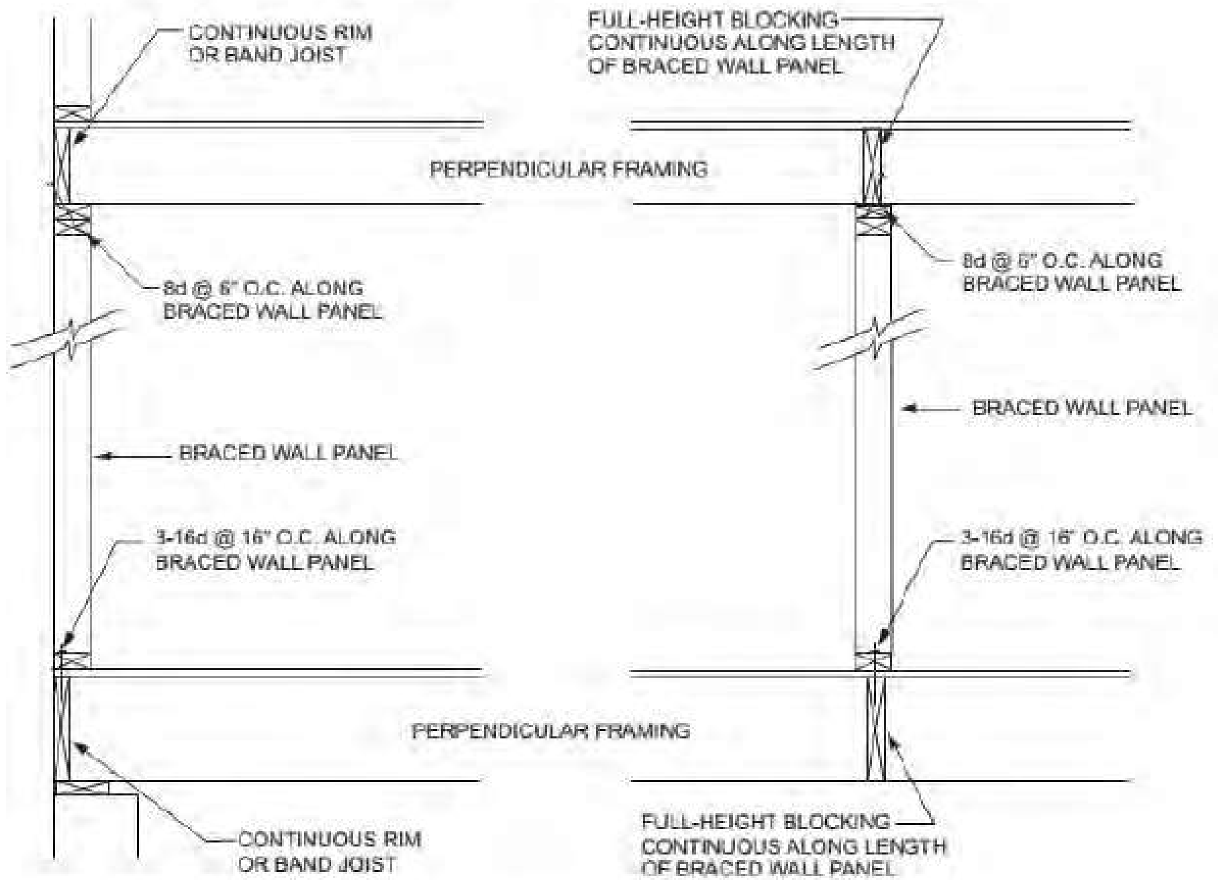


For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound = 4.45 N.

FIGURE R602.10.7
END CONDITIONS FOR BRACED WALL LINES WITH CONTINUOUS SHEATHING

R602.10.8 Braced wall panel connections. *Braced wall panel*s shall be connected to floor framing or foundations as follows:

1. Where joists are perpendicular to a *braced wall panel* above or below, a rim joist, band joist or blocking shall be provided along the entire length of the *braced wall panel* in accordance with Figure R602.10.8(1). Fastening of top and bottom wall plates to framing, rim joist, band joist or blocking shall be in accordance with Table R602.3(1).
2. Where joists are parallel to a *braced wall panel* above or below, a rim joist, end joist or other parallel framing member shall be provided directly above and below the *braced wall panel* in accordance with Figure R602.10.8(2). Where a parallel framing member cannot be located directly above and below the panel, full-depth blocking at 16-inch (406 mm) spacing shall be provided between the parallel framing members to each side of the *braced wall panel* in accordance with Figure R602.10.8(2). Fastening of blocking and wall plates shall be in accordance with Table R602.3(1) and Figure R602.10.8(2).
3. Connections of *braced wall panel*s to concrete or masonry shall be in accordance with Section R403.1.6.



For SI: 1 inch = 25.4 mm.

FIGURE R602.10.8(1)
BRACED WALL PANEL CONNECTION WHEN PERPENDICULAR TO FLOOR/CEILING FRAMING

R602.10.8.1 Braced wall panel connections for Seismic Design Categories D$_0$, D$_1$ and D$_2$~~.~~ Deleted. ~~*Braced wall panels* shall be fastened to required foundations in accordance with Section R602.11.1, and top plate lap splices shall be face-nailed with not less than eight 16d nails on each side of the splice.~~

R602.10.8.2 Connections to roof framing. Top plates of exterior *braced wall panels* shall be attached to rafters or roof trusses above in accordance with Table R602.3(1) and this section. Where required by this section, blocking between rafters or roof trusses shall be attached to top plates of *braced wall panels* and to rafters and roof trusses in accordance with Table R602.3(1). A continuous band, rim or header joist or roof truss parallel to the *braced wall panels* shall be permitted to replace the blocking required by this section. Blocking shall not be required over openings in continuously sheathed *braced wall lines*. In addition to the requirements of this section, lateral support shall be provided for rafters and ceiling joists in accordance with Section R802.8 and for trusses in accordance with Section R802.10.3. Roof *ventilation* shall be provided in accordance with Section R806.1.

1. For *Seismic Design Categories* A, B and C where the distance from the top of the *braced wall panel* to the top of the rafters or roof trusses above is $9^{1}/_{4}$ inches (235 mm) or less, blocking between rafters or roof trusses shall not be required. Where the distance from the top of the *braced wall panel* to the top of the rafters or roof trusses above is between $9^{1}/_{4}$ inches (235 mm) and $15^{1}/_{4}$ inches (387 mm), blocking between rafters or roof trusses shall be provided above the *braced wall panel* in accordance with Figure R602.10.8.2(1).

   Exception: Where the outside edge of truss vertical web members aligns with the outside face of the wall studs below, wood structural panel sheathing extending above the top plate as shown in Figure R602.10.8.2(3) shall be permitted to be fastened to each truss web with three-8d nails ($2^1/_2$ inches × 0.131 inch) and blocking between the trusses shall not be required.

2. Deleted. ~~For *Seismic Design Categories* D_0, D_1 and D_2, where the distance from the top of the *braced wall panel* to the top of the rafters or roof trusses is $15^1/_4$ inches (387 mm) or less, blocking between rafters or roof trusses shall be provided above the *braced wall panel* in accordance with Figure R602.10.8.2(1).~~

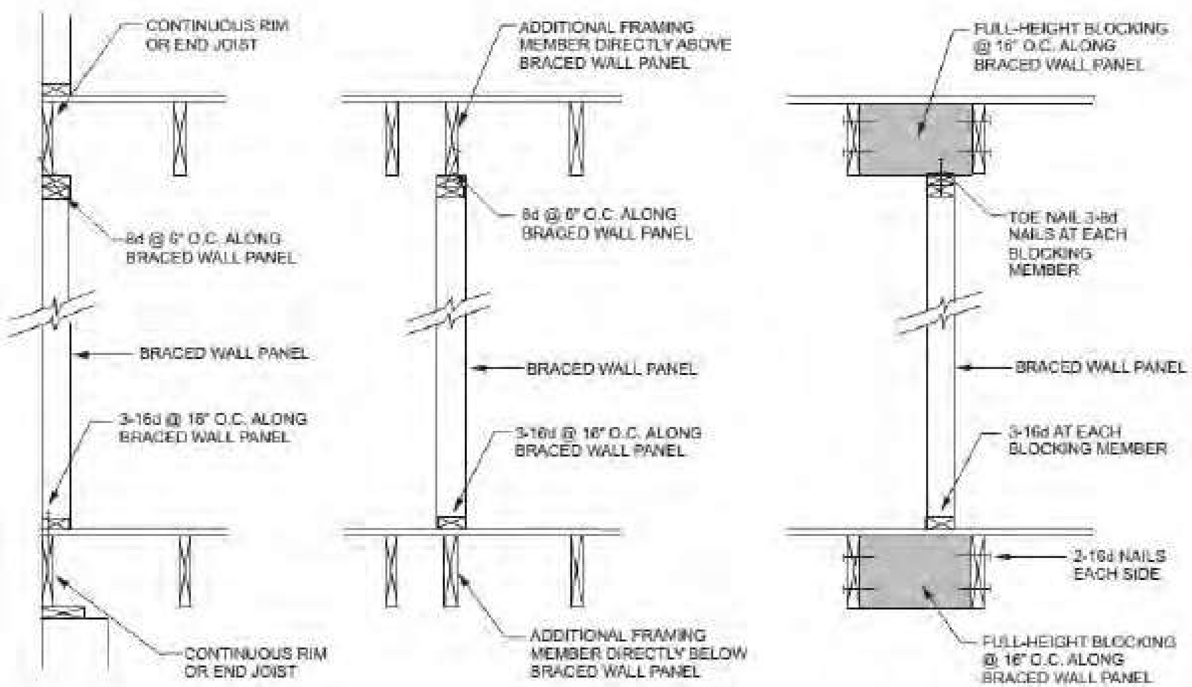
3. Where the distance from the top of the *braced wall panel* to the top of rafters or roof trusses exceeds $15^1/_4$ inches (387 mm), the top plates of the *braced wall panel* shall be connected to perpendicular rafters or roof trusses above in accordance with one or more of the following methods:

   3.1. Soffit blocking panels constructed in accordance with Figure R602.10.8.2(2).

   3.2. Vertical blocking panels constructed in accordance with Figure R602.10.8.2(3).

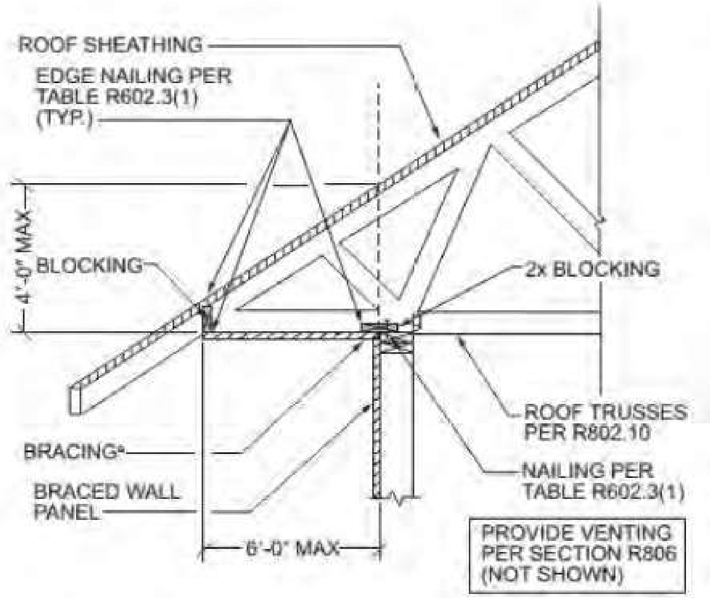
   3.3. Blocking panels provided by the roof truss manufacturer and designed in accordance with Section R802.

   3.4. Blocking, blocking panels or other methods of lateral load transfer designed in accordance with the AWC WFCM or accepted engineering practice.



For SI: 1 inch = 25.4 mm.

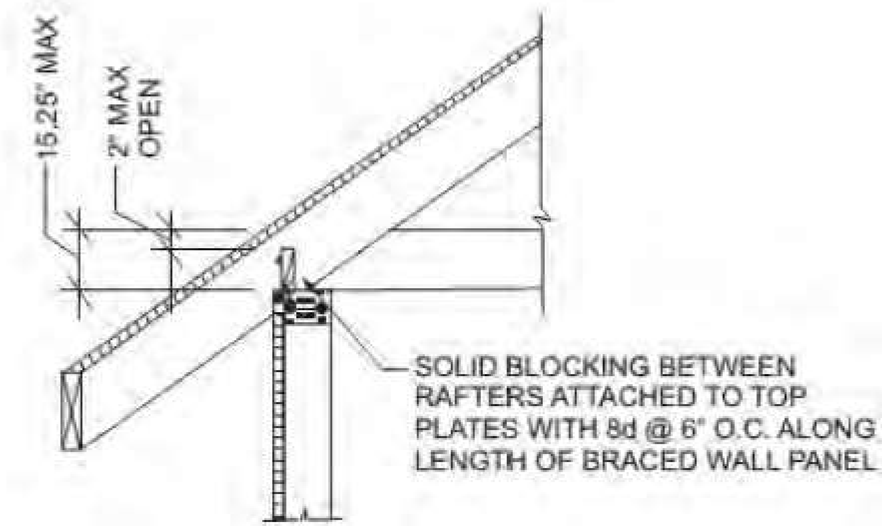
FIGURE R602.10.8(2)
BRACED WALL PANEL CONNECTION WHEN PARALLEL TO FLOOR/CEILING FRAMING



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

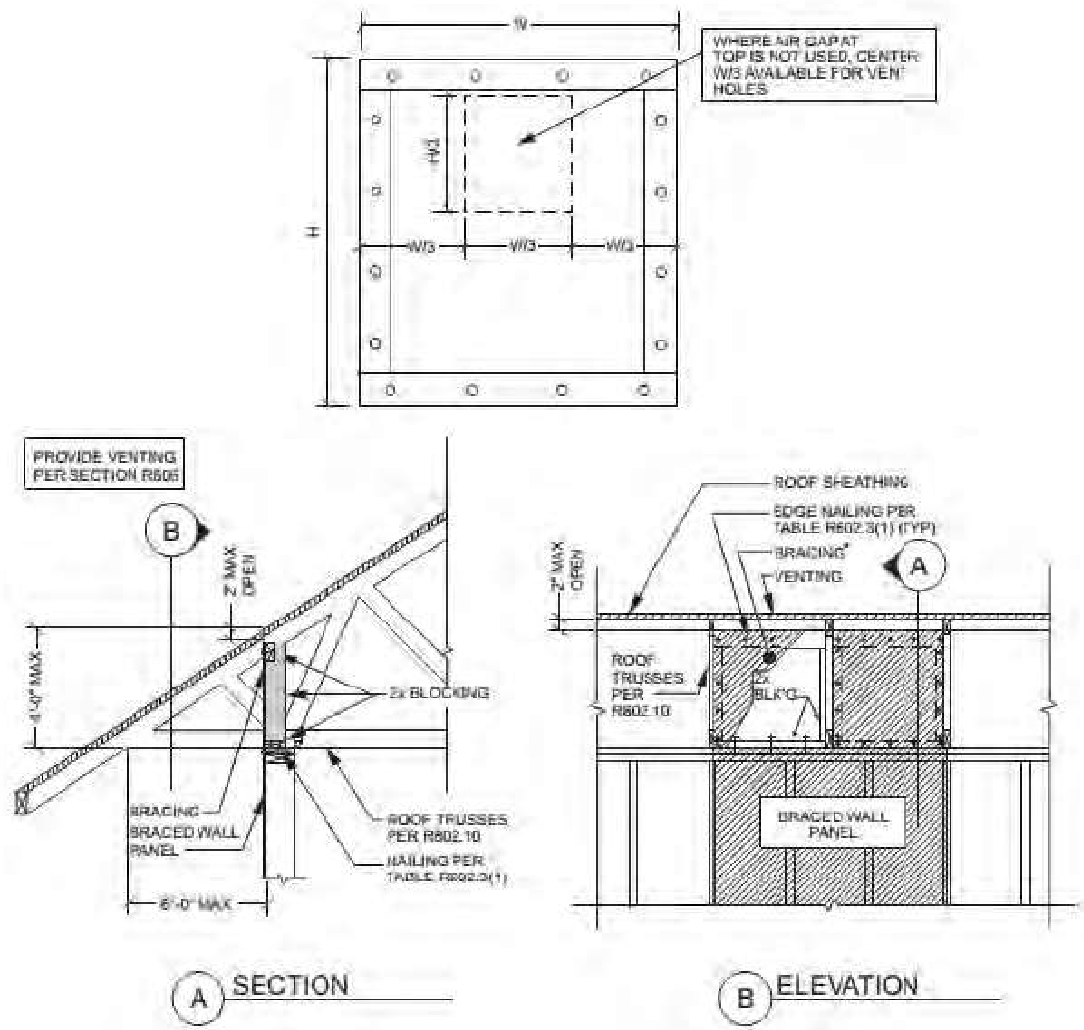
a. Methods of bracing shall be as described in **Section R602.10.4**.

FIGURE R602.10.8.2(2)
BRACED WALL PANEL CONNECTION OPTION TO PERPENDICULAR RAFTERS OR ROOF TRUSSES



For SI: 1 inch = 25.4 mm.

FIGURE R602.10.8.2(1)
BRACED WALL PANEL CONNECTION TO PERPENDICULAR RAFTERS



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

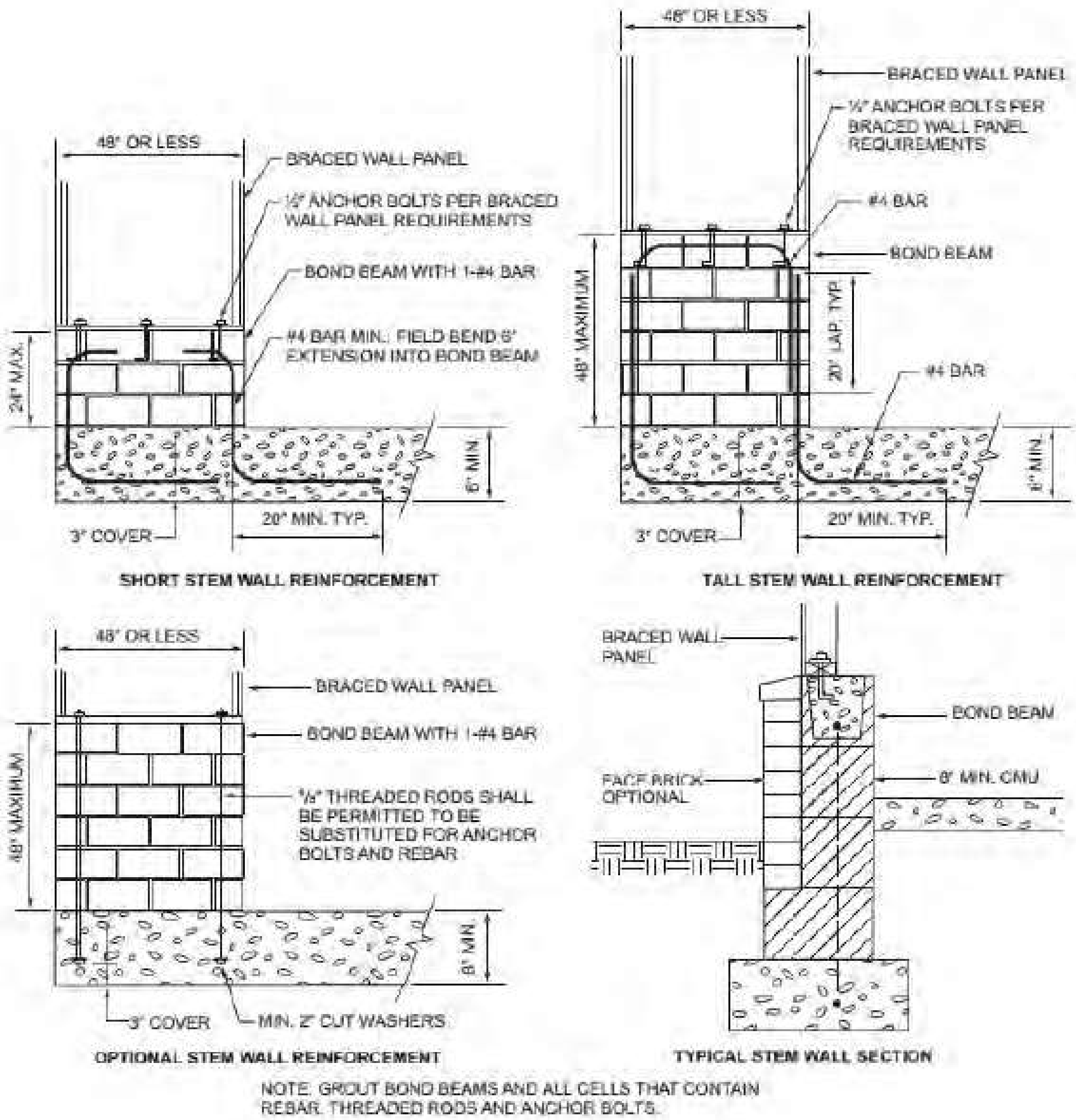
a. Methods of bracing shall be as described in **Section R602.10.4**.

FIGURE R602.10.8.2(3)
BRACED WALL PANEL CONNECTION OPTION TO PERPENDICULAR RAFTERS OR ROOF TRUSSES

R602.10.9 Braced wall panel support. *Braced wall panel* support shall be provided as follows:

1. Cantilevered floor joists complying with Section R502.3.3 shall be permitted to support *braced wall panel*s.
2. Raised floor system post or pier foundations supporting *braced wall panel*s shall be designed in accordance with accepted engineering practice.
3. Masonry stem walls with a length of 48 inches (1219 mm) or less supporting *braced wall panel*s shall be reinforced in accordance with Figure R602.10.9. Masonry stem walls with a length greater than 48 inches (1219 mm) supporting *braced wall panel*s shall be constructed in accordance with Section R403.1 Methods ABW and PFH shall not be permitted to attach to masonry stem walls.
4. Concrete stem walls with a length of 48 inches (1219 mm) or less, greater than 12 inches (305 mm) tall and less than 6 inches (152 mm) thick shall have reinforcement sized and located in accordance with Figure R602.10.9.

R602.10.9.1 Braced wall panel support for Seismic Design Categories D_0, D_1 and D_2.-Deleted. ~~In *Seismic Design Categories* D_0, D_1 and D_2, *braced wall panel* footings shall be as specified in Section R403.1.2.~~



For SI: 1 inch = 25.4 mm.

FIGURE R602.10.9
MASONRY STEM WALLS SUPPORTING BRACED WALL PANELS

R602.10.10 Cripple wall bracing. Cripple walls shall be constructed in accordance with Section R602.9 and braced in accordance with this section. Cripple walls shall be braced with the length and method of bracing used for the wall above in accordance with Tables R602.10.3(1) and R602.10.3(3), and the applicable adjustment factors in Table R602.10.3(2) or R602.10.3(4), respectively, except that the length of cripple wall bracing shall be multiplied by a factor of 1.15. Where gypsum wall board is not used on the inside of the cripple wall bracing, the length adjustments for the elimination of the gypsum wallboard, or equivalent, shall be applied as directed in Tables R602.10.3(2) and R602.10.3(4) to the length of cripple wall bracing required. This adjustment shall be taken in addition to the 1.15 increase.

R602.10.10.1 Cripple wall bracing for ~~Seismic Design Categories D_0 and D_1 and~~ townhouses in Seismic Design Category C. In addition to the requirements in Section R602.10.10, cripple wall bracing shall be limited to methods WSP and CS-WSP, and the distance between adjacent edges of *braced wall panel*s for cripple walls along a *braced wall line* shall be 14 feet (4267 mm) maximum.

Where *braced wall lines* at interior walls are not supported on a continuous foundation below, the adjacent parallel cripple walls, where provided, shall be braced with Method WSP or Method CS-WSP in accordance with Section R602.10.4. The length of bracing required in accordance with Table R602.10.3(3) for the cripple walls shall be multiplied by 1.5. Where the cripple walls do not have sufficient length to provide the required bracing, the spacing of panel edge fasteners shall be reduced to 4 inches (102 mm) on center and the required bracing length adjusted by 0.7. If the required length can still not be provided, the cripple wall shall be designed in accordance with accepted engineering practice.

R602.10.10.2 Cripple wall bracing for Seismic Design Category D_2. Deleted. ~~In *Seismic Design Category* D_2, cripple walls shall be braced in accordance with Tables R602.10.3(3) and R602.10.3(4).~~

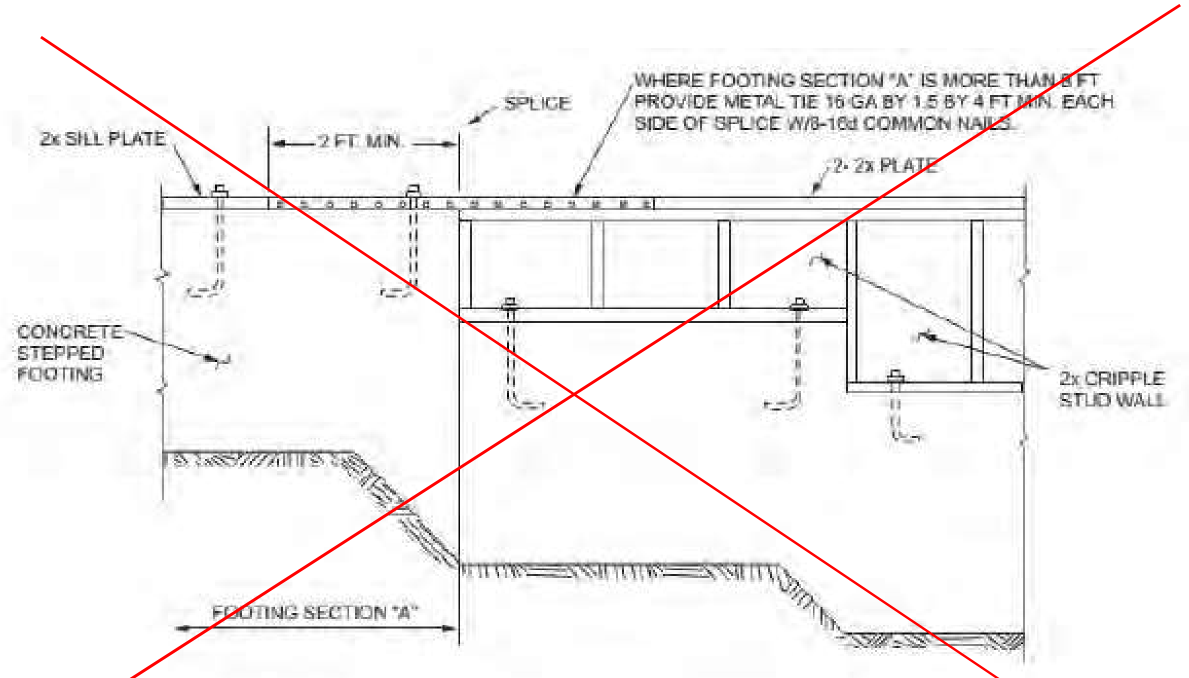
R602.10.10.3 Redesignation of cripple walls. Where all cripple wall segments along a *braced wall line* do not exceed 48 inches (1219 mm) in height, the cripple walls shall be permitted to be redesignated as a first-*story* wall for purposes of determining wall bracing requirements. Where any cripple wall segment in a *braced wall line* exceeds 48 inches (1219 mm) in height, the entire cripple wall shall be counted as an additional *story*. If the cripple walls are redesignated, the stories above the redesignated *story* shall be counted as the second and third stories, respectively.

R602.11 Wall anchorage. *Braced wall line* sills shall be anchored to concrete or masonry foundations in accordance with Sections R403.1.6 and R602.11.1.

R602.11.1 Wall anchorage for ~~all buildings in Seismic Design Categories D_0, D_1 and D_2 and~~ townhouses in Seismic Design Category C. Plate washers, not less than 0.229 inch by 3 inches by 3 inches (5.8 mm by 76 mm by 76 mm) in size, shall be provided between the foundation sill plate and the nut except where *approved* anchor straps are used. The hole in the plate washer is permitted to be diagonally slotted with a width of up to $^3/_{16}$ inch (5 mm) larger than the bolt diameter and a slot length not to exceed $1^3/_4$ inches (44 mm), provided a standard cut washer is placed between the plate washer and the nut.

R602.11.2 Stepped foundations in Seismic Design Categories D_0, D_1 and D_2. Deleted. ~~In all buildings located in *Seismic Design Categories* D_0, D_1 or D_2, where the height of a required *braced wall line* that extends from foundation to floor above varies more than 4 feet (1219 mm), the *braced wall line* shall be constructed in accordance with the following:~~

1. ~~Where the lowest floor framing rests directly on a sill bolted to a foundation not less than 8 feet (2440 mm) in length along a line of bracing, the line shall be considered as braced. The double plate of the cripple stud wall beyond the segment of footing that extends to the lowest framed floor shall be spliced by extending the upper top plate not less than 4 feet (1219 mm) along the foundation. Anchor bolts shall be located not more than 1 foot and 3 feet (305 and 914 mm) from the step in the foundation. See Figure R602.11.2.~~
2. ~~Where cripple walls occur between the top of the foundation and the lowest floor framing, the bracing requirements of Sections R602.10.10, R602.10.10.1 and R602.10.10.2 shall apply.~~
3. ~~Where only the bottom of the foundation is stepped and the lowest floor framing rests directly on a sill bolted to the foundations, the requirements of Sections R403.1.6 and R602.11.1 shall apply.~~



For SI: 1 foot = 304.8 mm.

Note: Where footing Section "A" is less than 8 feet long in a 25-foot-long wall, install bracing at cripple stud wall.

FIGURE R602.11.2
~~STEPPED FOUNDATION CONSTRUCTION~~

R602.12 Simplified wall bracing. Buildings meeting all of the following conditions shall be permitted to be braced in accordance with this section as an alternative to the requirements of Section R602.10. The entire building shall be braced in accordance with this section; the use of other bracing provisions of Section R602.10, except as specified herein, shall not be permitted.

1. There shall be not more than three stories above the top of a concrete or masonry foundation or basement wall. Permanent wood foundations shall not be permitted.
2. Floors shall not cantilever more than 24 inches (607 mm) beyond the foundation or bearing wall below.
3. Wall height shall not be greater than 10 feet (3048 mm).
4. The building shall have a roof eave-to-ridge height of 15 feet (4572 mm) or less.
5. Exterior walls shall have gypsum board with a minimum thickness of $^1/_2$ inch (12.7 mm) installed on the interior side fastened in accordance with Table R702.3.5.
6. The structure shall be located where the ultimate design wind speed is less than or equal to 130 mph (58 m/s), and the exposure category is B or C.
7. The structure shall be located in *Seismic Design Category* A, B or C for detached one- and two-family dwellings or *Seismic Design Category* A or B for townhouses.
8. Cripple walls shall not be permitted in three-story buildings.

R602.12.1 Circumscribed rectangle. The bracing required for each building shall be determined by circumscribing a rectangle around the entire building on each floor as shown in Figure R602.12.1. The rectangle shall surround all enclosed offsets and projections such as *sunrooms* and attached garages. Open structures, such as carports and decks, shall be permitted to be excluded. The rectangle shall not have a side greater than 60 feet (18 288 mm), and the ratio between the long side and short side shall be not greater than 3:1.

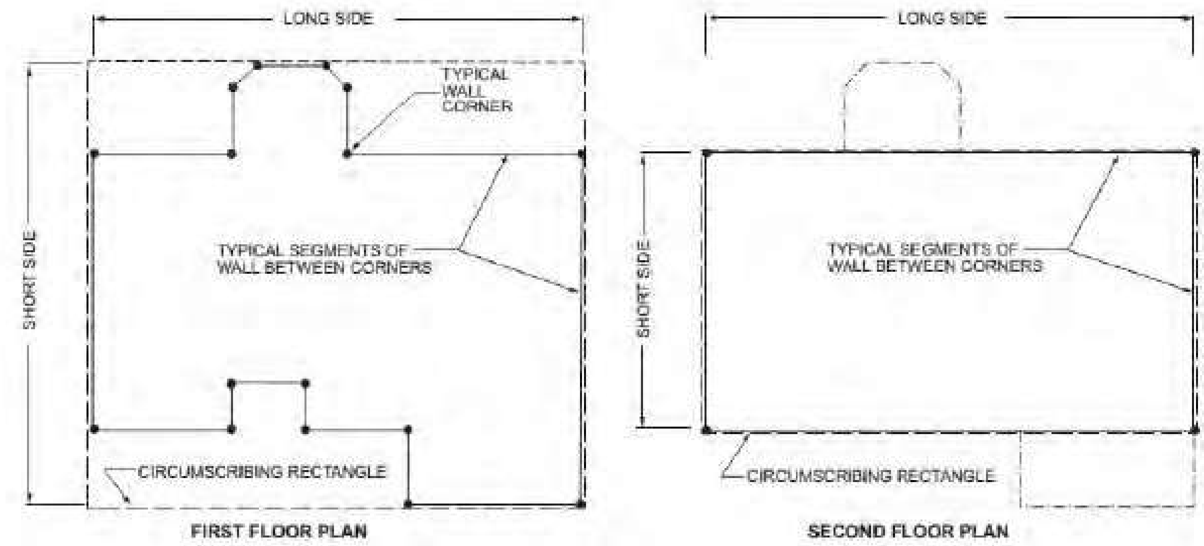


FIGURE R602.12.1
RECTANGLE CIRCUMSCRIBING AN ENCLOSED BUILDING

R602.12.2 Sheathing materials. The following sheathing materials installed on the exterior side of exterior walls shall be used to construct a bracing unit as defined in Section R602.12.3. Mixing materials is prohibited.

1. Wood structural panels with a minimum thickness of $^3/_8$ inch (9.5 mm) fastened in accordance with Table R602.3(3).
2. Structural fiberboard sheathing with a minimum thickness of $^1/_2$ inch (12.7 mm) fastened in accordance with Table R602.3(1).

R602.12.3 Bracing unit. A bracing unit shall be a full-height sheathed segment of the exterior wall without openings or vertical or horizontal offsets and a minimum length as specified herein. Interior walls shall not contribute toward the amount of required bracing. Mixing of Items 1 and 2 is prohibited on the same story.

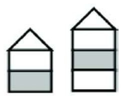
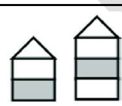
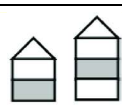
1. Where all framed portions of all exterior walls are sheathed in accordance with Section R602.12.2, including wall areas between bracing units, above and below openings and on gable end walls, the minimum length of a bracing unit shall be 3 feet (914 mm).
2. Where the exterior walls are braced with sheathing panels in accordance with Section R602.12.2 and areas between bracing units are covered with other materials, the minimum length of a bracing unit shall be 4 feet (1219 mm).

R602.12.3.1 Multiple bracing units. Segments of wall compliant with Section R602.12.3 and longer than the minimum bracing unit length shall be considered as multiple bracing units. The number of bracing units shall be determined by dividing the wall segment length by the minimum bracing unit length. Full-height sheathed segments of wall narrower than the minimum bracing unit length shall not contribute toward a bracing unit except as specified in Section R602.12.6.

R602.12.4 Number of bracing units. Each side of the circumscribed rectangle, as shown in Figure R602.12.1, shall have, at a minimum, the number of bracing units in accordance with Table R602.12.4 placed on the parallel exterior walls facing the side of the rectangle. Bracing units shall then be placed using the distribution requirements specified in Section R602.12.5.

TABLE R602.12.4
MINIMUM NUMBER OF BRACING UNITS ON EACH SIDE OF THE CIRCUMSCRIBED RECTANGLE

ULTIMATE DESIGN WIND SPEED (mph)	STORY LEVEL	EAVE-TO-RIDGE HEIGHT (feet)	MINIMUM NUMBER OF BRACING UNITS ON EACH LONG SIDE[a, b, d]	MINIMUM NUMBER OF BRACING UNITS ON EACH SHORT SIDE[a, b, d]
			Length of short side (feet)[c]	Length of long side (feet)[c]

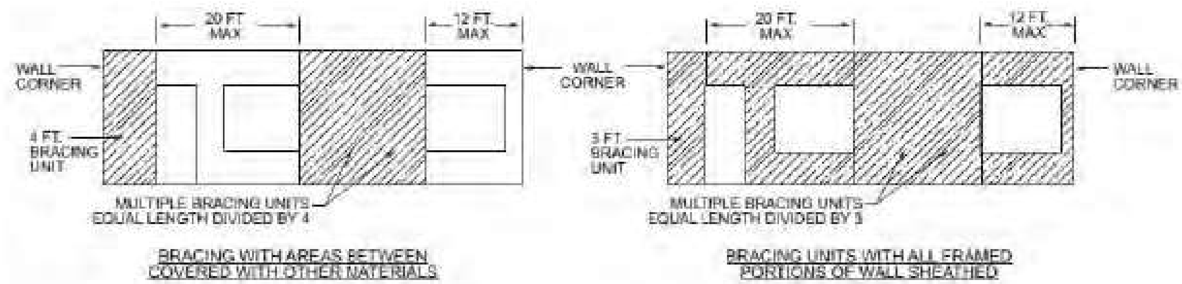
			10	20	30	40	50	60	10	20	30	40	50	60
115		10	1	2	2	2	3	3	1	2	2	2	3	3
			2	3	3	4	5	6	2	3	3	4	5	6
			2	3	4	6	7	8	2	3	4	6	7	8
		15	1	2	3	3	4	4	1	2	3	3	4	4
			2	3	4	5	6	7	2	3	4	5	6	7
			2	4	5	6	7	9	2	4	5	6	7	9
130		10	1	2	2	3	3	4	1	2	2	3	3	4
			2	3	4	5	6	7	2	3	4	5	6	7
			2	4	5	7	8	10	2	4	5	7	8	10
		15	2	3	3	4	4	6	2	3	3	4	4	6
			3	4	6	7	8	10	3	4	6	7	8	10
			3	6	7	10	11	13	3	6	7	10	11	13

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447m/s.
a. Interpolation shall not be permitted.

b. Cripple walls or wood-framed *basement walls* in a walk-out condition shall be designated as the first story and the stories above shall be redesignated as the second and third stories, respectively, and shall be prohibited in a three-story structure.
c. Actual lengths of the sides of the circumscribed rectangle shall be rounded to the next highest unit of 10 when using this table.
d. For Exposure Category C, multiply bracing units by a factor of 1.20 for a one-story building, 1.30 for a two-story building and 1.40 for a three-story building.

R602.12.5 Distribution of bracing units. The placement of bracing units on exterior walls shall meet all of the following requirements as shown in Figure R602.12.5.

1. A bracing unit shall begin not more than 12 feet (3658 mm) from any wall corner.
2. The distance between adjacent edges of bracing units shall be not greater than 20 feet (6096 mm).
3. Segments of wall greater than 8 feet (2438 mm) in length shall have not less than one bracing unit.



For SI: 1 foot = 304.8 mm.

FIGURE R602.12.5
BRACING UNIT DISTRIBUTION

R602.12.6 Narrow panels. The bracing methods referenced in Section R602.10 and specified in Sections R602.12.6.1 through R602.12.6.3 shall be permitted where using simplified wall bracing.

R602.12.6.1 Method CS-G. *Braced wall panels* constructed as Method CS-G in accordance with Tables R602.10.4 and R602.10.5 shall be permitted for one-story garages where all framed portions of all exterior walls are sheathed with *wood structural panels*. Each CS-G panel shall be equivalent to 0.5 of a bracing unit. Segments of wall that include a Method CS-G panel shall meet the requirements of Section R602.10.4.2.

R602.12.6.2 Method CS-PF. *Braced wall panels* constructed as Method CS-PF in accordance with Section R602.10.6.4 shall be permitted where all framed portions of all exterior walls are sheathed with *wood structural panels*. Each CS-PF panel shall equal 0.75 bracing units. Segments of wall that include a Method CS-PF panel shall meet the requirements of Section R602.10.4.2.

R602.12.6.3 Methods ABW, PFH and PFG. *Braced wall panels* constructed as Method ABW, PFH and PFG shall be permitted where bracing units are constructed using *wood structural panels* applied either continuously or intermittently. Each ABW and PFH panel shall equal one bracing unit and each PFG panel shall be equal to 0.75 bracing unit.

R602.12.7 Lateral support. For bracing units located along the eaves, the vertical distance from the outside edge of the top wall plate to the roof sheathing above shall not exceed 9.25 inches (235 mm) at the location of a bracing unit unless lateral support is provided in accordance with Section R602.10.8.2.

R602.12.8 Stem walls. Masonry stem walls with a height and length of 48 inches (1219 mm) or less supporting a bracing unit or a Method CS-G, CS-PF or PFG *braced wall panel* shall be constructed in accordance with Figure R602.10.9. Concrete stem walls with a length of 48 inches (1219 mm) or less, greater than 12 inches (305 mm) tall and less than 6 inches (152 mm) thick shall be reinforced sized and located in accordance with Figure R602.10.9.

SECTION R603
COLD-FORMED STEEL WALL FRAMING

(Deleted)

~~**R603.1 General.** Elements shall be straight and free of any defects that would significantly affect structural performance. Cold-formed steel wall framing members shall be in accordance with the requirements of this section.~~

~~**R603.1.1 Applicability limits.** The provisions of this section shall control the construction of exterior cold-formed steel wall framing and interior load-bearing cold-formed steel wall framing for buildings not more than 60 feet (18 288 mm) long perpendicular to the joist or truss span, not more than 40 feet (12 192 mm) wide parallel to the joist or truss span, and less than or equal to three stories above *grade plane*. Exterior walls installed in accordance with the provisions of this section shall be considered as *load-bearing walls*. Cold-formed steel walls constructed in accordance with the provisions of this section shall be limited to sites where the ultimate design wind speed is less than 140 miles per hour (63 m/s), Exposure Category B or C, and the ground snow load is less than or equal to 70 pounds per square foot (3.35 kPa).~~

~~R603.1.1.1 Alternate applications. Cold-formed steel wall framing for buildings exceeding the applicability limits of Section R603.1.1 are permitted to be designed and constructed in accordance with AISI S230, subject to the limits therein.~~

~~**R603.1.2 In-line framing.** Load bearing cold formed steel studs constructed in accordance with Section R603 shall be located in-line with joists, trusses and rafters in accordance with the tolerances specified in AISI S240, Section B1.2.3.~~

~~**R603.2 Structural framing.** Load-bearing cold-formed steel wall framing members shall be in accordance with this section.~~

~~**R603.2.1 Material.** Load-bearing cold-formed steel framing members shall be cold formed to shape from structural-quality sheet steel complying with the requirements of AISI 240, Section A3.~~

~~**R603.2.2 Corrosion protection.** Load-bearing cold-formed steel framing shall have a protective coating complying with AISI S240, Section A4.~~

~~**R603.2.3 Dimension, thickness and material grade.** Load bearing cold-formed steel wall framing members shall comply with the dimensional and thickness requirements specified in AISI S230, Section A4.3 and material grade requirements as specified in AISI S230, Section A4.4.~~

~~**R603.2.4 Identification.** Load bearing cold formed steel framing members shall meet the product identification requirements of AISI S240, Section A5.5.~~

~~**R603.2.5 Fastening.** Screws for steel-to-steel connections shall be installed with a minimum edge distance and center-to-center spacing of $^{1}/_{2}$ inch (12.7 mm), shall be self-drilling tapping and shall conform to ASTM C1513. Structural sheathing shall be attached to cold-formed steel studs with minimum No. 8 self-drilling tapping screws that conform to ASTM C1513. Screws for attaching structural sheathing to cold-formed steel wall framing shall have a minimum head diameter of 0.292 inch (7.4 mm) with countersunk heads and shall be installed with a minimum edge distance of $^{3}/_{8}$ inch (9.5 mm). Gypsum board shall be attached to cold-formed steel wall framing with minimum No. 6 screws conforming to ASTM C954 or ASTM C1513 with a bugle head style and shall be installed in accordance with Section R702. For connections, screws shall extend through the steel not fewer than three exposed threads. Fasteners shall have rust inhibitive coating suitable for the installation in which they are being used, or be manufactured from material not susceptible to corrosion.~~

~~**R603.2.6 Web holes, web hole reinforcing and web hole patching.** Web holes in wall studs shall comply with the conditions as prescribed in AISI S230, Section A4.5. Web holes not in conformance to the conditions as prescribed in AISI S230, Section A4.5 shall be reinforced in accordance with the provisions of AISI S230, Section A4.6 or patched in accordance with the provisions of AISI S230, Section A4.7.~~

~~**R603.3 Wall construction.** Exterior cold formed steel framed walls and interior load bearing cold formed steel framed walls shall be constructed in accordance with the provisions of this section.~~

~~**R603.3.1 Wall to foundation or floor connection.** Cold formed steel framed walls shall be anchored to foundations or floors in accordance with Table R603.3.1 and Figure R603.3.1(1), R603.3.1(2), R603.3.1(3) or R603.3.1(4). Anchor bolts shall be located not more than 12 inches (305 mm) from corners or the termination of~~

~~bottom tracks. Anchor bolts shall extend not less than 15 inches (381 mm) into masonry or 7 inches (178 mm) into concrete. Foundation anchor straps shall be permitted, in lieu of anchor bolts, if spaced as required to provide equivalent anchorage to the required anchor bolts and installed in accordance with manufacturer's requirements.~~

~~R603.3.1.1 Gable endwalls.~~ ~~Gable endwalls with heights greater than 10 feet (3048 mm) shall be anchored to foundations or floors in accordance with Table R603.3.1.1(1) or R603.3.1.1(2).~~

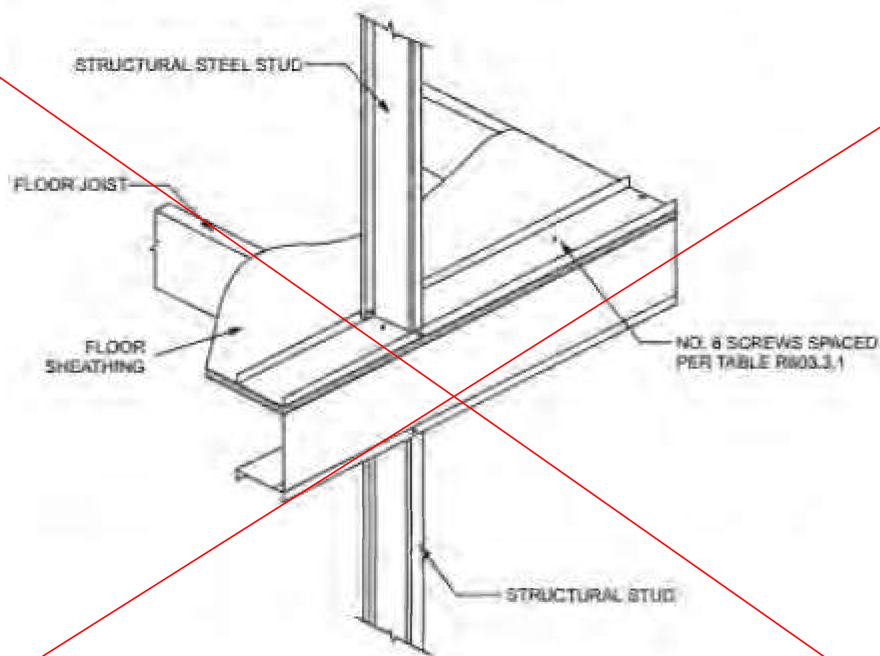
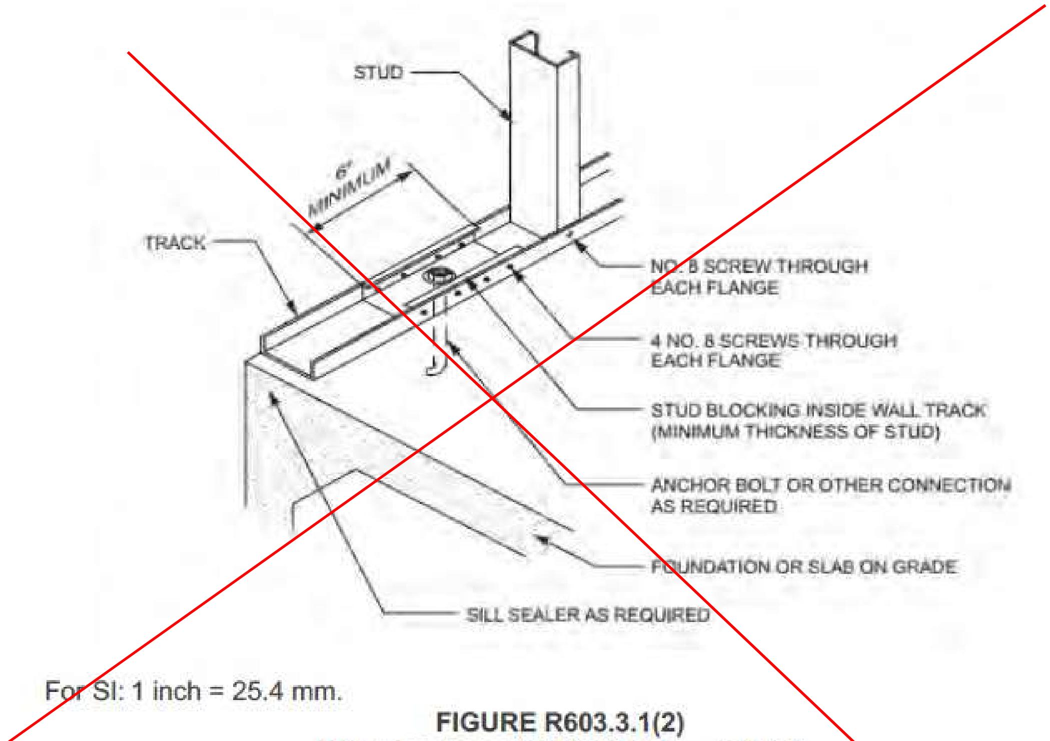
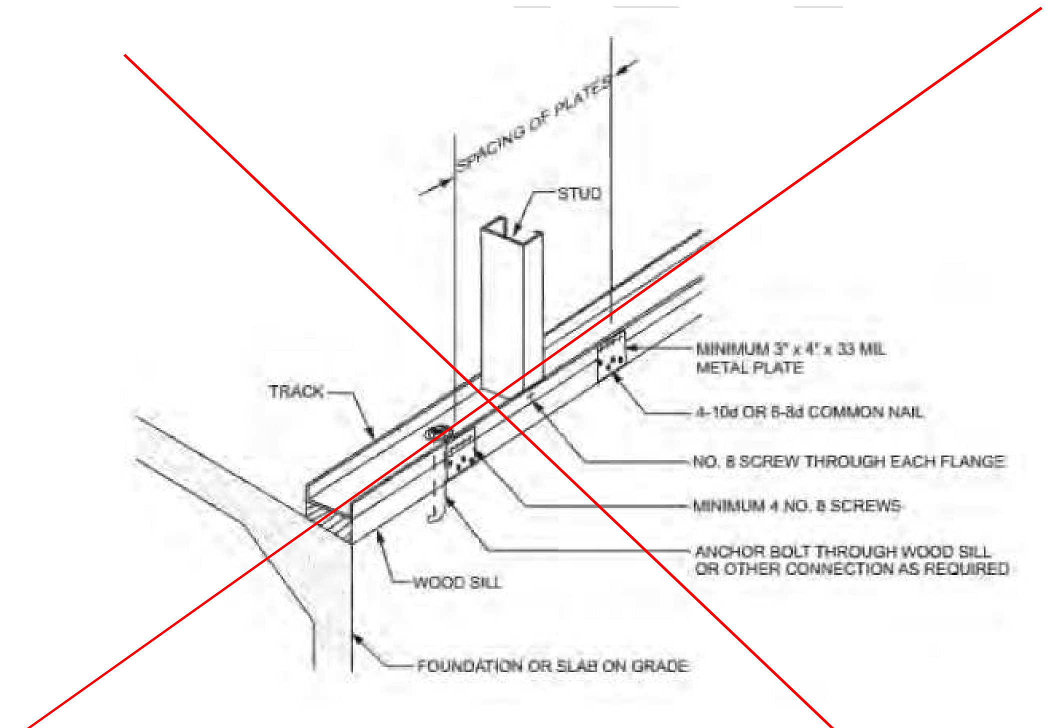


FIGURE R603.3.1(1)
~~WALL TO FLOOR CONNECTION~~



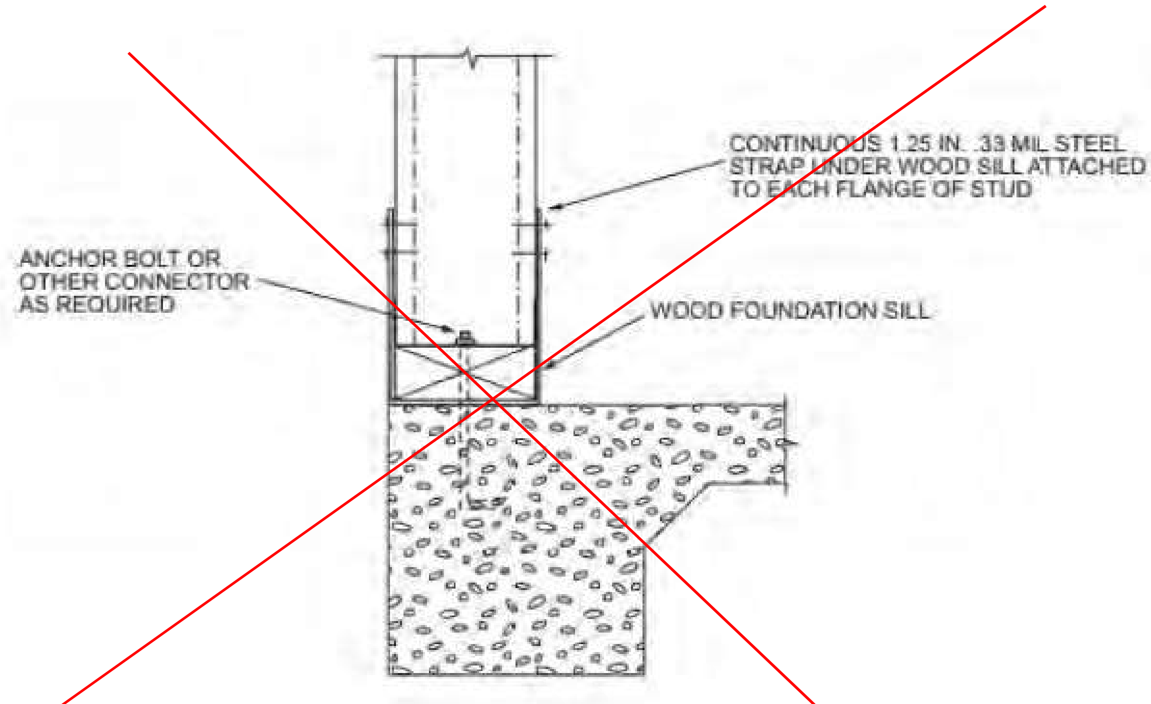
For SI: 1 inch = 25.4 mm.

FIGURE R603.3.1(2)
~~WALL TO FOUNDATION CONNECTION~~



For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm.

FIGURE R603.3.1(3)
~~WALL TO WOOD SILL CONNECTION~~



For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm.

FIGURE R603.3.1(4)
~~WIND UPLIFT CONNECTOR~~

~~**R603.3.2 Minimum stud sizes.** Cold-formed steel walls shall be constructed in accordance with Figure R603.3.1(1), R603.3.1(2) or R603.3.1(3), as applicable. Exterior wall stud size and thickness shall be determined in accordance with the limits set forth in Tables R603.3.2(2) through R603.3.2(16). Interior *load-bearing wall* stud size and thickness shall be determined in accordance with the limits set forth in Tables R603.3.2(2) through R603.3.2(16) based on an ultimate design wind speed of 115 miles per hour (51 m/s), Exposure Category B, and the building width, stud spacing and ground snow load, as appropriate. Fastening requirements shall be in accordance with Section R603.2.5 and Table R603.3.2(1). Top and bottom tracks shall have the same minimum thickness as the wall studs.~~

~~Exterior wall studs shall be permitted to be reduced to the next thinner size, as shown in Tables R603.3.2(2) through R603.3.2(16), but not less than 33 mils (0.84 mm), where both of the following conditions exist:~~

1. ~~Minimum of 1/2-inch (12.7 mm) gypsum board is installed and fastened on the interior surface in accordance with Section R702.~~
2. ~~Wood structural sheathing panels of minimum 7/16-inch thick (11.1 mm) oriented strand board or 15/32-inch-thick (12 mm) plywood are installed and fastened in accordance with Section R603.9.1 and Table R603.3.2(1) on the outside surface.~~

~~Interior load-bearing walls shall be permitted to be reduced to the next thinner size, as shown in Tables R603.3.2(2) through R603.3.2(16), but not less than 33 mils (0.84 mm), where not less than 1/2-inch (12.7 mm) gypsum board is installed and fastened in accordance with Section R702 on both sides of the wall. The tabulated stud thickness for *load-bearing walls* shall be used where the attic load is 10 pounds per square foot (480 Pa) or less. A limited attic storage load of 20 pounds per square foot (960 Pa) shall be permitted provided that the next higher snow load column is used to select the stud size from Tables R603.3.2(2) through R603.3.2(16).~~

~~For two-story buildings, the tabulated stud thickness for walls supporting one floor, roof and ceiling shall be used where the second floor *live load* is 30 pounds per square foot (1440 Pa). Second floor *live loads* of 40 psf (1920 Pa) shall be permitted provided that the next higher snow load column is used to select the stud size from Tables R603.3.2(2) through R603.3.2(11).~~

~~For three-story buildings, the tabulated stud thickness for walls supporting one or two floors, roof and ceiling shall be used where the third-floor *live load* is 30 pounds per square foot (1440 Pa). Third-floor *live loads* of 40 pounds per~~

~~square foot (1920 Pa) shall be permitted provided that the next higher snow load column is used to select the stud size from Tables R603.3.2(12) through R603.3.2(16).~~

~~**R603.3.2.1 Gable endwalls.** The size and thickness of gable endwall studs with heights less than or equal to 10 feet (3048 mm) shall be permitted in accordance with the limits set forth in Table R603.3.2.1(1). The size and thickness of gable endwall studs with heights greater than 10 feet (3048 mm) shall be determined in accordance with the limits set forth in Table R603.3.2.1(2).~~

~~TABLE R603.3.2.1(1)~~

~~ALL BUILDING WIDTHS GABLE ENDWALLS 8, 9 OR 10 FEET IN HEIGHT~~[a, b, c, d]

~~ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)~~		~~MEMBER SIZE~~	~~STUD SPACING (inches)~~	~~MINIMUM STUD THICKNESS (mils)~~		
~~Exp. B~~	~~Exp. C~~			~~8-foot Studs~~	~~9-foot Studs~~	~~10-foot Studs~~
~~115~~	—	~~350S162~~	~~16~~	~~33~~	~~33~~	~~33~~
			~~24~~	~~33~~	~~33~~	~~33~~
		~~550S162~~	~~16~~	~~33~~	~~33~~	~~33~~
			~~24~~	~~33~~	~~33~~	~~33~~
~~120~~	—	~~350S162~~	~~16~~	~~33~~	~~33~~	~~33~~
			~~24~~	~~33~~	~~33~~	~~43~~
		~~550S162~~	~~16~~	~~33~~	~~33~~	~~33~~
			~~24~~	~~33~~	~~33~~	~~33~~
~~130~~	~~115~~	~~350S162~~	~~16~~	~~33~~	~~33~~	~~33~~
			~~24~~	~~33~~	~~43~~	~~43~~
		~~550S162~~	~~16~~	~~33~~	~~33~~	~~33~~
			~~24~~	~~33~~	~~33~~	~~33~~
~~< 140~~	~~120~~	~~350S162~~	~~16~~	~~33~~	~~33~~	~~43~~
			~~24~~	~~33~~	~~43~~	~~54~~
		~~550S162~~	~~16~~	~~33~~	~~33~~	~~33~~
			~~24~~	~~33~~	~~33~~	~~33~~
—	~~130~~	~~350S162~~	~~16~~	~~33~~	~~33~~	~~43~~
			~~24~~	~~43~~	~~43~~	~~54~~
		~~550S162~~	~~16~~	~~33~~	~~33~~	~~33~~
			~~24~~	~~33~~	~~43~~	~~43~~
—	~~< 140~~	~~350S162~~	~~16~~	~~33~~	~~43~~	~~43~~
			~~24~~	~~43~~	~~54~~	~~54~~
		~~550S162~~	~~16~~	~~33~~	~~33~~	~~33~~
			~~24~~	~~43~~	~~43~~	~~43~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.~~

a. Deflection criterion $L/240$.
b. Design load assumptions:
    Ground snow load is 70 psf.
    Roof/ceiling dead load is 12 psf.
    Floor dead load is 10 psf.
    Floor live load is 40 psf.
    Attic dead load is 10 psf.
c. Building width is in the direction of horizontal framing members supported by the wall studs.
d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE R603.3.2.1(2)

ALL BUILDING WIDTHS GABLE ENDWALLS OVER 10 FEET IN HEIGHT[a, b, c, d]

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils) Stud Height, h (feet)					
Exp. B	Exp. C			$10 < h \leq 12$	$12 < h \leq 14$	$14 < h \leq 16$	$16 < h \leq 18$	$18 < h \leq 20$	$20 < h \leq 22$
115	—	350S162	16	33	43	68	97	—	—
			24	43	68	—	—	—	—
		550S162	16	33	33	33	43	43	54
			24	33	43	43	54	68	97
120	—	350S162	16	43	54	97	—	—	—
			24	54	97	—	—	—	—
		550S162	16	33	33	43	43	54	68
			24	33	43	54	54	68	97
130	115	350S162	16	43	54	97	—	—	—
			24	54	97	—	—	—	—
		550S162	16	33	33	43	54	54	97
			24	43	43	54	68	97	97
< 140	120	350S162	16	43	68	—	—	—	—
			24	68	—	—	—	—	—
		550S162	16	33	43	43	54	68	97
			24	43	54	54	68	97	—
—	130	350S162	16	54	97	—	—	—	—
			24	97	—	—	—	—	—
		550S162	16	33	43	54	68	97	—
			24	43	54	54	97	—	—
—	< 140	350S162	16	54	97	—	—	—	—
			24	97	—	—	—	—	—
		550S162	16	43	43	54	97	97	—

			24	54	54	68	—	—	—

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion *L*/240.

b. Design load assumptions:

Ground snow load is 70 psf.

Roof/ceiling dead load is 12 psf.

Floor dead load is 10 psf.

Floor live load is 40 psf.

Attic dead load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the wall studs.

d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE R603.3.1

WALL TO FOUNDATION OR FLOOR CONNECTION REQUIREMENTS[a, b]

FRAMING CONDITION			ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)					
			115 B	120 B	130 B or 115 C	≤ 140 B or 120 C	130 C	≤ 140 C
Wall bottom track to floor per Figure R603.3.1(1)			1 No. 8 screw at 12″ o.c.	1 No. 8 screw at 8″ o.c.	2 No. 8 screws at 8″ o.c.	2 No. 8 screws at 6″ o.c.	3 No. 8 screws at 8″ o.c.	3 No. 8 screws at 6″ o.c.
Wall bottom track to foundation per Figure R603.3.1(2)[d]			1/2″ minimum diameter anchor bolt at 6′ o.c.	1/2″ minimum diameter anchor bolt at 6′ o.c.	1/2″ minimum diameter anchor bolt at 4′ o.c.	1/2″ minimum diameter anchor bolt at 4′ o.c.	1/2″ minimum diameter anchor bolt at 3′ 4″ o.c.	1/2″ minimum diameter anchor bolt at 2′ 8″ o.c.
Wall bottom track to wood sill per Figure R603.3.1(3)			Steel plate spaced at 4′ o.c., with 4 No. 8 screws and 4-10d or 6-8d common nails	Steel plate spaced at 4′ o.c., with 4 No. 8 screws and 4-10d or 6-8d common nails	Steel plate spaced at 3′ o.c., with 4 No. 8 screws and 4-10d or 6-8d common nails	Steel plate spaced at 3′ o.c., with 4 No. 8 screws and 4-10d or 6-8d common nails	Steel plate spaced at 2′ o.c., with 4 No. 8 screws and 4-10d or 6-8d common nails	Steel plate spaced at 1′ 4″ o.c., with 4 No. 8 screws and 4-10d or 6-8d common nails
Wind uplift connector strength (lb)[c, e]	Stud Spacing (inches)	Roof Span (feet)						
	16	24	NR	NR	NR	NR	NR	NR
		28	NR	NR	NR	NR	NR	339
		32	NR	NR	NR	NR	NR	382
		36	NR	NR	NR	NR	333	426
		40	NR	NR	NR	NR	368	470
	24	24	NR	NR	NR	NR	343	443
		28	NR	NR	NR	NR	395	508
		32	NR	NR	NR	330	447	573
		36	NR	NR	NR	371	500	639
		40	NR	NR	345	411	552	704

~~For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s, 1 foot = 304.8 mm, 1 pound = 4.45 N.~~

~~a. Anchor bolts are to be located not more than 12 inches from corners or the termination of bottom tracks, such as at door openings or corners. Bolts are to extend not less than 15 inches into masonry or 7 inches into concrete.~~

~~b. All screw sizes shown are minimum.~~

~~c. NR = Uplift connector not required.~~

~~d. Foundation anchor straps are permitted in place of anchor bolts, if spaced as required to provide equivalent anchorage to the required anchor bolts and installed in accordance with manufacturer's requirements.~~

~~e. See Figure R603.3.1(4) for details.~~

~~TABLE R603.3.1.1(1)~~

~~GABLE ENDWALL TO FLOOR CONNECTION REQUIREMENTS~~[a, b, c]

ULTIMATE WIND SPEED (mph)		WALL BOTTOM TRACK TO FLOOR JOIST OR TRACK CONNECTION		
Exposure Category		Stud height, *h* (feet)		
B	C	10 < *h* ≤ 14	14 < *h* ≤ 18	18 < *h* ≤ 22
115	—	1 No. 8 screw @ 12″ o.c.	1 No. 8 screw @ 12″ o.c.	1 No. 8 screw @ 12″ o.c.
120	—	1 No. 8 screw @ 12″ o.c.	1 No. 8 screw @ 12″ o.c.	1 No. 8 screw @ 12″ o.c.
130	115	1 No. 8 screw @ 12″ o.c.	1 No. 8 screw @ 12″ o.c.	2 No. 8 screws @ 12″ o.c.
< 140	120	1 No. 8 screw @ 12″ o.c.	1 No. 8 screw @ 12″ o.c.	2 No. 8 screws @ 12″ o.c.
—	130	2 No. 8 screws @ 12″ o.c.	1 No. 8 screw @ 8″ o.c.	2 No. 8 screws @ 8″ o.c.
—	< 140	2 No. 8 screws @ 12″ o.c.	1 No. 8 screw @ 8″ o.c.	2 No. 8 screws @ 8″ o.c.

~~For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s, 1 foot = 304.8 mm.~~

~~a. Refer to Table R603.3.1.1(2) for gable endwall bottom track to foundation connections.~~

~~b. Where attachment is not given, special design is required.~~

~~c. Stud height, *h*, is measured from wall bottom track to wall top track or brace connection height.~~

~~TABLE R603.3.1.1(2)~~

~~GABLE ENDWALL BOTTOM TRACK TO FOUNDATION CONNECTION REQUIREMENTS~~[a, b, c]

ULTIMATE WIND SPEED (mph)		MINIMUM SPACING FOR $^1/_2$-INCH-DIAMETER ANCHOR BOLTS[d]		
Exposure Category		Stud height, *h* (feet)		
B	C	10 < *h* ≤ 14	14 < *h* ≤ 18	18 < *h* ≤ 22
115	—	6′- 0″ o.c.	6′- 0″ o.c.	6′- 0″ o.c.
120	—	6′- 0″ o.c.	5′- 7″ o.c.	6′- 0″ o.c.
130	115	5′- 0″ o.c.	6′- 0″ o.c.	6′- 0″ o.c.
< 140	120	6′- 0″ o.c.	5′- 6″ o.c.	6′- 0″ o.c.
—	130	5′- 3″ o.c.	6′- 0″ o.c.	6′- 0″ o.c.
—	< 140	3′- 0″ o.c.	3′- 0″ o.c.	3′- 0″ o.c.

~~For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s, 1 foot = 304.8 mm.~~

~~a. Refer to Table R603.3.1.1(1) for gable endwall bottom track to floor joist or track connection connections.~~

~~b. Where attachment is not given, special design is required.~~

~~c. Stud height, *h*, is measured from wall bottom track to wall top track or brace connection height.~~

~~d. Foundation anchor straps are permitted in place of anchor bolts if spaced as required to provide equivalent anchorage to the required anchor bolts and installed in accordance with manufacturer's requirements.~~

~~TABLE R603.3.2(1)~~
~~WALL FASTENING SCHEDULE[a]~~

DESCRIPTION OF BUILDING ELEMENT	NUMBER AND SIZE OF FASTENERS[a]	SPACING OF FASTENERS
Wall stud to top or bottom track	2-No. 8 screws	Each end of stud, one per flange
Structural sheathing to wall studs	No. 8 screws[b]	6″ o.c. on edges and 12″ o.c. at intermediate supports
$^1/_2$″ gypsum board to framing	No. 6 screws	12″ o.c.

~~For SI: 1 inch = 25.4 mm.~~

~~a. All screw sizes shown are minimum.~~

~~b. Screws for attachment of structural sheathing panels are to be bugle-head, flat-head, or similar head styles with a minimum head diameter of 0.29 inch.~~

~~TABLE R603.3.2(2)~~
~~24-FOOT-WIDE BUILDING SUPPORTING ROOF AND CEILING ONLY[a, b, c, d]~~

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-foot Studs				9-foot Studs				10-foot Studs			
				Ground Snow Load (psf)											
Exp. B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70
115	—	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	43	43
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	43
120	—	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	43	43	43	43
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	33	33	33	33	43
130	115	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	43	43	43	43	43	43	43	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	43
<140	120	350S162	16	33	33	33	33	33	33	33	33	33	33	33	43
			24	33	33	43	43	43	43	43	43	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	43	43	43	43
—	130	350S162	16	33	33	33	33	33	33	33	33	43	43	43	43
			24	43	43	43	43	54	54	54	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	43	43	43	43	43	43	43	43
—	<140	350S162	16	33	33	33	33	43	43	43	43	43	43	43	43
			24	43	43	43	54	54	54	54	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33

			24	43	43	43	43	43	43	43	43	43	43	43	43

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion: *L*/240.

b. Design load assumptions:

Second-floor dead load is 10 psf.

Second-floor live load is 30 psf.

Roof/ceiling dead load is 12 psf.

Attic live load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the wall studs.

d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE R603.3.2(3)

28-FOOT-WIDE BUILDING SUPPORTING ROOF AND CEILING ONLY[a, b, c, d]

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-foot Studs				9-foot Studs				10-foot Studs			
				Ground Snow Load (psf)											
Exp. B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70
115	—	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	43	43	33	33	43	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	43
120	—	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	43	43	43	43	43	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	43
130	115	350S162	16	33	33	33	33	33	33	33	33	33	33	33	43
			24	33	33	43	54	43	43	43	54	43	43	43	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	43
< 140	120	350S162	16	33	33	33	33	33	33	33	33	33	33	33	43
			24	33	33	43	54	43	43	43	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	43	43	43	43
—	130	350S162	16	33	33	33	33	33	33	33	43	43	43	43	43
			24	43	43	43	54	54	54	54	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	43	43	43	43	43	43	43	43

—	≤140	350S162	16	33	33	33	43	43	43	43	43	43	43	43	43
			24	43	43	43	54	54	54	54	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	43	43	43	43	43	43	43	43	43	43	43	43

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.~~

~~a. Deflection criterion: *L*/240.~~

~~b. Design load assumptions:~~

~~Second-floor dead load is 10 psf.~~

~~Second-floor live load is 30 psf.~~

~~Roof/ceiling dead load is 12 psf.~~

~~Attic live load is 10 psf.~~

~~c. Building width is in the direction of horizontal framing members supported by the wall studs.~~

~~d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.~~

~~TABLE R603.3.2(4)~~

~~32-FOOT-WIDE BUILDING SUPPORTING ROOF AND CEILING ONLY~~[a, b, c, d]

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-foot Studs				9-foot Studs				10-foot Studs			
				Ground Snow Load (psf)											
Exp. B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70
115	—	350S162	16	33	33	33	33	33	33	33	33	33	33	33	43
			24	33	33	43	54	33	33	43	54	43	43	43	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	43
120	—	350S162	16	33	33	33	33	33	33	33	33	33	33	33	43
			24	33	33	43	54	33	33	43	54	43	43	43	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	43	43
130	115	350S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	33	33	43	54	43	43	43	54	43	43	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	33	43	33	33	43	43
≤140	120	350S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	33	33	43	54	43	43	43	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	33	43	43	43	43	43

—	130	350S162	16	33	33	33	43	33	33	33	43	43	43	43	43
			24	43	43	43	54	54	54	54	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	43	43	43	43	43	43	43	43
—	< 140	350S162	16	33	33	33	43	43	43	43	43	43	43	43	43
			24	43	43	54	54	54	54	54	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	43	43	43	43	43	43	43	43	43	43	43	43

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.~~

~~a. Deflection criterion: *L*/240.~~

~~b. Design load assumptions:~~

~~Second-floor dead load is 10 psf.~~

~~Second-floor live load is 30 psf.~~

~~Roof/ceiling dead load is 12 psf.~~

~~Attic live load is 10 psf.~~

~~c. Building width is in the direction of horizontal framing members supported by the wall studs.~~

~~d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.~~

~~TABLE R603.3.2(5)~~

~~36-FOOT-WIDE BUILDING SUPPORTING ROOF AND CEILING ONLY~~[a, b, c, d]

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-foot Studs				9-foot Studs				10-foot Studs			
				Ground Snow Load (psf)											
Exp. B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70
115	—	350S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	33	33	43	54	33	33	43	54	43	43	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	43	43	33	33	43	43
120	—	350S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	33	33	43	54	33	33	43	54	43	43	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	43	43	33	33	43	43
130	115	350S162	16	33	33	33	43	33	33	33	43	33	33	43	43
			24	33	43	43	54	43	43	43	54	43	43	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	43	43	33	33	43	43

<140	120	350S162	16	33	33	33	43	33	33	33	33	33	33	43	43
			24	43	43	43	54	43	43	43	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	43	43	43	43	43	54
—	130	350S162	16	33	33	33	43	33	33	33	43	43	43	43	43
			24	43	43	54	54	54	54	54	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	43
			24	33	33	43	54	43	43	43	43	43	43	43	54
—	<140	350S162	16	33	33	33	43	43	43	43	43	43	43	43	54
			24	43	43	54	54	54	54	54	54	54	54	54	68
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	43
			24	43	43	43	54	43	43	43	43	43	43	43	54

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.~~

~~a. Deflection criterion: *L*/240.~~

~~b. Design load assumptions:~~

~~Second-floor dead load is 10 psf.~~

~~Second-floor live load is 30 psf.~~

~~Roof/ceiling dead load is 12 psf.~~

~~Attic live load is 10 psf.~~

~~c. Building width is in the direction of horizontal framing members supported by the wall studs.~~

~~d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.~~

~~TABLE R603.3.2(6)~~

~~40-FOOT-WIDE BUILDING SUPPORTING ROOF AND CEILING ONLY~~[a, b, c, d]

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-foot Studs				9-foot Studs				10-foot Studs			
				Ground Snow Load (psf)											
Exp. B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70
115	—	350S162	16	33	33	33	43	33	33	33	43	33	33	43	43
			24	33	33	43	54	33	43	43	54	43	43	54	54
		550S162	16	33	33	33	43	33	33	33	33	33	33	33	33
			24	33	33	43	54	33	33	43	43	33	33	43	54
120	—	350S162	16	33	33	33	43	33	33	33	43	33	33	43	43
			24	33	43	43	54	33	43	43	54	43	43	54	54
		550S162	16	33	33	33	43	33	33	33	33	33	33	33	43
			24	33	33	43	54	33	33	43	43	33	33	43	54

130	115	350S162	16	33	33	33	43	33	33	33	43	33	33	43	43
			24	43	43	54	54	43	43	54	54	43	54	54	54
		550S162	16	33	33	33	43	33	33	33	33	33	33	33	43
			24	33	33	43	54	33	33	43	54	33	33	43	54
≤140	120	350S162	16	33	33	33	43	33	33	33	43	33	33	43	43
			24	43	43	54	54	43	43	54	54	54	54	54	54
		550S162	16	33	33	33	43	33	33	33	33	33	33	33	43
			24	33	33	43	54	33	33	43	54	43	43	43	54
—	130	350S162	16	33	33	43	43	33	33	43	43	43	43	43	54
			24	43	43	54	54	54	54	54	54	54	54	54	68
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	33	33	43	54	43	43	43	54	43	43	43	54
—	≤140	350S162	16	33	33	43	43	43	43	43	43	43	43	43	54
			24	43	43	54	54	54	54	54	54	54	54	54	68
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	43	43	43	54	43	43	43	54	43	43	43	54

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.~~

~~a. Deflection criterion: *L*/240.~~

~~b. Design load assumptions:~~

~~Second-floor dead load is 10 psf.~~

~~Second-floor live load is 30 psf.~~

~~Roof/ceiling dead load is 12 psf.~~

~~Attic live load is 10 psf.~~

~~c. Building width is in the direction of horizontal framing members supported by the wall studs.~~

~~d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.~~

~~TABLE R603.3.2(7)~~

~~24-FOOT-WIDE BUILDING SUPPORTING ONE FLOOR, ROOF AND CEILING~~[a, b, c, d]

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-foot Studs				9-foot Studs				10-foot Studs			
				Ground Snow Load (psf)											
Exp. B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70
115	—	350S162	16	33	33	33	33	33	33	33	33	33	33	33	43
			24	33	33	43	43	43	43	43	43	43	43	43	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	43

120	—	350S162	16	33	33	33	33	33	33	33	33	33	33	33	43
			24	43	43	43	43	43	43	43	43	43	43	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	43
130	115	350S162	16	33	33	33	43	33	33	33	43	43	43	43	43
			24	43	43	43	54	43	43	54	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	43	43
<140	120	350S162	16	33	33	33	43	33	33	43	43	43	43	43	43
			24	43	43	43	54	43	54	54	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	33	43	43	43	43	43
—	130	350S162	16	33	33	33	43	43	43	43	43	43	43	43	54
			24	43	43	54	54	54	54	54	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	43	43	43	43	43	43	43	43
—	<140	350S162	16	43	43	43	43	43	43	43	43	54	54	54	54
			24	54	54	54	54	54	54	54	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	43	43	43	43	43	43	43	43	43	43	43	43

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.~~

~~a. Deflection criterion: *L*/240.~~

~~b. Design load assumptions:~~

~~Second-floor dead load is 10 psf.~~

~~Second-floor live load is 30 psf.~~

~~Roof/ceiling dead load is 12 psf.~~

~~Attic live load is 10 psf.~~

~~c. Building width is in the direction of horizontal framing members supported by the wall studs.~~

~~d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.~~

~~TABLE R603.3.2(8)~~

~~28-FOOT-WIDE BUILDING SUPPORTING ONE FLOOR, ROOF AND CEILING~~[a, b, c, d]

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-foot Studs				9-foot Studs				10-foot Studs			
				Ground Snow Load (psf)											
Exp. B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70

115	—	350S162	16	33	33	33	43	33	33	33	43	33	33	43	43
			24	43	43	43	54	43	43	43	54	43	43	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	43	43	33	33	43	43
120	—	350S162	16	33	33	33	43	33	33	33	43	33	33	43	43
			24	43	43	43	54	43	43	43	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	43	43	33	33	43	43
130	115	350S162	16	33	33	33	43	33	33	43	43	43	43	43	43
			24	43	43	43	54	43	54	54	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	43	43	43	43	43	43
≤140	120	350S162	16	33	33	33	43	43	43	43	43	43	43	43	43
			24	43	43	54	54	54	54	54	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	43	43	43	43	43	43
—	130	350S162	16	33	33	43	43	43	43	43	43	43	43	54	54
			24	54	54	54	54	54	54	54	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	43
			24	33	33	43	43	43	43	43	43	43	43	43	43
—	≤140	350S162	16	43	43	43	43	43	43	43	43	54	54	54	54
			24	54	54	54	54	54	54	54	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	43
			24	43	43	43	43	43	43	43	43	43	43	43	54

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.~~

~~a. Deflection criterion: *L*/240.~~

~~b. Design load assumptions:~~

~~Second-floor dead load is 10 psf.~~

~~Second-floor live load is 30 psf.~~

~~Roof/ceiling dead load is 12 psf.~~

~~Attic live load is 10 psf.~~

~~c. Building width is in the direction of horizontal framing members supported by the wall studs.~~

~~d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.~~

~~TABLE R603.3.2(9)~~

~~32-FOOT-WIDE BUILDING SUPPORTING ONE FLOOR, ROOF AND CEILING~~[a, b, c, d]

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph) Exp. B	ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph) Exp. C	MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils) 8-foot Studs, Ground Snow Load (psf) 20	8-foot 30	8-foot 50	8-foot 70	9-foot Studs 20	9-foot 30	9-foot 50	9-foot 70	10-foot Studs 20	10-foot 30	10-foot 50	10-foot 70
115	—	350S162	16	33	33	33	43	33	33	33	43	33	43	43	43
			24	43	43	43	54	43	43	43	54	54	54	54	54
		550S162	16	33	33	33	43	33	33	33	33	33	33	33	43
			24	33	43	43	54	33	33	43	43	33	33	43	43
120	—	350S162	16	33	33	33	43	33	33	33	43	43	43	43	43
			24	43	43	43	54	43	43	43	54	54	54	54	54
		550S162	16	33	33	33	43	33	33	33	33	33	33	33	43
			24	33	43	43	54	33	33	43	43	33	33	43	54
130	115	350S162	16	33	33	43	43	43	43	43	43	43	43	43	43
			24	43	43	54	54	54	54	54	54	54	54	54	54
		550S162	16	33	33	33	43	33	33	33	33	33	33	33	43
			24	33	43	43	54	33	33	43	43	43	43	43	54
≤140	120	350S162	16	33	33	43	43	43	43	43	43	43	43	43	54
			24	43	54	54	54	54	54	54	54	54	54	54	54
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	33	43	43	54	33	43	43	43	43	43	43	54
—	130	350S162	16	43	43	43	43	43	43	43	43	43	54	54	54
			24	54	54	54	54	54	54	54	54	54	54	54	54
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	43	43	43	54	43	43	43	54	43	43	43	54
—	≤140	350S162	16	43	43	43	43	43	43	43	54	54	54	54	54
			24	54	54	54	54	54	54	54	54	54	54	54	68
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	43	43	43	54	43	43	43	54	43	43	43	54

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.~~

~~a. Deflection criterion: *L*/240.~~

~~b. Design load assumptions:~~

~~Second-floor dead load is 10 psf.~~

~~Second-floor live load is 30 psf.~~

~~Roof/ceiling dead load is 12 psf.~~

~~Attic live load is 10 psf.~~

~~c. Building width is in the direction of horizontal framing members supported by the wall studs.~~

d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE R603.3.2(10)
36-FOOT-WIDE BUILDING SUPPORTING ONE FLOOR, ROOF AND CEILING[a, b, c, d]

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-foot Studs				9-foot Studs				10-foot Studs			
				Ground Snow Load (psf)											
Exp. B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70
115	—	350S162	16	33	33	43	43	33	33	43	43	43	43	43	43
			24	43	43	54	54	43	43	54	54	54	54	54	54
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	43	43	43	54	43	43	43	54	43	43	43	54
120	—	350S162	16	33	33	43	43	33	33	43	43	43	43	43	43
			24	43	43	54	54	43	43	54	54	54	54	54	54
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	43	43	43	54	43	43	43	54	43	43	43	54
130	115	350S162	16	33	33	43	43	43	43	43	43	43	43	43	54
			24	43	54	54	54	54	54	54	54	54	54	54	68
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	43	43	43	54	43	43	43	54	43	43	43	54
< 140	120	350S162	16	43	43	43	43	43	43	43	43	43	43	54	54
			24	54	54	54	54	54	54	54	54	54	54	54	68
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	43	43	43	54	43	43	43	54	43	43	43	54
—	130	350S162	16	43	43	43	43	43	43	43	43	54	54	54	54
			24	54	54	54	54	54	54	54	54	54	54	54	68
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	43	43	43	54	43	43	43	54	43	43	43	54
—	< 140	350S162	16	43	43	43	54	43	43	54	54	54	54	54	54
			24	54	54	54	54	54	54	54	54	54	54	54	68
		550S162	16	33	33	33	43	33	33	33	43	33	33	43	43
			24	43	43	43	54	43	43	43	54	43	43	54	54

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion: *L*/240.

~~b. Design load assumptions:~~

~~Second-floor dead load is 10 psf.~~

~~Second-floor live load is 30 psf.~~

~~Roof/ceiling dead load is 12 psf.~~

~~Attic live load is 10 psf.~~

~~c. Building width is in the direction of horizontal framing members supported by the wall studs.~~

~~d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.~~

~~TABLE R603.3.2(11)~~

~~40-FOOT-WIDE BUILDING SUPPORTING ONE FLOOR, ROOF AND CEILING~~[a, b, c, d]

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-foot Studs				9-foot Studs				10-foot Studs			
				Ground Snow Load (psf)											
Exp. B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70
115	—	350S162	16	33	33	43	43	33	33	43	43	43	43	43	54
			24	43	43	54	54	43	43	54	54	54	54	54	68
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	43	43	54	54	43	43	43	54	43	43	43	54
120	—	350S162	16	33	33	43	43	33	33	43	43	43	43	43	54
			24	43	43	54	54	54	54	54	54	54	54	54	68
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	43	43	54	54	43	43	43	54	43	43	43	54
130	115	350S162	16	43	43	43	54	43	43	43	43	43	43	54	54
			24	54	54	54	54	54	54	54	54	54	54	54	68
		550S162	16	33	33	43	43	33	33	33	43	33	33	43	43
			24	43	43	54	54	43	43	43	54	43	43	54	54
< 140	120	350S162	16	43	43	43	54	43	43	43	54	43	43	54	54
			24	54	54	54	54	54	54	54	54	54	54	54	68
		550S162	16	33	33	43	43	33	33	33	43	33	33	43	43
			24	43	43	54	54	43	43	43	54	43	43	54	54
—	130	350S162	16	43	43	43	54	43	43	43	54	54	54	54	54
			24	54	54	54	68	54	54	54	54	54	54	68	68
		550S162	16	33	33	43	43	33	33	33	43	33	33	43	43
			24	43	43	54	54	43	43	43	54	43	43	54	54
—	< 140	350S162	16	43	43	43	54	43	43	54	54	54	54	54	54
			24	54	54	54	68	54	54	54	68	54	54	68	68
		550S162	16	33	33	43	43	33	33	43	43	33	43	43	43

			24	43	43	54	54	43	43	43	54	43	43	54	54

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.~~

~~a. Deflection criterion: *L*/240.~~

~~b. Design load assumptions:~~

~~Second-floor dead load is 10 psf.~~

~~Second-floor live load is 30 psf.~~

~~Roof/ceiling dead load is 12 psf.~~

~~Attic live load is 10 psf.~~

~~c. Building width is in the direction of horizontal framing members supported by the wall studs.~~

~~d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.~~

~~TABLE R603.3.2(12)~~

~~24-FOOT-WIDE BUILDING SUPPORTING TWO FLOORS, ROOF AND CEILING~~[a, b, c, d]

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-foot Studs				9-foot Studs				10-foot Studs			
				Ground Snow Load (psf)											
Exp. B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70
115	—	350S162	16	43	43	43	43	33	33	33	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
		550S162	16	33	33	43	43	33	33	33	33	33	33	33	43
			24	43	43	54	54	43	43	43	43	43	43	43	54
120	—	350S162	16	43	43	43	43	33	33	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
		550S162	16	33	33	43	43	33	33	33	33	33	33	33	43
			24	43	43	54	54	43	43	43	43	43	43	43	54
130	115	350S162	16	43	43	43	43	43	43	43	43	43	43	43	54
			24	54	54	54	54	54	54	54	54	54	54	54	54
		550S162	16	33	33	43	43	33	33	33	33	33	33	33	43
			24	43	43	54	54	43	43	43	43	43	43	43	54
<140	120	350S162	16	43	43	43	43	43	43	43	43	43	43	54	54
			24	54	54	54	54	54	54	54	54	54	54	54	54
		550S162	16	33	33	43	43	33	33	33	33	33	33	33	43
			24	43	43	54	54	43	43	43	43	43	43	43	54
—	130	350S162	16	43	43	43	43	43	43	43	43	54	54	54	54
			24	54	54	54	54	54	54	54	54	54	54	68	68
		550S162	16	33	33	43	43	33	33	33	33	33	33	33	43

			24	43	43	54	54	43	43	43	43	43	43	43	54
—	≤140	350S162	16	43	43	43	43	43	43	54	54	54	54	54	54
			24	54	54	54	54	54	54	54	54	54	54	68	68
		550S162	16	33	33	43	43	33	33	33	33	33	33	43	43
			24	43	43	54	54	43	43	43	43	54	54	54	54

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion: *L*/240.

b. Design load assumptions:

Top- and middle-floor dead load is 10 psf.

Top-floor live load is 30 psf.

Middle-floor live load is 40 psf.

Roof/ceiling dead load is 12 psf.

Attic live load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the wall studs.

d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE R603.3.2(13)

28-FOOT-WIDE BUILDING SUPPORTING TWO FLOORS, ROOF AND CEILING[a, b, c, d]

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-foot Studs				9-foot Studs				10-foot Studs			
				Ground Snow Load (psf)											
Exp. B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70
115	—	350S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
120	—	350S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
130	115	350S162	16	43	43	43	43	43	43	43	43	43	43	54	54
			24	54	54	54	54	54	54	54	54	54	54	54	68
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
≤140	120	350S162	16	43	43	43	43	43	43	43	43	54	54	54	54
			24	54	54	54	54	54	54	54	54	54	54	68	68
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43

			24	54	54	54	54	54	54	54	54	54	54	54	54
—	130	350S162	16	43	43	43	43	43	43	43	54	54	54	54	54
			24	54	54	54	54	54	54	54	54	68	68	68	68
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
—	< 140	350S162	16	43	43	43	54	54	54	54	54	54	54	54	54
			24	54	54	54	54	54	54	54	68	68	68	68	68
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.~~

~~a. Deflection criterion: *L*/240.~~

~~b. Design load assumptions:~~

~~Top- and middle-floor dead load is 10 psf.~~

~~Top-floor live load is 30 psf.~~

~~Middle-floor live load is 40 psf.~~

~~Roof/ceiling dead load is 12 psf.~~

~~Attic live load is 10 psf.~~

~~c. Building width is in the direction of horizontal framing members supported by the wall studs.~~

~~d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.~~

~~TABLE R603.3.2(14)~~

~~32-FOOT-WIDE BUILDING SUPPORTING TWO FLOORS, ROOF AND CEILING~~[a, b, c, d]

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-foot Studs				9-foot Studs				10-foot Studs			
				Ground Snow Load (psf)											
Exp. B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70
115	—	350S162	16	43	43	43	54	43	43	43	43	43	43	43	54
			24	54	54	54	68	54	54	54	54	54	54	54	68
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
120	—	350S162	16	43	43	43	54	43	43	43	43	43	43	43	54
			24	54	54	54	68	54	54	54	54	54	54	54	68
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
130	115	350S162	16	43	43	43	54	43	43	43	43	54	54	54	54
			24	54	54	54	68	54	54	54	54	54	68	68	68
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43

			24	54	54	54	54	54	54	54	54	54	54	54	54
≤140	120	350S162	16	43	43	43	54	43	43	43	54	54	54	54	54
			24	54	54	54	68	54	54	54	54	68	68	68	68
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
—	130	350S162	16	43	43	43	54	43	54	54	54	54	54	54	54
			24	54	54	54	68	54	54	54	68	68	68	68	68
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
—	≤140	350S162	16	43	43	54	54	54	54	54	54	54	54	54	54
			24	54	54	54	68	54	68	68	68	68	68	68	68
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion: *L*/240.

b. Design load assumptions:

Top- and middle-floor dead load is 10 psf.

Top-floor live load is 30 psf.

Middle-floor live load is 40 psf.

Roof/ceiling dead load is 12 psf.

Attic live load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the wall studs.

d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE R603.3.2(15)

36-FOOT-WIDE BUILDING SUPPORTING TWO FLOORS, ROOF AND CEILING[a, b, c, d]

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-foot Studs				9-foot Studs				10-foot Studs			
				Ground Snow Load (psf)											
Exp. B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70
115	—	350S162	16	54	54	54	54	43	43	43	54	54	54	54	54
			24	68	68	68	68	54	54	54	68	68	68	68	68
		550S162	16	43	43	43	54	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
120	—	350S162	16	54	54	54	54	43	43	43	54	54	54	54	54
			24	68	68	68	68	54	54	54	68	68	68	68	68
		550S162	16	43	43	43	54	43	43	43	43	43	43	43	43

			24	54	54	54	54	54	54	54	54	54	54	54	54
130	115	350S162	16	54	54	54	54	43	43	43	54	54	54	54	54
			24	68	68	68	68	54	54	54	68	68	68	68	68
		550S162	16	43	43	43	54	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
≤ 140	120	350S162	16	54	54	54	54	43	43	54	54	54	54	54	54
			24	68	68	68	68	54	54	54	68	68	68	68	68
		550S162	16	43	43	43	54	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
—	130	350S162	16	54	54	54	54	54	54	54	54	54	54	54	54
			24	68	68	68	68	54	54	68	68	68	68	68	68
		550S162	16	43	43	43	54	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
—	≤ 140	350S162	16	54	54	54	54	54	54	54	54	54	54	54	54
			24	68	68	68	68	68	68	68	68	68	68	68	68
		550S162	16	43	43	43	54	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion: *L*/240.

b. Design load assumptions:

Top- and middle-floor dead load is 10 psf.

Top-floor live load is 30 psf.

Middle-floor live load is 40 psf.

Roof/ceiling dead load is 12 psf.

Attic live load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the wall studs.

d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE R603.3.2(16)

40-FOOT-WIDE BUILDING SUPPORTING TWO FLOORS, ROOF AND CEILING[a, b, c, d]

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-foot Studs				9-foot Studs				10-foot Studs			
				Ground Snow Load (psf)											
Exp. B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70
115	—	350S162	16	54	54	54	54	54	54	54	54	54	54	54	54
			24	68	68	68	68	68	68	68	68	68	68	68	68
		550S162	16	54	54	54	54	43	43	54	54	43	43	54	54

			~~24~~	~~54~~	~~54~~	~~54~~	~~68~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~
~~120~~	—	~~350S162~~	~~16~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~
			~~24~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~
		~~550S162~~	~~16~~	~~54~~	~~54~~	~~54~~	~~54~~	~~43~~	~~43~~	~~54~~	~~54~~	~~43~~	~~43~~	~~54~~	~~54~~
			~~24~~	~~54~~	~~54~~	~~54~~	~~68~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~
~~130~~	~~115~~	~~350S162~~	~~16~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~
			~~24~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~
		~~550S162~~	~~16~~	~~54~~	~~54~~	~~54~~	~~54~~	~~43~~	~~43~~	~~54~~	~~54~~	~~43~~	~~43~~	~~54~~	~~54~~
			~~24~~	~~54~~	~~54~~	~~54~~	~~68~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~
~~<140~~	~~120~~	~~350S162~~	~~16~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~
			~~24~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~
		~~550S162~~	~~16~~	~~54~~	~~54~~	~~54~~	~~54~~	~~43~~	~~43~~	~~54~~	~~54~~	~~43~~	~~43~~	~~54~~	~~54~~
			~~24~~	~~54~~	~~54~~	~~54~~	~~68~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~
—	~~130~~	~~350S162~~	~~16~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~
			~~24~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~
		~~550S162~~	~~16~~	~~54~~	~~54~~	~~54~~	~~54~~	~~43~~	~~43~~	~~54~~	~~54~~	~~43~~	~~43~~	~~54~~	~~54~~
			~~24~~	~~54~~	~~54~~	~~54~~	~~68~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~
—	~~<140~~	~~350S162~~	~~16~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~
			~~24~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~
		~~550S162~~	~~16~~	~~54~~	~~54~~	~~54~~	~~54~~	~~43~~	~~43~~	~~54~~	~~54~~	~~43~~	~~43~~	~~54~~	~~54~~
			~~24~~	~~54~~	~~54~~	~~54~~	~~68~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.~~

~~a. Deflection criterion: *L*/240.~~

~~b. Design load assumptions:~~

~~Top- and middle-floor dead load is 10 psf.~~

~~Top-floor live load is 30 psf.~~

~~Middle-floor live load is 40 psf.~~

~~Roof/ceiling dead load is 12 psf.~~

~~Attic live load is 10 psf.~~

~~c. Building width is in the direction of horizontal framing members supported by the wall studs.~~

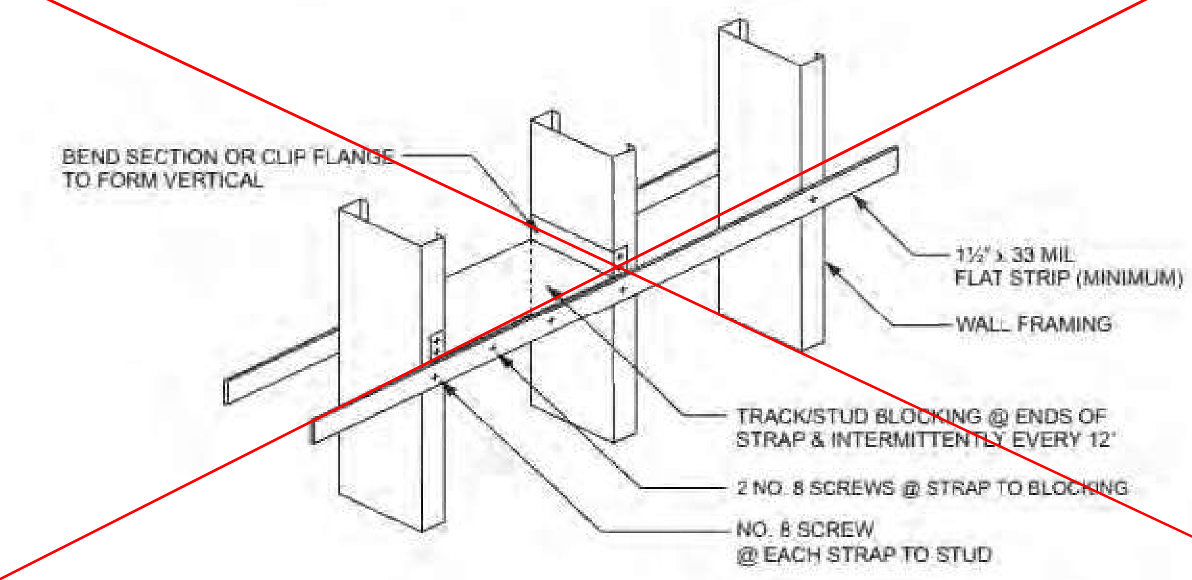
~~d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.~~

~~**R603.3.3 Stud bracing.** The flanges of cold-formed steel studs shall be laterally braced in accordance with one of the following:~~

1. ~~Gypsum board on both sides, structural sheathing on both sides, or gypsum board on one side and structural sheathing on the other side of *load-bearing walls* with gypsum board installed with minimum No. 6 screws in accordance with Section R702 and structural sheathing installed in accordance with Section R603.9 and Table R603.3.2(1).~~

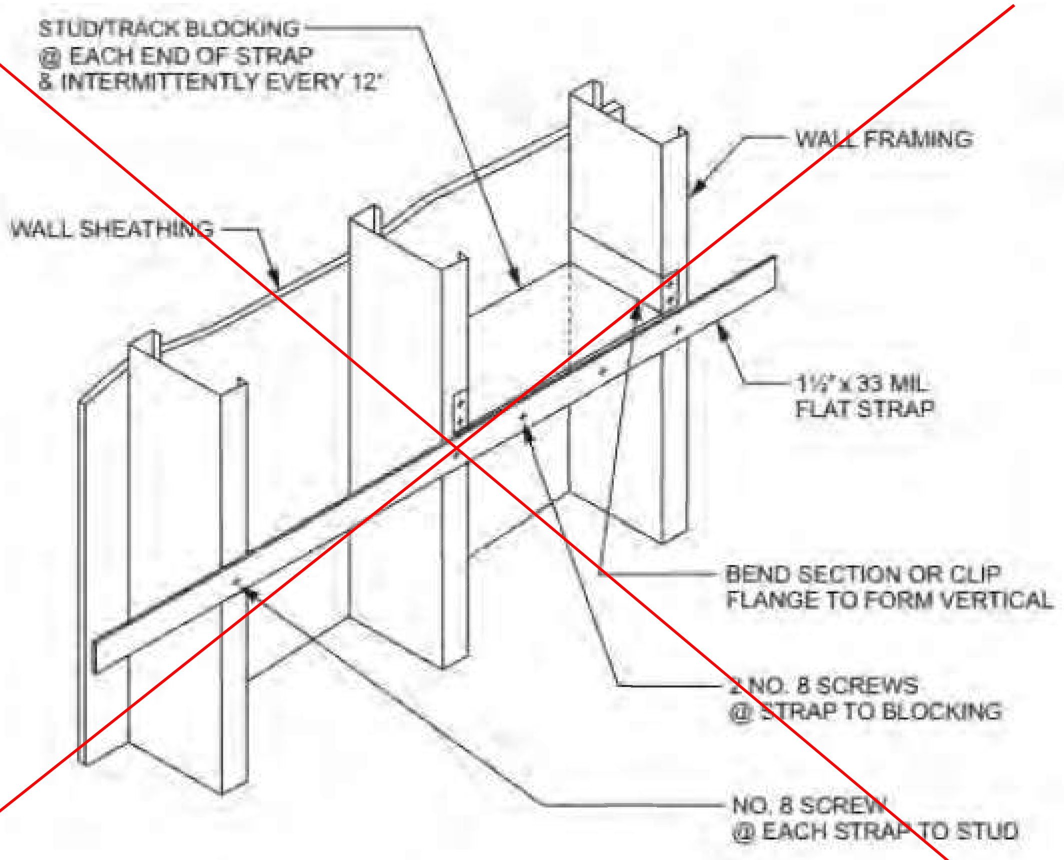
2. ~~Horizontal steel straps fastened in accordance with Figure R603.3.3(1) on both sides at mid-height for 8-foot (2438 mm) walls, and at one-third points for 9-foot and 10-foot (2743 mm and 3048 mm) walls. Horizontal steel straps shall be not less than $1^1/_2$ inches in width and 33 mils in thickness (38 mm by 0.84 mm). Straps shall be attached to the flanges of studs with one No. 8 screw. In-line blocking shall be installed between studs at the termination of straps and at 12-foot (3658 mm) intervals along the strap. Straps shall be fastened to the blocking with two No. 8 screws.~~

3. ~~Sheathing on one side and strapping on the other side fastened in accordance with Figure R603.3.3(2). Sheathing shall be installed in accordance with Item 1. Steel straps shall be installed in accordance with Item 2.~~



For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 foot = 304.8 mm.

FIGURE R603.3.3(1)
STUD BRACING WITH STRAPPING ONLY

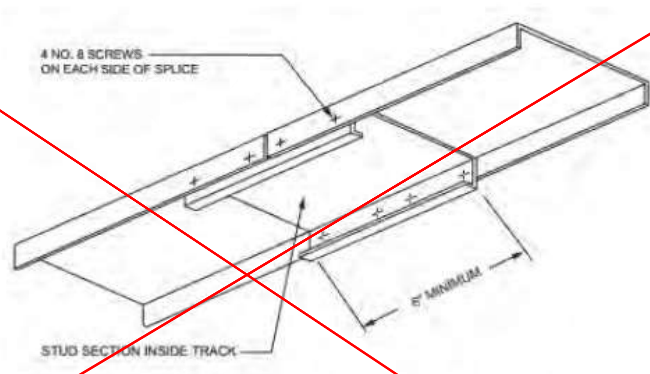


For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 foot = 304.8 mm.

FIGURE R603.3.3(2)
STUD BRACING WITH STRAPPING AND SHEATHING MATERIAL

~~**R603.3.4 Cutting and notching.** Flanges and lips of cold formed steel studs and headers shall not be cut or notched.~~

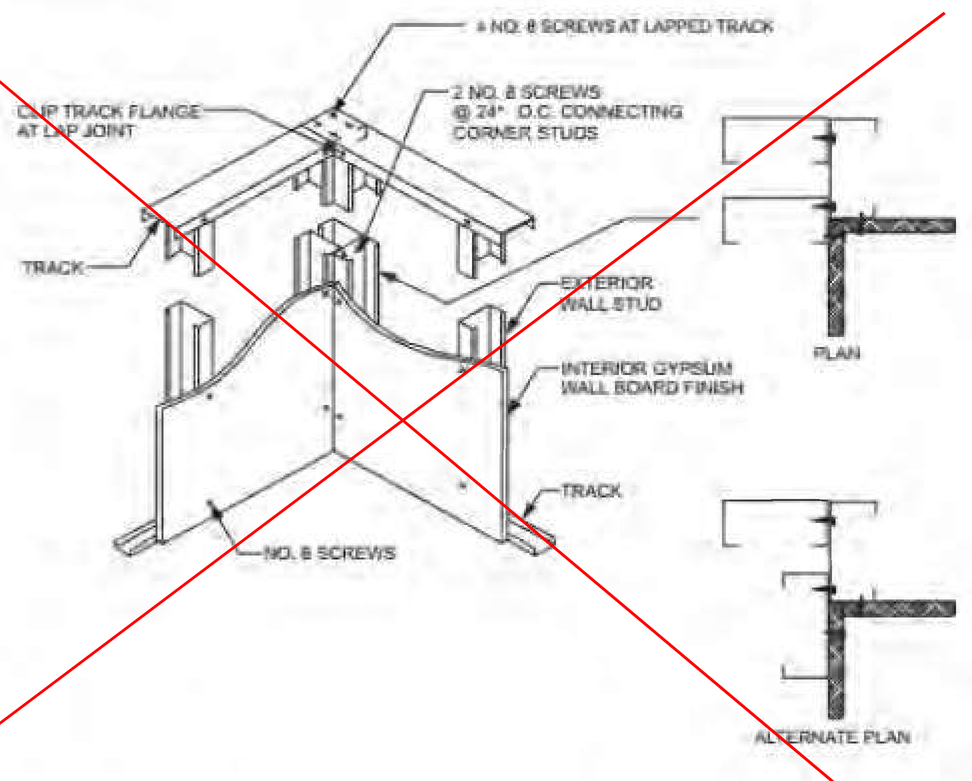
~~**R603.3.5 Splicing.** Steel studs and other structural members shall not be spliced without an *approved* design. Tracks shall be spliced in accordance with Figure R603.3.5.~~



For SI: 1 inch = 25.4 mm.

FIGURE R603.3.5
TRACK SPLICE

~~**R603.4 Corner framing.** In exterior walls, corner studs and the top tracks shall be installed in accordance with Figure R603.4.~~



For SI: 1 inch = 25.4 mm.

FIGURE R603.4
CORNER FRAMING

~~**R603.5 Exterior wall covering.** The method of attachment of exterior wall covering materials to cold-formed steel stud wall framing shall conform to the manufacturer's installation instructions.~~

~~**R603.6 Headers.** Headers shall be installed above all wall openings in exterior walls and interior *load-bearing walls*. Box beam headers and back-to-back headers each shall be formed from two equal sized C-shaped members in accordance with Figures R603.6(1) and R603.6(2), respectively, and Tables R603.6(1) through R603.6(6). L-shaped headers shall be permitted to be constructed in accordance with AISI S230. Alternately, headers shall be permitted to be designed and constructed in accordance with AISI S240.~~

~~**R603.6.1 Headers in gable endwalls.** Box beam and back-to-back headers in gable endwalls shall be permitted to be constructed in accordance with Section R603.6 or with the header directly above the opening in accordance with Figures R603.6.1(1) and R603.6.1(2) and the following provisions:~~

1. ~~Two 362S162-33 for openings less than or equal to 4 feet (1219 mm).~~
2. ~~Two 600S162-43 for openings greater than 4 feet (1219 mm) but less than or equal to 6 feet (1829 mm).~~
3. ~~Two 800S162-54 for openings greater than 6 feet (1829 mm) but less than or equal to 9 feet (2743 mm).~~

~~**TABLE R603.6(1)**~~

~~**BOX-BEAM AND BACK-TO-BACK HEADER SPANS**~~
~~**Headers Supporting Roof and Ceiling Only[a, b, d]**~~

~~MEMBER DESIGNATION~~	~~GROUND SNOW LOAD (20 psf)~~					~~GROUND SNOW LOAD (30 psf)~~				
	~~Building width[c] (feet)~~					~~Building width[c] (feet)~~				
	~~24~~	~~28~~	~~32~~	~~36~~	~~40~~	~~24~~	~~28~~	~~32~~	~~36~~	~~40~~

2-350S162-33	3′-3″	2′-8″	2′-2″	—	—	2′-8″	2′-2″	—	—	—
2-350S162-43	4′-2″	3′-9″	3′-4″	2′-11″	2′-7″	3′-9″	3′-4″	2′-11″	2′-7″	2′-2″
2-350S162-54	6′-2″	5′-10″	5′-8″	5′-3″	4′-10″	5′-11″	5′-8″	5′-2″	4′-10″	4′-6″
2-350S162-68	6′-7″	6′-3″	6′-0″	5′-10″	5′-8″	6′-4″	6′-1″	5′-10″	5′-8″	5′-6″
2-550S162-33	4′-8″	4′-0″	3′-6″	3′-0″	2′-6″	4′-1″	3′-6″	3′-0″	2′-6″	—
2-550S162-43	6′-0″	5′-4″	4′-10″	4′-4″	3′-11″	5′-5″	4′-10″	4′-4″	3′-10″	3′-5″
2-550S162-54	8′-9″	8′-5″	8′-1″	7′-9″	7′-3″	8′-6″	8′-1″	7′-8″	7′-2″	6′-8″
2-550S162-68	9′-5″	9′-0″	8′-8″	8′-4″	8′-1″	9′-1″	8′-8″	8′-4″	8′-1″	7′-10″
2-800S162-33	4′-5″	3′-11″	3′-5″	3′-1″	2′-10″	3′-11″	3′-6″	3′-1″	2′-9″	2′-3″
2-800S162-43	7′-3″	6′-7″	5′-11″	5′-4″	4′-10″	6′-7″	5′-11″	5′-4″	4′-9″	4′-3″
2-800S162-54	10′-10″	10′-2″	9′-7″	9′-0″	8′-5″	10′-2″	9′-7″	8′-11″	8′-4″	7′-9″
2-800S162-68	12′-8″	11′-10″	11′-2″	10′-7″	10′-1″	11′-11″	11′-2″	10′-7″	10′-0″	9′-6″
2-1000S162-43	7′-10″	6′-10″	6′-1″	5′-6″	5′-0″	6′-11″	6′-1″	5′-5″	4′-11″	4′-6″
2-1000S162-54	12′-3″	11′-5″	10′-9″	10′-2″	9′-6″	11′-6″	10′-9″	10′-1″	9′-5″	8′-9″
2-1000S162-68	14′-5″	13′-5″	12′-8″	12′-0″	11′-6″	13′-6″	12′-8″	12′-0″	11′-5″	10′-10″
2-1200S162-54	12′-11″	11′-3″	10′-0″	9′-0″	8′-2″	11′-5″	10′-0″	9′-0″	8′-1″	7′-4″
2-1200S162-68	15′-11″	14′-10″	14′-0″	13′-4″	12′-8″	15′-0″	14′-0″	13′-3″	12′-7″	11′-11″

For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

a. Deflection criteria: *L*/360 for live loads, *L*/240 for total loads.

b. Design load assumptions:

Roof/ceiling dead load is 12 psf.

Attic dead load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the header.

d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE R603.6(3)

BOX-BEAM AND BACK-TO-BACK HEADER SPANS
Headers Supporting One Floor, Roof and Ceiling[a, b, d]

MEMBER DESIGNATION	GROUND SNOW LOAD (20 psf)					GROUND SNOW LOAD (30 psf)				
	Building width[c] (feet)					Building width[c] (feet)				
	24	28	32	36	40	24	28	32	36	40
2-350S162-33	—	—	—	—	—	—	—	—	—	—
2-350S162-43	2′-2″	—	—	—	—	2′-1″	—	—	—	—
2-350S162-54	4′-4″	3′-10″	3′-5″	3′-1″	2′-9″	4′-3″	2′-9″	3′-4″	3′-0″	2′-8″
2-350S162-68	5′-0″	4′-9″	4′-7″	4′-2″	3′-9″	4′-11″	4′-8″	4′-6″	4′-1″	3′-9″

2-550S162-33	—	—	—	—	—	—	—	—	—	—
2-550S162-43	3′ 5″	2′ 9″	2′ 1″	—	—	3′ 3″	2′ 7″	—	—	—
2-550S162-54	6′ 6″	5′ 10″	5′ 3″	4′ 9″	4′ 4″	6′ 4″	5′ 9″	5′ 2″	4′ 8″	4′ 3″
2-550S162-68	7′ 2″	6′ 10″	6′ 5″	5′ 11″	5′ 6″	7′ 0″	6′ 9″	6′ 4″	5′ 10″	5′ 4″
2-800S162-33	2′ 1″	—	—	—	—	—	—	—	—	—
2-800S162-43	4′ 2″	3′ 4″	2′ 7″	—	—	4′ 0″	3′ 3″	2′ 5″	—	—
2-800S162-54	7′ 6″	6′ 9″	6′ 2″	5′ 7″	5′ 0″	7′ 5″	6′ 8″	6′ 0″	5′ 5″	4′ 11″
2-800S162-68	9′ 3″	8′ 5″	7′ 8″	7′ 1″	6′ 6″	9′ 1″	8′ 3″	7′ 7″	7′ 0″	6′ 5″
2-1000S162-43	4′ 4″	3′ 9″	2′ 11″	—	—	4′ 3″	3′ 8″	2′ 9″	—	—
2-1000S162-54	8′ 6″	7′ 6″	6′ 8″	6′ 0″	5′ 5″	8′ 4″	7′ 4″	6′ 6″	5′ 10″	5′ 4″
2-1000S162-68	10′ 6″	9′ 7″	8′ 9″	8′ 0″	7′ 5″	10′ 4″	9′ 5″	8′ 7″	7′ 11″	7′ 3″
2-1200S162-54	7′ 1″	6′ 2″	5′ 6″	5′ 0″	4′ 6″	6′ 11″	6′ 1″	5′ 5″	4′ 10″	4′ 5″
2-1200S162-68	11′ 7″	10′ 7″	9′ 8″	8′ 11″	8′ 2″	11′ 5″	10′ 5″	9′ 6″	8′ 9″	8′ 0″

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa.

a. Deflection criteria: *L*/360 for live loads, *L*/240 for total loads.

b. Design load assumptions:

Second-floor dead load is 10 psf.

Roof/ceiling dead load is 12 psf.

Second-floor live load is 30 psf.

Attic dead load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the header.

d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE R603.6(2)

BOX-BEAM AND BACK-TO-BACK HEADER SPANS
Headers Supporting Roof and Ceiling Only[a, b, d]

MEMBER DESIGNATION	GROUND SNOW LOAD (50 psf)					GROUND SNOW LOAD (70 psf)				
	Building width[c] (feet)					Building width[c] (feet)				
	24	28	32	36	40	24	28	32	36	40
2-350S162-33	—	—	—	—	—	—	—	—	—	—
2-350S162-43	2′ 4″	—	—	—	—	—	—	—	—	—
2-350S162-54	4′ 8″	4′ 2″	3′ 9″	3′ 5″	3′ 1″	3′ 7″	3′ 2″	2′ 9″	2′ 5″	2′ 0″
2-350S162-68	5′ 7″	5′ 2″	4′ 9″	4′ 4″	3′ 11″	4′ 7″	4′ 1″	3′ 7″	3′ 2″	2′ 10″
2-550S162-33	2′ 2″	—	—	—	—	—	—	—	—	—

2-550S162-43	3′-8″	3′-1″	2′-6″	—	—	2′-3″	—	—	—	—
2-550S162-54	6′-11″	6′-3″	5′-9″	5′-3″	4′-9″	5′-6″	4′-11″	4′-5″	3′-11″	3′-5″
2-550S162-68	8′-0″	7′-6″	6′-11″	6′-5″	5′-11″	6′-9″	6′-1″	5′-6″	5′-0″	4′-7″
2-800S162-33	2′-7″	—	—	—	—	—	—	—	—	—
2-800S162-43	4′-6″	3′-9″	3′-1″	2′-5″	—	2′-10″	—	—	—	—
2-800S162-54	8′-0″	7′-3″	6′-8″	6′-1″	5′-7″	6′-5″	5′-9″	5′-1″	4′-7″	4′-0″
2-800S162-68	9′-9″	9′-0″	8′-3″	7′-8″	7′-1″	8′-0″	7′-3″	6′-7″	6′-0″	5′-6″
2-1000S162-43	4′-8″	4′-1″	3′-6″	2′-9″	—	3′-3″	2′-2″	—	—	—
2-1000S162-54	9′-1″	8′-2″	7′-3″	6′-7″	6′-0″	7′-0″	6′-2″	5′-6″	5′-0″	4′-6″
2-1000S162-68	11′-1″	10′-2″	9′-5″	8′-8″	8′-1″	9′-1″	8′-3″	7′-6″	6′-10″	6′-3″
2-1200S162-54	7′-8″	6′-9″	6′-1″	5′-6″	5′-0″	5′-10″	5′-1″	4′-7″	4′-1″	3′-9″
2-1200S162-68	12′-3″	11′-3″	10′-4″	9′-7″	8′-11″	10′-1″	9′-1″	8′-3″	7′-6″	6′-10″

For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

a. Deflection criteria: *L*/360 for live loads, *L*/240 for total loads.

b. Design load assumptions:

Roof/ceiling dead load is 12 psf.

Attic dead load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the header.

d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE R603.6(4)

BOX-BEAM AND BACK-TO-BACK HEADER SPANS
Headers Supporting One Floor, Roof and Ceiling[a, b, d]

MEMBER DESIGNATION	GROUND SNOW LOAD (50 psf)					GROUND SNOW LOAD (70 psf)				
	Building width[c] (feet)					Building width[c] (feet)				
	24	28	32	36	40	24	28	32	36	40
2-350S162-33	—	—	—	—	—	—	—	—	—	—
2-350S162-43	—	—	—	—	—	—	—	—	—	—
2-350S162-54	3′-5″	3′-0″	2′-7″	2′-2″	—	2′-8″	2′-2″	—	—	—
2-350S162-68	4′-6″	4′-1″	3′-8″	3′-3″	2′-11″	3′-9″	3′-3″	2′-10″	2′-5″	2′-1″
2-550S162-33	—	—	—	—	—	—	—	—	—	—
2-550S162-43	2′-0″	—	—	—	—	—	—	—	—	—

~~2-550S162-54~~	~~5′ 3″~~	~~3′ 8″~~	~~4′ 1″~~	~~3′ 8″~~	~~3′ 2″~~	~~4′ 3″~~	~~3′ 8″~~	~~3′ 1″~~	~~2′ 7″~~	~~2′ 0″~~
~~2-550S162-68~~	~~6′ 5″~~	~~5′ 10″~~	~~5′ 3″~~	~~4′ 9″~~	~~4′ 4″~~	~~5′ 5″~~	~~4′ 9″~~	~~4′ 3″~~	~~3′ 9″~~	~~3′ 4″~~
~~2-800S162-33~~	—	—	—	—	—	—	—	—	—	—
~~2-800S162-43~~	~~2′ 6″~~	—	—	—	—	—	—	—	—	—
~~2-800S162-54~~	~~6′ 1″~~	~~5′ 5″~~	~~4′ 10″~~	~~4′ 3″~~	~~3′ 9″~~	~~4′ 11″~~	~~4′ 3″~~	~~3′ 8″~~	~~3′ 0″~~	~~2′ 5″~~
~~2-800S162-68~~	~~7′ 8″~~	~~6′ 11″~~	~~6′ 3″~~	~~5′ 9″~~	~~5′ 2″~~	~~6′ 5″~~	~~5′ 9″~~	~~5′ 1″~~	~~4′ 6″~~	~~4′ 0″~~
~~2-1000S162-43~~	~~2′ 10″~~	—	—	—	—	—	—	—	—	—
~~2-1000S162-54~~	~~6′ 7″~~	~~5′ 10″~~	~~5′ 3″~~	~~4′ 9″~~	~~4′ 3″~~	~~5′ 4″~~	~~4′ 9″~~	~~4′ 1″~~	~~3′ 5″~~	~~2′ 9″~~
~~2-1000S162-68~~	~~8′ 8″~~	~~7′ 10″~~	~~7′ 2″~~	~~6′ 6″~~	~~5′ 11″~~	~~7′ 4″~~	~~6′ 6″~~	~~5′ 9″~~	~~5′ 1″~~	~~4′ 6″~~
~~2-1200S162-54~~	~~5′ 6″~~	~~4′ 10″~~	~~4′ 4″~~	~~3′ 11″~~	~~3′ 7″~~	~~4′ 5″~~	~~3′ 11″~~	~~3′ 6″~~	~~3′ 2″~~	~~2′ 11″~~
~~2-1200S162-68~~	~~9′ 7″~~	~~8′ 8″~~	~~7′ 11″~~	~~7′ 2″~~	~~6′ 6″~~	~~8′ 1″~~	~~7′ 2″~~	~~6′ 4″~~	~~5′ 8″~~	~~5′ 0″~~

~~For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa, 1 ksi = 1,000 psi = 6.895 MPa.~~

~~a. Deflection criteria: *L*/360 for live loads, *L*/240 for total loads.~~

~~b. Design load assumptions:~~

~~Second-floor dead load is 10 psf.~~

~~Roof/ceiling dead load is 12 psf.~~

~~Second-floor live load is 30 psf.~~

~~Attic dead load is 10 psf.~~

~~c. Building width is in the direction of horizontal framing members supported by the header.~~

~~d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.~~

~~TABLE R603.6(5)~~

~~BOX-BEAM AND BACK-TO-BACK HEADER SPANS~~
~~Headers Supporting Two Floors, Roof and Ceiling[a, b, d]~~

~~MEMBER DESIGNATION~~	~~GROUND SNOW LOAD (20 psf)~~					~~GROUND SNOW LOAD (30 psf)~~				
	~~Building width[c] (feet)~~					~~Building width[c] (feet)~~				
	~~24~~	~~28~~	~~32~~	~~36~~	~~40~~	~~24~~	~~28~~	~~32~~	~~36~~	~~40~~
~~2-350S162-33~~	—	—	—	—	—	—	—	—	—	—
~~2-350S162-43~~	—	—	—	—	—	—	—	—	—	—
~~2-350S162-54~~	~~2′ 5″~~	—	—	—	—	~~2′ 4″~~	—	—	—	—
~~2-350S162-68~~	~~3′ 6″~~	~~3′ 0″~~	~~2′ 6″~~	~~2′ 1″~~	—	~~3′ 5″~~	~~2′ 11″~~	~~2′ 6″~~	~~2′ 0″~~	—

~~2-550S162-33~~	—	—	—	—	—	—	—	—	—	—
~~2-550S162-43~~	—	—	—	—	—	—	—	—	—	—
~~2-550S162-54~~	~~3′-11″~~	~~3′-3″~~	~~2′-8″~~	~~2′-0″~~	—	~~3′-10″~~	~~3′-3″~~	~~2′-7″~~	—	—
~~2-550S162-68~~	~~5′-1″~~	~~4′-5″~~	~~3′-10″~~	~~3′-3″~~	~~2′-9″~~	~~5′-0″~~	~~4′-4″~~	~~3′-9″~~	~~3′-3″~~	~~2′-9″~~
~~2-800S162-33~~	—	—	—	—	—	—	—	—	—	—
~~2-800S162-43~~	—	—	—	—	—	—	—	—	—	—
~~2-800S162-54~~	~~4′-7″~~	~~3′-10″~~	~~3′-1″~~	~~2′-5″~~	—	~~4′-6″~~	~~3′-9″~~	~~3′-0″~~	~~2′-4″~~	—
~~2-800S162-68~~	~~6′-0″~~	~~5′-3″~~	~~4′-7″~~	~~3′-11″~~	~~3′-4″~~	~~6′-0″~~	~~5′-2″~~	~~4′-6″~~	~~3′-11″~~	~~3′-3″~~
~~2-1000S162-43~~	—	—	—	—	—	—	—	—	—	—
~~2-1000S162-54~~	~~5′-0″~~	~~4′-4″~~	~~3′-6″~~	~~2′-9″~~	—	~~4′-11″~~	~~4′-3″~~	~~3′-5″~~	~~2′-7″~~	—
~~2-1000S162-68~~	~~6′-10″~~	~~6′-0″~~	~~5′-3″~~	~~4′-6″~~	~~3′-10″~~	~~6′-9″~~	~~5′-11″~~	~~5′-2″~~	~~4′-5″~~	~~3′-9″~~
~~2-1200S162-54~~	~~4′-2″~~	~~3′-7″~~	~~3′-3″~~	~~2′-11″~~	—	~~4′-1″~~	~~3′-7″~~	~~3′-2″~~	~~2′-10″~~	—
~~2-1200S162-68~~	~~7′-7″~~	~~6′-7″~~	~~5′-9″~~	~~5′-0″~~	~~4′-2″~~	~~7′-6″~~	~~6′-6″~~	~~5′-8″~~	~~4′-10″~~	~~4′-1″~~

~~For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa, 1 ksi = 1,000 psi = 6.895 MPa.~~

~~a. Deflection criteria: *L*/360 for live loads, *L*/240 for total loads.~~

~~b. Design load assumptions:~~

~~Second-floor dead load is 10 psf.~~
~~Roof/ceiling dead load is 12 psf.~~
~~Second-floor live load is 40 psf.~~
~~Third floor live load is 30 psf.~~
~~Attic live load is 10 psf.~~

~~c. Building width is in the direction of horizontal framing members supported by the header.~~

~~d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.~~

~~TABLE R603.6(6)~~

~~BOX-BEAM AND BACK-TO-BACK HEADER SPANS~~
~~Headers Supporting Two Floors, Roof and Ceiling~~[a, b, d]

~~MEMBER DESIGNATION~~	~~GROUND SNOW LOAD (50 psf)~~					~~GROUND SNOW LOAD (70 psf)~~				
	~~Building width~~[c] ~~(feet)~~					~~Building width~~[c] ~~(feet)~~				
	~~24~~	~~28~~	~~32~~	~~36~~	~~40~~	~~24~~	~~28~~	~~32~~	~~36~~	~~40~~
~~2-350S162-33~~	—	—	—	—	—	—	—	—	—	—
~~2-350S162-43~~	—	—	—	—	—	—	—	—	—	—
~~2-350S162-54~~	~~2′-2″~~	—	—	—	—	—	—	—	—	—
~~2-350S162-68~~	~~3′-3″~~	~~2′-9″~~	~~2′-3″~~	—	—	~~2′-11″~~	~~2′-5″~~	—	—	—

~~2-550S162-33~~	—	—	—	—	—	—	—	—	—	—
~~2-550S162-43~~	—	—	—	—	—	—	—	—	—	—
~~2-550S162-54~~	~~3′-7″~~	~~2′-11″~~	~~2′-3″~~	—	—	~~3′-3″~~	~~2′-7″~~	—	—	—
~~2-550S162-68~~	~~4′-9″~~	~~2′-1″~~	~~3′-6″~~	~~3′-0″~~	~~2′-5″~~	~~4′-4″~~	~~3′-9″~~	~~3′-2″~~	~~2′-8″~~	~~2′-1″~~
~~2-800S162-33~~	—	—	—	—	—	—	—	—	—	—
~~2-800S162-43~~	—	—	—	—	—	—	—	—	—	—
~~2-800S162-54~~	~~4′-3″~~	~~3′-5″~~	~~2′-8″~~	—	—	~~3′-9″~~	~~3′-0″~~	~~2′-3″~~	—	—
~~2-800S162-68~~	~~5′-8″~~	~~4′-11″~~	~~4′-2″~~	~~3′-7″~~	~~2′-11″~~	~~5′-3″~~	~~4′-6″~~	~~3′-10″~~	~~3′-3″~~	~~2′-7″~~
~~2-1000S162-43~~	—	—	—	—	—	—	—	—	—	—
~~2-1000S162-54~~	~~4′-8″~~	~~3′-11″~~	~~3′-1″~~	~~2′-2″~~	—	~~4′-3″~~	~~3′-5″~~	~~2′-7″~~	—	—
~~2-1000S162-68~~	~~6′-5″~~	~~5′-7″~~	~~4′-9″~~	~~4′-1″~~	~~3′-4″~~	~~5′-11″~~	~~5′-1″~~	~~4′-5″~~	~~3′-8″~~	~~2′-11″~~
~~2-1200S162-54~~	~~3′-11″~~	~~3′-5″~~	~~3′-0″~~	~~2′-4″~~	—	~~3′-7″~~	~~3′-2″~~	~~2′-10″~~	—	—
~~2-1200S162-68~~	~~7′-1″~~	~~6′-2″~~	~~5′-3″~~	~~4′-6″~~	~~3′-8″~~	~~6′-6″~~	~~5′-8″~~	~~4′-10″~~	~~4′-0″~~	~~3′-3″~~

~~For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa, 1 ksi = 1,000 psi = 6.895 MPa.~~

~~a. Deflection criteria: *L*/360 for live loads, *L*/240 for total loads.~~

~~b. Design load assumptions:~~

~~Second-floor dead load is 10 psf.~~

~~Roof/ceiling dead load is 12 psf.~~

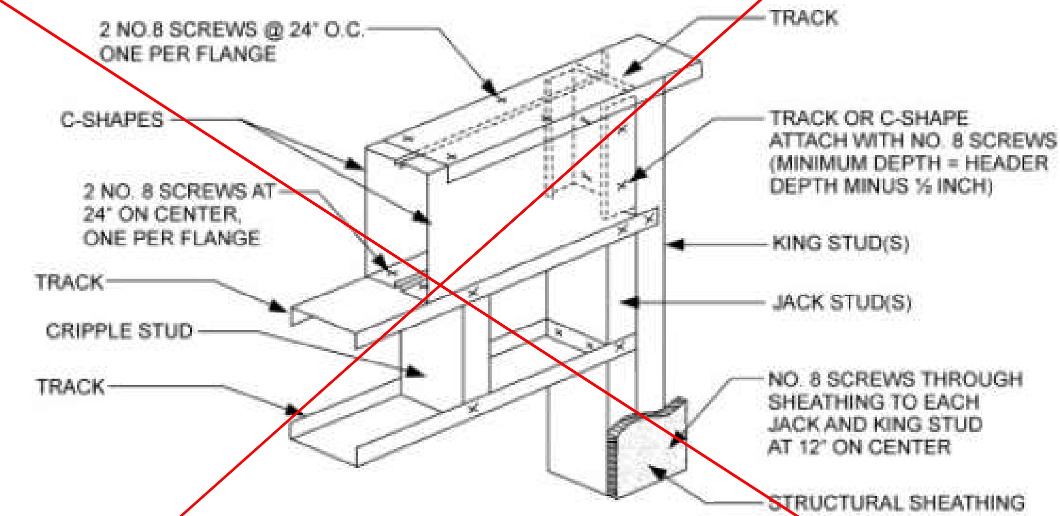
~~Second-floor live load is 40 psf.~~

~~Third floor live load is 30 psf.~~

~~Attic live load is 10 psf.~~

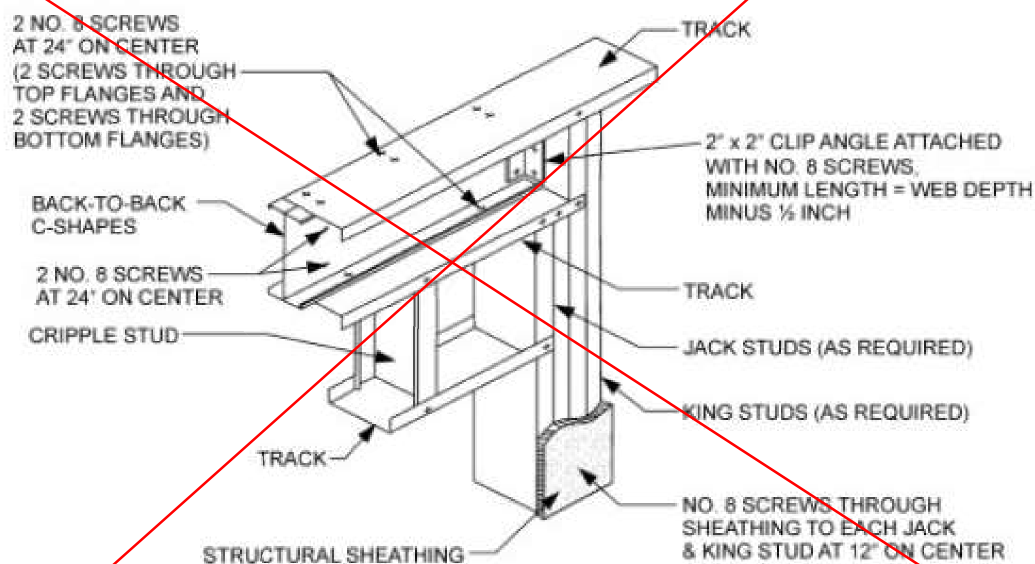
~~c. Building width is in the direction of horizontal framing members supported by the header.~~

~~d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.~~



For SI: 1 inch = 25.4 mm.

FIGURE R603.6(1)
BOX BEAM HEADER



For SI: 1 inch = 25.4 mm.

FIGURE R603.6(2)
BACK-TO-BACK HEADER

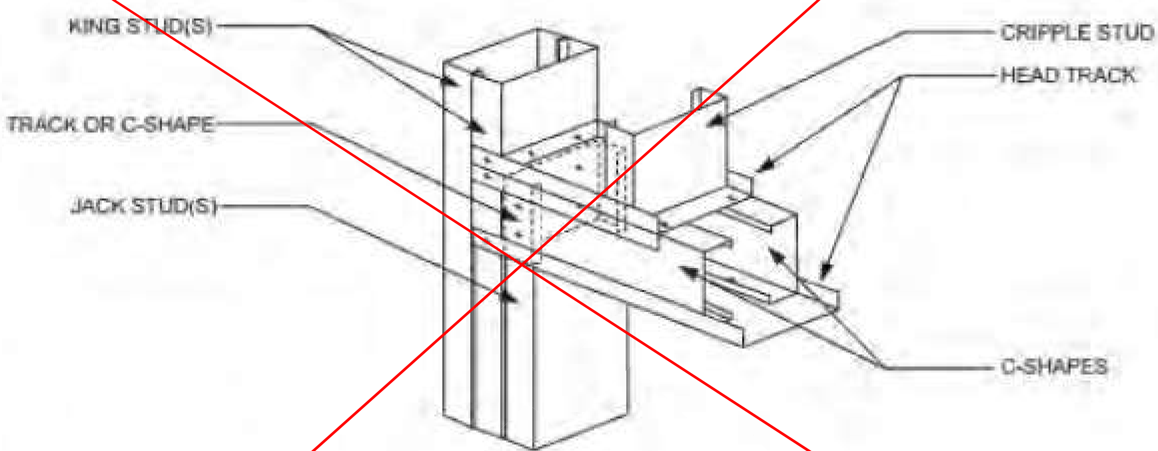
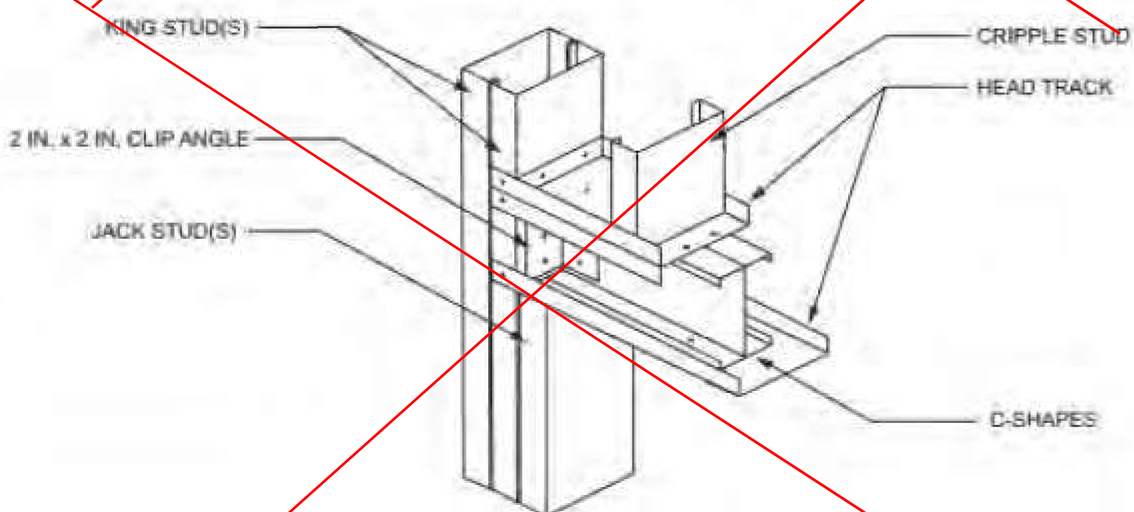


FIGURE R603.6.1(1)
BOX BEAM HEADER IN GABLE ENDWALL



For SI: 1 inch = 25.4 mm.

FIGURE R603.6.1(2)
BACK-TO-BACK HEADER IN GABLE ENDWALL

~~**R603.7 Jack and king studs.** The number of jack and king studs installed on each side of a header shall comply with Table R603.7(1). King, jack and cripple studs shall be of the same dimension and thickness as the adjacent wall studs. Headers shall be connected to king studs in accordance with Table R603.7(2) and the following provisions:~~

1. ~~For box beam headers, one-half of the total number of required screws shall be applied to the header and one-half to the king stud by use of C-shaped or track member in accordance with Figure R603.6(1). The track or C-shaped sections shall extend the depth of the header minus $^1/_2$ inch (12.7 mm) and shall have a minimum thickness not less than that of the wall studs.~~

2. ~~For back-to-back headers, one-half the total number of screws shall be applied to the header and one-half to the king stud by use of a minimum 2-inch by 2-inch (51 mm by 51 mm) clip angle in accordance with Figure R603.6(2). The clip angle shall extend the depth of the header minus $^1/_2$ inch (12.7 mm) and shall have a minimum thickness not less than that of the wall studs. Jack and king studs shall be interconnected with structural sheathing in accordance with Figures R603.6(1) and R603.6(2).~~

~~TABLE R603.7(1)~~

~~TOTAL NUMBER OF JACK AND KING STUDS REQUIRED AT EACH END OF AN OPENING~~

~~SIZE OF OPENING (feet-inches)~~	~~24-INCH O.C. STUD SPACING~~		~~16-INCH O.C. STUD SPACING~~	
	~~No. of jack studs~~	~~No. of king studs~~	~~No. of jack studs~~	~~No. of king studs~~
~~Up to 3′-6″~~	~~1~~	~~1~~	~~1~~	~~1~~
~~> 3′-6″ to 5′-0″~~	~~1~~	~~2~~	~~1~~	~~2~~
~~> 5′-0″ to 5′-6″~~	~~1~~	~~2~~	~~2~~	~~2~~
~~> 5′-6″ to 8′-0″~~	~~1~~	~~2~~	~~2~~	~~2~~
~~> 8′-0″ to 10′-6″~~	~~2~~	~~2~~	~~2~~	~~3~~
~~> 10′-6″ to 12′-0″~~	~~2~~	~~2~~	~~3~~	~~3~~
~~> 12′-0″ to 13′-0″~~	~~2~~	~~3~~	~~3~~	~~3~~
~~> 13′-0″ to 14′-0″~~	~~2~~	~~3~~	~~3~~	4
~~> 14′-0″ to 16′-0″~~	~~2~~	~~3~~	~~3~~	4
~~> 16′-0″ to 18′-0″~~	~~3~~	~~3~~	4	4

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

~~TABLE R603.7(2)~~

~~HEADER TO KING STUD CONNECTION REQUIREMENTS[a, b, c, d]~~

~~HEADER SPAN (feet)~~	~~ULTIMATE WIND SPEED (mph), EXPOSURE CATEGORY~~					
	~~115 B~~	~~120 B~~	~~130 B~~	~~< 140 B~~	~~130 C~~	~~<140 C~~
			~~115 C~~	~~120 C~~		
~~≤ 4~~	~~4-No. 8 screws~~	~~4-No. 8 screws~~	~~4-No. 8 screws~~	~~4-No. 8 screws~~	~~6-No. 8 screws~~	~~6-No. 8 screws~~
~~> 4 to 8~~	~~4-No. 8 screws~~	~~4-No. 8 screws~~	~~4-No. 8 screws~~	~~6-No. 8 screws~~	~~8-No. 8 screws~~	~~8-No. 8 screws~~
~~> 8 to 12~~	~~4-No. 8 screws~~	~~6-No. 8 screws~~	~~6-No. 8 screws~~	~~8-No. 8 screws~~	~~10-No. 8 screws~~	~~12-No. 8 screws~~
~~> 12 to 16~~	~~4-No. 8 screws~~	~~6-No. 8 screws~~	~~8-No. 8 screws~~	~~10-No. 8 screws~~	~~12-No. 8 screws~~	~~14-No. 8 screws~~

~~For SI: 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s, 1 pound = 4.448 N.~~

~~a. All screw sizes shown are minimum.~~

~~b. For headers located on the first floor of a two-story building or the first or second floor of a three-story building, the total number of screws is permitted to be reduced by 2 screws, but the total number of screws shall be not less than four.~~

~~c. For roof slopes of 6:12 or greater, the required number of screws shall be permitted to be reduced by half, but the total number of screws shall be not less than four.~~

~~d. Screws can be replaced by an uplift connector that has a capacity of the number of screws multiplied by 164 pounds.~~

~~R603.8 Head and sill track.~~ ~~Head track spans above door and window openings and sill track spans beneath window openings shall comply with Table R603.8. For openings less than 4 feet (1219 mm) in height that have both a head track and a sill track, multiplying the spans by 1.75 shall be permitted in Table R603.8. For openings less than or equal to 6 feet (1829 mm) in height that have both a head track and a sill track, multiplying the spans in Table R603.8 by 1.50 shall be permitted.~~

~~**TABLE R603.8**~~

~~**HEAD AND SILL TRACK SPAN**~~

~~ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)~~		~~ALLOWABLE HEAD AND SILL TRACK SPAN[a, b, c] (feet-inches)~~					
		~~TRACK DESIGNATION[d]~~					
~~B~~	~~C~~	~~350T125-33~~	~~350T125-43~~	~~350T125-54~~	~~550T125-33~~	~~550T125-43~~	~~550T125-54~~
~~115~~	—	~~5′ 9″~~	~~6′ 9″~~	~~9′ 3″~~	~~7′ 3″~~	~~9′ 1″~~	~~12′ 5″~~
~~120~~	—	~~5′ 6″~~	~~6′ 6″~~	~~8′ 11″~~	~~7′ 0″~~	~~8′ 9″~~	~~11′ 11″~~
~~130~~	~~115~~	~~4′ 10″~~	~~5′ 9″~~	~~7′ 10″~~	~~6′ 2″~~	~~7′ 8″~~	~~10′ 6″~~
~~< 140~~	~~120~~	~~4′ 8″~~	~~5′ 6″~~	~~7′ 6″~~	~~5′ 11″~~	~~7′ 4″~~	~~10′ 1″~~
—	~~130~~	~~4′ 3″~~	~~5′ 1″~~	~~6′ 11″~~	~~5′ 6″~~	~~6′ 9″~~	~~9′ 4″~~
—	~~< 140~~	~~4′ 0″~~	~~4′ 9″~~	~~6′ 5″~~	~~5′ 1″~~	~~6′ 4″~~	~~8′ 8″~~

~~For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s, 1 ksi = 1,000 psi = 6.895 MPa.~~

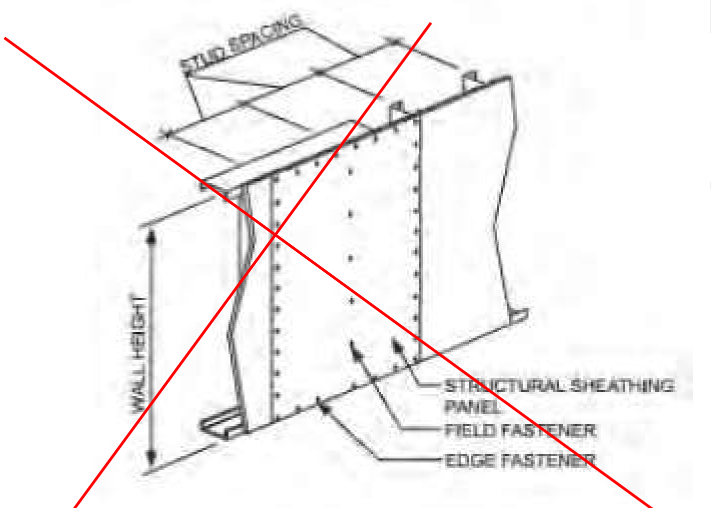
~~a. Deflection limit: *L*/240.~~

~~b. Head and sill track spans are based on components and cladding wind pressures and 48-inch tributary span.~~

~~c. For openings less than 4 feet in height that have both a head track and sill track, the spans are permitted to be multiplied by 1.75. For openings less than or equal to 6 feet in height that have both a head track and a sill track, the spans are permitted to be multiplied by a factor of 1.5.~~

~~d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.~~

~~**R603.9 Structural sheathing.** Structural sheathing shall be installed in accordance with Figure R603.9 and this section on all sheathable exterior wall surfaces, including areas above and below openings.~~



~~**FIGURE R603.9**~~

~~**R603.9.1 Sheathing materials.** Structural sheathing panels shall consist of minimum $^{7}/_{16}$-inch thick (11 mm) oriented strand board or $^{15}/_{32}$-inch-thick (12 mm) plywood.~~

~~**R603.9.2 Determination of minimum length of full- height sheathing.** The minimum length of full-height sheathing on each *braced wall line* shall be determined by multiplying the length of the *braced wall line* by the percentage obtained from Table R603.9.2(1) and by the plan aspect-ratio adjustment factors obtained from Table R603.9.2(2). The minimum length of full-height sheathing shall be not less than 20 percent of the *braced wall line* length.~~

~~To be considered full-height sheathing, structural sheathing shall extend from the bottom to the top of the wall without interruption by openings. Only sheathed, full-height wall sections, uninterrupted by openings, which are not less than 48 inches (1219 mm) wide, shall be counted toward meeting the minimum percentages in Table R603.9.2(1). In addition, structural sheathing shall comply with all of the following requirements:~~

1. ~~Be installed with the long dimension parallel to the stud framing and shall cover the full vertical height of wall from the bottom of the bottom track to the top of the top track of each *story*. Installing the long dimension perpendicular to the stud framing or using shorter segments shall be permitted provided that the horizontal joint is blocked as described in Item 2.~~
2. ~~Be blocked where the long dimension is installed perpendicular to the stud framing. Blocking shall be not less than 33 mil (0.84 mm) thickness. Each horizontal structural sheathing panel shall be fastened with No. 8 screws spaced at 6 inches (152 mm) on center to the blocking at the joint.~~
3. ~~Be applied to each end (corners) of each of the exterior walls with a minimum 48-inch-wide (1219 mm) panel.~~

~~**Exception:** Where stone or masonry veneer is installed, the required length of full-height sheathing and overturning anchorage required shall be determined in accordance with Section R603.9.5.~~

~~**R603.9.2.1 Full-height sheathing.** The minimum percentage of full-height structural sheathing shall be multiplied by 1.10 for 9-foot-high (2743 mm) walls and multiplied by 1.20 for 10-foot-high (3048 mm) walls.~~

~~**R603.9.2.2 Full-height sheathing in lowest story.** In the lowest *story* of a *dwelling*, multiplying the percentage of full-height sheathing required in Table R603.9.2(1) by 0.6 shall be permitted where hold-down anchors are provided in accordance with Section R603.9.4.2.~~

~~TABLE R603.9.2(1)~~

~~MINIMUM PERCENTAGE OF FULL-HEIGHT STRUCTURAL SHEATHING ON EXTERIOR WALLS~~[a, b]

WALL SUPPORTING	ROOF SLOPE	ULTIMATE WIND SPEED AND EXPOSURE (mph)					
		115 B	120 B	130 B 115 C	< 140 B 120 C	< 130 C	< 140 C
Roof and ceiling only (one story or top floor of two- or three-story building)	3:12	9	11	11	13	17	20
	6:12	13	15	17	22	28	35
	9:12	23	27	29	33	53	59
	12:12	32	39	40	44	70	76
One story, roof and ceiling (first floor of a two-story building or second floor of a three-story building)	3:12	26	32	34	39	53	67
	6:12	27	33	34	44	61	75
	9:12	38	45	46	61	78	92
	12:12	43	53	57	72	106	116
Two stories, roof and ceiling (first floor of a three-story building)	3:12	43	53	57	64	89	113
	6:12	41	51	51	67	95	114
	9:12	53	63	63	89	104	126
	12:12	54	67	74	100	142	157

~~For SI: 1 mph = 0.447 m/s.~~

~~a. Linear interpolation is permitted.~~

~~b. For hip-roofed homes the minimum percentage of full-height sheathing, based on wind, is permitted to be multiplied by a factor of 0.95 for roof slopes not exceeding 7:12 and a factor of 0.9 for roof slopes greater than 7:12.~~

~~TABLE R603.9.2(2)~~
~~FULL-HEIGHT SHEATHING LENGTH ADJUSTMENT FACTORS~~

~~PLAN ASPECT RATIO~~	~~LENGTH ADJUSTMENT FACTORS~~	
	~~Short wall~~	~~Long wall~~
~~1:1~~	~~1.0~~	~~1.0~~
~~1.5:1~~	~~1.5~~	~~0.67~~
~~2:1~~	~~2.0~~	~~0.50~~
~~3:1~~	~~3.0~~	~~0.33~~
~~4:1~~	~~4.0~~	~~0.25~~

~~**R603.9.3 Structural sheathing fastening.** Edges and interior areas of structural sheathing panels shall be fastened to framing members and tracks in accordance with Figure R603.9 and Table R603.3.2(1). Screws for attachment of structural sheathing panels shall be bugle head, flat head, or similar head style with a minimum head diameter of 0.29 inch (8 mm).~~

~~For continuously sheathed *braced wall lines* using *wood structural panels* installed with No. 8 screws spaced 4 inches (102 mm) on center at all panel edges and 12 inches (304.8 mm) on center on intermediate framing members, the following shall apply:~~

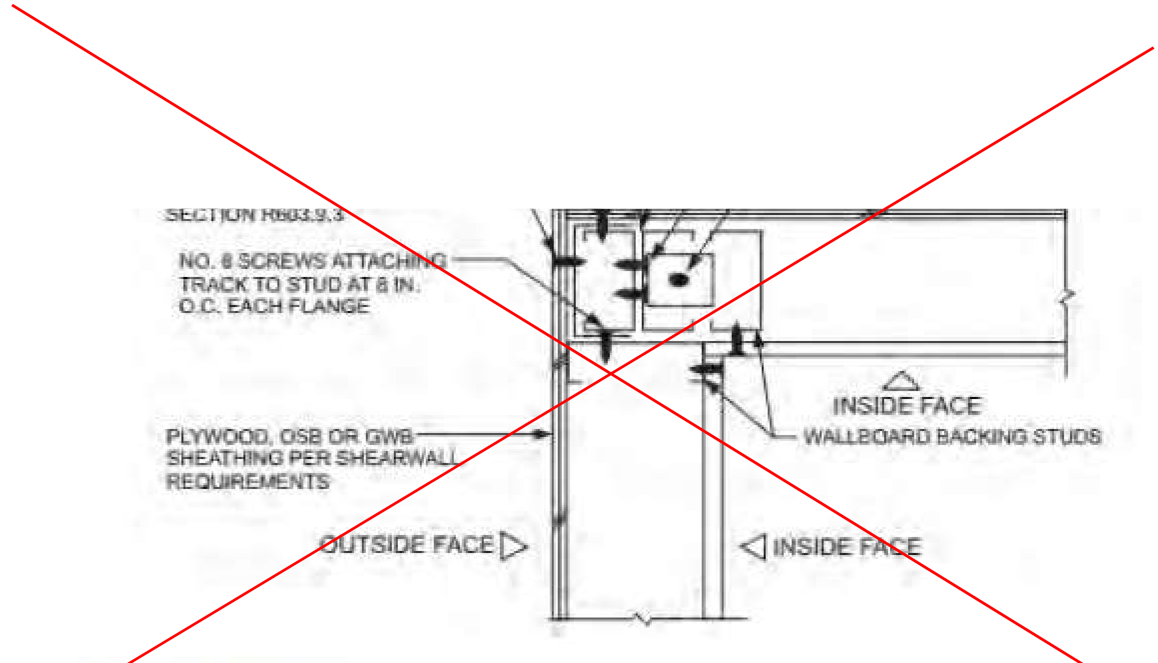
1. ~~Multiplying the percentages of full-height sheathing in Table R603.9.2(1) by 0.72 shall be permitted.~~
2. ~~For bottom track attached to foundations or framing below, the bottom track anchor or screw connection spacing in Tables R505.3.1(1) and R603.3.1 shall be multiplied by two-thirds.~~

~~**R603.9.4 Uplift connection requirements.** Uplift connections shall be provided in accordance with this section.~~

~~**R603.9.4.1 Ultimate design wind speeds greater than 130 mph.** Where ultimate design wind speeds exceed 130 miles per hour (58 m/s), Exposure Category C walls shall be provided with direct uplift connections in accordance with AISI S230, Section E13.3, and AISI S230, Section F8.2, as required for 140 miles per hour (63 m/s), Exposure Category C.~~

~~**R603.9.4.2 Hold-down anchor.** Where the percentage of full-height sheathing is adjusted in accordance with Section R603.9.2.2, a hold-down anchor, with a strength of 4,300 pounds (19 kN), shall be provided at each end of each full-height sheathed wall section used to meet the minimum percent sheathing requirements of Section R603.9.2. Hold-down anchors shall be attached to back-to-back studs; structural sheathing panels shall have edge fastening to the studs, in accordance with Section R603.9.3 and AISI S230, Table E11-1.~~

~~A single hold-down anchor, installed in accordance with Figure R603.9.4.2, shall be permitted at the corners of buildings.~~



~~SI: 1 inch = 25.4 mm.~~

~~**FIGURE R603.9.4.2**~~
~~**CORNER STUD HOLD-DOWN DETAIL**~~

~~**R603.9.5 St**~~ ... ~~in~~
~~accordance~~ ... ~~or~~
~~perpendicul~~

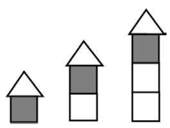
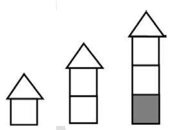
~~**R603.9.5.1 Seismic Design Category C.** In *Seismic Design Category* C, the length of structural sheathing for walls supporting one *story*, roof and ceiling shall be the greater of the amounts required by Section R603.9.2, except Section R603.9.2.2 shall be permitted.~~

~~**R603.9.5.2 Seismic Design Categories D_0, D_1 and D_2.** In *Seismic Design Categories* D_0, D_1 and D_2, the required length of structural sheathing and overturning anchorage shall be determined in accordance with Tables R603.9.5(1), R603.9.5(2), R603.9.5(3), and R603.9.5(4). Overturning anchorage shall be installed on the doubled studs at the end of each full-height wall segment.~~

~~**TABLE R603.9.5(1)**~~

~~**REQUIRED LENGTH OF FULL-HEIGHT SHEATHING AND ASSOCIATED OVERTURNING ANCHORAGE FOR WALLS SUPPORTING WALLS WITH STONE OR MASONRY VENEER AND USING 33-MIL COLD-FORMED STEEL FRAMING AND 6-INCH SCREW SPACING ON THE PERIMETER OF EACH PANEL OF STRUCTURAL SHEATHING**~~

~~SEISMIC DESIGN CATEGORY~~	~~STORY~~							~~SINGLE-STORY HOLD-DOWN FORCE (pounds)~~	~~CUMULATIVE HOLD-DOWN FORCE (pounds)~~
		—	—	—	—	—	—		
		~~Minimum total length of braced wall panels~~							
~~D_0~~		~~3.3~~	~~4.7~~	~~6.1~~	~~7.4~~	~~8.8~~	~~10.2~~	~~3,360~~	—
		~~5.3~~	~~8.7~~	~~12.1~~	~~15.4~~	~~18.8~~	~~22.2~~	~~3,360~~	~~6,720~~

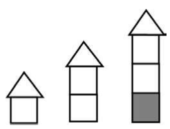
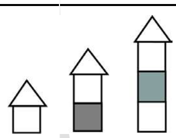
		~~7.3~~	~~12.7~~	~~18.0~~	~~23.4~~	~~28.8~~	~~34.2~~	~~3,360~~	~~10,080~~
~~D1~~		~~4.1~~	~~5.8~~	~~7.5~~	~~9.2~~	~~10.9~~	~~12.7~~	~~3,360~~	—
		~~6.6~~	~~10.7~~	~~14.9~~	~~19.1~~	~~23.3~~	~~27.5~~	~~3,360~~	~~6,720~~
		~~9.0~~	~~15.7~~	~~22.4~~	~~29.0~~	~~35.7~~	~~42.2~~	~~3,360~~	~~10,080~~
~~D2~~		~~5.7~~	~~8.2~~	~~10.6~~	~~13.0~~	~~15.4~~	~~17.8~~	~~3,360~~	—
		~~9.2~~	~~15.1~~	~~21.1~~	~~27.0~~	~~32.9~~	~~38.8~~	~~3,360~~	~~6,720~~
		~~12.7~~	~~22.1~~	~~31.5~~	~~40.9~~	~~50.3~~	~~59.7~~	~~3,360~~	~~10,080~~

~~For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound-force = 4.448 N.~~

~~TABLE R603.9.5(2)~~

~~REQUIRED LENGTH OF FULL-HEIGHT SHEATHING AND ASSOCIATED OVERTURNING ANCHORAGE FOR WALLS SUPPORTING WALLS WITH STONE OR MASONRY VENEER AND USING 43-MIL COLD-FORMED STEEL FRAMING AND 6-INCH SCREW SPACING ON THE PERIMETER OF EACH PANEL OF STRUCTURAL SHEATHING~~

~~SEISMIC DESIGN CATEGORY~~	~~STORY~~	~~BRACED WALL LINE LENGTH (feet)~~						~~SINGLE-STORY HOLD-DOWN FORCE (pounds)~~	~~CUMULATIVE HOLD-DOWN FORCE (pounds)~~
		—	—	—	—	—	—		
		~~required along each braced wall line (feet)~~							
~~D0~~		~~2.8~~	~~4.0~~	~~5.1~~	~~6.3~~	~~7.5~~	~~8.7~~	~~3,960~~	—

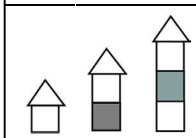
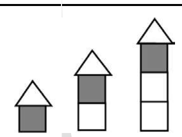
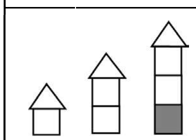
		~~4.5~~	~~7.4~~	~~10.2~~	~~13.1~~	~~16.0~~	~~18.8~~	~~3,960~~	~~7,920~~
		~~6.2~~	~~10.7~~	~~15.3~~	~~19.9~~	~~24.4~~	~~29.0~~	~~3,960~~	~~11, 880~~
~~D_1~~		~~3.5~~	~~4.9~~	~~6.4~~	~~7.8~~	~~9.3~~	~~10.7~~	~~3,960~~	—
		~~5.6~~	~~9.1~~	~~12.7~~	~~16.2~~	~~19.8~~	~~23.3~~	~~3,960~~	~~7,920~~
		~~7.7~~	~~13.3~~	~~19.0~~	~~24.6~~	~~30.3~~	~~35.9~~	~~3,960~~	~~11, 880~~
~~D_2~~		~~4.9~~	~~6.9~~	~~9.0~~	~~11.0~~	~~13.1~~	~~15.1~~	~~3,960~~	—
		~~7.8~~	~~12.9~~	~~17.9~~	~~22.9~~	~~27.9~~	~~32.9~~	~~3,960~~	~~7,920~~
		~~10.8~~	~~18.8~~	~~26.7~~	~~34.7~~	~~42.7~~	~~50.7~~	~~3,960~~	~~11, 880~~

~~For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound-force = 4.448 N.~~

~~TABLE R603.9.5(3)~~

~~REQUIRED LENGTH OF FULL-HEIGHT SHEATHING AND ASSOCIATED OVERTURNING ANCHORAGE FOR WALLS SUPPORTING WALLS WITH STONE OR MASONRY VENEER AND USING 33-MIL COLD-FORMED STEEL FRAMING AND 4-INCH SCREW SPACING ON THE PERIMETER OF EACH PANEL OF STRUCTURAL SHEATHING~~

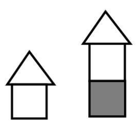
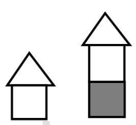
~~SEISMIC DESIGN CATEGORY~~	~~STORY~~							~~SINGLE-STORY HOLD-DOWN FORCE (pounds)~~	~~CUMULATIVE HOLD-DOWN FORCE (pounds)~~
		—	—	—	—	—	—		
		~~Minimum total length of braced wall~~							

		~~2.5~~	~~3.6~~	~~4.6~~	~~5.7~~	~~6.8~~	~~7.8~~	~~4,392~~	—
~~D_0~~		~~4.0~~	~~6.6~~	~~9.2~~	~~11.8~~	~~14.4~~	~~17.0~~	~~4,392~~	~~8,784~~
		~~5.6~~	~~9.7~~	~~13.8~~	~~17.9~~	~~22.0~~	~~26.2~~	~~4,392~~	~~13,176~~
		~~3.1~~	~~4.4~~	~~5.7~~	~~7.1~~	~~8.4~~	~~9.7~~	~~4,392~~	—
~~D_1~~		~~5.0~~	~~8.2~~	~~11.4~~	~~14.6~~	~~17.8~~	~~21.0~~	~~4,392~~	~~8,784~~
		~~6.9~~	~~12.0~~	~~17.1~~	~~22.2~~	~~27.3~~	~~32.4~~	~~4,392~~	~~13,176~~
		~~4.4~~	~~6.2~~	~~8.1~~	~~10.0~~	~~11.8~~	~~13.7~~	~~4,392~~	—
~~D_2~~		~~7.1~~	~~11.6~~	~~16.1~~	~~20.6~~	~~25.1~~	~~29.7~~	~~4,392~~	~~8,784~~
		~~9.7~~	~~16.9~~	~~24.1~~	~~31.3~~	~~38.5~~	~~45.7~~	~~4,392~~	~~13,176~~

~~For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound-force = 4.448 N.~~

~~TABLE R603.9.5(4)~~

~~REQUIRED LENGTH OF FULL-HEIGHT SHEATHING AND ASSOCIATED OVERTURNING ANCHORAGE FOR WALLS SUPPORTING WALLS WITH STONE OR MASONRY VENEER AND USING 43-MIL COLD-FORMED STEEL FRAMING AND 4-INCH SCREW SPACING ON THE PERIMETER OF EACH PANEL OF STRUCTURAL SHEATHING~~

~~SEISMIC DESIGN CATEGORY~~	~~STORY~~							~~SINGLE STORY HOLD-DOWN FORCE (pounds)~~	~~CUMULATIVE HOLD-DOWN FORCE (pounds)~~
		—	—	—	—	—	—		
		~~Minimum total length of braced wall~~							
~~D~~$_0$		~~1.9~~	~~2.7~~	~~3.4~~	~~4.2~~	~~5.0~~	~~5.8~~	~~5,928~~	—
		~~3.0~~	~~4.9~~	~~6.8~~	~~8.8~~	~~10.7~~	~~12.6~~	~~5,928~~	~~11,856~~
~~D~~$_1$		~~2.3~~	~~3.3~~	~~4.3~~	~~5.2~~	~~6.2~~	~~7.2~~	~~5,928~~	—
		~~3.7~~	~~6.1~~	~~8.5~~	~~10.8~~	~~13.2~~	~~15.6~~	~~5,928~~	~~11,856~~
~~D~~$_2$		~~3.3~~	~~4.6~~	~~6.0~~	~~7.4~~	~~8.7~~	~~10.1~~	~~5,928~~	—
		~~5.2~~	~~8.6~~	~~11.9~~	~~15.3~~	~~18.6~~	~~22.0~~	~~5,928~~	~~11,856~~

~~For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound-force = 4.448 N.~~

R606.2.7 Second-hand units. Second-hand *masonry units* shall not be reused unless they conform to the requirements of new units. The units shall be of whole, sound materials and free from cracks and other defects that will interfere with proper laying or use. Old mortar shall be cleaned from the unit before reuse.

Exception: Second hand units are permitted to be used for interior nonbearing conditions.

R606.2.8.3 Masonry in Seismic Design Categories D$_0$, D$_1$ and D$_2$. Deleted. ~~Mortar for masonry serving as the lateral-force-resisting system in *Seismic Design Categories* D$_0$, D$_1$ and D$_2$ shall be Type M or S Portland cement-lime or mortar cement.~~

R606.3.5 Grouting requirements.

R606.3.5.1 Grout placement. Grout shall be a plastic mix suitable for pumping without segregation of the constituents and shall be mixed thoroughly. Grout shall be placed by pumping or by an *approved* alternate method and shall be placed before any initial set occurs and not more than $1^1/_2$ hours after water has been added. Grout shall be consolidated by puddling or mechanical vibrating during placing and reconsolidated after excess moisture has been absorbed but before plasticity is lost. Grout shall not be pumped through aluminum pipes.

Maximum pour heights and the minimum dimensions of spaces provided for grout placement shall conform to Table R606.3.5.1. Grout shall be poured in lifts with a maximum height of 8 feet (2438 mm). Where a total grout pour exceeds 8 feet (2438 mm) in height, the grout shall be placed in lifts not exceeding 64 inches (1626 mm). ~~and special inspection during grouting shall be required.~~ If the work is stopped for 1 hour or longer, the horizontal construction joints shall be formed by stopping all tiers at the same elevation and with the grout 1 inch (25 mm) below the top.

R606.3.7 Masonry bonding pattern. Masonry laid in running and *stack bond* shall conform to Sections R606.3.7.1 and R606.3.7.2.

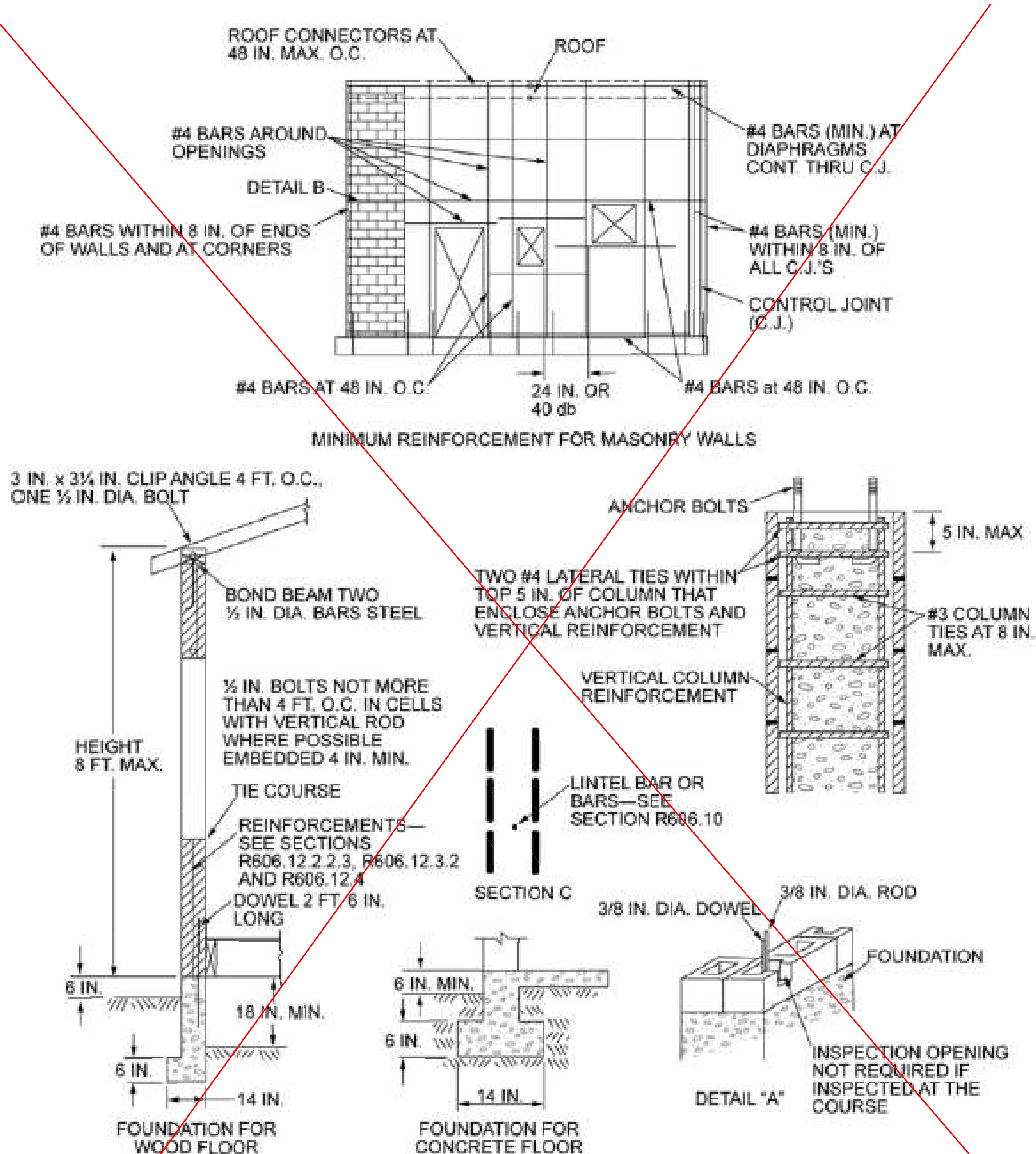
R606.3.7.1 Masonry laid in running bond. In each wythe of masonry laid in *running bond*, head joints in successive courses shall be offset by not less than one-fourth the unit length, or the masonry walls shall be reinforced longitudinally as required in Section R606.3.7.2.

R606.3.7.2 Masonry laid in stack bond. ~~Where unit masonry is laid with less head joint offset than in Section R606.3.7.1, the minimum area of horizontal reinforcement placed in mortar bed joints or in bond beams spaced not more than 48 inches (1219 mm) apart shall be 0.0007 times the vertical cross-sectional area of the wall.~~ In unreinforced masonry where masonry units are laid in stack bond, longitudinal reinforcement consisting of not less than two continuous wires each with a minimum aggregate cross-sectional area of 0.017 square inch (11 mm^2) shall be provided in horizontal bed joints spaced not more than 16 inches (406 mm) on center vertically.

R606.4.4 Parapet walls. Unreinforced *solid masonry* parapet walls shall be not less than 8 inches (203 mm) thick and their height shall not exceed four times their thickness. Unreinforced hollow unit masonry parapet walls shall be not less than 8 inches (203 mm) thick, and their height shall not exceed three times their thickness. Masonry parapet walls in areas subject to wind loads of 30 pounds per square foot (1.44 kPa) located ~~in *Seismic Design Category* D_0, D_1 or D_2, or~~ on townhouses in *Seismic Design Category* C shall be reinforced in accordance with Section R606.12.

R606.7.1 Pier cap. ~~Hollow piers shall be capped with 4 inches (102 mm) of *solid masonry* or concrete, a masonry cap block, or shall have cavities of the top course filled with concrete or grout.~~ Hollow piers shall be capped with 4 inches (102 mm) of solid masonry or concrete for one story and 8 inches (203 mm) of solid masonry or concrete for two stories and two and one-half stories or shall have cavities of the top course filled with concrete or grout or other approved methods.

R606.11 Anchorage. Masonry walls shall be anchored to floor and roof systems in accordance with the details shown in Figure R606.11(1)~~,~~ or R606.11(2) ~~or R606.11(3)~~. Footings shall be permitted to be considered as points of lateral support.



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

Note: A full bed joint must be provided. Cells containing vertical bars are to be filled to the top of wall and provide inspection opening as shown on detail "A." Horizontal bars are to be laid as shown on detail "B." Lintel bars are to be laid as shown on Section C.

FIGURE R606.11(3)
~~REQUIREMENTS FOR REINFORCED MASONRY CONSTRUCTION IN~~
SEISMIC DESIGN CATEGORY D_0, D_1 OR D_2

R606.12 Seismic requirements. ~~The seismic requirements of this section shall apply to the design of masonry and the construction of masonry building elements located in *Seismic Design Category* D_0, D_1 or D_2.~~ Townhouses in *Seismic Design Category* C shall comply with the requirements of Section R606.12.2. These requirements shall not apply to glass unit masonry conforming to Section R610, anchored masonry veneer conforming to Section R703.8 or adhered masonry veneer conforming to Section R703.12.

R606.12.1 General. Masonry structures and masonry elements shall comply with the requirements of Sections R606.12.2 through ~~R606.12.4~~ R606.12.2 based on the seismic design category established in Table R301.2.1(1). Masonry structures and masonry elements shall comply with the requirements of Section R606.12 and Figures R606.11(1)~~,~~ and R606.11(2) ~~and R606.11(3)~~ or shall be designed in accordance with TMS 402 or TMS 403.

R606.12.1.1 Floor and roof diaphragm construction. Floor and roof *diaphragms* shall be constructed of *wood structural panels* attached to wood framing in accordance with Table R602.3(1) ~~or to cold-formed steel floor framing in accordance with Table R505.3.1(2) or to cold-formed steel roof framing in accordance with Table R804.3~~. Additionally, sheathing panel edges perpendicular to framing members shall be backed by blocking, and sheathing shall be connected to the blocking with fasteners at the edge spacing. For *Seismic Design Categories* C, ~~D_0, D_1 and D_2~~, where the width-to-thickness dimension of the *diaphragm* exceeds 2-to-1, edge spacing of fasteners shall be 4 inches (102 mm) on center.

TABLE R606.12.2.1
MINIMUM SOLID WALL LENGTH ALONG EXTERIOR WALL LINES

SESIMIC DESIGN CATEGORY	MINIMUM SOLID WALL LENGTH (percent)[a]		
	One story or top story of two story	Wall supporting light-frame second story and roof	Wall supporting masonry second story and roof
Townhouses in C	20	25	35
~~D_0 or D_1~~	~~25~~	~~NP~~	~~NP~~
~~D_2~~	~~30~~	~~NP~~	~~NP~~

NP = Not Permitted, except with design in accordance with the *International Building Code*.

a. For all walls, the minimum required length of solid walls shall be based on the table percent multiplied by the dimension, parallel to the wall direction under consideration, of a rectangle inscribing the overall building plan.

R606.12.3 Seismic Design Category D_0 or D_1. Deleted. ~~Structures in *Seismic Design Category* D_0 or D_1 shall comply with the requirements of *Seismic Design Category* C and the additional requirements of this section. AAC masonry shall not be used for the design of masonry elements that are part of the lateral force-resisting system.~~

~~**R606.12.3.1 Design requirements.** Masonry elements other than those covered by Section R606.12.2.2.2 shall be designed in accordance with the requirements of Chapters 1 through 7 and Sections 8.1 and 8.3 of TMS 402 and shall meet the minimum reinforcement requirements contained in Sections R606.12.3.2 and R606.12.3.2.1. Otherwise, masonry shall be designed in accordance with TMS 403.~~

~~**Exception:** Masonry walls limited to one *story* in height and 9 feet (2743 mm) between lateral supports need not be designed provided they comply with the minimum reinforcement requirements of Sections R606.12.3.2 and R606.12.3.2.1.~~

~~**R606.12.3.2 Minimum reinforcement requirements for masonry walls.** Masonry walls other than those covered by Section R606.12.2.2.3 shall be reinforced in both the vertical and horizontal direction. The sum of the cross-sectional area of horizontal and vertical reinforcement shall be not less than 0.002 times the gross cross-sectional area of the wall, and the minimum cross-sectional area in each direction shall be not less than 0.0007 times the gross cross-sectional area of the wall. Reinforcement shall be uniformly distributed. Table R606.12.3.2 shows the minimum reinforcing bar sizes required for varying thicknesses of masonry walls. The maximum spacing of reinforcement shall be 48 inches (1219 mm) provided that the walls are solid grouted and constructed of hollow open-end units, hollow units laid with full head joints or two wythes of solid units. The maximum spacing of reinforcement shall be 24 inches (610 mm) for all other masonry.~~

~~**R606.12.3.2.1 Shear wall reinforcement requirements.** The maximum spacing of vertical and horizontal reinforcement shall be the smaller of one-third the length of the *shear wall*, one-third the height of the *shear wall*, or 48 inches (1219 mm). The minimum cross-sectional area of vertical reinforcement shall be one-third~~

~~of the required shear reinforcement. Shear reinforcement shall be anchored around vertical reinforcing bars with a standard hook.~~

~~TABLE R606.12.3.2~~

~~MINIMUM DISTRIBUTED WALL REINFORCEMENT FOR BUILDINGS ASSIGNED TO SEISMIC DESIGN CATEGORY~~ ~~D_0 or D_1~~

~~NOMINAL WALL THICKNESS (inches)~~	~~MINIMUM SUM OF THE VERTICAL AND HORIZONTAL REINFORCEMENT AREAS[a] (square inches per foot)~~	~~MINIMUM REINFORCEMENT AS DISTRIBUTED IN BOTH HORIZONTAL AND VERTICAL DIRECTIONS[b] (square inches per foot)~~	~~MINUMUM BAR SIZE FOR REINFORCEMENT SPACED AT 48 INCHES~~
~~6~~	~~0.135~~	~~0.047~~	~~#4~~
~~8~~	~~0.183~~	~~0.064~~	~~#5~~
~~10~~	~~0.231~~	~~0.081~~	~~#6~~
~~12~~	~~0.279~~	~~0.098~~	~~#6~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 square inch per foot = 2064 mm²/m.~~

~~a. Based on the minimum reinforcing ratio of 0.002 times the gross cross-sectional area of the wall.~~

~~b. Based on the minimum reinforcing ratio each direction of 0.0007 times the gross cross-sectional area of the wall.~~

~~R606.12.3.3 Minimum reinforcement for masonry columns.~~ ~~Lateral ties in masonry columns shall be spaced not more than 8 inches (203 mm) on center and shall be not less than ³/₈-inch (9.5 mm) diameter. Lateral ties shall be embedded in grout.~~

~~R606.12.3.4 Material restrictions.~~ ~~Type N mortar or masonry cement shall not be used as part of the lateral force-resisting system.~~

~~R606.12.3.5 Lateral tie anchorage.~~ ~~Standard hooks for lateral tie anchorage shall be either a 135-degree (2.4 rad) standard hook or a 180 degree (3.2 rad) standard hook.~~

R606.12.4 Seismic Design Category D_2. Deleted. ~~Structures in *Seismic Design Category* D_2 shall comply with the requirements of *Seismic Design Category* D_1 and to the additional requirements of this section.~~

~~R606.12.4.1 Design of elements not part of the lateral force-resisting system.~~ ~~*Stack bond* masonry that is not part of the lateral force-resisting system shall have a horizontal cross-sectional area of reinforcement of not less than 0.0015 times the gross cross-sectional area of masonry. Table R606.12.4.1 shows minimum reinforcing bar sizes for masonry walls. The maximum spacing of horizontal reinforcement shall be 24 inches (610 mm). These elements shall be solidly grouted and shall be constructed of hollow open-end units or two wythes of solid units.~~

~~TABLE R606.12.4.1~~

~~MINIMUM REINFORCING FOR STACKED BONDED MASONRY WALLS IN SEISMIC DESIGN CATEGORY~~ ~~D_2~~

~~NOMINAL WALL THICKNESS (inches)~~	~~MINIMUM BAR SIZE SPACED AT 24 INCHES~~
~~6~~	~~#4~~
~~8~~	~~#5~~
~~10~~	~~#5~~
~~12~~	~~#6~~

~~For SI: 1 inch = 25.4 mm.~~

~~R606.12.4.2 Design of elements part of the lateral force-resisting system.~~ ~~*Stack bond* masonry that is part of the lateral force-resisting system shall have a horizontal cross-sectional area of reinforcement of not less than 0.0025 times the gross cross-sectional area of masonry. Table R606.12.4.2 shows minimum reinforcing bar sizes~~

~~for masonry walls. The maximum spacing of horizontal reinforcement shall be 16 inches (406 mm). These elements shall be solidly grouted and shall be constructed of hollow open-end units or two wythes of solid units.~~

~~TABLE R606.12.4.2~~

~~MINIMUM REINFORCING FOR STACKED BONDED MASONRY WALLS IN SEISMIC DESIGN CATEGORY D_2~~

~~NOMINAL WALL THICKNESS (inches)~~	~~MINIMUM BAR SIZE SPACED AT 16 INCHES~~
~~6~~	~~#4~~
~~8~~	~~#5~~
~~10~~	~~#5~~
~~12~~	~~#6~~

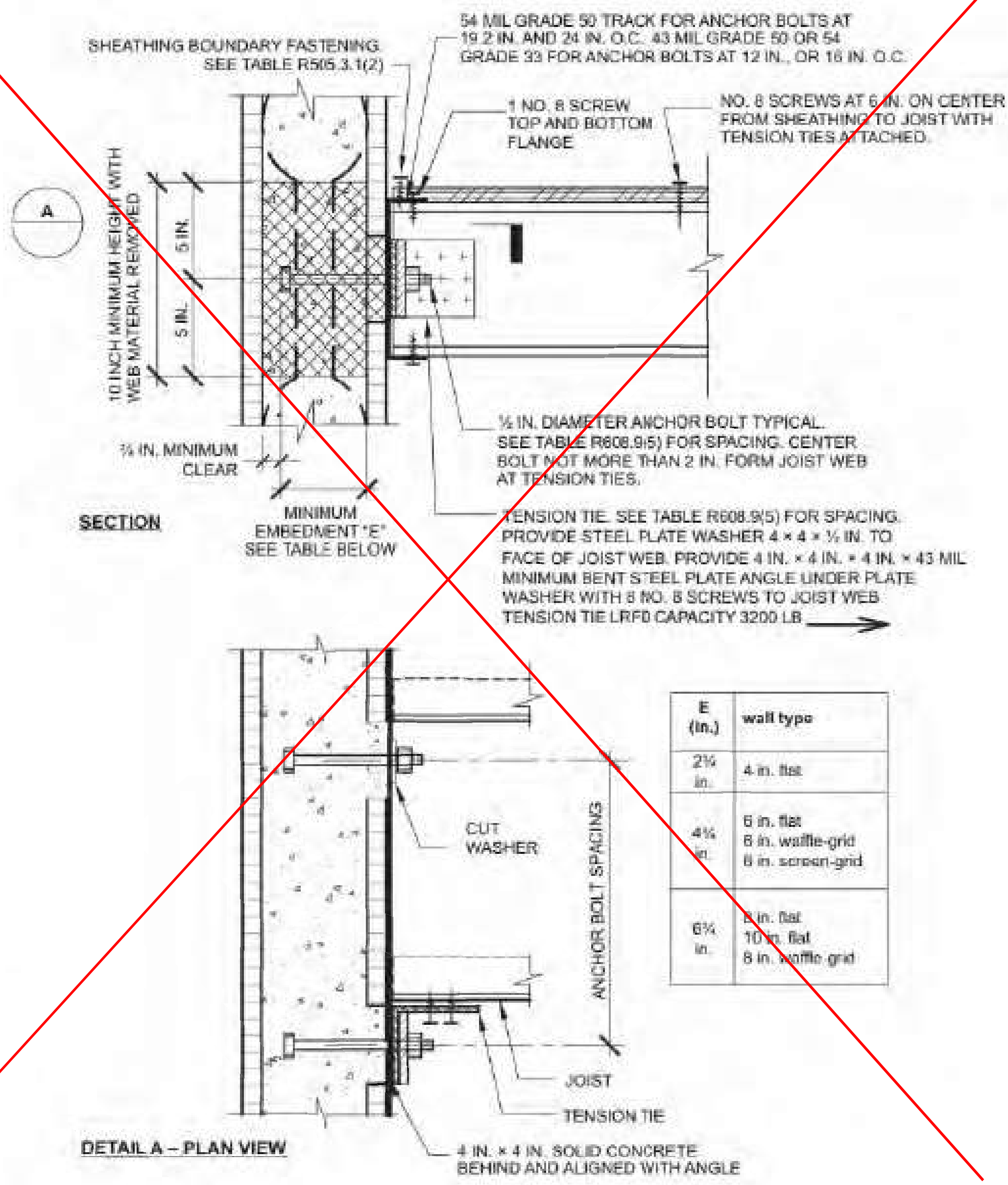
~~For SI: 1 inch = 25.4 mm.~~

R608.1 General. Exterior concrete walls shall be designed and constructed in accordance with the provisions of this section or in accordance with the provisions of PCA 100, ACI 318 or ACI 332. Where PCA 100, ACI 318, ACI 332 or the provisions of this section are used to design concrete walls, project drawings, typical details and specifications are not required to bear the seal of the ~~architect or engineer~~ *registered design professional* responsible for design, unless otherwise required by the state law of the *jurisdiction* having authority.

R608.9 Requirements for connections—general. Concrete walls shall be connected to footings, floors, ceilings and roofs in accordance with this section.

R608.9.1 Connections between concrete walls and light-frame floor, ceiling and roof systems. Connections between concrete walls and light-frame floor, ceiling and roof systems using the prescriptive details of Figures R608.9(1) through R608.9(~~12~~ 4) and R608.9(9) through R608.9(10) shall comply with this section and Sections R608.9.2 and R608.9.3.

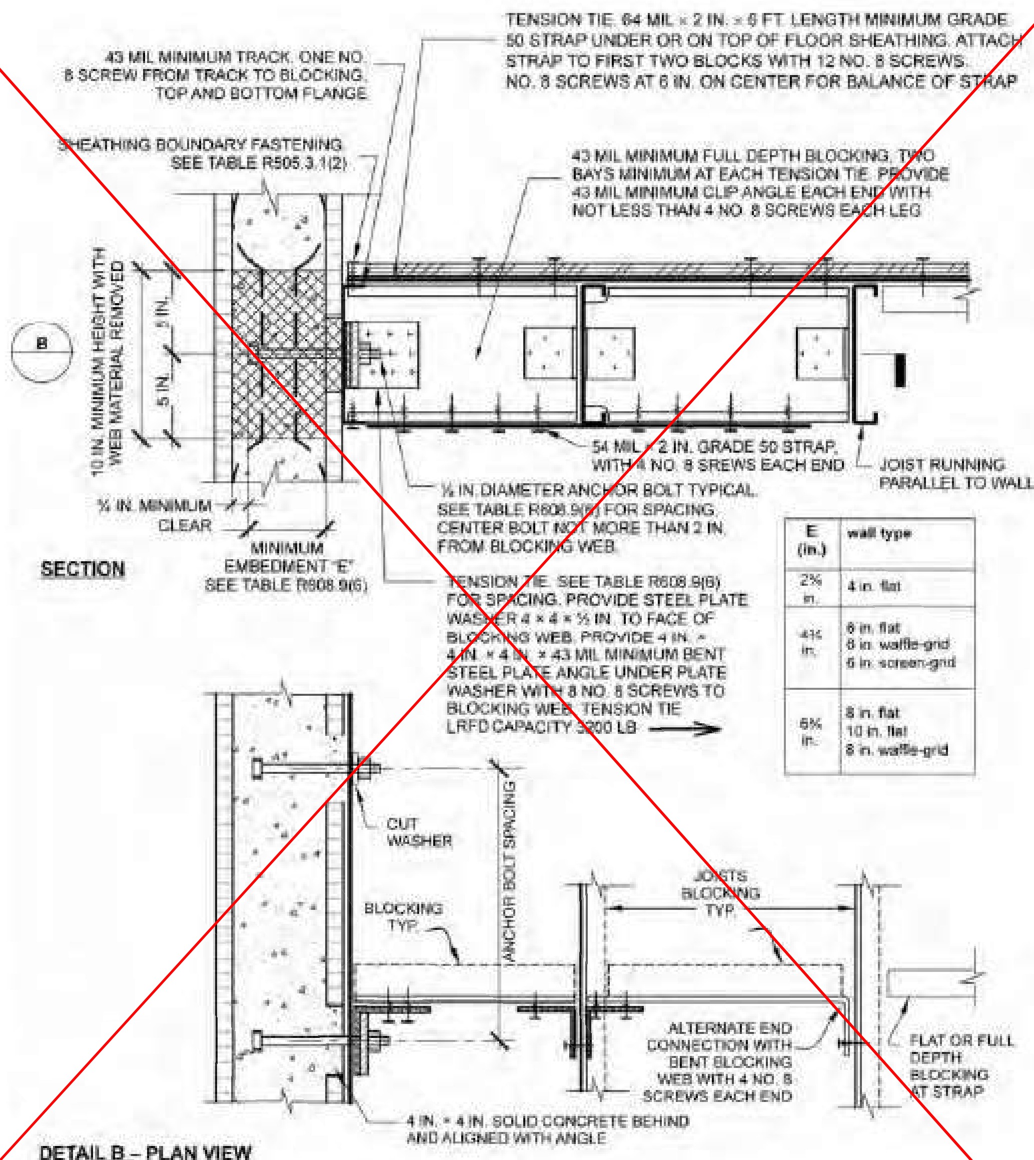
R608.9.1.1 Anchor bolts. Anchor bolts used to connect light-frame floor, ceiling and roof systems to concrete walls in accordance with Figures R608.9(1) through R608.9(~~12~~ 4) and R608.9(9) through R608.9(10) shall have heads, or shall be rods with threads on both ends with a hex or square nut on the end embedded in the concrete. Bolts and threaded rods shall comply with Section R608.5.2.2. Anchor bolts with J- or L-hooks shall not be used where the connection details in these figures are used.



E (in.)	wall type
2¾ in.	4 in. flat
4¾ in.	6 in. flat 6 in. waffle-grid 6 in. screen-grid
6¾ in.	8 in. flat 10 in. flat 8 in. waffle grid

For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 pound-force = 4.448 N.

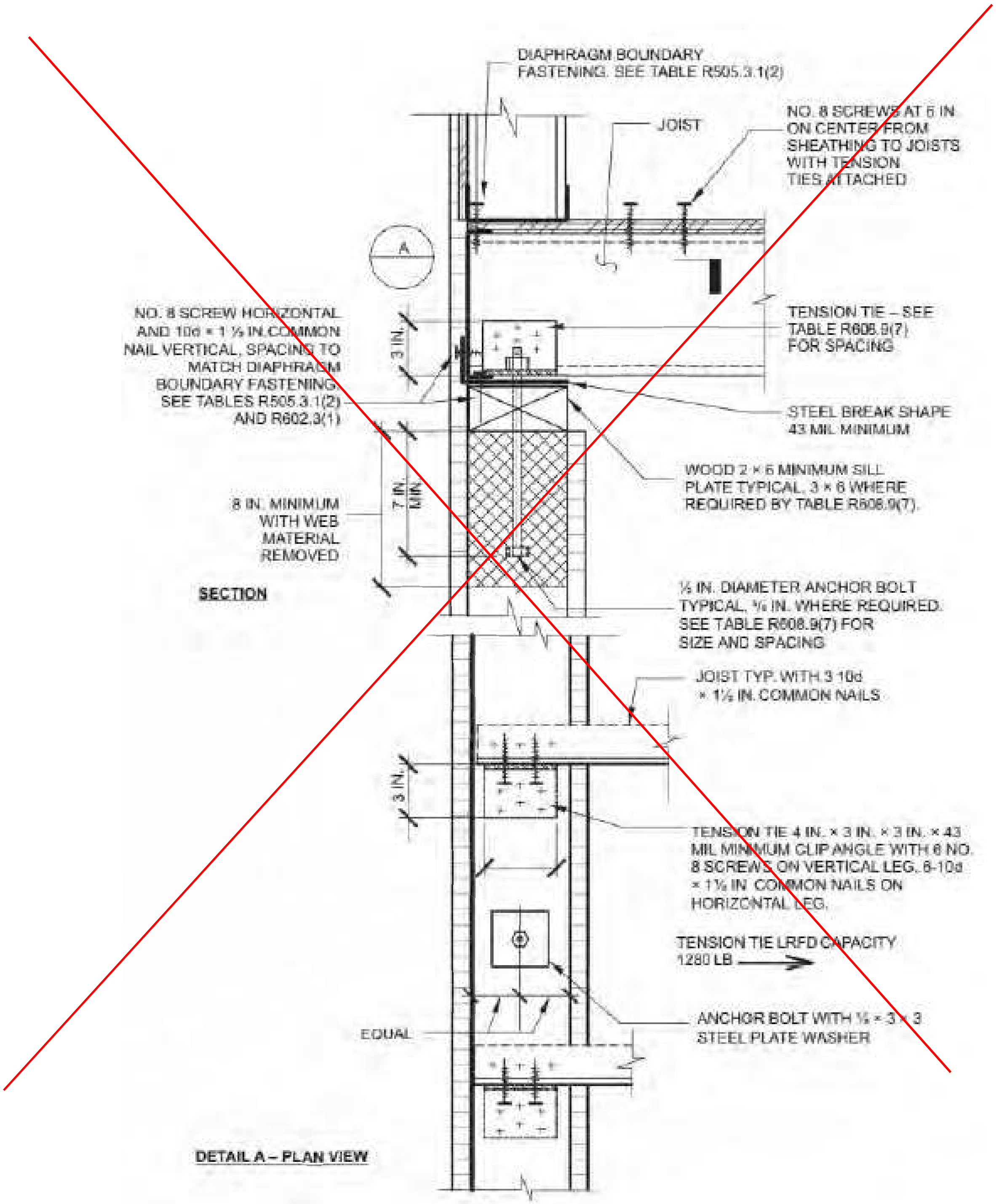
FIGURE R608.9(5)
COLD-FORMED STEEL FLOOR TO SIDE OF CONCRETE WALL, FRAMING PERPENDICULAR



E (in.)	wall type
2¾ in.	4 in. flat
4¾ in.	6 in. flat 6 in. waffle-grid 6 in. screen-grid
6¾ in.	8 in. flat 10 in. flat 8 in. waffle-grid

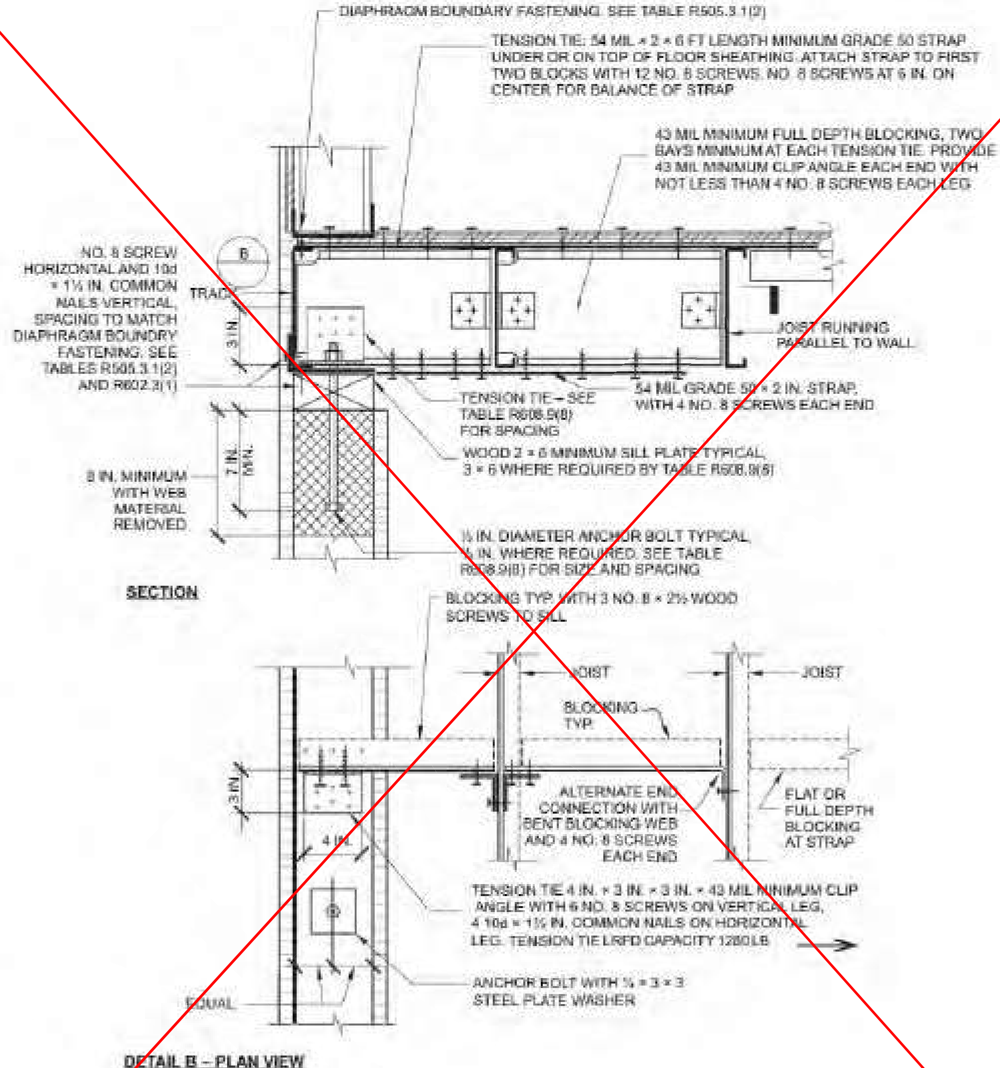
For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 pound-force = 4.448 N.

FIGURE R608.9(6)
COLD-FORMED STEEL FLOOR TO SIDE OF CONCRETE WALL, FRAMING PARALLEL



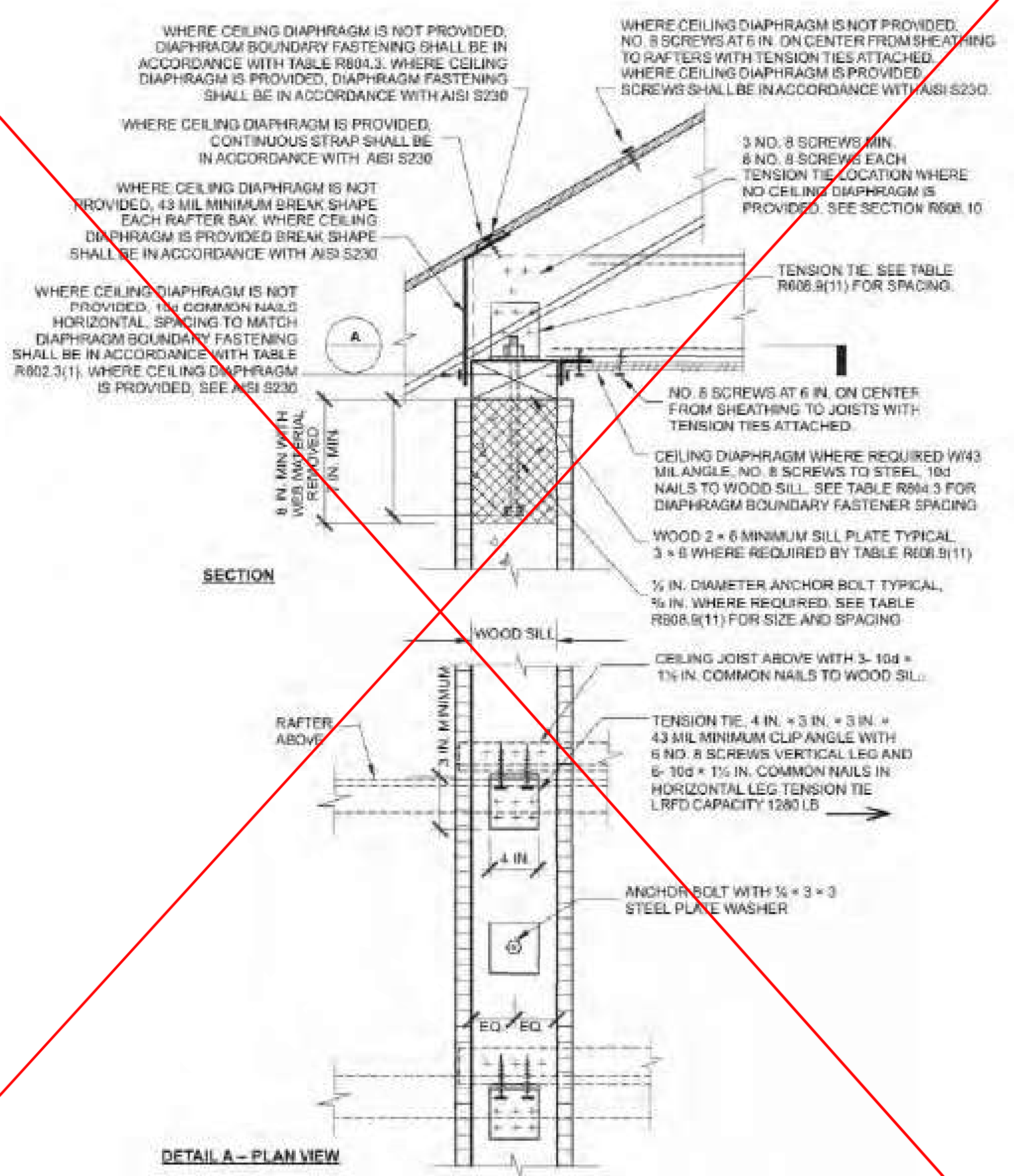
For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 pound-force = 4.448 N.

FIGURE R608.9(7)
COLD-FORMED STEEL FLOOR TO TOP OF CONCRETE WALL, FRAMING PERPENDICULAR



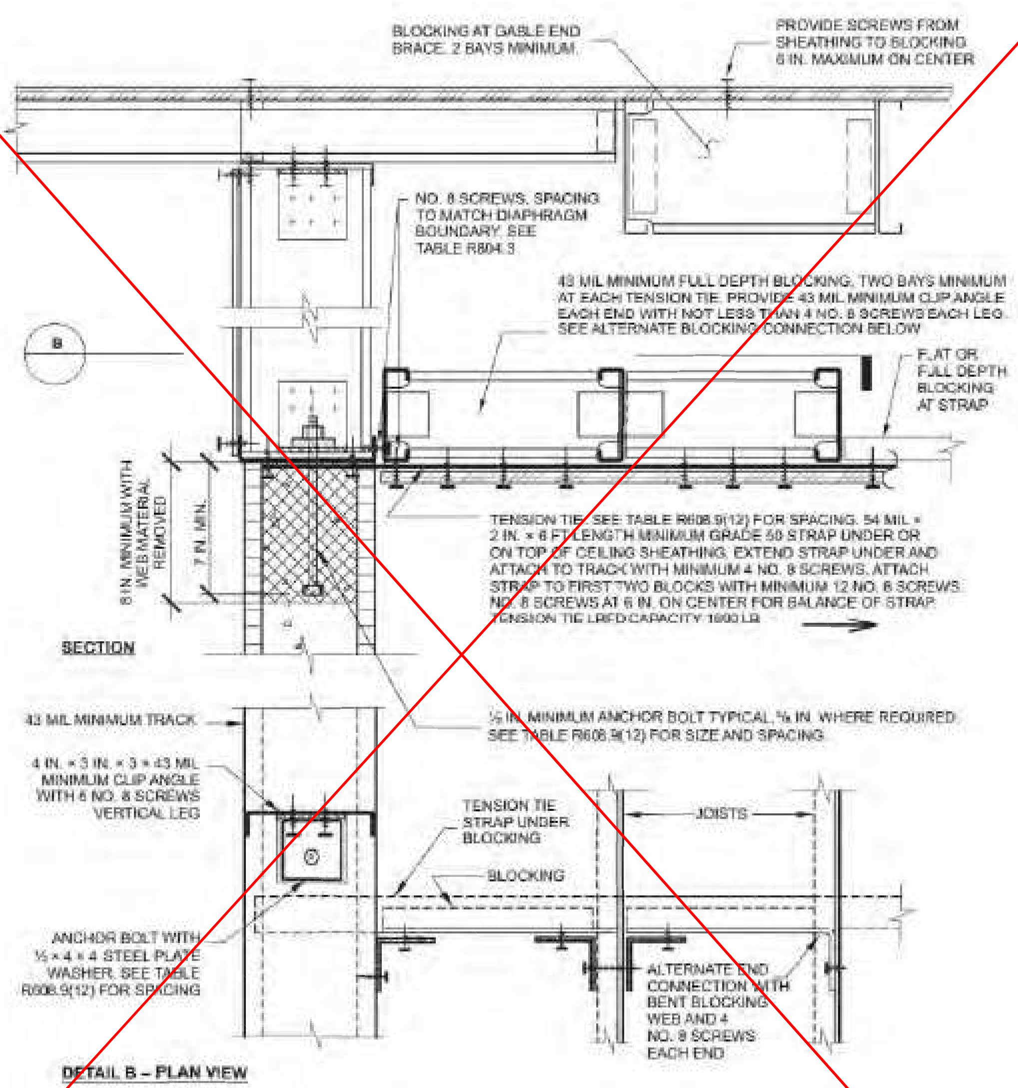
For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 pound-force = 4.448 N.

FIGURE R608.9(8)
COLD-FORMED STEEL FLOOR TO TOP OF CONCRETE WALL, FRAMING PARALLEL



For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound-force = 4.448 N.

FIGURE R608.9(11)
COLD-FORMED STEEL ROOF TO TOP OF CONCRETE WALL, FRAMING PERPENDICULAR



For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 pound-force = 4.448 N.

FIGURE R608.9(12)
COLD-FORMED STEEL ROOF TO TOP OF CONCRETE WALL, FRAMING PARALLEL

TABLE R608.9(1)
WOOD-FRAMED FLOOR TO SIDE OF CONCRETE WALL, FRAMING PERPENDICULAR[a, b]

R608.9.2 Connections between concrete walls and light-frame floor systems. Connections between concrete walls and light-frame floor systems shall be in accordance with one of the following:

1. For floor systems of wood-framed construction, the provisions of Section R608.9.1 and the prescriptive details of Figures R608.9(1) through R608.9(4), where permitted by the tables accompanying those figures. Portions of connections of wood-framed floor systems not noted in the figures shall be in accordance with Section R502, or AWC WFCM, if applicable. Wood framing members shall be of a species having a specific gravity equal to or greater than 0.42.
2. Deleted. ~~For floor systems of cold-formed steel construction, the provisions of Section R608.9.1 and the prescriptive details of Figures R608.9(5) through R608.9(8), where permitted by the tables accompanying those figures. Portions of connections of cold-formed steel-framed floor systems not noted in the figures shall be in accordance with Section R505, or AISI S230, if applicable.~~

3. Proprietary connectors selected to resist loads and load combinations in accordance with Appendix A (ASD) or Appendix B (LRFD) of PCA 100.
4. An engineered design using loads and load combinations in accordance with Appendix A (ASD) or Appendix B (LRFD) of PCA 100.
5. An engineered design using loads and material design provisions in accordance with this code, or in accordance with ASCE 7, ACI 318, and AWC NDS for wood-framed construction. ~~or AISI S100 for cold-formed steel frame construction.~~

R608.9.3 Connections between concrete walls and light-frame ceiling and roof systems. Connections between concrete walls and light-frame ceiling and roof systems shall be in accordance with one of the following:

1. For ceiling and roof systems of wood-framed construction, the provisions of Section R608.9.1 and the prescriptive details of Figures R608.9(9) and R608.9(10), where permitted by the tables accompanying those figures. Portions of connections of wood-framed ceiling and roof systems not noted in the figures shall be in accordance with Section R802, or AWC WFCM, if applicable. Wood framing members shall be of a species having a specific gravity equal to or greater than 0.42.
2. Deleted. ~~For ceiling and roof systems of cold-formed steel construction, the provisions of Section R608.9.1 and the prescriptive details of Figures R608.9(11) and R608.9(12), where permitted by the tables accompanying those figures. Portions of connections of cold-formed steel-framed ceiling and roof systems not noted in the figures shall be in accordance with Section R804, or AISI S230, if applicable.~~
3. Proprietary connectors selected to resist loads and load combinations in accordance with Appendix A (ASD) or Appendix B (LRFD) of PCA 100.
4. An engineered design using loads and load combinations in accordance with Appendix A (ASD) or Appendix B (LRFD) of PCA 100.
5. An engineered design using loads and material design provisions in accordance with this code, or in accordance with ASCE 7, ACI 318, and AWC NDS for wood-framed construction. ~~or AISI S100 for cold-formed steel-framed construction.~~

R608.10 Floor, roof and ceiling diaphragms. Floors and roofs in buildings with exterior walls of concrete shall be designed and constructed as diaphragms. Where gable-end walls occur, ceilings shall be designed and constructed as diaphragms. The design and construction of floors, roofs and ceilings of wood framing or cold-formed-steel framing serving as diaphragms shall comply with the applicable requirements of this code, or AWC WFCM ~~or AISI S230~~, if applicable. Wood framing members shall be of a species having a specific gravity equal to or greater than 0.42.

R609.2 Performance. Exterior windows and doors shall be capable of resisting the design wind loads specified in Table R301.2.1(1) adjusted for height and exposure in accordance with Table R301.2.1(2) or determined in accordance with ASCE 7 using the allowable stress design load combinations of ASCE 7. For exterior windows and doors tested in accordance with Sections R609.3 and R609.5, required design wind pressures determined from ASCE 7 using the ultimate strength design (USD) are permitted to be multiplied by 0.6. Design wind loads for exterior glazing not part of a labeled assembly shall be permitted to be determined in accordance with Chapter 24 of the *International Building Code*. Design wind loads for exterior glazing not part of a labeled assembly shall be permitted to be determined in accordance with Chapter 24 of the *International Building Code*.

Exception: Openings for exterior balconies, decks, or porches under roofs enclosed with screen or removable vinyl or acrylic wind break panels shall not be required to be protected provided the spaces are separated from the building interior by a wall and all openings in the wall separating the unit from the balcony, deck or porch are protected in accordance with this section. Vinyl and acrylic glazed panels shall be removable. Removable panels shall be identified as removable by a decal. The identification decal shall state "Removable panel SHALL be removed when wind speeds exceed 75 mph (34 m/s)." Decals shall be placed such that the decal is visible when the panel is installed.

CHAPTER 7
WALL COVERING

~~**User note:**~~

~~***About this chapter:** Chapter 7 establishes the various types of materials, materials standards and methods of application permitted as interior and exterior wall coverings. Interior coverings include interior plaster, gypsum board, ceramic tile, wood veneer paneling, hardboard paneling, wood shakes and wood shingles. Exterior wall coverings regulated by this section include aluminum, stone and masonry veneer, wood, hardboard, particleboard, wood structural panel siding, wood shakes and shingles, exterior plaster, steel, vinyl, fiber cement and exterior insulation finish systems. This chapter also contains requirements for the use of vapor retarders for moisture control in walls; wind resistance and* water-resistive barriers *for exterior wall coverings; and the* water-resistive barrier *required beneath exterior materials.*~~

SECTION R702
INTERIOR COVERING

R702.1 General. Interior coverings or wall finishes shall be installed in accordance with this chapter and Tables R702.1(1), R702.1(2), R702.1(3) and R702.3.5. Interior masonry veneer shall comply with the requirements of Section ~~R703.7.1~~ R703.8.1 for support and Section ~~R703.7.4~~ R703.8.4 for anchorage, except an airspace is not required. Interior finishes and materials shall conform to the flame spread and smoke-development requirements of Section R302.9.

R702.3.3 Cold-formed steel framing. Deleted. ~~Cold-formed steel framing supporting gypsum board and gypsum panel products shall be not less than $1^{1}/_{4}$ inches (32 mm) wide in the least dimension. Nonload-bearing cold-formed steel framing shall comply with AISI S220. Load-bearing cold-formed steel framing shall comply with AISI S240.~~

TABLE R702.3.5

MINIMUM THICKNESS AND APPLICATION OF GYPSUM BOARD AND GYPSUM PANEL PRODUCTS

c. Deleted. ~~Where cold-formed steel framing is used with a clinching design to receive nails by two edges of metal, the nails shall be not less than $^{5}/_{8}$ inch longer than the gypsum board or gypsum panel product thickness and shall have ringed shanks. Where the cold-formed steel framing has a nailing groove formed to receive the nails, the nails shall have barbed shanks or be 0.086-inch diameter, $1^{5}/_{8}$ inches long, $^{15}/_{64}$-inch head for $^{1}/_{2}$-inch gypsum board or gypsum panel product; and 0.099-inch diameter, $1^{7}/_{8}$ inches long, $^{15}/_{64}$-inch head for $^{5}/_{8}$-inch gypsum board or gypsum panel product.~~

TABLE R702.3.6

SHEAR CAPACITY FOR HORIZONTAL WOOD-FRAMED GYPSUM BOARD DIAPHRAGM CEILING ASSEMBLIES

MATERIAL	THICKNESS OF MATERIAL (min.) (inch)	SPACING OF FRAMING MEMBERS (max.) (inch)	SHEAR VALUE[a, b] (plf of ceiling)	MINIMUM FASTENER SIZE[c, d]
Gypsum board or gypsum panel product	$^{1}/_{2}$	16 o.c.	90	5d cooler or wallboard nail; $1^{5}/_{8}$-inch long; 0.086-inch shank; $^{15}/_{64}$-inch head
Gypsum board or gypsum panel product	$^{1}/_{2}$	24 o.c.	70	5d cooler or wallboard nail; $1^{5}/_{8}$-inch long; 0.086-inch shank; $^{15}/_{64}$-inch head

For SI: 1 inch = 25.4 mm, 1 pound per linear foot = 1.488 kg/m.

a. Values are not cumulative with other horizontal diaphragm values and are for short-term loading caused by wind or seismic loading. Values shall be reduced 25 percent for normal loading.

b. Deleted. ~~Values shall be reduced 50 percent in *Seismic Design Categories* D_0, D_1, D_2 and E.~~

c. $1^{1}/_{4}$-inch, No. 6 Type S or W screws shall be permitted to be substituted for the listed nails.

d. Fasteners shall be spaced not more than 7 inches on center at all supports, including perimeter blocking, and not less than $^{3}/_{8}$ inch from the edges and ends of the gypsum board.

R702.3.7 Water-resistant gypsum backing board. Gypsum board used as the base or backer for adhesive application of ceramic tile or other required nonabsorbent finish material shall conform to ASTM C1178, C1278 or C1396. Use of water-resistant gypsum backing board shall be permitted on ceilings. Use of water-resistant gypsum backing board shall be permitted on ceilings where framing spacing does not exceed 12 inches (305 mm) on center for 1/2-inch (12.7 mm) thick or 16 inches (406 mm) for 5/8-inch (16 mm) thick gypsum board. Water-resistant gypsum board shall not be installed over a Class I or II vapor retarder in a shower or tub compartment. Cut or exposed edges, including those at wall intersections, shall be sealed as recommended by the manufacturer.

TABLE R702.7(2)
VAPOR RETARDER OPTIONS

CLIMATE ZONE	VAPOR RETARDER CLASS		
	CLASS I[a]	CLASS II[a]	CLASS III
~~1, 2~~	~~Not Permitted~~	~~Not Permitted~~	~~Permitted~~
3, 4 (except Marine 4)	Not Permitted	Permitted[c]	Permitted
Marine 4, 5, ~~6, 7, 8~~	Permitted[b]	Permitted[c]	See Table R702.7(3)

TABLE R702.7(3)
CLASS III VAPOR RETARDERS

CLIMATE ZONE	CLASS III VAPOR RETARDERS PERMITTED FOR:[a, b]
~~Marine 4~~	~~Vented cladding over wood structural panels.~~
	~~Vented cladding over fiberboard.~~
	~~Vented cladding over gypsum.~~
	~~Continuous insulation with *R*-value ≥ 2.5 over 2 × 4 wall.~~
	~~Continuous insulation with *R*-value ≥ 3.75 over 2 × 6 wall.~~
5	Vented cladding over wood structural panels.
	Vented cladding over fiberboard.
	Vented cladding over gypsum.
	Continuous insulation with *R*-value ≥ 5 over 2 × 4 wall.
	Continuous insulation with *R*-value ≥ 7.5 over 2 × 6 wall.
~~6~~	~~Vented cladding over fiberboard.~~
	~~Vented cladding over gypsum.~~
	~~Continuous insulation with *R*-value ≥ 7.5 over 2 × 4 wall.~~
	~~Continuous insulation with *R*-value ≥ 11.25 over 2 × 6 wall.~~
~~7~~	~~Continuous insulation with *R*-value ≥ 10 over 2 × 4 wall.~~
	~~Continuous insulation with *R*-value ≥ 15 over 2 × 6 wall.~~

~~8~~	~~Continuous insulation with *R*-value ≥ 12.5 over 2 × 4 wall.~~ ~~Continuous insulation with *R*-value ≥ 20 over 2 × 6 wall.~~

a. Vented cladding shall include vinyl, polypropylene, or horizontal aluminum siding, brick veneer with a clear airspace as specified in Table R703.8.4(1), and other approved vented claddings.

b. The requirements in this table apply only to insulation used to control moisture in order to permit the use of Class III vapor retarders. The insulation materials used to satisfy this option also contribute to but do not supersede the thermal envelope requirements of Chapter 11.

TABLE R702.7(4)
CONTINUOUS INSULATION WITH CLASS II VAPOR RETARDER

CLIMATE ZONE	CLASS II VAPOR RETARDERS PERMITTED FOR:[a]
3	Continuous insulation with *R*-value ≥ 2.
4, 5 ~~and 6~~	Continuous insulation with *R*-value ≥ 3 over 2 × 4 wall. Continuous insulation with *R*-value ≥ 5 over 2 × 6 wall.
~~7~~	~~Continuous insulation with *R*-value ≥ 5 over 2 × 4 wall.~~ ~~Continuous insulation with *R*-value ≥ 7.5 over 2 × 6 wall.~~
~~8~~	~~Continuous insulation with *R*-value ≥ 7.5 over 2 × 4 wall.~~ ~~Continuous insulation with *R*-value ≥ 10 over 2 × 6 wall.~~

a. The requirements in this table apply only to insulation used to control moisture in order to permit the use of Class II vapor retarders. The insulation materials used to satisfy this option also contribute to but do not supersede the thermal envelope requirements of Chapter 11.

R703.2 Water-resistive barrier. ~~Not fewer than~~ A minimum one layer of *water-resistive barrier* shall be applied over studs or sheathing of all exterior walls with flashing as indicated in Section R703.4, in such a manner as to provide a continuous water-resistive barrier behind the exterior wall veneer. The water-resistive barrier material shall be continuous to the top of walls and terminated at penetrations and building appendages in a manner to meet the requirements of the exterior wall envelope as described in Section R703.1. Water-resistive barrier materials shall comply with one of the following:

1. No. 15 felt complying with ASTM D226, Type 1.
2. ASTM E2568, Type 1 or 2.
3. ASTM E331 in accordance with Section R703.1.1.
4. Other approved materials in accordance with the manufacturer's installation instructions.

No.15 asphalt felt and *water-resistive barriers* complying with ASTM E2556 shall be applied horizontally, with the upper layer lapped over the lower layer not less than 2 inches (51 mm), and where joints occur, shall be lapped not less than 6 inches (152 mm).

R703.3 Wall covering nominal thickness and attachments. The nominal thickness and attachment of exterior wall coverings shall be in accordance with Table R703.3(1), the wall covering material requirements of this section, and the wall covering manufacturer's installation instructions. Cladding attachment over foam sheathing shall comply with the additional requirements and limitations of Sections R703.15 ~~through~~ and R703.17. Nominal material thicknesses in Table R703.3(1) are based on a maximum stud spacing of 16 inches (406 mm) on center. Where specified by the siding manufacturer's instructions and supported by a test report or other documentation, attachment to studs with greater spacing is permitted. Fasteners for exterior wall coverings attached to wood framing shall be in accordance with Section R703.3.3 and Table R703.3(1). Exterior wall coverings shall be attached to cold-formed steel light frame construction in accordance with the cladding manufacturer's installation instructions, the requirements of Table R703.3(1) using screw fasteners substituted for the nails specified in accordance with Table R703.3(2), or an *approved* design.

R703.3.2 Wind limitations. Deleted. ~~Where the design wind pressure exceeds 30 psf or where the limits of Table R703.3.2 are exceeded, the attachment of wall coverings and soffits shall be designed to resist the component and cladding loads specified in Table R301.2.1(1) for walls, adjusted for height and exposure in accordance with Table~~

~~R301.2.1(2). For the determination of wall covering and soffit attachment, component and cladding loads shall be determined using an effective wind area of 10 square feet (0.93 m²).~~

R703.4 Flashing. *Approved* corrosion-resistant flashing shall be applied *shingle-fashion* in a manner to prevent entry of water into the wall cavity or penetration of water to the building structural framing components. Self-adhered membranes used as flashing shall comply with AAMA 711. Fluid-applied membranes used as flashing in exterior walls shall comply with AAMA 714. The flashing shall extend to the surface of the exterior wall finish. Aluminum flashing shall not be used in contact with cementitious material, except at counter flashing. *Approved* corrosion-resistant flashings shall be installed at the following locations:

1. Exterior window and door openings. Flashing at exterior window and door openings shall be installed in accordance with Section R703.4.1.
2. At the intersection of chimneys or other masonry construction with frame or stucco walls, with projecting lips on both sides under stucco copings.
3. Under and at the ends of masonry, wood or metal copings and sills.
4. Continuously above all projecting wood *trim*.
5. Where exterior porches, decks or stairs attach to a wall or floor assembly of wood-frame construction.
6. At wall and roof intersections.
7. At built-in gutters.

R703.7 Exterior plaster ~~(stucco)~~. Installation of exterior plaster shall be in compliance with ASTM C926, ASTM C1063 and the provisions of this code.

R703.8 Anchored stone and masonry veneer, general. Anchored stone and masonry veneer shall be installed in accordance with this chapter, Table R703.3(1) and Figures R703.8(1) and R703.8(2). These veneers installed over a backing of wood or cold-formed steel shall be limited to the first *story above grade plane* and shall not exceed 5 inches (127 mm) in thickness. See Section R602.10 for wall bracing requirements for masonry veneer for wood-framed construction and Section R603.9.5 for wall bracing requirements for masonry veneer for cold-formed steel construction.

Exceptions:

1. ~~For buildings in *Seismic Design Categories* A, B and C, exterior~~ Exterior stone or masonry veneer, as specified in Table R703.8(1), with a backing of wood or steel framing shall be permitted to the height specified in Table R703.8(1) above a noncombustible foundation.
2. Deleted. ~~For detached one- or two-family dwellings in *Seismic Design Categories* D_0, D_1 and D_2, exterior stone or masonry veneer, as specified in Table R703.8(2), with a backing of wood framing shall be permitted to the height specified in Table R703.8(2) above a noncombustible foundation.~~

~~TABLE R703.8(2)~~

~~STONE OR MASONRY VENEER LIMITATIONS AND REQUIREMENTS, ONE- AND TWO-FAMILY DETACHED DWELLINGS, SEISMIC DESIGN CATEGORIES D_0, D_1 AND D_2~~

~~SEISMIC DESIGN CATEGORY~~	~~NUMBER OF WOOD-FRAMED STORIES[a]~~	~~MAXIMUM HEIGHT OF VENEER ABOVE NONCOMBUSTIBLE FOUNDATION OR FOUNDATION WALL (feet)~~	~~MAXIMUM NOMINAL THICKNESS OF VENEER (inches)~~	~~MAXIMUM WEIGHT OF VENEER (psf)[b]~~
~~D_0~~	~~1~~	~~20[e]~~	~~4~~	~~40~~
	~~2~~	~~20[e]~~	~~4~~	~~40~~
	~~3~~	~~30[d]~~	~~4~~	~~40~~
~~D_1~~	~~1~~	~~20[e]~~	~~4~~	~~40~~
	~~2~~	~~20[e]~~	~~4~~	~~40~~
	~~3~~	~~20[e]~~	~~4~~	~~40~~

~~D_2~~	~~1~~	~~20[e]~~	~~3~~	~~30~~
	~~2~~	~~20[e]~~	~~3~~	~~30~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.479 kPa, 1 pound-force = 4.448 N.~~

~~a. Cripple walls are not permitted in *Seismic Design Categories* D_0, D_1 and D_2.~~

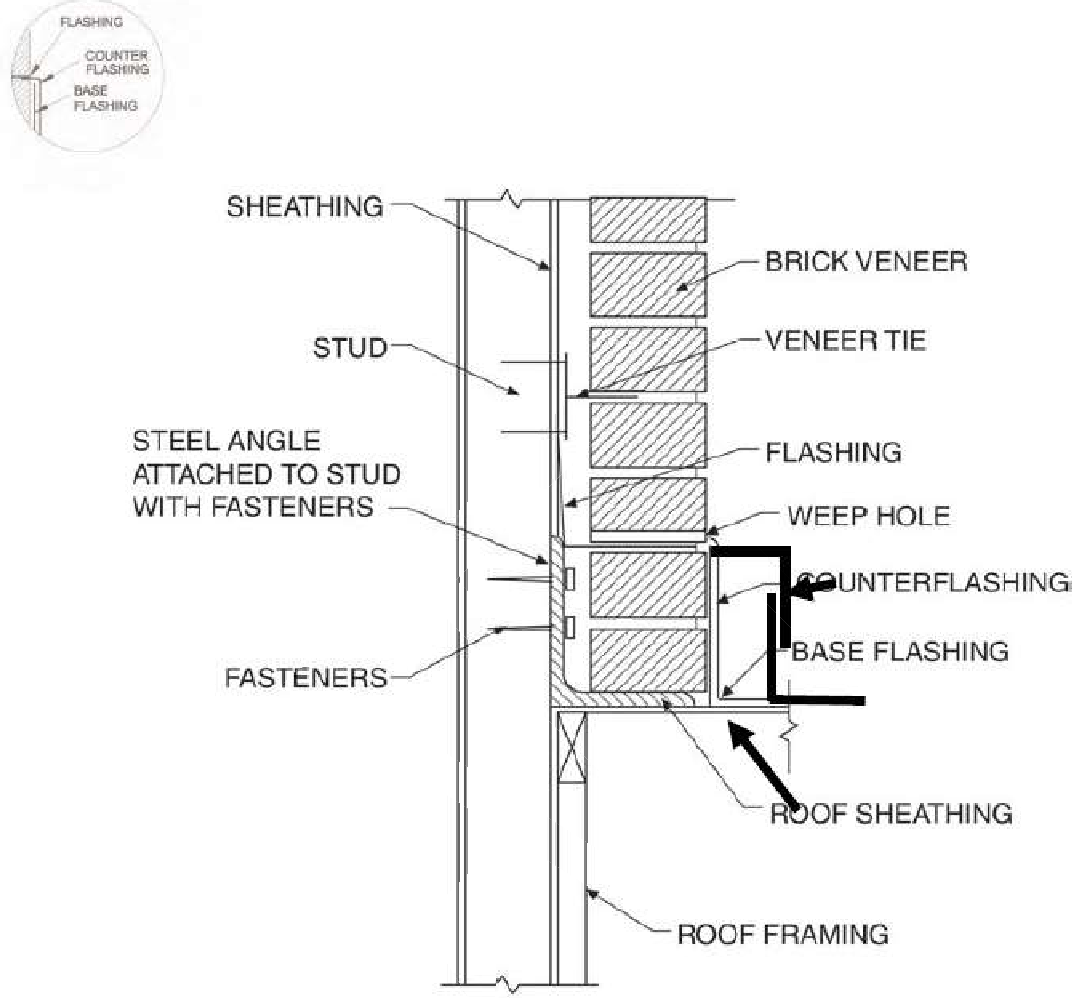
~~b. Maximum weight is installed weight and includes weight of mortar, grout and lath, and other materials used for installation.~~

~~c. The veneer shall not exceed 20 feet in height above a noncombustible foundation, with an additional 8 feet permitted for gable end walls, or 30 feet in height with an additional 8 feet for gable end walls where the lower 10 feet have a backing of concrete or masonry wall. See story height limitations of Section R301.3.~~

~~d. The veneer shall not exceed 30 feet in height above a noncombustible foundation, with an additional 8 feet permitted for gable end walls. See story height limitations of Section R301.3.~~

R703.8.2 Exterior veneer support. ~~Except in *Seismic Design Categories* D_0, D_1 and D_2, exterior~~ Exterior masonry veneers having an installed weight of 40 pounds per square foot (195 kg/m^2) or less shall be permitted to be supported on wood or cold-formed steel construction. Where masonry veneer supported by wood or cold-formed steel construction adjoins masonry veneer supported by the foundation, there shall be a movement joint between the veneer supported by the wood or cold-formed steel construction and the veneer supported by the foundation. The wood or cold-formed steel construction supporting the masonry veneer shall be designed to limit the deflection to $^1/_{600}$ of the span for the supporting members. The design of the wood or cold-formed steel construction shall consider the weight of the veneer and any other loads.

R703.8.2.1 Support by steel angle. A minimum 6-inch by 4-inch by $^5/_{16}$-inch (152 mm by 102 mm by 8 mm) steel angle, with the long leg placed vertically, shall be anchored to double 2-inch by 4-inch (51 mm by 102 mm) wood studs ~~or double 350S162 cold-formed steel studs~~ at a maximum on-center spacing of 16 inches (406 mm). Anchorage of the steel angle at every double stud spacing shall be ~~not less than~~ a minimum of two $^7/_{16}$-inch-diameter (11 mm) by 4-inch (102 mm) lag screws ~~for wood construction or two $^7/_{16}$-inch (11.1 mm) bolts with washers for cold-formed steel construction~~ at every double stud or shall be a minimum of two 7/16-inch diameter (11.1 mm) by 4 inches (102 mm) lag screws into solid double blocking with each pair of lag screws spaced at horizontal intervals not to exceed 16 inches (406 mm). The steel angle shall have a minimum clearance to underlying construction of $^1/_{16}$ inch (1.6 mm). ~~Not less than~~ A minimum of two-thirds the width of the masonry veneer thickness shall bear on the steel angle. Flashing and weep holes shall be located in the masonry veneer in accordance with Figure R703.8.2.1. The maximum height of masonry veneer above the steel angle support shall be 12 feet 8 inches (3861 mm). The airspace separating the masonry veneer from the wood backing shall be in accordance with Sections R703.8.4 and R703.8.4.2. The method of support for the masonry veneer on ~~wood construction~~ steel angle shall be constructed in accordance with Figure R703.8.2.1.



SUPPORT BY STEEL ANGLE

FIGURE R703.8.2.1
EXTERIOR MASONRY VENEER SUPPORT BY STEEL ANGLES

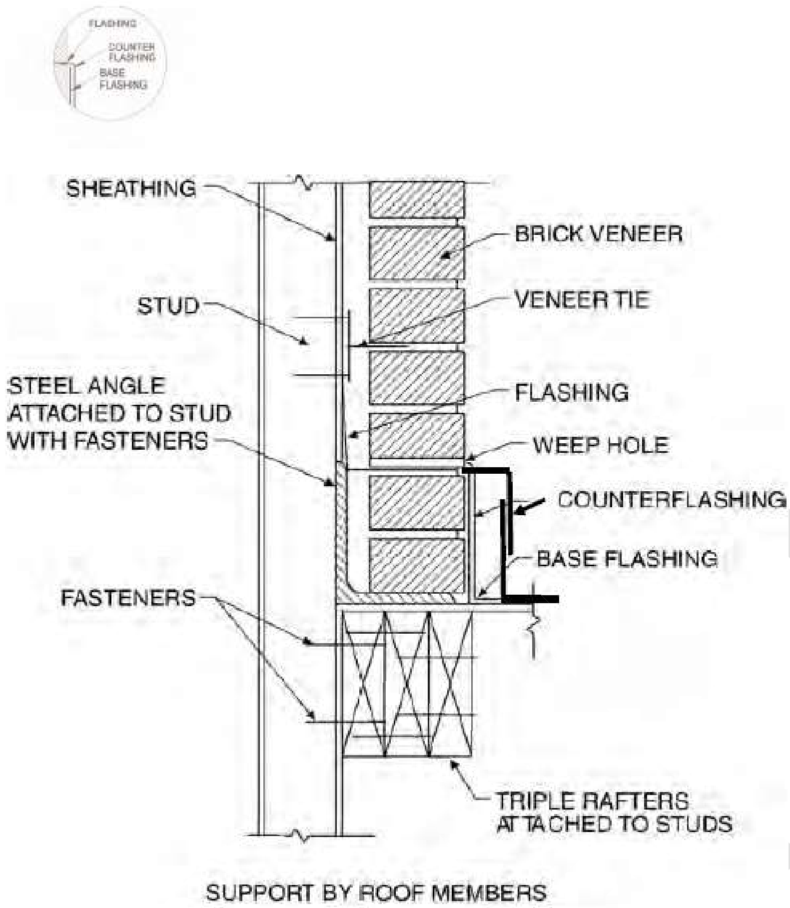


FIGURE R703.8.2.2
EXTERIOR MASONRY VENEER SUPPORT BY ROOF MEMBER

TABLE R703.8.3.1
ALLOWABLE SPANS FOR LINTELS SUPPORTING MASONRY VENEER[a, b, c, d, e]

SIZE OF STEEL ANGLE[a, c, d] (inches)	NO STORY ABOVE	ONE STORY ABOVE	TWO STORIES ABOVE	NO. OF $^1/_2$-INCH OR EQUIVALENT REINFORCING BARS IN REINFORCED LINTEL[b, d]
$3 \times 3 \times {}^1/_4$	6′-0″	4′-6″	3′-0″	1
$4 \times 3 \times {}^1/_4$	8′-0″	6′-0″	4′-6″	1
$5 \times 3^1/_2 \times {}^5/_{16}$	10′-0″	8′-0″	6′-0″	2
$6 \times 3^1/_2 \times {}^5/_{16}$	14′-0″	9′-6″	7′-0″	2
$2\text{-}6 \times 3^1/_2 \times {}^5/_{16}$	20′-0″	12′-0″	9′-6″	4

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

a. Long leg of the angle shall be placed in a vertical position.

b. Depth of reinforced lintels shall be not less than 8 inches and all cells of hollow masonry lintels shall be grouted solid. Reinforcing bars shall extend not less than 8 inches into the support.

c. Steel members indicated are adequate typical examples; other steel members meeting structural design requirements shall be permitted to be used.

d. Either steel angle or reinforced lintel shall span opening.

e. Span over 4 feet (1219 mm) shall be shored until cured.

TABLE R703.8.4(1)
TIE ATTACHMENT AND AIRSPACE REQUIREMENTS

BACKING AND TIE	MINIMUM TIE	MINIMUM TIE FASTENER[a]	AIRSPACE[b]	
Wood stud backing with corrugated sheet metal	22 U.S. gage (0.0299 in.) × $^{7}/_{8}$ in. wide	8d common nail[c] ($2^{1}/_{2}$ in. × 0.131 in.)	Nominal 1 in. between sheathing and veneer	
Wood stud backing with adjustable metal strand wire	W1.7 (No. 9 U.S. gage; 0.148 in. dia.) with hook embedded in mortar joint[d]	8d common nail[c] ($2^{1}/_{2}$ in. × 0.131 in.)	Minimum nominal 1 in. between sheathing and veneer	Maximum $4^{5}/_{8}$ in. between backing and veneer
Wood stud backing with adjustable metal strand wire	W2.8 (0.187 in. dia.) with hook embedded in mortar joint[e, f]	8d common nail[c] ($2^{1}/_{2}$ in. × 0.131 in.)	Greater than $4^{5}/_{8}$ in. between backing and veneer	Maximum $6^{5}/_{8}$ in. between backing and veneer
~~Cold-formed steel stud backing with adjustable metal strand wire~~	~~W1.7 (No. 9 U.S. gage; 0.148 in. dia.) with hook embedded in mortar joint[d]~~	~~No. 10 screw extending through the steel framing a minimum of three exposed threads~~	~~Minimum nominal 1 in. between sheathing and veneer~~	~~Maximum $4^{5}/_{8}$ in. between backing and veneer~~
~~Cold-formed steel stud backing with adjustable metal strand wire~~	~~W2.8 (0.187 in. dia.) with hook embedded in mortar joint[e, f]~~	~~No. 10 screw extending through the steel framing a minimum of three exposed threads~~	~~Greater than $4^{5}/_{8}$ in. between backing and veneer~~	~~Maximum $6^{5}/_{8}$ in. between backing and veneer~~

For SI: 1 inch = 25.4 mm.

a. All fasteners shall have rust-inhibitive coating suitable for the installation in which they are being used, or be manufactured from material not susceptible to corrosion.

b. An airspace that provides drainage shall be permitted to contain mortar from construction.

c. Deleted. ~~In Seismic Design Category D_0, D_1 or D_2, the minimum tie fastener shall be an 8d ring-shank nail ($2^{1}/_{2}$ in. × 0.131 in.).~~

d. Adjustable tie pintles shall include not fewer than 1 pintle leg of wire size W2.8 (MW18) with a maximum offset of $1^{1}/_{4}$ inches.

e. Adjustable tie pintles shall include not fewer than 2 pintle legs with a maximum offset of $1^{1}/_{4}$ inches. Distance between inside face of brick and end of pintle shall be a maximum of 2 inches.

f. Adjustable tie backing attachment components shall consist of one of the following: eyes with minimum wire W2.8 (MW18), barrel with minimum $^{1}/_{4}$-inch outside diameter, or plate with minimum thickness of 0.074 inch and minimum width of $1^{1}/_{4}$ inches.

R703.8.4.1 Size and spacing. Veneer ties, if strand wire, shall be not less in thickness than No. 9 U.S. gage [(0.148 inch) (4 mm)] wire and shall have a hook embedded in the mortar joint, or if sheet metal, shall be not less than No. 22 U.S. gage by [(0.0299 inch) (0.76 mm)] $^{7}/_{8}$ inch (22 mm) corrugated. Each tie shall support not more than 2.67 square feet (0.25 m^2) of wall area and shall be spaced not more than 32 inches (813 mm) on center horizontally and 24 inches (635 mm) on center vertically.

Exception: In ~~Seismic Design Category D_0, D_1 or D_2 or~~ townhouses in Seismic Design Category C or in wind areas of more than 30 pounds per square foot pressure (1.44 kPa), each tie shall support not more than 2 square feet (0.2 m^2) of wall area.

R703.8.5 Flashing. Flashing of 6 mil (0.152 mm) poly or other corrosion-resistant material shall be located beneath the first course of masonry above finished ground level above the foundation wall or slab and at other points of support, including structural floors, shelf angles and lintels where masonry veneers are designed in accordance with Section R703.8. Top of base flashing shall be installed with a minimum 2-inch (51 mm) lap behind building paper or water repellant sheathing. See Section R703.4 for additional requirements.

R703.8.6 Weepholes. Weepholes shall be provided in the outside wythe of masonry walls at a maximum spacing of ~~33~~ 48 inches (~~838~~ 1219 mm) on center. Weepholes shall be not less than $^{3}/_{16}$ inch (5 mm) in diameter. Weepholes shall be located immediately above the flashing.

R703.9 Exterior insulation and finish system (EIFS)/EIFS with drainage. Exterior insulation and finish systems (EIFS) shall comply with this chapter and Section R703.9.1. EIFS with drainage shall comply with this chapter and Section R703.9.2.

R703.9.1 Exterior insulation and finish systems (EIFS). EIFS shall comply with the following:

Non-drainable EIFS shall not be permitted.

1. ~~ASTM E2568.~~
2. ~~EIFS shall be limited to applications over substrates of concrete or masonry wall assemblies.~~
3. ~~Flashing of EIFS shall be provided in accordance with the requirements of Section R703.4.~~
4. ~~EIFS shall be installed in accordance with the manufacturer's instructions.~~
5. ~~EIFS shall terminate not less than 6 inches (152 mm) above the finished ground level.~~
6. ~~Decorative *trim* shall not be face-nailed through the EIFS.~~

R703.11.1.1 Fasteners. Deleted. ~~Unless specified otherwise by the manufacturer's instructions, fasteners for vinyl siding shall be 0.120-inch (3 mm) shank diameter nail with a 0.313-inch (8 mm) head or 16-gage staple with a $^{3}/_{8}$-inch (9.5 mm) to $^{1}/_{2}$-inch (12.7 mm) crown.~~

R703.11.1.2 Penetration depth. Deleted. ~~Unless specified otherwise by the manufacturer's instructions, fasteners shall penetrate into building framing. The total penetration into sheathing, furring framing or other *nailable substrate* shall be a minimum $1^{1}/_{4}$ inches (32 mm). Where specified by the manufacturer's instructions and supported by a test report, fasteners are permitted to penetrate into or fully through nailable sheathing or other *nailable substrate* of minimum thickness specified by the instructions or test report without penetrating into framing. Where the fastener penetrates fully through the sheathing, the end of the fastener shall extend a minimum of $^{1}/_{4}$ inch (6.4 mm) beyond the opposite face of the sheathing or *nailable substrate*.~~

R703.11.1.3 Spacing. Deleted. ~~Unless specified otherwise by the manufacturer's instructions, the maximum spacing between fasteners for horizontal siding shall be 16 inches (406 mm), and for vertical siding 12 inches (305 mm) both horizontally and vertically. Where specified by the manufacturer's instructions and supported by a test report, greater fastener spacing is permitted.~~

R703.11.2 Installation over foam plastic sheathing. Where vinyl siding or *insulated vinyl siding* is installed over foam plastic sheathing, the vinyl siding shall comply with Section R703.11 ~~and shall have a wind load design pressure rating in accordance with Table R703.11.2.~~

Exceptions:

1. Where the foam plastic sheathing is applied directly over *wood structural panels*, fiberboard, gypsum sheathing or other *approved* backing capable of independently resisting the design wind pressure, the vinyl siding shall be installed in accordance with Sections R703.3.3 and R703.11.1.
2. Deleted. ~~Where the vinyl siding manufacturer's product specifications provide an *approved* wind load design pressure rating for installation over foam plastic sheathing, use of this wind load design pressure rating shall be permitted and the siding shall be installed in accordance with the *manufacturer's installation instructions*.~~
3. Deleted. ~~Where the foam plastic sheathing and its attachment have a design wind pressure resistance complying with Sections R316.8 and R301.2.1, the vinyl siding shall be installed in accordance with Sections R703.3.3 and R703.11.1.~~

~~TABLE R703.11.2~~

~~REQUIRED MINIMUM WIND LOAD DESIGN PRESSURE RATING FOR VINYL SIDING INSTALLED OVER FOAM PLASTIC SHEATHING ALONE~~

~~ULTIMATE DESIGN WIND SPEED (MPH)~~	~~ADJUSTED MINIMUM DESIGN WIND PRESSURE (ASD) (PSF)[a, b]~~					
	~~Case 1: With interior gypsum wallboard[c]~~			~~Case 2: Without interior gypsum wallboard[c]~~		
	~~Exposure~~			~~Exposure~~		
	~~B~~	~~C~~	~~D~~	~~B~~	~~C~~	~~D~~
~~≤ 95~~	~~-30.0~~	~~-33.2~~	~~-39.4~~	~~-33.9~~	~~-47.4~~	~~-56.2~~
~~100~~	~~-30.0~~	~~-36.8~~	~~-43.6~~	~~-37.2~~	~~-52.5~~	~~-62.2~~
~~105~~	~~-30.0~~	~~-40.5~~	~~-48.1~~	~~-41.4~~	~~-57.9~~	~~-68.6~~

110	-31.8	-44.5	-52.8	-45.4	-63.5	-75.3
115	-35.5	-49.7	-59.0	-50.7	-71.0	-84.2
120	-37.4	-52.4	-62.1	-53.4	-74.8	-88.6
130	-44.9	-62.8	-74.5	-64.1	-89.7	-106
> 130	See Note d					

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 square foot = 0.0929 m^2, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa.~~

~~a. Linear interpolation is permitted.~~

~~b. The table values are based on a maximum 30-foot mean roof height, and effective wind area of 10 square feet Wall Zone 5 (corner), and the ASD design component and cladding wind pressure from Table R301.2.1(1), adjusted for exposure in accordance with Table R301.2.1(2), multiplied by the following adjustment factors: 1.87 (Case 1) and 2.67 (Case 2).~~

~~c. Gypsum wallboard, gypsum panel product or equivalent.~~

~~d. For the indicated wind speed condition and where foam sheathing is the only sheathing on the exterior of a frame wall with vinyl siding, the wall assembly shall be capable of resisting an impact without puncture at least equivalent to that of a wood frame wall with minimum $^7/_{16}$-inch OSB sheathing as tested in accordance with ASTM E1886. The vinyl siding shall comply with an adjusted design wind pressure requirement in accordance with Note b, using an adjustment factor of 2.67.~~

R703.16 Cladding attachment over foam sheathing to cold-formed steel framing. Deleted. ~~Cladding shall be specified and installed in accordance with Section R703, the cladding manufacturer's approved instructions, including any limitations for use over foam plastic sheathing, or an *approved* design. In addition, the cladding or furring attachments through foam sheathing to framing shall meet or exceed the minimum fastening requirements of Section R703.16.1, Section R703.16.2 or an *approved* design for support of cladding weight.~~

~~**Exceptions:**~~

1. ~~Where the cladding manufacturer has provided approved installation instructions for application over foam sheathing, those requirements shall apply.~~
2. ~~For exterior insulation and finish systems, refer to Section R703.9.~~
3. ~~For anchored masonry or stone veneer installed over foam sheathing, refer to Section R703.8.~~

~~**R703.16.1 Direct attachment.** Where cladding is installed directly over foam sheathing without the use of furring, cladding minimum fastening requirements to support the cladding weight shall be as specified in Table R703.16.1.~~

~~**R703.16.2 Furred cladding attachment.** Where steel or wood furring is used to attach cladding over foam sheathing, furring minimum fastening requirements to support the cladding weight shall be as specified in Table R703.16.2. Where placed horizontally, wood furring shall be preservative-treated wood in accordance with Section R317.1 or *naturally durable wood* and fasteners shall be corrosion resistant in accordance with Section R317.3. Steel furring shall have a minimum G60 galvanized coating.~~

~~**TABLE R703.16.1**~~

~~**CLADDING MINIMUM FASTENING REQUIREMENTS FOR DIRECT ATTACHMENT OVER FOAM PLASTIC SHEATHING TO SUPPORT CLADDING WEIGHT[a, b]**~~

CLADDING FASTENER THROUGH FOAM SHEATHING INTO:	CLADDING FASTENER TYPE AND MINIMUM SIZE[c]	CLADDING FASTENER VERTICAL SPACING (inches)	MAXIMUM THICKNESS OF FOAM SHEATHING[d] (inches)									
			16″ o.c. Fastener Horizontal Spacing					24″ o.c. Fastener Horizontal Spacing				
			Cladding Weight:					Cladding Weight:				
			3 psf	11 psf	15 psf	18 psf	25 psf	3 psf	11 psf	15 psf	18 psf	25 psf
Steel framing (minimum penetration of steel thickness + 3 threads)	No. 8 screw into 33-mil steel or thicker	6	3.00	2.95	2.50	2.20	1.45	3.00	2.35	1.75	1.25	DR
		8	3.00	2.55	2.00	1.60	0.60	3.00	1.80	0.90	DR	DR
		12	3.00	1.80	0.95	DR	DR	3.00	0.65	DR	DR	DR

	No. 10 screw into 33-mil steel	6	4.00	3.50	3.05	2.70	1.95	4.00	2.90	2.20	1.70	0.55
		8	4.00	3.10	2.50	2.05	1.00	4.00	2.25	1.35	0.70	DR
		12	4.00	2.25	1.35	0.70	DR	3.70	1.05	DR	DR	DR
	No. 10 screw into 43-mil steel or thicker	6	4.00	4.00	4.00	4.00	3.60	4.00	4.00	3.80	3.45	2.70
		8	4.00	4.00	4.00	3.70	3.00	4.00	3.85	3.25	2.80	1.80
		12	4.00	3.85	3.25	2.80	1.80	4.00	3.05	2.15	1.50	DR

~~For SI: 1 inch = 25.4 mm, 1 mil = 0.0254 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa.~~

~~DR = Design Required.~~

~~o.c. = On Center.~~

~~a. Steel framing shall be minimum 33-ksi steel for 33-mil and 43-mil steel, and 50-ksi steel for 54-mil steel or thicker.~~

~~b. Where cladding is attached to wood structural panel sheathing only, fastening requirements shall be in accordance with Table R703.3.3.~~

~~c. Screws shall comply with the requirements of ASTM C1513.~~

~~d. Foam sheathing shall have a minimum compressive strength of 15 psi in accordance with ASTM C578 or ASTM C1289.~~

~~TABLE R703.16.2~~

~~FURRING MINIMUM FASTENING REQUIREMENTS FOR APPLICATION OVER FOAM PLASTIC SHEATHING TO SUPPORT CLADDING WEIGHT~~[a]

FURRING MATERIAL	FRAMING MEMBER	FASTENER TYPE AND MINIMUM SIZE[b]	MINIMUM PENETRATION INTO WALL FRAMING (inches)	FASTENER SPACING IN FURRING (inches)	MAXIMUM THICKNESS OF FOAM SHEATHING[d] (inches)									
					16″ o.c. Furring[e]					24″ o.c. Furring[e]				
					Cladding Weight:					Cladding Weight:				
					3 psf	11 psf	15 psf	18 psf	25 psf	3 psf	11 psf	15 psf	18 psf	25 psf
Minimum 33-mil steel furring or minimum 1× wood furring[c]	33-mil steel stud	No. 8 screw	Steel thickness + 3 threads	12	3.00	1.80	0.95	DR	DR	3.00	0.65	DR	DR	DR
				16	3.00	1.00	DR	DR	DR	2.85	DR	DR	DR	DR
				24	2.85	DR	DR	DR	DR	2.20	DR	DR	DR	DR
		No. 10 screw	Steel thickness + 3 threads	12	4.00	2.25	1.35	0.70	DR	3.70	1.05	DR	DR	DR
				16	3.85	1.45	DR	DR	DR	3.40	DR	DR	DR	DR
				24	3.40	DR	DR	DR	DR	2.70	DR	DR	DR	DR
	43-mil or thicker steel stud	No. 8 Screw	Steel thickness + 3 threads	12	3.00	1.80	0.95	DR	DR	3.00	0.65	DR	DR	DR
				16	3.00	1.00	DR	DR	DR	2.85	DR	DR	DR	DR
				24	2.85	DR	DR	DR	DR	2.20	DR	DR	DR	DR
		No. 10 screw	Steel thickness + 3 threads	12	4.00	3.85	3.25	2.80	1.80	4.00	3.05	2.15	1.50	DR
				16	4.00	3.30	2.55	1.95	0.60	4.00	2.25	1.05	DR	DR
				24	4.00	2.25	1.05	DR	DR	4.00	0.65	DR	DR	DR

~~For SI: 1 inch = 25.4 mm, 1 mil = 0.0254 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa.~~

~~DR = Design Required.~~

~~o.c. = On Center.~~

~~a. Wood furring shall be Spruce-pine-fir or any softwood species with a specific gravity of 0.42 or greater. Steel furring shall be minimum 33-ksi steel. Steel studs shall be minimum 33-ksi steel for 33-mil and 43-mil thickness, and 50-ksi steel for 54-mil steel or thicker.~~

~~b. Screws shall comply with the requirements of ASTM C1513.~~

~~c. Where the required cladding fastener penetration into wood material exceeds $^3/_4$ inch and is not more than $1^1/_2$ inches, a minimum 2-inch nominal wood furring or an approved design shall be used.~~

~~d. Foam sheathing shall have a minimum compressive strength of 15 psi in accordance with ASTM C578 or ASTM C1289.~~

e. ~~Furring shall be spaced not more than 24 inches (610 mm) on center, in a vertical or horizontal orientation. In a vertical orientation, furring shall be located over wall studs and attached with the required fastener spacing. In a horizontal orientation, the indicated 8-inch and 12-inch fastener spacing in furring shall be achieved by use of two fasteners into studs at 16 inches and 24 inches on center, respectively.~~

CHAPTER 8
ROOF-CEILING CONSTRUCTION

~~***User note:***~~

~~***About this chapter:** Chapter 8 addresses the design and construction of roof-ceiling systems. This chapter contains two roof-ceiling framing systems: wood framing and cold-formed steel framing. Allowable span tables are provided to simplify the selection of rafter and ceiling joist size for wood roof framing and cold-formed steel framing. Chapter 8 also provides requirements for the application of ceiling finishes, the proper ventilation of concealed spaces in roofs (for example, enclosed attics and rafter spaces), unvented attic assemblies and attic access.*~~

R801.3 Roof drainage. Deleted. ~~In areas where *expansive soils* or *collapsible soils* are known to exist, all *dwellings* shall have a controlled method of water disposal from roofs that will collect and discharge roof drainage to the ground surface not less than 5 feet (1524 mm) from foundation walls or to an *approved* drainage system.~~

R802.3 Ridge. A ridge board used to connect opposing rafters shall be not less than 1 inch (25 mm) nominal thickness and not less in depth than the cut end of the rafter. Opposing rafters at the ridge must align within the thickness of the ridge member. Regularly spaced hip and valley rafters need not align. Where ceiling joist or rafter ties do not provide continuous ties across the structure as required by Section R802.5.2, the ridge shall be supported by a wall or ridge beam designed in accordance with accepted engineering practice and supported on each end by a wall or column.

TABLE R802.5.2(1)
RAFTER/CEILING JOIST HEEL JOINT CONNECTIONS[g]

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

a. 10d common (3″ × 0.148″) nails shall be permitted to be substituted for 16d common ($3^1/_2$″ × 0.162″) nails where the required number of nails is taken as 1.2 times the required number of 16d common nails, rounded up to the next full nail.

b. Heel joint connections are not required where the ridge is supported by a load-bearing wall, header or ridge beam.

c. Where intermediate support of the rafter is provided by vertical struts or purlins to a load-bearing wall, the tabulated heel joint connection requirements shall be permitted to be reduced proportionally to the reduction in span.

d. Equivalent nailing patterns are required for ceiling joist to ceiling joist lap splices.

e. Applies to roof live load of 20 psf or less.

f. Tabulated heel joint connection requirements assume that ceiling joists or rafter ties are located at the bottom of the attic space. Where ceiling joists or rafter ties are located higher in the attic, heel joint connection requirements shall be increased by the adjustment factors in Table 802.5.2(2).

g. Tabulated requirements are based on 10 psf roof dead load in combination with the specified ~~roof~~ ground snow load and roof live load.

R802.10.2 Design. Wood trusses shall be designed in accordance with accepted engineering practice. The design and manufacture of metal-plate-connected wood trusses shall comply with ANSI/TPI 1. The *truss design drawings* shall be prepared by a *registered design professional.* ~~where required by the statutes of the *jurisdiction* in which the project is to be constructed in accordance with Section R106.1.~~

R802.11.1 Truss uplift resistance. Trusses shall be attached to supporting wall assemblies by connections capable of resisting uplift forces as specified on the *truss design drawings* for the ultimate design wind speed as determined by ~~Figure R301.2(2)~~ Table R301.2(4) and listed in Table R301.2 or as shown on the *construction documents*. Uplift forces shall be permitted to be determined as specified by Table R802.11, if applicable, or as determined by accepted engineering practice.

SECTION R804
COLD-FORMED STEEL ROOF FRAMING

Deleted.

~~**R804.1 General.** Elements shall be straight and free of any defects that would significantly affect their structural performance. Cold-formed steel roof framing members shall be in accordance with the requirements of this section.~~

~~**R804.1.1 Applicability limits.** The provisions of this section shall control the construction of cold-formed steel roof framing for buildings not greater than 60 feet (18 288 mm) perpendicular to the joist, rafter or truss span, not greater than 40 feet (12 192 mm) in width parallel to the joist span or truss, less than or equal to three stories above *grade* plane and with roof slopes not less than 3:12 (25-percent slope) or greater than 12:12 (100-percent slope). Cold-formed steel roof framing constructed in accordance with the provisions of this section shall be limited to~~

~~sites where the ultimate design wind speed is less than 140 miles per hour (63 m/s), Exposure Category B or C, and the ground snow load is less than or equal to 70 pounds per square foot (3350 Pa).~~

~~**R804.1.1.1 Alternate applications.** Cold-formed steel roof and ceiling framing for buildings exceeding the applicability limits of Section R804.1.1 is permitted to be designed and constructed in accordance with AISI S230, subject to the limits therein.~~

~~**R804.1.2 In-line framing.** Cold-formed steel roof framing constructed in accordance with Section R804 shall be located in line with the tolerances specified in AISI S240, Section B1.2.3.~~

~~**R804.2 Structural framing.** Load-bearing, cold-formed steel roof framing members shall be in accordance with this section.~~

~~**R804.2.1 Material.** Load-bearing, cold-formed steel framing members shall be cold formed to shape from structural quality sheet steel complying with the requirements of AISI S240, Section A3.~~

~~**R804.2.2 Corrosion protection.** Load-bearing, cold-formed steel framing shall have a protective coating complying with AISI S240, Section A4.~~

~~**R804.2.3 Dimension, thickness and material grade.** Load-bearing, cold-formed steel roof framing members shall comply with AISI S230, Section A4.3 and material grade requirements as specified in AISI S230, Section A4.4.~~

~~**R804.2.4 Identification.** Load-bearing, cold-formed steel framing members shall meet the product identification requirements of AISI S240, Section A5.5.~~

~~**R804.2.5 Fastening requirements.** Screws for steel-to-steel connections shall be installed with a minimum edge distance and center-to-center spacing of $^1/_2$ inch (12.7 mm), shall be self-drilling tapping and shall conform to ASTM C1513. Structural sheathing shall be attached to cold-formed steel roof rafters with minimum No. 8 self-drilling tapping screws that conform to ASTM C1513. Screws for attaching structural sheathing to cold-formed steel roof framing shall have a minimum head diameter of 0.292 inch (7.4 mm) with countersunk heads and shall be installed with a minimum edge distance of $^3/_8$ inch (9.5 mm). Gypsum board ceilings shall be attached to cold-formed steel joists with minimum No. 6 screws conforming to ASTM C954 or ASTM C1513 with a bugle-head style and shall be installed in accordance with Section R805. For all connections, screws shall extend through the steel not fewer than three exposed threads. Fasteners shall have rust-inhibitive coating suitable for the installation in which they are being used, or be manufactured from material not susceptible to corrosion.~~

~~**R804.2.6 Web holes, web hole reinforcing and web hole patching.** Web holes in roof or ceiling joists shall comply with the conditions as prescribed in AISI S230, Section A4.5. Web holes not in conformance to the conditions of AISI S230, Section A4.5 shall be reinforced in accordance with the provisions of AISI S230, Section A4.6 or patched in accordance with the provisions of AISI S230, Section A4.7.~~

~~**R804.3 Roof construction.** Cold-formed steel roof systems constructed in accordance with the provisions of this section shall consist of both ceiling joists and rafters in accordance with Figure R804.3 and fastened in accordance with Table R804.3.~~

~~TABLE R804.3~~

~~ROOF FRAMING FASTENING SCHEDULE[a, b]~~

~~DESCRIPTION OF BUILDING ELEMENTS~~	~~NUMBER AND SIZE OF FASTENERS[a]~~	~~SPACING OF FASTENERS~~
~~Roof sheathing (oriented strand board or plywood) to rafter~~	~~No. 8 screws~~	~~6″ o.c. on edges and 12″ o.c. at interior supports. 6″ o.c. at gable end truss.~~
~~Gypsum board to ceiling joists~~	~~No. 6 screws~~	~~12″ o.c.~~
~~Gable end truss to endwall top track~~	~~No. 10 screws~~	~~12″ o.c.~~
~~Rafter to ceiling joist and to ridge member~~	~~Minimum No. 10 screws, in accordance with Table R804.3.1.1(3)~~	~~Evenly spaced, not less than $^1/_2$″ from all edges.~~

	~~Ceiling joist or truss spacing (in.)~~	~~Roof Span (ft)~~	~~Ultimate Design Wind Speed (mph) and Exposure Category~~				
			~~130 B 115 C~~	~~≤ 139 B 120 C~~	~~130 C~~	~~≤ 139 C~~	
~~Ceiling joist or roof truss to top track of bearing wall[b]~~	~~16~~	~~24~~	~~3~~	~~3~~	~~4~~	~~5~~	~~Each ceiling joist or roof truss.~~
		~~28~~	~~3~~	~~3~~	~~4~~	~~5~~	
		~~32~~	~~3~~	~~4~~	~~5~~	~~6~~	
		~~36~~	~~4~~	~~4~~	~~5~~	~~6~~	
		~~40~~	~~4~~	~~4~~	~~6~~	~~7~~	
	~~24~~	~~24~~	~~4~~	~~5~~	~~6~~	~~7~~	
		~~28~~	~~4~~	~~5~~	~~6~~	~~8~~	
		~~32~~	~~4~~	~~6~~	~~7~~	~~8~~	
		~~36~~	~~4~~	~~6~~	~~8~~	~~9~~	
		~~40~~	~~6~~	~~6~~	~~8~~	~~10~~	

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 mil = 0.0254 mm.~~

~~a. Screws are a minimum No. 10 unless noted otherwise.~~

~~b. Indicated number of screws shall be applied through the flanges of the truss or ceiling joist or through each leg of a 54 mil clip angle. See Section R804.3.8 for additional requirements to resist uplift forces.~~

~~**R804.3.1 Ceiling joists.** Cold-formed steel ceiling joists shall be in accordance with this section.~~

~~**R804.3.1.1 Minimum ceiling joist size.** Ceiling joist size and thickness shall be determined in accordance with the limits set forth in Tables R804.3.1.1(1) and R804.3.1.1(2). When determining the size of ceiling joists, the lateral support of the top flange shall be classified as unbraced, braced at midspan or braced at third points in accordance with Section R804.3.1.3. Where sheathing material is attached to the top flange of ceiling joists or where the bracing is spaced closer than at third points of the joists, the "third point" values from Tables R804.3.1.1(1) and R804.3.1.1(2) shall be used.~~

~~Ceiling joists shall have a bearing support length of not less than $1^1/_2$ inches (38 mm) and shall be connected to roof rafters (heel joint) with No. 10 screws in accordance with Figure R804.3.1.1 and Table R804.3.1.1(3).~~

~~Where continuous joists are framed across interior bearing supports, the interior bearing supports shall be located within 24 inches (610 mm) of midspan of the ceiling joist, and the individual spans shall not exceed the applicable spans in Tables R804.3.1.1(1) and R804.3.1.1(2).~~

~~**Where the attic is to be used as an *occupied space*, the ceiling joists shall be designed in accordance with Section R505.**~~

~~**TABLE R804.3.1.1(1)**~~

~~**CEILING JOIST SPANS 10 PSF LIVE LOAD (NO ATTIC STORAGE)[a, b, c, d]**~~

~~**MEMBER DESIGNATION**~~	~~**ALLOWABLE SPAN (feet-inches)**~~					
	~~**Lateral Support of Top (Compression) Flange**~~					
	~~**Unbraced**~~		~~**Midspan Bracing**~~		~~**Third-point Bracing**~~	
	~~**Ceiling Joist Spacing (inches)**~~					
	~~**16**~~	~~**24**~~	~~**16**~~	~~**24**~~	~~**16**~~	~~**24**~~

350S162-33	9′ 6″	8′ 6″	11′ 10″	9′ 10″	11′ 10″	10′ 4″
350S162-43	10′ 4″	9′ 3″	12′ 10″	11′ 3″	12′ 10″	11′ 3″
350S162-54	11′ 1″	9′ 11″	13′ 9″	12′ 0″	13′ 9″	12′ 0″
350S162-68	12′ 2″	10′ 10″	14′ 9″	12′ 10″	14′ 9″	12′ 10″
550S162-33	10′ 11″	9′ 10″	15′ 7″	12′ 0″	16′ 10″	12′ 0″
550S162-43	11′ 8″	10′ 6″	16′ 10″	14′ 10″	18′ 4″	16′ 0″
550S162-54	12′ 7″	11′ 3″	18′ 0″	16′ 2″	19′ 4″	17′ 2″
550S162-68	13′ 7″	12′ 1″	19′ 3″	17′ 3″	20′ 6″	18′ 5″
800S162-33	—	—	—	—	—	—
800S162-43	13′ 1″	11′ 9″	18′ 9″	16′ 9″	21′ 2″	18′ 7″
800S162-54	13′ 11″	12′ 6″	20′ 1″	18′ 1″	21′ 5″	20′ 5″
800S162-68	14′ 11″	13′ 4″	21′ 4″	19′ 2″	22′ 9″	21′ 9″
1000S162-43	—	—	—	—	—	—
1000S162-54	14′ 10″	13′ 4″	21′ 4″	19′ 2″	22′ 8″	21′ 8″
1000S162-68	15′ 10″	14′ 3″	22′ 9″	20′ 5″	24′ 3″	23′ 3″
1200S162-43	—	—	—	—	—	—
1200S162-54	—	—	—	—	—	—
1200S162-68	16′ 8″	14′ 11″	23′ 11″	21′ 7″	25′ 5″	24′ 5″

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 pound per square foot = 0.0479 kPa.

a. Deflection criterion: $L/240$ for total loads.

b. Ceiling dead load = 5 psf.

c. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

d. Listed allowable spans are not applicable for 350S162-33, 550S162-33, 550S162-43 and 800S162-43 continuous joist members.

TABLE R804.3.1.1(2)

CEILING JOIST SPANS 20 PSF LIVE LOAD (LIMITED ATTIC STORAGE)[a, b, c, d]

MEMBER DESIGNATION	ALLOWABLE SPAN (feet-inches)					
	Lateral Support of Top (Compression) Flange					
	Unbraced		Midspan Bracing		Third-point Bracing	
	Ceiling Joist Spacing (inches)					
	16	24	16	24	16	24
350S162-33	8′ 0″	6′ 5″	9′ 2″	7′ 5″	9′ 11″	7′ 5″
350S162-43	8′ 11″	7′ 8″	10′ 9″	8′ 9″	10′ 0″	9′ 6″
350S162-54	9′ 7″	8′ 7″	11′ 7″	10′ 2″	11′ 7″	10′ 2″

350S162-68	10′ 4″	9′ 3″	12′ 5″	10′ 10″	12′ 5″	10′ 10″
550S162-33	9′ 5″	6′ 11″	10′ 5″	6′ 11″	10′ 5″	6′ 11″
550S162-43	10′ 2″	9′ 2″	14′ 2″	11′ 8″	15′ 2″	11′ 8″
550S162-54	10′ 10″	9′ 9″	15′ 7″	14′ 0″	16′ 7″	14′ 5″
550S162-68	11′ 8″	10′ 5″	16′ 7″	14′ 10″	17′ 9″	15′ 6″
800S162-33	—	—	—	—	—	—
800S162-43	11′ 4″	10′ 2″	16′ 1″	11′ 0″	16′ 6″	11′ 0″
800S162-54	12′ 0″	10′ 10″	17′ 4″	15′ 7″	18′ 7″	17′ 7″
800S162-68	12′ 10″	11′ 6″	18′ 6″	16′ 7″	19′ 11″	18′ 11″
1000S162-43	—	—	—	—	—	—
1000S162-54	12′ 10″	11′ 7″	18′ 5″	16′ 6″	19′ 8″	18′ 8″
1000S162-68	13′ 8″	12′ 3″	19′ 8″	17′ 9″	21′ 1″	20′ 1″
1200S162-43	—	—	—	—	—	—
1200S162-54	—	—	—	—	—	—
1200S162-68	14′ 5″	12′ 11″	20′ 9″	18′ 7″	22′ 0″	21′ 0″

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 pound per square foot = 0.0479 kPa.

a. Deflection criterion: *L*/240 for total loads.

b. Ceiling deal load = 5 psf.

c. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

d. Listed allowable spans are not applicable for 350S162-33, 350S162-43, 550S162-33, 550S162-43 and 800S162-43 continuous joist members.

TABLE R804.3.1.1(3)
NUMBER OF SCREWS REQUIRED FOR CEILING JOIST TO ROOF RAFTER CONNECTION[a]

ROOF SLOPE	NUMBER OF SCREWS																			
	Building width (feet)																			
	24				28				32				36				40			
	Ground snow load (psf)																			
	20	30	50	70	20	30	50	70	20	30	50	70	20	30	50	70	20	30	50	70
3/12	5	6	9	11	5	7	10	13	6	8	11	15	7	8	13	17	8	9	14	19
4/12	4	5	7	9	4	5	8	10	5	6	9	12	5	7	10	13	6	7	11	14
5/12	3	4	6	7	4	4	6	8	4	5	7	10	5	5	8	11	5	6	9	12
6/12	3	3	5	6	3	4	6	7	4	4	6	8	4	5	7	9	4	5	8	10
7/12	3	3	4	6	3	3	5	7	3	4	6	7	4	4	6	8	4	5	7	9
8/12	2	3	4	5	3	3	5	6	3	4	5	7	3	4	6	8	4	4	6	8
9/12	2	3	4	5	3	3	4	6	3	3	5	6	3	4	5	7	3	4	6	8
10/12	2	2	4	5	2	3	4	5	3	3	5	6	3	3	5	7	3	4	6	7

~~11/12~~	~~2~~	~~2~~	~~3~~	~~4~~	~~2~~	~~3~~	~~4~~	~~5~~	~~3~~	~~3~~	~~4~~	~~6~~	~~3~~	~~3~~	~~5~~	~~6~~	~~3~~	~~4~~	~~5~~	~~7~~
~~12/12~~	~~2~~	~~2~~	~~3~~	~~4~~	~~2~~	~~3~~	~~4~~	~~5~~	~~2~~	~~3~~	~~4~~	~~5~~	~~3~~	~~3~~	~~5~~	~~6~~	~~3~~	~~4~~	~~5~~	~~7~~

~~For SI: 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kPa.~~
~~a. Screws shall be No. 10.~~

~~**R804.3.1.2 Ceiling joist bottom flange bracing.** The bottom flanges of ceiling joists shall be laterally braced by the application of gypsum board or continuous steel straps installed perpendicular to the joist run in accordance with one of the following:~~

1. ~~Gypsum board shall be fastened with No. 6 screws in accordance with Section R702.~~
2. ~~Steel straps with a minimum size of $1^1/_2$ inches by 33 mils (38 mm by 0.84 mm) shall be installed at a maximum spacing of 4 feet (1219 mm). Straps shall be fastened to the bottom flange at each joist with one No. 8 screw and shall be fastened to blocking with two No. 8 screws. Blocking shall be installed between joists at a maximum spacing of 12 feet (3658 mm) measured along a line of continuous strapping (perpendicular to the joist run), and at the termination of all straps.~~

~~**R804.3.1.3 Ceiling joist top flange bracing.** The top flanges of ceiling joists shall be laterally braced as required by Tables R804.3.1.1(1) and R804.3.1.1(2), in accordance with one of the following:~~

1. ~~Minimum 33-mil (0.84 mm) C-shaped member in accordance with Figure R804.3.1.3(1).~~
2. ~~Minimum 33-mil (0.84 mm) track section in accordance with Figure R804.3.1.3(1).~~
3. ~~Minimum 33-mil (0.84 mm) hat section in accordance with Figure R804.3.1.3(1).~~
4. ~~Minimum 54-mil (1.37 mm) $1^1/_2$-inch (38 mm) cold-rolled channel section in accordance with Figure R804.3.1.3(1).~~
5. ~~Minimum $1^1/_2$-inch by 33-mil (38 mm by 0.84 mm) continuous steel strap in accordance with Figure R804.3.1.3(2).~~

~~Lateral bracing shall be installed perpendicular to the ceiling joists and shall be fastened to the top flange of each joist with one No. 8 screw. Blocking shall be installed between joists in line with bracing at a maximum spacing of 12 feet (3658 mm) measured perpendicular to the joists. Ends of lateral bracing shall be attached to blocking or anchored to a stable building component with two No. 8 screws.~~

~~**R804.3.1.4 Ceiling joist splicing.** Splices in ceiling joists shall be permitted, if ceiling joist splices are supported at interior bearing points and are constructed in accordance with Figure R804.3.1.4. The number of screws on each side of the splice shall be the same as required for the heel joint connection in Table R804.3.1.1(3).~~

~~**R804.3.2 Roof rafters.** Cold-formed steel roof rafters shall be in accordance with this section.~~

~~**R804.3.2.1 Minimum roof rafter sizes.** Roof rafter size and thickness shall be determined in accordance with the limits set forth in Table R804.3.2.1(1) based on the horizontal projection of the roof rafter span. For determination of roof rafter sizes, reduction of roof spans shall be permitted where a roof rafter support brace is installed in accordance with Section R804.3.2.2. The reduced roof rafter span shall be taken as the larger of the distances from the roof rafter support brace to the ridge or to the heel measured horizontally.~~

~~For the purpose of determining roof rafter sizes in Table R804.3.2.1(1), ultimate design wind speeds shall be converted to equivalent ground snow loads in accordance with Table R804.3.2.1(2). Roof rafter sizes shall be based on the higher of the ground snow load or the equivalent snow load converted from the ultimate design wind speed.~~

~~TABLE R804.3.2.1(1)~~

~~ROOF RAFTER SPANS[a, b, c, d]~~

~~MEMBER DESIGNATION~~	~~ALLOWABLE SPAN MEASURED HORIZONTALLY (feet-inches)~~			
	~~Ground snow load (psf)~~			
	~~20~~	~~30~~	~~50~~	~~70~~

	~~Rafter spacing (inches)~~							
	~~16~~	~~24~~	~~16~~	~~24~~	~~16~~	~~24~~	~~16~~	~~24~~
~~550S162-33~~	~~13′ 11″~~	~~11′ 4″~~	~~11′ 9″~~	~~9′ 7″~~	~~9′ 5″~~	~~7′ 8″~~	~~8′ 1″~~	~~6′ 7″~~
~~550S162-43~~	~~15′ 9″~~	~~13′ 8″~~	~~14′ 3″~~	~~11′ 8″~~	~~11′ 4″~~	~~9′ 3″~~	~~9′ 9″~~	~~7′ 11″~~
~~550S162-54~~	~~16′ 11″~~	~~14′ 10″~~	~~15′ 3″~~	~~13′ 4″~~	~~13′ 3″~~	~~11′ 7″~~	~~12′ 0″~~	~~10′ 6″~~
~~550S162-68~~	~~18′ 2″~~	~~15′ 10″~~	~~16′ 5″~~	~~14′ 4″~~	~~14′ 3″~~	~~12′ 5″~~	~~12′ 11″~~	~~11′ 3″~~
~~800S162-33~~	~~16′ 4″~~	~~13′ 4″~~	~~13′ 11″~~	~~11′ 4″~~	~~11′ 1″~~	~~9′ 0″~~	~~9′ 6″~~	~~6′ 7″~~
~~800S162-43~~	~~19′ 7″~~	~~16′ 0″~~	~~16′ 8″~~	~~13′ 7″~~	~~13′ 4″~~	~~10′ 10″~~	~~11′ 5″~~	~~9′ 4″~~
~~800S162-54~~	~~22′ 9″~~	~~19′ 11″~~	~~20′ 7″~~	~~17′ 11″~~	~~17′ 10″~~	~~4′ 9″~~	~~15′ 6″~~	~~12′ 7″~~
~~800S162-68~~	~~24′ 7″~~	~~21′ 6″~~	~~22′ 2″~~	~~19′ 5″~~	~~19′ 3″~~	~~16′ 10″~~	~~17′ 5″~~	~~14′ 8″~~
~~1000S162-43~~	~~22′ 2″~~	~~18′ 1″~~	~~18′ 10″~~	~~15′ 4″~~	~~15′ 1″~~	~~12′ 4″~~	~~12′ 11″~~	~~10′ 7″~~
~~1000S162-54~~	~~27′ 1″~~	~~23′ 8″~~	~~24′ 6″~~	~~20′ 9″~~	~~20′ 5″~~	~~16′ 8″~~	~~17′ 6″~~	~~14′ 3″~~
~~1000S162-68~~	~~29′ 5″~~	~~25′ 8″~~	~~26′ 6″~~	~~23′ 2″~~	~~23′ 0″~~	~~19′ 6″~~	~~20′ 6″~~	~~16′ 9″~~
~~1200S162-54~~	~~31′ 3″~~	~~27′ 0″~~	~~28′ 1″~~	~~22′ 11″~~	~~22′ 6″~~	~~18′ 4″~~	~~19′ 4″~~	~~15′ 9″~~
~~1200S162-68~~	~~34′ 0″~~	~~29′ 8″~~	~~30′ 8″~~	~~26′ 9″~~	~~26′ 6″~~	~~21′ 7″~~	~~22′ 8″~~	~~18′ 6″~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.~~

~~a. Table provides maximum horizontal rafter spans in feet and inches for slopes between 3:12 and 12:12.~~

~~b. Deflection criteria: *L*/240 for live loads and *L*/180 for total loads.~~

~~c. Roof dead load = 12 psf.~~

~~d. Grade 33 ksi steel is permitted to be used for 33 mil and 43 mil thicknesses. Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.~~

~~TABLE R804.3.2.1(2)~~

~~ULTIMATE DESIGN WIND SPEED TO EQUIVALENT SNOW LOAD CONVERSION~~

~~ULTIMATE WIND SPEED AND EXPOSURE~~		~~EQUIVALENT GROUND SNOW LOAD (psf)~~									
		~~Roof slope~~									
~~Exposure~~	~~Wind speed (mph)~~	~~3:12~~	~~4:12~~	~~5:12~~	~~6:12~~	~~7:12~~	~~8:12~~	~~9:12~~	~~10:12~~	~~11:12~~	~~12:12~~
~~B~~	~~115~~	~~20~~	~~20~~	~~20~~	~~20~~	~~20~~	~~20~~	~~20~~	~~20~~	~~20~~	~~20~~
	~~120~~	~~20~~	~~20~~	~~20~~	~~20~~	~~20~~	~~20~~	~~20~~	~~20~~	~~20~~	~~20~~
	~~130~~	~~20~~	~~20~~	~~20~~	~~20~~	~~20~~	~~20~~	~~20~~	~~20~~	~~20~~	~~20~~
	~~<140~~	~~20~~	~~20~~	~~20~~	~~20~~	~~20~~	~~20~~	~~20~~	~~30~~	~~30~~	~~30~~
~~C~~	~~115~~	~~20~~	~~20~~	~~20~~	~~20~~	~~20~~	~~20~~	~~20~~	~~20~~	~~30~~	~~30~~
	~~120~~	~~20~~	~~20~~	~~20~~	~~20~~	~~20~~	~~20~~	~~20~~	~~30~~	~~30~~	~~50~~
	~~130~~	~~20~~	~~20~~	~~30~~	~~30~~	~~30~~	~~30~~	~~30~~	~~30~~	~~50~~	~~50~~
	~~<140~~	~~30~~	~~30~~	~~50~~	~~50~~	~~30~~	~~30~~	~~50~~	~~50~~	~~50~~	~~50~~

~~For SI: 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa.~~

~~**R804.3.2.1.1 Eave overhang.** Eave overhangs shall not exceed 24 inches (610 mm) measured horizontally.~~

~~**R804.3.2.1.2 Rake overhangs.** Rake overhangs shall not exceed the limitations provided for Option 1 or 2 in Figure R804.3.2.1.2. Outlookers at gable endwalls shall be installed in accordance with Figure R804.3.2.1.2. The required strength for uplift connectors required for Option 1 shall be determined in accordance with AISI S230, Table F3-4.~~

~~**R804.3.2.2 Roof rafter support brace.** Where used to reduce roof rafter spans in determining roof rafter sizes, a roof rafter support brace shall meet all of the following conditions:~~

1. ~~Minimum 350S162-33 C-shaped brace member with maximum length of 8 feet (2438 mm).~~
2. ~~Minimum brace member slope of 45 degrees (0.785 rad) to the horizontal.~~
3. ~~Minimum connection of brace to a roof rafter and ceiling joist with four No.10 screws at each end.~~
4. ~~Maximum 6 inches (152 mm) between brace/ceiling joist connection and *load-bearing wall* below.~~
5. ~~Each roof rafter support brace greater than 4 feet (1219 mm) in length, shall be braced with a supplemental brace having a minimum size of 350S162-33 or 350T162-33 such that the maximum unsupported length of the roof rafter support brace is 4 feet (1219 mm). The supplemental brace shall be continuous and shall be connected to each roof rafter support brace using two No. 8 screws.~~

~~**R804.3.2.3 Roof rafter splice.** Roof rafters shall not be spliced.~~

~~**R804.3.2.4 Roof rafter to ceiling joist and ridge member connection.** Roof rafters shall be connected to a parallel ceiling joist to form a continuous tie between exterior walls in accordance with Figure R804.3.1.1 and Table R804.3.1.1(3). Ceiling joists shall be connected to the top track of the *load-bearing wall* in accordance with Table R804.3, either with the required number of No. 10 screws applied through the flange of the ceiling joist or by using a 54-mil (1.37 mm) clip angle with the required number of No.10 screws in each leg. Roof rafters shall be connected to a ridge member with a minimum 2 inch by 2 inch (51 mm by 51 mm) clip angle fastened with No. 10 screws to the ridge member in accordance with Figure R804.3.2.4 and Table R804.3.2.4. The clip angle shall have a steel thickness equivalent to or greater than the roof rafter thickness and shall extend the depth of the roof rafter member to the extent possible. The ridge member shall be fabricated from a C-shaped member and a track section that shall have a minimum size and steel thickness equivalent to or greater than that of adjacent roof rafters and shall be installed in accordance with Figure R804.3.2.4. The ridge member shall extend the full depth of the sloped roof rafter cut.~~

~~**TABLE R804.3.2.4**~~

~~**SCREWS REQUIRED AT EACH LEG OF CLIP ANGLE FOR ROOF RAFTER TO RIDGE MEMBER CONNECTION[a]**~~

BUILDING WIDTH (feet)	NUMBER OF SCREWS			
	Ground snow load (psf)			
	0 to 20	21 to 30	31 to 50	51 to 70
24	2	2	3	4
28	2	3	4	5
32	2	3	4	5
36	3	3	5	6
40	3	4	5	7

~~For SI: 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.~~
~~a. Screws shall be No. 10 minimum.~~

~~**R804.3.2.5 Roof rafter bottom flange bracing.** The bottom flanges of roof rafters shall be continuously braced, at a maximum spacing of 4 feet (1219 mm) as measured parallel to the roof rafters, with one of the following members:~~

1. ~~Minimum 33-mil (0.84 mm) C-shaped member.~~
2. ~~Minimum 33-mil (0.84 mm) track section.~~
3. ~~Minimum $1^1/_2$-inch by 33-mil (38 mm by 0.84 mm) steel strap.~~

~~The bracing element shall be fastened to the bottom flange of each roof rafter with one No. 8 screw and shall be fastened to blocking with two No. 8 screws. Blocking shall be installed between roof rafters in line with the continuous bracing at a maximum spacing of 12 feet (3658 mm) measured perpendicular to the roof rafters. The ends of continuous bracing shall be fastened to blocking or anchored to a stable building component with two No. 8 screws.~~

~~**R804.3.3 Cutting and notching.** Flanges and lips of load-bearing, cold-formed steel roof framing members shall not be cut or notched.~~

~~**R804.3.4 Headers.** Roof-ceiling framing above wall openings shall be supported on headers. The allowable spans for headers in *load-bearing walls* shall not exceed the values set forth in Section R603.6 and Tables R603.6(1) through R603.6(6).~~

~~**R804.3.5 Framing of openings in roofs and ceilings.** Openings in roofs and ceilings shall be framed with header and trimmer joists. Header joist spans shall not exceed 4 feet (1219 mm) in length. Header and trimmer joists shall be fabricated from joist and track members having a minimum size and thickness equivalent to the adjacent ceiling joists or roof rafters and shall be installed in accordance with Figures R804.3.5(1) and R804.3.5(2). Each header joist shall be connected to trimmer joists with not less than four 2-inch by 2-inch (51 by 51 mm) clip angles. Each clip angle shall be fastened to both the header and trimmer joists with four No. 8 screws, evenly spaced, through each leg of the clip angle. The steel thickness of the clip angles shall be not less than that of the ceiling joist or roof rafter. Each track section for a built-up header or trimmer joist shall extend the full length of the joist (continuous).~~

~~**R804.3.6 Roof trusses.** Cold-formed steel trusses shall be designed and installed in accordance with AISI S230, Section F6. In the absence of specific bracing requirements, trusses shall be braced in accordance with accepted industry practices, such as the SBCA *Cold-Formed Steel Building Component Safety Information (CFSBCSI) Guide to Good Practice for Handling, Installing & Bracing of Cold-Formed Steel Trusses*. Trusses shall be connected to the top track of the *load-bearing wall* in accordance with Table R804.3, either with the required number of No. 10 screws applied through the flange of the truss or by using a 54-mil (1.37 mm) clip angle with the required number of No. 10 screws in each leg.~~

~~**R804.3.7 Ceiling and roof diaphragms.** Ceiling and roof diaphragms shall be in accordance with this section.~~

~~**R804.3.7.1 Ceiling diaphragms.** At gable endwalls a ceiling *diaphragm* shall be provided by attaching a minimum $^1/_2$-inch (12.7 mm) gypsum board or a minimum $^3/_8$-inch (9.5 mm) wood structural panel sheathing, that complies with Section R803, to the bottom of ceiling joists or roof trusses and connected to wall framing in accordance with Figures R804.3.7.1(1) and R804.3.7.1(2), unless studs are designed as full height without bracing at the ceiling. Flat blocking shall consist of C-shaped or track section with a minimum thickness of 33 mils (0.84 mm). For a gypsum board sheathed ceiling, the *diaphragm* length shall be in accordance with Table R804.3.7.1. For a wood structural panel sheathed ceiling, the *diaphragm* length shall be not less than 12 feet (3658 mm) for building widths less than 36 feet (10 973 mm), or not less than 14 feet (4267 mm) for building widths greater than or equal to 36 feet (10 973 mm).~~

~~The ceiling *diaphragm* shall be secured with screws spaced at a maximum 6 inches (152 mm) o.c. at panel edges and a maximum 12 inches (305 mm) o.c. in the field. The required lengths in Table R804.3.7.1 for gypsum board sheathed ceiling diaphragms shall be permitted to be multiplied by 0.35 if all panel edges are blocked. Multiplying the required lengths in Table R804.3.7.1 for gypsum board sheathed ceiling diaphragms by 0.9 shall be permitted if all panel edges are secured with screws spaced at 4 inches (102 mm) o.c.~~

~~TABLE R804.3.7.1~~

~~REQUIRED LENGTHS FOR CEILING DIAPHRAGMS AT GABLE ENDWALLS GYPSUM BOARD SHEATHED, CEILING HEIGHT = 8 FEET~~[a, b, c, d, e, f, g]

~~EXPOSURE CATEGORY~~	~~ULTIMATE DESIGN WIND SPEED (mph)~~					
~~B~~	~~115~~	~~120~~	~~130~~	~~≤ 140~~	—	—
~~C~~	—	—	~~115~~	~~120~~	~~130~~	~~≤ 140~~

~~Roof pitch~~	~~Building endwall width (feet)~~	~~Minimum diaphragm length (feet)~~					
~~3:12 to 6:12~~	~~24–28~~	~~16~~	~~18~~	~~24~~	~~26~~	~~30~~	~~34~~
	~~> 28–32~~	~~20~~	~~20~~	~~26~~	~~32~~	~~34~~	~~40~~
	~~> 32–36~~	~~24~~	~~26~~	~~30~~	~~36~~	~~42~~	~~46~~
	~~> 36–40~~	~~26~~	~~28~~	~~36~~	~~40~~	~~48~~	~~52~~
~~6:12 to 9:12~~	~~> 24–28~~	~~20~~	~~20~~	~~26~~	~~30~~	~~34~~	~~38~~
	~~> 28–32~~	~~24~~	~~26~~	~~30~~	~~36~~	~~42~~	~~46~~
	~~> 32–36~~	~~26~~	~~30~~	~~38~~	~~42~~	~~48~~	~~54~~
	~~> 36–40~~	~~30~~	~~34~~	~~40~~	~~50~~	~~56~~	~~62~~
~~9:12 to 12:12~~	~~> 24–28~~	~~22~~	~~24~~	~~30~~	~~34~~	~~38~~	~~44~~
	~~> 28–32~~	~~26~~	~~28~~	~~36~~	~~40~~	~~46~~	~~52~~
	~~> 32–36~~	~~30~~	~~32~~	~~40~~	~~48~~	~~54~~	~~62~~
	~~> 36–40~~	~~36~~	~~38~~	~~48~~	~~56~~	~~64~~	~~72~~

~~For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s, 1 foot = 304.8 mm, 1 mil = 0.0254 mm.~~

~~a. Ceiling diaphragm is composed of 1/2-inch gypsum board (min. thickness) secured with screws spaced at 6 inches o.c. at panel edges and 12 inches o.c. infield. Use No. 8 screws (min.) where framing members have a designation thickness of 54 mils or less and No. 10 screws (min.) where framing members have a designation thickness greater than 54 mils.~~

~~b. Maximum aspect ratio (length/width) of diaphragms is 2:1.~~

~~c. Building width is in the direction of horizontal framing members supported by the wall studs.~~

~~d. Required diaphragm lengths are to be provided at each end of the structure.~~

~~e. Multiplying required diaphragm lengths by 0.35 is permitted if all panel edges are blocked.~~

~~f. Multiplying required diaphragm lengths by 0.9 is permitted if all panel edges are secured with screws spaced at 4 inches o.c.~~

~~g. To determine the minimum diaphragm length for buildings with ceiling heights of 9 feet or 10 feet values in this table shall be multiplied by 1.15.~~

~~**R804.3.7.2 Roof diaphragm.** A roof *diaphragm* shall be provided by attaching not less than 3/8-inch (9.5 mm) *wood structural panel* that complies with Section R803 to roof rafters or truss top chords in accordance with Table R804.3. Buildings with 3:1 or larger plan *aspect ratio* and with roof rafter slope (pitch) of 9:12 or larger shall have the roof rafters and ceiling joists blocked in accordance with Figure R804.3.7.2.~~

~~**R804.3.8 Roof tie-down.** *Roof assemblies* shall be connected to walls below in accordance with Table R804.3. A continuous load path shall be provided to transfer uplift loads to the foundation.~~

R806.2 Minimum vent area. ~~The minimum net free ventilating area shall be 1/150 of the area of the vented space.~~

~~**Exception:** The minimum net free ventilation area shall be 1/300 of the vented space provided both of the following conditions are met:~~

1. <u>Deleted.</u> ~~In Climate Zones 6, 7 and 8, a Class I or II vapor retarder is installed on the warm-in-winter side of the ceiling.~~
2. ~~Not less than 40 percent and not more than 50 percent of the required ventilating area is provided by ventilators located in the upper portion of the attic or rafter space. Upper ventilators shall be located not more than 3 feet (914 mm) below the ridge or highest point of the space, measured vertically. The balance of the required *ventilation* provided shall be located in the bottom one third of the attic space. Where the location of wall or roof framing members conflicts with the installation of upper ventilators, installation more than 3 feet (914 mm) below the ridge or highest point of the space shall be permitted.~~

The total net free ventilating area shall not be less than 1/150 of the area of the space ventilated except that reduction of the total area to 1/300 is permitted provided that at least 50 percent and not more than 80 percent of the required ventilating area is provided by ventilators located in the upper portion of the space to be ventilated at least 3 feet (914 mm) above the eave or cornice vents, with the balance of the required ventilation provided by eave or cornice vents. As an alternative, the net free cross-ventilation area may be reduced to 1/300 when a Class I or II vapor retarder is installed on the warm-in-winter side of the ceiling.

Exceptions:

1. Enclosed attic/rafter spaces requiring less than 1 square foot (0.0929 m^2) of ventilation may be vented with continuous soffit ventilation only.
2. Enclosed attic/rafter spaces over unconditioned space may be vented with continuous soffit vent only.

R806.5 Unvented attic and unvented enclosed rafter assemblies. Unvented *attics* and unvented enclosed roof framing assemblies created by ceilings that are applied directly to the underside of the roof framing members and structural roof sheathing applied directly to the top of the roof framing members/rafters, shall be permitted where all the following conditions are met:

1. The unvented *attic* space is completely within the *building thermal envelope*.
2. Interior Class I vapor retarders are not installed on the ceiling side (*attic* floor) of the unvented *attic* assembly or on the ceiling side of the unvented enclosed roof framing assembly.
3. Where wood shingles or shakes are used, a minimum $^1/_4$-inch (6.4 mm) vented airspace separates the shingles or shakes and the roofing underlayment above the structural sheathing.
4. In Climate Zones 5, ~~6, 7 and 8,~~ any *air-impermeable insulation* shall be a Class II vapor retarder, or shall have a Class II vapor retarder coating or covering in direct contact with the underside of the insulation.
5. Insulation shall comply with Item 5.3 and either Item 5.1 or 5.2:
   - 5.1. Item 5.1.1, 5.1.2, 5.1.3 or 5.1.4 shall be met, depending on the air permeability of the insulation directly under the structural roof sheathing.
     - 5.1.1. Where only *air-impermeable insulation* is provided, it shall be applied in direct contact with the underside of the structural roof sheathing.
     - 5.1.2. Where *air-permeable insulation* is installed directly below the structural sheathing, rigid board or sheet insulation shall be installed directly above the structural roof sheathing in accordance with the *R*-values in Table R806.5 for condensation control.
     - 5.1.3. Where both *air-impermeable* and *air-permeable insulation* are provided, the *air-impermeable insulation* shall be applied in direct contact with the underside of the structural roof sheathing in accordance with Item 5.1.1 and shall be in accordance with the *R*-values in Table R806.5 for condensation control. The *air-permeable insulation* shall be installed directly under the *air-impermeable insulation*.
     - 5.1.4. Alternatively, sufficient rigid board or sheet insulation shall be installed directly above the structural roof sheathing to maintain the monthly average temperature of the underside of the structural roof sheathing above 45°F (7°C). For calculation purposes, an interior air temperature of 68°F (20°C) is assumed and the exterior air temperature is assumed to be the monthly average outside air temperature of the three coldest months.
   - 5.2. In Climate Zones 1, 2 and 3, air-permeable insulation installed in unvented *attics* shall meet the following requirements:
     - 5.2.1. An approved *vapor diffusion port* shall be installed not more than 12 inches (305 mm) from the highest point of the roof, measured vertically from the highest point of the roof to the lower edge of the port.
     - 5.2.2. The port area shall be greater than or equal to 1:600 of the ceiling area. Where there are multiple ports in the attic, the sum of the port areas shall be greater than or equal to the area requirement.

5.2.3. The vapor-permeable membrane in the *vapor diffusion port* shall have a vapor permeance rating of greater than or equal to 20 perms when tested in accordance with Procedure A of ASTM E96.

5.2.4. The *vapor diffusion port* shall serve as an air barrier between the *attic* and the exterior of the building.

5.2.5. The *vapor diffusion port* shall protect the *attic* against the entrance of rain and snow.

5.2.6. Framing members and blocking shall not block the free flow of water vapor to the port. Not less than a 2-inch (51 mm) space shall be provided between any blocking and the roof sheathing. Air-permeable insulation shall be permitted within that space.

5.2.7. The roof slope shall be greater than or equal to 3:12 (vertical/horizontal).

5.2.8. Where only air-permeable insulation is used, it shall be installed directly below the structural roof sheathing, on top of the attic floor, or on top of the ceiling.

5.2.9. *Air-impermeable insulation*, where used in conjunction with air-permeable insulation, shall be directly above or below the structural roof sheathing and is not required to meet the *R*-value in Table R806.5. Where directly below the structural roof sheathing, there shall be no space between the *air-impermeable insulation* and air-permeable insulation.

5.2.10. Where air-permeable insulation is used and is installed directly below the roof structural sheathing, air shall be supplied at a flow rate greater than or equal to 50 CFM (23.6 L/s) per 1,000 square feet (93 m^2) of ceiling. The air shall be supplied from ductwork providing supply air to the occupiable space when the conditioning system is operating. Alternatively, the air shall be supplied by a supply fan when the conditioning system is operating.

Exceptions:

1. Where both air-impermeable and air-permeable insulation are used, and the *R*-value in Table 806.5 is met, air supply to the attic is not required.
2. Where only air-permeable insulation is used and is installed on top of the attic floor, or on top of the ceiling, air supply to the attic is not required.

5.3. Where preformed insulation board is used as the air-impermeable insulation layer, it shall be sealed at the perimeter of each individual sheet interior surface to form a continuous layer.

TABLE R806.5

INSULATION FOR CONDENSATION CONTROL

CLIMATE ZONE	MINIMUM RIGID BOARD ON AIR-IMPERMEABLE INSULATION *R*-VALUE[a, b]
~~2B and 3B tile roof only~~	~~0 (none required)~~
~~1, 2A, 2B,~~ 3A~~, 3B, 3C~~	R-5
~~4C~~	~~R-10~~
4A~~, 4B~~	R-15
5	R-20
~~6~~	~~R-25~~
~~7~~	~~R-30~~
~~8~~	~~R-35~~

a. Contributes to but does not supersede the requirements in Section N1102.

b. Alternatively, sufficient continuous insulation shall be installed directly above the structural roof sheathing to maintain the monthly average temperature of the underside of the structural roof sheathing above 45°F (7°C). For calculation purposes, an interior air temperature of 68°F (20°C) is assumed and the exterior air temperature is assumed to be the monthly average outside air temperature of the three coldest months.

SECTION R807
ATTIC ACCESS

R807.1 Attic access. ~~Buildings with combustible ceiling or roof construction shall have an attic access opening to attic areas that have a vertical height of 30 inches (762 mm) or greater over an area of not less than 30 square feet (2.8 m^2). The vertical height shall be measured from the top of the ceiling framing members to the underside of the roof framing members.~~

~~The rough-framed opening shall be not less than 22 inches by 30 inches (559 mm by 762 mm) and shall be located in a hallway or other location with *ready access*. Where located in a wall, the opening shall be not less than 22 inches wide by 30 inches high (559 mm wide by 762 mm high). Where the access is located in a ceiling, minimum unobstructed headroom in the attic space shall be 30 inches (762 mm) at some point above the access measured vertically from the bottom of ceiling framing members. See Section M1305.1.2 for access requirements where mechanical *equipment* is located in *attics*.~~

An attic access opening shall be provided to attic areas that exceed 400 square feet (37.16 m2) and have a vertical height of 60 inches (1524 mm) or greater. The net clear opening shall not be less than 20 inches by 30 inches (508 mm by 762 mm) and shall be located in a hallway or other readily accessible location. A 30-inch (762 mm) minimum unobstructed headroom in the attic space shall be provided at some point above the access opening. See Section M1305.1.2 for access requirements where mechanical equipment is located in attics.

Exceptions:

1. Concealed areas not located over the main structure including porches, areas behind knee walls, dormers, bay windows, etc. are not required to have access.
2. Pull down stair treads, stringers, handrails, and hardware may protrude into the net clear opening.

CHAPTER 9
ROOF ASSEMBLIES

~~**User note:**~~

~~***About this chapter:*** *Chapter 9 addresses the design and construction of roof assemblies. A roof assembly includes the roof deck, substrate or thermal barrier, insulation, vapor retarder and roof covering. This chapter provides the requirement for wind resistance of roof coverings. The types of roof covering materials and installation addressed by Chapter 9 are: asphalt shingles, clay and concrete tile, metal roof shingles, mineral-surfaced roll roofing, slate and slate-type shingles, wood shakes and shingles, built-up roofs, metal roof panels, modified bitumen roofing, thermoset and thermoplastic single-ply roofing, sprayed polyurethane foam roofing, liquid applied coatings and photovoltaic shingles. Chapter 9 also provides requirements for roof drainage, flashing, above-deck thermal insulation, rooftop-mounted photovoltaic systems and recovering or replacing an existing roof covering.*~~

R903.3 Coping. Parapet walls shall be properly coped with noncombustible, weatherproof materials of a width not less than the thickness of the parapet wall. Parapet coping shall extend 2 inches (51 mm) minimum down the faces of the parapet.

TABLE R905.1.1(1)
UNDERLAYMENT TYPES

ROOF COVERING	SECTION	**MAXIMUM ULTIMATE DESIGN WIND SPEED, Vult < 130 MPH** ~~**AREAS WHERE WIND DESIGN IS NOT REQUIRED IN ACCORDANCE WITH FIGURE R301.2.1.1 Table 301.2(4) and Table 301.2(5)**~~	~~**AREAS WHERE WIND DESIGN IS REQUIRED IN ACCORDANCE WITH FIGURE R301.2.1.1 Table 301.2(4) and Table 301.2(5)**~~
Asphalt shingles	R905.2	ASTM D226 Type I or II ASTM D48696 Type I, II, III or IV ASTM D6757	~~ASTM D226 Type II~~ ~~ASTM D4869 Type III or Type IV~~
Clay and concrete tile	R905.3	ASTM D226 Type II ASTM D2626 Type I ASTM D6380 Class M mineral-surfaced roll roofing	~~ASTM D226 Type II~~
Metal roof shingles	R905.4	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV	~~ASTM D226 Type II~~ ~~ASTM D4869 Type III or Type IV~~
Mineral-surfaced roll roofing	R905.5	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV	~~ASTM D226 Type II~~ ~~ASTM D4869 Type III or Type IV~~
Slate and slate-type shingles	R905.6	ASTM D226 Type I ASTM D4869 Type I, II, III or IV	~~ASTM D226 Type II~~ ~~ASTM D4869 Type III or Type IV~~
Wood shingles	R905.7	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV	~~ASTM D226 Type II~~ ~~ASTM D4869 Type III or Type IV~~
Wood shakes	R905.8	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV	~~ASTM D226 Type II~~ ~~ASTM D4869 Type III or Type IV~~
Metal panels	R905.10	Manufacturer's instructions	~~ASTM D226 Type II~~ ~~ASTM D4869 Type III or Type IV~~
Photovoltaic shingles	R905.16	ASTM D4869 Type I, II, III or IV ASTM D6757	~~ASTM D4869 Type III or Type IV~~

For SI: 1 mile per hour = 0.447 m/s.

TABLE R905.1.1(2)
UNDERLAYMENT APPLICATION

ROOF COVERING	SECTION	MAXIMUM ULTIMATE DESIGN WIND SPEED, Vult < 130 MPH ~~AREAS WHERE WIND DESIGN IS NOT REQUIRED IN ACCORDANCE WITH FIGURE R301.2.1.1 Table 301.2(4) and Table 301.2(5)~~	~~AREAS WHERE WIND DESIGN IS REQUIRED IN ACCORDANCE WITH FIGURE R301.2.1.1 Table 301.2(4) and Table 301.2(5)~~
Asphalt shingles	R905.2	For roof slopes from 2 units vertical in 12 units horizontal (2:12), up to 4 units vertical in 12 units horizontal (4:12), underlayment shall be two layers applied in the following manner: apply a 19-inch strip of underlayment felt parallel to and starting at the eaves. Starting at the eave, apply 36-inch-wide sheets of underlayment, overlapping successive sheets 19 inches. Distortions in the underlayment shall not interfere with the ability of the shingles to seal. End laps shall be 4 inches and shall be offset by 6 feet. For roof slopes of 4 units vertical in 12 units horizontal (4:12) or greater, underlayment shall be one layer applied in the following manner: underlayment shall be applied shingle fashion, parallel to and starting from the eave and lapped 2 inches, Distortions in the underlayment shall not interfere with the ability of the shingles to seal. End laps shall be 4 inches and shall be offset by 6 feet.	~~Underlayment shall be two layers applied in the following manner: apply a 19-inch strip of underlayment felt parallel to and starting at the eaves. Starting at the eave, apply 36-inch-wide sheets of underlayment, overlapping successive sheets 19 inches. Distortions in the underlayment shall not interfere with the ability of the shingles to seal. End laps shall be 4 inches and shall be offset by 6 feet.~~
Clay and concrete tile	R905.3	For roof slopes from $2^{1}/_{2}$ units vertical in 12 units horizontal ($2^{1}/_{2}$:12), up to 4 units vertical in 12 units horizontal (4:12), underlayment shall be not fewer than two layers applied as follows: starting at the eave, apply a 19-inch strip of underlayment parallel with the eave. Starting at the eave, apply 36-inch-wide strips of underlayment felt, overlapping successive sheets 19 inches. End laps shall be 4 inches and shall be offset by 6 feet. For roof slopes of 4 units vertical in 12 units horizontal (4:12) or greater, underlayment shall be not fewer than one layer of underlayment felt applied shingle fashion, parallel to and starting from the eaves and lapped 2 inches. End laps shall be 4 inches and shall be offset by 6 feet.	~~Underlayment shall be two layers applied in the following manner: apply a 19-inch strip of underlayment felt parallel to and starting at the eaves. Starting at the eave, apply 36-inch-wide sheets of underlayment, overlapping successive sheets 19 inches. Distortions in the underlayment shall not interfere with the ability of the shingles to seal. End laps shall be 4 inches and shall be offset by 6 feet.~~
Metal roof shingles	R905.4	Apply in accordance with the manufacturer's installation instructions.	~~Underlayment shall be two layers applied in the following manner: apply a 19-inch strip of underlayment felt parallel to and starting at the eaves. Starting at the eave, apply 36-inch-wide sheets of underlayment, overlapping successive sheets 19 inches. End laps shall be 4 inches and shall be offset by 6 feet.~~
Mineral-surfaced roll roofing	R905.5		
Slate and slate-type shingles	R905.6		
Wood shingles	R905.7		
Wood shakes	R905.8		
Metal panels	R905.10		

Photovoltaic shingles	R905.16	For roof slopes from 2 units vertical in 12 units horizontal (2:12), up to 4 units vertical in 12 units horizontal (4:12), underlayment shall be two layers applied in the following manner: apply a 19-inch strip of underlayment felt parallel to and starting at the eaves. Starting at the eave, apply 36-inch-wide sheets of underlayment, overlapping successive sheets 19 inches. Distortions in the underlayment shall not interfere with the ability of the shingles to seal. End laps shall be 4 inches and shall be offset by 6 feet. For roof slopes of 4 units vertical in 12 units horizontal (4:12) or greater, underlayment shall be one layer applied in the following manner: underlayment shall be applied shingle fashion, parallel to and starting from the eave and lapped 2 inches. Distortions in the underlayment shall not interfere with the ability of the shingles to seal. End laps shall be 4 inches and shall be offset by 6 feet.	~~Underlayment shall be two layers applied in the following manner: apply a 19-inch strip of underlayment felt parallel to and starting at the eaves. Starting at the eave, apply 36-inch-wide sheets of underlayment, overlapping successive sheets 19 inches. Distortions in the underlayment shall not interfere with the ability of the shingles to seal. End laps shall be 4 inches and shall be offset by 6 feet.~~

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s.

TABLE R905.1.1(3)

UNDERLAYMENT APPLICATION

ROOF COVERING	SECTION	**MAXIMUM ULTIMATE DESIGN WIND SPEED, Vult < 130 MPH** ~~AREAS WHERE WIND DESIGN IS NOT REQUIRED IN ACCORDANCE WITH FIGURE R301.2.1.1 Table 301.2(4) and Table 301.2(5)~~	~~AREAS WHERE WIND DESIGN IS REQUIRED IN ACCORDANCE WITH FIGURE R301.2.1.1 Table 301.2(4) and Table 301.2(5)~~
Asphalt shingles	R905.2	Fastened sufficiently to hold in place	~~The underlayment shall be attached with corrosion-resistant fasteners in a grid pattern of 12 inches between side laps with a 6-inch spacing at side and end laps. Underlayment shall be attached using annular ring or deformed shank nails with 1-inch-diameter metal or plastic caps. Metal caps shall have a thickness of not less than 32-gage sheet metal. Power-driven metal caps shall have a minimum thickness of 0.010 inch. Minimum thickness of the outside edge of plastic caps shall be 0.035 inch. The cap nail shank shall be not less than 0.083 inch. The cap nail shank shall have a length sufficient to penetrate through the roof sheathing or not less than~~ ~~$^3/_4$ inch into the roof sheathing.~~
Clay and concrete tile	R905.3		
Photovoltaic	R905.16		
Metal roof shingles	R905.4	Manufacturer's installation instructions.	~~The underlayment shall be attached with corrosion-resistant fasteners in a grid pattern of 12 inches between side laps with a 6-inch spacing at side and end laps. Underlayment shall be attached using annular ring or deformed shank nails with 1-inch-diameter metal or plastic caps. Metal caps shall have a thickness of not less than 32-gage sheet metal. Power-driven metal caps shall~~
Mineral-surfaced roll roofing	R905.5		
Slate and slate-type shingles	R905.6		
Wood shingles	R905.7		
Wood shakes	R905.8		

Metal panels	R905.10		~~have a minimum thickness of 0.010 inch. Minimum thickness of the outside edge of plastic caps shall be 0.035 inch. The cap nail shank shall be not less than 0.083 inch. The cap nail shank shall have a length sufficient to penetrate through the roof sheathing or not less than 3/4 inch into the roof sheathing.~~

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.

R905.1.2 Ice barriers. In areas where ~~there has been a history of ice forming along the eaves causing a backup of water as designated in Table R301.2~~, the average daily temperature in January is 25°F (-4° C) or less or when Table R301.2(1) criteria so designates, an ice barrier shall be installed for asphalt shingles, metal roof shingles, mineral-surfaced roll roofing, slate and slate-type shingles, wood shingles and wood shakes. The ice barrier shall consist of not fewer than two layers of *underlayment* cemented together, or a self-adhering polymer-modified bitumen sheet shall be used in place of normal *underlayment* and extend from the lowest edges of all roof surfaces to a point not less than 24 inches (610 mm) inside the exterior wall line of the building. On roofs with slope equal to or greater than 8 units vertical in 12 units horizontal (67-percent slope), the ice barrier shall also be applied not less than 36 inches (914 mm) measured along the roof slope from the eave edge of the building.

Exception: Detached *accessory structures* not containing conditioned floor area.

R905.2.6 Attachment. Asphalt shingles shall have the minimum number of fasteners required by the manufacturer's *approved* installation instructions, but not less than four fasteners per strip shingle or two fasteners per individual shingle. Where the roof slope exceeds 21 units vertical in 12 units horizontal (21:12, 175-percent slope), shingles shall be installed in accordance with the manufacturer's *approved* installation instructions.

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

1. The ultimate wind speed in accordance with Table R301.2(4) is 130 miles per hour (58 m/s) or greater and the eave is 20 feet (6096 mm) or higher above grade.
2. The ultimate wind speed in accordance with Table R301.2(4) is 140 miles per hour (63 m/s) or greater.
3. Special mountain regions in accordance with Table R301.2(5) that meet Items 1 or 2 in this section.
4. **R905.2.8.3 Sidewall flashing.** Base flashing against a vertical sidewall shall be continuous at horizontal surfaces or step flashing at sloped surfaces and shall be not less than 4 inches (102 mm) in height and 4 inches (102 mm) in width and shall direct water away from the vertical sidewall onto the roof or into the gutter. Where siding is provided on the vertical sidewall, the vertical leg of the flashing shall be continuous under the siding. Where anchored masonry veneer is provided on the vertical sidewall, the base flashing shall be provided in accordance with this section and counterflashing shall be provided in accordance with Section R703.8.2.2. Where exterior plaster or adhered masonry veneer is provided on the vertical sidewall, the base flashing shall be provided in accordance with this section and Section ~~R703.6.3~~ R703.8.5.

R905.2.8.5 Drip edge. ~~A drip edge shall be provided at eaves and rake edges of shingle roofs. Adjacent segments of drip edge shall be overlapped not less than 2 inches (51 mm). Drip edges shall extend not less than 1/4 inch (6.4 mm) below the roof sheathing and extend up back onto the *roof deck* not less than 2 inches (51 mm). Drip edges shall be mechanically fastened to the *roof deck* at not more than 12 inches (305 mm) o.c. with fasteners as specified in Section R905.2.5. *Underlayment* shall be installed over the drip edge along eaves and under the drip edge along rake edges.~~

Not required unless required by the roof covering manufacturer installation instructions. The drip edge placed around the edge of a roof prior to installing the roofing material shall be designed so that water runs off over the drip edge and falls from a slight projection at the bottom edge of the roof rather than running back under, or along the eaves. Metal, wood or exterior composite materials can be used for the drip edge.

TABLE R905.4.4.1
CLASSIFICATION OF STEEP SLOPE METAL ROOF SHINGLES TESTED IN ACCORDANCE WITH ASTM D3161

MAXIMUM ULTIMATE DESIGN WIND SPEED, V_{ult}, FROM ~~FIGURE R301.2(2)~~ Table 301.2(4) and Table 301.2(5) (mph)	~~MAXIMUM BASIC WIND SPEED, V_{ASD}, FROM TABLE R301.2.1.3 (mph)~~	ASTM D3161 SHINGLE CLASSIFICATION
110	~~85~~	A, D or F
116	~~90~~	A, D or F
129	~~100~~	A, D or F
142	~~110~~	F
155	~~120~~	F
168	~~130~~	F
181	~~140~~	F
194	~~150~~	F

For SI: 1 mile per hour = 1.609 kph.

TABLE R905.16.6
CLASSIFICATION OF PHOTOVOLTAIC SHINGLES

MAXIMUM ULTIMATE DESIGN WIND SPEED, V_{ult}, FROM FIGURE R301.2(2) (mph)	MAXIMUM BASIC WIND SPEED, V_{ASD}, FROM TABLE R301.2.1.3 (mph)	UL 7103 SHINGLE CLASSIFICATION
110	85	A, D or F
116	90	A, D or F
129	100	A, D or F
~~142~~	~~110~~	~~F~~
~~155~~	~~120~~	~~F~~
~~168~~	~~130~~	~~F~~
~~181~~	~~140~~	~~F~~
~~194~~	~~150~~	~~F~~

For SI: 1 mile per hour = 1.609 kph.

R908.3 Roof replacement. *Roof replacement* shall include the removal of existing layers of roof coverings down to the *roof deck*. and replacement of up to 15% of the total existing roof deck. Replacement of up to 15% of the total roof deck shall not be considered structural work.

CHAPTER 10
CHIMNEYS AND FIREPLACES

~~**User note:**~~

~~***About this chapter:*** Chapter 10 contains requirements for the construction, seismic reinforcing and anchorage of masonry chimneys and fireplaces; and establishes standards for the use and installation of factory-built chimneys, fireplaces and masonry heaters. Chimneys and fireplaces constructed of masonry rely on prescriptive requirements for the details of their construction; factory-built versions rely on the listing and labeling method of approval.~~

R1001.3 Seismic reinforcing. Deleted. ~~Masonry or concrete chimneys in Seismic Design Category D_0, D_1 or D_2 shall be reinforced. Reinforcing shall conform to the requirements set forth in Table R1001.1 and Section R606.~~

TABLE R1001.1
SUMMARY OF REQUIREMENTS FOR MASONRY FIREPLACES AND CHIMNEYS

ITEM	LETTER[a]	REQUIREMENTS
Hearth slab thickness	A	4 inches
Hearth extension (each side of opening)	B	8-inch fireplace opening < 6 square feet. 12-inch fireplace opening ≥ 6 square feet.
Hearth extension (front of opening)	C	16-inch fireplace opening < 6 square feet. 20-inch fireplace opening ≥ 6 square feet.
Hearth slab reinforcing	D	Reinforced to carry its own weight and all imposed loads.
Thickness of wall of firebox	E	10-inch solid brick or 8 inches where a firebrick lining is used. Joints in firebrick $^1/_4$-inch maximum.
Distance from top of opening to throat	F	8 inches
Smoke chamber wall thickness Unlined walls	G	6 inches 8 inches
Chimney Vertical reinforcing[b]	H	Four No. 4 full-length bars for chimney up to 40 inches wide. Add two No. 4 bars for each additional 40 inches or fraction of width or each additional flue.
Horizontal reinforcing	J	$^1/_4$-inch ties at 18 inches and two ties at each bend in vertical steel.
Bond beams	K	No specified requirements.
Fireplace lintel	L	Noncombustible material.
Chimney walls with flue lining	M	Solid masonry units or hollow masonry units grouted solid with not less than 4-inch nominal thickness.
Distances between adjacent flues	—	See Section R1003.13.
Effective flue area (based on area of fireplace opening)	P	See Section R1003.15.
Clearances Combustible material Mantel and *trim* Above roof	R	 See Sections R1001.11 and R1003.18. See Section R1001.11, Exception 4. 3 feet at roofline and 2 feet at 10 feet.
Anchorage[b] Strap Number Embedment into chimney Fasten to Bolts	S	 $^3/_{16}$-inch × 1-inch Two 12 inches hooked around outer bar with 6-inch extension. 4 joists ~~Two~~ Three $^1/_2$-inch diameter.

Footing		
Thickness	T	12 inches min.
Width		~~6~~ 12 inches each side of fireplace wall.

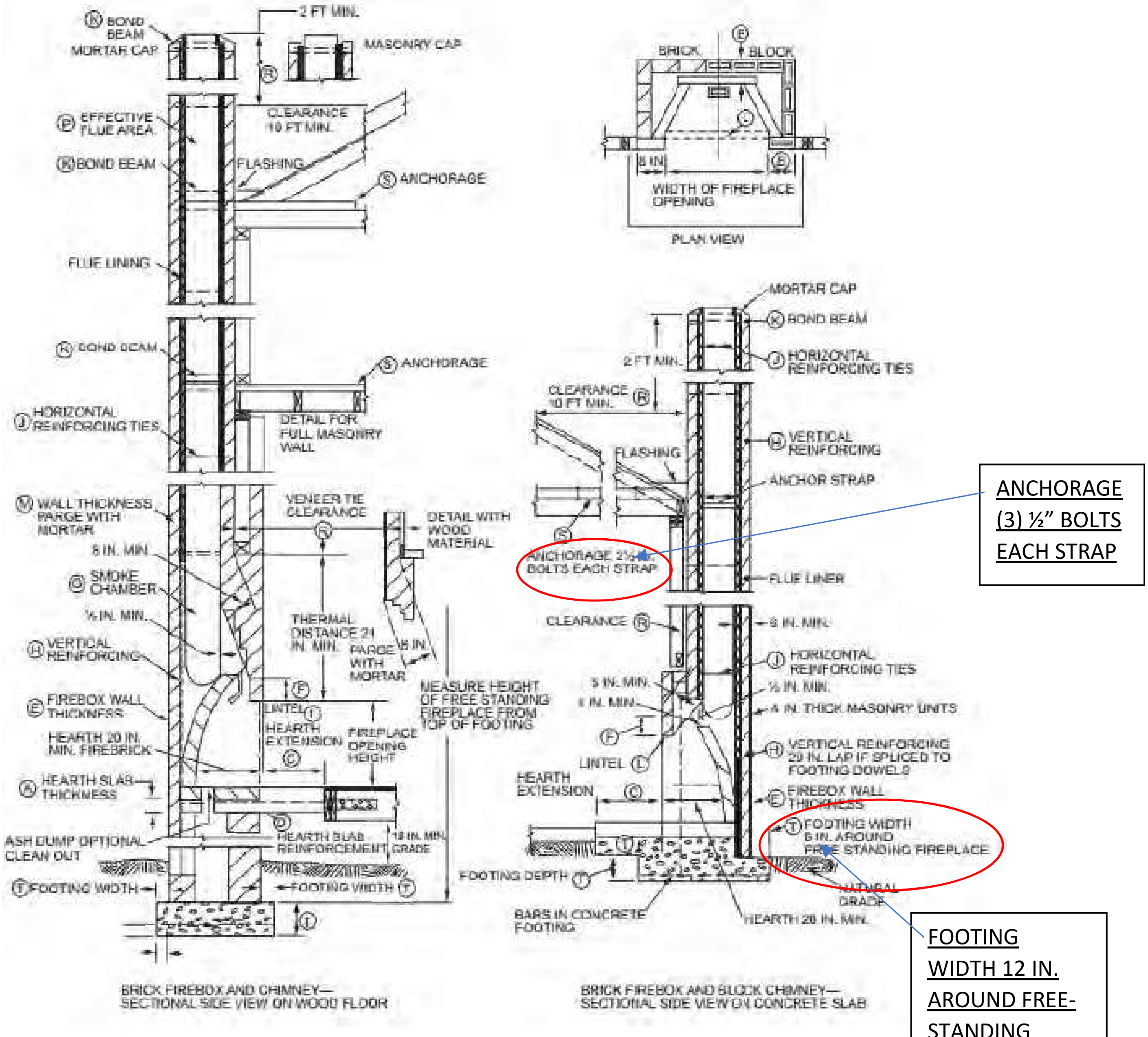
For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 square foot = 0.0929 m^2.

Note: This table provides a summary of major requirements for the construction of masonry chimneys and fireplaces. Letter references are to Figure R1001.1, which shows examples of typical construction. This table does not cover all requirements, nor does it cover all aspects of the indicated requirements. For the actual mandatory requirements of the code, see the indicated section of text.

a. The letters refer to Figure R1001.1.

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

R1002.4 Seismic reinforcing. Deleted. ~~In *Seismic Design Categories* D_0, D_1 and D_2, *masonry heaters* shall be anchored to the masonry foundation in accordance with Section R1003.3. Seismic reinforcing shall not be required within the body of a *masonry heater* whose height is equal to or less than 3.5 times its body width and where the *masonry chimney* serving the heater is not supported by the body of the heater. Where the *masonry chimney* shares a common wall with the facing of the *masonry heater*, the chimney portion of the structure shall be reinforced in accordance with Section R1003.~~



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

FIGURE R1001.1
FIREPLACE AND CHIMNEY DETAILS

~~**R1001.3.1 Vertical reinforcing.** For chimneys up to 40 inches (1016 mm) wide, four No. 4 continuous vertical bars shall be placed between wythes of *solid masonry* or within the cells of hollow unit masonry and grouted in accordance with Section R606. Grout shall be prevented from bonding with the flue liner so that the flue liner is free to move with thermal expansion. For chimneys more than 40 inches (1016 mm) wide, two additional No. 4 vertical bars shall be provided for each additional flue incorporated into the chimney or for each additional 40 inches (1016 mm) in width or fraction thereof.~~

~~**R1001.3.2 Horizontal reinforcing.** Vertical reinforcement shall be placed within $^1/_4$-inch (6.4 mm) ties, or other reinforcing of equivalent net cross-sectional area, placed in the bed joints in accordance with Section R606 at not~~

~~less than every 18 inches (457 mm) of vertical height. Two such ties shall be installed at each bend in the vertical bars~~.

R1001.4 Seismic anchorage. Deleted. ~~Masonry or concrete chimneys in Seismic Design Category D_0, D_1 or D_2 shall be anchored at each floor, ceiling or roof line more than 6 feet (1829 mm) above *grade*, except where constructed completely within the exterior walls. Anchorage shall conform to the requirements of Section R1001.4.1.~~

~~**R1001.4.1 Anchorage.** Two $^{3}/_{16}$-inch by 1-inch (5 mm by 25 mm) straps shall be embedded not less than 12 inches (305 mm) into the chimney. Straps shall be hooked around the outer bars and extend 6 inches (152 mm) beyond the bend. Each strap shall be fastened to not less than four floor ceiling or floor joists or rafters with two $^{1}/_{2}$-inch (12.7 mm) bolts.~~

~~**R1001.4.1.1 Cold-formed steel framing.** Where cold-formed steel framing is used, the location where the $^{1}/_{2}$-inch (12.7 mm) bolts are used to attach the straps to the framing shall be reinforced with not less than a 3-inch × 3-inch × 0.229-inch (76 mm × 76 mm × 5.8 mm) steel plate on top of the strap that is screwed to the framing with not fewer than seven No. 6 screws for each bolt.~~

R1003.3 Seismic reinforcing. Masonry or concrete chimneys shall be constructed, anchored, supported and reinforced as required in this chapter. ~~In Seismic Design Category D_0, D_1 or D_2 masonry and concrete chimneys shall be reinforced and anchored as detailed in Sections R1003.3.1, R1003.3.2 and R1003.4.~~ In Seismic Design Category A, B or C, reinforcement and seismic anchorage are not required.

R1003.3.1 Vertical reinforcing. Deleted. ~~For chimneys up to 40 inches (1016 mm) wide, four No. 4 continuous vertical bars, anchored in the foundation, shall be placed in the concrete, or between wythes of *solid masonry*, or within the cells of hollow unit masonry, and grouted in accordance with Section R608.1.1. Grout shall be prevented from bonding with the flue liner so that the flue liner is free to move with thermal expansion. For chimneys more than 40 inches (1016 mm) wide, two additional No. 4 vertical bars shall be installed for each additional 40 inches (1016 mm) in width or fraction thereof.~~

R1003.3.2 Horizontal reinforcing. Deleted. ~~Vertical reinforcement shall be placed enclosed within $^{1}/_{4}$-inch (6.4 mm) ties, or other reinforcing of equivalent net cross-sectional area, spaced not to exceed 18 inches (457 mm) on center in concrete, or placed in the bed joints of unit masonry, at not less than every 18 inches (457 mm) of vertical height. Two such ties shall be installed at each bend in the vertical bars.~~

R1003.4 Seismic anchorage. Deleted. ~~Masonry and concrete chimneys and foundations in Seismic Design Category D_0, D_1 or D_2 shall be anchored at each floor, ceiling or roof line more than 6 feet (1829 mm) above *grade*, except where constructed completely within the exterior walls. Anchorage shall conform to the requirements in Section R1003.4.1.~~

~~**R1003.4.1 Anchorage.** Two $^{3}/_{16}$-inch by 1-inch (5 mm by 25 mm) straps shall be embedded not less than 12 inches (305 mm) into the chimney. Straps shall be hooked around the outer bars and extend 6 inches (152 mm) beyond the bend. Each strap shall be fastened to not less than four floor joists with two $^{1}/_{2}$-inch (12.7 mm) bolts.~~

~~**R1003.4.1.1 Cold-formed steel framing.** Where cold-formed steel framing is used, the location where the $^{1}/_{2}$-inch (12.7 mm) bolts are used to attach the straps to the framing shall be reinforced with not less than a 3-inch × 3-inch × 0.229-inch (76 mm × 76 mm × 5.8 mm) steel plate on top of a strap that is screwed to the framing with not fewer than seven No. 6 screws for each bolt.~~

CHAPTER 25
PLUMBING ADMINISTRATION

~~User notes:~~

~~***About this chapter:*** *Chapter 25 covers regulations for existing plumbing installations and testing of new or repaired systems. These general requirements can be superseded by more specific requirements for certain applications in Chapters 26 through 33.*~~

~~**Code development reminder:** Code change proposals to this chapter will be considered by the IRC — Mechanical/Plumbing Code Development Committee during the 2021 (Group A) Code Development Cycle.~~ The text of this chapter is extracted from the 2024 edition of the *North Carolina Plumbing Code* and has been modified where necessary to conform to the scope of application of the *North Carolina Residential Code for One- and Two-Family Dwellings*.

SECTION P2501
GENERAL

~~**P2501.1 Scope.** The provisions of this chapter shall establish the general administrative requirements applicable to plumbing systems and inspection requirements of this code.~~ **P2501.1 Scope.** The provisions of Chapters 25 through 33 of this code shall apply to the erection, installation, alteration, repairs, relocation, replacement, addition to, use or maintenance of plumbing systems within this jurisdiction. The installation of fuel gas distribution piping and equipment, fuel-gas-fired water heaters and water heater venting systems shall be regulated by the *International Fuel Gas Code*. Provisions in the appendices shall not apply unless specifically adopted.

P2501.3 Intent. The purpose of this code is to establish minimum standards to provide a reasonable level of safety, health, property protection and public welfare by regulating and controlling the design, construction, installation, quality of materials, location, operation and maintenance or use of plumbing equipment and systems.

P2501.4 Severability. If any section, subsection, sentence, clause or phrase of this code is for any reason held to be unconstitutional, such decision shall not affect the validity of the remaining portions of this code.

P2501.5 Appendices. Provisions in the appendices shall not apply unless specifically adopted or referenced in this code.

P2501.6 Requirements of other State agencies, occupational licensing board or commissions. The North Carolina State Building Codes do not include all additional requirements for buildings and structures that may be imposed by other State agencies, occupational licensing boards and commissions. It shall be the responsibility of a permit holder, design professional, contractor or occupational license holder to determine whether any additional requirements exist.

SECTION P2502
EXISTING PLUMBING SYSTEMS

~~**P2502.1 Existing building sewers and building drains.** Where the entire sanitary drainage system of an existing building is replaced, existing *building drains* under concrete slabs and existing *building sewers* that will serve the new system shall be internally examined to verify that the piping is sloping in the correct direction, is not broken, is not obstructed and is sized for the drainage load of the new plumbing drainage system to be installed.~~

P2502.1 Existing building sewers and building drains. Plumbing systems lawfully in existence at the time of the adoption of this code shall be permitted to have their use and maintenance continued if the use, maintenance or repair is in accordance with the original design; and if hazard to life, health or property is not created by such plumbing system.

P2502.3 Change in occupancy. It shall be unlawful to make any change in the *occupancy* of any structure that will subject the structure to any special provision of this code applicable to the new *occupancy* without approval of the code official. The code official shall certify that such structure meets the intent of the provisions of law governing building construction for the proposed new *occupancy* and that such change of *occupancy* does not result in any hazard to the public health, safety or welfare.

P2502.4 Historic buildings. The provisions of this code relating to the construction, alteration, repair, enlargement, restoration, relocation or moving of buildings or structures shall not be mandatory for existing buildings or structures identified and classified by the state or local jurisdiction as historic buildings where such buildings or structures are judged by the code official to be safe and in the public interest of health, safety and welfare regarding any proposed construction, alteration, repair, enlargement, restoration, relocation or moving of buildings.

P2502.5 Moved buildings. Except as determined by Section P2502.1, plumbing systems that are a part of buildings or structures moved into or within the jurisdiction shall comply with the provisions of this code for new installations.

P2502.6 Referenced codes and standards. The codes and standards referenced in this code shall be those that are listed in Chapter 44 and such codes and standards shall be considered as part of the requirements of this code to the prescribed extent of each such reference and as further regulated in Sections P2502.6.1 and P2502.6.2.

P2502.6.1 Conflicts. Where conflicts occur between provisions of this code and the referenced standards, the provisions of this code shall apply

P2502.6.2 Provisions in referenced codes and standards. Where the extent of the reference to a referenced code or standard includes subject matter that is within the scope of this code, the provisions of this code shall be the minimum requirements.

P2502.7 Requirements not covered by code. Any requirements necessary for the strength, stability or proper operation of an existing or proposed plumbing system, or for the public safety, health and general welfare, not specifically covered by this code shall be determined by the code official.

P2502.8 Other laws. The provisions of this code shall not be deemed to nullify any provisions of local, state or federal law.

P2502.9 Application of references. Reference to chapter section numbers, or to provisions not specifically identified by number, shall be construed to refer to such chapter, section or provision of this code.

P2503.3 Responsibility of permittee. ~~Test equipment, materials and labor shall be furnished by the permittee.~~ The permit holder shall make the applicable tests prescribed in Sections P2503.4 through P2503.8 to determine compliance with the provisions of this code. The permit holder shall give reasonable advance notice to the code official when the plumbing work is ready for tests. The equipment, material, power and labor necessary for the inspection and test shall be furnished by the permit holder and the permit holder shall be responsible for determining that the work will withstand the test pressure prescribed in the following tests. All plumbing system piping shall be tested with either water or by air. After the plumbing fixtures have been set and their traps filled with water, the entire drainage system shall be submitted to final tests. The code official shall require the removal of any cleanouts if necessary to ascertain whether the pressure has reached all parts of the system.

P2503.4 Building sewer testing. **DELETED**~~The *building sewer* shall be tested by insertion of a test plug at the point of connection with the public sewer, filling the *building sewer* with water and pressurizing the sewer to not less than a 10-foot (3048 mm) head of water. The test pressure shall not decrease during a period of not less than 15 minutes. The *building sewer* shall be watertight at all points.~~

~~A forced sewer test shall consist of pressurizing the piping to a pressure of not less than 5 psi (34.5 kPa) greater than the pump rating and maintaining such pressure for not less than 15 minutes. The forced sewer shall be watertight at all points.~~

P2503.5 Drain, waste and vent systems testing. Rough-in and finished plumbing installations of drain, waste and vent systems shall be tested in accordance with Sections P2503.5.1 and P2503.5.2.

P2503.5.1 Rough plumbing. DWV systems shall be tested on completion of the rough piping installation by water, **by air** for piping systems ~~other than plastic~~, **or** by **a vacuum of** air **for plastic piping systems**, without evidence of leakage. **The ~~a water~~** test shall be applied to the drainage system in its entirety or in sections after rough-in piping has been installed, as follows:

1. Water test. ~~Each section shall be filled with water to a point not less than **10** feet **(3048** mm) above the highest fitting connection in that section, or to the highest point in the completed system. Water shall be held in the section under test for a period of 15 minutes. The system shall prove leak free by visual inspection.~~ . If applied to the entire system, all openings in the piping shall be tightly closed, except the highest opening, and the system shall be filled with water to the point of overflow. If the system is tested in sections, each opening shall be tightly plugged except the highest openings of the section under test, and each section shall be filled with water, but no section shall be tested with less than a 10-foot (3048 mm) head of water. In testing successive sections, at least the upper 10 feet (3048 mm) of the next preceding section shall be tested so that no joint or pipe in the building, except the uppermost 10 feet (3048 mm) of the system, shall have been submitted to a test of less than a 10-foot (3048 mm) head of water. This pressure shall be held for not less than 15 minutes. The system shall then be tight at all points.

   Exception: Rough plumbing testing for one- and two-family dwellings shall be as specified above except the water level shall be a minimum of 3 feet (914 mm) above the highest drainage fitting. Under slab piping systems shall be tested with a minimum of 10 feet (3048 mm) of head.

2. ~~Drainage and vent~~ Air test. ~~The portion under test shall be maintained at a gauge pressure of 5 pounds per square inch (psi) (34 kPa) or 10 inches of mercury column (34 kPa). This pressure shall be held without introduction of additional air for a period of 15 minutes.~~ An air test shall be made by forcing air into the system until there is a uniform gauge pressure of 5 psi (34.5 kPa) or sufficient to balance a 10-inch (254 mm) column of mercury. This pressure shall be held for a test period of not less than 15 minutes. Any adjustments to the test pressure required because of changes in ambient temperatures or the seating of gaskets shall be made prior to the beginning of the test period.
3. *Vacuum test. The portion under test shall be evacuated of air by a vacuum-type pump to achieve a uniform gauge pressure of -5 pounds per square inch or a negative 10 inches of mercury column (-34 kPa). This pressure shall be held without the removal of additional air for a period of 15 minutes.*

P2503.6 Shower liner or pan test. Where shower floors and receptors are made watertight by the application of materials required by Section P2709.2, the completed liner installation shall be tested. The pipe from the shower drain shall be plugged watertight for the test. The floor and receptor area shall be filled with ~~potable~~ water to a depth of not less than 2 inches (51 mm) measured at the threshold. Where a threshold of not less than 2 inches (51 mm) in height does not exist, a temporary threshold shall be constructed to retain the test water in the lined floor or receptor area to a level not less than 2 inches (51 mm) in depth measured at the threshold. The water shall be retained for a test period of not less than 15 minutes and there shall not be evidence of leakage.

P2503.7 Water-~~supply~~ distribution system testing. ~~Upon completion of the water-supply system or a section of it, the system or portion completed shall be tested and proved tight under a water pressure of not less than the working pressure of the system or, for piping systems other than plastic, by an air test of not less than 50 psi (345 kPa). This pressure shall be held for not less than 15 minutes. The water used for tests shall be obtained from a potable water source.~~ Upon completion of a section of or the entire water distribution system, the system, or portion completed, shall be tested and proved tight under a water or air test of not less than 100 psi (688 kPa). Repaired sections of existing water systems shall be tested at existing operating pressure. This pressure shall be held for not less than 15 minutes. The water utilized for tests shall be obtained from a potable source of supply. The required tests shall be performed in accordance with this section.

~~**Exception:** For PEX piping systems, testing with a compressed gas shall be an alternative to hydrostatic testing where compressed air or other gas pressure testing is specifically authorized by the manufacturer's instructions for~~

~~the PEX pipe and fittings products installed at the time the system is being tested, and compressed air or other gas testing is not otherwise prohibited by applicable codes, laws or regulations outside of this code.~~

P2503.8 Inspection and testing of backflow prevention devices. **DELETED** ~~Inspection and testing of backflow prevention devices shall comply with Sections P2503.8.1 and P2503.8.2.~~

~~**P2503.8.1 Inspections.** Inspections shall be made of backflow prevention assemblies to determine whether they are operable.~~

~~**P2503.8.2 Testing.** Reduced pressure principle, double check, double check detector and pressure vacuum breaker backflow preventer assemblies shall be tested at the time of installation, immediately after repairs or relocation and every year thereafter.~~

P2503.~~9~~ Test gauges. Gauges used for testing shall be as follows:

1. Tests requiring a pressure of 10 psi or less shall utilize a testing gauge having increments of 0.10 psi (0.69 kPa) or less.
2. Tests requiring a pressure ~~higher~~ greater than 10 psi (0.69 kPa) but less than or equal to 100 psi (690 kPa) shall use a testing gauge having increments of 1 psi (6.9 kPa) or less.
3. Tests requiring a pressure ~~higher~~ greater than 100 psi (690 kPa) shall use a testing gauge having increments of 2 psi (14 kPa) or less.

SECTION P2504
APPROVAL

P2504.1 Modifications.
Where there are practical difficulties involved in carrying out the provisions of this code, the code official shall have the authority to grant modifications for individual cases, upon application of the owner or owner's authorized agent, provided the code official shall first find that special individual reason makes the strict letter of this code impractical and the modification conforms to the intent and purpose of this code and that such modification does not lessen health, life and fire safety requirements. The details of action granting modifications shall be recorded and entered in the files of the plumbing inspection department.

P2504.2 Alternative materials, methods and equipment.
The provisions of this code are not intended to prevent the installation of any material or to prohibit any method of construction not specifically prescribed by this code, provided that any such alternative has been *approved.* An alternative material or method of construction shall be *approved* where the code official finds that the proposed alternative material, method or equipment complies with the intent of the provisions of this code and is not less than the equivalent of that prescribed in this code. Where the alternative material, design or method of construction is not *approved*, the code official shall respond in writing, stating the reasons why the alternative was not *approved*.

P2504.2.1 Research reports.
Supporting data, where necessary to assist in the approval of materials or assemblies not specifically provided for in this code, shall consist of valid research reports from *approved* sources.

P2504.3 Required testing.
Where there is insufficient evidence of compliance with the provisions of this code, or evidence that a material or method does not conform to the requirements of this code, or in order to substantiate claims for alternate materials or methods, the code official shall have the authority to require tests as evidence of compliance to be made at no expense to the jurisdiction.

P2504.3.1 Test methods.
Test methods shall be as specified in this code or by other recognized test standards. In the absence of recognized and accepted test methods, the code official shall approve the testing procedures.

P2504.3.2 Testing agency.
Tests shall be performed by an *approved agency*.

P2504.3.3 Test reports.
Reports of tests shall be retained by the code official for the period required for retention of public records.

P2504.4 Alternative engineered design.

The design, documentation, inspection, testing and approval of an *alternative engineered design* plumbing system shall comply with Sections P2504.4.1 through P2504.4.6.

P2504.4.1 Design criteria.

An *alternative engineered design* shall conform to the intent of the provisions of this code and shall provide an equivalent level of quality, strength, effectiveness, fire resistance, durability and safety. Material, equipment or components shall be designed and installed in accordance with the manufacturer's installation instructions.

P2504.4.2 Submittal.

The registered design professional shall indicate on the permit application that the plumbing system is an *alternative engineered design*. The permit and permanent permit records shall indicate that an *alternative engineered design* was part of the *approved* installation.

P2504.4.3 Technical data.

The registered design professional shall submit sufficient technical data to substantiate the proposed *alternative engineered design* and to prove that the performance meets the intent of this code.

P2504.4.4 Construction documents.

The registered design professional shall submit to the code official two complete sets of signed and sealed construction documents for the *alternative engineered design*. The construction documents shall include floor plans and a riser diagram of the work. Where appropriate, the construction documents shall indicate the direction of flow, all pipe sizes, grade of horizontal piping, loading, and location of fixtures and appliances.

P2504.4.5 Design approval.

Where the code official determines that the *alternative engineered design* conforms to the intent of this code, the plumbing system shall be *approved*. If the *alternative engineered design* is not *approved*, the code official shall notify the registered design professional in writing, stating the reasons thereof.

P2504.4.6 Inspection and testing.

The *alternative engineered design* shall be tested and inspected in accordance with the requirements of Section P2503.

P2504.5 Approved materials and equipment.

Materials, equipment and devices *approved* by the code official shall be constructed and installed in accordance with such approval.

P2504.5.1 Material and equipment reuse.

Materials, equipment and devices shall not be reused unless such elements have been reconditioned, tested, placed in good and proper working condition and *approved*.

SECTION P2505

TEMPORARY EQUIPMENT, SYSTEMS AND USES

P2505.1 General.

The code official is authorized to issue a permit for temporary equipment, systems and uses. Such permits shall be limited as to time of service, but shall not be permitted for more than 180 days. The code official is authorized to grant extensions for demonstrated cause.

P2505.2 Conformance.

Temporary equipment, systems and uses shall conform to the structural strength, fire safety, means of egress, accessibility, light, ventilation and sanitary requirements of this code as necessary to ensure the public health, safety and general welfare.

P2505.3 Temporary utilities.

The code official is authorized to give permission to temporarily supply utilities before an installation has been fully completed and the final certificate of completion has been issued. The part covered by the temporary certificate shall comply with the requirements specified for temporary lighting, heat or power in the code.

P2505.4 Termination of approval.

The code official is authorized to terminate such permit for temporary equipment, systems or uses and to order the temporary equipment, systems or uses to be discontinued.

P2505.5 (311.1)Toilet Facilities

Toilet facilities shall be provided for construction workers in accordance with the table below and such facilities shall be maintained in a sanitary condition. Construction worker toilet facilities of the non-sewer type shall conform to ANSI Z4.3.

Number of Employees	**Minimum Number of Facilities**
Less than 20	1 toilet
20 to 200	1 toilet & 1 urinal per 40 workers
More than 200	1 toilet & urinal per 50 workers

There shall be at least one facility for every two contiguous construction sites. Such facilities may be portable, enclosed, chemically treated, tank-tight units. Portable toilets shall be enclosed, screened and weatherproofed with internal latches. Temporary toilet facilities need not be provided on site for crews on a job site for no more than one working day and having transportation readily available to toilet facilities.

CHAPTER 26
GENERAL PLUMBING REQUIREMENTS

~~User notes:~~

~~***About this chapter:*** *Chapter 26 contains general requirements that could apply to Chapters 26 through 33. Placing such requirements in only one location eliminates code development coordination issues associated with the same requirement in multiple locations. This chapter covers liquid waste disposal requirements, special installation provisions for flood hazard areas and requirements for third-party certification of materials and products that are required to comply with a referenced standard.*~~

~~***Code development reminder:*** *Code change proposals to this chapter will be considered by the IRC—Mechanical/Plumbing Code Development Committee during the 2021 (Group A) Code Development Cycle.*~~

The text of this chapter is extracted from the 2024 edition of the *North Carolina Plumbing Code* and has been modified where necessary to conform to the scope of application of the *North Carolina Residential Code for One- and Two-Family Dwellings*.

P2601.2 Connections to drainage system. Plumbing fixtures, drains, appurtenances and *appliances* used to receive or discharge liquid wastes or sewage shall be directly connected to the sanitary drainage system of the building or premises, in accordance with the requirements of this code. This section shall not be construed to prevent indirect waste connections where required by the code.

Exception: All drain waste and vent piping associated with gray water or rainwater recycling systems shall be installed in compliance with this code. Bathtubs, showers, lavatories, clothes washers and laundry trays shall not be required to discharge to the sanitary drainage system where such fixtures discharge to systems complying with Sections P2910 and P2913.

P2601.3 Flood hazard areas. In flood hazard areas as established by Table R301.2(1), plumbing fixtures, drains, and *appliances* shall be located or installed in accordance with Section R322.1.6.

SECTION P2602
INDIVIDUAL WATER SUPPLY AND SEWAGE DISPOSAL

P2602.1 General. The water-distribution system of any building or premises where plumbing fixtures are installed shall be connected to a public water supply~~, or sewer system, respectively, if available.~~ Where a public water-supply system, or both are ~~is~~ not available, or connection to ~~them~~ the supply is not feasible, an individual water supply ~~or individual (private) sewage-disposal system, or both,~~ shall be provided. Individual water supplies shall be constructed and installed in accordance with the applicable state and local laws. ~~Where such laws do not address the requirements set forth in NGWA-01, individual water supplies shall comply with NGWA-01 for those requirements not addressed by state and local laws.~~

Sanitary drainage piping from plumbing fixtures in buildings and sanitary drainage piping systems from premises shall be connected to a public sewer. Where a public sewer is not available, the sanitary drainage piping and systems shall be connected to a private sewage disposal system in compliance with state or local requirements. ~~Where state or local requirements do not exist for private sewage disposal systems, the sanitary drainage piping and systems shall be connected to an *approved* private sewage disposal system that is in accordance with the *International Private Sewage Disposal Code*.~~

Exception: All drain waste and vent piping associated with gray water or rainwater recycling systems shall be installed in compliance with this code. Bathtubs, showers, lavatories, clothes washers and laundry trays shall not be required to discharge to the sanitary drainage system where such fixtures discharge to systems complying with Sections P2910 and P2913.

P2602.2 Flood-resistant installation. In flood hazard areas as established by Table R301.2(1):

1. Water supply systems shall be designed and constructed to prevent infiltration of floodwaters.

2. Pipes for sewage disposal systems shall be designed and constructed to prevent infiltration of floodwaters into the systems and discharges from the systems into floodwaters.

P2603.3 Protection against corrosion. Metallic piping, except for cast iron, ductile iron and galvanized steel, shall not be placed in direct contact with steel framing members, concrete or masonry. Metallic piping shall not be placed in direct contact with corrosive soil. Where sheathing is used to prevent direct contact, the sheathing material thickness shall be not less than 0.008 inch (8 mil) (0.203 mm) and shall be made of plastic. ~~Where sheathing protects piping that penetrates concrete or masonry walls or floors, the sheathing shall be installed in a manner that allows movement of the piping within the sheathing.~~ Pipes passing through concrete or cinder walls and floors or other corrosive material shall be protected against external corrosion by a protective sheathing or wrapping or other means that will withstand any reaction from the lime and acid of concrete, cinder or other corrosive material. Sheathing or wrapping shall allow for movement including expansion and contraction of piping. The wall thickness of the material shall be not less than 0.025 inch (0.64 mm).

P2603.4 Pipes through or under footings or foundation walls. ~~A pipe that passes through a foundation wall shall be provided with a relieving arch, or a pipe sleeve shall be built into the foundation wall. The sleeve shall be two pipe sizes greater than the pipe passing through the wall.~~ Any pipe that passes within 12 inches (305 mm) of the bottom of the footing or through a foundation wall shall be provided with a relieving arch or a pipe sleeve. Pipe sleeves for foundation walls shall be built into the foundation wall. The sleeve shall be two pipe sizes greater than the pipe passing through the wall. Piping shall not be run under pier footings (refer to Section **P2604**). Annular spaces between sleeves and pipes shall be filled or tightly sealed in an *approved* manner. Annular spaces between sleeves and pipes in fire-resistance-rated assemblies shall be filled or tightly sealed in accordance with the *North Carolina Building Code*. Only sleeves through foundation or exterior building walls shall be sealed on both sides.

~~**P2603.5 Freezing.** In localities having a winter design temperature of 32°F (0°C) or lower as shown in Table R301.2 of this code, a water, soil or waste pipe shall not be installed outside of a building, in exterior walls, in *attics* or crawl spaces, or in any other place subjected to freezing temperature unless adequate provision is made to protect it from freezing by insulation or heat or both. Water service pipe shall be installed not less than 12 inches (305 mm) deep and not less than 6 inches (152 mm) below the frost line.~~

P2603.5 Freezing. ~~Water, soil and waste pipes shall not be installed outside of a building, in attics or crawl spaces, concealed in outside walls, or in any other place subjected to freezing temperatures unless adequate provision is made to protect such pipes from freezing by insulation or heat or both. Exterior water supply system piping shall be installed not less than 6 inches (152 mm) below the frost line and not less than 12 inches (305 mm) below grade.~~

Water pipes installed in a wall or ceiling exposed to the exterior shall be located on the heated side of the wall or ceiling insulation. Water, soil and waste pipes shall not be installed outside of a building. When soil and waste piping is installed under a non-enclosed area of a building or structure, freeze protections shall be installed at the discretion of the authority having jurisdiction. When installed in unconditioned utility rooms, or in the building in any other place subjected to freezing temperatures, adequate provision shall be made to protect such pipes from freezing by a minimum of R6.5 insulation determined at 75°F (24°C) in accordance with ASTM C177 or heat, or both.

Exterior water supply system piping shall be installed below the frost line and in no case less than 12 inches (305 mm) below grade.

Note: These provisions are minimum requirements, which have been found suitable for normal weather conditions. Abnormally low temperatures for extended periods may require additional provisions to prevent freezing.

P2603.5.1 Frost protection.

No traps of soil or waste pipe shall be installed or permitted outside of a building, or concealed in outside walls or in any place where they may be subjected to freezing temperatures, unless adequate provision is made to protect them from freezing.

P2603.5.2 Sewer depth. *Building sewers* that connect to private sewage disposal systems shall be installed not less than ~~{NUMBER}~~ 3-inches (76.2 mm) below finished grade at the point of septic tank connection. *Building sewers* shall be not less than ~~{NUMBER}~~ 3-inches (76.2 mm) below grade.

SECTION P2604
TRENCHING AND BACKFILLING

P2604.1 Trenching and bedding. Where trenches are excavated such that the bottom of the trench forms the bed for the pipe, solid and continuous load-bearing support shall be provided between joints. Where over-excavated, the trench shall be backfilled to the proper grade with compacted earth, sand, fine gravel or similar granular material. Piping shall not be supported on rocks or blocks at any point. Rocky or unstable soil shall be over-excavated by two or more pipe diameters and brought to the proper grade with suitable compacted granular material.

P2604.1.1 Over-excavation.
Where trenches are excavated below the installation level of the pipe such that the bottom of the trench does not form the bed for the pipe, the trench shall be backfilled to the installation level of the bottom of the pipe with sand or fine gravel placed in layers not greater than 6 inches (152 mm) in depth and such backfill shall be compacted after each placement.

P2604.1.2 Rock removal.
Where rock is encountered in trenching, the rock shall be removed to not less than 3 inches (76 mm) below the installation level of the bottom of the pipe, and the trench shall be backfilled to the installation level of the bottom of the pipe with sand tamped in place so as to provide uniform load-bearing support for the pipe between joints. The pipe, including the joints, shall not rest on rock at any point.

P2604.1.3 Soft load-bearing materials.
If soft materials of poor load-bearing quality are found at the bottom of the trench, stabilization shall be achieved by over excavating not less than two pipe diameters and backfilling to the installation level of the bottom of the pipe with fine gravel, crushed stone or a concrete foundation. The concrete foundation shall be bedded with sand tamped into place so as to provide uniform load-bearing support for the pipe between joints.

P2604.5 Tracer Wire. For plastic sewer piping, an insulated copper tracer wire or other *approved* conductor shall be installed adjacent to and over the full length of the piping. Access shall be provided to the tracer wire or the tracer wire shall terminate at the cleanout between the building drain and the building sewer. The tracer wire shall be not less than 14 AWG and the insulation type shall be listed for direct burial.

SECTION P2605
SUPPORT

P2605.1 General. Piping shall be supported in accordance with the following:

1. Piping shall be supported to ensure alignment and prevent sagging, and allow movement associated with the expansion and contraction of the piping system.
2. Piping in the ground shall be laid on a firm bed for its entire length, except where support is otherwise provided.
3. Hangers and *anchors* shall be of sufficient strength to maintain their proportional share of the weight of pipe and contents and of sufficient width to prevent distortion to the pipe. Hangers and strapping shall be of *approved* material that will not promote galvanic action.
4. Where horizontal pipes 4 inches (102 mm) and larger convey drainage or waste, and where a pipe fitting changes the flow direction greater than 45 degrees (0.79 rad), rigid bracing or other rigid support arrangements shall be installed to resist movement of the upstream pipe in the direction of flow. A change of flow direction into a vertical pipe shall not require the upstream pipe to be braced.
5. Piping shall be supported at distances not to exceed those indicated in Table P2605.1.

6. A thermal expansion tank shall be supported in accordance with the manufacturer's instructions. Thermal expansion tanks shall not be supported by the piping that connects to such tanks.

PLACE TABLE P2605.1 HERE

SECTION P2607
WATERPROOFING OF OPENINGS

P2607.1 Pipes penetrating roofs. Where a pipe penetrates a roof, a flashing of lead, copper, galvanized steel or an *approved* elastomeric material shall be installed in a manner that prevents water entry into the building. Counterflashing into the opening of pipe serving as a vent terminal shall not reduce the required internal cross-sectional area of the vent pipe to less than the internal cross-sectional area of one pipe size smaller. Joints at the roof and around vent pipes shall be made watertight by the use of lead, copper, galvanized steel, aluminum, plastic or other *approved* flashings or flashing material.

P2609.2.1 (402.2) Materials for specialty fixtures.
Materials for specialty fixtures not otherwise covered in this code shall be of stainless steel, soapstone, chemical stoneware or plastic, or shall be lined with lead, copper-base alloy, nickel-copper alloy, corrosion-resistant steel or other material especially suited to the application for which the fixture is intended.

P2609.2.2 (402.3) Sheet copper.
Sheet copper for general applications shall conform to ASTM B 152 and shall not weigh less than 12 ounces per square foot (3.7 kg/m^2).

P2609.2.3 (402.4) Sheet lead.
Sheet lead for pans shall not weigh less than 4 pounds per square foot (19.5 kg/m^2) and shall be coated with an asphalt paint or other *approved* coating.

CHAPTER 27
PLUMBING FIXTURES

~~User notes:~~

~~***About this code:*** *Because fixture design and quality are paramount to ensure that plumbing fixtures operate properly, Chapter 27 specifies numerous product and material standards for plumbing fixtures. Regulations for locating plumbing fixtures and constructing field-built shower receptors are provided.*~~

~~***Code development reminder:*** *Code change proposals to this chapter will be considered by the IRC—Mechanical/Plumbing Code Development Committee during the 2021 (Group A) Code Development Cycle.*~~

~~The text of this chapter is extracted from the 2018 edition of the *North Carolina Plumbing Code* and has been modified where necessary to conform to the scope of application of the *North Carolina Residential Code* for One- and Two-Family Dwellings.~~

PLACE P2701.1 Here

SECTION P2701
FIXTURES, FAUCETS AND FIXTURE FITTINGS

P2701.1 Quality of fixtures. Plumbing fixtures, faucets and fixture fittings shall have smooth impervious surfaces, shall be free from defects, shall not have concealed fouling surfaces, and shall conform to the standards indicated in Table P2701.1 and elsewhere in this code. All porcelain enameled surfaces on plumbing fixtures shall be acid resistant.

SECTION P2702
FIXTURE ACCESSORIES

P2702.1 Plumbing fixtures. Plumbing fixtures, other than water closets, shall be provided with *approved* strainers.

Exception: Hub drains receiving only clear water waste and standpipes shall not require strainers.

P2702.2 Waste fittings. Waste fittings shall conform to ASME A112.18.2/CSA B125.2, ASTM F409 or shall be made from pipe and pipe fittings complying with any of the standards indicated in Tables P3002.1(1) and P3002.3.

P2702.3 Plastic tubular fittings. Plastic tubular fittings shall conform to ASTM F409 as indicated in Table P2701.1.

P2702.4 Carriers for wall-hung water closets. Carriers for wall-hung water closets shall conform to ASME A112.6.2. Wall hung water closet bowls shall be supported by a concealed metal carrier that is attached to the building structural members so that strain is not transmitted to the closet connector or any other part of the plumbing system.

SECTION P2703
TAIL PIECES

P2703.1 Minimum size. Fixture tail pieces shall be not less than $1^1/_2$ inches (38 mm) in diameter for sinks, dishwashers, laundry tubs, bathtubs and similar fixtures, and not less than $1^1/_4$ inches (32 mm) in diameter for bidets, lavatories and similar fixtures.

SECTION P2704
SLIP-JOINT CONNECTIONS

P2704.1 Slip joints. Slip-joint connections shall be installed only for tubular waste piping and only between the trap outlet of a fixture and the connection to the drainage piping. Slip-joint connections shall be made with an *approved* elastomeric sealing gasket. Slip-joint connections shall be accessible. Such access shall provide an opening that is not less than 12 inches (305 mm) in its smallest dimension. Where such access cannot be provided, access doors shall not be required, provided that all joints are soldered, solvent cemented or screwed to form a solid connection.

SECTION P2705
INSTALLATION

P2705.1 General. The installation of fixtures shall conform to the following:

1. Floor-outlet or floor-mounted fixtures shall be secured to the drainage connection and to the floor, where so designed, by screws, bolts, washers, nuts and similar fasteners of copper, copper alloy or other corrosion-resistant material.
2. Wall-hung fixtures shall be rigidly supported so that strain is not transmitted to the plumbing system.
3. Where fixtures come in contact with walls and floors, the contact area shall be watertight.
4. Plumbing fixtures shall be usable.
5. ~~Water closets, lavatories and bidets. A water closet, lavatory or bidet shall not be set closer than 15 inches (381 mm) from its center to any side wall, partition or vanity or closer than 30 inches (762 mm) center-to-center between adjacent fixtures. There shall be a clearance of not less than 21 inches (533 mm) in front of a water closet, lavatory or bidet to any wall, fixture or door.~~ See Figure R307.1 for minimum fixture clearances.
6. The location of piping, fixtures or equipment shall not interfere with the operation of windows or doors.
7. In flood hazard areas as established by Table R301.2, plumbing fixtures shall be located or installed in accordance with Section R322.1.6.
8. Integral fixture-fitting mounting surfaces on manufactured plumbing fixtures or plumbing fixtures constructed on site, shall meet the design requirements of ASME A112.19.2/CSA B45.1 or ASME A112.19.3/CSA B45.4.
9. Floor flanges for water closets or similar fixtures shall be not less than 0.125 inch (3.2 mm) thick for brass, 0.25 inch (6.4 mm) thick for plastic and 0.25 inch (6.4 mm) thick and not less than a 2-inch (51 mm) caulking depth for cast iron or galvanized malleable iron. Floor flanges of hard lead shall weigh not less than 1 pound, 9 ounces (0.7 kg) and shall be composed of lead alloy with not less than 7.75-percent antimony by weight. Flanges shall be secured to the building structure with corrosion-resistant screws or bolts.

10. Where any fixture is provided with an overflow, the waste shall be designed and installed so that standing water in the fixture will not rise in the overflow when the stopper is closed, and no water will remain in the overflow when the fixture is empty. The overflow from any fixture shall discharge into the drainage system on the inlet or fixture side of the trap.

    Exception: The overflow from a flush tank serving a water closet or urinal shall discharge into the fixture served.

11. Fixtures shall be set level and in proper alignment with reference to adjacent walls.

SECTION P2706
WASTE RECEPTORS

P2706.1 General. ~~For other than hub drains that receive only clear-water waste and standpipes, a removable strainer or basket shall cover the waste outlet of waste receptors.~~ Every waste receptor shall be of an *approved* type. A removable strainer or basket shall cover the waste outlet of waste receptors. Waste receptors shall be installed in ventilated spaces. Waste receptors shall not be installed in concealed spaces. Waste receptors shall not be installed in plenums, attics, crawl spaces or interstitial spaces above ceilings and below floors. Waste receptors shall be *readily accessible*.

Exceptions:

1. **Where hub drains are installed in a crawl space for condensate waste.**
2. **This section shall not apply to hub drains in equipment rooms and furnace rooms in dwelling units.**
3. **Hub drains shall not be required to have strainers.**

P2706.1.1 Hub drains. Hub drains shall be in the form of a hub or a pipe that extends not less than 1 inch (25.4 mm) above a water-impervious floor and shall not be required to have a strainer.

P2706.1.2 Standpipes. ~~Standpipes shall extend not less than 18 inches (457 mm) and not greater than 42 inches (1067 mm) above the trap weir.~~ Standpipes shall be individually trapped. ~~Standpipes shall extend not less than 18 inches (457 mm) but not greater than 42 inches (1066 mm) above the trap weir.~~ *Access* shall be provided to standpipes and drains for rodding. Standpipes shall be not less than 2 inches (51 mm) in diameter and not less than 18 inches (762 mm) or more than 48 inches (1219 mm) in height as measured from the crown weir. The standpipe shall extend 34 inches (864 mm) minimum above the base of the clothes washer unless recommended otherwise by the manufacturer. The connection of a laundry tray waste line may be made into a standpipe for the automatic clothes-washer drain. The standpipe shall extend above the flood level rim of the laundry tray. The outlet of the laundry tray shall be a maximum horizontal distance of 30 inches (762 mm) from the standpipe trap.

SECTION P2708
SHOWERS

P2708.1 General. Shower compartments shall have not less than 900 square inches ($0.6\ m^2$) of interior cross-sectional area. Shower compartments shall be not less than 30 inches (762 mm) in minimum dimension measured from the finished interior dimension of the shower compartment, exclusive of fixture valves, shower heads, soap dishes, and safety grab bars or rails. The minimum required area and dimension shall be measured from the finished interior dimension at a height equal to the top of the threshold and at a point tangent to its centerline and shall be continued to a height of not less than 70 inches (1778 mm) above the shower drain outlet. Hinged shower doors shall open outward.

The wall area above built-in tubs having installed shower heads and in shower compartments shall be constructed in accordance with Section R702.4. Such walls shall form a watertight joint with each other and with either the tub, receptor or shower floor.

Exceptions:

1. Fold-down seats shall be permitted in the shower, provided that the required 900-square-inch (0.6 m^2) dimension is maintained when the seat is in the folded-up position.
2. Shower compartments having not less than 25 inches (635 mm) in minimum dimension measured from the finished interior dimension of the compartment provided that the shower compartment has a cross-sectional area of not less than 1,300 square inches (0.838 m^2).
3. Shower compartments with prefabricated receptors conforming to the standards listed in Table **P2708.1**
4. Where load-bearing, bonded, waterproof membranes meeting ANSI A118.10 are used, integrated bonding flange drains shall be approved. Clamping devices and weep holes are not required where shower drains include an integrated bonding flange. Manufacturer's installation instructions shall be followed to achieve a watertight seal between the bonded waterproof membrane and the integrated bonding flange drain. Integrated bonding flange drains shall conform to ASME A112.6.3, ASME A112.18.2/CSA B125.2, or CSA B79.

P2708.2 Shower drain. ~~Shower drains shall have an outlet size of not less than 1 1/2 inches (38 mm) in diameter.~~ Shower drains shall have an outlet size of not less than ~~1 1/2~~ 2 inches [~~38~~ 51 mm] in diameter, and for other than waste outlets in bathtubs, shall have removable strainers not less than 3 inches (76 mm) in diameter with strainer openings not less than 1/4 inch (6.4 mm) in least dimension. Where each shower space is not provided with an individual waste outlet, the waste outlet shall be located and the floor pitched so that waste from one shower does not flow over the floor area serving another shower. Waste outlets shall be fastened to the waste pipe in an *approved* manner

Exception: Retaining pre-existing 1-1/2 inch (38 mm) in diameter waste outlets shall be permitted when removing an existing bathtub and installing a shower in its place.

P2708.3 Water supply riser. Water supply risers from the shower valve to the shower head outlet, whether exposed or concealed, shall be attached to the structure using support devices designed for use with the specific piping material or fittings anchored ~~with screws~~.with corrosion resistant screws of a minimum nominal length of ¾ inch (19 mm)

P2708.4 Shower control valves. Individual shower and tub/shower combination valves shall be balanced-pressure, thermostatic or combination balanced-pressure/thermostatic valves that conform to the requirements of ASSE 1016/ASME 112.1016/CSA B125.16 or ASME A112.18.1/CSA B125.1. Shower control valves shall be rated for the flow rate of the installed shower head. Such valves shall be installed at the point of use. Shower and tub/shower combination valves required by this section shall be equipped with a means to limit the maximum setting of the valve to 120°F (49°C), which shall be field adjusted in accordance with the manufacturer's instructions to provide water at a temperature not to exceed 120ºF (49°C). In-line thermostatic valves shall not be utilized for compliance with this section. Scald preventative valves are not required in dwelling units with individual water heaters set at 120°F (49°C).

P2709.2 Lining required. The adjoining walls and floor framing enclosing on-site built-up shower receptors shall be lined with one of the following materials:

1. Sheet lead. Sheet lead shall weigh not less than 4 pounds per square foot (19.5 kg/m^2) and shall be coated with an asphalt paint or other *approved* coating. The lead sheet shall be insulated from conducting substances other than the connecting drain by 15-pound (6.80 kg) asphalt felt or an equivalent. Sheet lead shall be joined by burning.
2. Sheet copper. Sheet copper shall conform to ASTM B 152 and shall weigh not less than 12 ounces per square foot (3.7 kg/m^2). The copper sheet shall be insulated from conducting substances other than the connecting drain by 15-pound (6.80 kg) asphalt felt or an equivalent. Sheet copper shall be joined by brazing or soldering.

3. Plastic liner material ~~that complies~~ shall be a minimum of 0.040 inch (1.02mm) thick and shall comply with ASTM D4068 or ASTM D4551.
4. Hot mopping in accordance with Section P2709.2.3.
5. Sheet-applied load-bearing, bonded waterproof membranes that comply with ANSI A118.10.

The lining material shall extend not less than 2 inches (51 mm) beyond or around the rough jambs and not less than 2 inches (51 mm) above finished thresholds. Sheet-applied load bearing, bonded waterproof membranes shall be applied in accordance with the manufacturer's instructions.

P2709.2.1 PVC sheets. Plasticized polyvinyl chloride (PVC) sheet shall be a minimum of 0.040 inch (1.02 mm) thick and shall meet the requirements of ASTM D4551. Sheets shall be joined by solvent welding in accordance with the manufacturer's instructions.

P2709.2.2 Chlorinated polyethylene (CPE) sheets. Nonplasticized chlorinated polyethylene sheet shall be a minimum of 0.040 inch (1.02 mm) thick and shall meet the requirements of ASTM D4068. The liner shall be joined in accordance with the manufacturer's instructions.

P2709.2.4 Liquid-type, trowel-applied, load-bearing, bonded waterproof materials. Liquid-type, trowel-applied, load-bearing, bonded waterproof materials shall meet the requirements of ANSI A118.10 and shall be applied in accordance with the manufacturer's instructions.

1. **P2709.3 Installation.** Lining materials shall be sloped a minimum of $^{1}/_{4}$ unit vertical in 12 units horizontal (2-percent slope) to weep holes in the subdrain by means of a smooth, solidly formed subbase, shall be properly recessed and fastened to *approved* backing so as not to occupy the space required for the wall covering, and shall not be nailed or perforated at any point less than 1 inch (25.4 mm) above the finished threshold.

P2709.3.1 Materials. Lead and copper linings shall be insulated from conducting substances other than the connecting drain by 15-pound (6.80 kg) asphalt felt or its equivalent. Sheet lead liners shall weigh not less than 4 pounds per square foot (19.5 kg/m^2) and shall be coated with an asphalt paint or other *approved* coating. Sheet copper liners shall weigh not less than 12 ounces per square foot (3.7 kg/m^2). Joints in lead and copper pans or liners shall be burned or silver brazed, respectively. Joints in plastic liner materials shall be joined in accordance with the manufacturer's instructions.

P2712.10 (420.4) Water closet connections.

A 4-inch by 3-inch (102 mm by 76 mm) closet bend shall be acceptable. Where a 3-inch (76 mm) bend is utilized on water closets, a 4-inch by 3-inch (102 mm by 76 mm) flange shall be installed to receive the fixture horn.

SECTION P2713
BATHTUBS

P2713.1 Bathtub waste outlets and overflows. ~~Bathtubs shall be equipped with a waste out~~let-that is ~~not less than 1^1/$_2$ inches (38 mm) in diameter. The waste outlet shall be equipped with a watertight stopper.~~ Where an overflow is installed, the overflow shall be not less than 1^1/$_2$ inches (38 mm) in diameter. Bathtubs shall be equipped with a waste outlet and an overflow outlet. The outlets shall be connected to waste tubing or piping not less than 1-1/2 inches (38 mm) in diameter. The waste outlet shall be equipped with a water-tight stopper.

Exception: An overflow outlet is not required for bathtubs located on an impervious floor with a floor drain or trench drain, or installed in a shower enclosure.

P2713.2 Bathtub enclosures. Doors within a bathtub enclosure shall conform to ASME A112.19.15.

P2713.3 Bathtub and whirlpool bathtub valves ~~Hot water supplied to bathtubs and whirlpool bathtubs shall be limited to a temperature of not greater than 120°F (49°C) by a water-temperature limiting device that conforms to ASSE 1070 or CSA B125.3, except where such protection is otherwise provided by a combination tub/shower valve in accordance with Section P2708.4.~~ Bathtubs and whirlpool bathtub valves shall have or be supplied by a water-temperature-limiting device that conforms to ASSE 1070/ASME A112.1070/CSA B125.70, except where such valves are combination tub/shower valves in accordance with Section P2708.4. The water-temperature-limiting device required by this section shall be equipped with a means to limit the maximum setting of the device to 120ºF (49ºC), and, where adjustable, shall be field adjusted in accordance with the manufacturer's instructions to provide hot water at a temperature not to exceed 120ºF (49ºC). Access shall be provided to water-temperature-limiting devices that conform to ASSE 10705/ASME A112.1070/CSA B125.70.

Exception: Access is not required for nonadjustable water-temperature-limiting devices that conform to ASSE 1070/ASME A112.1070/CSA B125.70 and are integral with a fixture fitting, provided that the fixture fitting itself can be accessed for replacement.

P2713.4 Approval.
Bathtubs shall conform to ASME A112.19.1/ CSA B45.2, ASME A112.19.2/CSA B45.1, ASME A112.19.3/ CSA B45.4 or CSA B45.5/IAPMO Z124.

SECTION P2714
SINKS

P2714.1 Sink waste outlets. Sinks shall be provided with waste outlets not less than $1^1/_2$ inches (38 mm) in diameter. A strainer, crossbar or other device shall be provided to restrict the clear opening of the waste outlet.

P2714.2 Movable sink systems. Movable sink systems shall comply with ASME A112.19.12.

P2714.3 Approval. Sinks shall conform to ASME A112.19.1/CSA B45.2, ASME A112.19.2/CSA B45.1, ASME A112.19.3/CSA B45.4 or CSA B45.5/IAPMO Z124.

SECTION P2715
LAUNDRY TUBS

P2715.1 Laundry tub waste outlet. Each compartment of a laundry tub shall be provided with a waste outlet not less than $1^1/_2$ inches (38 mm) in diameter. A strainer or crossbar shall restrict the clear opening of the waste outlet.

P2715.2 Approval. Laundry tubs shall conform to ASME A112.19.1/CSA B45.2, ASME A112.19.2/CSA B45.1, ASME A112.19.3/CSA B45.4 or CSA B45.5/IAPMO Z124.

SECTION P2716
FOOD-WASTE DISPOSER

P2716.1 Food-waste disposer waste outlets. Food-waste disposers shall be connected to a drain of not less than $1^1/_2$ inches (38 mm) in diameter.

P2716.2 Water supply required. A sink equipped with a food-waste disposer shall be provided with a faucet.

P2716.3 Approval. Domestic food waste disposers shall conform to ASSE 1008 and shall be listed and labeled in accordance with UL 430.

SECTION P2717
DISHWASHING MACHINES

P2717.1 Protection of water supply. The water supply to a dishwasher shall be protected against backflow by an *air gap* complying with ASME A112.1.3 or A112.1.2 that is installed integrally within the machine or a backflow preventer in accordance with Section P2902.

P2717.2 Sink and dishwasher waste connection. The combined discharge from a dishwasher and a one- or two-compartment sink, with or without a food-waste disposer, shall be served by a trap of not less than $1^1/_2$ inches (38 mm) in outside diameter. ~~The dishwasher discharge pipe or tubing shall rise to the underside of the counter and be fastened or otherwise held in that position before connecting to the head of the food-waste disposer or to a wye fitting in the sink tailpiece.~~ The waste connection of a residential dishwasher shall connect directly to a wye branch fitting on the tailpiece of the kitchen sink, directly to the dishwasher connection of a food waste disposer, or through an *air break* to a standpipe. The waste line of a residential dishwasher shall rise and shall be securely fastened to the underside of the sink rim or countertop, before connecting to the head of the food-waste disposer or to a wye fitting in the sink tailpiece.

P2717.3 Approval. Residential dishwashers shall conform to NSF 184.

SECTION P2718
CLOTHES WASHING MACHINE

P2718.1 Waste connection. ~~The discharge from a clothes washing machine shall be through an *air break*.~~ The waste from an automatic clothes washer shall connect to a vertical drain of not less than 2 inches (51 mm) in diameter, or a horizontal drain of not less than 3 inches (76 mm) in diameter. The 2-inch (51 mm) trap in the waste connection may be used as a cleanout for both the 2-inch (51 mm) and the 3-inch (76 mm). In retrofit or remodel work automatic domestic clothes washers shall be permitted to drain to a laundry sink. Automatic clothes washers that discharge by gravity shall be permitted to drain to a waste receptor or an approved trench drain.

P2718.2 Water connection.
The water supply to an automatic clothes washer shall be protected against backflow by an *air gap* that is integral with the machine or a backflow preventer shall be installed in accordance with Section 608. *Air gaps* shall comply with ASME A112.1.2 or A112.1.3.

P2719.2 Location. Floor drains shall be located to drain the entire floor area.

P2719.3 Approval. Floor drains shall conform to ASME A112.3.1, ASME A112.6.3 or CSA B79.

SECTION P2720
WHIRLPOOL BATHTUBS

P2720.1 Access to pump. Access shall be provided to circulation pumps in accordance with the fixture or pump manufacturer's installation instructions. Where the manufacturer's instructions do not specify the location and minimum size of field-fabricated access openings, an opening of not less than 12 inches by 12 inches (305 mm by 305 mm) shall be installed for access to the circulation pump. Where pumps are located more than 2 feet (610 mm) from the access opening, an opening of not less than 18 inches by 18 inches (457 mm by 457 mm) shall be installed. A door or panel shall be permitted to close the opening. The access opening shall be unobstructed and be of the size necessary to permit the removal and replacement of the circulation pump. A minimum clearance of 21 inches (533 mm) is required in front of the access door. Removal of a toilet cannot be used to obtain the required clearance.

P2720.2 Piping drainage. The circulation pump shall be accessibly located above the crown weir of the trap. ~~The pump drain line shall be properly graded to ensure minimum water retention in the volute after fixture use. The circulation piping shall be installed to be self-draining.~~ The pump drain and circulation piping shall be sloped to drain the water in the volute and the circulation piping when the whirlpool bathtub is empty.

P2720.5 Suction fittings.
Suction fittings for whirlpool bathtubs shall comply with ASME A112.19.7/CSA B45.10.

P2720.6 Approval. Whirlpool bathtubs shall comply with ASME A112.19.7/CSA B45.10 and shall be listed and labeled in accordance with UL 1795.

P2721.3 Approval. Bidets shall conform to ASME A112.19.2/ CSA B45.1.

P2722.4 Individual pressure-balancing in-line valves for individual fixture fittings. Individual pressure-balancing in-line valves for individual fixture fittings shall comply with ASSE 1066. Such valves shall be installed in an accessible location and shall not be used as a substitute for the balanced pressure, thermostatic or combination shower valves required in Section P2708.~~3~~4.

SECTION P2723
MACERATING TOILET SYSTEMS

P2723.1 General. Macerating toilet systems shall be installed in accordance with shall comply with ASME A112.3.4/CSA B45.9 and manufacturer's instructions.

CHAPTER 28
WATER HEATERS

~~User notes:~~

~~***About this chapter:*** Chapter 28 contains regulations concerning the safety of water heating units and hot water storage tanks. Heated potable water is needed for plumbing fixtures that are associated with washing, bathing and kitchen activities. Heated water is commonly stored in pressurized storage tanks that must be protected against explosion by pressure and temperature relief valves specified in this chapter. This chapter also covers the access requirements to water heaters and hot water storage tanks to allow for the maintenance and replacement of that equipment.~~

~~***Code development reminder:*** *Code change proposals to this chapter will be considered by the IRC—Mechanical/Plumbing Code Development Committee during the 2021 (Group A) Code Development Cycle.*~~ *The text of this chapter is extracted from the 2018 edition of the North Carolina Plumbing Code and has been modified where necessary to conform to the scope of application of the North Carolina Residential Code for One- and Two-Family Dwellings.*

P2801.2 Drain valves. Drain valves for emptying shall be installed at the bottom of each tank-type water heater and hot water storage tank. Drain valves shall conform to ASSE 1005. The drain valve inlet shall be not less than $^{3}/_{4}$-inch (19.1 mm) nominal iron pipe size and the outlet shall be provided with a male hose thread.

P2801.5 Prohibited locations. Water heaters shall be located in accordance with Chapter 20, Section 2005.2 and as elsewhere required in this code.

P2801.6 Required pan. Where a storage tank-type water heater or a hot water storage tank is installed in: (a) remote locations such as a suspended ceiling, (b) attics, (c) above occupied spaces, (d) above crawl spaces or (e) in unventilated crawl spaces, a location where water leakage from the tank will cause damage to primary structural framing, the tank or water heater shall be installed in a galvanized steel or aluminum pan constructed of one of the following:

1. Galvanized steel or aluminum of not less than 0.0236 inch (0.6010 mm) in thickness.
2. Plastic not less than 0.036 inch (0.9 mm) in thickness.
3. Other *approved* materials.

A plastic pan beneath a gas-fired water heater shall be constructed of material having a flame spread index of 25 or less and a *smoke-developed index* of 450 or less when tested in accordance with ASTM E84 or UL 723.

Exception: Water heater(s) installed on concrete slab construction and located on the lowest floor or in a private garage.

P2801.6.1 Pan size and drain. The pan shall be not less than $1^{1}/_{2}$ inches (38 mm) deep and shall be of sufficient size and shape to receive dripping or condensate from the tank or water heater. The pan shall be drained by an indirect waste pipe of not less than $^{3}/_{4}$ inch (19 mm) diameter. Piping for safety pan drains shall be of those materials indicated in Table P2906.5.

Where a pan drain was not previously ~~installed~~ required,, a pan drain shall not be required for a replacement water heater installation.

P2801.6.1.1 Water Heater Located in a Pan. Where Water Heater(s) are subject to water damage when drain pans fill, that portion of the Water Heater shall be installed above the rim of the pan. Supports located inside of the pan to support the appliance or equipment shall be water resistant and approved.

P2801.7 Water heaters installed in garages. Water heaters having an *ignition source* shall be elevated such that the source of ignition is not less than 18 inches (457 mm) above the garage floor.

Exception: Elevation of the *ignition source* is not required for *appliances* that are *listed* as flammable vapor ignition-resistant. (FVIR)

P2801.9 Rooms used as a plenum.

Water heaters using solid, liquid or gas fuel shall not be installed in a room containing air-handling machinery where such room is used as a plenum.

P2801.10 (502.3) Water heaters installed in attics.

Attics containing a water heater shall be provided with an opening and unobstructed passageway large enough to allow removal of the water heater. The passageway shall be not less than 30 inches (762 mm) in height and 22 inches (559 mm) in width and not more than 20 feet (6096 mm) in length when measured along the centerline of the passageway from the opening to the water heater. If 6 feet (1829 mm) of headroom is provided along the centerline of the passageway from the opening to the water heater, the length of the passageway is permitted to exceed 20 feet (6096 mm) in length. The passageway shall have continuous solid flooring not less than 24 inches (610 mm) in width. A level service space not less than 30 inches (762 mm) in length and 30 inches (762 mm) in width shall be present at the front or service side of the water heater. The clear access opening dimensions shall be not less than 20 inches by 30 inches (508 mm by 762 mm) where such dimensions are large enough to allow removal of the water heater.

P2801.11 (502.6) Installation in crawl spaces.

Under-floor spaces containing appliances requiring access shall be provided with an access opening and unobstructed passageway large enough to remove the largest component of the appliance. The passageway shall not be less than 22 inches (559 mm) high and 36 inches (914 mm) wide, nor more than 20 feet (6096 mm) in length when measured along the centerline of the passageway from the opening to the equipment. A level service space not less than 30 inches (762 mm) deep and 30 inches (762 mm) wide shall be present at the front or service side of the appliance. If the depth of the passageway or the service space exceeds 12 inches (305mm) below the adjoining grade, the walls of the passageway shall be lined with concrete or masonry extending 4 inches (102 mm) above the adjoining grade and having sufficient lateral-bearing capacity to resist collapse. The clear access opening dimensions shall be a minimum of 22 inches by 30 inches (559 mm by 762 mm), where such dimensions are large enough to allow removal of the largest component of the appliance.

Exceptions:

1. The passageway is not required where the level service space is present when the access is open and the appliance is capable of being serviced and removed through the required opening.
2. Where the passageway is not less than 6 feet high (1829 mm) for its entire length, the passageway shall not be limited in length.

P2801.12 (502.7) Under-floor and exterior-grade installation.

P2801.12.1 (502.7.1) Exterior-grade installations.

Equipment and appliances installed above grade level shall be supported on a solid base or approved material a minimum of 2 inches (51 mm) thick.

P2801.12.2 (502.7.2) Under-floor installation.

Suspended equipment shall be a minimum of 6 inches (152 mm) above the adjoining grade.

P2801.12.3 (502.7.3) Crawl space supports.

The support shall be a minimum of a 2-inch (51 mm) thick solid base, 2-inch (51 mm) thick formed concrete, or stacked masonry units held in place by mortar or other approved method. The water heater shall be supported not less than 2 inches (51 mm) above grade.

P2801.12.4 (502.7.4) Drainage.

Below-grade installations shall be provided with a natural drain or an automatic lift or sump pump. Existing installation that can be terminated outdoors must terminate outdoors. Where the installation is such that outdoor termination is impossible, indoor termination is allowable.

P2801.13 (502.8) Prohibited installations.

Water heaters, (using solid, liquid or gas fuel) with the exception of those having direct vent systems, shall not be installed in bathrooms and bedrooms or in a closet with access only through a bedroom or bathroom. However, water heaters of the automatic storage type may be installed as replacement in a bathroom, when approved by the plumbing official, provided they are vented and supplied with adequate combustion air.

Exception: When a closet, having a weather-stripped solid door with an approved closing device, has been designed exclusively for the water heater and where all air for combustion and ventilation is supplied from outdoors.

P2804.6 Installation of relief valves. A check or shutoff valve shall not be installed in any of the following locations:

1. Between a relief valve and the termination point of the relief valve discharge pipe.
2. Between a relief valve and a tank.
3. Between a relief valve and heating *appliances* or equipment.

P2804.6.1 Requirements for discharge pipe. The discharge piping serving a pressure relief valve, temperature relief valve or combination valve shall:

1. Not be directly connected to the drainage system.
2. Discharge through an *air gap* located in the same room as the water heater.
3. Not be smaller than the diameter of the outlet of the valve served and shall discharge full size to the *air gap*.
4. Serve a single relief device and shall not connect to piping serving any other relief device or equipment.
5. Discharge to the floor, to the pan serving the water heater or storage tank, to a waste receptor or to the outdoors.
6. Discharge in a manner that does not cause personal injury or structural damage.
7. Discharge to a termination point that is readily observable by the building occupants.
8. Not be trapped.
9. Be installed to flow by gravity.
10. Terminate not more than 6 inches (152 mm) and not less than two times the discharge pipe diameter above the floor or waste receptor flood level rim.
11. Not have a threaded connection at the end of the piping.
12. Not have valves or tee fittings.
13. Be constructed of those materials indicated in Section P2906.5 or materials tested, rated and *approved* for such use in accordance with ASME A112.4.1.
14. ~~Be one nominal size larger than the size of the relief-valve outlet, where the relief-valve discharge piping is constructed of PEX or PE-RT tubing. The outlet end of such tubing shall be fastened in place.~~ The discharge pipe shall be clamped or otherwise supported with not less than one clamp or support within 12-inches (305 mm) of the point of discharge.

P2804.8 (501.9) Relief valve installation by manufacturer.

The following is a reprint of GS 66-27.1, "Safety Features of Hot Water Heaters."

a. No individual, firm, corporation or business shall install, sell or offer for sale any automatic hot water tank or heater of 120-gallon (454 L) capacity or less, except for a tankless water heater, which does not have installed thereon by the manufacturer of the tank or heater an American Society of Mechanical Engineers and National Board of Boiler and Pressure Vessel Inspectors approved type pressure-temperature relief valve set at or below the safe working pressure of the tank as indicated, and so labeled by the manufacturer's Identification stamped or cast upon the tank or heater or upon a plate secured to it.

b. No individual, firm, corporation or business shall install, sell or offer for sale any relief valve, whether it be pressure type, temperature type or pressure-temperature type, which does not carry the stamp of approval of the American Society of Mechanical Engineers and the National Board of Boiler and Pressure Vessel Inspectors.

The following is a reprint of GS 66-27.1A, "Water heater thermostat settings."

a. The thermostat of any new residential water heater offered for sale or lease for use in a single-family or multifamily dwelling in the State shall be preset by the manufacturer or installer no higher than approximately 120°F (49°C). A water heater reservoir temperature may be set higher if it is supplying space heaters that require higher temperatures. For purposes of this section, a water heater shall mean the primary source of hot water for any single-family or multifamily residential dwelling including, but not limited to any solar or other hot water heating systems.

b. Nothing in this section shall prohibit the occupant of a single-family or multiunit residential dwelling with an individual water heater from resetting or having reset the thermostat on the water heater. Any such resetting shall relieve the manufacturer or installer of the water heater and, in the case of a residential dwelling that is leased or rented, also the unit's owner, from liability for damages attributed to the resetting.

c. A warning tag or sticker shall be placed on or near the operating thermostat control of any residential water heater. This tag or sticker shall state that the thermostat settings above the preset temperature may cause severe burns. This tag or sticker may carry such other appropriate warnings as may be agreed upon by manufacturers, installers and other interested parties.

P2804.9 (501.10) Fossil fuel equipment installation.

The installation of the following equipment and systems shall comply with the *North Carolina Fuel Gas Code*:

a. Fuel piping for any fossil fuel-burning equipment.

b. Venting systems for fossil fuel-burning equipment which is part of the plumbing system.

SECTION P2805 (503)
CONNECTIONS

P2805.1 Cold water line valve.

The cold water *branch* line from the main water supply line to each hot water storage tank or water heater shall be provided with a valve, located within 3 feet (914 mm) of the equipment and serving only the hot water storage tank or water heater. The valve shall not interfere or cause a disruption of the cold water supply to the remainder of the cold water system. The valve shall be provided with *access* on the same floor level as the water heater served.

P2805.2 Water circulation.

The method of connecting a circulating water heater to the tank shall provide circulation of water through the water heater. The pipe or tubes required for the installation of appliances that will draw from the water heater or storage tank shall comply with the provisions of this code for material and installation. Installation shall comply with the manufacturer's instructions and the requirements of the *North Carolina Energy Conservation Code*.

SECTION P2806
SAFETY DEVICES

P2806.1 Antisiphon devices.

An *approved* means, such as a cold water "dip" tube with a hole at the top or a vacuum relief valve installed in the cold water supply line above the top of the heater or tank, shall be provided to prevent siphoning of any storage water heater or tank.

P2806.2 Shutdown.

A means for disconnecting an electric hot water supply system from its energy supply shall be provided in accordance with NFPA 70. A separate valve shall be provided to shut off the energy fuel supply to all other types of hot water supply systems.

SECTION P2807
INSULATION

P2807.1 Unfired vessel insulation.

Unfired hot water storage tanks shall be insulated to R-12.5 $(h \cdot ft^2 \cdot °F)/Btu$ (R-2.2 $m^2 \cdot K/W$).

SECTION P2808
VEHICLE IMPACT PROTECTION

P2808.1 General. Equipment and appliances shall be installed as required by the terms of their approval, in accordance with the conditions of the listing, the manufacturer's installation instructions and this code. Manufacturer's installation instructions shall be available on the job site at the time of inspection.

P2808.2 Protection from impact. *Appliances* located in private garages and carports shall be installed with a minimum clearance of 6 feet (1829 mm) above the floor. *Appliances* located out of the normal path of travel are not required to be protected.

> **Exception:** The requirements of this section shall not apply where the appliances are protected from motor vehicle impact and installed in accordance with Figure P2808.1.

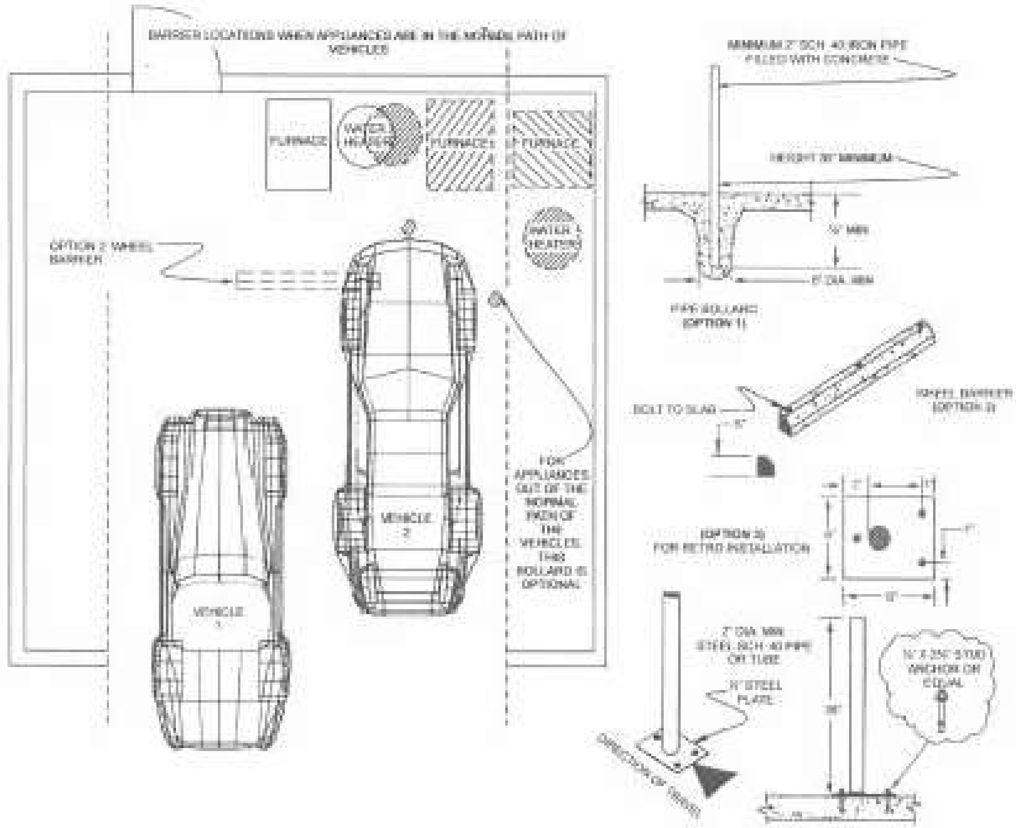


Figure 2808.1
MOTOR VEHICLE IMPACT PROTECTION

CHAPTER 29
WATER SUPPLY AND DISTRIBUTION

~~User notes:~~

~~***About this chapter:*** Many plumbing fixtures require a supply of potable water. Other fixtures could be supplied with nonpotable water such as reclaimed water. Chapter 29 covers the requirements for water distribution piping systems to and within buildings. The regulations include the types of materials and the connection methods for such systems. This chapter regulates the assemblies, devices and methods that are used for the prevention of backflow of contaminated or polluted water into the potable water system. Also contained in this chapter are the design requirements for the installation of fire sprinkler systems, as such systems are connected to the potable water supply for the building. Storm water and some liquid waste from a building can be a source of nonpotable water that can used to reduce the volume of potable water supplied to the building. This chapter provides the requirements for storage, treatment and distribution of this resource. This chapter also regulates the piping systems for reclaimed water supplied by a wastewater treatment facility.~~

Code development reminder: Code change proposals to this chapter will be considered by the IRC—Mechanical/Plumbing Code Development Committee during the 2021 (Group A) Code Development Cycle.

P2901.3 (608.10) Reuse of piping.
Piping that has been utilized for any purpose other than conveying potable water shall not be utilized for conveying potable water.

P2902.5.5 Solar thermal systems. Where a solar thermal system heats potable water to supply a potable hot water distribution or any other type of heating system, the solar thermal system shall be in accordance with Section P2902.5.5.1, P2902.5.5.2 or P2902.5.5.3 as applicable. Solar energy systems used for heating potable water or using an independent medium for heating potable water shall comply with the applicable requirements of this code. The use of solar energy shall not compromise the requirements for cross connection or protection of the potable water supply system required by this code.

P2903.3.2 Maximum pressure. The static water pressure shall be not greater than 80 psi (551 kPa). Where the main pressure exceeds 80 psi (551 kPa), an *approved* pressure-reducing valve conforming to ASSE 1003 or CSA B356 shall be installed on the domestic water branch main or riser at the connection to the water service pipe.

Exception: Service lines to sill cocks and outside hydrants when equipped with a shutoff valve.

P2903.5 Water hammer. The flow velocity of the water distribution system shall be controlled to reduce the possibility of water hammer. A water-hammer arrestor shall be installed where quick-closing valves are utilized for clothes washers, dishwashers, ice makers, or similar applications. Water-hammer arrestors shall be installed in accordance with the manufacturer's instructions. Water-hammer arrestors shall conform to ASSE 1010.

P2903.8 Gridded and parallel water distribution systems. ~~Hot water and c~~Cold water manifolds installed with parallel-connected individual distribution lines and cold water manifolds installed with gridded distribution lines to each fixture or fixture fitting shall be designed in accordance with Sections P2903.8.1 through P2903.8.5. Gridded systems for hot water distribution systems shall be prohibited.

TABLE P2903.8.1
MANIFOLD SIZING[a]

PLASTIC		METALLIC	
Nominal Size ID (inches)	Maximum[b] gpm	Nominal Size ID (inches)	Maximum[b] gpm
3/4	17	3/4	11
1	29	1	20
1 1/4	46	1 1/4	31
1 1/2	66	1 1/2	44

For SI: 1 inch = 25.4 mm, 1 gallon per minute = 3.785 L/m, 1 foot per second = 0.3048 m/s.

a. See Table P2903.6 for w.s.f.u and Table P2903.6(1) for gallon-per-minute (gpm) flow rates.

~~a.~~ b. Based on velocity limitation: plastic, 12 feet per second; metal, 8 feet per second.

P2903.9.1 Service valve. Each *dwelling unit* shall be provided with an accessible main shutoff valve located either inside or outside the dwelling within 5 feet (1524 mm) of the foundation wall in a readily accessible valve box, in the crawl space within 3 feet (914 mm) of the crawl space access door or within the dwelling in a location where it may be accessed without the use of a ladder or a tool. ~~near the entrance of the water service.~~ The valve shall be of a full-open type having nominal restriction to flow, with provision for drainage such as a bleed orifice or installation of a separate drain valve. ~~Additionally, the water service shall be valved at the curb or *lot line* in accordance with local requirements.~~

P2903.9.2 Water heater valve. A *readily accessible* full-open valve shall be installed in the cold-water supply pipe to each water heater ~~at or near~~ within 3 feet (914 mm) the water heater. The valve shall not interfere or cause a disruption of the cold water supply to the remainder of the cold water system. The valve shall be provided with *access* on the same floor level as the water heater served.

P2903.11 Drain water heat recovery units. Drain water heat recovery units shall be in accordance with Section N1103.5.~~4~~ 3.

P2906.2 Lead content. The lead content in pipe and fittings used in the water supply system shall be ~~not greater than 8 percent~~ in accordance with Section P2906.2.1.

P2906.4 Water service pipe. Water service pipe shall conform to NSF 61 and shall conform to one of the standards indicated in Table P2906.4. Water service pipe or tubing, installed underground and outside of the structure, shall have a working pressure rating of not less than 160 pounds per square inch at 73°F (1103 kPa at 23°C). Where the water pressure exceeds 160 pounds per square inch (1103 kPa), piping material shall have a rated working pressure equal to or greater than the highest available pressure. Water service pipe shall terminate 5 feet (1524 mm) inside or outside of the building foundation wall. Water service piping materials not third-party certified for water distribution shall terminate at or before the full open valve located at the entrance to the structure. Ductile iron water service piping shall be cement mortar lined in accordance with AWWA C104/A21.4.

P2906.4.1 Separation of water service and building sewer. Trenching, pipe installation and backfilling shall be in accordance with Section P2604. ~~P2906.4.1 Separation of water service and building sewer. Trenching, pipe installation and backfilling shall be in accordance with Section P2604. Where water service piping is located in the same trench with the building sewer, such sewer shall be constructed of materials listed in Table P3002.1(2). Where the building sewer piping is not constructed of materials indicated in Table P3002.1(2), the water service pipe and the building sewer shall be horizontally separated by not less than 5 feet (1524 mm) of undisturbed or compacted earth. The required separation distance shall not apply where a water service pipe crosses a sewer pipe, provided the water service is sleeved to a point not less than 5 feet (1524 mm) horizontally from the sewer pipe centerline on both sides of such crossing. The sleeve shall be of pipe materials indicated in Table P2906.4, P3002.1(2) or P3002.2. The required separation distance shall not apply where the bottom of the water service pipe that is located within 5 feet (1524 mm) of the sewer is not less than 12 inches (305 mm) above the highest point of the top of the building sewer.~~

1. Where water service piping is located in the same trench with the *building sewer*, such sewer shall be constructed of materials listed in Table P3002.1(2).
2. Where the *building sewer* piping is not constructed of materials indicated in Table P3002.1(2), the water service pipe and the *building sewer* shall be horizontally separated by not less than 5 feet (1524 mm) of undisturbed or compacted earth.
3. The required separation distance shall not apply where a water service pipe crosses a sewer pipe, provided that the water service is sleeved to a point not less than 5 feet (1524 mm) horizontally from the sewer pipe centerline on both sides of such crossing. The sleeve shall be of pipe materials indicated in Table P2906.4, P3002.1(2) or P3002.2.

4. The required separation distance shall not apply where the bottom of the water service pipe that is located within 5 feet (1524 mm) of the sewer is not less than 12 inches (305 mm) above the highest point of the top of the *building sewer*.

P2906.5 Water distribution pipe. Water distribution piping within *dwelling units* shall conform to NSF 61 and shall conform to one of the standards indicated in Table P2906.5. Hot water distribution pipe and tubing shall have a pressure rating of not less than 100 psi at 180°F (689 kPa at 82°C). Cold water distribution pipe and tubing shall have a pressure rating of not less than 160 psi at 73.4°F (1100 kPa at 23°C).

P2906.9.1.1 ABS plastic pipe. ~~Solvent cement for ABS plastic pipe conforming to ASTM D 2235 shall be applied to all joint surfaces.~~ Joint surfaces shall be clean and free from moisture. Solvent cement that conforms to ASTM D 2235 shall be applied to all joint surfaces. The joint shall be made while the cement is wet. Joints shall be made in accordance with ASTM D 2235. Solvent-cement joints shall be permitted above or below ground.

P2906.9.1.4 PVC plastic pipe. A purple primer or an ultraviolet purple primer that conforms to ASTM F 656 shall be applied to PVC solvent-cemented joints. When an ultraviolet primer is used, the installer shall provide an ultraviolet light to the inspector to be used during the inspection. Solvent cement for PVC plastic pipe conforming to ASTM D 2564 shall be applied to all joint surfaces.

P2906.18.2 Joint between PVC water service and CPVC water distribution. Where a PVC water service pipe connects to a CPVC pipe at the beginning of a water distribution system, the transition shall be by a mechanical fitting, an *approved* adapter fitting~~, a~~ or transition fitting ~~or by a single, solvent-cemented transition joint. A single, solvent-cemented transition joint shall be in compliance with ASTM F493 and the pipe, fitting and solvent cement manufacturers' instructions. Solvent cement joint surfaces shall be clean, free from moisture and prepared with an *approved* primer. Solvent cement conforming to ASTM F493 shall be applied to the joint surfaces and the joint assembled while the cement is wet~~.

P2906.18.3 Plastic pipe or tubing to other piping material. Joints between different types of plastic pipe or between plastic pipe and other piping material shall be made with an *approved* adapter fitting or transition fitting.

P2906.22 Polybutylene plastic.

Joints between polybutylene plastic pipe and tubing or fittings shall comply with Sections P2906.22.1 through P2906.22.3.

P2906.22.1 (605.26.1) Flared joints.

Flared pipe ends shall be made by a tool designed for that operation.

P2906.22.2 (605.26.2) Heat-fusion joints.

Joints shall be of the socket-fusion or butt-fusion type. Joint surfaces shall be clean and free from moisture. All joint surfaces shall be heated to the melting temperature and joined. The joint shall be undisturbed until cool. Joints shall be made in accordance with ASTM D 2657, ASTM D 3309 or CAN3-B137.8M.

P2906.22.3 (605.26.3) Mechanical joints.

Mechanical joints shall be installed in accordance with the manufacturer's installation instructions.

SECTION P2910
NONPOTABLE WATER SYSTEMS

P2910.1 Scope. The provisions of ~~Chapter 13~~ Sections P2909, P2910, P2911, P2912 and P2913 shall govern the materials, design, construction and installation of systems for the collection, storage, treatment and distribution of nonpotable water. For nonpotable rainwater systems, the provisions of CSA B805/ICC 805 shall be an alternative for regulating the materials, design, construction and installation of systems for rainwater collection, storage, treatment and distribution of nonpotable water. The use and application of nonpotable water shall comply with laws, rules and ordinances applicable in the jurisdiction.

P2910.2.2 Filtration required. Nonpotable water utilized for water closet and urinal flushing applications shall be filtered by a 100 micron or finer filter. Non-potable water for use within a building shall be colored blue or green.

Exception: Reclaimed water sources shall not be required to comply with the requirements of this section.

~~P2910.2.3 **Applications.**~~

~~Untreated *rainwater* shall be utilized in accordance with Section P2910.2.3.1. Treated *rainwater* shall be utilized in accordance with Section P2910.2.3.2.~~

~~P2910.2.3.1 **Examples of acceptable uses without treatment.**~~

~~1. Outdoor Irrigation~~

~~2. Decorative Fountains~~

~~3. Yard Hydrants~~

~~4. Industrial Processes (eg. Dust Control, Indoor Hose Bibs Spray)~~

~~5. Vehicle Washing~~

~~6. Outdoor Hose Bibs (not routed through building wall)~~

~~P2910.2.3.2 **Examples of acceptable uses with disinfection and filtration.**~~

~~1. Toilet Flushing~~

~~2. Urinal Flushing~~

~~3. Evaporative Cooling Tower Make-up~~

~~4. Trap Primers~~

~~5. Fire Suppression Systems~~

~~6. Clothes Washers~~

~~7. Outdoor Pools and Spas~~

~~8. Hose Bibs – Residential~~

P2910.3 Signage required. Nonpotable water outlets such as hose connections, sillcocks, hose bibs, wall hydrants, yard hydrants, other outdoor outlets, open-ended pipes and faucets shall be identified at the point of use for each outlet with signage that reads, "Nonpotable water is utilized for [application name]. CAUTION: NONPOTABLE WATER. DO NOT DRINK." The words shall be legibly and indelibly printed on a tag or sign constructed of corrosion-resistant, waterproof material or shall be indelibly printed on the fixture. The letters of the words shall be not less than 0.5 inches (12.7 mm) in height and in colors contrasting the background on which they are applied. In addition to the required wordage, the pictograph shown in Figure P2910.3 shall appear on the signage required by this section.

P2910.6.1 Identification of non-potable water systems.

Where non-potable plumbing systems (drainage or supply within gray water, rain water or reclaimed water systems) are installed, the piping conveying the non-potable water shall be identified either by color marking, metal tags or tape in accordance with Section P2910.6.2.

P2910.6.2 Non-potable pipe labeling and marking.
Non-potable distribution piping shall be purple in color or shall be embossed, or integrally stamped or marked, with the words: "CAUTION: NON-POTABLE WATER – DO NOT DRINK" or the piping shall be installed with a purple identification tape or wrap. Pipe identification shall include the contents of the piping system and an arrow indicating the direction of flow. Hazardous piping systems shall also contain information addressing the nature of the hazard. Pipe identification shall be repeated at intervals not exceeding 25 feet (7620 mm) and at each point where the piping passes through a wall, floor or roof. Lettering shall be readily observable within the room or space where the piping is located.

P2910.6.2.1 Color.
The color of the pipe identification shall be discernable and consistent throughout the building. The color purple shall be used to identify reclaimed, rain and gray water distribution systems.

P2910.6.2.2 (1301.6.2.2) Lettering size.

The size of the background color field and lettering shall comply with Table **P2910.6.2.2**.

TABLE P2910.6.2.2 (1301.6.2.2)
SIZE OF PIPE IDENTIFICATION

PIPE DIAMETER (inches)	LENGTH BACKGROUND COLOR FIELD (inches)	SIZE OF LETTERS (inches)
3/8 to 1-1/4	8	0.5
1-1/2 to 2	8	0.75
2-1/2 to 6	12	1.25
8 to 10	24	2.5
over 10	32	3.5

For SI 1 inch = 25.4 mm.

P2910.6.2.3 Identification tape.
Where used, identification tape shall be at least 3 inches (76 mm) wide and have white or black lettering on a purple field stating "CAUTION: NON-POTABLE WATER – DO NOT DRINK." Identification tape shall be installed on top of non-potable rainwater distribution pipes, fastened at least every 10 feet (3048 mm) to each pipe length and run continuously the entire length of the pipe.

P2910.7 Insect and vermin control. The system shall be protected to prevent the entrance of insects and vermin into storage tanks and piping systems. Screens installed on vent pipes, inlets, and overflow pipes shall have an aperture of not greater than 1/16 inch (1.59 mm) and shall be close-fitting or other *approved* methods. Screen materials shall be compatible with contacting system components and shall not accelerate the corrosion of system components.

P2910.11 Storage tank tests. Storage tanks shall be tested in accordance with the following:

1. Storage tanks shall be filled with water to the overflow line prior to and during inspection. Seams and joints shall be left exposed and the tank shall remain watertight without leakage for a period of 24 hours.

   Exception: If air testing, system shall be pressurized with air equivalent to the water pressure for the full depth of the tank in accordance with Section P2503.7.

2. After 24 hours, supplemental water shall be introduced for a period of 15 minutes to verify proper drainage of the overflow system and leaks do not exist.
3. Following a successful test of the overflow, the water level in the tank shall be reduced to a level that is 2 inches (51 mm) below the makeup water trigger point by using the tank drain. The tank drain shall be observed for proper operation. The makeup water system shall be observed for proper operation, and successful automatic shutoff of the system at the refill threshold shall be verified. Water shall not be drained from the overflow at any time during the refill test.

P2911.5 Filtration. Untreated water collected for reuse shall be filtered as required for the intended end use. Filters shall be accessible for inspection and maintenance. Filters shall utilize a pressure gauge or other *approved* method to provide indication when a filter requires servicing or replacement. Filters shall be installed with shutoff valves immediately upstream and downstream to allow for isolation during maintenance. Non-potable water for use within a building shall be colored blue or green.

P2911.6 Disinfection. Nonpotable water collected on site for reuse shall be disinfected, treated or both as determined by a *registered design professional* to provide the quality of water needed for the intended end-use application. Where the intended end-use application does not have requirements for the quality of water, disinfection and treatment of water collected on site for reuse shall not be required. Nonpotable water collected on site containing untreated graywater shall be retained in collection reservoirs for not more than 24 hours.

P2911.10 Water pressure-reducing valve or regulator. Where the water pressure supplied by the pumping system exceeds 80 psi (552 kPa) static, a pressure-reducing valve shall be installed to reduce the pressure in the nonpotable water distribution system piping to 80 psi (552 kPa) static or less. Pressure-reducing valves shall be specified and installed in accordance with Section P2903.3.2.

Exception: Service lines to sill cocks and outside hydrants, and main supply risers where pressure from the mains is reduced to 80 psi (552 kPa) or less at individual fixtures.

P2911.12.4 Inspection and testing of backflow prevention assemblies. ~~The testing of backflow preventers and backwater valves shall be conducted in accordance with Section P2503.8~~.

P2910.2.3 **Applications.**
Untreated *rainwater* shall be utilized in accordance with Section P2910.2.3.1. Treated *rainwater* shall be utilized in accordance with Section P2910.2.3.2.

P2910.2.3.1 **Examples of acceptable uses without treatment.**

1. Outdoor Irrigation

2. Decorative Fountains

3. Yard Hydrants

4. Industrial Processes (eg. Dust Control, Indoor Hose Bibs Spray)

5. Vehicle Washing

6. Outdoor Hose Bibs (not routed through building wall)

P2910.2.3.2 **Examples of acceptable uses with disinfection and filtration.**

1. Toilet Flushing

2. Urinal Flushing

3. Evaporative Cooling Tower Make-up

4. Trap Primers

5. Fire Suppression Systems

6. Clothes Washers

7. Outdoor Pools and Spas

8. Hose Bibs – Residential

P2912.2 Collection surface. Rainwater shall be collected only from above-ground impervious roofing surfaces constructed from *approved* materials for acceptable uses without treatment listed in Section P2910.2.3.1 or where additional appropriate treatment is designed by a *registered design professional*. Collection of water from vehicular parking or pedestrian walkway surfaces shall be prohibited except where the water is used exclusively for landscape irrigation. Overflow and bleed-off pipes from roof-mounted *appliances* including, but not limited to, evaporative coolers, water heaters and solar water heaters shall not discharge onto rainwater collection surfaces.

P2912.3 Debris excluders. Downspouts and leaders shall be connected to a roof washer and shall be equipped with a debris excluder or equivalent device to prevent the contamination of collected rainwater with leaves, sticks, pine needles and ~~similar~~ undesirable material. Debris excluders and equivalent devices shall be self-cleaning.

P2912.8 Filtration. Collected rainwater shall be filtered as required for the intended end use. Filters shall be accessible for inspection and maintenance. Filters shall utilize a pressure gauge or other *approved* method to provide indication when a filter requires servicing or replacement. Filters shall be installed with shutoff valves installed immediately upstream and downstream to allow for isolation during maintenance. Non-potable water for use within a building shall be colored blue or green.

P2912.9 Disinfection. Where the intended application for rainwater requires disinfection or other treatment or both, it shall be disinfected as ~~needed~~ determined by a *registered design professional* to to ensure that the required water quality is delivered at the point of use.

P2912.13 Water pressure-reducing valve or regulator. Where the water pressure supplied by the pumping system exceeds 80 psi (552 kPa) static, a pressure-reducing valve shall be installed to reduce the pressure in the rainwater distribution system piping to 80 psi (552 kPa) static or less. Pressure-reducing valves shall be specified and installed in accordance with Section P2903.3.2.

Exception: Service lines to sill cocks and outside hydrants, and main supply risers where pressure from the mains is reduced to 80 psi (552 kPa) or less at individual fixtures.

P2912.15 Tests and inspections. Tests and inspections shall be performed in accordance with Sections P2912.15.1 through P2912.15.8.

P2912.15.1 Roof gutter inspection and test. DELETED ~~Roof gutters shall be inspected to verify that the installation and slope is in accordance with Section P2912.5.1. Gutters shall be tested by pouring not less than 1 gallon of water (3.8 L) into the end of the gutter opposite the collection point. The gutter being tested shall not leak and shall not retain standing water.~~

P2912.15.2 Roofwasher test. DELETED ~~Roofwashers shall be tested by introducing water into the gutters. Proper diversion of the first quantity of water in accordance with the requirements of Section P2912.4 shall be verified.~~

P2912.15.6 Inspection and testing of backflow prevention assemblies. Deleted ~~The testing of backflow preventers and backwater valves shall be conducted in accordance with Section P2503.8.~~

P2912.16.1 Manual. A detailed operations and maintenance manual shall be supplied ~~in hard copy form~~ for each system.

P2913.2 Water pressure-reducing valve or regulator. Where the reclaimed water pressure supplied to the building exceeds 80 psi (552 kPa) static, a pressure-reducing valve shall be installed to reduce the pressure in the reclaimed water distribution system piping to 80 psi (552 kPa) static or less. Pressure-reducing valves shall be specified and installed in accordance with Section P2903.3.2

Exception: Service lines to sill cocks and outside hydrants, and main supply risers where pressure from the mains is reduced to 80 psi (552 kPa) or less at individual fixtures.

P2913.4.2 Inspection and testing of backflow prevention assemblies. DELETED ~~The testing of backflow preventers shall be conducted in accordance with Section P2503.8.~~

TABLE P2906.6
PIPE FITTINGS

MATERIAL	STANDARD
Acrylonitrile butadiene styrene (ABS) plastic	ASTM D2468
Cast iron	ASME B16.4
Chlorinated polyvinyl chloride (CPVC) plastic	ASSE 1061; ASTM D2846; ASTM F437; ASTM F438; ASTM F439; CSA B137.6
Copper or copper alloy (Brass)	ASME B16.15; ASME B16.18; ASME B16.22; ASME B16.26; ASME B16.51; ASSE 1061; ASTM F3226
Cross-linked polyethylene/aluminum/high-density polyethylene (PEX-AL-HDPE)	ASTM F1986
Fittings for cross-linked polyethylene (PEX) plastic tubing	ASSE 1061; ASTM F877; ASTM F1807; ASTM F1960; ASTM F2080; ASTM F2098; ASTM F2159; ASTM F2434; ASTM F2735; CSA B137.5
Gray iron and ductile iron	AWWA C110/A21.10; AWWA C153/A21.53
Malleable iron	ASME B16.3
Insert fittings for polyethylene/aluminum/polyethylene (PE-AL-PE) and cross-linked polyethylene/aluminum/cross-linked polyethylene (PEX-AL-PEX)	ASTM F1281; ASTM F1282; ASTM F1974; CSA B137.9; CSA B137.10
Polyethylene (PE) plastic	ASTM D2609; CSA B137.1
Fittings for polyethylene of raised temperature (PE-RT) plastic tubing	ASSE 1061; ASTM D2683; ASTM D3261; ASTM F1055; ASTM F1807; ASTM F2098; ASTM F2159; ASTM F2735; ASTM F2769; CSA B137.18
Polybutylene (PB) plastic	ASSE 1061; CSA B137.8
Polypropylene (PP) plastic pipe or tubing	ASTM F2389; CSA B137.11
Polyvinyl chloride (PVC) plastic	ASTM D2464; ASTM D2466; ASTM D2467; CSA B137.2; CSA B137.3

Stainless steel (Type 304/304L) pipe	ASTM A312; ASTM A778
Stainless steel (Type 316/316L) pipe	ASTM A312; ASTM A778
Steel	ASME B16.9; ASME B16.11; ASME B16.28

CHAPTER 30
SANITARY DRAINAGE

~~User notes:~~

~~**About this chapter:** Chapter 30 regulates methods and piping systems that remove water that has been used for purposes such as flushing water closets, bathing, culinary activities and equipment discharges. The types of materials, drainage fitting and connection methods for these systems, beginning at the receiving fixtures and ending at the point of disposal for the liquid waste, are covered. A design method for a gravity flow system of vertical and horizontal piping is provided based on the probability of flows from specific fixtures.~~

__Code development reminder:__ Code change proposals to this chapter will be considered by the IRC—Mechanical/Plumbing Code Development Committee during the 2021 (Group A) Code Development Cycle.

P3001.2 Protection from freezing. ~~Portions of the above- grade DWV system, other than vent terminals, shall not be located outside of a building, in *attics* or crawl spaces, concealed in outside walls, or in any other place subjected to freezing temperatures unless adequate provision is made to protect them from freezing by insulation or heat or both, except in localities having a winter design temperature greater than 32°F (0°C) (ASHRAE 97.5 percent column, winter, see Chapter 3).~~ Water pipes installed in a wall or ceiling exposed to the exterior shall be located on the heated side of the wall insulation. Water, soil and waste pipes shall not be installed outside of a building. When soil and waste piping is installed under a non-enclosed area of a building or structure, freeze protections shall be installed at the discretion of the authority having jurisdiction. When installed in unconditioned utility rooms, or in the building in any other place subjected to freezing temperatures, adequate provision shall be made to protect such pipes from freezing by a minimum of R6.5 insulation determined at 75°F (24°C) in accordance with ASTM C177 or heat, or both.

No traps of soil or waste pipe shall be installed or permitted outside of a building, or concealed in outside walls or in any place where they may be subjected to freezing temperatures, unless adequate provision is made to protect them from freezing.

Exterior water supply system piping shall be installed below the frost line and in no case less than 12 inches (305 mm) below grade.

Building sewers that connect to private sewage disposal systems shall be installed not less than 3 inches (76.2 mm) below finished grade at the point of septic tank connection. *Building sewers* shall be installed not less than 3 inches (76.2 mm) below grade.

Note: These provisions are minimum requirements, which have been found suitable for normal weather conditions. Abnormally low temperatures for extended periods may require additional provisions to prevent freezing.

P3002.2.1 Building sewer pipe near the water service. The proximity of a *building sewer* to a water service shall comply with Section P2906.~~1.4~~.4.1.

P3002.3 Fittings. Pipe fittings shall be *approved* for installation with the piping material installed and shall comply with the applicable standards indicated in Table P3002.3. Pipe fittings shall not be solvent cemented inside of plastic pipe.

P3003.2 Prohibited joints. Running threads and bands shall not be used in the drainage system. Drainage and vent piping shall not be drilled, tapped, burned or welded.

The following types of joints and connections shall be prohibited:

1. Cement or concrete.
2. Mastic or hot-pour bituminous joints.
3. Joints made with fittings not *approved* for the specific installation.
4. Joints between different diameter pipes made with elastomeric rolling O-rings.
5. Solvent-cement joints between different types of plastic pipe ~~except where provided for in Section P3003.13.4~~.

6. Saddle-type fittings.

P3003.6 Copper and copper-alloy (brass) pipe and tubing. Joints between copper or copper-alloy pipe tubing or fittings shall comply with Sections P3003.6.1 through P3003.6.4.

P3003.6.3 Soldered joints. Copper and copper-alloy **(brass)** joints shall be soldered in accordance with ASTM B828. Cut tube ends shall be reamed to the full inside diameter of the tube end. Joint surfaces shall be cleaned. Fluxes for soldering shall be in accordance with ASTM B813 and shall become noncorrosive and nontoxic after soldering. The joint shall be soldered with a solder conforming to ASTM B32.

P3003.9.2 Solvent cementing. Joint surfaces shall be clean and free from moisture. A purple primer, or an ultraviolet purple primer ~~or other *approved* primer,~~ that conforms to ASTM F656 shall be applied. When an ultraviolet primer is used, the installer shall provide an ultraviolet light to the inspector to be used during the inspection. Solvent cement not purple in color and conforming to ASTM D2564, CSA B137.3 or CSA B181.2 shall be applied to all joint surfaces. The joint shall be made while the cement is wet, and shall be in accordance with ASTM D2855. Solvent-cement joints shall be installed above or below ground. Clear primer conforming to ASTM F 656 may be applied to all joint surfaces where the piping is exposed under sinks and in buildings.

~~**Exception:** A primer shall not be required where all of the following conditions apply:~~

1. ~~The solvent cement used is third-party certified as conforming to ASTM D2564.~~
2. ~~The solvent cement is used only for joining PVC drain, waste and vent pipe and fittings in nonpressure applications in sizes up to and including 4 inches (102 mm) in diameter~~

P3003.13.1 Copper pipe or tubing to cast-iron hub pipe. Joints between copper pipe or tubing and cast-iron hub pipe shall be made with a copper-alloy (brass) ferrule or compression joint. The copper pipe or tubing shall be soldered to the ferrule in an *approved* manner, and the ferrule shall be joined to the cast-iron hub by a caulked joint or a mechanical compression joint.

P3003.13.2 Copper pipe or tubing to galvanized steel pipe. Joints between copper pipe or tubing and galvanized steel pipe shall be made with a copper-alloy (brass) or dielectric fitting. The copper tubing shall be soldered to the fitting in an *approved* manner, and the fitting shall be screwed to the threaded pipe.

P3003.13.3 Cast-iron pipe to galvanized steel or copper-alloy (brass) pipe. Joints between cast-iron and galvanized steel or copper-alloy (brass) pipe shall be made by either caulked or threaded joints or with an *approved* adapter fitting.

P3003.13.4 Plastic pipe or tubing to other piping material. Joints between different types of plastic pipe shall be made with an *approved* adapter fitting ~~or by a solvent-cement joint only where a single joint is made between ABS and PVC pipes at the end of a building drainage pipe and the beginning of a *building sewer* pipe using a solvent cement complying with ASTM D3138~~. Joints between plastic pipe and other piping material shall be made with an *approved* adapter fitting. Joints between plastic pipe and cast-iron hub pipe shall be made by a caulked joint or a mechanical compression joint.

P3003.14 Joints between drainage piping and water closets. Joints between drainage piping and water closets or similar fixtures shall be made by means of a closet flange or a waste connector and sealing gasket compatible with the drainage system material, securely fastened to a structurally firm base. Floor outlet fixtures shall be secured to the floor or floor flanges by screws or bolts of corrosion-resistant material. The joint shall be bolted, with an *approved* gasket flange to fixture connection complying with ASME A112.4.3 or setting compound between the fixture and the closet flange or waste connector and sealing gasket. The waste connector and sealing gasket joint shall comply with the joint-tightness test of ASME A112.4.3 and shall be installed in accordance with the manufacturer's instructions.

P3003.14.1 (405.4.1) Floor flanges.
Floor flanges for water closets or similar fixtures shall be not less than 0.125 inch (3.2 mm) thick for brass, 0.25 inch (6.4 mm) thick for plastic and 0.25 inch (6.4 mm) thick and not less than a 2-inch (51 mm) caulking depth for cast iron or galvanized malleable iron.

Floor flanges of hard lead shall weigh not less than 1 pound, 9 ounces (0.7 kg) and shall be composed of lead alloy with not less than 7.75-percent antimony by weight.

P3003.14.2 (405.4.3) Securing wall-hung water closet bowls.
Wall hung water closet bowls shall be supported by a concealed metal carrier that is attached to the building

structural members so that strain is not transmitted to the closet connector or any other part of the plumbing system. The carrier shall conform to ASME A112.6.1M or ASME A112.6.2.

SECTION P3005
DRAINAGE SYSTEM

P3005.1 Drainage fittings and connections. Fittings shall be installed to guide sewage and waste in the direction of flow. Changes in direction in drainage piping shall be made by the appropriate use of sanitary tees, wyes, sweeps, bends or by a combination of these drainage fittings in accordance with Table P3005.1. Change in direction by combination fittings, heel or side inlets or increasers shall be installed in accordance with Table P3005.1 and Sections P3005.1.1 through P3005.1.4, based on the pattern of flow created by the fitting. Double sanitary tee patterns shall not receive the discharge of appliances with pumping action discharge.

P3005.1.1 Horizontal to vertical (multiple connection fittings). Double fittings such as double sanitary tees and tee-wyes or *approved* multiple connection fittings and back-to-back fixture arrangements that connect two or more branches at the same level shall be permitted as long as directly opposing connections are the same size and the discharge into directly opposing connections is from similar fixture types or fixture groups. Double sanitary tee patterns shall not receive the discharge of ~~back-to-back water closets and fixtures or~~ *appliances* with pumping action discharge.

Exception: **Deleted** ~~Back-to-back water closet connections to double sanitary tee patterns shall be permitted where the horizontal *developed length* between the outlet of the water closet and the connection to the double sanitary tee is 18 inches (457 mm) or greater.~~

TABLE P3005.1
FITTINGS FOR CHANGE IN DIRECTION

~~TYPE OF FITTING PATTERN~~	~~CHANGE IN DIRECTION~~		
	~~Horizontal to vertical~~	~~Vertical to horizontal~~	~~Horizontal to horizontal~~
~~Sixteenth bend~~	~~X~~	~~X~~	~~X~~
~~Eighth bend~~	~~X~~	~~X~~	~~X~~
~~Sixth bend~~	~~X~~	~~X~~	~~X~~
~~Quarter bend~~	~~X~~	~~X[a]~~	~~X[a]~~
~~Short sweep~~	~~X~~	~~X[a,b]~~	~~X[a]~~
~~Long sweep~~	~~X~~	~~X~~	~~X~~
~~Sanitary tee~~	~~X[c]~~	~~—~~	~~—~~
~~Wye~~	~~X~~	~~X~~	~~X~~
~~Combination wye and eighth bend~~	~~X~~	~~X~~	~~X~~

~~For SI: 1 inch = 25.4 mm.~~
~~a. The fittings shall only be permitted for a 2-inch or smaller fixture drain.~~
~~b. Three inches or larger.~~
~~c. For a limitation on double sanitary tees, see Section 706.3.~~

For SI: 1 inch = 25.4 mm.

a. The

TYPE OF FITTING PATTERN	CHANGE IN DIRECTION		
	Horizontal to vertical	Vertical to horizontal	Horizontal to horizontal
Sixteenth bend	X	X	X
Eighth bend	X	X	X
Sixth bend	X	X	X
Quarter bend	X	X ~~a,~~d,f	X ~~a~~,e
Short sweep	X	X a,b	X a
Long sweep	X	X	X
Sanitary tee	X c	—	—
Wye	X	X	X
Combination wye and eighth bend	X	X	X

fittings shall only be permitted for a 2-inch or smaller sink or lavatory fixture drain.

b. ~~Three~~ Two inches or larger.

c. For a limitation on double sanitary tees, see Section P3005.1.1.

d. May be used only within 12 inches below water closet flange measured to centerline of the quarter bend.

e. This fitting shall only be permitted to be used as the first fitting directly behind the fixture for drains 2 inches and smaller, except clothes washers.

f. The heel inlet connection of a quarter bend may be used as a wet or dry vent if the heel inlet connection of the quarter bend is located in the vertical position. The heel or side inlet connection may be used as a wet vent if the quarter bend is located directly below a water closet or other fixture with one integral trap.

P3005.1.2 Heel- or side-inlet quarter bends, drainage. Deleted.~~Heel-inlet quarter bends shall be an acceptable means of connection, except where the quarter bends serves a water closet. A low-heel inlet shall not be used as a wet-vented connection. Side-inlet quarter bends shall be an acceptable means of connection for both drainage, wet venting and stack venting arrangements.~~

P3005.1.6 Drainage piping size reduction in the direction of flow. The size of the drainage piping shall not be reduced in the direction of the flow. The following shall not be considered a reduction in size in the direction of flow:

1. A 4-inch by 3-inch (102 mm by 76 mm) water closet flange.
2. A water closet bend fitting having a 4-inch (102 mm) inlet and a 3-inch (76 mm) outlet provided that the 4-inch (102 mm) leg of the fitting is upright and below, but not necessarily directly connected to, the water closet flange.
3. An offset closet flange with a full flow, minimum 3-inch interior diameter throat.

P3005.2.1) Gravity **horizontal drains and building drains.** *Horizontal* drainage pipes in buildings shall have cleanouts located at intervals of not more than 100 feet (30 480 mm). *Building drains* shall have cleanouts located at intervals of not more than 100 feet (30 480 mm) except where manholes are used instead of cleanouts, the manholes shall be located at intervals of not more than 400 feet (122 m). The interval length shall be measured from the cleanout or manhole opening, along the *developed length* of the piping to the next drainage fitting providing access for cleaning, the end of the *horizontal* drain or the end of the *building drain*.

Exception: Horizontal *fixture drain* piping serving a nonremovable trap shall not be required to have a cleanout for the section of piping between the trap and the vent connection for such trap.

P3005.2.2 Gravity **building sewers.** *Building sewers* smaller than 8 inches (203 mm) shall have cleanouts located at intervals of not more than 100 feet (30 480 mm). *Building sewers* 8 inches (203 mm) and larger shall have a manhole located not more than 200 feet (60 960 mm) from the junction of the *building drain* and *building sewer* and at intervals of not more than 400 feet (122 m). The interval length shall be measured from the cleanout or manhole opening, along the *developed length* of the piping to the next drainage fitting providing access for cleaning, a manhole or the end of the *building sewer*.

P3005.2.3 Building drain and building sewer junction. ~~The junction of the *building drain* and the *building sewer* shall be served by a cleanout that is located at the junction or within 10 feet (3048 mm) *developed length* of piping upstream of the junction. For the requirements of this section, removal of a water closet shall not be required to provide cleanout access.~~ There shall be a cleanout at the junction of the building drain and the building sewer. The cleanout shall be outside the building wall and shall be brought up to the finished ground level. An approved two-way cleanout is allowed to be used at this location to serve as a required cleanout for both the building drain and building sewer. The cleanout at the junction of the building drain and building sewer shall not be required if the cleanout on a 3 inch (76 mm) or larger diameter soil stack is located within a developed length of not more than 15 feet (4572 mm) from the building drain and building sewer connection and is extended to the outside of the building. The minimum size of the cleanout at the junction of the building drain and building sewer shall comply with Section P3005.2.5.

P3005.2.4 Changes of direction. ~~Where a horizontal drainage pipe, a *building drain* or a *building sewer* has a change of horizontal direction greater than 45 degrees (0.79 rad), a cleanout shall be installed at the change of direction. Where more than one change of horizontal direction greater than 45 degrees (0.79 rad) occurs within 40 feet (12 192 mm) of *developed length* of piping, the cleanout installed for the first change of direction shall serve as the cleanout for all changes in direction within that 40 feet (12 192 mm) of developed length of piping.~~ One cleanout shall be required for every four horizontal 45 degree (0.79 rad) changes located in series. (A long sweep is equivalent to two 45 degree (0.79 rad) bends.)

P3005.2.5 Cleanout size. Cleanouts shall be the same size as the piping served by the cleanout, except cleanouts for piping larger than 4 inches (102 mm) need not be larger than 4 inches (102 mm).

Exceptions:

1. A removable P-trap with slip- or ground-joint connections can serve as a cleanout for drain piping that is one size larger than the P-trap size.
2. Cleanouts located on stacks can be one size smaller than the stack size.
3. The size of cleanouts for cast-iron piping can be in accordance with the referenced standards for cast iron fittings as indicated in Table P3002.3.
4. "P" traps into which floor drains, shower drains or tub drains with removable strainers discharge.
5. "P" traps into which the straight-through type waste and overflow discharge with the overflow connecting to the top of the tee.
6. "P" traps into which residential washing machines discharge.
7. Test tees or cleanouts in a vertical pipe.
8. Cleanout near the junction of the building drain and the building sewer which may be rodded both ways.
9. Water closets for the water closet fixture drain only.

P3005.4.1 Branch and stack sizing. Branches and stacks shall be sized in accordance with Table P3005.4.1. Below grade drain pipes shall be not less than ~~1 1/2~~ 2 inches (~~38~~ 51 mm) in diameter. Drain stacks shall be not smaller than the largest horizontal branch connected.

Exceptions:

1. A 4-inch by 3-inch (102 mm by 76 mm) closet bend or flange.
2. ~~A 4-inch (102 mm) closet bend connected to a 3-inch (76 mm) stack tee shall not be prohibited.~~

TABLE P3005.4.1

MAXIMUM FIXTURE UNITS ALLOWED TO BE CONNECTED TO BRANCHES AND STACKS[d,e]

NOMINAL PIPE SIZE (inches)	ANY HORIZONTAL FIXTURE BRANCH	ANY ONE VERTICAL STACK OR DRAIN
1 1/4[a, b]	—	—
1 1/2[b]	3	4
2[b]	6	10
2 1/2[b]	12	20
3[f]	20[c]	48
4	160	240

For SI: 1 inch = 25.4 mm.

a. 1 1/4-inch pipe size limited to a single-fixture drain. See Table P3201.7.

b. Water closets prohibited.

c. No more than four water closets.

d. 50 percent less for circuit-vented fixture branches.

e. Minimum of 2-inch diameter underground.

f. The minimum size of any branches serving a water closet shall be 3 inches.

. TABLE P3005.4.2

MAXIMUM NUMBER OF FIXTURE UNITS ALLOWED TO BE CONNECTED TO THE BUILDING DRAIN, BUILDING DRAIN BRANCHES OR THE BUILDING SEWER[c,e]

DIAMETER OF PIPE (inches)	SLOPE PER FOOT		
	1/8 inch	1/4 inch	1/2 inch
1 1/2[a, b]	—	Note a	Note a
2[b]	—	21	27
2 1/2[b]	—	24	31
3[d]	36	42	50
4	180	216	250

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

a. $1^{1}/_{2}$-inch pipe size limited to a building drain branch serving not more than two waste fixtures, or not more than one waste fixture if serving a pumped discharge fixture or food waste disposer discharge.

b. No water closets.

c. No building sewer shall be less than 4 inches in size.

d. No more thanfour water closets.

e. Minimum of 2-inch diameter underground.

P3005.6 Dead ends. In the installation or removal of any part of a drainage system, dead ends shall be prohibited. Cleanout extensions and approved future fixture drainage piping shall not be considered as dead ends.

P3007.2 Valves required. A check valve ~~and~~ a full open valve and a means for cleanout located on the discharge side of the check valve shall be installed in the pump or ejector discharge piping between the pump or ejector and the gravity drainage system. Access shall be provided to such valves. Such valves shall be located above the sump cover required by Section P3007.3.2 or, where the discharge pipe from the ejector is below grade, the valves shall be accessibly located outside the sump below grade in an access pit with a removable access cover.

P3007.3.3 Discharge pipe and fittings. Discharge pipe and fittings serving sump pumps and ejectors shall be constructed of materials pressure-rated for not less than the maximum discharge pressure of the pump in accordance with Sections P3007.3.3.1 and P3007.3.3.2.

P3007.3.3.1 Materials.. ~~Pipe and fitting materials shall be constructed of copper alloy, copper, CPVC, ductile iron, PE, or PVC~~ Forced main sewer pipe and fitting material shall conform to one of the standards for ABS plastic pipe, copper or copper-alloy tubing, PVC plastic pipe or pressure-rated pipe indicated in Table P3002.2., excluding cell-core products.

P3007.3.3.2 Ratings. Pipe and fittings shall be rated for the maximum system operating pressure and temperature. Pipe fitting materials shall be compatible with the pipe material. Where pipe and fittings are buried in the earth, they shall be suitable for burial. DWV fittings with that are properly rated and allowed by the manufacturer's installation instructions shall be acceptable.

P3007.3.4.1 **(712.3.4.1) Sump alarms**.

Sumps that discharge by means of automatic pumping equipment shall be provided with an approved, electrically operated high-water indicating alarm. A remote sensor shall activate the alarm when the fluid level exceeds a preset level that is less than the maximum capacity of the sump. The alarm shall function to provide an audiovisual signal to occupants within the building. Electrical power for the alarm shall be supplied through a branch circuit separate from that supplying the pump motor.

Exception: Sump alarms are not required for single point-of-use sump pumps and macerating toilet systems.

P3007.4 Sewage pumps and sewage ejectors. A sewage pump or sewage ejector shall automatically discharge the contents of the sump to the building drainage system. The ejector pump discharge pipe shall not discharge directly into a septic tank. The pumped line shall discharge laterally into a 4-inch (102 mm) gravity line not less than 10 feet (3048 mm) from the connection to the tank through a lateral wye branch.

SECTION P3008
BACKWATER VALVES

P3008.1 Where required. ~~Where the flood level rims of plumbing fixtures are below plumbing fixtures are installed on a floor with a finished floor elevation below the elevation of the manhole cover of the next upstream manhole in the public sewer, the fixtures shall be protected by a backwater valve installed in the *building drain*, branch of the *building drain* or *horizontal* branch serving such fixtures.~~ Where plumbing fixtures are installed on a floor with a finished floor elevation below the elevation of the manhole cover of the next upstream manhole in the public *sewer,* such fixtures shall be protected by a backwater valve installed in the *building drain*, or horizontal *branch* serving such fixtures. Plumbing fixtures installed on a floor with a finished floor elevation above the elevation of the manhole cover of the next upstream manhole in the public *sewer* shall not discharge through a backwater valve.

Exception:

1. In existing buildings, fixtures above the elevation of the manhole cover of the next upstream manhole in the public *sewer* shall not be prohibited from discharging through a backwater valve.
2. Where the sewer service line ties directly to a manhole, that manhole is considered to be the next upstream manhole.
3. Where hub drains are located in the crawl space for condensate waste, a backwater valve shall be installed.

P3008.2 Allowable installations. **DELETED** ~~Where plumbing fixtures are installed on a floor with a finished floor elevation above the elevation of the manhole cover of the next upstream manhole in the public sewer, and a backwater valve is installed in the *building drain* or horizontal branch serving such fixtures, the backwater valve shall be of the normally open type.~~

~~**Exception:** Normally closed backwater valve installations for existing buildings shall not be prohibited.~~

P3008.3 Material. Backwater valves shall comply with ASME A112.14.1, CSA B181.1 or CSA B181.2.

P3008.4 Location. Backwater valves shall be installed so that access is provided to the working parts.

P3008.5 Diameter.
Backwater valves, when fully opened, shall have a capacity not less than that of the pipes in which they are installed.

P3008.6 Crawl spaces.
All hub drains or floor drains installed in crawl spaces shall be protected from backflow into the building by a check valve or back-water valve installed in the lateral serving the said hub drain or floor drain.

SECTION P3009
GRAYWATER SOIL ABSORPTION SYSTEMS

DELETED

~~**P3009.1 Scope.** The provisions of this section shall govern the materials, design, construction and installation of subsurface graywater soil absorption systems connected to nonpotable water from on-site water reuse systems.~~

~~**P3009.2 Materials.** Above-ground drain, waste and vent piping for subsurface graywater soil absorption systems shall conform to one of the standards indicated in Table P3002.1(1). Subsurface graywater soil absorption, underground building drainage and vent pipe shall conform to one of the standards indicated in Table P3002.1(2).~~

~~**P3009.3 Tests.** Drain, waste and vent piping for subsurface graywater soil absorption systems shall be tested in accordance with Section P2503.~~

~~**P3009.4 Inspections.** Subsurface graywater soil absorption systems shall be inspected in accordance with Section R109.~~

~~**P3009.5 Disinfection.** Disinfection shall not be required for on-site nonpotable reuse water for subsurface graywater soil absorption systems.~~

~~**P3009.6 Coloring.** On-site nonpotable reuse water used for subsurface graywater soil absorption systems shall not be required to be dyed.~~

~~**P3009.7 Sizing.** The system shall be sized in accordance with the sum of the output of all water sources connected to the graywater soil absorption system. Where graywater collection piping is connected to subsurface graywater soil absorption systems, graywater output shall be calculated according to the gallons-per-day-per-occupant (liters per day per occupant) number based on the type of fixtures connected. The graywater discharge shall be calculated by the following equation:~~

~~$C = A \times B$ **(Equation 30-1)**~~

~~where:~~

~~*A* = Number of occupants:~~

~~Number of occupants shall be determined by the actual number of occupants, but not less than two occupants for one bedroom and one occupant for each additional bedroom.~~

~~*B* = Estimated flow demands for each occupant:~~

~~25 gallons (94.6 L) per day per occupant for showers, bathtubs and lavatories and 15 gallons (56.7 L) per day per occupant for clothes washers or laundry trays.~~

~~*C* = Estimated graywater discharge based on the total number of occupants.~~

~~**P3009.8 Percolation tests.** The permeability of the soil in the proposed absorption system shall be determined by percolation tests or permeability evaluation.~~

~~**P3009.8.1 Percolation tests and procedures.** Not less than three percolation tests in each system area shall be conducted. The holes shall be spaced uniformly in relation to the bottom depth of the proposed absorption system. More percolation tests shall be made where necessary, depending on system design.~~

~~**P3009.8.1.1 Percolation test hole.** The test hole shall be dug or bored. The test hole shall have vertical sides and a horizontal dimension of 4 inches to 8 inches (102 mm to 203 mm). The bottom and sides of the hole shall be scratched with a sharp-pointed instrument to expose the natural soil. Loose material shall be removed from the hole and the bottom shall be covered with 2 inches (51 mm) of gravel or coarse sand.~~

~~**P3009.8.1.2 Test procedure, sandy soils.** The hole shall be filled with clear water to not less than 12 inches (305 mm) above the bottom of the hole for tests in sandy soils. The time for this amount of water to seep away shall be determined, and this procedure shall be repeated if the water from the second filling of the hole seeps away in 10 minutes or less. The test shall proceed as follows: Water shall be added to a point not more than 6 inches (152 mm) above the gravel or coarse sand. Thereupon, from a fixed reference point, water levels shall be measured at 10-minute intervals for a period of 1 hour. Where 6 inches (152 mm) of water seeps away in less than 10 minutes, a shorter interval between measurements shall be used. The water depth shall not exceed 6 inches (152 mm). Where 6 inches (152 mm) of water seeps away in less than 2 minutes, the test shall be stopped and a rate of less than 3 minutes per inch (7.2 s/mm) shall be reported. The final water level drop shall be used to calculate the percolation rate. Soils not meeting these requirements shall be tested in accordance with Section P3009.8.1.3.~~

~~**P3009.8.1.3 Test procedure, other soils.** The hole shall be filled with clear water, and a minimum water depth of 12 inches (305 mm) shall be maintained above the bottom of the hole for a 4-hour period by refilling whenever necessary or by use of an automatic siphon. Water remaining in the hole after 4 hours shall not be removed. Thereafter, the soil shall be allowed to swell not less than 16 hours or more than 30 hours. Immediately after the soil swelling period, the measurements for determining the percolation rate shall be made as follows: any soil sloughed into the hole shall be removed and the water level shall be adjusted to 6 inches (152 mm) above the gravel or coarse sand. Thereupon, from a fixed reference point, the water level shall be measured at 30-minute intervals for a period of 4 hours, unless two successive water level drops do not vary by more than $^{1}/_{16}$ inch (1.59 mm). Not less than three water level drops shall be observed and recorded. The hole shall be filled with clear water to a point not more than 6 inches (152 mm) above the gravel or coarse sand whenever it becomes nearly empty. Adjustments of the water level shall not be made during the three measurement periods except to the limits of the last measured water level drop. When the first 6 inches (152 mm) of water seeps away in less than 30 minutes, the time interval between measurements shall be 10 minutes and the test run for 1 hour. The water depth shall not exceed 5 inches (127 mm) at any time during the measurement period. The drop that occurs during the final measurement period shall be used in calculating the percolation rate.~~

~~**P3009.8.1.4 Mechanical test equipment.** Mechanical percolation test equipment shall be of an *approved* type.~~

~~**P3009.8.2 Permeability evaluation.** Soil shall be evaluated for estimated percolation based on structure and texture in accordance with accepted soil evaluation practices. Borings shall be made in accordance with Section P3009.8.1.1 for evaluating the soil.~~

~~**P3009.9 Subsurface graywater soil absorption system site location.** The surface grade of soil absorption systems shall be located at a point lower than the surface grade of any water well or reservoir on the same or adjoining lot. Where this is not possible, the site shall be located so surface water drainage from the site is not directed toward a well or reservoir. The soil absorption system shall be located with a minimum horizontal distance between various elements as indicated in Table P3009.9. Private sewage disposal systems in compacted areas, such as parking lots and driveways, are prohibited. Surface water shall be diverted away from any soil absorption site on the same or neighboring lots.~~

~~TABLE P3009.9~~

~~LOCATION OF SUBSURFACE IRRIGATION SYSTEM~~

~~ELEMENT~~	~~MINIMUM HORIZONTAL DISTANCE~~	
	~~STORAGE TANK (feet)~~	~~**ABSORPTION** FIELD (feet)~~
~~Buildings~~	~~5~~	~~2~~
~~Lot line adjoining private property~~	~~5~~	~~5~~
~~Public water main~~	~~10~~	~~10~~
~~Seepage pits~~	~~5~~	~~5~~
~~Septic tanks~~	~~0~~	~~5~~
~~Streams and lakes~~	~~50~~	~~50~~
~~Water service~~	~~5~~	~~5~~
~~Water wells~~	~~50~~	~~100~~

~~For SI: 1 foot = 304.8 mm.~~

~~**P3009.10 Installation.** Absorption systems shall be installed in accordance with Sections P3009.10.1 through P3009.11.1.~~

~~**P3009.10.1 Absorption area.** The total absorption area required shall be computed from the estimated daily graywater discharge and the design loading rate based on the percolation rate for the site. The required absorption area equals the estimated graywater discharge divided by the design loading rate from Table P3009.10.1.~~

~~TABLE P3009.10.1~~

~~DESIGN LOADING RATE~~

~~PERCOLATION RATE (minutes per inch)~~	~~DESIGN LOADING FACTOR (gallons per square foot per day)~~
~~0 to less than 10~~	~~1.2~~
~~10 to less than 30~~	~~0.8~~
~~30 to less than 45~~	~~0.72~~
~~45 to 60~~	~~0.4~~

~~For SI: 1 minute per inch = min/25.4 mm,~~
~~1 gallon per square foot = 40.7 L/m^2.~~

~~**P3009.10.2 Seepage trench excavations.** Seepage trench excavations shall be not less than 1 foot (304 mm) in width and not greater than 5 feet (1524 mm) in width. Trench excavations shall be spaced not less than 2 feet (610 mm) apart. The soil absorption area of a seepage trench shall be computed by using the bottom of the trench area (width) multiplied by the length of pipe. Individual seepage trenches shall be not greater than 100 feet (30 480 mm) in *developed length*.~~

~~**P3009.10.3 Seepage bed excavations.** Seepage bed excavations shall be not less than 5 feet (1524 mm) in width and have more than one distribution pipe. The absorption area of a seepage bed shall be computed by using the bottom of the trench area. Distribution piping in a seepage bed shall be uniformly spaced not greater than 5 feet (1524 mm) and not less than 3 feet (914 mm) apart, and greater than 3 feet (914 mm) and not less than 1 foot (305 mm) from the sidewall or headwall.~~

~~**P3009.10.4 Excavation and construction.** The bottom of a trench or bed excavation shall be level. Seepage trenches or beds shall not be excavated where the soil is so wet that such material rolled between the hands forms a soil wire. Smeared or compacted soil surfaces in the sidewalls or bottom of seepage trench or bed excavations shall be scarified to the depth of smearing or compaction and the loose material removed. Where rain falls on an open excavation, the soil shall be left until sufficiently dry so a soil wire will not form when soil from the excavation bottom is rolled between the hands. The bottom area shall then be scarified and loose material removed.~~

~~**P3009.10.5 Aggregate and backfill.** Not less than 6 inches (150 mm) in depth of aggregate ranging in size from $^{1}/_{2}$ to $2^{1}/_{2}$ inches (12.7 mm to 64 mm) shall be laid into the trench below the distribution piping elevation. The aggregate shall be evenly distributed not less than 2 inches (51 mm) in depth over the top of the distribution pipe. The aggregate shall be covered with *approved* synthetic materials or 9 inches (229 mm) of uncompacted marsh hay or straw. Building paper shall not be used to cover the aggregate. Not less than 9 inches (229 mm) of soil backfill shall be provided above the covering.~~

~~**P3009.11 Distribution piping.** Distribution piping shall be not less than 3 inches (76 mm) in diameter. Materials shall comply with Table P3009.11. The top of the distribution pipe shall be not less than 8 inches (203 mm) below the original surface. The slope of the distribution pipes shall be not less than 2 inches (51 mm) and not greater than 4 inches (102 mm) per 100 feet (30 480 mm).~~

~~**TABLE P3009.11**~~

~~**DISTRIBUTION PIPE**~~

~~MATERIAL~~	~~STANDARD~~
~~Polyethylene (PE) plastic pipe~~	~~ASTM F405~~
~~Polyvinyl chloride (PVC) plastic pipe~~	~~ASTM D2729~~
~~Polyvinyl chloride (PVC) plastic pipe with a 3.5-inch O.D. and solid, cellular core or composite wall~~	~~ASTM F1488~~

~~For SI: 1 inch = 25.4 mm.~~

~~**P3009.11.1 Joints.** Joints in distribution pipe shall be made in accordance with Section P3003.~~

P3010.8 Pressure testing. The replacement piping system ~~and the connections to the replacement piping~~ and the connections to the replacement piping shall be tested in accordance with Section P2503.4.

P3011.8 Post-installation recorded video camera survey. When a permit is issued, the completed relined piping system shall be inspected internally by a live ~~recorded~~ video camera survey after the system has been flushed and flow-tested with water. The video survey shall be submitted to the building official prior to finalization of the permit. The video survey shall be reviewed and evaluated to provide verification that no defects exist. Any defects identified shall be repaired and replaced in accordance with this code.

TABLE P3002.2

BUILDING SEWER PIPE

MATERIAL	STANDARD

Acrylonitrile butadiene styrene (ABS) plastic pipe in IPS diameters, including Schedule 40, DR 22 (PS 200) and DR 24 (PS 140); with a solid, cellular core or composite wall	ASTM D2661; ASTM F628; ASTM F1488
Acrylonitrile butadiene styrene (ABS) plastic pipe in sewer and drain diameters, including SDR 42 (PS 20), PS35, SDR 35 (PS 45), PS50, PS100, PS140, SDR 23.5 (PS 150) and PS200; with a solid, cellular core or composite wall	ASTM D2751; ASTM F1488
Polyvinyl chloride (PVC) plastic pipe in sewer and drain diameters, including PS 25, SDR 41 (PS 28), PS 35, SDR 35 (PS 46), PS 50, PS 100, SDR 26 (PS 115), PS140 and PS 200; with a solid, cellular core or composite wall	ASTM D3034; ASTM F891; ASTM F1488; CSA B182.2; CSA B182.4 ANSI/AWWA C900
Cast-iron pipe	ASTM A74; ASTM A888; CISPI 301
Concrete pipe	ASTM C14; ASTM C76; CSA A257.1; CSA A257.2
Copper or copper-alloy tubing (Brass), (Type K or L)	ASTM B75/B75M; ASTM B88; ASTM B251/B251M
Ductile iron pipe	ANSI/AWWA C150/A21.50
Polyethylene (PE) plastic pipe (SDR-PR)	ASTM F714
Polyolefin pipe	ASTM F1412; CSA B181.3
Polyvinyl chloride (PVC) plastic pipe in IPS diameters, including Schedule 40, DR 22 (PS 200) and DR 24 (PS 140); with solid, cellular core or composite wall	ASTM D2665; ASTM D2949; ASTM D3034; ASTM F1412; CSA B182.2; CSA B182.4
Polyvinyl chloride (PVC) plastic pipe with a 3.25-inch O.D. and a solid, cellular core or composite wall	ASTM D2949, ASTM F1488
Stainless steel drainage systems, Types 304 and 316L	ASME A112.3.1
Vitrified clay pipe	ASTM C425; ASTM C700

For SI: 1 inch = 25.4 mm.

TABLE P3002.1(1)
ABOVE-GROUND DRAINAGE AND VENT PIPE

MATERIAL	STANDARD
Acrylonitrile butadiene styrene (ABS) plastic pipe in IPS diameters, including Schedule 40, DR 22 (PS 200) and DR 24 (PS 140); with a solid, cellular core or composite wall	ASTM D2661; ASTM D2680; ASTM F628; ASTM F1488; CSA B181.1
Cast-iron pipe	ASTM A74; ASTM A888; CISPI 301
Copper or copper-alloy pipe (Brass),	ASTM B42; ASTM B43; ASTM B302
Copper or copper-alloy tubing (Brass), (Type K, L, M or DWV)	ASTM B75/B75M; ASTM B88; ASTM B251/B251M; ASTM B306
Galvanized steel pipe	ASTM A53/A53M
Polyolefin pipe	CSA B181.3
Polyvinyl chloride (PVC) plastic pipe in IPS diameters, including Schedule 40, DR 22 (PS 200) and DR 24 (PS 140); with a solid, cellular core or composite wall	ASTM D2665; ASTM F891; ASTM F1488; CSA B181.2

Polyvinyl chloride (PVC) plastic pipe with a 3.25-inch O.D. and a solid, cellular core or composite wall	ASTM D2949; ASTM F1488
Stainless steel drainage systems, Types 304 and 316L	ASME A112.3.1

For SI: 1 inch = 25.4 mm.

TABLE P3002.3
PIPE FITTINGS

PIPE MATERIAL	FITTING STANDARD
Acrylonitrile butadiene styrene (ABS) plastic pipe in IPS diameters	ASME A112.4.4; ASTM D2661; ASTM D3311; ASTM F628; CSA B181.1
Acrylonotrile butadiene styrene (ABS) plastic pipe in sewer and drain diameters	ASTM D2751
Cast-iron	ASME B16.4; ASME B16.12; ASTM A74; ASTM A888; CISPI 301
Copper or copper alloy (Brass),	ASME B16.15; ASME B16.18; ASME B16.22; ASME B16.23; ASME B16.26; ASME B16.29
Gray iron and ductile iron	AWWA C110/A21.10
Polyethylene	ASTM D2683
Polyolefin	ASTM F1412; CSA B181.3
Polyvinyl chloride (PVC) plastic in IPS diameters	ASME A112.4.4; ASTM D2665; ASTM D3311; ASTM F1866
Polyvinyl chloride (PVC) plastic pipe in sewer and drain diameters	ASTM D3034
Polyvinyl chloride (PVC) plastic pipe with a 3.25-inch O.D.	ASTM D2949
PVC fabricated fittings	ASTM F1866
Stainless steel drainage systems, Types 304 and 316L	ASME A112.3.1
Vitrified clay	ASTM C700

For SI: 1 inch = 25.4 mm.

TABLE P3004.1
DRAINAGE FIXTURE UNIT (d.f.u.) VALUES FOR VARIOUS PLUMBING FIXTURES

TYPE OF FIXTURE OR GROUP OF FIXTURES	DRAINAGE FIXTURE UNIT VALUE (d.f.u.)[a]
Bar sink	1
Bathtub (with or without a shower head or whirlpool attachments)	2
Bidet	1
Clothes washer standpipe	2
Dishwasher	2

Floor drain[b] (including waste receptors or hub drains for condensate waste)	0
Kitchen sink	2
Lavatory	1
Laundry tub	2
Shower stall	2
Water closet (1.6 gallons per flush)	3
Water closet (greater than 1.6 gallons per flush)	4
Full-bath group with bathtub (with 1.6-gallons-per-flush water closet, and with or without shower head and/or whirlpool attachment on the bathtub or shower stall)	5
Full-bath group with bathtub (water closet greater than 1.6 gallons per flush, and with or without shower head and/or whirlpool attachment on the bathtub or shower stall)	6
Half-bath group (1.6-gallons-per-flush water closet plus lavatory)	4
Half-bath group (water closet greater than 1.6 gallons per flush plus lavatory)	5
Kitchen group (dishwasher and sink with or without food-waste disposer)	2
Laundry group (clothes washer standpipe and laundry tub)	3
Multiple-bath groups[c]: 1.5 baths 2 baths 2.5 baths 3 baths 3.5 baths	 7 8 9 10 11

For SI: 1 gallon = 3.785 L, 1 gallon per minute = 3.785 L/m.

a. For a continuous or semicontinuous flow into a drainage system, such as from a pump or similar device, ~~1.5~~ 2 fixture units shall be allowed per gpm of flow. For a fixture not listed, use the highest d.f.u. value for a similar *listed* fixture.

b. A floor drain itself does not add hydraulic load. Where used as a receptor, the fixture unit value of the fixture discharging into the receptor shall be applicable.

c. Add 2 d.f.u. for each additional full bath.

CHAPTER 31
VENTS

~~**User notes:**~~

~~***About this chapter:** Chapter 31 regulates connection locations, various venting system arrangements and the sizing of piping for vent systems. The proper operation of a gravity flow drainage system (Chapter 30) depends on maintaining an air path throughout the system to prevent waste and odor "blow back" into fixtures and siphoning of the trap seal in fixture traps (Chapter 32).*~~

~~***Code development reminder**: Code change proposals to this chapter will be considered by the IRC—Mechanical/Plumbing Code Development Committee during the 2021 (Group A) Code Development Cycle.*~~

P3101.2.1 Venting required. Every *trap* and trapped fixture shall be vented in accordance with one of the venting methods specified in this chapter. All fixtures discharging downstream from a water closet shall be individually vented.

P3101.4 Extension outside a structure. DELETED ~~In climates where the 97.5-percent value for outside design temperature is 0°F (-18°C) or less (ASHRAE 97.5-percent column, winter, see Chapter 3), vent pipes installed on the exterior of the structure shall be protected against freezing by insulation, heat or both. Vent terminals shall be protected from frost closure in accordance with Section P3103.2.~~

P3101.5 Flood resistance. In flood hazard areas as established by Table R301.2, vents shall be located at or above the elevation required in Section R322.1 (flood hazard areas including A Zones) or R322.2 (coastal high-hazard areas including V Zones). The plumbing systems, pipes and fixtures shall not be mounted on or penetrate through walls intended to break away under flood loads.

P3101.6 (901.5) Tests.
The vent system shall be tested in accordance with Section **P2503.5**.

P3101.7 (902.1) Materials

The materials and methods utilized for the construction and installation of venting systems shall comply with the applicable provisions of Section P2906.

P3101.7.1 (902.2) Sheet copper.
Sheet copper for vent pipe flashings shall conform to ASTM B 152 and shall weigh not less than 8 ounces per square foot (2.5 kg/m^2).

P3101.7.2 (902.3) Sheet lead.
Sheet lead for vent pipe flashings shall weigh not less than 3 pounds per square foot (15 kg/m^2) for field-constructed flashings and not less than 2-1/2 pounds per square foot (12 kg/m^2) for prefabricated flashings.

SECTION P3102
VENT STACKS AND STACK VENTS

P3102.1 ~~**Required vent extension.**~~ **Stack required** ~~The vent system serving each *building drain* shall have not less than one vent pipe that extends to the outdoors~~. Every building in which plumbing is installed shall have at least one stack the size of which is not less than one-half of the required diameter of the building drain, and not less than 2 inches (51 mm) in diameter. Such stack shall run undiminished in size and as directly as possible from the building drain through to the open air or to a vent header that extends to the open air.

P3102.1.1 (904.1.1) Connection to drainage system.
A vent stack shall connect to the building drain or to the base of a drainage stack in accordance with Section P3005.5. A stack vent shall be an extension of the drainage stack. For townhouses and one- and two-family dwellings, the main vent shall connect to the building drain, building stack or branch thereof not less than 3 inches (76 mm) in size.

P3102.4 (904.3) Stack vent termination.

Stack vents shall terminate outdoors to the open air or to a stack-type air admittance valve in accordance with Section P3114.

P3102.5 (904.5) Stack vent headers.

Stack vents connected into a common vent header at the top of the *stacks* and extending to the open air at one point shall be sized in accordance with the requirements of Section P3113.1. The number of fixture units shall be the sum of all fixture units on all *stacks* connected thereto, and the *developed length* shall be the longest vent length from the intersection at the base of the most distant *stack* to the vent terminal in the open air, as a direct extension of one *stack.*

SECTION P3103
VENT TERMINALS

P3103.1 Vent pipes terminating outdoors. Vent pipes terminating outdoors shall be extended to the outdoors through the roof or a sidewall of the building in accordance with one of the methods identified in Sections P3103.1.1 through P3103.1.4.

P3103.1.2 Roof used for recreational purposes. Where a roof is to be used for assembly, as a promenade, observation deck or sunbathing deck, or for similar purposes, open vent pipes shall terminate not less than 7 feet (2134 mm) above the roof.

Exception: Vent terminals greater than 10 feet from a demarcation line of the occupied area.

P3103.2 Frost closure. DELETED ~~Where the 97.5-percent value for outdoor design temperature is 0°F (-18°C) or less, vent extensions through a roof or wall shall be not less than 3 inches (76 mm) in diameter. Any increase in the size of the vent shall be made not less than 1 foot (305 mm) inside the thermal envelope of the building.~~

P3103.4 Prohibited use. A vent terminal shall not be used for any purpose other than a vent terminal. Vent terminals shall not be used as a flag pole or to support flag poles, television aerials or similar items, except when the piping has been anchored in an approved manner.

P3103.5 Location of vent terminal. ~~An open vent terminal from a drainage system shall not be located less than 4 feet (1219 mm) directly beneath any door, openable window, or other air intake opening of the building or of an adjacent building, nor shall any such vent terminal be within 10 feet (3048 mm) horizontally of such an opening unless it is not less than 3 feet (914 mm) above the top of such opening.~~ An open vent terminal from a drainage system shall not be located directly beneath any door, openable window, or other air intake opening of the building or of an adjacent building or property line, and any such vent terminal shall not be within 10 feet (3048 mm) horizontally of such an opening unless it is 2 feet (610 mm) or more above the top of such opening.

P3103.6 Extension through the wall.

Vent terminals extending through the wall shall terminate not less than 10 feet (3048 mm) from the *lot line* and 10 feet (3048 mm) above the highest adjacent *grade* within 10 feet (3048 mm) horizontally of the vent terminal. Vent terminals shall not terminate under the overhang of a structure with soffit vents. Side wall vent terminals shall be protected to prevent birds or rodents from entering or blocking the vent opening.

P3104.4 Vertical rise of vent. A dry vent shall rise vertically to not less than 6 inches (152 mm) above the flood level rim of the highest trap or trapped fixture being vented.

Exceptions:

1. Vents for interceptors located outdoors.

2. When vents for interceptors are not located near an adjacent wall, the vent must rise 6 inches (152 mm) vertically before turning horizontally and continuing to the nearest wall. For cleaning purposes, a cleanout of the same size as the vent shall be installed.

P3107.2 Connection at the same level. Where the *fixture drains* being common vented connect at the same level, the vent connection shall be at the interconnection of the *fixture drains* ~~or downstream of the interconnection~~.

P3107.3 Connection at different levels. Where the *fixture drains* connect at different levels, the vent shall connect as a vertical extension of the vertical drain. The vertical drain pipe connecting the two *fixture drains* shall be considered to be the vent for the lower *fixture drain*, and shall be sized in accordance with Table P3107.3. The upper fixture shall not be a water closet or clothes washer.

SECTION P3108
WET VENTING

P3108.1 Horizontal wet vent permitted. ~~Any combination of fixtures within two *bathroom groups* located on the same floor level shall be permitted to be vented by a horizontal wet vent. The wet vent shall be considered to be the vent for the fixtures and shall extend from the connection of the dry vent along the direction of the flow in the drain pipe to the most downstream *fixture drain* connection. Each *fixture drain* shall connect horizontally to the horizontal branch being wet vented or shall have a dry vent. Each wet-vented *fixture drain* shall connect independently to the horizontal wet vent. Only the fixtures within the *bathroom groups* shall connect to the wet-vented horizontal branch drain. Any additional fixtures shall discharge downstream of the horizontal wet vent.~~

Any combination of fixtures located on the same floor level shall be permitted to be vented by a wet vent. The wet vent shall be considered the vent for the fixtures and shall extend from the connection of the dry vent along the direction of the flow in the drain pipe to the most downstream *fixture drain* connection. Each *fixture drain* shall connect horizontally to the horizontal branch being wet vented or shall have a dry vent. Each wet-vented *fixture drain* shall connect independently to the horizontal wet vent. A residential clothes washer drain line shall not be used as a wet vent.

P3108.2 Dry vent connection. The required dry-vent connection for wet-vented systems shall comply with Sections P3108.2.1 and P3108.2.2.

P3108.2.1 Horizontal wet vent. ~~The dry vent connection for a horizontal wet vent system shall be an individual vent or a common vent for any *bathroom group* fixture, except an emergency floor drain. Where the dry vent connects to a water closet *fixture drain*, the drain shall connect horizontally to the horizontal wet vent system. Not more than one wet-vented *fixture drain* shall discharge upstream of the dry-vented *fixture drain* connection.~~

The dry-vent connection for a horizontal wet-vent system shall be an individual vent or a common vent for any fixture, except an emergency floor drain. Where the dry vent connects to a water closet *fixture drain*, the drain shall connect horizontally to the horizontal wet vent system.

SECTION P3110
CIRCUIT VENTING (DELETED)

~~**P3110.1 Circuit vent permitted.** Not greater than eight fixtures connected to a horizontal branch drain shall be permitted to be circuit vented. Each *fixture drain* shall connect horizontally to the horizontal branch being circuit vented. The horizontal branch drain shall be classified as a vent from the most downstream *fixture drain* connection to the most upstream *fixture drain* connection to the horizontal branch.~~

~~**P3110.2 Vent connection.** The circuit vent connection shall be located between the two most upstream *fixture drains*. The vent shall connect to the horizontal branch and shall be installed in accordance with Section P3104. The circuit vent pipe shall not receive the discharge of any soil or waste.~~

~~**P3110.3 Slope and size of horizontal branch.** The slope of the vent section of the horizontal branch drain shall be not greater than 1 unit vertical in 12 units horizontal (8-percent slope). The entire length of the vent section of the horizontal branch drain shall be sized for the total drainage discharge to the branch in accordance with Table P3005.4.1.~~

~~**P3110.4 Additional fixtures.** Fixtures, other than circuit-vented fixtures, shall be permitted to discharge to the horizontal branch drain. Such fixtures shall be located on the same floor as the circuit-vented fixtures and shall be either individually or common vented.~~

SECTION P3111
COMBINATION WASTE AND VENT SYSTEM (DELETED)

~~**P3111.1 Type of fixtures.** A combination waste and vent system shall only serve floor drains, sinks, lavatories and drinking fountains. A combination waste and vent system shall be considered to be the vent for those fixtures. The *developed length* of a *fixture drain* to the combination waste and vent system piping shall not exceed the limitations of Table P3105.1.~~

~~**P3111.1.1 Single-fixture systems.** A horizontal *fixture drain* shall be considered to be a combination waste and vent system provided that the *fixture drain* size complies with Table P3111.3.~~

~~**P3111.2 Installation.** The only vertical pipe of a combination waste and vent system shall be the connection between a *fixture drain* and a horizontal combination waste and vent pipe. The length of the vertical pipe shall be not greater than 8 feet (2438 mm).~~

~~**P3111.2.1 Slope.** The slope of horizontal combination waste and vent piping shall be not greater than $^1/_2$ unit vertical in 12 units horizontal (4-percent slope) and shall be not less than that indicated in Section P3005.2.~~

~~**P3111.2.2 Vent connection.** A combination waste and vent system shall be provided with a dry vent connected at any point within the system, or the system shall connect to a horizontal drain or *building drain* that serves vented fixtures located on the same floor. Combination waste and vent systems connecting to *building drains* receiving only the discharge from one or more stacks shall be provided with a dry vent. The dry vent connected to the combination waste and vent pipe shall extend vertically to a point not less than 6 inches (152 mm) above the flood level rim of the highest fixture being vented by the combination waste and vent system before horizontal offsets in the dry vent piping are allowed.~~

~~**P3111.2.3 Vent size.** The dry vent connected to the combination waste and vent system shall be sized for the total drainage fixture unit load in accordance with Section P3111.1.~~

~~**P3111.3 Size and length.** The size of a combination drain and vent piping shall be not less than that specified in Table P3111.3. The horizontal length of a combination drain and vent system shall be unlimited.~~

~~**TABLE P3111.3**~~

~~**SIZE OF COMBINATION WASTE AND VENT PIPE**~~

~~DIAMETER PIPE (inches)~~	~~MAXIMUM NUMBER OF FIXTURE UNITS (d.f.u.)~~	
	~~Connecting to a horizontal branch or stack~~	~~Connecting to a building drain or building subdrain~~
~~2~~	~~3~~	~~4~~
~~2$^1/_2$~~	~~6~~	~~26~~
~~3~~	~~12~~	~~31~~
~~4~~	~~20~~	~~50~~

~~For SI: 1 inch = 25.4 mm.~~

P3113.4.1 Sewage pumps and sewage ejectors other than pneumatic. Drainage piping below sewer level shall be vented in the same manner as that of a gravity system. Building sump vent sizes for sumps with sewage pumps or sewage ejectors, other than pneumatic, shall be determined in accordance with Table P3113.4.1. An open vent terminal from a drainage system shall not be located directly beneath any door, openable window, or other air intake opening of the building or of an adjacent building or property line, and any such vent terminal shall not be within 10 feet (3048 mm) horizontally of such an opening unless it is at least 2 feet (610 mm) above the top of such opening.

P3114.8 Prohibited installations. *Air admittance valves* shall not be used to vent sumps or tanks except where the vent system for the sump or tank has been designed by an engineer. *Air admittance valves* shall not be installed on outdoor vent terminals for the sole purpose of reducing clearances to gravity or mechanical air intakes. Air admittance valves shall not be located in spaces utilized as supply or return air plenums.

CHAPTER 32
TRAPS

~~**User notes:**~~

~~***About this chapter:*** *Chapter 32 regulates the design of fixture traps, methods for preventing evaporation of trap seals in traps, and the required locations for interceptors and separators. The trap seal of a trap is an essential feature of a drainage system to prevent odors from the drainage piping from entering the building. The discharge of various processes such as cooking and laundry creates the need for equipment to retain detrimental greases and solids from entering the drainage systems.*~~

Code development reminder: *Code change proposals to this chapter will be considered by the IRC—Mechanical/Plumbing Code Development Committee during the 2021 (Group A) Code Development Cycle.*

P3201.2 Trap seals. Each fixture trap shall have a liquid seal of not less than 2 inches (51 mm) and not more than 4 inches (102 mm).

> **Exception:** Trap seal protection for waste receptors or hub drains used for condensate waste shall be by the use of a deep seal trap.

TABLE P3201.7
SIZE OF TRAPS FOR PLUMBING FIXTURES

PLUMBING FIXTURE	TRAP SIZE MINIMUM (inches)
Bathtub (with or without shower head and/or whirlpool attachments)	$1^1/_2$
Bidet	$1^1/_4$
Clothes washer standpipe	2
Dishwasher (on separate trap)	$1^1/_2$
Floor drain	2
Kitchen sink (one or two traps, with or without dishwasher and food waste disposer)	$1^1/_2$
Laundry tub (one or more compartments)	$1^1/_2$
Lavatory	$1^1/_4$
Shower (based on the total flow rate through showerheads and body sprays) Flow rate:	
5.7 gpm and less	~~$1^1/_2$~~ 2
More than 5.7 gpm up to 12.3 gpm	2
More than 12.3 gpm up to 25.8 gpm	3
More than 25.8 gpm up to 55.6 gpm	4

For SI: 1 inch = 25.4 mm, 1 gallon per minute = 3.785 L/m.

CHAPTER 33
STORM DRAINAGE (DELETED)

~~**User notes:**~~

~~***About this chapter:** Chapter 33 regulates methods and systems that control storm water from a building, such as from subsoil drainage systems and rainfall on roof surfaces. Regulations for sumps and pumping systems for subsoil drainage systems are provided in this chapter.*~~

~~***Code development reminder:** Code change proposals to this chapter will be considered by the IRC—Mechanical/Plumbing Code Development Committee during the 2021 (Group A) Code Development Cycle.*~~

~~SECTION P3301~~
~~GENERAL~~

~~**P3301.1 Scope.** The provisions of this chapter shall govern the materials, design, construction and installation of storm drainage.~~

~~SECTION P3302~~
~~SUBSOIL DRAINS~~

~~**P3302.1 Subsoil drains.** *Subsoil drains* shall be open-jointed, horizontally split or perforated pipe conforming to one of the standards indicated in Table P3302.1. Such drains shall be not less than 4 inches (102 mm) in diameter. Where the building is subject to backwater, the *subsoil drain* shall be protected by an accessibly located backwater valve. *Subsoil drains* shall discharge to a trapped area drain, sump, dry well or *approved* location above ground. The subsoil sump shall not be required to have either a gastight cover or a vent. The sump and pumping system shall comply with Section P3303.~~

~~SECTION P3303~~
~~SUMPS AND PUMPING SYSTEMS~~

~~**P3303.1 Pumping system.** The sump pump, sump and discharge piping shall conform to Sections P3303.1.1 through P3303.1.4.~~

~~**P3303.1.1 Pump capacity and head.** The sump pump shall be of a capacity and head appropriate to anticipated use requirements.~~

~~**P3303.1.2 Sump pit.** The sump shall be not less than 18 inches (457 mm) in diameter and 24 inches (610 mm) deep, unless otherwise *approved*. The sump shall be *accessible* and located so that all drainage flows into the sump by gravity. The sump shall be constructed of tile, steel, plastic, cast iron, concrete or other *approved* material, with a removable cover adequate to support anticipated loads in the area of use. The sump floor shall be solid and provide permanent support for the pump.~~

~~**P3303.1.3 Electrical.** Electrical outlets shall meet the requirements of Chapters 34 through 43.~~

~~**P3303.1.4 Piping.** Discharge piping shall meet the requirements of Sections P3002.1, P3002.2, P3002.3 and P3003. Discharge piping shall include an *accessible* full-flow check valve. Pipe and fittings shall be the same size as, or larger than, the pump discharge tapping.~~

~~**TABLE P3302.1**~~
~~**SUBSOIL DRAIN PIPE**~~

~~MATERIAL~~	~~STANDARD~~
~~Cast-iron pipe~~	~~ASTM A74; ASTM A888; CISPI 301~~
~~Polyethylene (PE) plastic pipe~~	~~ASTM F405; CSA B182.1; CSA B182.6; CSA B182.8~~
~~Polyvinyl chloride (PVC) plastic pipe~~ ~~(type sewer pipe, SDR 35, PS25, PS50 or PS100)~~	~~ASTM D2729; ASTM D3034; ASTM F891; CSA B182.2; CSA B182.4~~

~~Stainless steel drainage systems, Type 316L~~	~~ASME A112.3.1~~
~~Vitrified clay pipe~~	~~ASTM C4; ASTM C700~~

CHAPTER 45
HIGH WIND ZONES

This chapter is a North Carolina addition and not part of the 2021 International Residential Code.
There will be no underlined text.

SECTION R4501
GENERAL

R4501.1 General. The provisions of this chapter shall be applicable to buildings constructed in high wind zones as noted by the text. These provisions shall be in addition to or in lieu of previous chapters.

R4501.2 Alternate construction. In lieu of specific code requirements for structures in the 130, 140, and 150 miles per hour (58 m/s, 63 m/s and 67 m/s) wind zones, compliance with International Code Council ICC 600 *Standard for Residential Construction in High-Wind Regions* or AF&PA *Wood Frame Construction Manual for One- and Two-Family Dwellings* is acceptable.

SECTION R4502
DESIGN PRESSURE FOR DOORS AND WINDOWS

R4502.1 Performance. Exterior windows and doors shall be designed to resist the design wind pressures specified in Table R4502(a) through Table R4502(c). Garage door shall be designed to resist the design wind pressures specified in Table R4502(d) through Table R4502(f).

TABLE R4502(a)
DESIGN PRESSURES FOR DOORS AND WINDOWS [a, b, c, d, e, f]
POSITIVE AND NEGATIVE IN PSF; EXPOSURE B

VELOCITY (mph)	MEAN ROOF HEIGHT (feet)			
	15	20	30	40
130	21	22	25	27
140	24	26	29	31
150	27	29	33	36

TABLE R4502(b)
DESIGN PRESSURES FOR DOORS AND WINDOWS [a, b, c, d, e, f]
POSITIVE AND NEGATIVE IN PSF; EXPOSURE C

VELOCITY (mph)	MEAN ROOF HEIGHT (feet)			
	15	20	30	40
130	30	32	35	37
140	35	37	40	43
150	40	42	46	49

TABLE R4502(c)
DESIGN PRESSURES FOR DOORS AND WINDOWS [a, b, c, d, e, f]
POSITIVE AND NEGATIVE IN PSF; EXPOSURE D

VELOCITY (mph)	MEAN ROOF HEIGHT (feet)			
	15	20	30	40
130	36	38	41	43
140	42	44	47	50

150	48	51	54	57

For SI: 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s, 1 degree = 0.01745 rad.

a. Alternative pressures may be determined by using the *North Carolina Building Code*, ASCE-7, or the *International Building Code*.

b. If window or door is more than 4 feet from a corner, the pressure from this table shall be permitted to be multiplied by 0.81. This adjustment does not apply to garage doors.

c. For effective area between those given, the load shall be interpolated, or the load associated with the lower effective areas shall be used.

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

e. Design pressure ratings based on the standards listed in Section R609 are adequate documentation of capacity to resist pressures from the table.

f. Where the mean roof height exceeds this table, values shall be determined by a design professional.

TABLE R4502(~~b~~ d)
DESIGN PRESSURES ~~(IN PSF)~~ FOR GARAGE DOORS IN PSF; EXPOSURE B [a, b, c, d, e, f]

MEAN ROOF HEIGHT (feet)	DOOR SIZE	ULTIMATE DESIGN WIND SPEED V_{ult} (mph)		
		130	140	150
15	Single (8' x 7')	17	20	23
	Double (16' x 7')	16	19	21
20	Single (8' x 7')	19	22	25
	Double (16' x 7')	17	20	23
30	Single (8' x 7')	21	24	28
	Double (16' x 7')	19	22	26
40	Single (8' x 7')	23	27	30
	Double (16' x 7')	21	24	28

TABLE R4502(e)
DESIGN PRESSURES FOR GARAGE DOORS IN PSF; EXPOSURE C [a, b, c, d, e, f]

MEAN ROOF HEIGHT (feet)	DOOR SIZE	ULTIMATE DESIGN WIND SPEED V_{ult} (mph)		
		130	140	150
15	Single (8' x 7')	25	29	34
	Double (16' x 7')	23	27	31
20	Single (8' x 7')	27	31	36
	Double (16' x 7')	25	29	33
30	Single (8' x 7')	29	34	39
	Double (16' x 7')	27	31	36
40	Single (8' x 7')	31	36	41
	Double (16' x 7')	29	33	38

TABLE R4502(f)
DESIGN PRESSURES FOR GARAGE DOORS IN PSF; EXPOSURE D [a, b, c, d, e, f]

MEAN ROOF HEIGHT (feet)	DOOR SIZE	ULTIMATE DESIGN WIND SPEED V_{ult} (mph)		
		130	140	150
15	Single (8' x 7')	31	36	41
	Double (16' x 7')	28	33	38
20	Single (8' x 7')	32	38	43
	Double (16' x 7')	30	35	40
30	Single (8' x 7')	35	40	46
	Double (16' x 7')	32	37	42
40	Single (8' x 7')	36	42	48
	Double (16' x 7')	34	39	44

~~a. The pressures in this table are for garage doors at least 9 feet by 7 feet and at least 2 feet from the corner.~~ For door sizes or wind speeds between those given above the load may be interpolated, otherwise use the load associated with the smaller door size.

b. Alternative design pressures may be determined by using the *North Carolina Building Code*, ASCE-7, or the *International Building Code*.

c. For doors in a structure with a roof slope of 10 degrees (2:12) or less from the horizontal the pressures from this table may be multiplied by 0.90.

d. Garage door design pressure ratings based on tests ~~done according to~~ in accordance with ASTM E330 or ANSI/DASMA 108 ~~are adequate documentation.~~

e. Garage doors on the ground level of a structure in a flood zone do not have to meet the above design pressures provided all of the following conditions are met:
   1. Structure is anchored to the girders and top of the piling to resist the forces given in Chapter 45.
   2. The garage door occurs below the top of the piling.
   3. Provide openings at the garage level that comply with either of the following options:
      i. Design all exterior walls at the garage level to break away at 20 psf or less; or
      ii. Provide openings (in walls at the garage level without the garage level without the garage door) equal to at least 20 percent of the total wall area from the ground to the roof.

f. Where the mean roof height exceeds this table, values shall be determined by a design professional.

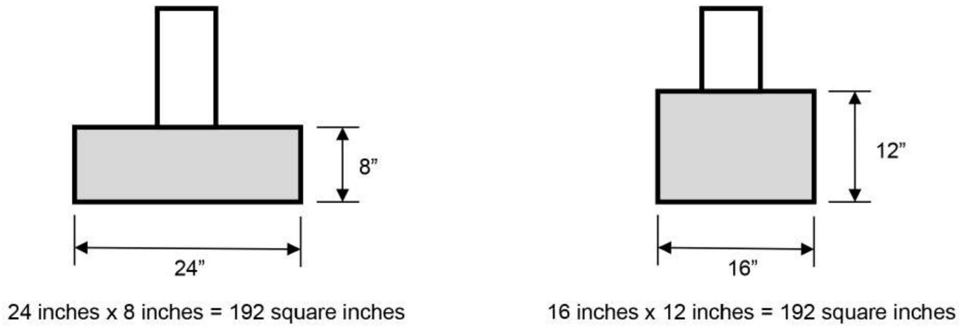
SECTION R4503
FOOTINGS

R4503.1 General. All exterior walls shall be supported on continuous concrete footings in the 140 and 150 mph (63 m/s and 67 m/s) wind zones. Exterior wall footings in the 130 mph (58 m/s) wind zone shall be constructed in accordance with Section R403.1.

Exception: Pile foundations shall be constructed in accordance with Chapter 46.

R4503.1.1 Footing size. Footings shall be a minimum of 8 inches by 24 inches (203 mm by 610 mm) for houses two and one-half stories and less. The footings for a three-story building shall be 10 inches by 24 inches (254 mm by 610 mm).

Exception: Alternative footing sizes are permitted when a footing mass equivalent is provided to resist uplift forces. See Figure R4503.1.1.



For SI: 1 foot = 304.8 mm.

FIGURE R4503.1.1
ALTERNATIVE FOOTING SIZE

R4503.1.2 Footing reinforcement. Footings shall be reinforced with three #4 bars or two #5 bars at 3 inches (76 mm) above the bottom of the footing. The bars shall be equally spaced with 3 inches (76 mm) clear minimum from the side of the footing. The bars shall be continuous or lapped 25 inches at all splices.

R4503.1.3 Interior piers and pier footings. The dimensions for the interior piers and pier footings shall comply with Table R403.1(2).

R4503.1.4 Interior thickened slabs. Monolithic slabs with integral footings resisting uplift shall be reinforced in accordance with Section R4503.1.2.

R4503.1.5 Interior foundation walls. Interior foundation walls resisting uplift shall be reinforced in accordance with Section R4503.1.2.

R4503.2 Pier and curtain wall footings. Pier and curtain walls in the 140 and 150 mph (63 m/s and 67 m/s) wind zones shall be constructed in accordance with Sections R4503.2.1 and R4503.2.2 and Figures R4503.2(a) through R4503.2(d).

R4503.2.1 Enlarged footings at piers. The curtain wall footing must meet the minimum projection requirements in Figure R403.1(1) and footing dimensions for the pier footings shall comply with Table R4503.2.1.

TABLE R4503.2.1
FOOTINGS TO RESIST UPLIFT FROM PIERS
IN 140 AND 150 MPH WIND ZONES SUPPORTING
GIRDERS IN EXTERIOR WALLS

	FOOTING SIZE GIRDER SPAN		
VELOCITY (mph)	4′-0″	6′-0″	8′-0″
140	2′-0″ × 2′-0″ × 10″	2′-4″ × 2′-4″ × 10″	2′-8″ × 2′-8″ × 10″
150	3′-0″ × 3′-0″ × 10″	3′-4″ × 3′-4″ × 12″	3′-8″ × 3′-8″ × 12″

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s.
Note: See Table R403.1(2) for 130 mph wind zone.

R4503.2.2 Continuous width footings. Uniform continuous width footings for pier and curtain wall foundations shall be a minimum of 8 inches (203 mm) thick and 24 inches (60 mm) wide. Footings shall be reinforced with three #4 bars (or two #5 bars) at 3 inches (76 mm) above the bottom of the footing. The bars shall be continuous or lapped 25 inches (635 mm) at all splices.

R4503.3 Footing dowels. All footings shall have reinforcing dowel bars to match the vertical reinforcing bars in the foundation wall above. Dowels or threaded rods shall have a standard hook length of 12 times the bar diameter embedded in the footing and shall lap the wall or pier reinforcing at least 25 inches (635 mm).

R4503.4 Footing anchor bolts. All anchor bolts shall have a standard hook length of 12 times the bolt diameter embedded in the footing or foundation wall. They shall not be permitted to be lapped.

Exceptions:

1. Anchor bolts in bond beams as permitted by Section R4504.2.1.1
2. Anchor bolts in slabs on grade as permitted by Section R4504.2.2

SECTION R4504
WALL AND FOUNDATION ANCHORAGE

R4504.1 Anchorage in the 130 mph wind zone. Exterior walls of structures in the 130 mph (58 m/s) wind zone shall be anchored to the foundation wall or slab on grade with 1/2- inch (13 mm) anchor bolts, 4 feet (1219 mm) on center extended 15 inches (381 mm) into masonry and 7 inches (178 mm) into concrete and are exempt from the other requirements of this section.

R4504.2 Anchorage in the 140 and 150 mph wind zones. Exterior walls of structures in the 140 and 150 mph (63 m/s and 67 m/s) wind zones shall be anchored to the footing to resist the forces specified in Section R4508.2, by the prescriptive requirements of this section and Figures R4504.2(a) through R4504.2(f), or as allowed by Section R4508.4.

**TABLE R4503.2.1
FOOTINGS TO RESIST UPLIFT FROM PIERS
IN 140 AND 150 MPH WIND ZONES SUPPORTING
GIRDERS IN EXTERIOR WALLS**

VELOCITY (mph)	FOOTING SIZE GIRDER SPAN		
	4′-0″	6′-0″	8′-0″
140	2′-0″ × 2′-0″ × 10″	2′-4″ × 2′-4″ × 10″	2′-8″ × 2′-8″ × 10″
150	3′-0″ × 3′-0″ × 10″	3′-4″ × 3′-4″ × 12″	3′-8″ × 3′-8″ × 12″

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s.
Note: See Table R403.1(2) for 130 mph wind zone.

R4504.2.1 Exterior foundation walls. Vertical reinforcement bars shall be installed not more than 2 feet (51 mm) from each corner and at intervals not to exceed Table R4504.2.1 with all reinforced cells grouted solid. The reinforcement bars shall terminate in a bond beam in accordance with Section R4504.2.1.1 or continuous anchorage bolts shall terminate at the sill plate or exterior wall framing in accordance with Section R4504.2.1.2.

TABLE R4504.2.1
WALL REINFORCEMENT BARS OR CONTINUOUS ANCHORAGE BOLTS[a, b, c, d]

BAR/BOLT SIZE (inches)	$^5/_8$	$^1/_2$	$^3/_8$
MAXIMUM SPACING (inches)	96	72	42

For SI: 1 inch = 25.4 mm.

a. Applies to 140 and 150 mph wind zones.

b. Continuous anchorage from footing to girder or wall framing.

c. Applies to footing dowel bars, vertical reinforcement and anchor bolts.

d. Spacing may exceed the tabulated values by up to 8 inches provided the total number of required bars is installed.

TABLE R4504.2.1
WALL REINFORCEMENT BARS OR CONTINUOUS ANCHORAGE BOLTS[a, b, c, d]

For SI: 1 inch = 25.4 mm.
a. Applies to 140 and 150 mph wind zones.
b. Continuous anchorage from footing to girder or wall framing.
c. Applies to footing dowel bars, vertical reinforcement and anchor bolts.
d. Spacing may exceed the tabulated values by up to 8 inches provided the total number of required bars is installed.

R4504.2.1.1 Bond beams. The top of a concrete or masonry foundation wall shall have a bond beam in accordance with Figure R4504.2(a). The bond beam shall be reinforced with one #5 bar. The bar shall be continuous or lapped 25 inches (635 mm) at all splices.

R4504.2.1.1.1 Bond beam plate anchorage. A minimum of two 2 × 6 sill plates shall be anchored with 1/2-inch (13 mm) anchor bolts with 2 × 2 × 1/8 inch (51 × 51 × 3 mm) washers at intervals not to exceed Table R4504.2.1.1. An approved anchor from the sill plate to the wall framing shall be installed to resist the forces specified in Table R4508.2 or sheathing shall be fastened in accordance with Figure R4508.4(b). See Figure R4504.2(a).

TABLE R4504.2.1.1
ANCHOR BOLT SPACING[a]

WIND SPEED (mph)	140	150
MAXIMUM SPACING (inches)	21	18

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.

a. Required spacing of $^1/_2$-inch anchor bolts where a bond beam is required and for slab on grade with a single sole plate. See Figure R403.1(1) for 130 mph or less.

TABLE R4504.2.1.1

ANCHOR BOLT SPACING[a]

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.
a. Required spacing of 1/2-inch anchor bolts where a bond beam is required and for slab on grade with a single sole plate. See Figure R403.1(1) for 130 mph or less.

R4504.2.1.2 Continuous anchorage bolts. A minimum of two 2 × 6 sill plates shall be anchored with continuous anchor bolts in accordance with Table R4504.2.1 with 2 × 2 × 1/8 inch (51 × 51 × 3 mm) washers. Where the vertical anchorage bolts terminate at the sill plate, an approved anchor from the sill plate to the wall framing shall be installed to resist the forces specified in Table R4508.2 or sheathing shall be fastened in accordance with Figure R4508.4(b). See Figure R4504.2(b).

Exception: Where the uplift anchorage bolts from Table R4504.2.1 are continuous from the footing to the exterior wall framing, a single 2 × 6 sill plate is permitted. See Figure R4504.2(c).

R4504.2.2 Exterior concrete slab-on-grade footings. Anchorage shall be installed at intervals not to exceed Table R4504.2.1 and shall terminate in a minimum 2 × 4 double sole plate. See Figure 4504.2(d).

Exceptions:

1. Where the bolts terminate in a single sole plate, anchorage shall be installed at intervals not to exceed Table R4504.2.1.1. See Figure R4504.2(e).
2. Foundation anchorage spaced and installed in accordance with the manufacturer's installation instructions that provides equivalent anchorage to resist the forces in Table R4508.2 shall be installed to provide continuous load path from the single sole plate to the wall.

R4504.2.3 Ground supported slab with masonry stem wall. A minimum of two 2× sill plates shall be anchored with 1/2-inch (13 mm) continuous anchor bolts with 2 × 2 × 1/8 inch (51 × 51 × 3 mm) washers at intervals not to exceed Table R4504.2.1. An approved anchor from the sill plate to the wall framing shall be installed to resist the forces specified in Table R4508.2 or sheathing shall be fastened in accordance with Figure R4508.4(b). See Figure R4504.2(f).

SECTION R4505
WALL CONSTRUCTION

R4505.1 Construction. Exterior walls of wood frame construction shall be in accordance with Figures R602.3(1) and R602.3(2). Components of exterior walls shall be fastened in accordance with Table R602.3(1). Walls of wood frame construction shall be designed and constructed in accordance with ANSI AWC *National Design Specification for Wood Construction*, listed in Chapter 44.

Exterior walls subject to wind speeds of 130 mph (58 m/s) or greater as established in Table R301.2(1) shall be designed in accordance with accepted engineering practice. See Tables R4505(a) through R4505(c).

In bearing walls, studs which are not more than 10 feet (3048 mm) in length shall be spaced not more than is specified in Tables R4505(d) for the corresponding stud size.

SECTION R4506
STRUCTURAL BRACING

R4506.1 Structural bracing in 130 mph wind zone. Structural bracing in the 130 mph (58 m/s) wind zone shall comply with Section R602.10.

R4506.2 Structural bracing in 140 and 150 mph wind zones. All stories shall be continuously sheathed with wood structural panels. All panels shall be fastened in accordance with Table R4506.2. Where sheathing is used to resist uplift, see Section R4508.4 for blocking requirements. Otherwise, blocking shall be installed if less than 50 percent of the wall length is sheathed. If a wall is sheathed less than 25 percent of its length, then that wall shall be designed in accordance with approved engineering practice.

TABLE R4505(a)
STUDS IN 130, 140, AND 150 MPH ZONES
Requirements for Wood Stud In: Exterior Walls Supporting One Floor, Roof and Ceiling or Less/Exterior Nonloadbearing Walls in Two Story Structure or Less/Interior Walls Supporting One Floor, Roof and Ceiling or Less

STUD LENGTH	STUD SPACING	130 MPH		130 MPH		140 MPH		150 MPH	
		2 x 4	2 x 6	2 x 4	2 x 6	2 x 4	2 x 6	2 x 4	2 x 6
		Species: Spruce Pine Fir (South) without Structural Sheathing		Species: Spruce Pine Fir (South) with 3/8″ Wood Structural Sheathing					
8	16	#2	Stud	Stud	Stud	Stud	Stud	#2	Stud
8	24	#2	Stud	#2	Stud	#2	Stud	#2	Stud
10	16	#2	Stud	#2	Stud	#2	Stud	#2	Stud
10	24	Design	#2	Design	#2	Design	#2	Design	#2
		Species: Spruce Pine Fir without Structural Sheathing		Species: Spruce Pine Fir with 3/8″ Wood Structural Sheathing					
8	16	Stud	Stud	Stand	Stud	Stud	Stud	#3	Stud
8	24	#2	Stud	#3	Stud	#2	Stud	#2	Stud
10	16	#2	Stud	#2	Stud	#2	Stud	#2	Stud
10	24	Design	Stud	#2	Stud	Design	Stud	Design	Stud

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.
Explanation of Table Entries:
Design – Studs with this entry shall be in accordance with accepted engineering practice.
#2 – #2 Grade construction
#3 – #3 Grade
Stud – Stud grade
Standard – Standard grade
Utility – Utility grade
3/8″ wood structural sheathing shall be attached with 8d nails at 6″ at perimeter and 12″ at intermediate supports. When a grade is specified in the table any grade above it in this list may be used.

TABLE R4505(a)
STUDS IN 130, 140, AND 150 MPH ZONES
Requirements for Wood Stud In: Exterior Walls Supporting One Floor, Roof and Ceiling or Less/Exterior Nonloadbearing Walls in Two Story Structure or Less/Interior Walls Supporting One Floor, Roof and Ceiling or Less

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.
Explanation of Table Entries:
Design – Studs with this entry shall be in accordance with accepted engineering practice.
#2 – #2 Grade construction
#3 – #3 Grade
Stud – Stud grade
Standard – Standard grade
Utility – Utility grade
3/83 wood structural sheathing shall be attached with 8d nails at 63 at perimeter and 123 at intermediate supports. When a grade is specified in the table any grade above it in this list may be used.

TABLE R4505(b)
EXTERIOR WALLS FOR FIRST FLOOR OF THREE STORY

EXTERIOR BEARING WALLS[a, b, c, d, e] FIRST FLOOR OF THREE STORY		
	Spruce Pine Fir	
WIND ZONE (mph)	2 × 4 @ 12″ o.c. Structural Sheathing	3 × 4 or 2 × 6 @ 16″ o.c. Structural Sheathing
130	#2	Any grade
140	#2	Any grade
150	#2	Any grade

Exterior Nonbearing Walls[a, b, c, d, e, f] First Floor of Three Story			
	Spruce Pine Fir		
WIND ZONE (mph)	2 × 4 @ 12″ o.c. Blocking	2 × 4 @ 16″ o.c. Blocking	3 × 4 or 2 × 6 @ 16″ o.c. Structural Sheathing
130	#2, Stud	#2	Any grade
140	#2, Stud	NP	Any grade
150	#2	NP	Any grade

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

a. Any grade = any grade except standard, utility and economy.

b. Corner bracing is required where blocking is specified.

c. 2 – 2 × 4s at 16 inches or 1 – 2 × 4 at 8 inches may be used where 3 × 4 at 16 inches is specified.

d. Refer to Sections R4506 and R4508.4 for sheathing requirements.

e. Bearing stud height is limited to 10 feet.

f. 2× full depth blocking at mid-height.

TABLE 4505 (a)
MINIMUM LUMBER GRADE, SIZE, AND SPACING FOR EXTERIOR LOAD-BEARING STUDS USING SOUTHERN PINE (SP)

		EXPOSURE B						EXPOSURE C					
		ULTIMATE DESIGN WIND SPEED V_{ULT} (mph)											
STUD	STUD	130		140		150		130		140		150	
LENGTH	SPACING (IN.)	2X4	2X6	2X4	2X6	2X4	2X6	2X4	2X6	2X4	2X6	2X4	2X6
8	12			No.3/ Stud		No.3/ Stud		No.3/ Stud		No.3/ Stud		No.3/ Stud	
	16			No.3/ Stud		No.3/ Stud		No.3/ Stud		No.3/ Stud		No.3/ Stud	
	24			No.3/ Stud		No. 2		No. 2		No. 2		No. 2	
9	12	No.3/ Stud		No.3/ Stud		No.3/ Stud		No.3/ Stud		No.3/ Stud		No.3/ Stud	No.3/ Stud
	16		No.3/ Stud	No.3/ Stud	No.3/ Stud	No.3/ Stud	No.3/ Stud	No.3/ Stud	No.3/ Stud	No. 2	No.3/ Stud	No. 2	
	24			No. 2		No. 2		No. 2		No. 2		-	
10	12			No.3/ Stud		No.3/ Stud		No.3/ Stud		No.3/ Stud		No. 2	
	16			No.3/ Stud		No. 2		No. 2		No. 2		No. 2	
	24	No. 2		No. 2		No.1		-		-		-	No. 2

TABLE 4505 (b)
MINIMUM LUMBER GRADE, SIZE, AND SPACING FOR EXTERIOR LOAD-BEARING STUDS USING SPRUCE-PINE-FIR (SPF)

		EXPOSURE B						EXPOSURE C					
		ULTIMATE DESIGN WIND SPEED V_{ULT} (mph)											
STUD	STUD	130		140		150		130		140		150	
LENGTH	SPACING (IN.)	2X4	2X6	2X4	2X6	2X4	2X6	2X4	2X6	2X4	2X6	2X4	2X6
8	12					No.3/ Stud		No.3/ Stud		No.3/ Stud		No.3/ Stud	
	16					No.3/ Stud		No.3/ Stud		No.3/ Stud		No.3/ Stud	
	24					No.3/ Stud		No.3/ Stud		No. 2		No. 2	
9	12	No.3/ Stud		No.3/ Stud		No.3/ Stud		No.3/ Stud		No.3/ Stud		No.3/ Stud	
	16		No.3/ Stud		No.3/ Stud	No.3/ Stud	No.3/ Stud	No.3/ Stud	No.3/ Stud	No.3/ Stud	No.3/ Stud	No. 2	No.3/ Stud
	24					No. 2		No. 2		No. 2		SS	
10	12					No.3/ Stud		No.3/ Stud		No.3/ Stud		No.3/ Stud	
	16					No.3/ Stud		No.3/ Stud		No. 2		No. 2	
	24	No. 2		No. 2		SS		-		-		-	

TABLE 4505 (c)												
MAXIMUM STUD LENGTHS FOR EXTERIOR NON-LOAD-BEARING STUDS (ft) (APPLIED TO STUDS USING SOUTHERN PINE (SP) AND SPRUCE-PINE-FIR (SPF))												
	EXPOSURE B						EXPOSURE C					
	ULTIMATE DESIGN WIND SPEED V_{ULT} (mph)											
STUD SPACING (IN.)	130		140		150		130		140		150	
	2X4	2X6	2X4	2X6	2X4	2X6	2X4	2X6	2X4	2X6	2X4	2X6
12	13	20	13	20	12	19	12	19	11	18	11	17
16	12	19	11	18	11	17	11	17	10	16	10	15
24	10	16	10	15	9	15	9	14	9	13	8	12

TABLE R4505(d)

SIZE, HEIGHT, AND SPACING LIMITS FOR WOOD STUDS (BASED ON DEAD AND LIVE LAOD)

LOADING BEARING STUDS SUPPORTING	2X4	2X6	2X8
	MAXIMUM STUD SPACING (in. o.c.)		
ROOF & CEILING ONLY	24	24	24
1 FLOOR ONLY	24	24	24
ROOF & CEILING & 1 FLOOR ONLY	16	24	24
2 FLOOR ONLY	16	24	24
ROOF, CEILING, & 2 FLOORS	-	16	24
NON-LOADING BEARING STUDS	MAXIMUM UNSUPPORTED STUD LENGTH (ft)		
	14	20	20
	MAXIMUM STUD SPACING (in. o.c.)		
	24	24	24

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

SP = Southern Pine, SPF = Spruce-Pine Fir
"-" Limber Grade not available

a. Maximum mean roof height = 33 feet. (Per 2018 WFCM Section 2.1.3.1)
b. Total roof span shall not exceed 36 feet. (Per 2018 WFCM Section 3.1.3.4)
c. Exterior wall stud deflection limit = H/180
d. 3/8 inches thick wood structural sheathing shall be attached with 8d common nails (2.5" x 0.131") at 6 inches at perimeter and 12 inches at intermediate support.
e. Wind exposure category D is not covered by the tables and shall be designed in accordance with accepted engineering practice. (See 2018 NCRC Section R301.2.1.4 for definition of Exposure Category)
f. Load bearing wall shall not exceed 10 feet in height. (Per 2018 NCRC Table R602.3(5))
g. To address additional end zone loading requirements, end zone stud spacings shall be multiplied by 0.80 for framing located 4 feet of corners.

TABLE R4506.2
PANEL FASTENER SPACING[a]

	BLOCKING REQUIRED	NO BLOCKING REQUIRED
Center of Panel	6″	12″
Vertical Edge of Panel	6″	6″
Horizontal Edge of Panel	3″	3″

For SI: 1 inch = 25.4 mm.
a. Table based on 8d nails.

R4506.3 Gable endwalls. Gable endwalls in the 130, 140 and 150 mph (58 m/s, 63 m/s and 67 m/s) wind zones shall either be supported by lateral bracing at the ceiling or have continuous studs from the floor to the roof. Non bearing studs in gable wall shall be limited to a height in accordance with Table 4505(c). ~~See Nonbearing 2 × 4 studs at 16 inches (406 mm) on center are limited to 14 feet (3048 mm) in length between supports. Nonbearing 2 × 6 SPF #2 studs at 16 inches (406 mm) on center with 3/8-inch (9 mm) wood structural panel sheathing are limited to unsupported lengths of 18 feet (5486 mm) in 130 mph (58 m/s), 16 feet (4877 mm) in 140 mph (53 m/s) and 14 feet (4267 mm) in 150 mph (67 m/s) wind zones.~~

Where open web trusses are installed, wood structural panel sheathing shall extend 12 inches (305 mm) beyond horizontal construction joints. Where the horizontal joint occurs over minimum 1 inch (25 mm) thick OSB or plywood or 2× rimboard, a minimum 11/2 inch (38 mm) overlap is required.

R4506.4 Lateral support at ceiling. Where studs are not continuous, the ceiling must be used to support the endwall. 2 × 4 lateral bracing shall be installed on the top of ceiling joists or truss bottom chords at 8 feet (2438 mm) on center and extend 8 feet (2438 mm) inward from the gable endwall. See Figure R4506.7(a).
R4506.5 Full height studs. Full height studs may be sized using the bracing at the ceiling to limit the stud length. See Figure R4506.5.
R4506.6 Cathedral endwalls. Studs shall be continuous from the uppermost floor to either the ceiling or the roof.
R4506.7 Overhang at endwalls. The overhang is limited to 12 inches (305 mm) where a laddered soffit is installed. The overhang may be increased to 24 inches (610 mm) where outlookers are framed over a dropped endwall into the first rafter or truss. See Figures R4506.7(a) and R4506.7(b). If the overhang exceeds 24 inches (610 mm), then the overhang shall be designed in accordance with approved engineering practice.
R4506.8 Roof sheathing attachment. The roof sheathing panel edges shall be blocked and nailed at the end two rafter or truss spaces. See Figure R4506.8.

Exception: The panel edges need not be blocked where 2 × 4 diagonal braces are framed from the top of the endwall to the lateral bracing at the ceiling.

SECTION R4507
MASONRY WALL CONSTRUCTION

R4507.1 Reinforcement. Masonry walls subject to wind speeds of 140 mph (63 m/s) or greater, as established in Table R301.2(1), shall be constructed in accordance with Table R4507.1 or the requirements of Figures R4507.1(a) and R4507.1(b) and this section. Additionally, the minimum area of reinforcement shall not be less than 0.002 times the gross cross-sectional area wall, not more than two-thirds of which may be used in either direction. No required vertical reinforcement shall be less than 3/8 inch (9.5 mm) in diameter. Principal wall reinforcement shall have a maximum spacing of 4 feet (1219 mm) on center. For 130 mph (58 m/s) wind zones, see Figure R606.11(1) and Table R606.6.4.

TABLE R4507.1
H/T LATERAL SUPPORT RATIOS FOR UNREINFORCED EXTERIOR MASONRY WALLS[a, b, d, e]

	ULTIMATE WIND SPEED, MPH[c]	
Wall Construction	**140**	**150**
Solid masonry units	13	11
Hollow concrete masonry units or masonry bonded hollow walls	9	8
Cavity walls identical wythes	The *H/t* ratio shall be 0.70 of the *H/t* ratio for single wythe walls. The *t*-value shall be the sum of the nominal thickness of the individual wythes.	
Cavity walls with wythes of different types or size masonry	The wall shall be designed based on ACI-530 or the *H/t* ratio may be 0.70 of the *H/t* ratio of a single wythe hollow wall. The *t*-value shall be the sum of the nominal thickness of the individual wythes.	

a. *H* = clear height or length between lateral supports.
t = nominal wall thickness.

b. All masonry units shall be laid in Type M, S or N mortar. Where Type N mortar is used and the wall spans in the vertical direction, the ratios shall be reduced by 10 percent.

c. Design based on partially enclosed building.

d. These values are based on using masonry cement mortar. If nonair-entrained Portland cement/lime mortar is used, the values in the table may be increased by 1.25. Larger *H/t* ratios may be used if the design is done in accordance with ACI-530.

e. Larger *H/t* ratios may be used if the design is done in accordance with ACI-530.

SECTION R4508
ROOF TIE DOWN

R4508.1 Roof tie down. Roof assemblies in the 130, 140 and 150 mph (58 m/s, 63 m/s and 67 m/s) wind zones as established in Table R301.2(1) shall have rafter or truss ties provided in accordance with either Table R4508.2 through Table R4508.3 or the prescriptive requirements of Section R4508. Anchorage in the 130 mph (58 m/s) wind zone shall be continuous from the roof to the foundation wall or pier. Anchorage in the 140 and 150 mph (63 m/s and 67 m/s) wind zones shall be continuous from the roof to the footing. See Section R4504.

TABLE R4508.2
ROOF TIE DOWN REQUIREMENTS ALONG EXTERIOR WALLS (plf)[a, b, c, d]

WIND SPEED (mph)	STRUCTURE WIDTH	
	24 feet	36 feet
130	240	345
140	330	470
150	430	615

For SI: 1 foot = 304.8 mm, 1 mile per hour = 0.R45 m/s.

a. Alternate to the requirements of this table or roof not covered by this table shall be designed in accordance with the *North Carolina Building Code* or ICC 600 *Standard for Residential Construction in High-Wind Regions.*

b. See Section 4505 for material requirements in Coastal High Hazard Areas and Ocean Hazard Areas and Ocean Hazard Areas.

c. Roof slope 2:12 to 12:12.

d. The uplift load requirements may be interpolated for intermediate structure widths.

R4508.2 Considerations. For trusses, the nailing requirements from Table R4508.2 shall include the nailing requirements for both rafters and ceiling joists. As an alternative to the anchorage requirements of ~~Tables R602.3(1) and~~ R4508.2 and Table R4508.3, the anchorage for roof members may be based on a designed connection taking into account all horizontal and vertical forces. Forces for alternative anchorage design may result from wind uplift; wind lateral on roof; wind lateral on walls to be transferred to the top plate of the wall; roof/ceiling loads; and other loads depending on the specific building design. If roof members align with the studs, the connection may be made from the roof member directly to the studs. If the connection is from the roof member to the top plate, a double top plate is required and both connections must meet the requirements of Table R4508.2. Where ceiling joists are not parallel with and connect to the roof members, the anchorage requirements for each roof member shall be increased by 110 pound (50 kg). Hip end walls and hip rafters shall be anchored in accordance with this section.

TABLE 4508.2

RAFTER OR TRUSS UPLIFT CONNECTION FORCE FROM WIND (POUNDS PER CONNECTION)[a,b,c,d,e,f,g]

RAFTER OR TRUSS SPACING	ROOF SPAN (feet)	EXPOSURE B ULTIMATE DESIGN WIND SPEED V_{ULT} (mph)		
		130	140	150
12" o.c.	12	96	123	151
	16	113	146	181
	20	131	170	211

	24	149	193	241
	28	167	217	271
	32	186	241	301
	36	204	265	331
16" o.c.	12	128	164	202
	16	151	195	241
	20	175	226	281
	24	199	258	321
	28	223	290	361
	32	248	322	401
	36	272	354	441
24" o.c.	12	192	245	303
	16	227	292	362
	20	263	339	421
	24	299	387	481
	28	335	434	541
	32	371	482	602
	36	408	530	662

TABLE 4508.2 - continued

RAFTER OR TRUSS UPLIFT CONNECTION FORCE FROM WIND (POUNDS PER CONNECTION)

RAFTER OR TRUSS SPACING	**ROOF SPAN (feet)**	**EXPOSURE C ULTIMATE DESIGN WIND SPEED V_{ULT} (mph)**		
		130	**140**	**150**
12" o.c.	12	161	198	238
	16	193	238	286
	20	224	278	335
	24	256	318	383
	28	289	358	432
	32	321	398	481
	36	353	438	530
16" o.c.	12	215	264	318
	16	257	317	382
	20	299	370	446
	24	342	423	511
	28	385	477	576
	32	428	531	641
	36	471	584	706
24" o.c.	12	322	397	477
	16	385	475	572

	20	449	555	669
	24	513	635	766
	28	577	715	864
	32	642	796	962
	36	706	877	1059

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s, 1 pound = 0.454 kg, 1 pound per square foot = 47.9 N/m^2, 1 pound per linear foot = 14.6 N/m.

a. The uplift connection forces are based on a maximum 33-foot mean roof height and Wind Exposure Category B or C.

b. The uplift connection forces include an allowance for roof and ceiling assembly dead load of 15 psf and the tabulated uplift loads reduced with 0.6 factor.

c. The tabulated uplift connection forces are limited to a maximum roof overhang of 24 inches.

d. The tabulated uplift connection forces shall be permitted to be multiplied by 0.75 for connections not located within 8 feet of building corners.

e. For wall-to-wall and wall-to-foundation connections, the uplift connection force shall be permitted to be reduced by 60 pounds per linear foot for each full wall above.

f. Linear interpolation between tabulated roof spans and wind speeds shall be permitted.

g. The tabulated forces for a 12-inch on-center spacing shall be permitted to be used to determine the uplift load in pounds per linear foot.

h. Tabulated value limited from roof pitch 2:12 to 12:12

TABLE 4508.3
RAFTER OR TRUSS LATERAL CONNECTION FORCE FROM WIND

RAFTER OR TRUSS SPACING	EXPOSURE B					
	ULTIMATE DESIGN WIND SPEED V_{ULT} (mph)					
	130		140		150	
	POUNDS PER CONNECTOR	NUMBER OF FASTENERS	POUNDS PER CONNECTOR	NUMBER OF FASTENERS	POUNDS PER CONNECTOR	NUMBER OF FASTENERS
12" o.c.	111	2	129	2	148	2
16" o.c.	148	2	171	2	197	2
24" o.c.	222	3	257	3	295	3

TABLE 4508.3 - continued
RAFTER OR TRUSS LATERAL CONNECTION FORCE FROM WIND

RAFTER OR TRUSS SPACING	EXPOSURE C					
	ULTIMATE DESIGN WIND SPEED V_{ULT} (mph)					
	130		140		150	
	POUNDS PER CONNECTOR	NUMBER OF FASTENERS	POUNDS PER CONNECTOR	NUMBER OF FASTENERS	POUNDS PER CONNECTOR	NUMBER OF FASTENERS
12" o.c.	154	2	179	2	205	3

16" o.c.	205	3	238	3	273	3
24" o.c.	308	4	357	4	410	5

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s, 1 pound = 0.454 kg, 1 pound per square foot = 47.9 N/m^2, 1 pound per linear foot = 14.6 N/m.

a. Number of Fasteners = 8d common nails or 10d Box Nail (toenailed)

b. To avoid splitting, no more than 2 toenails shall be installed in each side of a rafter when fastened to a 2x4 top plate or 3 toenails in each side when fastened to a 2x6 top plate

c. Tabular lateral connections covered up to 36 feet roof span.

TABLE 4508.4
TOP AND BOTTOM PLATE TO STUD LATERAL CONNECTION FOR WIND LOAD
REQUIRED NUMBER OF 16d COMMON NAILS (ENDNAIL) PER CONNECTION

STUD SPACING (INCH)	EXPOSURE B			EXPOSURE C		
	ULTIMATE DESIGN WIND SPEED V_{ULT} (mph)					
	130	140	150	130	140	150
12" o.c.	2	2	2	2	2	2
16" o.c.	2	2	2	2	2	2
24" o.c.	2	2	2	3	3	3

R4508.3 Anchorage from roof to wall. One and one-half inch (38 mm) by 18 gage fabricated metal ties at 24 inches (610 mm) on center with five 8d nails at each end may be used to resist the uplift loads from the roof to the double top plate. Install one tie at each end of each rafter in 130 mph (58 m/s) and two ties at each end of each rafter in 140 mph (63 m/s) and 150 mph (67 m/s) wind zones. Truss anchorage shall be in accordance with design specifications. See Figure R4508.3.

R4508.4 Anchorage using wood structural panels. Wood structural panel sheathing may be used to resist both lateral load and uplift simultaneously. Panels shall be installed as follows:

1. Panels may be installed parallel or perpendicular to studs.
2. Panels shall be 3/8-inch (10 mm) minimum thickness.
3. Nail spacing shall be 8d at 6 inches (152 mm) on center along vertical edges of panel and 12 inches (305 mm) at intermediate vertical framing.
4. At double edge panel locations, the horizontal nail spacing shall be 8d staggered at 3 inches (76 mm) on center. See Figure R4508.4(b).
5. Where open web trusses are installed, panel shall extend 12 inches (305 mm) beyond horizontal construction joints and shall overlap girders their full depth. Where the horizontal joint occurs over minimum 1 inch (25 mm) thick OSB or plywood or 2× rimboard a minimum 11/2 inch (38 mm) overlap is required. See Figure R4508.4(a).
6. Panel attachment to framing shall be as illustrated in Figure R4508.4(b).
7. Blocking shall be required at all joints if sheathing is used to resist uplift.

TABLE 4508.4

UPLIFT CAPACITY OF WOOD STRUCTURAL PANEL SHEATHING USED TO RESIST BOTH LATERAL LOAD AND UPLIFT [a,b]

	8d COMMON NAIL 6" PANEL EDGE SPACING 12" FIELD SPACING		
ALTERNATE NAIL SPACING AT TTOP AND BOTTOM PANEL EDGES	6"	4"	3"
UPLIFT CAPACITY (plf) NAILS DOUBLE ROW	216	432	648

For SI: 1 inch = 25.4 mm.

a. Tabulated values are for Spruce-Pine-Fir framing.

b. Tabulated values are modified by the ASD reduction factor of 2.0.

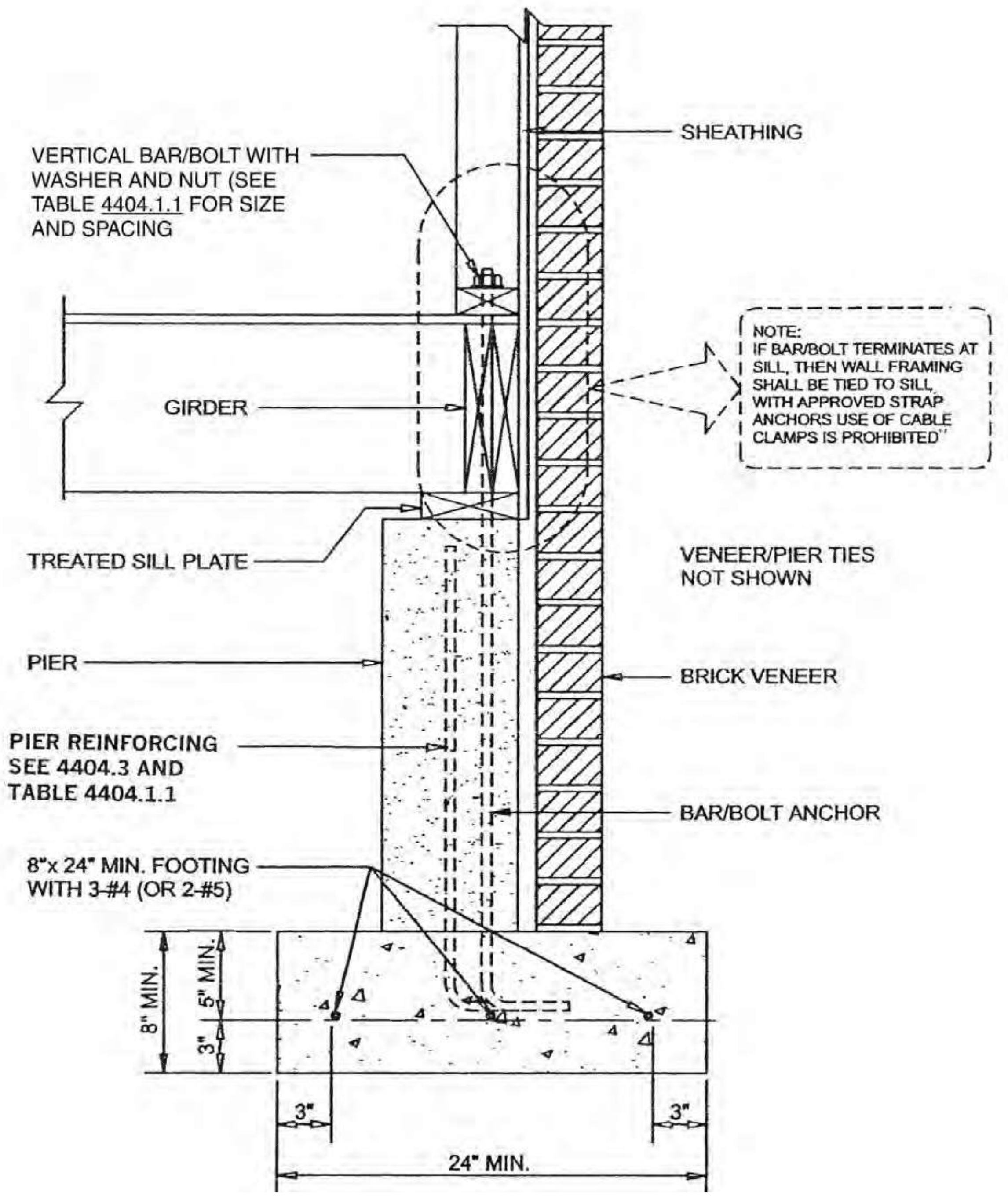


FIGURE R4503.2(a)
CONTINUOUS VENEER PIER/CURTAIN WALL

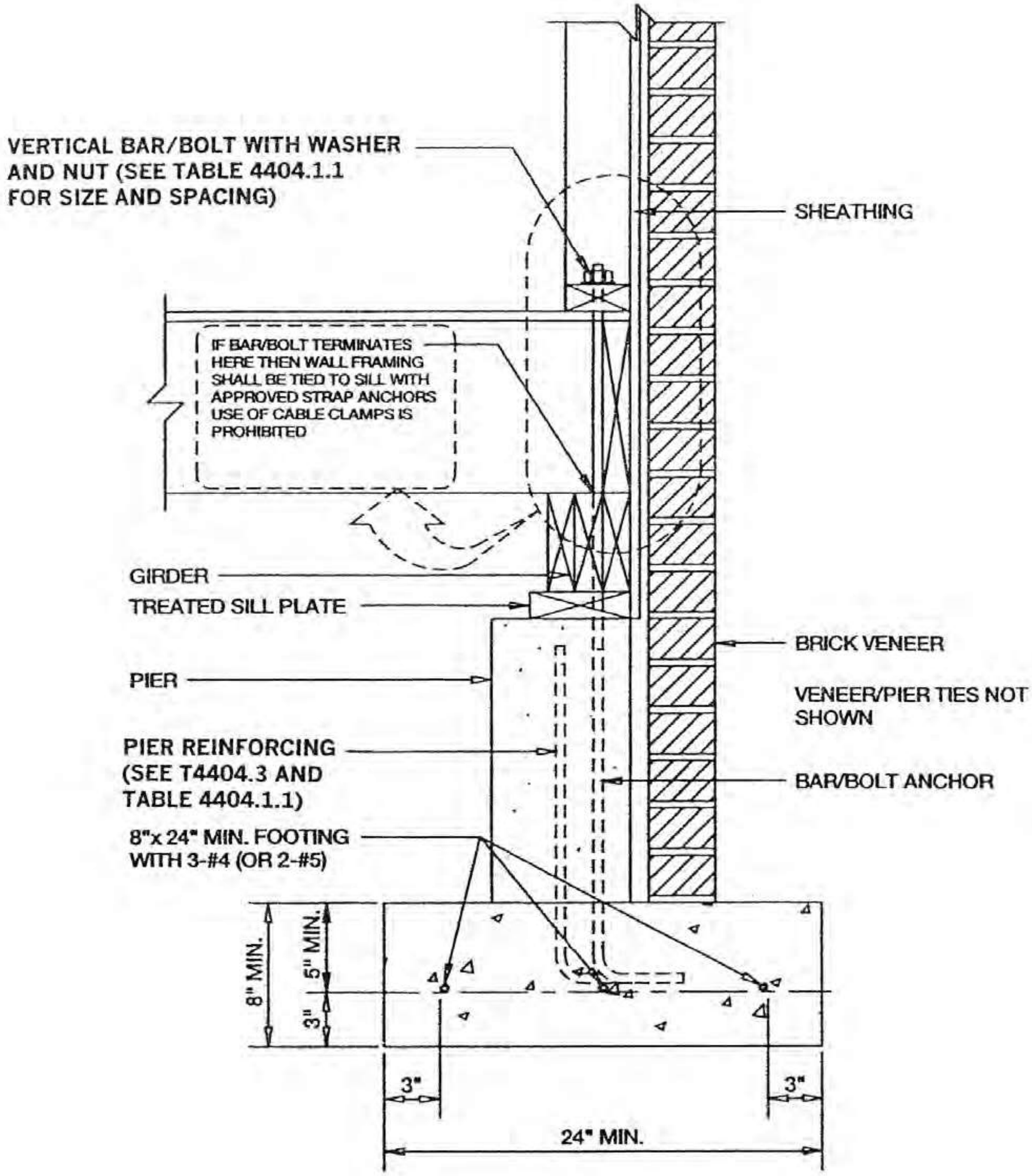


FIGURE R4503.2(b)
CONTINUOUS VENEER PIER/CURTAIN WALL

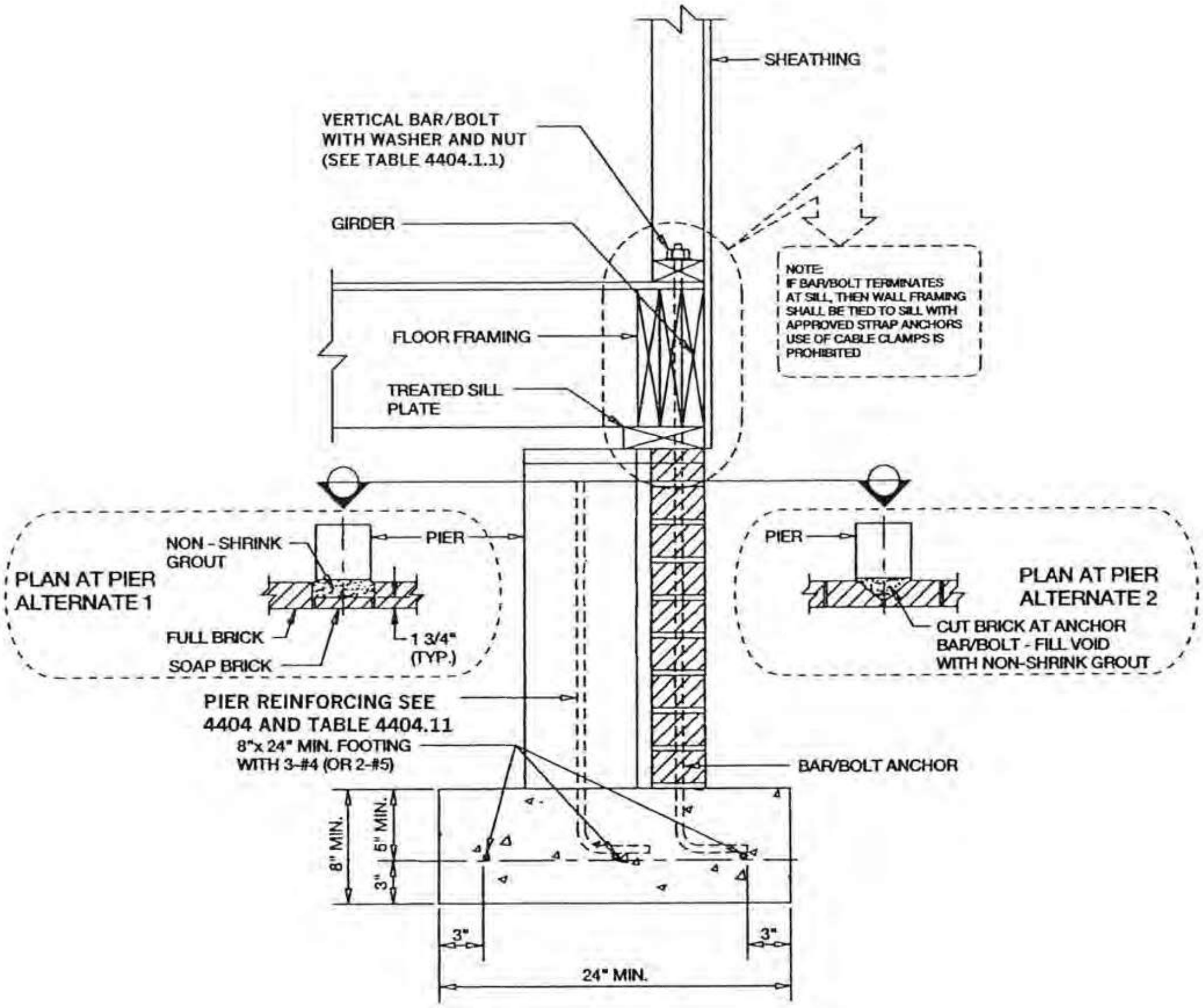


FIGURE R4503.2(c)
VENEER SHIRT WALL
PIER/CURTAIN WALL

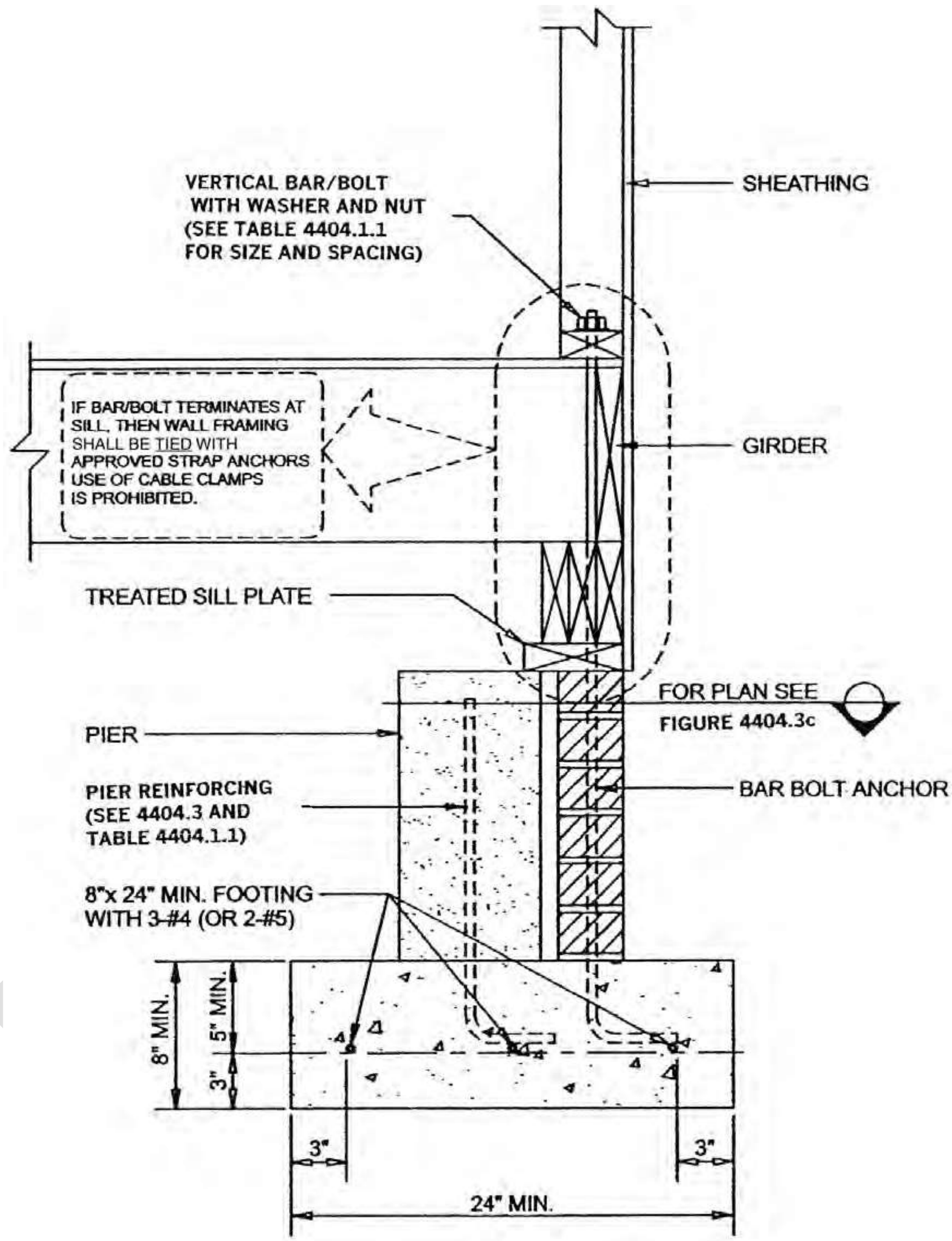


FIGURE R4503.2(d)
VENEER SHIRT WALL PIER/CURTAIN WALL

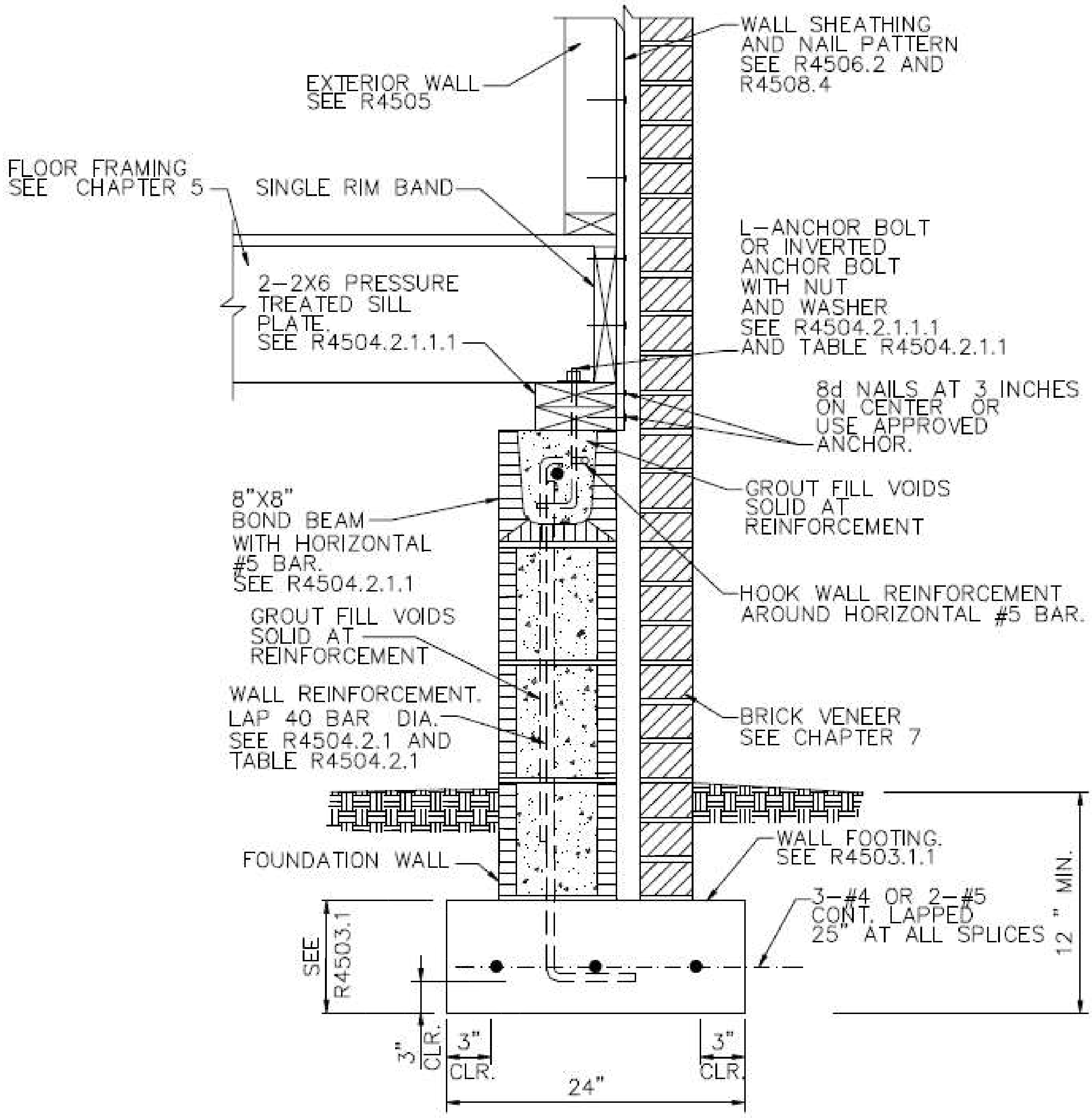


FIGURE R4504.2(a)
FOUNDATION WALL WITH BOND BEAM

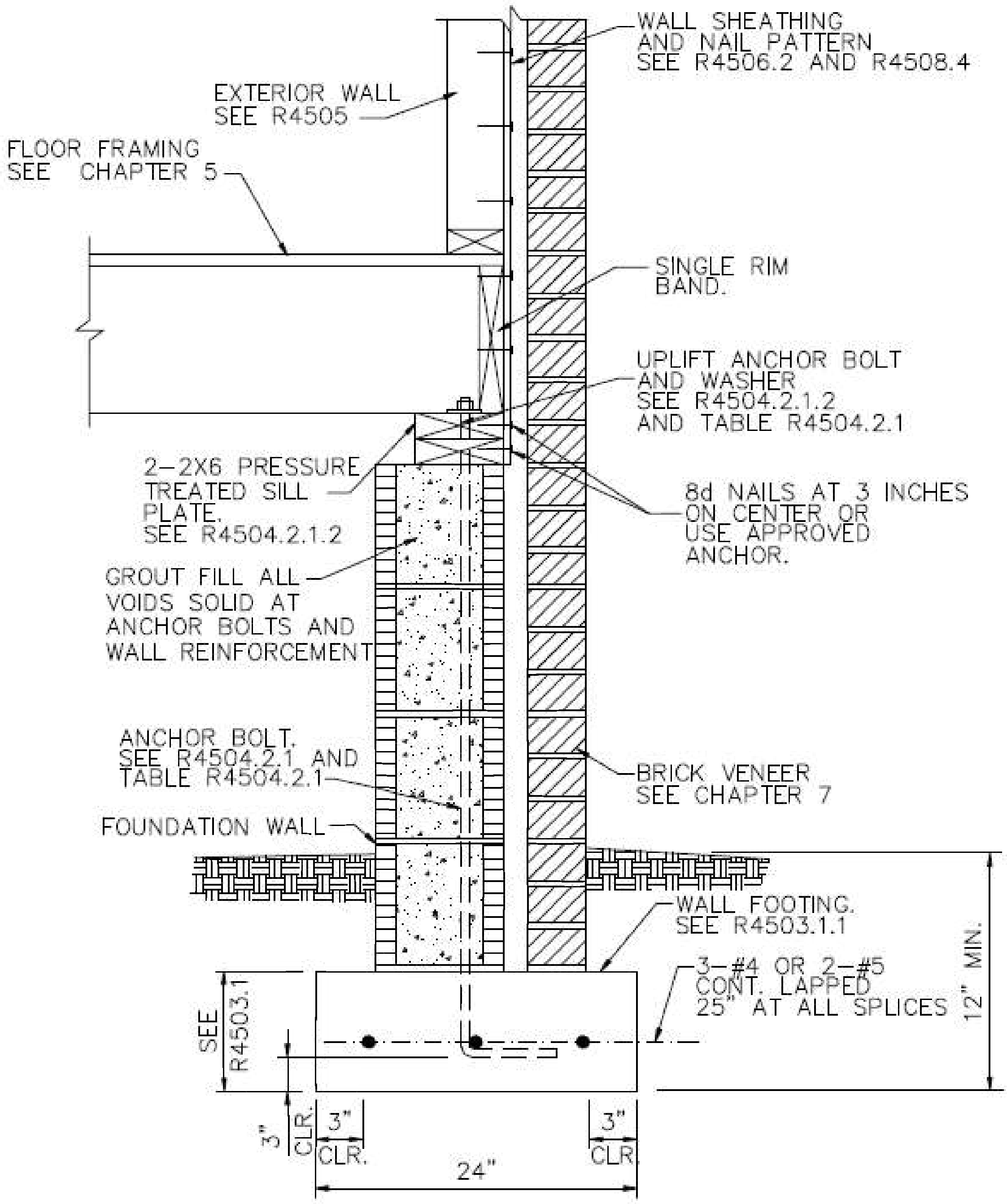


FIGURE R4504.2(b)
FOUNDATION WALL WITH UPLIFT ANCHOR BOLTS FROM FOOTING TO SILL PLATE

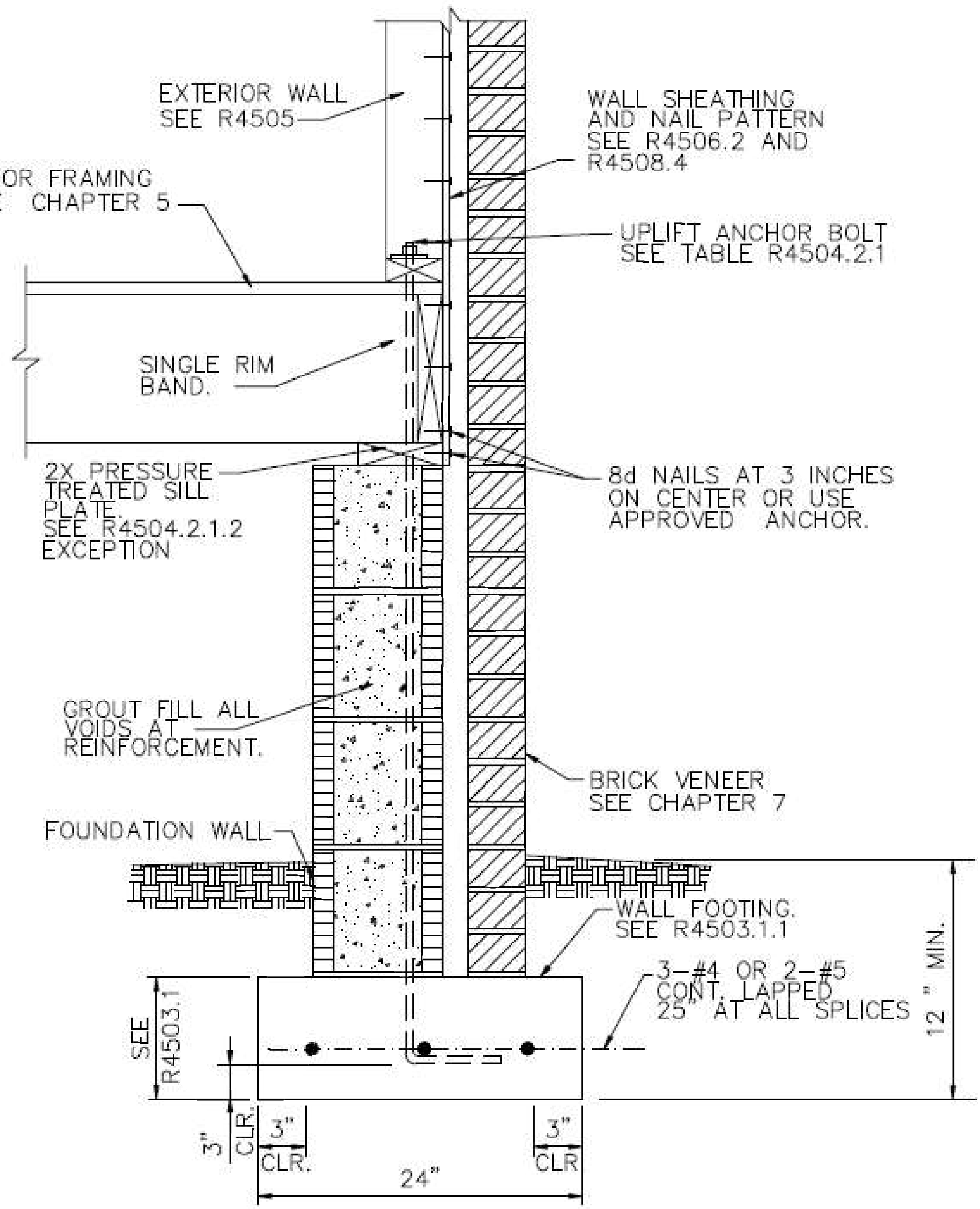


FIGURE R4504.2(c)
FOUNDATION WALL WITH UPLIFT ANCHOR BOLTS CONTINUOUS FROM FOOTING TO EXTERIOR WALL FRAMING

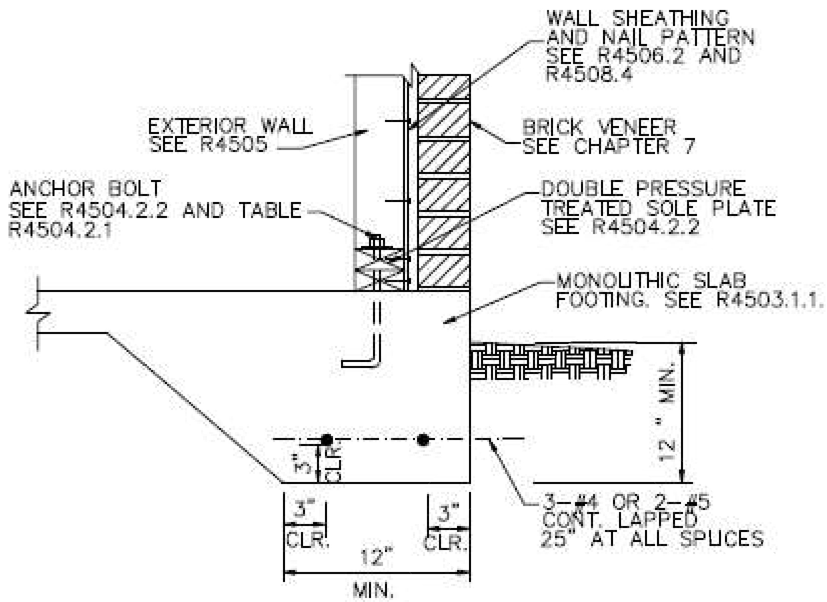


FIGURE R4504.2(d)
EXTERIOR CONCRETE SLAB ON
GRADE FOOTING – DOUBLE SOLE PLATE

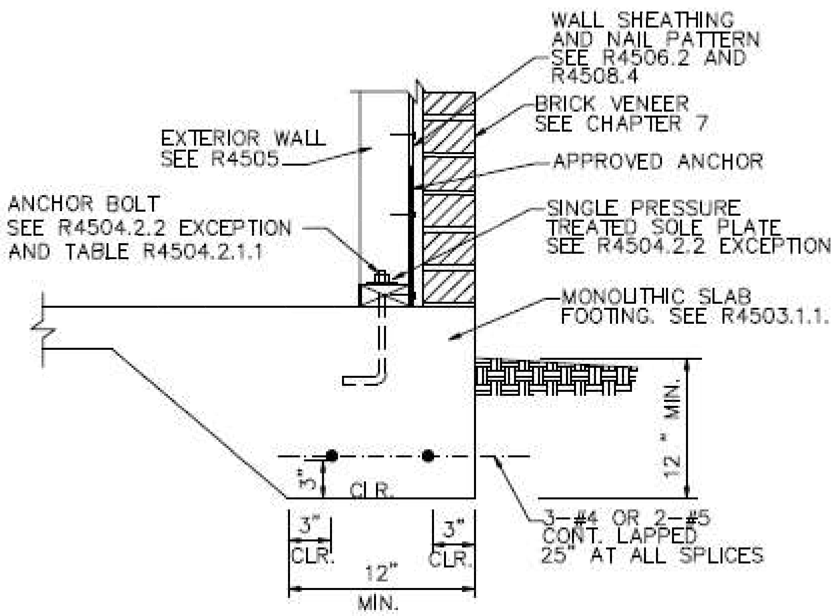


FIGURE R4504.2(e)
EXTERIOR CONCRETE SLAB ON
GRADE FOOTING – SINGLE SOLE PLATE

ANCHOR BOLT

SEE R4504.2.3 AND TABLE R4504.2.1

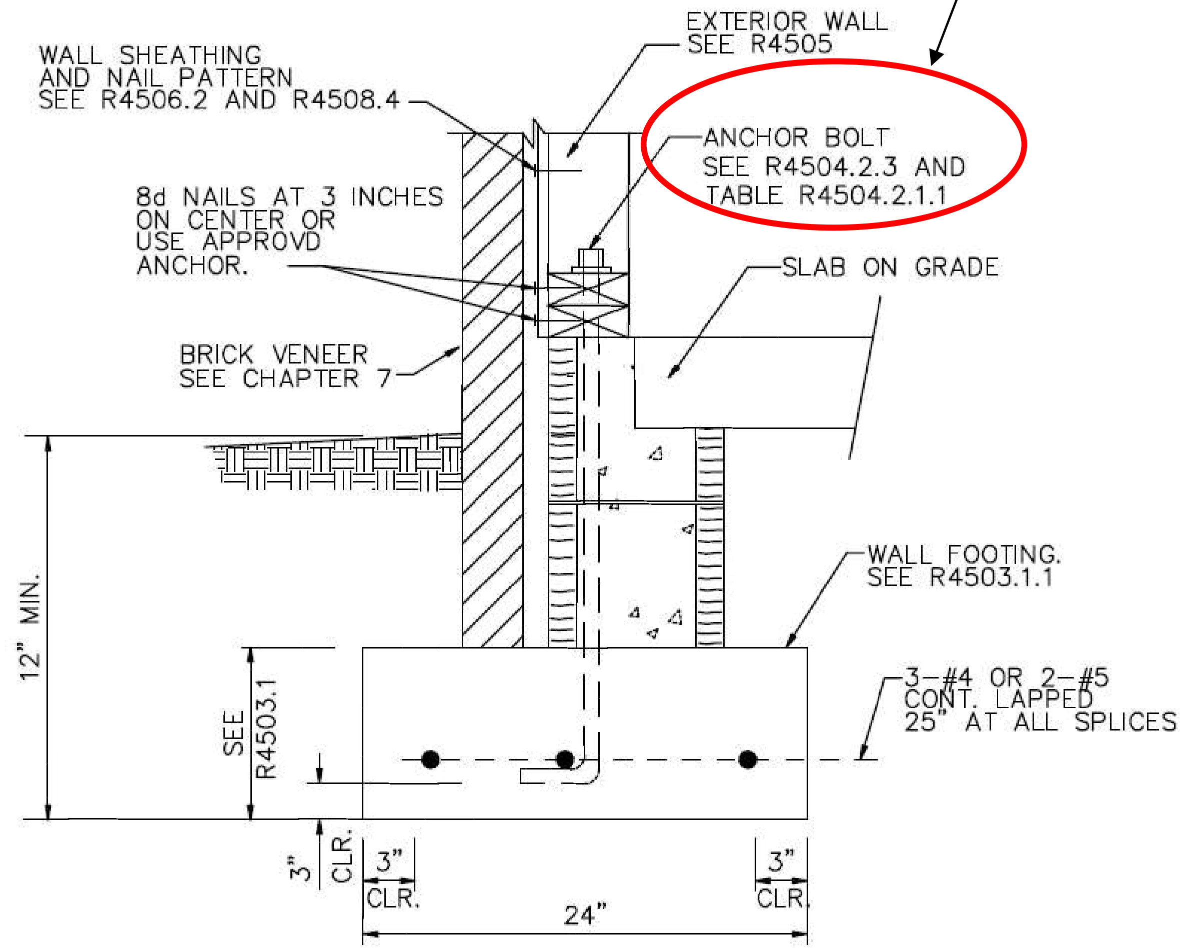


FIGURE R4504.2(f)
GROUND SUPPORTED SLAB WITH
MASONRY STEM WALL

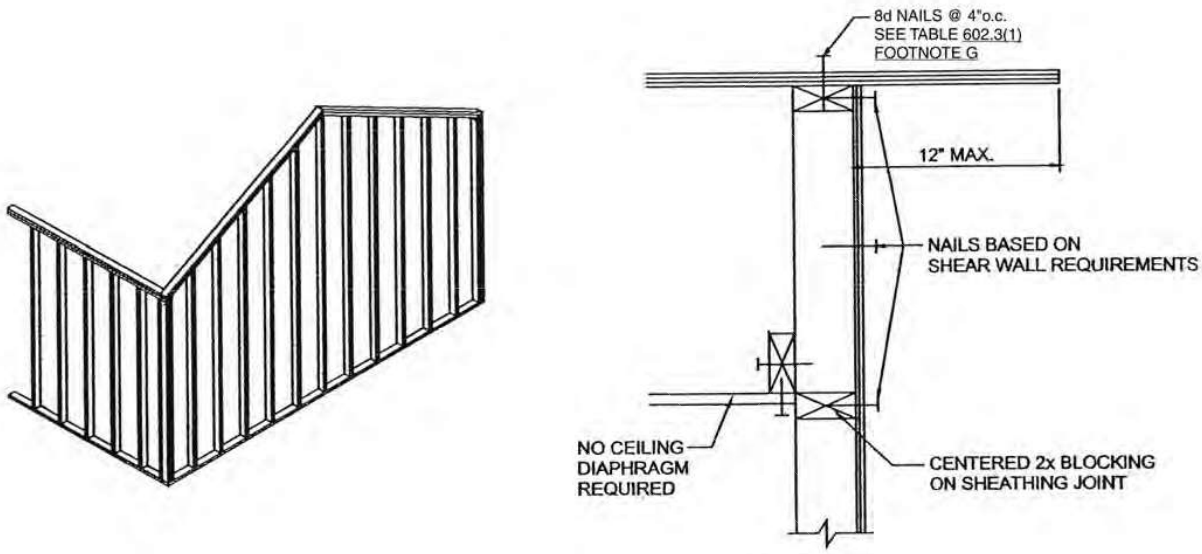


FIGURE R4506.5
GABLE ENDWALL BALLOON FRAMING PREFERRED METHOD

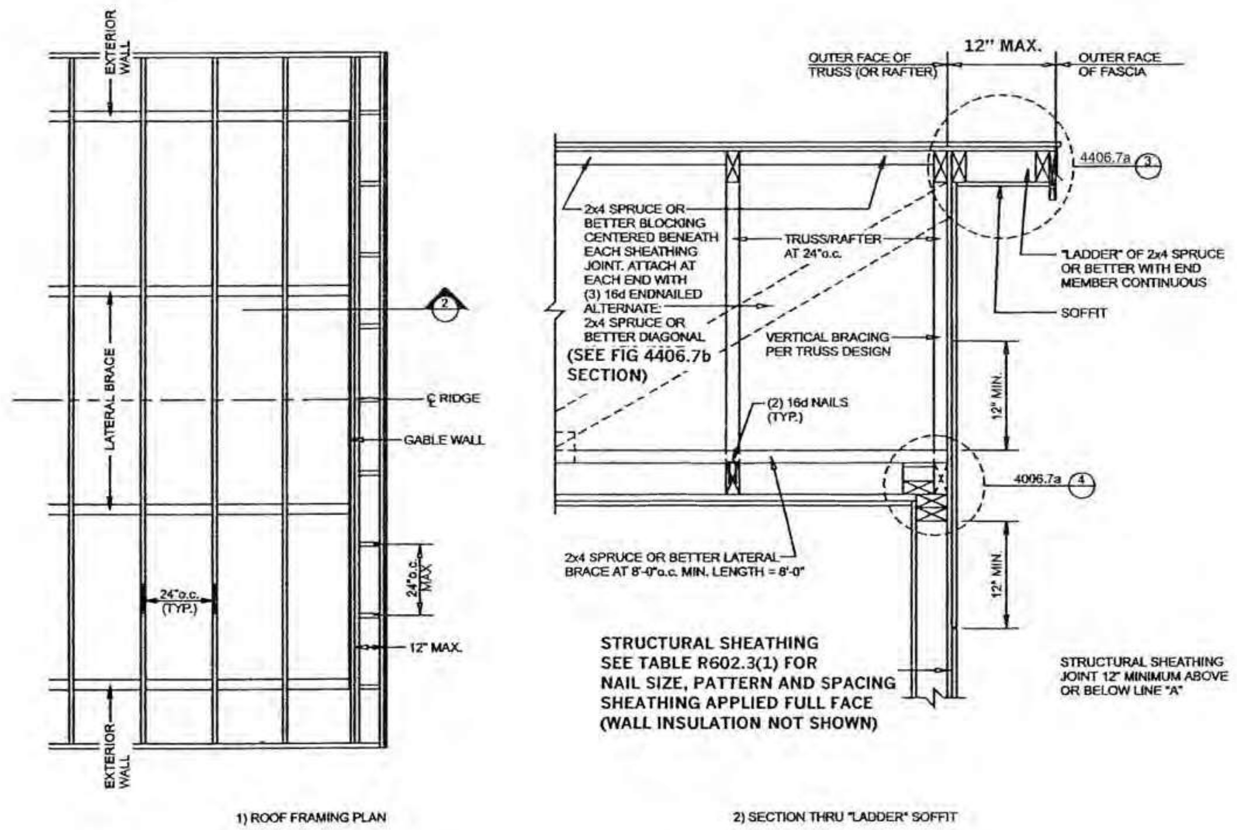
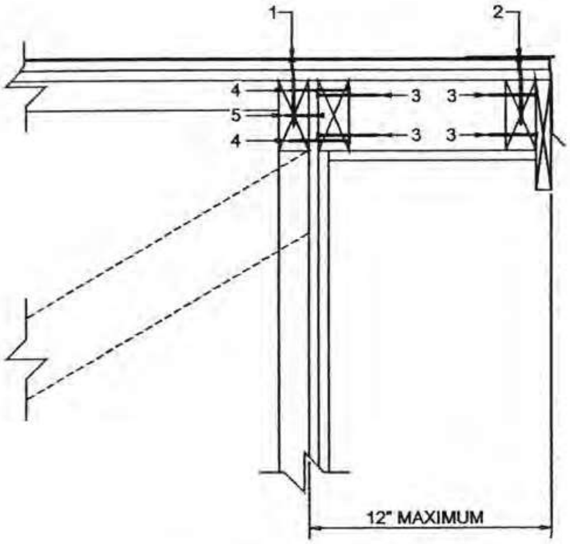
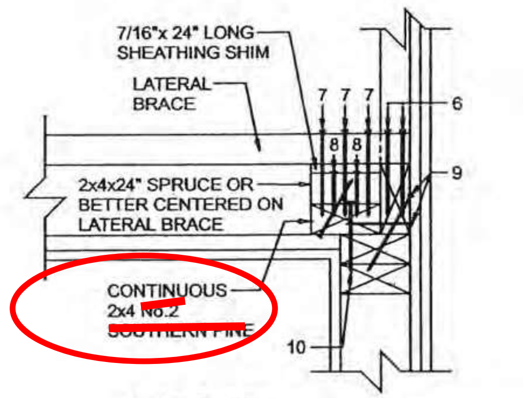


FIGURE R4506.7(a)
OVERHANG AT ENDWALLS



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



4 4406.7a
NAILING DETAIL AT LATERAL BRACE

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

FIGURE R4506.7(a)—continued
OVERHANG AT ENDWALLS

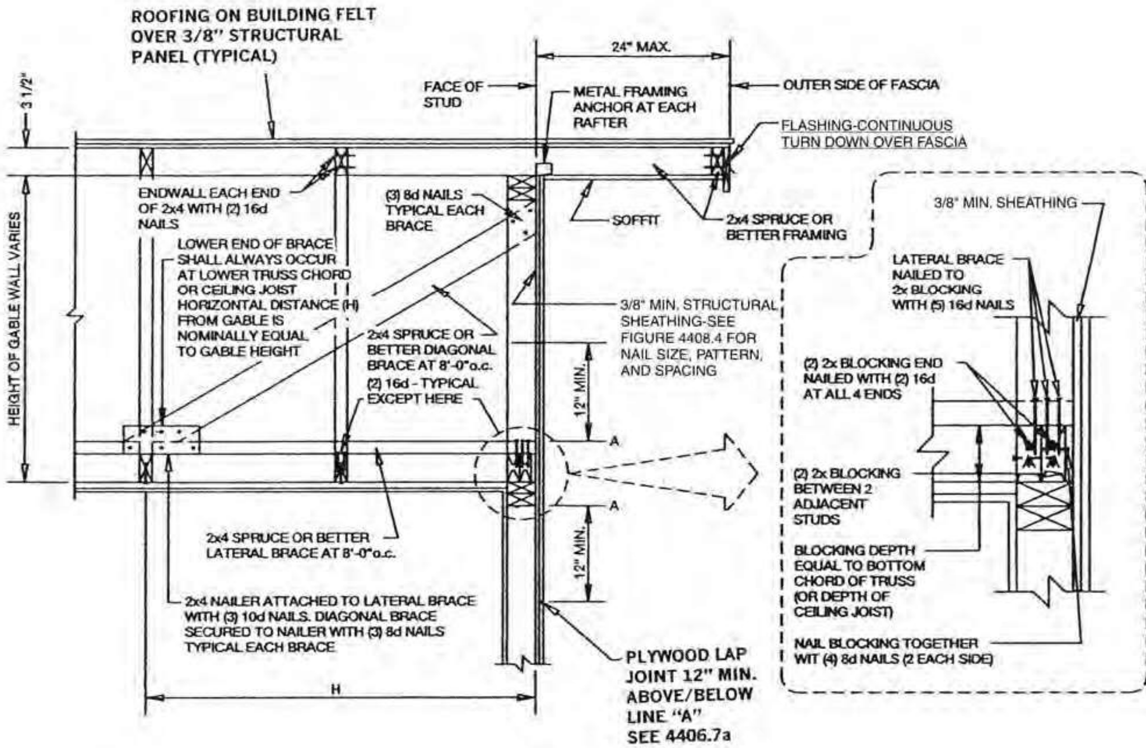


FIGURE R4506.7(b)
GABLE END OVERHANG

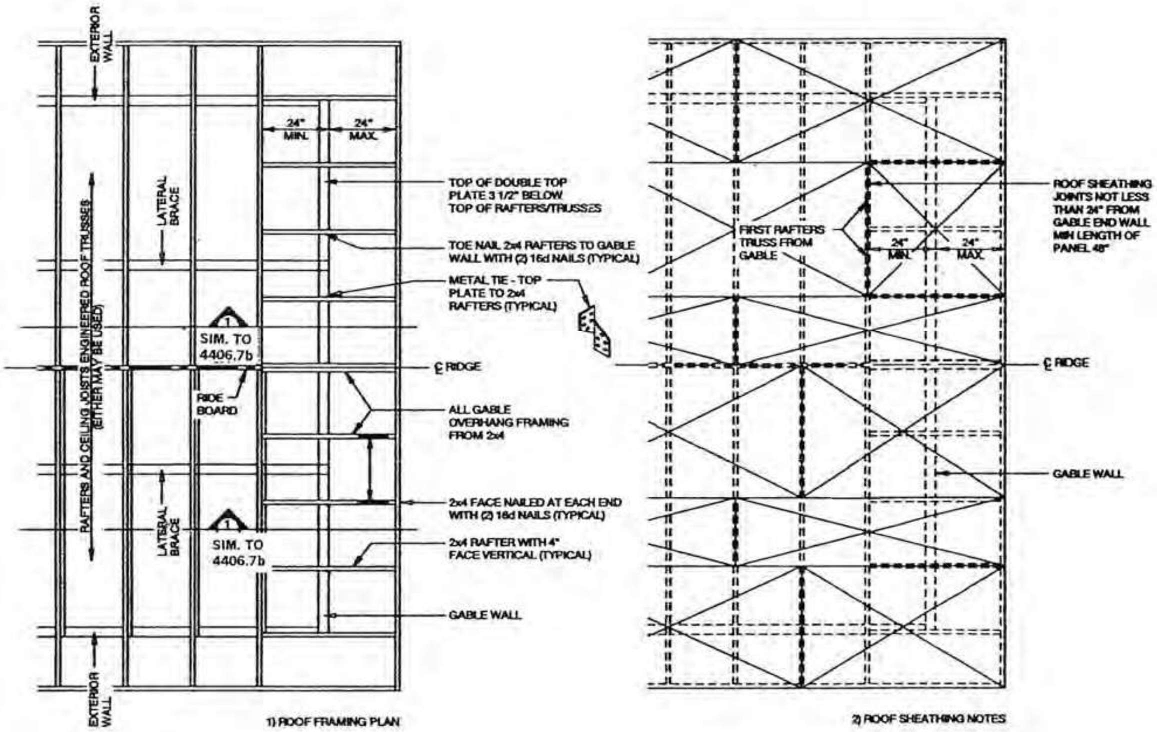


FIGURE R4506.7(c)
GABLE END OVERHANG

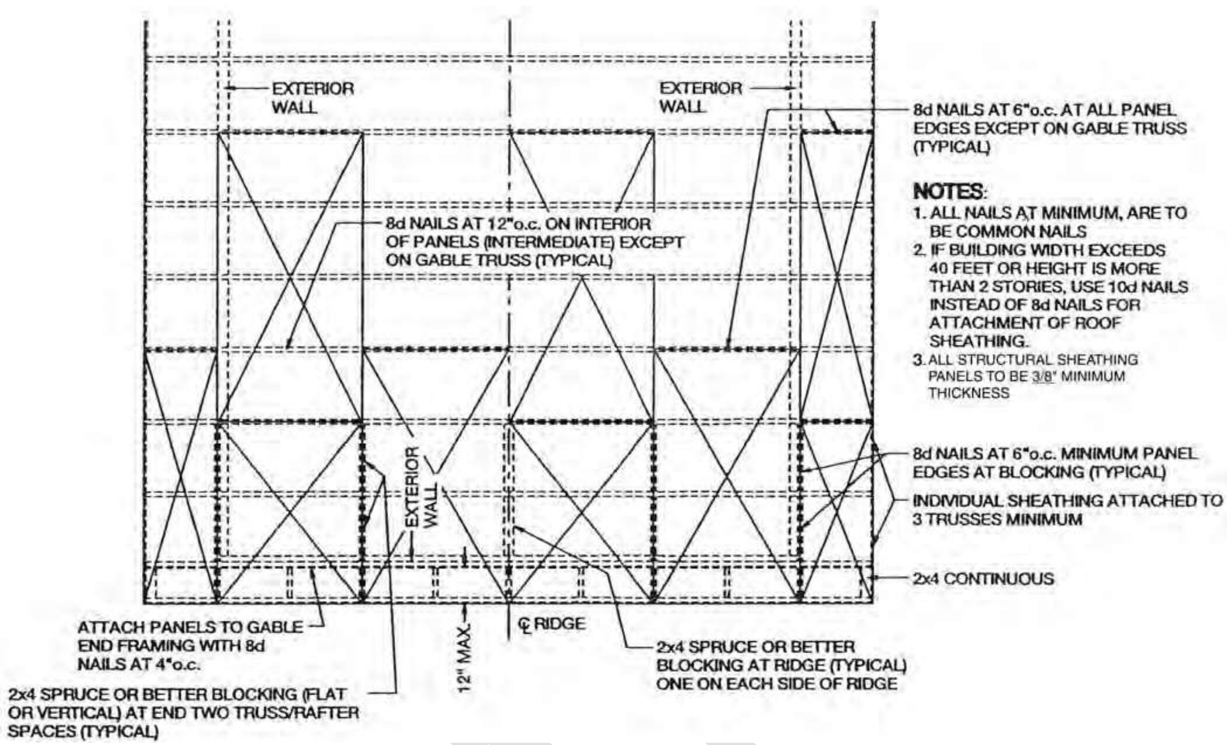
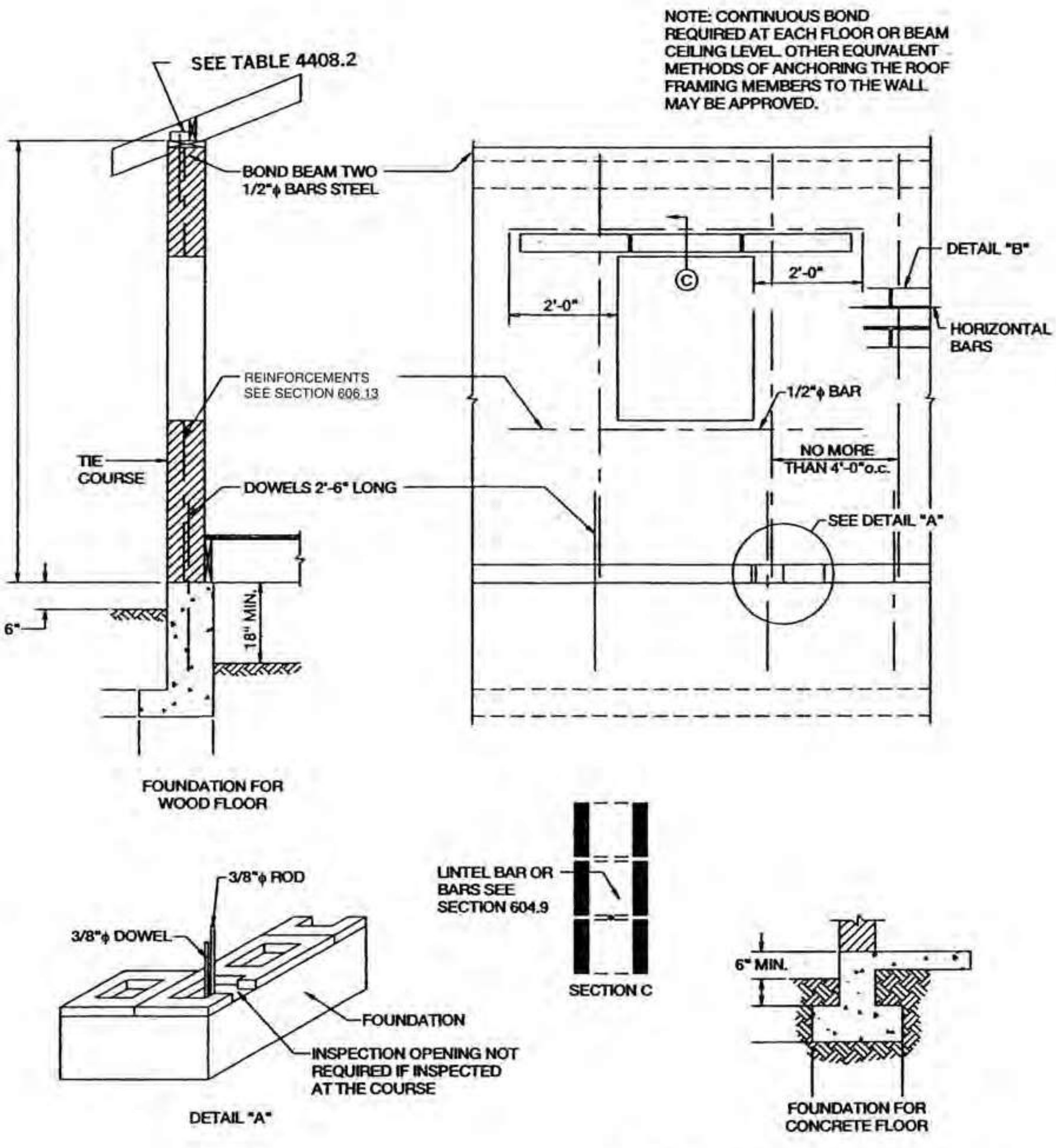


FIGURE R4506.8
ROOF SHEATHING ATTACHMENT PLAN



A FULL BED JOINT MUST BE PROVIDED. ALL CELLS CONTAINING VERTICAL BARS ARE TO BE FILLED TO TOP OF WALL. PROVIDE INSPECTION OPENING AS SHOWN ON DETAIL "A". HORIZONTAL BARS ARE TO BE LAID AS SHOWN ON DETAIL "B". LINTEL BARS ARE TO BE LAID AS SHOWN ON SECTION "C".

FIGURE R4507.1(a)
REQUIREMENTS FOR REINFORCED GROUTED MASONRY CONSTRUCTION WHERE WIND ZONES ARE 140 MPH OR GREATER

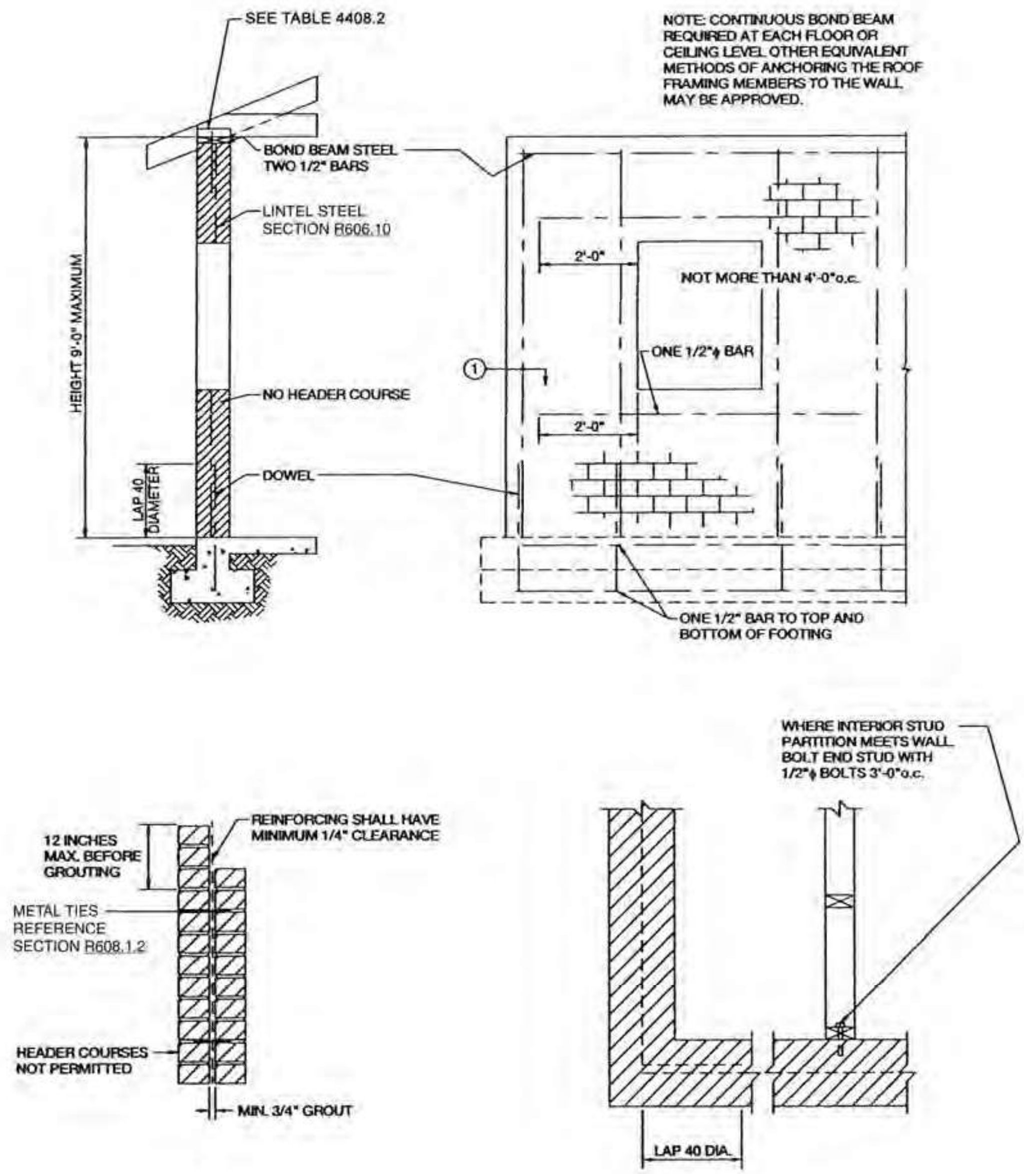


FIGURE R4507.1(b)
REQUIREMENTS FOR REINFORCED HOLLOW-UNIT MASONRY CONSTRUCTIONWHERE WIND ZONES ARE 140 MPH OR GREATER

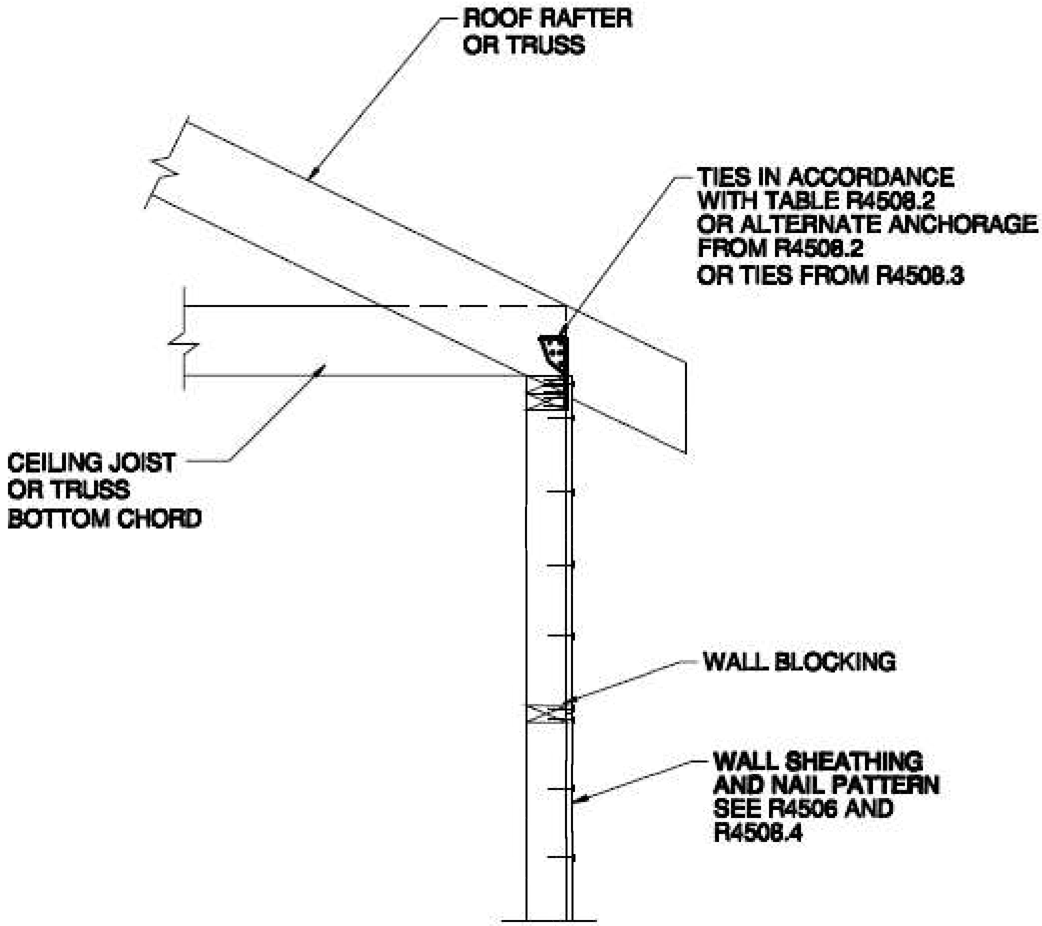


FIGURE R4508.3
ROOF RAFTER/TRUSS ANCHORAGE

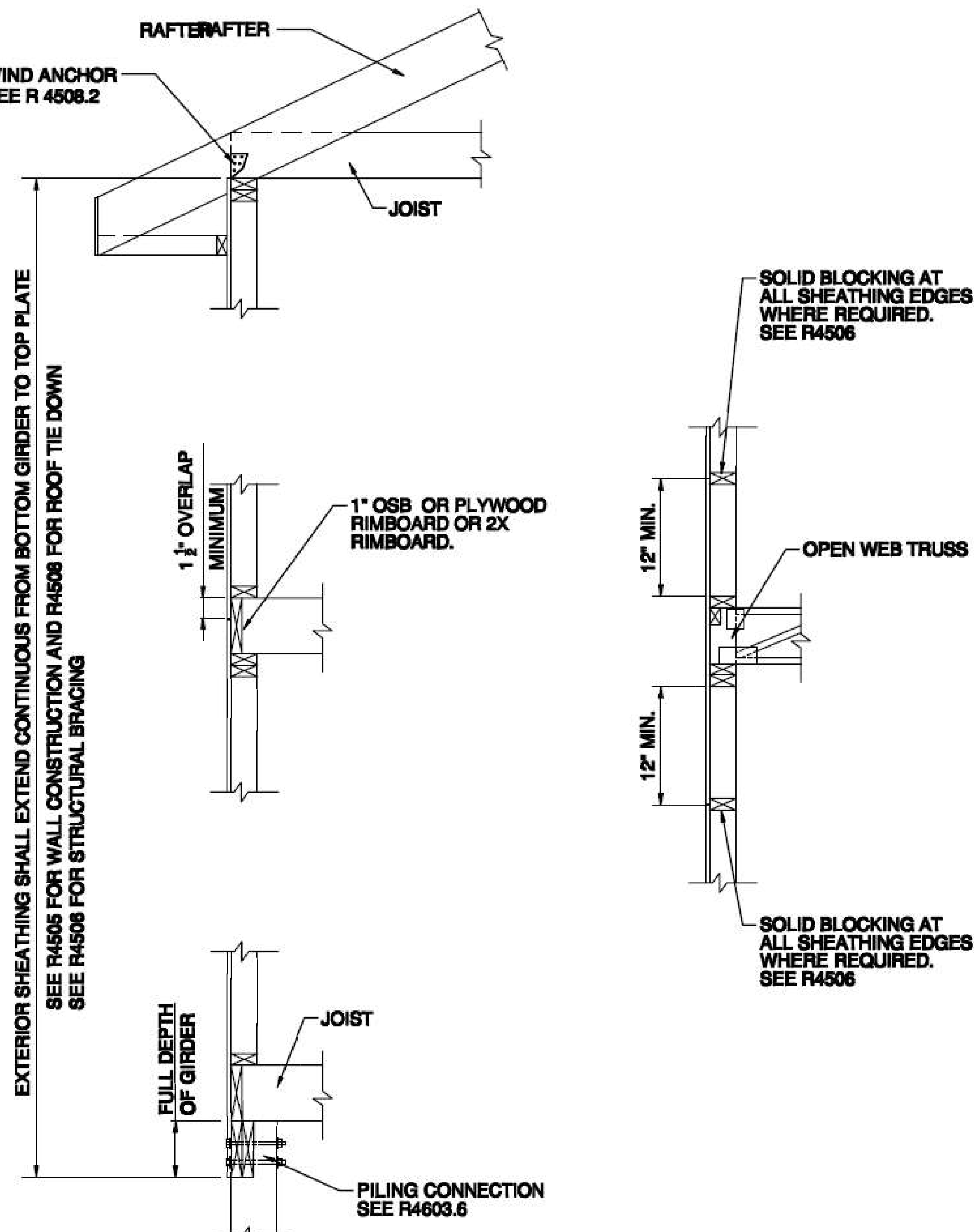


FIGURE R4508.4(a)
TWO STORY WALL SECTION - PANEL ATTACHMENT

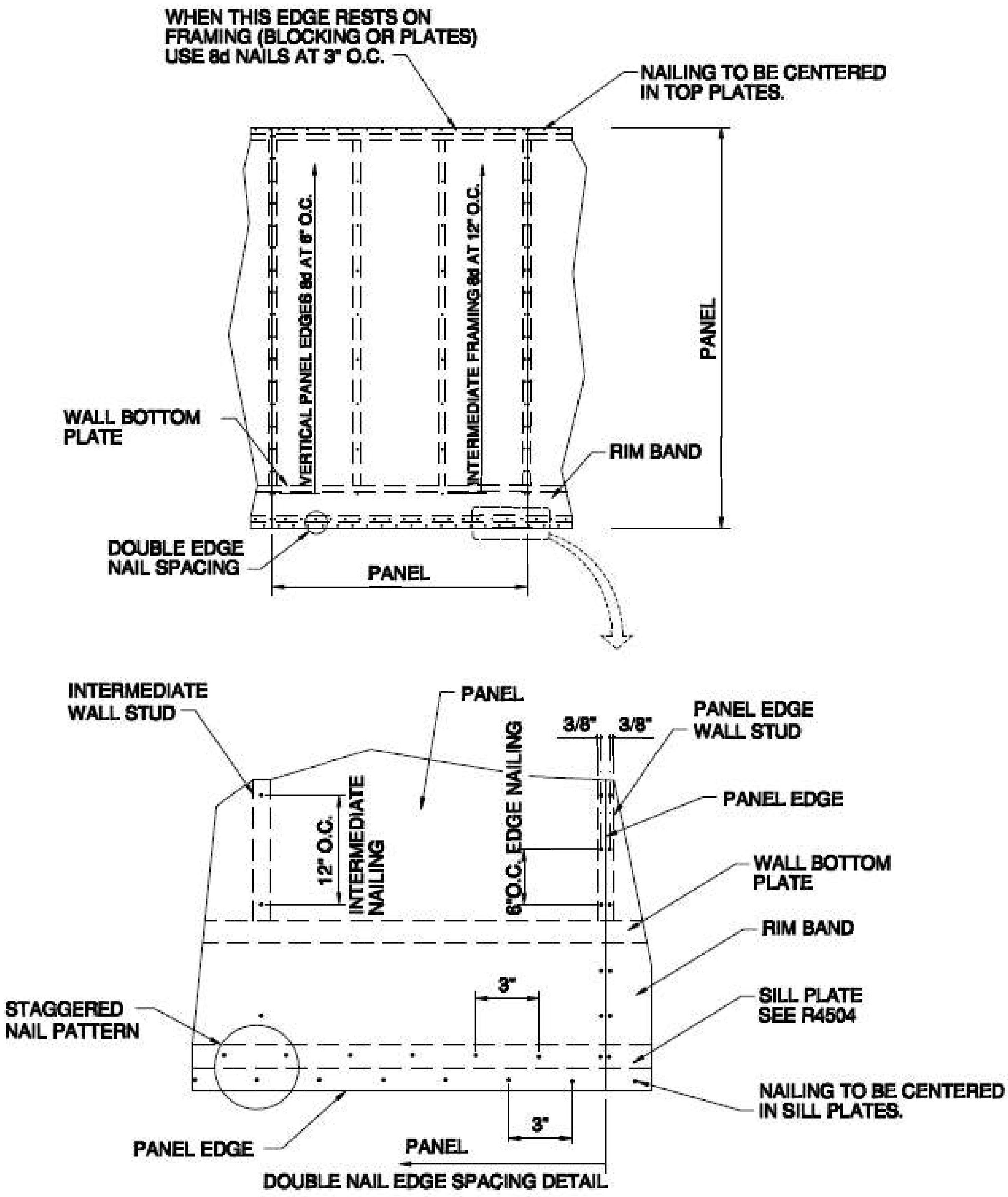


FIGURE R4508.4(b)
PANEL ATTACHMENT TO COUNTER UPLIFT HORIZONTAL OR VERTICAL

CHAPTER 46
COASTAL AND FLOOD PLAIN CONSTRUCTION STANDARDS

This chapter is a North Carolina addition and not part of the 2021 International Residential Code. There will be no underlined text.

SECTION R4601
PURPOSE, APPLICATION AND SCOPE

R4601.1. General.
The requirements set forth in this section shall apply to all construction located within areas identified by governmental agency (state and federal) as coastal high hazard areas, ocean hazard areas, the regulatory flood plain areas, and all areas designated as 150 mph (67 m/s) wind zone. See Table R301.2(1).

SECTION R4602
DEFINITIONS

See Chapter 2 for definitions

SECTION R4603
PILING STANDARDS

R4603.1. General.
All one- and two-family dwellings in areas identified as coastal high hazard areas or ocean hazard areas shall be constructed on a pile foundation of wood or concrete.

R4603.2 Concrete piles.
Concrete piles are permitted to be used if made and installed in accordance with the *North Carolina Building Code*, Chapter 18.

R4603.3 Size of wood piles.
Round timber piles shall not be less than 8 inches (203 mm) in diameter at building level and have a minimum tip diameter of 6 inches (152 mm). Square timber piles shall not be less than 8 inches square (0.005 m2), nominal. Piles supporting uncovered stairs, uncovered walkways and uncovered decks shall be 6 inches × 6 inches (153 mm × 153 mm) minimum, or if round, have a minimum tip diameter of 6 inches (153 mm). Piles supporting uncovered stairs, uncovered walkways and uncovered decks less than 5 feet (1524 mm) above grade are permitted to be 4 inches × 4 inches (102 mm × 102 mm) minimum.

R4603.4 Required depth of piles.
Pile tip shall extend to a depth of not less than 8 feet (2438 mm) below the natural grade or finished grade of the lot, whichever is lower. All pilings within the Ocean Hazard Area shall have a tip penetration of at least 5 feet (1524 mm) below mean sea level or 16 feet (4877 mm) below

average original grade, whichever is least. Structures within Ocean Hazard Areas which are placed upon the site behind a line 60 times the annual erosion rate away from the most seaward line of stable natural vegetation are exempt from this additional tip penetration requirement.

R4603.5 Spacing of wood piles.
The maximum center-to-center spacing of wood piles shall not be more than 8 feet (2438 mm) on center under load-bearing sills, beams, or girders. For dwellings having more than two stories above piles or where the piling spacing exceeds 8 feet (2438 mm) on center, the pile foundation shall be designed by a *registered design professional.* Pile spacing in the non-load bearing direction are permitted to be 12 feet (305 mm).

R4603.6 Tying and bracing of wood piles.
Beams and girders shall fully bear on pilings and butt joints shall occur over pilings. Sills, beams or girders shall be attached to the piling, using either bolts or screws at each piling connection in accordance with Table 4603.6 and Figure R4603.6 (a). When the piling is notched so that the cross-section is reduced below 50 percent or the girder is top bearing, sills, beams or girders shall be attached using 3/16 × 4 × 18-inch (5 × 102 × 467 mm) hot dip galvanized straps, one each side, fastened top and bottom with either bolts or screws in accordance with Table R4603.6 and Figure R4603.6(b) and Figure R4603.6(c). Where butt joints occur over the piling and screws are used, there shall be two straps on each side of the piling, having a minimum size of 3/16 × 2 × 18 inches (5 × 51 × 467 mm), with four self-drilling screws as described below in each end.

Bracing of pile foundations is required where the clear height from ground to sill, beam or girder exceeds 10 feet (3048 mm) or the dwelling is more than one story above piles. A line of X-bracing is defined as a row of piles with X-bracing provided in at least two bays. A line of X-bracing shall be provided at all exterior pile lines. Where the perimeter lines of X-bracing exceed 40 feet (12 192 mm), an additional line of X-bracing shall be provided near the center of the building. See Figure R4603.6(e). X-bracing shall be with 2 × 10s through bolted with two 3/4-inch (19.1 mm) bolts at each end. The *code official* is permitted to accept alternate bracing designs if they bear the seal of a *registered design professional*

R4603.6.1 Tying at corners.
At corners, girders shall be connected to the pile with a minimum 3/16 × 4 × 18-inch (5 × 102 × 467 mm) hot dip galvanized strap bolted with two 5/8 inch (15.9 mm) galvanized through bolts on the exterior and a minimum L4 x 4 x 3/16 x 1'-6" (102 × 5 × 467 mm) galvanized steel angle bolted with two 5/8 inch (15.9 mm) galvanized through bolts on the interior in accordance with Figure R4603.6(d), or with a minimum of (2) 3/16" x 4" x 18" (5x102x467 mm) hot dip galvanized straps installed on the outside of the girders with fasteners per Table R4603.6.1 and in accordance with Figure R4603.6 (e).

Table R4603.6
Minimum Fastening of Corner Beams and Girder to Pilings

Amount Piling is Notched	Beam/Girder Continuous		Beam/Girder Butt joint	
	Bolts	Screws	Bolts	Screws
≤ 50%	two 5/8" bolts[2]	four screws[3]	four 5/8" bolts[2]	eight screws[3]
> 50%[1]	two 5/8" bolts[2]	four screws[3]	four 5/8" bolts[2]	eight screws[3]

1. Where piling is notched over 50%, use strap as required in Section 4603.6. Install the specified number of bolts or screws in each end of the strap.
2. Bolts shall be 5/8” diameter hot dipped galvanized through bolts with nuts and washers.
3. Screws shall be 0.270” (6.9 mm) minimum in diameter, hot dipped galvanized to a minimum of A153, Class C, and having a minimum length of 4”, and also shall be long enough to penetrate at least one inch through the remaining pile and into the girder.

Table R4603.6.1
Minimum Fastening of Corner Beams and Girder to Pilings

Amount Piling is Notched	Associated Figure	Hardware	Fasteners
> 50%[1]	R4603.6(d)	one 3/16” x 4” x 18”	six 5/8" bolts[2]
		one L 4 x 4 x 3/16 x 18”	
	R4603.6(e)	two 3/16” x 4” x 18”	eight 0.27"x4" each strap[3]

1. Where piling is notched over 50%, use strap as required in Section 4603.6. Install the specified number of bolts or screws in each end of the strap.
2. Bolts shall be 5/8” diameter hot dipped galvanized through bolts with nuts and washers.
3. Screws shall be 0.270” (6.9 mm) minimum in diameter, hot dipped galvanized to a minimum of A153, Class C, and have a minimum length of 4” or shall be long enough to penetrate through the girder and a minimum of one inch into the remaining pile, whichever is greater.

R4603.6.2 Bracing of Pilings.
Bracing of pile foundations is required where the clear height from ground to sill, beam or girder exceeds 10 feet (3048 mm) or the dwelling is more than one story above piles. A line of X-bracing is defined as a row of piles with X-bracing provided in at least two bays. A line of X-bracing shall be provided at all exterior pile lines. Where the perimeter lines of X-bracing exceed 40 feet (12 192 mm), an additional line of X-bracing shall be provided near the center of the building. See Figure R4603.6(f). X-bracing shall be with 2 × 10s through bolted with two 3/4-inch (19.1 mm) bolts at each end. The code official is permitted to accept alternate bracing designs if they bear the seal of a registered design professional.

R4603.7. Protection against decay.
The minimum net retention of preservatives shall be in accordance with AWPA U1.

R4603.8 Piling may be placed by auger, jetting or drop hammer.
Piling shall receive a final set by drop hammer or other approved methods, acceptable to the *code official* to ensure compaction of material at end bearing.

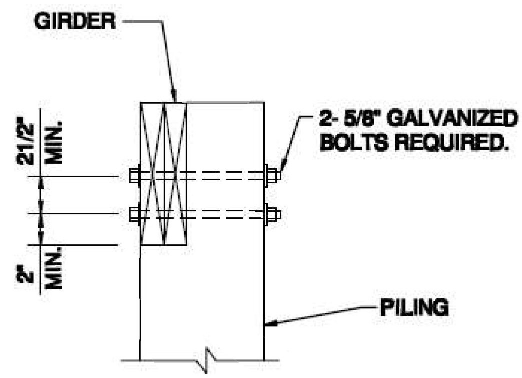


FIGURE R4603.6(a)
PILING NOTCHED LESS THAN 50%

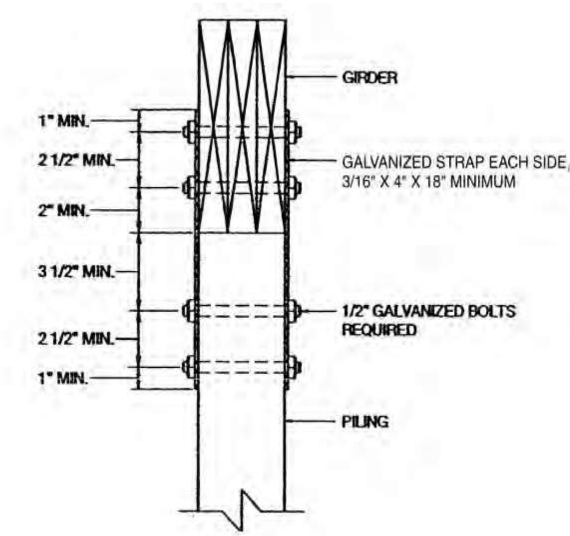
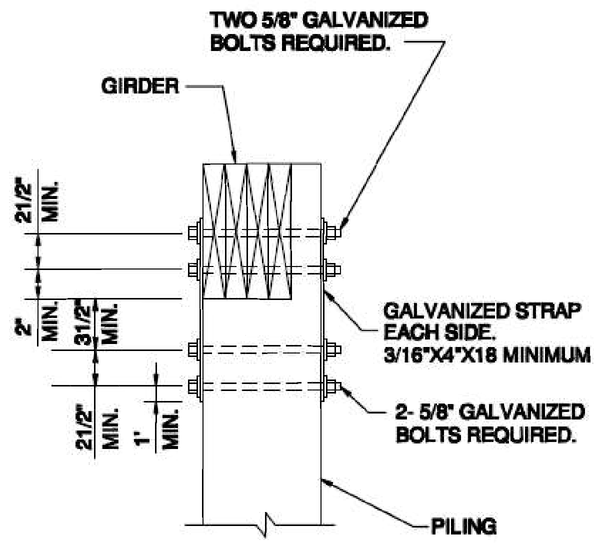


FIGURE R4603.6(<u>b</u>)
<u>TOP MOUNTED GIRDER</u>



<u>FIGURE R4603.6(c)</u>
<u>PILING NOTCHED MORE THAN 50%</u>

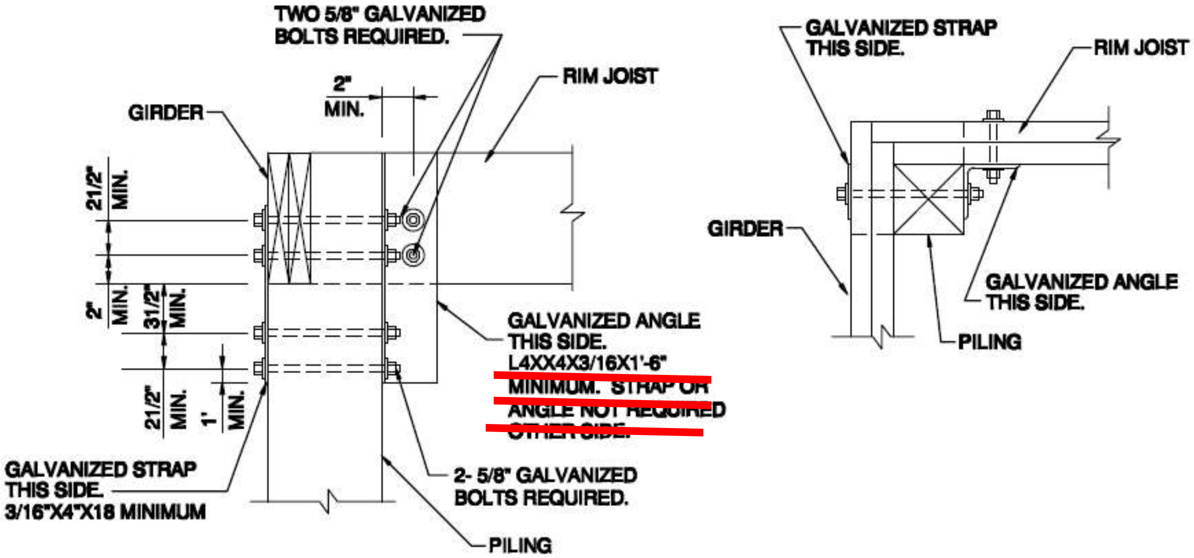


FIGURE R4603.6(d)
CORNER PILE CONNECTION

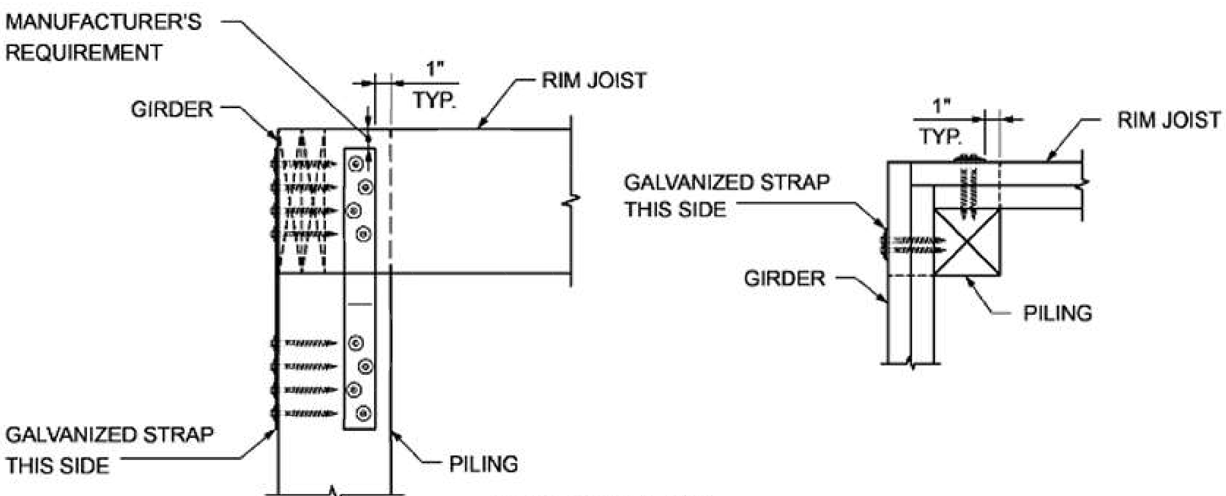


FIGURE R4603.6(e)
CORNER PILE CONNECTION

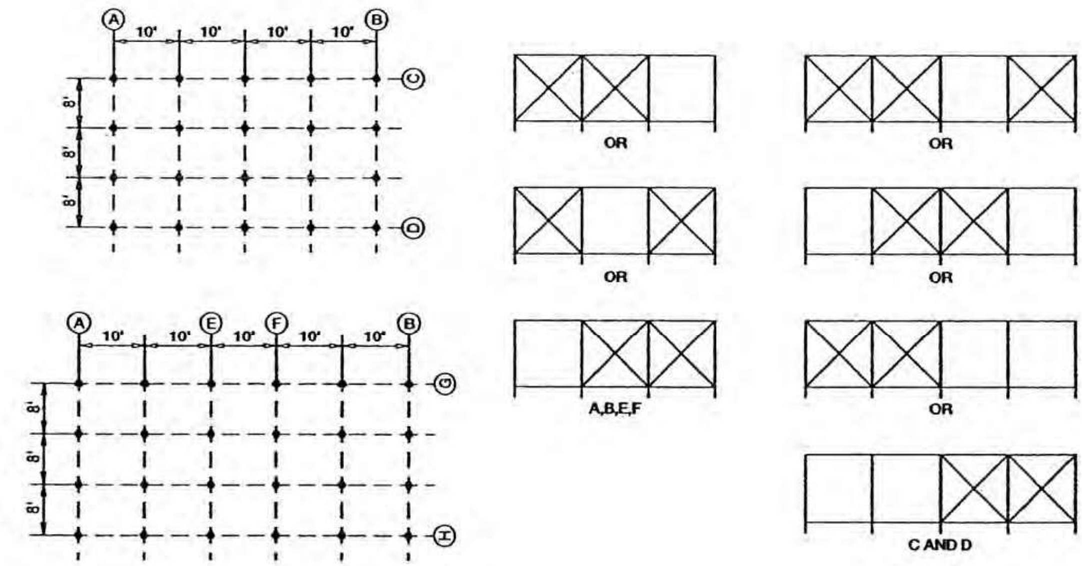


FIGURE R4603.6(f)

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

SECTION R4604
ELEVATION STANDARDS

R4604.1. Lowest structural member.
The lowest structural member, excluding pilings and bracing supporting the lowest habitable floor in the coastal high hazard area and ocean hazard area, shall be elevated above the base flood elevation.

R4604.2. First habitable floor.
The elevation of the first habitable floor of all structures in the regulatory flood plain except in the coastal high hazard areas shall be above the base flood elevation.

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

R4604.3. Walls below flood elevation.
Where walls are constructed below flood elevation in coastal high hazard area and ocean hazard area, they shall be constructed in a manner to eliminate wave forces on the piling.

SECTION R4605
CONSTRUCTION MATERIALS
AND METHODS STANDARDS

R4605.1. General.
The requirements of Sections R4605.2 through R4605.8 are applicable in the coastal high-hazard area, the ocean hazard area, and all areas defined as 150 mph (~~57~~ m/s) wind zone.

R4605.2. Roof anchorage.
Every rafter or roof truss shall be anchored to the bearing wall as required by Section R4508. At the ridges, rafters shall have a minimum 1 × 6 or 2 × 4 collar or wind beam. Every third rafter not to exceed 4 feet (1219 mm) on center shall be anchored vertically with minimum 1 × 6 or 2 × 4 from its midpoint to ceiling joists below.

R4605.3 Wood frame wall construction.
Maximum stud spacing shall be 16 inches o.c. (406 mm) for 2 × 4s and 24 inches (610 mm) for 2 × 6s. See Section R4505 for wall construction requirements. See Section R4508 for uplift anchorage requirements.

R4605.4. Design by registered design professional.
Equal or better methods of tying structures together and to foundations designed for a specific building by a *registered design professional* shall be accepted by the *code official*.

R4605.5 Building anchorage.

1. For masonry buildings, the roof structure, including rafters and joists, shall be anchored to the wall in accordance with Section R606.11. All mortar used for masonry walls shall be Type M or S.

2. For masonry or wood frame buildings, all sills, beams or girders which resist uplift (including interior sills, beams, girders, and joists where the perimeter is unenclosed) shall be anchored to the footing in accordance with Section R4504. Footing dowel bars shall have an 8-inch (203 mm) hook.

3. Where wood partitions and masonry walls join, the stud abutting the masonry shall be double and bolted to the masonry with three 1/2-inch (13 mm) galvanized bolts.

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

R4605.6 Insulation.
Insulation installed in floors in exposed areas under buildings elevated on pilings shall be held in place with plywood with exterior glue or other material approved by the *code official*.

R4605.7 Accessory structures.
Detached accessory structures and out buildings shall be bolted to their foundation or otherwise constructed so as to prevent overturning.

SECTION R4606
FASTENER CORROSION RESISTANCE

R4606.1 Fastener corrosion resistance.
In the Coastal High Hazard Area, the Corrosion Resistance Area and the Ocean Hazard Area, all metal connectors and fasteners outside of conditioned spaces shall be hot-dip galvanized steel after fabrication and meet ASTM A 153. Exposed metal connectors, such as tie-down straps on porches, decks, and areas under the structure, shall be a minimum 3/16-inch (5 mm) thick, and shall be hot-dip galvanized after fabrication and meet ASTM A 123 or ASTM A 153. Stainless steel light-gage metal connectors shall be permitted in exposed or partially exposed locations. Metal connectors of approved equivalent corrosion resistant material are permitted to be accepted. See Table R4606.1.

TABLE R4606.1[a]
CORROSION RESISTANCE

	OPEN (exterior, porches, under house)	EXPOSURE LEVEL VENTED/ENCLOSED (attic, floor trusses, enclosed crawl spaces and stud cavity)	CONDITIONED (heated/cooled living areas)
Nails, staples, screws	Hot-dip galvanized	Hot-dip galvanized	-
Nuts, bolts, washers, tie rods	Hot-dip galvanized	Hot-dip galvanized	-
Steel angles, connection plates & straps (3/16″ minimum thickness)	Hot-dip galvanized after fabrication	Hot-dip galvanized	-
Sheet metal connectors, wind anchors, joists hangers, steel joists and beams	Stainless steel or hot-dipped galvanized after fabrication	Hot-dip galvanized after plate fabrication or triple galvanized[b]	Hot-dip galvanized or triple galvanized[b]
Truss plates	Stainless steel or hot-dipped galvanized after fabrication	Hot-dip galvanized after fabrication, stainless steel, triple galvanized[b] or in accordance with TPI-1 of the Truss Plate Institute within 6′-0″ of a gable louver, ridge or soffit vent. Otherwise, standard galvanized[b].	Standard galvanized

a. Applies only to structures located in Coastal High-Hazard Area, Corrosion Resistance Area and Ocean Hazard Area.
b. Triple galvanizing – G185, standard galvanizing – G60, both per ASTM A 653 / A 653M.

CHAPTER 47
WOOD DECKS

SECTION 4701
GENERAL

4701.1 Decks. Wood-framed decks shall be in accordance with this section. Decks shall be designed for the live load required in Section R301.

4701.2 Deck design. Computer deck design programs are permitted to be accepted by the *building official*.

SECTION 4702
MATERIALS

4702.1 Wood materials. Wood materials shall be No. 2 grade or better *pressure- preservative treated wood*, or *approved*, *naturally durable lumber*. Wood structural members shall be designed using the wet service factor defined in AWC NDS. All *pressure-preservative treated wood* products in contact with the ground shall be *labeled* for such usage.

4702.2 Plastic composites. *Plastic composite* exterior deck boards, stair treads, *guards* and *handrails* containing wood, cellulosic or other biodegradable materials shall comply with the requirements of ASTM D7032.

4702.3 Flashing. Flashing shall be corrosion-resistant metal of nominal thickness not less than 0.019 inch (0.48 mm) or *approved* nonmetallic material that is compatible with the substrate of the structure and the decking materials.

SECTION 4703
FASTENERS AND CONNECTORS

4703.1 Fasteners and connectors in contact with pressure-preservative treated wood. Fasteners, including nuts and washers, and connectors in contact with *pressure-preservative treated wood* shall be in accordance with this section. The coating weights for zinc-coated fasteners shall be in accordance with ASTM A153. Stainless steel driven fasteners shall be in accordance with the material requirements of ASTM F1667.

4703.2 Fasteners for pressure-preservative treated wood. Fasteners, including nuts and washers, for *pressure-preservative treated wood* shall be of hot-dipped, zinc-coated galvanized steel, stainless steel, silicon bronze or copper. Staples shall be of stainless steel. Coating types and weights for connectors in contact with preservative-treated wood shall be in accordance with the connector manufacturer's recommendations. In the absence of manufacturer's recommendations, not less than ASTM A653 type G185 zinc-coated galvanized steel, or equivalent, shall be used.

Exceptions:

1. $^1/_2$-inch-diameter (12.7 mm) or greater steel bolts.
2. Fasteners other than nails, staples and timber rivets shall be permitted to be of mechanically deposited zinc-coated steel with coating weights in accordance with ASTM B695, Class 55 minimum.
3. Plain carbon steel fasteners in SBX/DOT and zinc borate preservative-treated wood in an interior, dry environment shall be permitted.

4703.3 Fastenings for wood foundations. Fastenings, including nuts and washers, for wood foundations shall be as specified in this code and Table 4703.3.

TABLE 4703.3
FASTENER AND CONNECTOR SPECIFICATIONS [a, b]

ITEM	MATERIAL	MINIMUM FINISH/COATING	ALTERNATE FINISH/COATING[e]
Nails and **glulam** rivets	In accordance with ASTM F1667	Hot-dipped galvanized per ASTM A153, **Class D for $^{3}/_{8}$-inch diameter and less**	Stainless steel, silicon bronze or copper
Bolts[c] Lag screws[d] (including nuts and washers)	In accordance with ASTM A307 (bolts), ASTM A563 (nuts), ASTM F844 (washers)	Hot-dipped galvanized per ASTM A153, Class C (Class D for $^{3}/_{8}$-inch diameter and less) or mechanically galvanized per ASTM B695, Class 55 or 410 stainless steel	Stainless steel, silicon bronze or copper
Metal connectors	Per manufacturer's specification	ASTM A653 type G185 zinc-coated galvanized steel or post hot-dipped galvanized per ASTM A123 providing a minimum average coating weight of 2.0 oz./ft^2 (total both sides)	Stainless steel

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

a. Equivalent materials, coatings and finishes shall be permitted.

~~b. Fasteners and connectors exposed to salt water or located within 300 feet of a saltwater shoreline shall be stainless steel.~~

b. Holes for bolts shall be drilled a minimum $^{1}/_{32}$ inch and a maximum $^{1}/_{16}$ inch larger than the bolt.

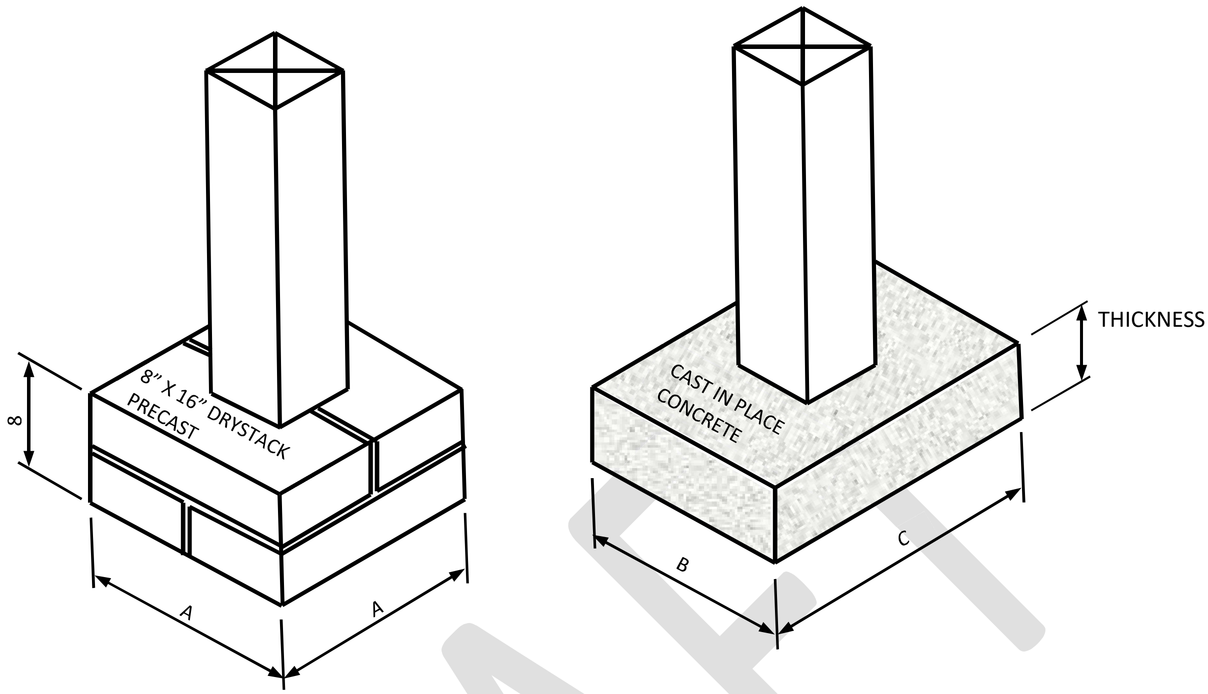
~~d. Lag screws $^{1}/_{2}$ inch and larger shall be predrilled to avoid wood splitting per the *National Design Specification (NDS) for Wood Construction*.~~

c. Stainless-steel-driven fasteners shall be in accordance with ASTM F1667.

SECTION 4704
FOOTINGS

4704.1 Minimum size. Support posts shall be supported by a minimum concrete masonry or concrete footings in accordance with Figure 4704.1 and Table 4704.1. Tributary area is calculated as shown in Figure 4704.2. Post footings in wind zones of 120 mph or higher shall be concrete.

4704.2 Minimum depth. The bottom of the footing shall be 12 inches (305 mm) below finished grade but not less than the frost line as determined by the local building official.



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

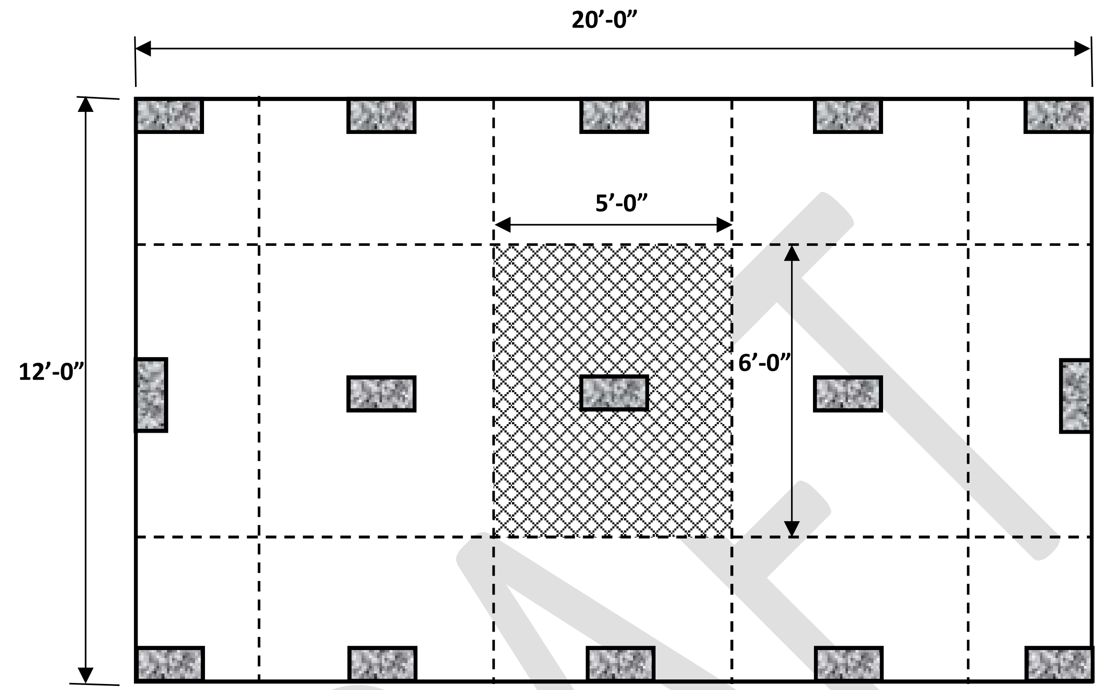
FIGURE 4704.1
SUPPORT POST FOOTING

TABLE 4704.1
FOOTING TABLE[a,b,c]

SIZE (inches)		TRIBUTARY AREA	THICKNESS (inches)	
A x A	**B x C**	**(sq. ft.)**	**Precast**	**Cast-In-Place**
8 x 16	8 x 16	35	4	6
12 x 12	12 x 12	40	4	6
16 x 16	16 x 16	70	8	8
-	16 x 24	100	-	8
-	24 x 24	150	-	8

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

a. Footing values are based on single floor loads.
b. Support post must rest in center 1/3 of footing.
c. Top of footing shall be level for full bearing support of post.



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

Note: Tributary area of shaded section on the free standing *deck* shown is 5' x 6' = 30 sq. ft.(2.79 m^2). Code will require a minimum footing of 8" x 16" (203 mm x 406 mm) in accordance with Table 401.1.

FIGURE 4704.2
CALCULATED TRIBUTARY AREA

SECTION 4705
POSTS

4705.1 Height. Maximum height of deck support posts shall be in accordance with Table 4705.1.

TABLE 4705.1
DECK SUPPORT POST HEIGHT

POST SIZE[a]	MAXIMUM POST HEIGHT[b,c,d]
4" x 4"	8'-0"
6" x 6"	20'-0"

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

a. This table is based on No. 2 Southern Pine posts.
b. From top of footing to bottom of girder.
c. Decks with post heights exceeding these requirements shall be designed by a registered design professional.
d. Bracing shall be provided as required by Section 4711.

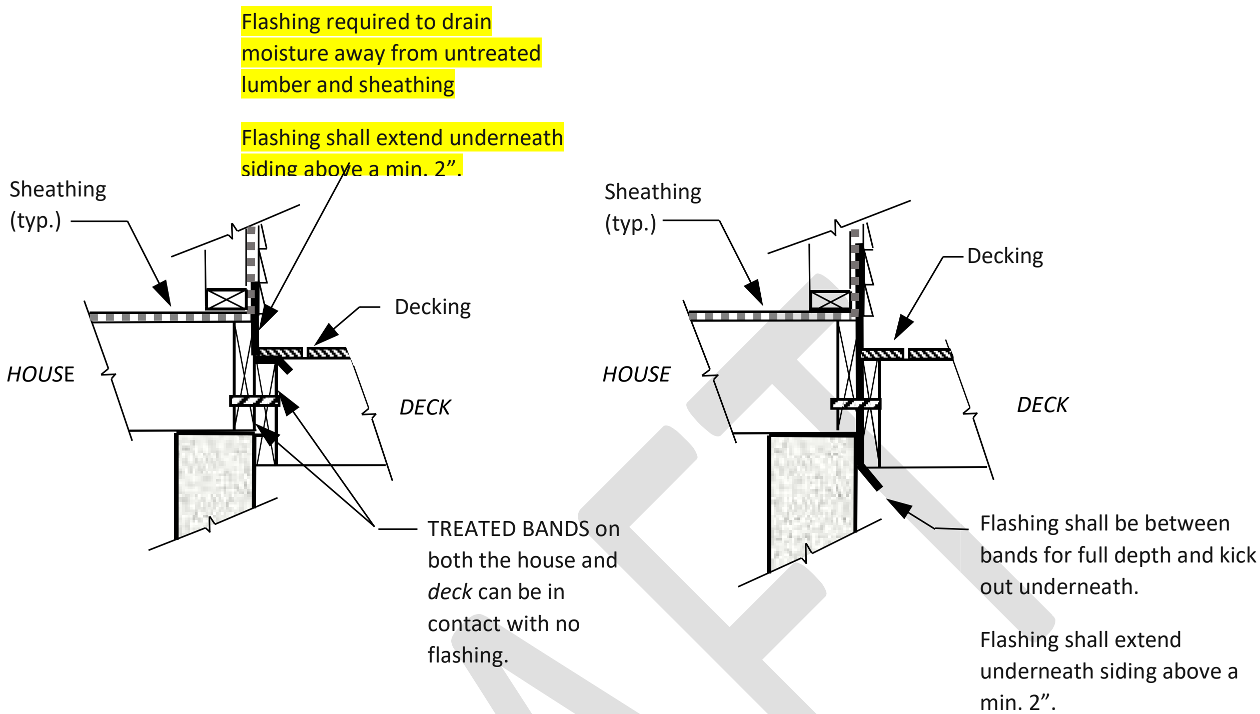
~~**4705.2 Anchorage in high wind zones.** in winds zones of 120 mph or greater each post shall be anchored to the footing with one anchor a minimum of ½" diameter galvanized steel or equivalent. The anchor shall extend a minimum of 7 inches into the concrete footing and have a minimum standard hook length of 12 times the bolt diameter.~~

4705.2 Anchorage. Each post shall be anchored to the footing with one 1/2 inch galvanized anchor or equivalent in winds speeds of 120 mph and 130 mph. The center hole for the anchor shall be located in the center 1/3 of the post not less than 4 inches from the bottom end of the post and not less than 3-1/2 inches below the top of the footing. The anchor shall extend not less than 1/2 of the larger footing width. Anchors in 140 mph and 150 mph wind zones shall be designed by a NC design professional.

> **Exception:** Mechanical fasteners meeting the manufacturer's installation instructions for the applicable wind zone is acceptable.

SECTION 4706
DECK ATTACHMENT TO DWELLING

4706.1 Weatherproofing. When attached to a *dwelling* or accessory building, the building to which attached shall have a treated wood band for the length of the *deck*, or corrosion-resistant flashing shall be used to prevent moisture from coming in contact with the untreated framing of the *dwelling*. Aluminum flashing shall not be used in conjunction with *deck* construction. The *deck* band and the *dwelling* band shall be constructed in contact with each other except on brick veneer structures and where structural sheathing is required and properly flashed. Siding shall not be installed between the structure and the *deck* band. If attached to a brick structure, neither the flashing nor a treated band for brick structure is required. In addition, the treated *deck* band shall be constructed in contact with the brick veneer. Flashing shall be installed per Figure 4706.1.



NO FLASHING BETWEEN TREATED BANDS

FLASHING FOR TREATED DECK BAND TO UNTREATED HOUSE BAND

For SI: 1 inch = 25.4 mm

FIGURE 4706.1
FLASHING FOR DECK ATTACHED TO STRUCTURE

SECTION 4707
SUPPORT BY DWELLING

4707.1 Attachment. When a deck is supported at the structure by attaching the deck to the structure, Tables 4707.1(1) and 4707.1(2) shall apply for attaching the deck band to the structure.

TABLE 4707.1(1)
DECK ATTACHMENT FOR ALL STRUCTURES EXCEPT BRICK VENEER

FASTENERS	8' MAX JOIST SPAN[a]	16' MAX JOIST SPAN[a]
5/8" Hot dip galvanized bolts with nut and washer[b] **and** 16d Common hot dip galvanized nails[c]	1 @ 3'-6" o.c. **and** 2 @ 8" o.c.	1 @ 1'-8" o.c. **and** 3 @ 6" o.c.
OR		
Self-Drilling Screw Fastener[d]	12" o.c. staggered	6" o.c. staggered

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

a. Attachment interpolation between 8 foot and 16 foot joists span is allowed.
b. Minimum edge distance for bolts is 2 ½ inches.
c. Nails must penetrate the supporting structure band a minimum of 1 ½ inches.
d. Self-drilling screw fastener having a minimum shank diameter of 0.195 inches and a length long enough to penetrate through the supporting structure band. The structure band shall have a minimum depth of 1-1/8 inches. Screw shall be evaluated by an approved testing agency for allowable shear load for Southern Pine to Southern Pine lumber of 250 pounds and shall have a corrosion resistant finish equivalent to hot dip galvanized. Minimum edge distance for screws is 1-7/16 inches. A maximum of ½ inch thick wood structural panel is permitted to be located between the deck ledger and the structure band.

TABLE 4707.1(2)
DECK ATTACHMENT FOR BRICK VENEER STRUCTURES

FASTENERS	8' MAX JOIST SPAN[a]	16' MAX JOIST SPAN[a]
5/8" Hot dip galvanized bolts with nut and washer[b]	1 @ 2'-4" o.c.	1 @ 1'-4" o.c.

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

a. Attachment interpolation between 8 foot and 16 foot joist span is allowed.
b. Minimum edge distance for bolts is 21/2 inches.

4707.2 Masonry ledge support. A deck band supported on a minimum 1/2 inch (13 mm) masonry ledge along the foundation wall attached with 5/8 inch (16 mm) hot dip galvanized bolts with washers spaced a maximum of 48 inches (1219 mm) o.c. shall be permitted.

4707.3 Other means of support. Joist hangers or other means of attachment are permitted to be connected to the dwelling band and shall be properly flashed.

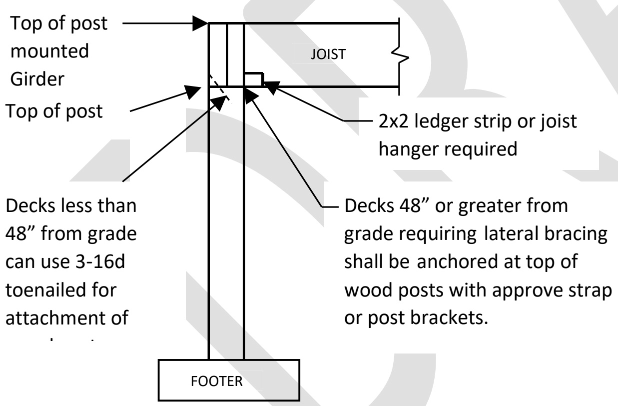
SECTION 4708
GIRDER SUPPORT AND SPAN

4708.1 Girder to post bearing and connection. Girders shall bear directly on the support post with the post attached at top to prevent lateral displacement or be connected to the side of the posts with one of the methods shown in Table 4708.1. Girder support is permitted to be installed in accordance with Figure 4708.1(1) for top mount, Figure 4708.1(2) for side mount, Figure 4708.1(3) for split girders, and Figure 4708.1(4) for cantilevered girders.

Table 4708.1
Girder Connection to Side of Post[c]

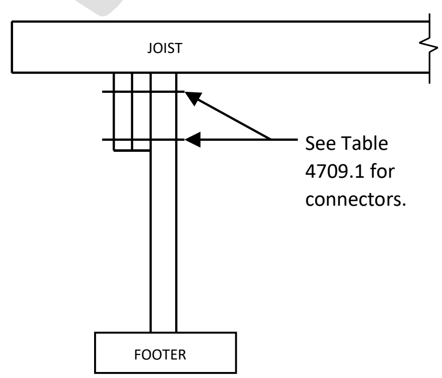
Maximum Girder Thickness		
Any	3” (Double 2X)	1-1/2” (Single 2X)
Two 5/8” diameter bolts[a]	Four 6” long screws[b]	Three 4” long screws[b]

a. Bolts shall be hot dip galvanized through bolts and nuts.
b. Screws shall be hot dipped galvanized self-drilling screw fastener having a minimum diameter of 0.270”, staggered so that the screws are not in a line, and having a minimum edge distance of 1-1/2 inches.
c. Hot dipped galvanized washers shall be provided at the head and nut of each through bolt and the head of each screw.



For SI: 1 inch = 25.4 mm.

FIGURE 4708.1(1)
TOP MOUNT/FLUSH GIRDER



For SI: 1 inch = 25.4 mm

FIGURE 4708.1(2)
SIDE MOUNT DROPPED GIRDER

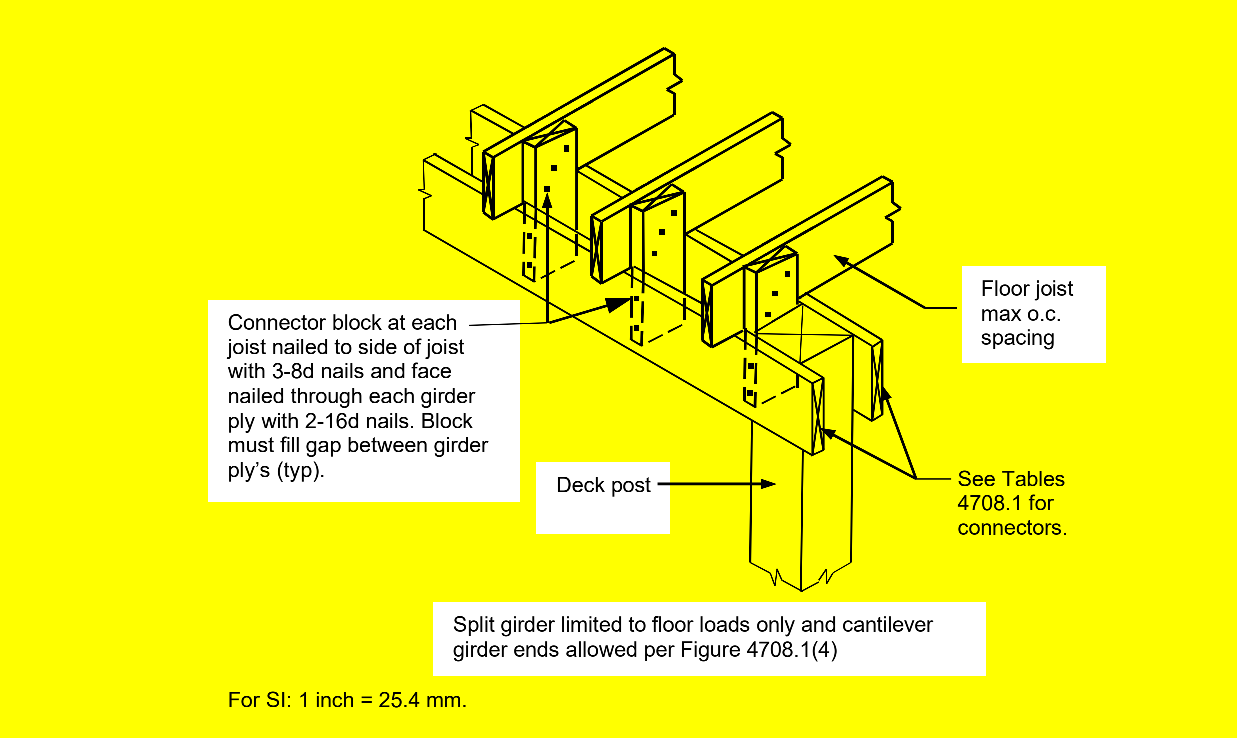


FIGURE 701.1(3)
SPLIT GIRDER

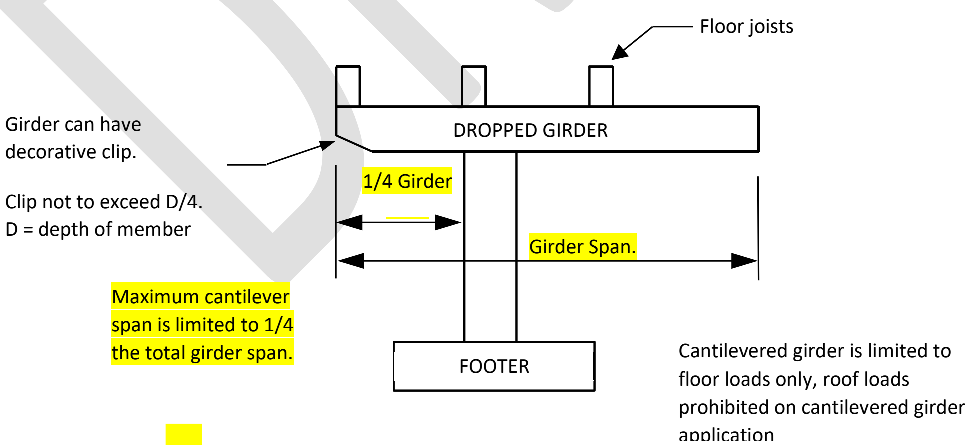


FIGURE 701.1(4)
CANTILIEVERED DROPPED GIRDER

4708.2 Girder spans for uncovered decks. Maximum allowable spans for wood deck girders, as shown in Figure 4708.2, shall be in accordance with Table 4708.2. Girder plies shall be fastened with two rows of 10d (3-inch × 0.128-inch) nails minimum at 16 inches (406 mm) on center along each edge. Girders shall be permitted to cantilever at each end up to one-fourth of the actual beam span. Splices of multi-span beams shall be located at interior post locations.

TABLE 4708.2
DECK GIRDER SPANS LENGTHS [a,b]
(feet – inches)

SPECIES[c]	SIZE[d]	DECK JOIST SPAN LESS THAN OR EQUAL TO: (feet)						
		6	**8**	**10**	**12**	**14**	**16**	**18**
Southern pine	2 – 2 × 6	6-11	5-11	5-4	4-10	4-6	4-3	4-0
	2 – 2 × 8	8-9	7-7	6-9	6-2	5-9	5-4	5-0
	2 – 2 × 10	10-4	9-0	8-0	7-4	6-9	6-4	6-0
	2 – 2 × 12	12-2	10-7	9-5	8-7	8-0	7-6	7-0
	3 – 2 × 6	8-2	7-5	6-8	6-1	5-8	5-3	5-0
	3 – 2 × 8	10-10	9-6	8-6	7-9	7-2	6-8	6-4
	3 – 2 × 10	13-0	11-3	10-0	9-2	8-6	7-11	7-6
	3 – 2 × 12	15-3	13-3	11-10	10-9	10-0	9-4	8-10
Douglas fir-larch[e], hem-fir[e], spruce-pine-fir[e], redwood, western cedars, ponderosa pine[f], red pine[f]	3 × 6 or 2 – 2 x 6	5-5	4-8	4-2	3-10	3-6	3-1	2-9
	3 × 8 or 2 – 2 × 8	6-10	5-11	5-4	4-10	4-6	4-1	3-8
	3 × 10 or 2 – 2 × 10	8-4	7-3	6-6	5-11	5-6	5-1	4-8
	3 × 12 or 2 – 2 × 12	9-8	8-5	7-6	6-10	6-4	5-11	5-7
	4 × 6	6-5	5-6	4-11	4-6	4-2	3-11	3-8
	4 × 8	8-5	7-3	6-6	5-11	5-6	5-2	4-10
	4 × 10	9-11	8-7	7-8	7-0	6-6	6-1	5-8
	4 × 12	11-5	9-11	8-10	8-1	7-6	7-0	6-7
	3 – 2 × 6	7-4	6-8	6-0	5-6	5-1	4-9	4-6
	3 – 2 × 8	9-8	8-6	7-7	6-11	6-5	6-0	5-8
	3 – 2 × 10	12-0	10-5	9-4	8-6	7-10	7-4	6-11
	3 – 2 × 12	13-11	12-1	10-9	9-10	9-1	8-6	8-1

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound = 0.454 kg.

a. Ground snow load, live load = 40 psf, dead load = 10 psf, L/Δ = 360 at main span, L/Δ = 180 at cantilever with a 220-pound point load applied at the end.
b. Girders supporting deck joists from one side only.
c. No. 2 grade, wet service factor.
d. Girder depth shall be greater than or equal to depth of joists with a flush beam condition.
e. Includes incising factor.
f. Northern species. Incising factor not included.

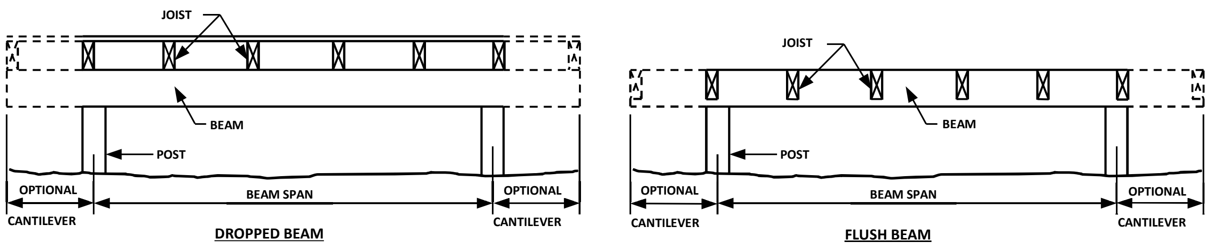


FIGURE 4708.2
TYPICAL DECK GIRDER SPANS

4708.3 Girder span for roofed porches and decks. Girder spans for covered *decks* shall be in accordance with Tables R602.7(1), (2) and (3).

SECTION 4709
ALLOWABLE JOIST SPANS AND CANTILEVERS~~, AND RAFTERS AND ROOFING~~

4709.1 Joist spans for uncovered decks. Maximum allowable spans for wood *deck* joists, as shown in Figure 4709.1, shall be in accordance with Table 4709.1or with the 2021 edition or later of American Wood Council online span calculator. *Deck* joists shall be permitted to cantilever not greater than one-fourth of the actual, adjacent joist span.

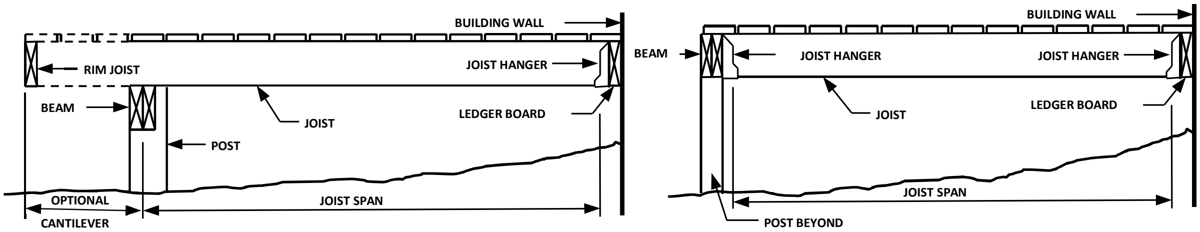
TABLE 4709.1
JOIST SPANS FOR COMMON LUMBER SPECIES[f] (ft. - in.)

SPECIES[a]	SIZE	SPACING OF DECK JOISTS WITH NO CANTILEVER[b] (inches)			SPACING OF DECK JOISTS WITH CANTILEVERS[c] (inches)		
		12	16	24	12	16	24
Southern pine	2 × 6	9-11	9-0	7-7	6-8	6-8	6-8
	2 × 8	13-1	11-10	9-8	10-1	10-1	9-8
	2 × 10	16-2	14-0	11-5	14-6	14-0	11-5
	2 × 12	18-0	16-6	13-6	18-0	16-6	13-6
Douglas fir-larch[d], hem-fir[d] spruce-pine-fir[d]	2 × 6	9-6	8-8	7-2	6-3	6-3	6-3
	2 × 8	12-6	11-1	9-1	9-5	9-5	9-1
	2 × 10	15-8	13-7	11-1	13-7	13-7	11-1
	2 × 12	18-0	15-9	12-10	18-0	15-9	12-10
Redwood, western cedars, ponderosa pine[e], red pine[e]	2 × 6	8-10	8-0	7-0	5-7	5-7	5-7
	2 × 8	11-8	10-7	8-8	8-6	8-6	8-6
	2 × 10	14-11	13-0	10-7	12-3	12-3	10-7
	2 × 12	17-5	15-1	12-4	16-5	15-1	12-4

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound = 0.454 kg.

a. No. 2 grade with wet service factor.
b. Ground snow load, live load = 40 psf, dead load = 10 psf, L/D = 360.
c. Ground snow load, live load = 40 psf, dead load = 10 psf, L/D = 360 at main span, L/D = 180 at cantilever with a 220-pound point load applied to end.
d. Includes incising factor.
e. Northern species with no incising factor

f. Cantilevered spans not exceeding the nominal depth of the joist are permitted.



JOIST WITH DROPPED BEAM JOIST WITH FLUSH BEAM

FIGURE 4709.1
TYPICAL DECK JOIST SPANS

~~**4709.2 Joist spans roofed porches and decks.** Joists spans shall be in accordance with Table R502.3.1(2) with 40 lbs per sq. ft. live load and 10 lbs per sq. ft. dead load. Cantilevered floor joists shall be in accordance with Table R502.3.3(1).~~

4709.2 Lateral restraint at supports. Joist ends and bearing locations shall be provided with lateral restraint to prevent rotation. Where lateral restraint is provided by joist hangers or blocking between joists, their depth shall equal not less than 60 percent of the joist depth. Where lateral restraint is provided by rim joists, they shall be secured to the end of each joist with not less than (3) 10d (3-inch × 0.128-inch) nails or (3) No. 10 × 3-inch (76 mm) long wood screws.

~~**4709.4 Rafters and roofing.** Rafters and roofing shall comply with R802. Fasteners shall comply with Tables R602.3(1) and R602.3(2).~~

SECTION 4710
FLOOR DECKING

4710.1 Wood. Floor decking shall be No. 2 grade pressure preservative treated Southern Pine or equivalent. The minimum floor decking thickness shall be in accordance with Table 4710.1.

TABLE 4710.1
FLOOR DECKING THICKNESS

SUPPORT SPACING	DECKING (nominal)
12” o.c.	1” S4S
16” o.c.	1” T&G
19.2” o.c.	1 ¼” S4S
24”-36” o.c.	2” S4S

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

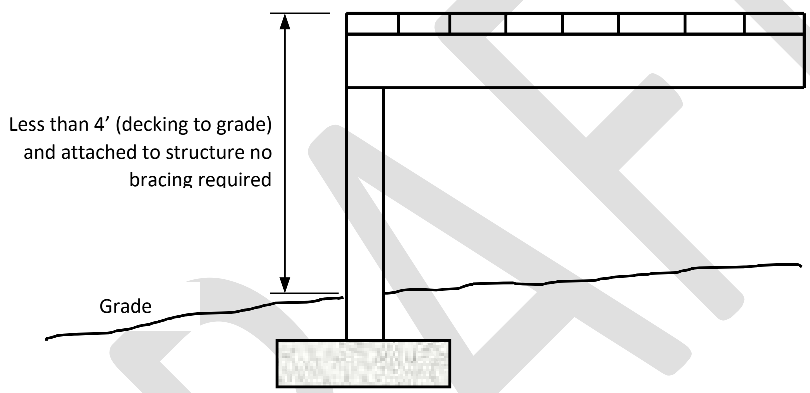
4710.2 Plastic composites. *Plastic composite* shall comply with Section 4702.2 and the manufacturer’s installation instructions.

SECTION 4711
BRACING

4711.1 General. Decks shall be braced to provide lateral stability. Lateral stability shall be provided in accordance with one of the methods in Sections 4711.2 through 4711.6.

4711.2 Lateral bracing not required. When any of the following apply additional lateral bracing is not required:

1. When the deck floor height is less than 4 feet (1219 mm) above finished grade as shown in Figure 4711.2 and the deck is attached to the structure in accordance with Chapter 6, lateral bracing is not required.
2. Lateral bracing is not required for freestanding decks with a deck floor height 30 inches (762 mm) or less above finished grade.
3. Lateral bracing is not required when the deck complies with Section 4711.5.
4. Lateral bracing is not required when the deck complies with Section 4711.6.



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

FIGURE 4711.2
NO LATERAL BRACING

4711.3 Knee bracing.
4x4 wood knee braces are permitted to be provided on each column in both directions for freestanding decks or parallel to the structure at the exterior column line for attached decks. The knee braces shall attach to each post at a point not less than 1/3 of the post length from the top of the post, and the braces shall be angled between 45 degrees (0.79 rad) and 60 degrees (1.05 rad) from the horizontal. Knee braces shall be fastened to the post and the girder/double band in accordance with Table 4711.3 and Figures 4711.3(1), (2), and (3).

TABLE 4711.3
FASTENING OF BRACE TO POST AND GIRDER/BAND (CHOOSE ONE)

Fastener	Installation	Minimum Distances
One 5/8" diameter hot dipped galvanized through bolt with nut and washer	Perpendicular to post or girder/band	2-3/16" end distance
Two hot dipped galvanized (ASTM A153, Class C, minimum) screws having minimum diameter of 0.270" and long enough to achieve 3" penetration into the post or girder/band.	Perpendicular to post or girder/band	1" edge distance, 1-1/2" horizontal spacing, minimum 3" end distance

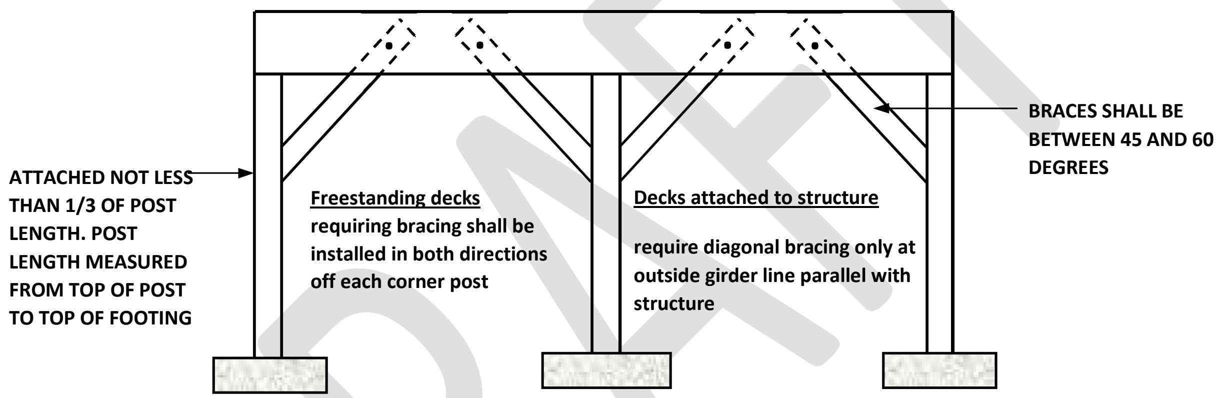


FIGURE 4711.3(1)
KNEE BRACING

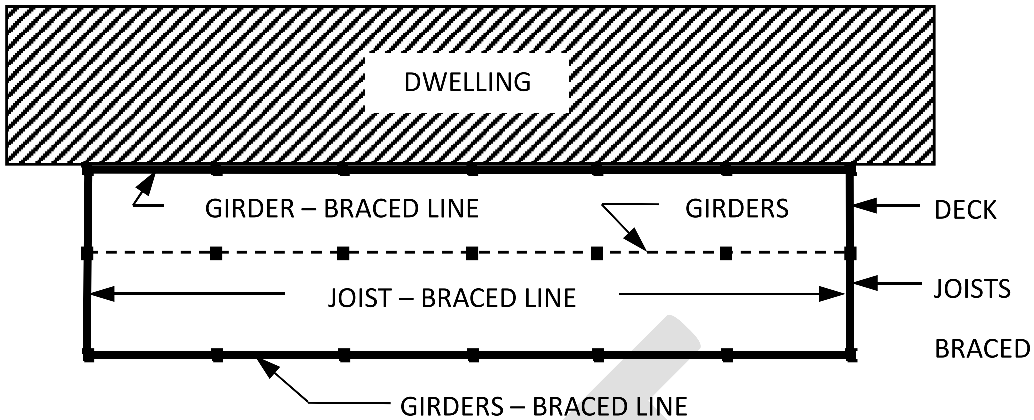


FIGURE 4711.3(2)
FREESTANDING DECK KNEE BRACING LINE
(plan view)

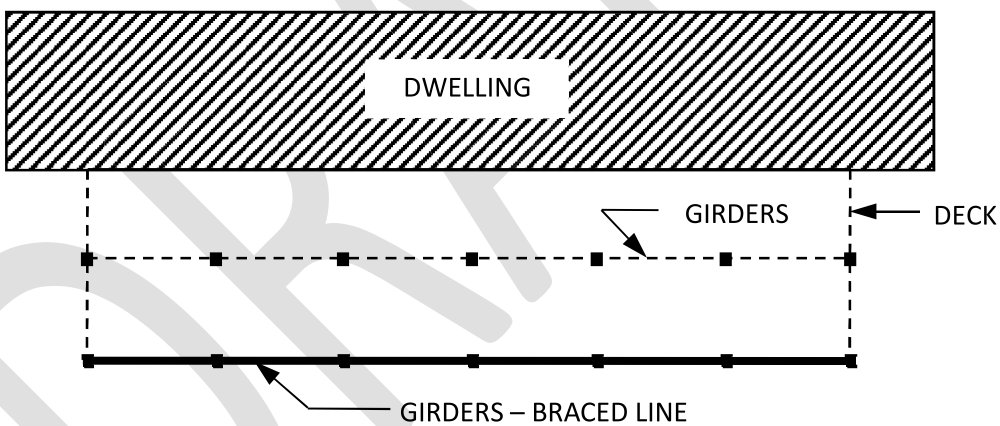


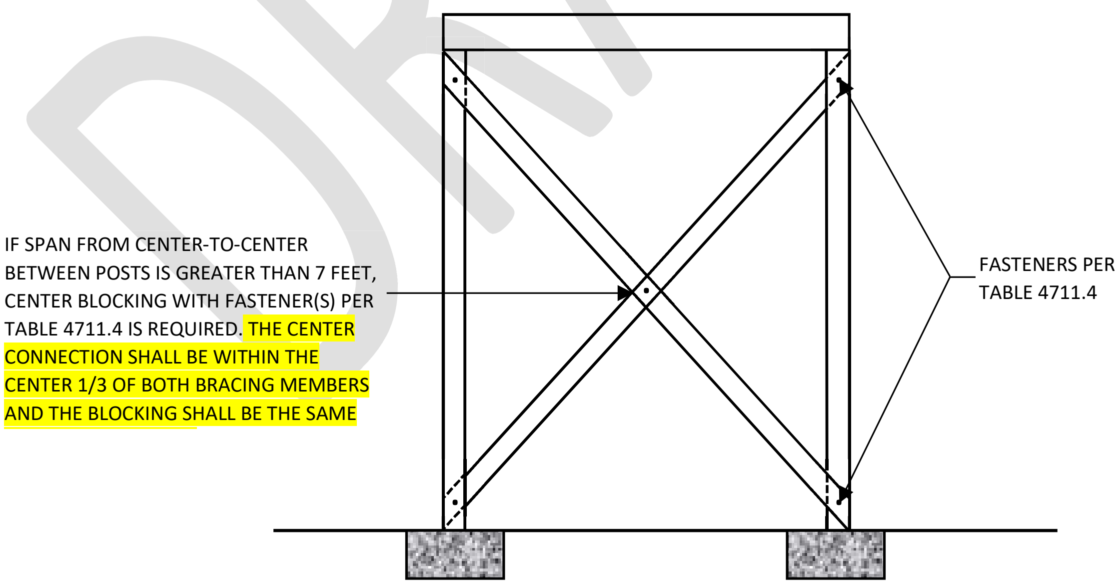
FIGURE 4711.3(3)
DWELLING ATTACHED DECK KNEE BRACING LINE
(plan view)

4711.4 Cross bracing. 2x6 diagonal vertical cross bracing is permitted to be provided in two perpendicular directions for free standing decks or parallel to the structure at the exterior column line for attached decks in accordance with Figures 4711.4 (3), and 4711.4 (4). The 2x6 bracing shall be attached to the posts with one of the methods in Table 4711.4 at each end of each bracing member in accordance with Figures 4711.4(1). Bracing members shall extend to within 6 inches of the top and bottom of the posts. Where more than one cross brace is installed between posts a 2x6 horizontal strut is required as shown in Figure 4711.4(2) and shall be fastened per Table 4711.4.

Table 4711.4
FASTENING OF BRACE (CHOOSE ONE)

Fastener Type	Diameter (inches)	QTY	Length
Bolt	5/8[a]	1	As required
Screws	0.27[b]	2	Long enough to achieve a 1 ½" thread penetration of structural member opposite head of screw

a. Bolts shall be hot dip galvanized through bolts with nut and washer
b. Screws shall be hot dip galvanized (ASTM A153, Class C, minimum) self drilling screw fastener having a minimum diameter of 0.27", and installed in the center of the post with a minimum of 1" space between screws.



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

FIGURE 4711.4(1)
CROSS BRACING

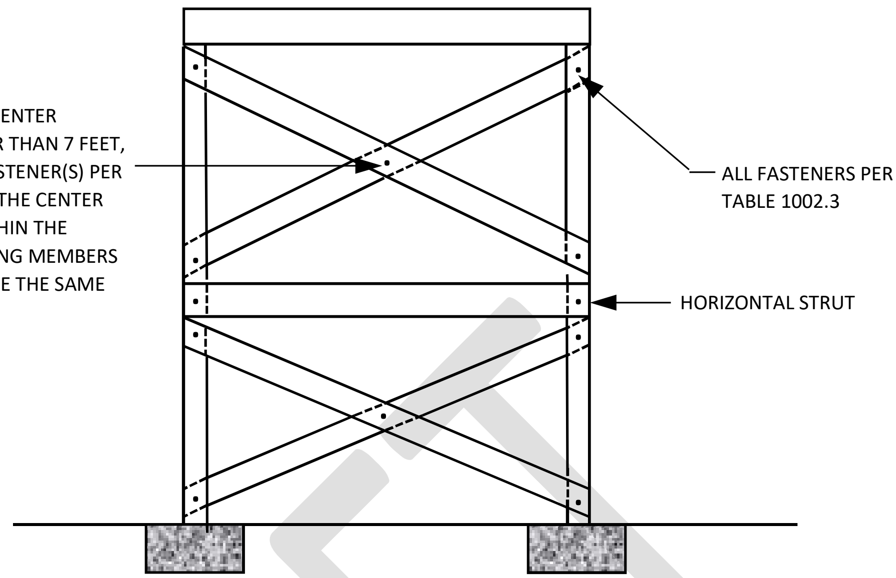


FIGURE 4711.4(2)

CROSS BRACING

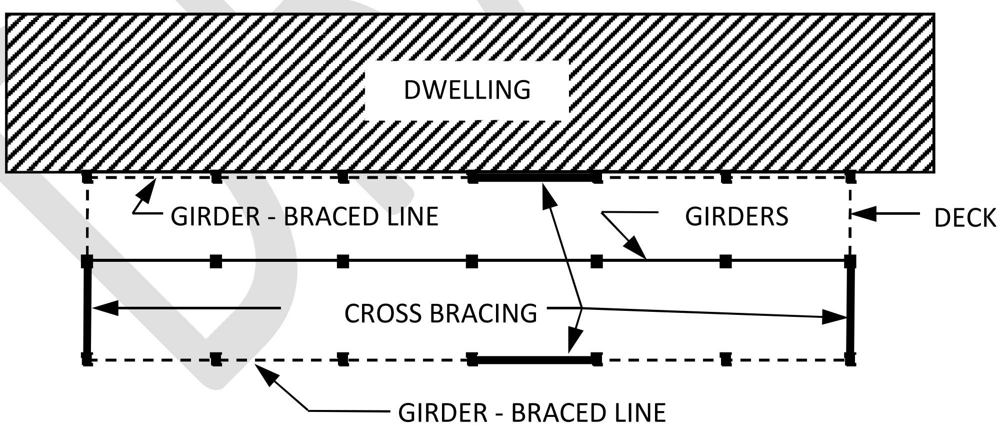


FIGURE 4711.4(3)
FREESTANDING DECK CROSS BRACING LINE
(plan view)

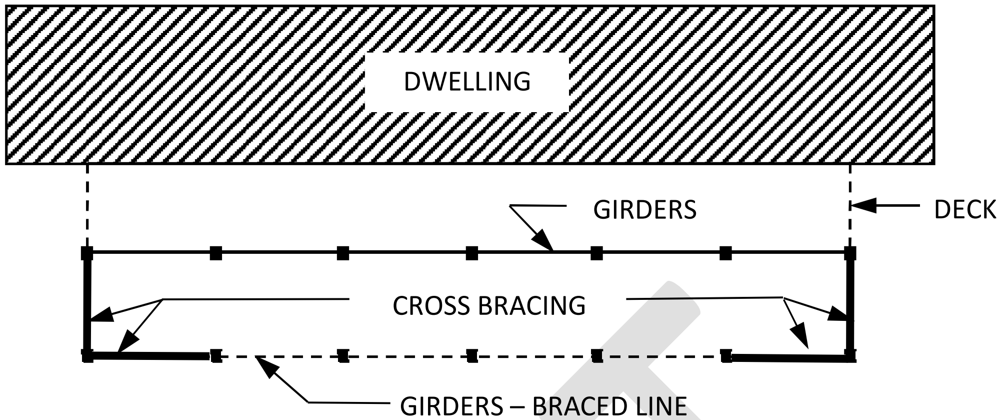
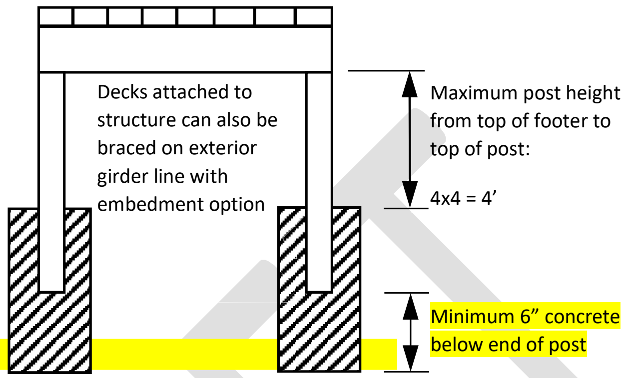


FIGURE 4711.4(4)
DWELLING ATTACHED DECK CROSS BRACING LINE
(plan view)

4711.5 Post embedment bracing. For free standing decks without knee braces or cross bracing, lateral stability is permitted to be provided by embedding the post in accordance with Figure 4711.5 and Table 4711.5.



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

FIGURE 1002.4
POST EMBEDMENT

TABLE 4711.5
POST EMBEDMENT FOR FREE STANDING DECKS

POST SIZE	MAXIMUM TRIBUTARY AREA	MAXIMUM POST HEIGHT	EMPEDMENT DEPTH	CONCRETE DIAMETER
4" x 4"	48 SF	4'-0"	2'-6"	1'-0"
6" x 6"	120 SF	6'-0"	3'-6"	1'-8"

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

4711.6 Piles bracing in coastal regions. Pile tip shall extend to a depth of not less than 8 feet (2438 mm) below the natural grade or finished grade of the lot, whichever is lower. All pilings within the *Ocean Hazard Area* shall have a tip penetration of at least 5 feet (1524 mm) below mean sea level or 16 feet (4877 mm) below average original grade, whichever is least. Structures within *Ocean Hazard Areas* which are placed upon the site behind a line 60 times the annual erosion rate away from the most seaward line of stable natural vegetation are exempt from this additional tip penetration requirement.

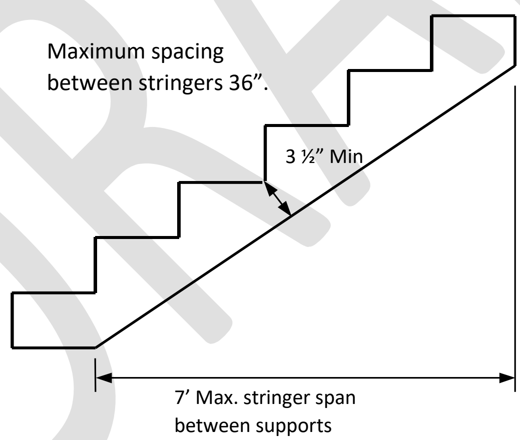
4711.6 Pile bracing in coastal regions. Additional bracing is not required where pile tips extend to a depth of not less than 8 feet (2438 mm) below the natural grade or finished grade of the lot, whichever is lower. All pilings within the *Ocean Hazard Area* shall have a tip penetration of at least 5 feet (1524 mm) below mean sea level or 16 feet (4877 mm) below average original grade, whichever is least.

Exception: Structures within *Ocean Hazard Areas* which are placed on a site behind a line 60 times the annual erosion rate away from the most seaward line of stable natural vegetation are allowed to comply with Table 4711.5.

SECTION 4712
STAIRS

4712.1 Construction. Stair shall comply with R311.7 and 4712.1.1

4712.1.1 Stringers. Stringer spans shall be no greater than 7 feet (2134 mm) between supports. Spacing between stringers shall be based upon decking material used in accordance with 4710. Each stringer shall have a minimum of 3 ½ inches (89 mm) between step cut and back of stringer. If used, suspended headers shall be attached with 3/8 inch (9.5 mm) galvanized bolts with nuts and washers to securely support stringers at the top. See Figure 4712.1.1.

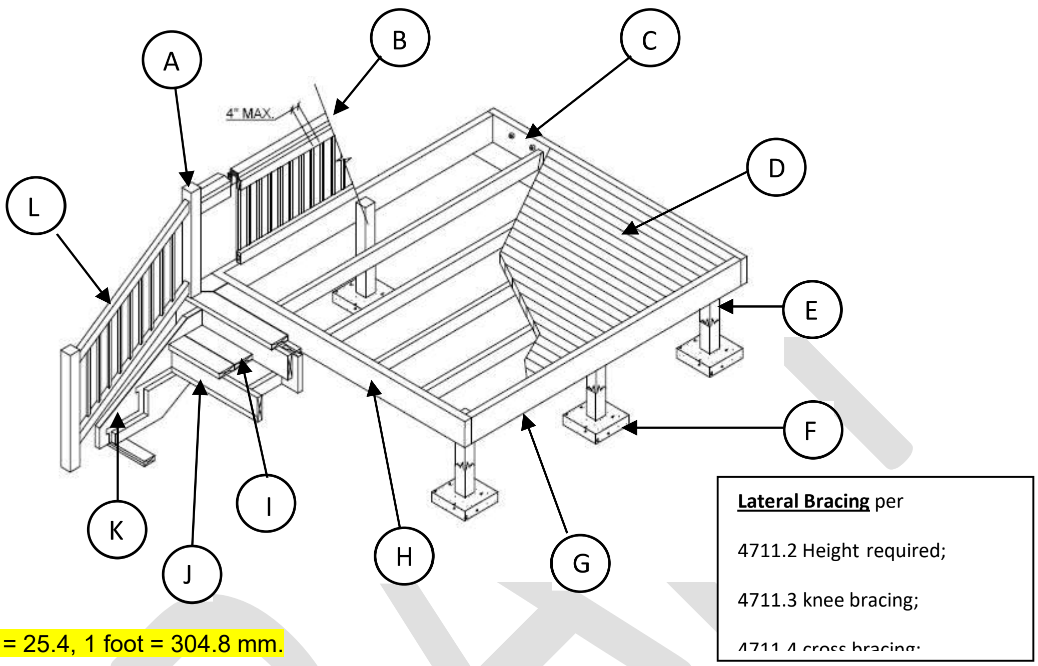


For SI: 1 inch = 25.4, 1 foot = 304.8 mm.

FIGURE 4712.1.1
STAIR STRINGER

SECTION 4713
HANDRAILS, GUARDS AND GENERAL

4713.1 Handrails, guards and general. Deck handrails, guards and general construction shall be as shown in Figure 4713.1.



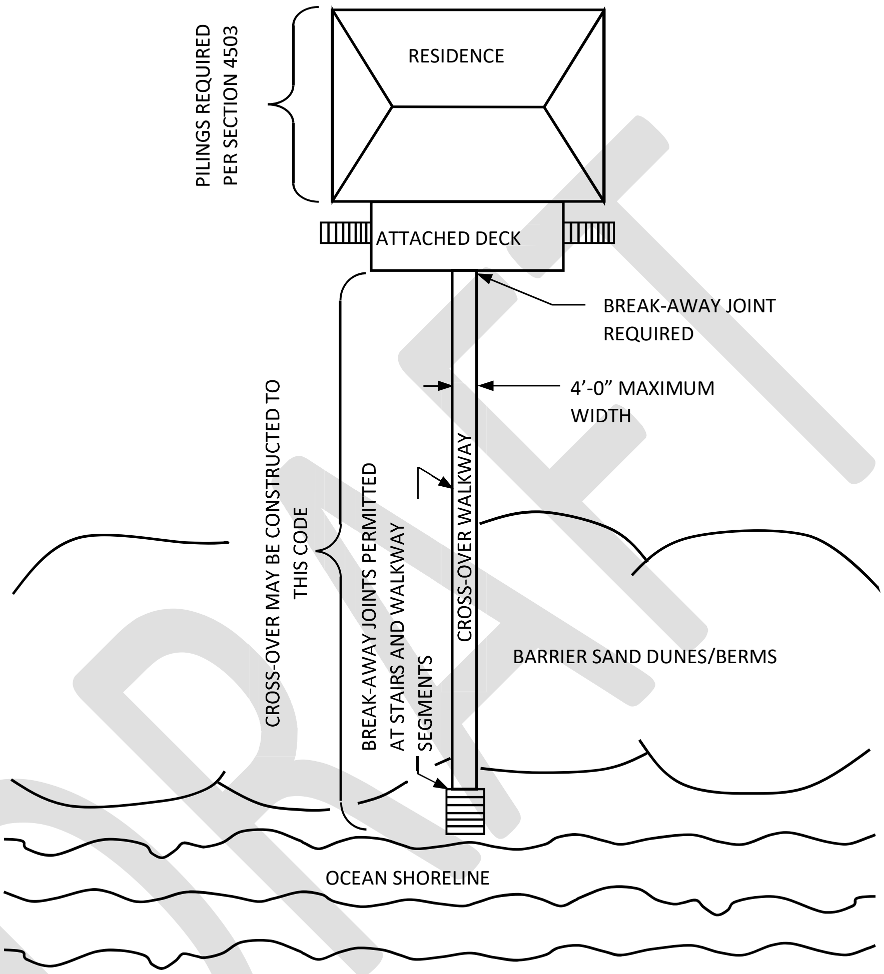
For SI: 1 inch = 25.4, 1 foot = 304.8 mm.

A. **Rail posts** shall be located a maximum of 8 feet o.c. Posts shall be attached to outer girder and joist bands with 2-3/8" galv. bolts with nut & washer to outer bands.
B. **Guards** at a minimum 36" height required with 30" drop and opening limits, top rail and post to support 200lbs with infill to meet 50lbs.
C. **Attachment** to structure shall comply with 4707.
D. **Decking** per 4710.
E. **Deck post** per 4705 and 4711.5.
F. **Shallow Footers** per 4704.
G. **Floor joist cantilevers** allowed per 4709.1 and 4709.2.
H. **Exterior Girder Clear Spans** per 4708.2 and 4708.3.
I. **Stairs treads and risers** per 4712.
J. **Riser openings** for stairs with a 30" or more vertical rise must have solid risers or opening restricted to prevent passage of a 4" sphere per R311.7.5.1.
K. **Stair Guard at Risers.** The triangle openings at the open side of stairs, formed by the riser, tread and bottom rail of a guard, shall not allow passage of a sphere 6 inches in diameter per R312.1.3.
L. **Stair handrail/Guard**. Height between 34"-38" per R312.1.2. Openings on side of stairs requiring guards shall not allow a sphere 4 3/8" to pass per R312.1.3.

FIGURE 4713.1
DECK CONSTRUCTION

SECTION 4714
WALKWAYS OVER DUNES IN OCEAN HAZARD AREAS

4714.1 Construction. Walkways over dunes in *ocean hazard areas* shall be constructed as shown in Figure 4714.1.



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

a. Posts for walkways over dunes or berms shall be embedded a minimum depth of 4′ - 0″ and post heights shall be limited to 5′- 0″ above grade for 4×4 and 10′ - 0″ above grade for 6 × 6. Walkways or portions of walkways over 4′ 0″ in width shall comply with the requirements of Chapters 45 and 46. Maximum walkway surface height is 30″ above grade without guard rails.
b. Walkway stair runs from walkway down to ocean shoreline grade are permitted to be greater than 12′ without a landing.
c. Open risers permitted on ocean shoreline stair.
d. Horizontal guards permitted to have maximum 18-inch opening on cross-over walkway and ocean shoreline stair.

FIGURE 4714.1
WALKWAYS OVER DUNES OR BERMS IN OCEAN HAZARD AREAS

APPENDIX AA

SIZING AND CAPACITIES OF GAS PIPING

This appendix is an excerpt from the 2021 International Fuel Gas Code® informative Appendix A. Table references in the text, other than AA tables, are as numbered in the International Fuel Gas Code (IFGC). For related table references in this code, you can find the IFGC table number in brackets adjacent to the table number in Chapter 24 of this code. For example, Table 402.4(2) in the IFGC is related to Table G2413.4(1) [402.4(2)] in this code.

~~**User note:**~~

~~***About this appendix:*** *Appendix AA provides commentary, guidance and examples for sizing of gas piping systems.*~~

APPENDIX AB

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

This appendix is an excerpt from the 2021 **International Fuel Gas Code**® *informative Appendix B. Section and table references in the text, other than AB sections and tables, are as numbered in the* **International Fuel Gas Code** *(IFGC). For related table references in this code, you can find the IFGC table number in brackets adjacent to the table number in Chapter 24 of this code. For example, Table 504.2(2) in the IFGC is related to Table G2428.2(2) [504.2(2)] in this code.*

~~**User note:**~~

~~***About this appendix:*** *Appendix AB provides commentary, guidance and examples for the design of venting systems for the types of appliances that vent by natural draft and have draft hoods or are* listed *as Category I or are* listed *for use with Type B vents.*~~

APPENDIX AC
EXIT TERMINALS OF MECHANICAL DRAFT AND DIRECT-VENT VENTING SYSTEMS

This appendix is informative and is not part of the code. This appendix is an excerpt from the *2018 International Fuel Gas Code®*, coordinated with the section numbering of the *International Residential Code*.

~~**User note:**~~

~~***About this appendix:*** *Appendix AC provides a graphic depiction of the venting terminal location requirements of the code.*~~

APPENDIX AD

RECOMMENDED PROCEDURE FOR SAFETY INSPECTION OF AN EXISTING APPLIANCE INSTALLATION

This appendix is an excerpt from the *2021* International Fuel Gas Code® informative Appendix D, coordinated with the section numbering of the International Residential Code.

~~**User note:**~~

~~***About this appendix:*** *Appendix AD provides procedures for testing and inspecting existing gas appliance installations for safe operation.*~~

APPENDIX AE

MANUFACTURED HOUSING USED AS DWELLINGS

(DELETED)

~~*The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.*~~

~~**User note:**~~

~~***About this appendix:*** *Appendix AE regulates the installation, relocation, maintenance and repair of manufactured housing, including mobile homes. It addresses permits, fees, inspections, utility service, location on a lot and foundation systems. This appendix is not intended to regulate the design and construction of those portions of manufactured housing or mobile homes that are above the foundation system except where manufactured housing or mobile homes are moved or altered. Federal standards regulate those portions of manufactured housing and mobile homes that are above the foundation system.*~~

~~SECTION AE101~~
~~SCOPE~~

~~**AE101.1 General.** These provisions shall be applicable only to a *manufactured home* used as a single *dwelling unit* installed on privately owned (nonrental) lots and shall apply to the following:~~

1. ~~Construction, *alteration* and *repair* of any foundation system that is necessary to provide for the installation of a *manufactured home* unit.~~
2. ~~Construction, installation, addition, *alteration*, *repair* or maintenance of the building service equipment that is necessary for connecting *manufactured homes* to water, fuel, or power supplies and sewage systems.~~
3. ~~*Alterations*, *additions* or repairs to existing *manufactured homes*. The construction, *alteration*, moving, demolition, *repair* and use of accessory buildings and structures, and their building service equipment, shall comply with the requirements of the codes adopted by this *jurisdiction*.~~

~~These provisions shall not be applicable to the design and construction of *manufactured homes* and shall not be deemed to authorize either modifications or *additions* to *manufactured homes* where otherwise prohibited.~~

~~**AE101.2 Flood hazard areas.** New and replacement manufactured homes to be installed in flood hazard areas as established in Table R301.2 shall meet the applicable requirements of Section R322.~~

~~SECTION AE102~~
~~APPLICATION TO EXISTING MANUFACTURED HOMES AND BUILDING SERVICE EQUIPMENT~~

~~**AE102.1 General.** *Manufactured homes* and their building service equipment to which *additions*, *alterations* or repairs are made shall comply with all the requirements of these provisions for new facilities, except as specifically provided in this section.~~

~~**AE102.2 Additions, alterations or repairs.** *Additions* made to a *manufactured home* shall conform to one of the following:~~

1. ~~Be certified under the National Manufactured Housing Construction and Safety Standards Act of 1974 (42 U.S.C. Section 5401, et seq.).~~
2. ~~Be designed and constructed to comply with the applicable provisions of the National Manufactured Housing Construction and Safety Standards Act of 1974 (42 U.S.C. Section 5401, et seq.).~~
3. ~~Be designed and constructed in compliance with the code adopted by this *jurisdiction*.~~

~~*Additions* shall be structurally separated from the *manufactured home*.~~

~~**Exception:** A structural separation need not be provided where structural calculations are provided to justify the omission of such separation.~~

~~*Alterations* or repairs may be made to any *manufactured home* or to its building service equipment without requiring the existing *manufactured home* or its building service equipment to comply with all the requirements of these provisions, provided that the *alteration* or repair conforms to that required for new construction, and provided further that hazard to life, health or safety will not be created by such *additions*, *alterations* or repairs.~~

~~*Alterations* or repairs to an existing *manufactured home*, which are nonstructural and do not adversely affect any structural member or any part of the building or structure having required fire protection, shall be made with materials equivalent to those of which the *manufactured home* structure is constructed, subject to approval by the *building official*.~~

~~**Exception:** The installation or replacement of glass shall be required for new installations.~~

~~Minor *additions*, *alterations* and repairs to existing building service equipment installations may be made in accordance with the codes in effect at the time the original installation was made, subject to the approval of the *building official*, and provided that such *additions*, *alterations* and repairs will not cause the existing building service equipment to become unsafe, insanitary or overloaded.~~

~~**AE102.3 Existing installations.** Building service equipment lawfully in existence at the time of the adoption of the applicable codes shall have their use, maintenance or repair continued if the use, maintenance or repair is in accordance with the original design and hazard to life, health or property has not been created by such building service equipment.~~

~~**AE102.4 Existing occupancy.** *Manufactured home*s that are in existence at the time of the adoption of these provisions shall have their existing use or occupancy continued if such use or occupancy was legal at the time of the adoption of these provisions, provided that such continued use is not dangerous to life, health and safety.~~

~~The use or occupancy of any existing *manufactured home* shall not be changed unless evidence satisfactory to the *building official* is provided to show compliance with all applicable provisions of the codes adopted by this *jurisdiction*. Upon any change in use or occupancy, the *manufactured home* shall cease to be classified as such within the intent of these provisions.~~

~~**AE102.5 Maintenance.** *Manufactured homes* and their building service equipment, existing and new, and all parts thereof, shall be maintained in a safe and sanitary condition. Devices or safeguards that are required by applicable codes or by the *Manufactured Home* Standards shall be maintained in conformance to the code or standard under which it was installed. The *owner* or the owner's designated agent shall be responsible for the maintenance of *manufactured homes*, accessory buildings, structures and their building service equipment. To determine compliance with this section, the *building official* has the authority to cause any *manufactured home*, accessory building or structure to be reinspected.~~

~~**AE102.6 Relocation.** *Manufactured home*s that are to be relocated within this *jurisdiction* shall comply with these provisions.~~

~~SECTION AE103~~
~~DEFINITIONS~~

~~**AE103.1 General.** For the purpose of these provisions, certain abbreviations, terms, phrases, words and their derivatives shall be construed as defined or specified herein.~~

~~**ACCESSORY BUILDING.** Any building or structure or portion thereto, located on the same property as a *manufactured home*, which does not qualify as a *manufactured home* as defined herein.~~

~~**BUILDING SERVICE EQUIPMENT.** Refers to the plumbing, mechanical and electrical equipment, including piping, wiring, fixtures and other accessories that provide sanitation, lighting, heating, ventilation, cooling, fire protection and facilities essential for the habitable occupancy of a *manufactured home* or accessory building or structure for its designated use and occupancy.~~

~~**MANUFACTURED HOME.** A structure transportable in one or more sections that, in the traveling mode, is 8 body feet (2438 body mm) or more in width or 40 body feet (12 192 body mm) or more in length or, where erected on site, is 320 or more square feet (30 m^2), and is built on a permanent chassis and designed to be used as a *dwelling* with or without a permanent foundation when connected to the required utilities, and includes the plumbing, heating, air-conditioning and electrical systems contained therein; except that such term shall include any structure that meets all of the requirements of this paragraph, except the size requirements and with respect to which the manufacturer voluntarily files a certification required by the Secretary of the US Department of Housing and Urban Development (HUD) and complies with the standards established under this title.~~

~~For mobile homes built prior to June 15, 1976, a *label* certifying compliance with the *Standard for Mobile Homes*, NFPA 501, ANSI 119.1, in effect at the time of manufacture, is required. For the purpose of these provisions, a mobile home shall be considered to be a *manufactured home*.~~

~~**MANUFACTURED HOME INSTALLATION.** Construction that is required for the installation of a *manufactured home*, including the construction of the foundation system, required structural connections thereto and the installation of on-site water, gas, electrical and sewer systems and connections thereto that are necessary for the normal operation of the *manufactured home*.~~

~~**MANUFACTURED HOME STANDARDS.** The *Manufactured Home Construction and Safety Standards* as promulgated by the HUD.~~

~~**PRIVATELY OWNED (NONRENTAL) LOT.** A parcel of real estate outside of a *manufactured home* rental community (park) where the land and the *manufactured home* to be installed thereon are held in common ownership.~~

~~SECTION AE104~~
~~PERMITS~~

~~**AE104.1 Initial installation.** A *manufactured home* shall not be installed on a foundation system, reinstalled or altered without first obtaining a *permit* from the *building official*. A separate *permit* shall be required for each *manufactured home* installation. Where *approved* by the *building official*, such *permit* may include accessory buildings and structures, and their building service equipment, if the accessory buildings or structures will be constructed in conjunction with the *manufactured home* installation.~~

~~**AE104.2 Additions, alterations and repairs to a manufactured home.** A *permit* shall be obtained to alter, remodel, repair or add accessory buildings or structures to a *manufactured home* subsequent to its initial installation. *Permit* issuance and fees therefor shall be in conformance to the codes applicable to the type of work involved.~~

~~An *addition* made to a *manufactured home*, as defined in these provisions, shall comply with these provisions.~~

~~**AE104.3 Accessory buildings.** Except as provided in Section AE104.1, *permits* shall be required for all accessory buildings and structures, and their building service equipment. *Permit* issuance and fees therefor shall be in conformance to the codes applicable to the types of work involved.~~

~~**AE104.4 Exempted work.** A *permit* shall not be required for the types of work specifically exempted by the applicable codes. Exemption from the *permit* requirements of any of said codes shall not be deemed to grant authorization for any work to be done in violation of the provisions of said codes or any other laws or ordinances of this *jurisdiction*.~~

~~SECTION AE105~~
~~APPLICATION FOR PERMIT~~

~~**AE105.1 Application.** To obtain a *manufactured home* installation *permit*, the applicant shall first file an application, in writing, on a form furnished by the *building official* for that purpose. At the option of the *building official*, every such application shall:~~

1. ~~Identify and describe the work to be covered by the *permit* for which application is made.~~
2. ~~Describe the land on which the proposed work is to be done by legal description, street address or similar description that will readily identify and definitely locate the proposed building or work.~~
3. ~~Indicate the use or occupancy for which the proposed work is intended.~~
4. ~~Be accompanied by plans, diagrams, computations and specifications, and other data as required in Section AE105.2.~~
5. ~~Be accompanied by a soil investigation where required by Section AE114.2.~~
6. ~~State the valuation of any new building or structure; or any *addition*, remodeling or *alteration* to an existing building.~~
7. ~~Be signed by the permittee, or permittee's authorized agent, who may be required to submit evidence to indicate such authority.~~
8. ~~Give other data and information where required by the *building official*.~~

~~**AE105.2 Plans and specifications.** Plans, engineering calculations, diagrams and other data as required by the *building official* shall be submitted in not less than two sets with each application for a *permit*. The *building official*~~

~~has the authority to require plans, computations and specifications to be prepared and designed by an engineer or architect licensed by the state to practice as such.~~

~~Where unusual site conditions do not exist, the *building official* has the authority to accept *approved* standard foundation plans and details in conjunction with the manufacturer's *approved* installation instructions without requiring the submittal of engineering calculations.~~

~~**AE105.3 Information on plans and specifications.** Plans and specifications shall be drawn to scale on substantial paper or cloth, and shall be of sufficient clarity to indicate the location, nature and extent of the work proposed and shown in detail that it will conform to these provisions and all relevant laws, ordinances, rules and regulations. The *building official* shall determine what information is required on plans and specifications to ensure compliance.~~

~~SECTION AE106~~
~~PERMITS ISSUANCE~~

~~**AE106.1 Issuance.** The application, plans and specifications, and other data filed by an applicant for *permit* shall be reviewed by the *building official*. Such plans may be reviewed by other departments of this *jurisdiction* to verify compliance with any applicable laws under their *jurisdiction*. If the *building official* finds that the work described in an application for a *permit*, and the plans, specifications and other data filed therewith conform to the requirements of these provisions and other pertinent codes, laws and ordinances, and that the fees specified in Section AE107 have been paid, the *building official* shall issue a *permit* therefor to the applicant.~~

~~Upon issuing a *permit* where plans are required, the *building official* shall endorse in writing or stamp the plans and specifications *APPROVED*. Such *approved* plans and specifications shall not be changed, modified or altered without authorization from the *building official*, and all work shall be done in accordance with the *approved* plans.~~

~~**AE106.2 Retention of plans.** One set of *approved* plans and specifications shall be returned to the applicant and shall be kept on the site of the building or work at all times during which the work authorized thereby is in progress. One set of *approved* plans, specifications and computations shall be retained by the *building official* until final approval of the work.~~

~~**AE106.3 Validity of permit.** The issuance of a *permit* or approval of plans and specifications shall not be construed to be a *permit* for, or an approval of, any violation of any of these provisions or other pertinent codes of any other ordinance of the *jurisdiction*. A *permit* presuming to give authority to violate or cancel these provisions shall not be valid.~~

~~The issuance of a *permit* based on plans, specifications and other data shall not prevent the *building official* from thereafter requiring the correction of errors in said plans, specifications and other data, or from preventing building operations being carried on thereunder when in violation of these provisions or of any other ordinances of this *jurisdiction*.~~

~~**AE106.4 Expiration.** Every *permit* issued by the *building official* under these provisions shall expire by limitation and become null and void if the work authorized by such *permit* is not commenced within 180 days from the date of such *permit*, or if the work authorized by such *permit* is suspended or abandoned at any time after the work is commenced for a period of 180 days. Before such work can be recommenced, a new *permit* shall be first obtained, and the fee therefor shall be one-half the amount required for a new *permit* for such work, provided that changes have not been made or will not be made in the original plans and specifications for such work, and provided further that such suspension or abandonment has not exceeded 1 year. In order to renew action on a *permit* after expiration, the permittee shall pay a new full *permit* fee.~~

~~Any permittee holding an unexpired *permit* may apply for an extension of the time within which work shall commence under that *permit* where the permittee is unable to commence work within the time required by this section for good and satisfactory reasons. The *building official* has the authority to extend the time for action by the permittee for a period not exceeding 180 days upon written request by the permittee showing that circumstances beyond the control of the permittee have prevented action from being taken. A *permit* shall not be extended more than once.~~

~~**AE106.5 Suspension or revocation.** The *building official* may, in writing, suspend or revoke a *permit* issued under these provisions whenever the *permit* is issued in error or on the basis of incorrect information supplied, or in violation of any ordinance or regulation or any of these provisions.~~

~~SECTION AE107~~
~~FEES~~

~~**AE107.1 Permit fees.** The fee for each *manufactured home* installation *permit* shall be established by the *building official*.~~

~~Where *permit* fees are to be based on the value or valuation of the work to be performed, the determination of value or valuation under these provisions shall be made by the *building official*. The value to be used shall be the total value of all work required for the *manufactured home* installation plus the total value of all work required for the construction of accessory buildings and structures for which the *permit* is issued, as well as all finish work, painting, roofing, electrical, plumbing, heating, air conditioning, elevators, fire-extinguishing systems and any other permanent equipment that is a part of the accessory building or structure. The value of the *manufactured home* itself shall not be included.~~

~~**AE107.2 Plan review fees.** Where plans or other data are required to be submitted by Section AE105.2, a plan review fee shall be paid at the time of submitting plans and specifications for review. Said plan review fee shall be as established by the *building official*. Where plans are incomplete or changed so as to require additional plan review, an additional plan review fee shall be charged at a rate as established by the *building official*.~~

~~**AE107.3 Other provisions.**~~

~~**AE107.3.1 Expiration of plan review.** Applications for which a *permit* has not been issued within 180 days following the date of application shall expire by limitation, and plans and other data submitted for review shall thereafter be returned to the applicant or destroyed by the *building official*. The *building official* has the authority to extend the time for action by the applicant for a period not exceeding 180 days upon request by the applicant showing that circumstances beyond the control of the applicant have prevented action from being taken. An application shall not be extended more than once. In order to renew action on an application after expiration, the applicant shall resubmit plans and pay a new plan review fee.~~

~~**AE107.3.2 Investigation fees—work without a permit.**~~

~~**AE107.3.2.1 Investigation.** Whenever any work for which a *permit* is required by these provisions has been commenced without first obtaining said *permit*, a special investigation shall be made before a *permit* is issued for such work.~~

~~**AE107.3.2.2 Fee.** An investigation fee, in addition to the *permit* fee, shall be collected whether or not a *permit* is then or subsequently issued. The investigation fee shall be equal to the amount of the *permit* fee required. The minimum investigation fee shall be the same as the minimum fee established by the *building official*. The payment of such investigation fee shall not exempt any person from compliance with all other provisions of either these provisions or other pertinent codes or from any penalty prescribed by law.~~

~~**AE107.3.3 Fee refunds.**~~

~~**AE107.3.3.1 Permit fee erroneously paid or collected.** The *building official* has the authority to authorize the refunding of any fee paid hereunder that was erroneously paid or collected.~~

~~**AE107.3.3.2 Permit fee paid where no work done.** The *building official* has the authority to authorize the refunding of not more than 80 percent of the *permit* fee paid where no work has been done under a *permit* issued in accordance with these provisions.~~

~~**AE107.3.3.3 Plan review fee.** The *building official* has the authority to authorize the refunding of not more than 80 percent of the plan review fee paid where an application for a *permit* for which a plan review fee has been paid is withdrawn or canceled before any plan reviewing is done.~~

~~The *building official* shall not authorize the refunding of any fee paid, except upon written application by the original permittee not later than 180 days after the date of the fee payment.~~

~~SECTION AE108~~
~~INSPECTIONS~~

~~**AE108.1 General.** All construction or work for which a *manufactured home* installation *permit* is required shall be subject to inspection by the *building official*, and certain types of construction shall have continuous inspection by special inspectors as specified in Section AE109. The *building official* has the authority to require a survey of the *lot* to verify that the structure is located in accordance with the *approved* plans.~~

~~It shall be the duty of the *permit* applicant to cause the work to be accessible and exposed for inspection purposes. Neither the *building official* nor this *jurisdiction* shall be liable for expense entailed in the removal or replacement of any material required to allow inspection.~~

~~**AE108.2 Inspection requests.** It shall be the duty of the person doing the work authorized by a *manufactured home* installation *permit* to notify the *building official* that such work is ready for inspection. The *building official* has the authority to require that every request for inspection be filed not less than one working day before such inspection is desired. Such request shall be in writing or by telephone at the option of the *building official*.~~

~~It shall be the duty of the person requesting any inspections required, either by these provisions or other applicable codes, to provide access to and means for proper inspection of such work.~~

~~**AE108.3 Inspection record card.** Work requiring a *manufactured home* installation *permit* shall not be commenced until the *permit* holder or the *permit* holder's agent shall have posted an inspection record card in a conspicuous place on the premises and in such position as to allow the *building official* conveniently to make the required entries thereon regarding inspection of the work. This card shall be maintained in such position by the *permit* holder until final approval has been issued by the *building official*.~~

~~**AE108.4 Approval required.** Work shall not be done on any part of the *manufactured home* installation beyond the point indicated in each successive inspection without first obtaining the approval of the *building official*. Such approval shall be given only after an inspection has been made of each successive step in the construction as indicated by each of the inspections required in Section AE108.5. There shall be a final inspection and approval of the *manufactured home* installation, including connections to its building service equipment, when completed and ready for occupancy or use.~~

~~**AE108.5 Required inspections.**~~

~~**AE108.5.1 Structural inspections for the manufactured home installation.** Reinforcing steel or structural framework of any part of any *manufactured home* foundation system shall not be covered or concealed without first obtaining the approval of the *building official*. The *building official*, upon notification from the *permit* holder or the *permit* holder's agent, shall make the following inspections and shall either approve that portion of the construction as completed or shall notify the *permit* holder or the *permit* holder's agent wherein the same fails to comply with these provisions or other applicable codes:~~

1. ~~Foundation inspection: To be made after excavations for footings are completed and any required reinforcing steel is in place. For concrete foundations, any required forms shall be in place prior to inspection. Materials for the foundation shall be on the job, except where concrete from a central mixing plant (commonly termed "transit mixed") is to be used, the concrete materials need not be on the job. Where the foundation is to be constructed of *approved* treated wood, requirements for additional framing inspections shall be subject to the evaluation of the *building official*.~~
2. ~~Concrete slab or under-floor inspection: To be made after all in-slab or under-floor building service equipment, conduit, piping accessories and other ancillary equipment items are in place but before any concrete is poured or the *manufactured home* is installed.~~
3. ~~Anchorage inspection: To be made after the *manufactured home* has been installed and permanently anchored.~~

~~**AE108.5.2 Structural inspections for accessory building and structures.** Inspections for accessory buildings and structures shall be made as set forth in this code.~~

~~**AE108.5.3 Building service equipment inspections.** Building service equipment that is required as a part of a *manufactured home* installation, including accessory buildings and structures authorized by the same *permit*, shall be inspected by the *building official*. Building service equipment shall be inspected and tested as required by the applicable codes. Such inspections and testing shall be limited to site construction and shall not include building service equipment that is a part of the *manufactured home* itself. No portion of any building service equipment intended to be concealed by any permanent portion of the construction shall be concealed until inspected and *approved*. Building service equipment shall not be connected to a water, fuel or power supply, or sewer system, until authorized by the *building official*.~~

~~**AE108.5.4 Final inspection.** Where finish grading and the *manufactured home* installation, including the installation of all required building service equipment, is completed and the *manufactured home* is ready for occupancy, a final inspection shall be made.~~

~~**AE108.6 Other inspections.** In addition to the called inspections specified in Section AE108.5.4, the *building official* has the authority to make or require other inspections of any construction work to ascertain compliance with these provisions or other codes and laws that are enforced by the code enforcement agency.~~

~~SECTION AE109~~
~~SPECIAL INSPECTIONS~~

~~**AE109.1 General.** In addition to the inspections required by Section AE108, the *building official* has the authority to require the *owner* to employ a special inspector during construction of specific types of work as described in this code.~~

~~SECTION AE110~~
~~UTILITY SERVICE~~

~~**AE110.1 General.** Utility service shall not be provided to any building service equipment regulated by these provisions or other applicable codes, and for which a *manufactured home* installation *permit* is required by these provisions, until *approved* by the *building official*.~~

~~SECTION AE111~~
~~OCCUPANCY CLASSIFICATION~~

~~**AE111.1 Manufactured homes.** A *manufactured home* shall be limited in use to a single *dwelling unit*.~~

~~**AE111.2 Accessory buildings.** Accessory buildings shall be classified as to occupancy by the *building official* as set forth in this code.~~

~~SECTION AE112~~
~~LOCATION ON PROPERTY~~

~~**AE112.1 General.** *Manufactured homes* and accessory buildings shall be located on the property in accordance with applicable codes and ordinances of this *jurisdiction*.~~

~~SECTION AE113~~
~~DESIGN~~

~~**AE113.1 General.** A *manufactured home* shall be installed on a foundation system designed and constructed to sustain within the stress limitations specified in this code and all loads specified in this code.~~

> ~~**Exception:** Where specifically authorized by the *building official*, foundation and anchorage systems that are constructed in accordance with the methods specified in Section AE120 of these provisions, or in the HUD, *Permanent Foundations for Manufactured Housing,* 1984 Edition, Draft, shall be deemed to meet the requirements of this appendix.~~

~~**AE113.2 Manufacturer's installation instructions.** The installation instructions as provided by the manufacturer of the *manufactured home* shall be used to determine permissible points of support for vertical loads and points of attachment for anchorage systems used to resist horizontal and uplift forces.~~

~~**AE113.3 Rationality.** Any system or method of construction to be used shall submit to a rational analysis in accordance with well-established principles of mechanics.~~

~~SECTION AE114~~
~~FOUNDATION SYSTEMS~~

~~**AE114.1 General.** Foundation systems designed and constructed in accordance with this section shall be considered a permanent installation.~~

~~**AE114.2 Soil classification.** The classification of the soil at each *manufactured home* site shall be determined where required by the *building official*. The *building official* has the authority to require that the determination be made by an engineer or architect licensed by the state to conduct soil investigations.~~

~~The classification shall be based on observation and any necessary tests of the materials disclosed by borings or excavations made in appropriate locations. Additional studies may be necessary to evaluate soil strength, the effect of moisture variation on soil-bearing capacity, compressibility and expansiveness.~~

~~Where required by the *building official*, the soil classification design-bearing capacity and lateral pressure shall be shown on the plans.~~

~~**AE114.3 Footings and foundations.** Footings and foundations, unless otherwise specifically provided, shall be constructed of materials specified by this code for the intended use and in all cases shall extend below the frost line. Footings of concrete and masonry shall be of solid material. Foundations supporting untreated wood shall extend not less than 8 inches (203 mm) above the adjacent finish *grade*. Footings shall have a minimum depth below finished *grade* of 12 inches (305 mm) unless a greater depth is recommended by a foundation investigation.~~

~~Piers and bearing walls shall be supported on masonry or concrete foundations or piles, or other *approved* foundation systems that shall be of sufficient capacity to support all loads.~~

~~**AE114.4 Foundation design.** Where a design is provided, the foundation system shall be designed in accordance with the applicable structural provisions of this code and shall be designed to minimize differential settlement. Where a design is not provided, the minimum foundation requirements shall be as set forth in this code.~~

~~**AE114.5 Drainage.** Provisions shall be made for the control and drainage of surface water away from the *manufactured home*.~~

~~**AE114.6 Under-floor clearances—ventilation and access.** A minimum clearance of 12 inches (305 mm) shall be maintained beneath the lowest member of the floor support framing system. Clearances from the bottom of wood floor joists or perimeter joists shall be as specified in this code.~~

~~Under-floor spaces shall be ventilated with openings as specified in this code. If *combustion air* for one or more heat-producing *appliance* is taken from within the under-floor spaces, ventilation shall be adequate for proper *appliance* operation.~~

~~Under-floor access openings shall be provided. Such openings shall be not less than 18 inches (457 mm) in any dimension and not less than 3 square feet (0.279 m^2) in area, and shall be located so that any water supply and sewer drain connections located under the *manufactured home* are accessible.~~

~~SECTION AE115~~
~~SKIRTING AND PERIMETER ENCLOSURES~~

~~**AE115.1 Skirting and permanent perimeter enclosures.** Skirting and permanent perimeter enclosures shall be installed only where specifically required by other laws or ordinances. Skirting shall be of material suitable for exterior exposure and contact with the ground. Permanent perimeter enclosures shall be constructed of materials as required by this code for regular foundation construction.~~

~~Skirting shall be installed in accordance with the skirting manufacturer's installation instructions. Skirting shall be adequately secured to ensure stability, minimize vibration and susceptibility to wind damage, and compensate for possible frost heave.~~

~~**AE115.2 Retaining walls.** Where retaining walls are used as a permanent perimeter enclosure, they shall resist the lateral displacements of soil or other materials and shall conform to this code as specified for foundation walls. Retaining walls and foundation walls shall be constructed of *approved* treated wood, concrete, masonry or other *approved* materials or combination of materials as for foundations as specified in this code. Siding materials shall extend below the top of the exterior of the retaining or foundation wall, or the joint between the siding and enclosure wall shall be flashed in accordance with this code.~~

~~SECTION AE116~~
~~STRUCTURAL ADDITIONS~~

~~**AE116.1 General.** Accessory buildings shall not be structurally supported by or attached to a *manufactured home* unless engineering calculations are submitted to substantiate any proposed structural connection.~~

> ~~**Exception:** The *building official* has the authority to waive the submission of engineering calculations if it is found that the nature of the work applied for is such that engineering calculations are not necessary to show conformance to these provisions.~~

~~SECTION AE117~~
~~BUILDING SERVICE EQUIPMENT~~

~~**AE117.1 General.** The installation, *alteration*, *repair*, replacement, addition to or maintenance of the building service equipment within the *manufactured home* shall conform to regulations set forth in the *Manufactured Home* Standards. Such work that is located outside the *manufactured home* shall comply with the applicable codes adopted by this *jurisdiction*.~~

~~SECTION AE118~~
~~EXITS~~

~~**AE118.1 Site development.** Exterior *stairways* and *ramps* that provide egress to the *public way* shall comply with the applicable provisions of this code.~~

~~**AE118.2 Accessory buildings.** Every accessory building or portion thereof shall be provided with exits as required by this code.~~

~~SECTION AE119~~
~~OCCUPANCY, FIRE SAFETY AND ENERGY CONSERVATION STANDARDS~~

~~**AE119.1 General.** *Alterations* made to a *manufactured home* subsequent to its initial installation shall conform to the occupancy, fire safety and energy conservation requirements set forth in the *Manufactured Home* Standards.~~

~~SECTION AE120~~
~~SPECIAL REQUIREMENTS~~
~~FOR FOUNDATION SYSTEMS~~

~~**AE120.1 General.** This section is applicable only where specifically authorized by the *building official*.~~

~~SECTION AE121~~
~~FOOTINGS AND FOUNDATIONS~~

~~**AE121.1 General.** The capacity of individual load-bearing piers and their footings shall be sufficient to sustain all loads specified in this code within the stress limitations specified in this code. Footings, unless otherwise *approved* by the *building official*, shall be placed level on firm, undisturbed soil or an engineered fill that is free of organic material, such as weeds and grasses. Where used, an engineered fill shall provide a minimum load-bearing capacity of not less than 1,000 pounds per square foot (48 kN/m^2). Continuous footings shall conform to the requirements of this code. Section AE114 of these provisions shall apply to footings and foundations constructed under the provisions of this section.~~

~~SECTION AE122~~
~~PIER CONSTRUCTION~~

~~**AE122.1 General.** Piers shall be designed and constructed to distribute loads evenly. Multiple-section homes may have concentrated roof loads that will require special consideration. Load-bearing piers shall be constructed utilizing one of the following methods listed. Such piers shall be considered to resist only vertical forces acting in a downward direction. They shall not be considered as providing any resistance to horizontal loads induced by wind or earthquake forces.~~

1. ~~A prefabricated load-bearing device that is *listed* and *labeled* for the intended use.~~
2. ~~Mortar shall comply with ASTM C270, Type M, S or N; this may consist of one part Portland cement, one-half part hydrated lime and four parts sand by volume. Lime shall not be used with plastic or waterproof cement.~~
3. ~~A cast-in-place concrete pier with concrete having specified compressive strength at 28 days of 2,500 pounds per square inch (17 225 kPa).~~

~~Alternative materials and methods of construction used for piers shall be designed by an engineer or architect licensed by the state to practice as such.~~

~~Caps and leveling spacers may be used for leveling of the *manufactured home*. Spacing of piers shall be as specified in the manufacturer's installation instructions, if available, or by an *approved* designer.~~

~~SECTION AE123~~
~~HEIGHT OF PIERS~~

~~**AE123.1 General.** Piers constructed as indicated in Section AE122 shall have heights as follows:~~

1. ~~Except for corner piers, piers 36 inches (914 mm) or less in height shall be constructed of *masonry units*, placed with cores or cells vertically. Piers shall be installed with their long dimension at right angles to the main frame member they support and shall have a minimum cross-sectional area of 128 square inches (82 560 mm^2). Piers shall be capped with minimum 4-inch (102 mm) *solid masonry* units or equivalent.~~
2. ~~Piers between 36 and 80 inches (914 and 2032 mm) in height and all corner piers greater than 24 inches (610 mm) in height shall be not less than 16 inches by 16 inches (406 mm by 406 mm) consisting of interlocking *masonry units* and shall be fully capped with minimum 4-inch (102 mm) *solid masonry* units or equivalent.~~
3. ~~Piers greater than 80 inches (2032 mm) in height shall be constructed in accordance with the provisions of Item 2, provided that the piers shall be filled solid with grout and reinforced with four continuous No. 5 bars. One bar shall be placed in each corner cell of hollow masonry unit piers or in each corner of the grouted space of piers constructed of *solid masonry* units.~~
4. ~~Cast-in-place concrete piers meeting the same size and height limitations of Items 1, 2 and 3 may be substituted for piers constructed of masonry units.~~

~~SECTION AE124~~
~~ANCHORAGE INSTALLATIONS~~

~~**AE124.1 Ground anchors.** Ground anchors shall be designed and installed to transfer the anchoring loads to the ground. The load-carrying portion of the ground anchors shall be installed to the full depth called for by the manufacturer's installation instructions and shall extend below the established frost line into undisturbed soil.~~

~~Manufactured ground anchors shall be *listed* and installed in accordance with the terms of their listing and the anchor manufacturer's instructions, and shall include the means of attachment of ties meeting the requirements of Section AE125. Ground anchor manufacturer's installation instructions shall include the amount of preload required and load capacity in various types of soil. These instructions shall include tensioning adjustments where needed to prevent damage to the *manufactured home*, particularly damage that can be caused by frost heave. Each ground anchor shall be marked with the manufacturer's identification and *listed* model identification number, which shall be visible after installation. Instructions shall accompany each *listed* ground anchor specifying the types of soil for which the anchor is suitable under the requirements of this section.~~

~~Each *approved* ground anchor, when installed, shall be capable of resisting an allowable working load not less than 3,150 pounds (14 kN) in the direction of the tie plus a 50 percent overload [4,725 pounds (21 kN) total] without failure. Failure shall be considered to have occurred when the anchor moves more than 2 inches (51 mm) at a load of 4,725 pounds (21 kN) in the direction of the tie installation. Those ground anchors that are designed to be installed so that loads on the anchor are other than direct withdrawal shall be designed and installed to resist an applied design load of 3,150 pounds (14 kN) at 40 to 50 degrees from vertical or within the angle limitations specified by the home manufacturer without displacing the tie end of the anchor more than 4 inches (102 mm) horizontally. Anchors designed for the connection of multiple ties shall be capable of resisting the combined working load and overload consistent with the intent expressed herein.~~

~~Where it is proposed to use ground anchors and the *building official* has reason to believe that the soil characteristics at a given site are such as to render the use of ground anchors advisable, or where there is doubt regarding the ability of the ground anchors to obtain their *listed* capacity, the *building official* has the authority to require that a representative field installation be made at the site in question and tested to demonstrate ground-anchor capacity. The *building official* shall approve the test procedures.~~

~~**AE124.2 Anchoring equipment.** Anchoring equipment, where installed as a permanent installation, shall be capable of resisting all loads as specified within these provisions. Where the stabilizing system is designed by an engineer or~~

~~architect licensed by the state to practice, such alternative designs shall include anchoring equipment capable of withstanding a load equal to 1.5 times the calculated load. Anchoring equipment shall be *listed* and *labeled* as being capable of meeting the requirements of these provisions. Anchors as specified in this code shall be attached to the main frame of the *manufactured home* by an *approved* $^{3}/_{16}$-inch-thick (4.76 mm) slotted steel plate anchoring device. Other anchoring devices or methods meeting the requirements of these provisions shall be subject to the evaluation and *approval* of the *building official*.~~

~~Anchoring systems shall be so installed as to be permanent. Anchoring equipment shall be so designed to prevent self-disconnection with no hook ends used.~~

~~**AE124.3 Resistance to weather deterioration.** All anchoring equipment, tension devices and ties shall have a resistance to deterioration as required by this code.~~

~~**AE124.4 Tensioning devices.** Tensioning devices, such as turnbuckles or yoke-type fasteners, shall be ended with clevis or welded eyes.~~

~~SECTION AE125~~
~~TIES, MATERIALS AND INSTALLATION~~

~~**AE125.1 General.** Steel strapping, cable, chain or other *approved* materials shall be used for ties. Ties shall be fastened to ground anchors and drawn tight with turnbuckles or other adjustable tensioning devices or devices supplied with the ground anchor. Tie materials shall be capable of resisting an allowable working load of 3,150 pounds (14 kN) with not more than 2-percent elongation and shall withstand a 50-percent overload [4,750 pounds (21 kN)]. Ties shall comply with the weathering requirements of Section AE124.3. Ties shall connect the ground anchor and the main structural frame. Ties shall not connect to steel outrigger beams that fasten to and intersect the main structural frame unless specifically stated in the manufacturer's installation instructions. Connection of cable ties to main frame members shall be $^{5}/_{8}$-inch (15.9 mm) closed-eye bolts affixed to the frame member in an *approved* manner. Cable ends shall be secured with not fewer than two U-bolt cable clamps with the "U" portion of the clamp installed on the short (dead) end of the cable to ensure strength equal to that required by this section.~~

~~Wood floor support systems shall be fixed to perimeter foundation walls in accordance with provisions of this code. The minimum number of ties required per side shall be sufficient to resist the wind load stated in this code. Ties shall be as evenly spaced as practicable along the length of the *manufactured home* with the distance from each end of the home and the tie nearest that end not exceeding 8 feet (2438 mm). Where continuous straps are provided as vertical ties, such ties shall be positioned at rafters and studs. Where a vertical tie and diagonal tie are located at the same place, such ties connected to a single anchor that is capable of carrying both loads. Multiple-section *manufactured homes* require diagonal ties only. Diagonal ties shall be installed on the exterior main frame and slope to the exterior at an angle of 40 to 50 degrees from the vertical or within the angle limitations specified by the home manufacturer. Vertical ties that are not continuous over the top of the *manufactured home* shall be attached to the main frame.~~

~~SECTION AE126~~
~~REFERENCED STANDARDS~~

~~**AE126.1 General.** See Table AE126.1 for standards that are referenced in various section of this appendix. Standards are listed by the standard indentification with the effective date, the standard title, and the section or sections of this appendix that reference this standard.~~

~~**TABLE AE126.1**~~

~~**REFERENCED STANDARDS**~~

~~STANDARD ACRONYM~~	~~STANDARD NAME~~	~~SECTIONS HEREIN REFERENCED~~
~~ASTM C270—14A~~	~~*Specification for Mortar for Unit Masonry*~~	~~AE122.1~~
~~NFPA 501—17~~	~~*Standard on Manufactured Housing*~~	~~AE103.1~~

APPENDIX AF

RADON CONTROL METHODS

If a sub-soil exhaust system is provided, the system shall conform to the requirements of this appendix.

~~*The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.*~~

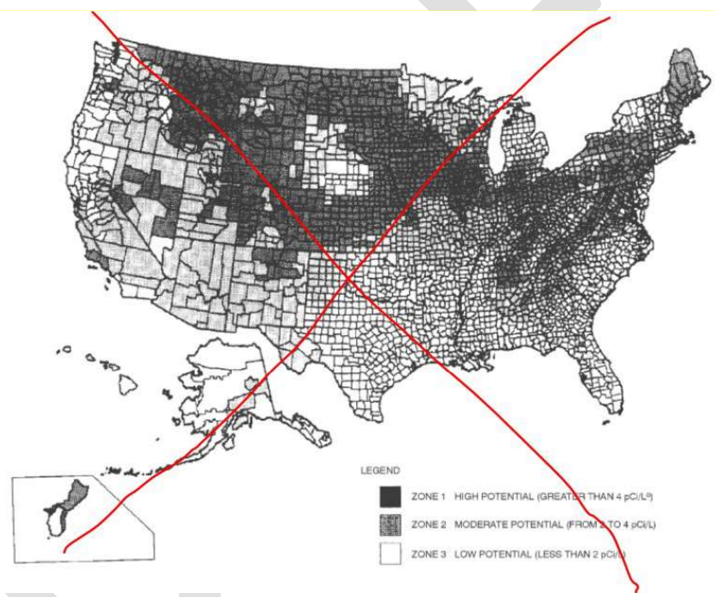
~~**User note:**~~

~~***About this appendix:*** *Appendix AF contains provisions that are intended to mitigate the transfer of radon gases from the soil into dwelling units. Radon is a radioactive gas that has been identified as a cancer-causing agent. Radon comes from the natural breakdown of uranium in soil, rock and water.*~~

SECTION AF101
SCOPE

AF101.1 General. This appendix contains requirements for new construction ~~in *jurisdictions*~~ where radon-~~resistant~~ control ~~construction~~ systems ~~is~~ are ~~required~~. provided.

~~Inclusion of this appendix by *jurisdictions* shall be determined through the use of locally available data or determination of Zone 1 designation in Figure AF101.1 and Table AF101.1.~~



~~**AF101FIGURE AF101.1**~~
~~**EPA MAP OF RADON ZONES**~~

SECTION AF102
DEFINITIONS

AF102.1 General. For the purpose of these requirements, the terms used shall be defined as follows:

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.

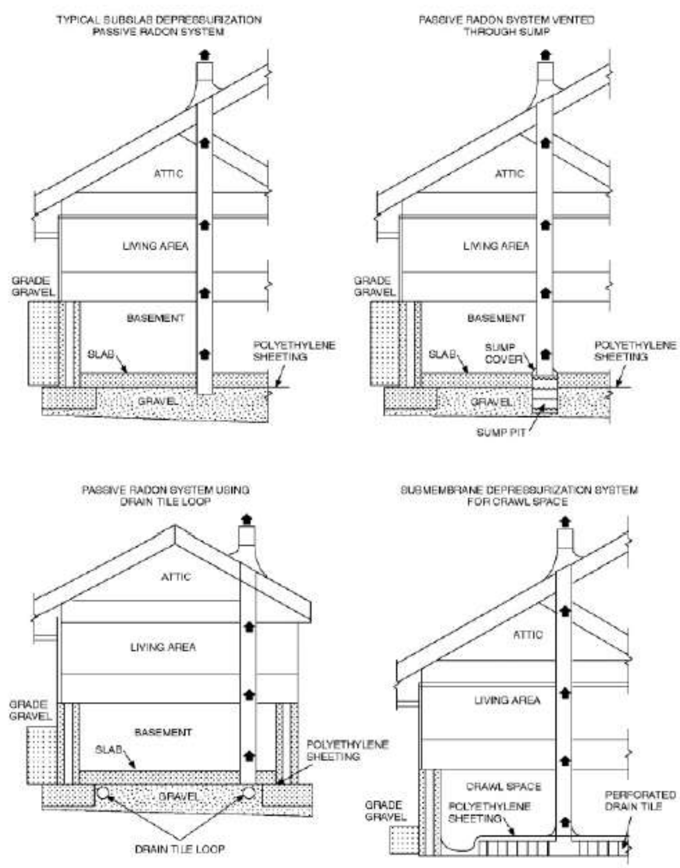
SUBMEMBRANE DEPRESSURIZATION SYSTEM. A system designed to achieve lower submembrane air pressure relative to *crawl space* air pressure by use of a vent drawing air from beneath the soil-gas-retarder membrane.

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

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

SECTION AF103
REQUIREMENTS

AF103.1 General. The following construction techniques are intended to resist radon entry and prepare the building for post-construction radon mitigation.~~, if necessary (see Figure AF103.1). These techniques are required in areas where designated by the *jurisdiction*.~~



~~FIGURE AF103~~FIGURE AF103.1
RADON-RESISTANT CONSTRUCTION DETAILS FOR FOUR FOUNDATION TYPES

AF103.2 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 subslab depressurization system, if needed. The gas-permeable layer shall consist of one of the following:

1. A uniform layer of clean aggregate, not less than 4 inches (102 mm) thick. The aggregate shall consist of material that will pass through a 2-inch (51 mm) sieve and be retained by a $^1/_4$-inch (6.4 mm) sieve.
2. A uniform layer of sand (native or fill), not less than 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 subfloor area.

AF103.3 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 not less than 12 inches (305 mm). The sheeting shall fit closely around any pipe, wire or other penetrations of the material. Punctures or tears in the material shall be sealed or covered with additional sheeting.

AF103.4 Entry routes. Potential radon entry routes shall be closed in accordance with Sections AF103.4.1 through AF103.4.10.

AF103.4.1 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.

AF103.4.2 Concrete joints. 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.

AF103.4.3 Condensate drains. Condensate drains shall be trapped or routed through nonperforated pipe to daylight.

AF103.4.4 Sumps. Sump pits open to soil or serving as the termination point for subslab or exterior drain tile loops shall be covered with a gasketed or otherwise sealed lid. Sumps used as the suction point in a subslab 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.

AF103.4.5 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 the 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.

AF103.4.6 Dampproofing. The exterior surfaces of portions of concrete and masonry block walls below the ground surface shall be dampproofed in accordance with Section R406.

AF103.4.7 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.

AF103.4.8 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 seams and joints sealed by closure systems in accordance with Section M1601.4.1.

AF103.4.9 Crawl space floors. Openings around all penetrations through floors above crawl spaces shall be caulked or otherwise filled to prevent air leakage.

AF103.4.10 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.

AF103.5 Passive submembrane depressurization system. In buildings with *crawl space* foundations, the following components of a passive submembrane depressurization system shall be installed during construction.

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

AF103.5.1 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 R408.1.

AF103.5.2 Soil-gas-retarder. The soil in crawl spaces shall be covered with a continuous layer of minimum 6-mil (0.15 mm) polyethylene soil-gas-retarder. The ground cover shall be lapped not less than 12 inches (305 mm) at joints and shall extend to all foundation walls enclosing the *crawl space* area.

AF103.5.3 Vent pipe. A plumbing tee or other *approved* connection shall be inserted horizontally beneath the sheeting and connected to a 3- or 4-inch-diameter (76 or 102 mm) fitting with a vertical vent pipe installed through the sheeting. The vent pipe shall be extended up through the building floors, and terminate not less than 12 inches (305 mm) above the roof in a location not less than 10 feet (3048 mm) away from any window or other opening into the *conditioned spaces* of the building that is less than 2 feet (610 mm) below the exhaust point, and 10 feet (3048 mm) from any window or other opening in adjoining or adjacent buildings.

AF103.6 Passive subslab depressurization system. In *basement* or slab-on-grade buildings, the following components of a passive subslab depressurization system shall be installed during construction.

AF103.6.1 Vent pipe. A minimum 3-inch-diameter (76 mm) ABS, PVC or equivalent gastight pipe shall be embedded vertically into the subslab aggregate or other permeable material before the slab is cast. A "T" fitting or equivalent method shall be used to ensure that the pipe opening remains within the subslab permeable material. Alternatively, the 3-inch (76 mm) pipe shall be inserted directly into an interior perimeter drain tile loop or through a sealed sump cover where the sump is exposed to the subslab aggregate or connected to it through a drainage system.

The pipe shall be extended up through the building floors, and terminate not less than 12 inches (305 mm) above the surface of the roof in a location not less than 10 feet (3048 mm) away from any window or other opening into the *conditioned spaces* of the building that is less than 2 feet (610 mm) below the exhaust point, and 10 feet (3048 mm) from any window or other opening in adjoining or adjacent buildings.

AF103.6.2 Multiple vent pipes. In buildings where interior footings or other barriers separate the subslab aggregate or other gas-permeable material, each area shall be fitted with an individual vent pipe. Vent pipes shall connect to a single vent that terminates above the roof or each individual vent pipe shall terminate separately above the roof.

AF103.7 Vent pipe drainage. Components of the radon vent pipe system shall be installed to provide positive drainage to the ground beneath the slab or soil-gas-retarder.

AF103.8 Vent pipe accessibility. Radon vent pipes shall be accessible for future fan installation through an attic or other area outside the *habitable space*.

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

AF103.9 Vent pipe identification. Exposed and visible interior radon vent pipes shall be identified with not less than one *label* on each floor and in accessible *attics*. The *label* shall read: "Radon Reduction System."

AF103.10 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.

AF103.11 Building depressurization. Joints in air ducts and plenums in un*conditioned spaces* shall meet the requirements of Section M1601. Thermal envelope air infiltration requirements shall comply with the energy conservation provisions in Chapter 11. Fireblocking shall meet the requirements contained in Section R302.11.

AF103.12 Power source. To provide for future installation of an active submembrane or subslab 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 be accessible in anticipated locations of system failure alarms.

SECTION AF104

TESTING

AF104.1 Testing. Where radon-resistant construction is ~~required~~ performed, radon testing shall be as specified in Items 1 through 11:

1. Testing shall be performed after the dwelling passes its air tightness test.
2. Testing shall be performed after the radon control system and HVAC installations are complete. The HVAC system shall be operating during the test. Where the radon system has an installed fan, the dwelling shall be tested with the radon fan operating.
3. Testing shall be performed at the lowest occupied floor level, whether or not that space is finished. Spaces that are physically separated and served by different HVAC systems shall be tested separately.
4. Testing shall not be performed in a closet, hallway, stairway, laundry room, furnace room, bathroom or kitchen.
5. Testing shall be performed with a commercially available radon test kit or testing shall be performed by an approved third party with a continuous radon monitor. Testing with test kits shall include two tests, and the test results shall be averaged. Testing shall be in accordance with this section and the testing laboratory kit manufacturer's instructions.
6. Testing shall be performed with the windows closed. Testing shall be performed with the exterior doors closed, except when being used for entrance or exit. Windows and doors shall be closed for not fewer than 12 hours prior to the testing.
7. Testing shall be performed by the builder, a registered design professional or an approved third party.
8. Testing shall be conducted over a period of not less than 48 hours or not less that the period specified by the testing device manufacturer, whichever is longer.
9. Written radon test results shall be provided by the test lab or testing party. ~~The final written test report with results less than 4 picocuries per liter (pCi/L) shall be provided to the code official.~~
10. Where the radon test result is 4 pCi/L or greater, the fan for the radon vent pipe shall be installed as specified in Sections AF103.9 and AF103.12.
11. Where the radon test result is 4 pCi/L or greater, the system shall be modified and retested until the test result is less than 4 pCi/L.

Exception: Testing is not required where the occupied space is located above an unenclosed open space.

~~ALABAMA~~
~~Calhoun~~
~~Clay~~
~~Cleburne~~
~~Colbert~~
~~Coosa~~
~~Franklin~~
~~Jackson~~
~~Lauderdale~~
~~Lawrence~~
~~Limestone~~
~~Madison~~

~~Morgan~~
~~Talladega~~
~~CALIFORNIA~~
~~Santa Barbara~~
~~Ventura~~
~~COLORADO~~
~~Adams~~
~~Arapahoe~~
~~Baca~~
~~Bent~~
~~Boulder~~
~~Chaffee~~
~~Cheyenne~~
~~Clear Creek~~
~~Crowley~~
~~Custer~~
~~Delta~~
~~Denver~~
~~Dolores~~
~~Douglas~~
~~El Paso~~
~~Elbert~~
~~Fremont~~
~~Garfield~~
~~Gilpin~~
~~Grand~~
~~Gunnison~~
~~Huerfano~~
~~Jackson~~
~~Jefferson~~
~~Kiowa~~
~~Kit Carson~~
~~Lake~~
~~Larimer~~

~~Las Animas~~
~~Lincoln~~
~~Logan~~
~~Mesa~~
~~Moffat~~
~~Montezuma~~
~~Montrose~~
~~Morgan~~
~~Otero~~
~~Ouray~~
~~Park~~
~~Phillips~~
~~Pitkin~~
~~Prowers~~
~~Pueblo~~
~~Rio Blanco~~
~~San Miguel~~
~~Summit~~
~~Teller~~
~~Washington~~
~~Weld~~
~~Yuma~~
~~CONNECTICUT~~
~~Fairfield~~
~~Middlesex~~
~~New Haven~~
~~New London~~
~~GEORGIA~~
~~Cobb~~
~~De Kalb~~
~~Fulton~~
~~Gwinnett~~
~~IDAHO~~
~~Benewah~~

~~Blaine~~
~~Boise~~
~~Bonner~~
~~Boundary~~
~~Butte~~
~~Camas~~
~~Clark~~
~~Clearwater~~
~~Custer~~
~~Elmore~~
~~Fremont~~
~~Gooding~~
~~Idaho~~
~~Kootenai~~
~~Latah~~
~~Lemhi~~
~~Shoshone~~
~~Valley~~
~~ILLINOIS~~
~~Adams~~
~~Boone~~
~~Brown~~
~~Bureau~~
~~Calhoun~~
~~Carroll~~
~~Cass~~
~~Champaign~~
~~Coles~~
~~De Kalb~~
~~De Witt~~
~~Douglas~~
~~Edgar~~
~~Ford~~
~~Fulton~~

~~Greene~~
~~Grundy~~
~~Hancock~~
~~Henderson~~
~~Henry~~
~~Iroquois~~
~~Jersey~~
~~Jo Daviess~~
~~Kane~~
~~Kendall~~
~~Knox~~
~~La Salle~~
~~Lee~~
~~Livingston~~
~~Logan~~
~~Macon~~
~~Marshall~~
~~Mason~~
~~McDonough~~
~~McLean~~
~~Menard~~
~~Mercer~~
~~Morgan~~
~~Moultrie~~
~~Ogle~~
~~Peoria~~
~~Piatt~~
~~Pike~~
~~Putnam~~
~~Rock Island~~
~~Sangamon~~
~~Schuyler~~
~~Scott~~
~~Stark~~

~~Stephenson~~
~~Tazewell~~
~~Vermilion~~
~~Warren~~
~~Whiteside~~
~~Winnebago~~
~~Woodford~~
~~**INDIANA**~~
~~Adams~~
~~Allen~~
~~Bartholomew~~
~~Benton~~
~~Blackford~~
~~Boone~~
~~Carroll~~
~~Cass~~
~~Clark~~
~~Clinton~~
~~De Kalb~~
~~Decatur~~
~~Delaware~~
~~Elkhart~~
~~Fayette~~
~~Fountain~~
~~Fulton~~
~~Grant~~
~~Hamilton~~
~~Hancock~~
~~Harrison~~
~~Hendricks~~
~~Henry~~
~~Howard~~
~~Huntington~~
~~Jay~~

~~Jennings~~
~~Johnson~~
~~Kosciusko~~
~~LaGrange~~
~~Lawrence~~
~~Madison~~
~~Marion~~
~~Marshall~~
~~Miami~~
~~Monroe~~
~~Montgomery~~
~~Noble~~
~~Orange~~
~~Putnam~~
~~Randolph~~
~~Rush~~
~~Scott~~
~~Shelby~~
~~St. Joseph~~
~~Steuben~~
~~Tippecanoe~~
~~Tipton~~
~~Union~~
~~Vermillion~~
~~Wabash~~
~~Warren~~
~~Washington~~
~~Wayne~~
~~Wells~~
~~White~~
~~Whitley~~
~~IOWA~~
~~All Counties~~

~~**TABLE AF101.1**~~
~~**HIGH RADON-POTENTIAL (ZONE 1) COUNTIES[a]**~~

~~**TABLE AF101.1—continued**~~
~~**HIGH RADON-POTENTIAL (ZONE 1) COUNTIES[a]**~~

~~**KANSAS**~~
~~Atchison~~
~~Barton~~
~~Brown~~
~~Cheyenne~~
~~Clay~~
~~Cloud~~
~~Decatur~~
~~Dickinson~~
~~Douglas~~
~~Ellis~~
~~Ellsworth~~
~~Finney~~
~~Ford~~
~~Geary~~
~~Gove~~
~~Graham~~
~~Grant~~
~~Gray~~
~~Greeley~~
~~Hamilton~~
~~Haskell~~
~~Hodgeman~~
~~Jackson~~
~~Jewell~~
~~Johnson~~
~~Kearny~~
~~Kingman~~
~~Kiowa~~

~~Lane~~
~~Leavenworth~~
~~Lincoln~~
~~Logan~~
~~Marion~~
~~Marshall~~
~~McPherson~~
~~Meade~~
~~Mitchell~~
~~Nemaha~~
~~Ness~~
~~Norton~~
~~Osborne~~
~~Ottawa~~
~~Pawnee~~
~~Phillips~~
~~Pottawatomie~~
~~Pratt~~
~~Rawlins~~
~~Republic~~
~~Rice~~
~~Riley~~
~~Rooks~~
~~Rush~~
~~Saline~~
~~Scott~~
~~Sheridan~~
~~Sherman~~
~~Smith~~
~~Stanton~~
~~Thomas~~
~~Trego~~
~~Wallace~~
~~Washington~~

~~Wichita~~
~~Wyandotte~~
~~**KENTUCKY**~~
~~Adair~~
~~Allen~~
~~Barren~~
~~Bourbon~~
~~Boyle~~
~~Bullitt~~
~~Casey~~
~~Clark~~
~~Cumberland~~
~~Fayette~~
~~Franklin~~
~~Green~~
~~Harrison~~
~~Hart~~
~~Jefferson~~
~~Jessamine~~
~~Lincoln~~
~~Marion~~
~~Mercer~~
~~Metcalfe~~
~~Monroe~~
~~Nelson~~
~~Pendleton~~
~~Pulaski~~
~~Robertson~~
~~Russell~~
~~Scott~~
~~Taylor~~
~~Warren~~
~~Woodford~~
~~**MAINE**~~

~~Androscoggin~~
~~Aroostook~~
~~Cumberland~~
~~Franklin~~
~~Hancock~~
~~Kennebec~~
~~Lincoln~~
~~Oxford~~
~~Penobscot~~
~~Piscataquis~~
~~Somerset~~
~~York~~
~~MARYLAND~~
~~Baltimore~~
~~Calvert~~
~~Carroll~~
~~Frederick~~
~~Harford~~
~~Howard~~
~~Montgomery~~
~~Washington~~
~~MASS.~~
~~Essex~~
~~Middlesex~~
~~Worcester~~
~~MICHIGAN~~
~~Branch~~
~~Calhoun~~
~~Cass~~
~~Hillsdale~~
~~Jackson~~
~~Kalamazoo~~
~~Lenawee~~
~~St. Joseph~~

~~Washtenaw~~
~~MINNESOTA~~
~~Becker~~
~~Big Stone~~
~~Blue Earth~~
~~Brown~~
~~Carver~~
~~Chippewa~~
~~Clay~~
~~Cottonwood~~
~~Dakota~~
~~Dodge~~
~~Douglas~~
~~Faribault~~
~~Fillmore~~
~~Freeborn~~
~~Goodhue~~
~~Grant~~
~~Hennepin~~
~~Houston~~
~~Hubbard~~
~~Jackson~~
~~Kanabec~~
~~Kandiyohi~~
~~Kittson~~
~~Lac Qui Parle~~
~~Le Sueur~~
~~Lincoln~~
~~Lyon~~
~~Mahnomen~~
~~Marshall~~
~~Martin~~
~~McLeod~~
~~Meeker~~

~~Mower~~
~~Murray~~
~~Nicollet~~
~~Nobles~~
~~Norman~~
~~Olmsted~~
~~Otter Tail~~
~~Pennington~~
~~Pipestone~~
~~Polk~~
~~Pope~~
~~Ramsey~~
~~Red Lake~~
~~Redwood~~
~~Renville~~
~~Rice~~
~~Rock~~
~~Roseau~~
~~Scott~~
~~Sherburne~~
~~Sibley~~
~~Stearns~~
~~Steele~~
~~Stevens~~
~~Swift~~
~~Todd~~
~~Traverse~~
~~Wabasha~~
~~Wadena~~
~~Waseca~~
~~Washington~~
~~Watonwan~~
~~Wilkin~~
~~Winona~~

~~Wright~~
~~Yellow Medicine~~
~~MISSOURI~~
~~Andrew~~
~~Atchison~~
~~Buchanan~~
~~Cass~~
~~Clay~~
~~Clinton~~
~~Holt~~
~~Iron~~
~~Jackson~~
~~Nodaway~~
~~Platte~~

~~(continued)~~

~~(continued)~~

~~MONTANA~~
~~Beaverhead~~
~~Big Horn~~
~~Blaine~~
~~Broadwater~~
~~Carbon~~
~~Carter~~
~~Cascade~~
~~Chouteau~~
~~Custer~~
~~Daniels~~
~~Dawson~~
~~Deer Lodge~~
~~Fallon~~
~~Fergus~~

~~Flathead~~
~~Gallatin~~
~~Garfield~~
~~Glacier~~
~~Granite~~
~~Hill~~
~~Jefferson~~
~~Judith Basin~~
~~Lake~~
~~Lewis and Clark~~
~~Madison~~
~~McCone~~
~~Meagher~~
~~Missoula~~
~~Park~~
~~Phillips~~
~~Pondera~~
~~Powder River~~
~~Powell~~
~~Prairie~~
~~Ravalli~~
~~Richland~~
~~Roosevelt~~
~~Rosebud~~
~~Sanders~~
~~Sheridan~~
~~Silver Bow~~
~~Stillwater~~
~~Teton~~
~~Toole~~
~~Valley~~
~~Wibaux~~
~~Yellowstone~~
~~**NEBRASKA**~~

~~Adams~~
~~Boone~~
~~Boyd~~
~~Burt~~
~~Butler~~
~~Cass~~
~~Cedar~~
~~Clay~~
~~Colfax~~
~~Cuming~~
~~Dakota~~
~~Dixon~~
~~Dodge~~
~~Douglas~~
~~Fillmore~~
~~Franklin~~
~~Frontier~~
~~Furnas~~
~~Gage~~
~~Gosper~~
~~Greeley~~
~~Hamilton~~
~~Harlan~~
~~Hayes~~
~~Hitchcock~~
~~Hurston~~
~~Jefferson~~
~~Johnson~~
~~Kearney~~
~~Knox~~
~~Lancaster~~
~~Madison~~
~~Nance~~
~~Nemaha~~

~~Nuckolls~~
~~Otoe~~
~~Pawnee~~
~~Phelps~~
~~Pierce~~
~~Platte~~
~~Polk~~
~~Red Willow~~
~~Richardson~~
~~Saline~~
~~Sarpy~~
~~Saunders~~
~~Seward~~
~~Stanton~~
~~Thayer~~
~~Washington~~
~~Wayne~~
~~Webster~~
~~York~~
~~**NEVADA**~~
~~Carson City~~
~~Douglas~~
~~Eureka~~
~~Lander~~
~~Lincoln~~
~~Lyon~~
~~Mineral~~
~~Pershing~~
~~White Pine~~
~~**NEW HAMPSHIRE**~~
~~Carroll~~
~~**NEW JERSEY**~~
~~Hunterdon~~
~~Mercer~~

~~Monmouth~~
~~Morris~~
~~Somerset~~
~~Sussex~~
~~Warren~~
~~NEW MEXICO~~
~~Bernalillo~~
~~Colfax~~
~~Mora~~
~~Rio Arriba~~
~~San Miguel~~
~~Santa Fe~~
~~Taos~~
~~NEW YORK~~
~~Albany~~
~~Allegany~~
~~Broome~~
~~Cattaraugus~~
~~Cayuga~~
~~Chautauqua~~
~~Chemung~~
~~Chenango~~
~~Columbia~~
~~Cortland~~
~~Delaware~~
~~Dutchess~~
~~Erie~~
~~Genesee~~
~~Greene~~
~~Livingston~~
~~Madison~~
~~Onondaga~~
~~Ontario~~
~~Orange~~

~~Otsego~~
~~Putnam~~
~~Rensselaer~~
~~Schoharie~~
~~Schuyler~~
~~Seneca~~
~~Steuben~~
~~Sullivan~~
~~Tioga~~
~~Tompkins~~
~~Ulster~~
~~Washington~~
~~Wyoming~~
~~Yates~~
~~N. CAROLINA~~
~~Alleghany~~
~~Buncombe~~
~~Cherokee~~
~~Henderson~~
~~Mitchell~~
~~Rockingham~~
~~Transylvania~~
~~Watauga~~
~~N. DAKOTA~~
~~All Counties~~
~~OHIO~~
~~Adams~~
~~Allen~~
~~Ashland~~
~~Auglaize~~
~~Belmont~~
~~Butler~~
~~Carroll~~
~~Champaign~~

~~Clark~~
~~Clinton~~
~~Columbiana~~
~~Coshocton~~
~~Crawford~~
~~Darke~~
~~Delaware~~
~~Fairfield~~
~~Fayette~~
~~Franklin~~
~~Greene~~
~~Guernsey~~
~~Hamilton~~
~~Hancock~~
~~Hardin~~
~~Harrison~~
~~Holmes~~
~~Huron~~
~~Jefferson~~
~~Knox~~
~~Licking~~
~~Logan~~
~~Madison~~
~~Marion~~
~~Mercer~~
~~Miami~~
~~Montgomery~~
~~Morrow~~
~~Muskingum~~
~~Perry~~

~~TABLE AF101.1—continued~~

~~HIGH RADON-POTENTIAL (ZONE 1) COUNTIES[a]~~

~~(continued)~~

~~**OHIO** – continued~~
~~Pickaway~~
~~Pike~~
~~Preble~~
~~Richland~~
~~Ross~~
~~Seneca~~
~~Shelby~~
~~Stark~~
~~Summit~~
~~Tuscarawas~~
~~Union~~
~~Van Wert~~
~~Warren~~
~~Wayne~~
~~Wyandot~~
~~**PENNSYLVANIA**~~
~~Adams~~
~~Allegheny~~
~~Armstrong~~
~~Beaver~~
~~Bedford~~
~~Berks~~
~~Blair~~
~~Bradford~~
~~Bucks~~
~~Butler~~
~~Cameron~~
~~Carbon~~
~~Centre~~
~~Chester~~
~~Clarion~~
~~Clearfield~~
~~Clinton~~

~~Columbia~~
~~Cumberland~~
~~Dauphin~~
~~Delaware~~
~~Franklin~~
~~Fulton~~
~~Huntingdon~~
~~Indiana~~
~~Juniata~~
~~Lackawanna~~
~~Lancaster~~
~~Lebanon~~
~~Lehigh~~
~~Luzerne~~
~~Lycoming~~
~~Mifflin~~
~~Monroe~~
~~Montgomery~~
~~Montour~~
~~Northampton~~
~~Northumberland~~
~~Perry~~
~~Schuylkill~~
~~Snyder~~
~~Sullivan~~
~~Susquehanna~~
~~Tioga~~
~~Union~~
~~Venango~~
~~Westmoreland~~
~~Wyoming~~
~~York~~
~~RHODE ISLAND~~
~~Kent~~

~~Washington~~
~~S. CAROLINA~~
~~Greenville~~
~~S. DAKOTA~~
~~Aurora~~
~~Beadle~~
~~Bon Homme~~
~~Brookings~~
~~Brown~~
~~Brule~~
~~Buffalo~~
~~Campbell~~
~~Charles Mix~~
~~Clark~~
~~Clay~~
~~Codington~~
~~Corson~~
~~Davison~~
~~Day~~
~~Deuel~~
~~Douglas~~
~~Edmunds~~
~~Faulk~~
~~Grant~~
~~Hamlin~~
~~Hand~~
~~Hanson~~
~~Hughes~~
~~Hutchinson~~
~~Hyde~~
~~Jerauld~~
~~Kingsbury~~
~~Lake~~
~~Lincoln~~

~~Lyman~~
~~Marshall~~
~~McCook~~
~~McPherson~~
~~Miner~~
~~Minnehaha~~
~~Moody~~
~~Perkins~~
~~Potter~~
~~Roberts~~
~~Sanborn~~
~~Spink~~
~~Stanley~~
~~Sully~~
~~Turner~~
~~Union~~
~~Walworth~~
~~Yankton~~
~~TENNESEE~~
~~Anderson~~
~~Bedford~~
~~Blount~~
~~Bradley~~
~~Claiborne~~
~~Davidson~~
~~Giles~~
~~Grainger~~
~~Greene~~
~~Hamblen~~
~~Hancock~~
~~Hawkins~~
~~Hickman~~
~~Humphreys~~
~~Jackson~~

~~Jefferson~~
~~Knox~~
~~Lawrence~~
~~Lewis~~
~~Lincoln~~
~~Loudon~~
~~Marshall~~
~~Maury~~
~~McMinn~~
~~Meigs~~
~~Monroe~~
~~Moore~~
~~Perry~~
~~Roane~~
~~Rutherford~~
~~Smith~~
~~Sullivan~~
~~Trousdale~~
~~Union~~
~~Washington~~
~~Wayne~~
~~Williamson~~
~~Wilson~~
~~UTAH~~
~~Carbon~~
~~Duchesne~~
~~Grand~~
~~Piute~~
~~Sanpete~~
~~Sevier~~
~~Uintah~~
~~VIRGINIA~~
~~Alleghany~~
~~Amelia~~

~~Appomattox~~
~~Augusta~~
~~Bath~~
~~Bland~~
~~Botetourt~~
~~Bristol~~
~~Brunswick~~
~~Buckingham~~
~~Buena Vista~~
~~Campbell~~
~~Chesterfield~~
~~Clarke~~
~~Clifton Forge~~
~~Covington~~
~~Craig~~
~~Cumberland~~
~~Danville~~
~~Dinwiddie~~
~~Fairfax~~
~~Falls Church~~
~~Fluvanna~~
~~Frederick~~
~~Fredericksburg~~
~~Giles~~
~~Goochland~~
~~Harrisonburg~~
~~Henry~~
~~Highland~~
~~Lee~~
~~Lexington~~
~~Louisa~~
~~Martinsville~~
~~Montgomery~~
~~Nottoway~~

~~Orange~~
~~Page~~
~~Patrick~~
~~Pittsylvania~~
~~Powhatan~~
~~Pulaski~~
~~Radford~~
~~Roanoke~~
~~Rockbridge~~
~~Rockingham~~
~~Russell~~
~~Salem~~
~~Scott~~
~~Shenandoah~~
~~Smyth~~
~~Spotsylvania~~

~~TABLE AF101.1—continued~~
~~HIGH RADON-POTENTIAL (ZONE 1) COUNTIES[a]~~

~~TABLE AF101.1—continued~~
~~HIGH RADON-POTENTIAL (ZONE 1) COUNTIES[a]~~

~~(continued)~~

~~a. The EPA recommends that this county listing be supplemented with other available state and local data to further understand the radon potential of a Zone 1 area.~~

~~**VIRGINIA**—continued~~
~~Stafford~~
~~Staunton~~
~~Tazewell~~
~~Warren~~
~~Washington~~
~~Waynesboro~~
~~Winchester~~
~~Wythe~~
~~**WASHINGTON**~~

~~Clark~~
~~Ferry~~
~~Okanogan~~
~~Pend Oreille~~
~~Skamania~~
~~Spokane~~
~~Stevens~~
~~**W. VIRGINIA**~~
~~Berkeley~~
~~Brooke~~
~~Grant~~
~~Greenbrier~~
~~Hampshire~~
~~Hancock~~
~~Hardy~~
~~Jefferson~~
~~Marshall~~
~~Mercer~~
~~Mineral~~
~~Monongalia~~
~~Monroe~~
~~Morgan~~
~~Ohio~~
~~Pendleton~~
~~Pocahontas~~
~~Preston~~
~~Summers~~
~~Wetzel~~
~~**WISCONSIN**~~
~~Buffalo~~
~~Crawford~~
~~Dane~~
~~Dodge~~
~~Door~~

~~Fond du Lac~~
~~Grant~~
~~Green~~
~~Green Lake~~
~~Iowa~~
~~Jefferson~~
~~Lafayette~~
~~Langlade~~
~~Marathon~~
~~Menominee~~
~~Pepin~~
~~Pierce~~
~~Portage~~
~~Richland~~
~~Rock~~
~~Shawano~~
~~St. Croix~~
~~Vernon~~
~~Walworth~~
~~Washington~~
~~Waukesha~~
~~Waupaca~~
~~Wood~~
~~WYOMING~~
~~Albany~~
~~Big Horn~~
~~Campbell~~
~~Carbon~~
~~Converse~~
~~Crook~~
~~Fremont~~
~~Goshen~~
~~Hot Springs~~
~~Johnson~~

~~Laramie~~
~~Lincoln~~
~~Natrona~~
~~Niobrara~~
~~Park~~
~~Sheridan~~
~~Sublette~~
~~Sweetwater~~
~~Teton~~
~~Uinta~~
~~Washakie~~

APPENDIX AG

PIPING STANDARDS FOR VARIOUS APPLICATIONS

~~**User note:**~~

~~***About this appendix:** Plastic piping is commonly used in the construction of buildings covered by this code. Appendix AG provides a table of the most commonly used standards for plastic piping in a variety of applications. Although some standards in this table are not referenced in the code, the majority of standards indicated are listed in the Referenced Standards chapter of this code.*~~

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

APPENDIX AH

PATIO COVERS

Deleted.

~~*The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.*~~

~~**User note:**~~

~~***About this appendix:*** *Appendix AH relaxes certain provisions contained in the body of the code as related to patio covers, including those regarding: permitted uses; exterior wall insect screens; glazing and translucent or transparent plastic; light, ventilation and emergency egress; height; structural design loads; and footings. This appendix also includes provisions that are specifically applicable to* hurricane-prone regions.~~

~~SECTION AH101~~
~~GENERAL~~

~~**AH101.1 Scope.** Patio covers shall conform to the requirements of Sections AH101 through AH106.~~

~~**AH101.2 Permitted uses.** Patio covers detached from or attached to *dwelling units* shall be used only for recreational, outdoor living purposes, and not as carports, garages, storage rooms or habitable rooms.~~

~~SECTION AH102~~
~~DEFINITION~~

~~**AH102.1 General.** The following word and term shall, for the purposes of this appendix, have the meaning shown herein.~~

~~**PATIO COVER.** A structure with open or glazed walls that is used for recreational, outdoor living purposes associated with a *dwelling unit*.~~

~~SECTION AH103~~
~~EXTERIOR WALLS AND OPENINGS~~

~~**AH103.1 Enclosure walls.** Enclosure walls shall be permitted to be of any configuration, provided that the open or glazed area of the longer wall and one additional wall is not less than 65 percent of the area below 6 feet 8 inches (2032 mm) of each wall, measured from the floor. Openings shall be enclosed with any of the following:~~

1. ~~Insect screening.~~
2. ~~*Approved* translucent or transparent plastic not more than 0.125 inch (3.2 mm) in thickness.~~
3. ~~Glass conforming to the provisions of Section R308.~~
4. ~~Any combination of the foregoing.~~

~~**AH103.2 Light, ventilation and emergency egress.** Exterior openings required for light and ventilation into a patio structure conforming to Section AH101 shall be unenclosed where such openings serve as emergency egress or rescue openings from sleeping rooms. Where such exterior openings serve as an exit from the *dwelling unit*, the patio structure, unless unenclosed, shall be provided with exits conforming to the provisions of Section R311.~~

~~SECTION AH104~~
~~HEIGHT~~

~~**AH104.1 Height.** Patio covers are limited to one-story structures not exceeding 12 feet (3657 mm) in height.~~

~~SECTION AH105~~
~~STRUCTURAL PROVISIONS~~

~~**AH105.1 Design loads.** Patio covers shall be designed and constructed to sustain, within the stress limits of this code, all dead loads plus a vertical *live load* of not less than 10 pounds per square foot (0.48 kN/m²), except that snow loads shall be used where such snow loads exceed this minimum. Such covers shall be designed to resist the minimum wind loads set forth in Section R301.2.1.~~

~~**AH105.2 Footings.** In areas with a frostline depth of zero as specified in Table R301.2, for patio covers supported on a slab-on-*grade* without footings, the slab shall conform to the provisions of Section R506, shall be not less than 3.5 inches (89 mm) thick and the columns shall not support live and dead loads in excess of 750 pounds (3.34 kN) per column.~~

~~SECTION AH106~~
~~SPECIAL PROVISIONS FOR ALUMINUM SCREEN ENCLOSURES IN HURRICANE-PRONE REGIONS~~

~~**AH106.1 General.** Screen enclosures in *hurricane-prone regions* shall be in accordance with the provisions of this section.~~

~~**AH106.1.1 Habitable spaces.** Screen enclosures shall not be considered *habitable spaces*.~~

~~**AH106.1.2 Minimum ceiling height.** Screen enclosures shall have a ceiling height of not less than 7 feet (2134 mm).~~

~~**AH106.2 Definition.** The following word and term shall, for the purposes of this appendix, have the meaning shown herein.~~

~~**SCREEN ENCLOSURE.** A building or part thereof, in whole or in part self-supporting, and having walls of insect screening, and a roof of insect screening, plastic, aluminum or similar lightweight material.~~

~~**AH106.3 Screen enclosures.** Screen enclosures shall comply with Sections AH106.3.1 and AH106.3.2.~~

~~**AH106.3.1 Thickness.** Actual wall thickness of extruded aluminum members shall be not less than 0.040 inch (1.02 mm).~~

~~**AH106.3.2 Density.** Screen density shall be not more than 20 threads per inch by 20 threads per inch mesh.~~

~~**AH106.4 Design.** The structural design of screen enclosures shall comply with Sections AH106.4.1 through AH106.4.3.~~

~~**AH106.4.1 Wind load.** Structural members supporting screen enclosures shall be designed to support the minimum wind loads given in Tables AH106.4.1(1) and AH106.4.1(2) for the ultimate design wind speed,~~ $\cancel{V_{ult}}$, ~~determined from Figure AH106.4.1. Where any value is less than 10 pounds per square foot (psf) (0.479 kN/m²) use 10 pounds per square foot (0.479 kN/m²).~~

~~**AH106.4.2 Deflection limit.** For members supporting screen surfaces only, the total load deflection shall not exceed *l*/60. Screen surfaces shall be permitted to include not more than 25-percent solid flexible finishes.~~

~~**AH106.4.3 Roof live load.** The roof *live load* shall be not less than 10 psf (0.479 kN/m²).~~

~~**AH106.5 Footings.** In areas with a frost line depth of zero, screen enclosures supported on a concrete slab-on-*grade* without footings shall conform to the provisions of Section R506, be not less than 3½ inches (89 mm) thick and the columns shall not support loads in excess of 750 pounds (3.36 kN) per column.~~

~~TABLE AH106.4.1(1)~~
~~DESIGN WIND PRESSURES FOR SCREEN ENCLOSURE FRAMING~~[a, b, e, f, g, h]

~~LOAD CASE~~	~~WALL~~	~~ULTIMATE DESIGN WIND SPEED,~~ $\cancel{V_{ult}}$ ~~(mph)~~											
		~~90~~	~~95~~	~~100~~	~~105~~	~~110~~	~~120~~	~~130~~	~~140~~	~~150~~	~~160~~	~~170~~	~~180~~
		~~Exposure Category B Design Pressure (psf)~~											

A[e]	Windward and leeward walls (flow thru) and windward wall (nonflow thru) *L/W* = 0-1	5	6	6	7	8	9	11	13	14	16	18	21
A[e]	Windward and leeward walls (flow thru) and windward wall (nonflow thru) *L/W* = 2	6	7	7	8	9	11	12	14	16	19	21	24
B[d]	Windward: Nongable roof	7	8	9	10	11	13	15	18	21	23	26	30
B[d]	Windward: Gable roof	10	10	11	13	14	16	19	22	26	29	33	37
	ROOF												
All[e]	Roof-screen	2	2	2	3	3	3	4	4	5	6	7	7
All[e]	Roof-solid	6	6	7	8	8	10	12	13	15	18	20	22

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.44 m/s, 1 pound per square foot = 0.0479 kPa, 1 foot = 304.8 mm.

a. Design pressure shall be not less than 10 psf in accordance with Section AH106.4.1.

b. Loads are applicable to screen enclosures with a mean roof height of 30 feet or less in Exposure B. For screen enclosures of different heights or exposure, the pressures given shall be adjusted by multiplying the table pressure by the adjustment factor given in Table AH106.4.1(2).

c. For Load Case A flow-thru condition, the pressure given shall be applied simultaneously to both the upwind and downwind screen walls acting in the same direction as the wind. The structure shall be analyzed for wind coming from the opposite direction. For the nonflow-thru condition, the screen enclosure wall shall be analyzed for the load applied acting toward the interior of the enclosure.

d. For Load Case B, the table pressure multiplied by the projected frontal area of the screen enclosure is the total drag force, including drag on screen surfaces parallel to the wind, that must be transmitted to the ground. Use Load Case A for members directly supporting the screen surface perpendicular to the wind. Load Case B loads shall be applied only to structural members that carry wind loads from more than one surface.

e. The roof structure shall be analyzed for the pressure given occurring both upward and downward.

f. Table pressures are MWFRS loads. The design of solid roof panels and their attachments shall be based on component and cladding loads for enclosed or partially enclosed structures as appropriate.

g. Table pressures apply to 20-inch by 20-inch by 0.013-inch mesh screen. For 18-inch by 14-inch by 0.013-inch mesh screen, pressures on screen surfaces shall be permitted to be multiplied by 0.88. For screen densities greater than 20 inches by 20 inches by 0.013 inch, pressures for enclosed buildings shall be used.

h. Linear interpolation shall be permitted.

TABLE AH106.4.1(2)

ADJUSTMENT FACTOR FOR BUILDING HEIGHT AND EXPOSURE

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

For SI: 1 foot = 304.8 mm.

APPENDIX AI
PRIVATE SEWAGE DISPOSAL

Deleted

~~*The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.*~~

~~**User note:**~~

~~***About this appendix:*** Appendix AI has one simple requirement that private sewage disposal systems must be in accordance with the International Private Sewage Disposal Code®.~~

~~SECTION AI101~~
~~GENERAL~~

~~**AI101.1 Scope.** Private sewage disposal systems shall conform to the *International Private Sewage Disposal Code.*~~

APPENDIX AJ
EXISTING BUILDINGS AND STRUCTURES

DELETED. See North Carolina Existing Building Code.

~~*The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.*~~

~~**User note:**~~

~~***About this appendix:*** *Appendix AJ regulates the repair, renovation alteration and reconstruction of existing buildings that are within the scope of this code. It is intended to encourage the continued safe use of existing buildings and ensure that new work conforms to the intent of the code and that exiting conditions remain at their current level of compliance or are improved.*~~

~~SECTION AJ101~~
~~PURPOSE AND INTENT~~

~~**AJ101.1 General.** The purpose of these provisions is to encourage the continued use or reuse of legally existing buildings and structures. These provisions are intended to permit work in existing buildings that is consistent with the purpose of this code. Compliance with these provisions shall be deemed to meet the requirements of this code.~~

~~**AJ101.2 Classification of work.** For purposes of this appendix, work in existing buildings shall be classified into the categories of *repair*, renovation, *alteration* and reconstruction. Specific requirements are established for each category of work in these provisions.~~

~~**AJ101.3 Multiple categories of work.** Work of more than one category shall be part of a single work project. Related work permitted within a 12-month period shall be considered to be a single work project. Where a project includes one category of work in one building area and another category of work in a separate and unrelated area of the building, each project area shall comply with the requirements of the respective category of work. Where a project with more than one category of work is performed in the same area or in related areas of the building, the project shall comply with the requirements of the more stringent category of work.~~

~~SECTION AJ102~~
~~COMPLIANCE~~

~~**AJ102.1 General.** Regardless of the category of work being performed, the work shall not cause the structure to become unsafe or adversely affect the performance of the building; shall not cause an existing mechanical or plumbing system to become unsafe, hazardous, insanitary or overloaded; and unless expressly permitted by these provisions, shall not make the building any less compliant with this code or to any previously *approved* alternative arrangements than it was before the work was undertaken.~~

~~**AJ102.2 Requirements by category of work.** Repairs shall conform to the requirements of Section AJ107. Renovations shall conform to the requirements of Section AJ108. *Alterations* shall conform to the requirements of Section AJ109 and the requirements for renovations. Reconstructions shall conform to the requirements of Section AJ110 and the requirements for *alterations* and renovations.~~

~~**AJ102.3 Smoke detectors.** Regardless of the category of work, smoke detectors shall be provided where required by Section R314.2.2.~~

~~**AJ102.4 Replacement windows.** Regardless of the category of work, where an existing window, including the sash and glazed portion, or safety glazing is replaced, the replacement window or safety glazing shall comply with the requirements of Sections AJ102.4.1 through AJ102.4.4, as applicable.~~

~~**AJ102.4.1 Energy efficiency.** Replacement windows shall comply with the requirements of Chapter 11.~~

~~**AJ102.4.2 Safety glazing.** Replacement glazing in hazardous locations shall comply with the safety glazing requirements of Section R308.~~

~~**AJ102.4.3** Replacement windows for **emergency escape and rescue openings.** Where windows are required to provide emergency escape and rescue openings, replacement windows shall be exempt from Sections R310.2 and R310.4 provided that the replacement window meets the following conditions:~~

1. ~~The replacement window is the manufacturer's largest standard size window that will fit within the existing frame or existing rough opening. The replacement window shall be permitted to be of the same operating~~

~~style as the existing window or a style that provides for an equal or greater window opening area than the existing window.~~

2. ~~Where the replacement window is not part of a change of occupancy.~~

~~Window opening control devices and fall prevention devices complying with ASTM F2090 shall be permitted for use on windows serving as required emergency escape and rescue openings.~~

~~AJ102.4.3.1 Control devices. Emergency escape and rescue openings with window opening control devices or fall prevention devices complying with ASTM F2090, after operation to release the control device allowing the window to fully open, shall not reduce the net clear opening area of the window unit. Emergency escape and rescue openings shall be operational from the inside of the room without the use of keys or tools.~~

~~**AJ102.4.4 Window control devices.** Window opening control devices or fall prevention devices complying with ASTM F2090 shall be installed where an existing window is replaced and where all of the following apply to the replacement window:~~

1. ~~The window is operable.~~
2. ~~One of the following applies:~~
    2.1. ~~The window replacement includes replacement of the sash and the frame.~~
    2.2. ~~The window replacement includes the sash only when the existing frame remains.~~
3. ~~The bottom of the clear opening of the window opening is at a height less than 24 inches (610 mm) above the finished floor.~~
4. ~~The window will permit openings that will allow passage of a 4-inch-diameter (102 mm) sphere where the window is in its largest opened position.~~
5. ~~The vertical distance from the top of the sill of the window opening to the finished grade or other surface below, on the exterior of the building, is greater than 72 inches (1829 mm).~~

~~**AJ102.5 Flood hazard areas.** Work performed in existing buildings located in a flood hazard area as established by Table R301.2(1) shall be subject to the provisions of Section R105.3.1.1.~~

~~**AJ102.6 Equivalent alternatives.** Work performed in accordance with the *International Existing Building Code* shall be deemed to comply with the provisions of this appendix. These provisions are not intended to prevent the use of any alternative material, alternative design or alternative method of construction not specifically prescribed herein, provided that any alternative has been deemed to be equivalent and its use authorized by the *building official*.~~

~~**AJ102.7 Other alternatives.** Where compliance with these provisions or with this code as required by these provisions is technically infeasible or would impose disproportionate costs because of construction or dimensional difficulties, the building official shall have the authority to accept alternatives. These alternatives include materials, design features and operational features.~~

~~**AJ102.8 More restrictive requirements.** Buildings or systems in compliance with the requirements of this code for new construction shall not be required to comply with any more restrictive requirement of these provisions.~~

~~**AJ102.9 Features exceeding code requirements.** Elements, components and systems of existing buildings with features that exceed the requirements of this code for new construction, and are not otherwise required as part of *approved* alternative arrangements or deemed by the *building official* to be required to balance other building elements not complying with this code for new construction, shall not be prevented by these provisions from being modified as long as they remain in compliance with the applicable requirements for new construction.~~

~~SECTION AJ103~~
~~PRELIMINARY MEETING~~

~~**AJ103.1 General.** If a building *permit* is required at the request of the prospective *permit* applicant, the *building official* or his or her designee shall meet with the prospective applicant to discuss plans for any proposed work under these provisions prior to the application for the *permit*. The purpose of this preliminary meeting is for the *building official* to gain an understanding of the prospective applicant's intentions for the proposed work, and to determine, together with the prospective applicant, the specific applicability of these provisions.~~

~~SECTION AJ104~~
~~EVALUATION OF AN EXISTING BUILDING~~

~~**AJ104.1 General.** The *building official* shall have the authority to require an existing building to be investigated and evaluated by a *registered design professional* in the case of proposed reconstruction of any portion of a building. The evaluation shall determine the existence of any potential nonconformities to these provisions, and shall provide a basis for determining the impact of the proposed changes on the performance of the building. The evaluation shall use the following sources of information, as applicable:~~

1. ~~Available documentation of the existing building.~~
    1.1. ~~Field surveys.~~
    1.2. ~~Tests (nondestructive and destructive).~~
    1.3. ~~Laboratory analysis.~~

~~**Exception:** Detached one- or two-family dwellings that are not irregular buildings under Section R301.2.2.6 and are not undergoing an extensive reconstruction shall not be required to be evaluated.~~

~~SECTION AJ105~~
~~PERMIT~~

~~**AJ105.1 Identification of work area.** The work area shall be clearly identified on the *permits* issued under these provisions.~~

~~SECTION AJ106~~
~~DEFINITIONS~~

~~AJ106.1 **General.** For purposes of this appendix, the terms used are defined as follows:~~

~~**ALTERATION.** The reconfiguration of any space; the addition or elimination of any door or window; the reconfiguration or extension of any system; or the installation of any additional equipment.~~

~~**CATEGORIES OF WORK.** The nature and extent of construction work undertaken in an existing building. The categories of work covered in this appendix, listed in increasing order of stringency of requirements, are *repair*, renovation, *alteration* and reconstruction.~~

~~**DANGEROUS.** Where the stresses in any member; the condition of the building, or any of its components or elements or attachments; or other condition that results in an overload exceeding 150 percent of the stress allowed for the member or material in this code.~~

~~**EQUIPMENT OR FIXTURE.** Any plumbing, heating, electrical, ventilating, air conditioning, refrigerating and fire protection equipment; and elevators, dumb waiters, boilers, pressure vessels, and other mechanical facilities or installations that are related to building services.~~

~~**MATERIALS AND METHODS REQUIREMENTS.** Those requirements in this code that specify material standards; details of installation and connection; joints; penetrations; and continuity of any element, component or system in the building. The required quantity, fire resistance, flame spread, acoustic or thermal performance, or other performance attribute is specifically excluded from materials and methods requirements.~~

~~**RECONSTRUCTION.** The reconfiguration of a space that affects an exit, a renovation or *alteration* where the work area is not permitted to be occupied because existing means of egress and fire protection systems, or their equivalent, are not in place or continuously maintained; or there are extensive *alterations* as defined in Section AJ109.3.~~

~~**REHABILITATION.** Any *repair*, renovation, *alteration* or reconstruction work undertaken in an existing building.~~

~~**RENOVATION.** The change, strengthening or addition of load-bearing elements; or the refinishing, replacement, bracing, strengthening, upgrading or extensive repair of existing materials, elements, components, equipment or fixtures. Renovation does not involve reconfiguration of spaces. Interior and exterior painting are not considered refinishing for purposes of this definition, and are not renovation.~~

~~**REPAIR.** The patching, restoration or minor replacement of materials, elements, components, equipment or fixtures for the purposes of maintaining those materials, elements, components, equipment or fixtures in good or sound condition.~~

~~**WORK AREA.** That portion of a building affected by any renovation, *alteration* or reconstruction work as initially intended by the *owner* and indicated as such in the *permit*. Work area excludes other portions of the building where incidental work entailed by the intended work must be performed, and portions of the building where work not initially intended by the *owner* is specifically required by these provisions for a renovation, *alteration* or reconstruction.~~

~~SECTION AJ107~~
~~REPAIRS~~

~~AJ107.1 **Materials.** Except as otherwise required herein, work shall be done using like materials or materials permitted by this code for new construction.~~

~~AJ107.1.1 **Hazardous materials.** Hazardous materials no longer permitted, such as asbestos and lead-based paint, shall not be used.~~

~~AJ107.1.2 **Plumbing materials and supplies.** The following plumbing materials and supplies shall not be used:~~

1. ~~All-purpose solvent cement, unless *listed* for the specific application.~~
2. ~~Flexible traps and tailpieces, unless *listed* for the specific application.~~
3. ~~Solder having more than 0.2-percent lead in the repair of potable water systems.~~

~~AJ107.2 **Water closets.** Where any water closet is replaced with a newly manufactured water closet, the replacement water closet shall comply with the requirements of Section P2903.2.~~

~~AJ107.3 **Electrical.** Repair or replacement of existing electrical wiring and equipment undergoing repair with like material shall be permitted.~~

~~**Exceptions:**~~

1. ~~Replacement of electrical receptacles shall comply with the requirements of Chapters 34 through 43.~~
2. ~~Plug fuses of the Edison base type shall be used for replacements only where there is not evidence of overfusing or tampering in accordance with the applicable requirements of Chapters 34 through 43.~~
3. ~~For replacement of nongrounding-type receptacles with grounding-type receptacles and for branch circuits that do not have an equipment grounding conductor in the branch circuitry, the grounding conductor of a grounding-type receptacle outlet shall be permitted to be grounded to any accessible point on the grounding electrode system, or to any accessible point on the grounding electrode conductor, as allowed and described in Chapters 34 through 43.~~

~~SECTION AJ108~~
~~RENOVATIONS~~

~~AJ108.1 **Materials and methods.** The work shall comply with the materials and methods requirements of this code.~~

~~AJ108.2 **Door and window dimensions.** Minor reductions in the clear opening dimensions of replacement doors and windows that result from the use of different materials shall be allowed, whether or not they are permitted by this code.~~

~~AJ108.3 **Interior finish.** Wood paneling and textile wall coverings used as an interior finish shall comply with the flame spread requirements of Section R302.9.~~

~~AJ108.4 **Structural.** Unreinforced masonry buildings located in Seismic Design Category D_2 or E shall have parapet bracing and wall anchors installed at the roofline whenever a *reroofing permit* is issued. Such parapet bracing and wall anchors shall be of an *approved* design.~~

~~SECTION AJ109~~
~~ALTERATIONS~~

~~AJ109.1 **Newly constructed elements.** Newly constructed elements, components and systems shall comply with the requirements of this code.~~

~~**Exceptions:**~~

1. ~~Added openable windows are not required to comply with the light and *ventilation* requirements of Section R303.~~
2. ~~Newly installed electrical equipment shall comply with the requirements of Section AJ109.5.~~

~~AJ109.2 **Nonconformities.** The work shall not increase the extent of noncompliance with the requirements of Section AJ110, or create nonconformity to those requirements that did not previously exist.~~

~~AJ109.3 **Extensive alterations.** Where the total area of all of the work areas included in an *alteration* exceeds 50 percent of the area of the *dwelling unit*, the work shall be considered to be a reconstruction and shall comply with the requirements of these provisions for reconstruction work.~~

~~**Exception:** Work areas in which the *alteration* work is exclusively plumbing, mechanical or electrical shall not be included in the computation of the total area of all work areas.~~

~~AJ109.4 **Structural.** The minimum design loads for the structure shall be the loads applicable at the time the building was constructed, provided that a dangerous condition is not created. Structural elements that are uncovered during the course of the *alteration* and that are found to be unsound or dangerous shall be made to comply with the applicable requirements of this code.~~

~~AJ109.5 **Electrical equipment and wiring.**~~

~~AJ109.5.1 **Materials and methods.** Newly installed electrical equipment and wiring relating to work done in any work area shall comply with the materials and methods requirements of Chapters 34 through 43.~~

~~**Exception:** Electrical equipment and wiring in newly installed partitions and ceilings shall comply with the applicable requirements of Chapters 34 through 43.~~

~~AJ109.5.2 **Electrical service.** Service to the *dwelling unit* shall be not less than 100 ampere, three-wire capacity and service *equipment* shall be dead front having no live parts exposed that could allow accidental contact. Type "S" fuses shall be installed where fused equipment is used.~~

~~**Exception:** Existing service of 60 ampere, three-wire capacity, and feeders of 30 ampere or larger two- or three-wire capacity shall be accepted if adequate for the electrical load being served.~~

~~AJ109.5.3 **Additional electrical requirements.** Where the work area includes any of the following areas within a *dwelling unit*, the requirements of Sections AJ109.5.3.1 through AJ109.5.3.5 shall apply.~~

~~AJ109.5.3.1 **Enclosed areas.** Enclosed areas other than closets, kitchens, *basements*, garages, hallways, laundry areas and bathrooms shall have not less than two duplex receptacle outlets, or one duplex receptacle outlet and one ceiling- or wall-type lighting outlet.~~

~~AJ109.5.3.2 **Kitchen and laundry areas.** Kitchen areas shall have not less than two duplex receptacle outlets. Laundry areas shall have not less than one duplex receptacle outlet located near the laundry equipment and installed on an independent circuit.~~

~~AJ109.5.3.3 **Ground-fault circuit interruption.** Ground-fault circuit interruption shall be provided on newly installed receptacle outlets if required by Chapters 34 through 43.~~

~~AJ109.5.3.4 **Lighting outlets.** Not less than one lighting outlet shall be provided in every bathroom, hallway, *stairway*, attached garage and detached garage with electric power to illuminate outdoor entrances and exits, and in utility rooms and *basements* where these spaces are used for storage or contain equipment requiring service.~~

~~AJ109.5.3.5 **Clearance.** Clearance for electrical service equipment shall be provided in accordance with Chapters 34 through 43.~~

~~AJ109.6 **Ventilation.** Reconfigured spaces intended for occupancy and spaces converted to habitable or occupiable space in any work area shall be provided with *ventilation* in accordance with Section R303.~~

~~AJ109.7 **Ceiling height.** *Habitable spaces* created in existing *basements* shall have ceiling heights of not less than 6 feet, 8 inches (2032 mm), except that the ceiling height at obstructions shall be not less than 6 feet 4 inches (1930 mm) from the *basement* floor. Existing finished ceiling heights in nonhabitable spaces in *basements* shall not be reduced.~~

~~AJ109.8 **Stairs.**~~

~~AJ109.8.1 **Stair width.** Existing *basement* stairs and *handrails* not otherwise being altered or modified shall be permitted to maintain their current clear width at, above and below existing *handrails*.~~

~~AJ109.8.2 **Stair headroom.** Headroom height on existing *basement* stairs being altered or modified shall not be reduced below the existing *stairway* finished headroom. Existing *basement* stairs not otherwise being altered shall be permitted to maintain the current finished headroom.~~

~~AJ109.8.3 **Stair landing.** Landings serving existing *basement* stairs being altered or modified shall not be reduced below the existing *stairway* landing depth and width. Existing *basement* stairs not otherwise being altered shall be permitted to maintain the current landing depth and width.~~

~~SECTION AJ110~~
~~RECONSTRUCTION~~

~~AJ110.1 **Stairways, handrails and guards.**~~

~~AJ110.1.1 **Stairways.** *Stairways* within the work area shall be provided with illumination in accordance with Section R303.6.~~

~~AJ110.1.2 **Handrails.** Every required exit *stairway* that has four or more risers, is part of the means of egress for any work area, and is not provided with not fewer than one *handrail*, or in which the existing *handrails* are judged to be in danger of collapsing, shall be provided with *handrails* designed and installed in accordance with Section R311 for the full length of the run of steps on not less than one side.~~

~~AJ110.1.3 **Guards.** Every open portion of a *stair*, landing or balcony that is more than 30 inches (762 mm) above the floor or *grade* below, is part of the egress path for any work area, and does not have *guards*, or in which the existing *guards* are judged to be in danger of collapsing, shall be provided with *guards* designed and installed in accordance with Section R312.~~

~~AJ110.2 **Wall and ceiling finish.** The interior finish of walls and ceilings in any work area shall comply with the requirements of Section R302.9. Existing interior finish materials that do not comply with those requirements shall be removed or shall be treated with an *approved* fire-retardant coating in accordance with the manufacturer's instructions to secure compliance with the requirements of this section.~~

~~AJ110.3 **Separation walls.** Where the work area is in an attached *dwelling unit*, walls separating *dwelling units* that are not continuous from the foundation to the underside of the roof sheathing shall be constructed to provide a continuous fire separation using construction materials consistent with the existing wall or complying with the requirements for new structures. Performance of work shall be required only on the side of the wall of the *dwelling unit* that is part of the work area.~~

~~AJ110.4 **Ceiling height.** *Habitable spaces* created in existing *basements* shall have ceiling heights of not less than 6 feet, 8 inches (2032 mm), except that the ceiling height at obstructions shall be not less than 6 feet 4 inches (1930 mm) from the *basement* floor. Existing finished ceiling heights in nonhabitable spaces in *basements* shall not be reduced.~~

~~SECTION AJ111~~
~~REFERENCED STANDARDS~~

~~**AJ111.1 General.** See Table AJ111.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, the standard title and the section or sections of this appendix that reference the standard.~~

~~TABLE AJ111.1~~

~~REFERENCED STANDARDS~~

~~STANDARD ACRONYM~~	~~STANDARD NAME~~	~~SECTION HEREIN REFERENCED~~
~~ASTM F2090—17~~	~~*Specification for Window Fall Prevention Devices with Emergency Escape (Egress) Release Mechanisms*~~	~~AJ102.4.3, AJ102.4.4~~

~~IEBC—21~~	~~*International Existing Building Code*~~	~~AJ102.6~~

APPENDIX AK
SOUND TRANSMISSION

The provisions contained in this appendix are ~~not mandatory unless specifically referenced in the adopting ordinance.~~ adopted as part of this code.

~~**User note:**~~

~~***About this appendix:*** *Sound transmission relates directly to the psychological and long-term physical well-being of building occupants. Many human activities cannot be accommodated efficiently or comfortably in various types of building spaces without proper attention to the mitigation of sound transmission from other spaces within the building, or from outside of the building. In Appendix AK, attention is specifically paid to the mitigation of sound transmission between dwelling units and other dwelling units and occupancies.*~~

APPENDIX AL

PERMIT FEES

Deleted

~~*The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.*~~

~~**User note:**~~

~~***About this appendix:*** *Appendix AL is intended to provide guidance to building departments in their efforts to set fees for building* permits. *This appendix provides examples that may be used as a reference when setting fee schedules and are not intended to be literally applied.*~~

~~SECTION AL101~~
~~GENERAL~~

~~**AL101.1 Permit fee schedule.** *Permit* fees shall be in accordance with Table AL101.1.~~

~~**TABLE AL101.1**~~

~~**TABLE AL101.1**~~
~~**PERMIT FEE SCHEDULE**~~

~~TOTAL VALUATION~~	~~FEE~~
~~$1 to $500~~	~~$24~~
~~$501 to $2,000~~	~~$24 for the first $500; plus $3 for each additional $100 or fraction thereof, up to and including $2,000~~
~~$2,001 to $40,000~~	~~$69 for the first $2,000; plus $11 for each additional $1,000 or fraction thereof, up to and including $40,000~~
~~$40,001 to $100,000~~	~~$487 for the first $40,000; plus $9 for each additional $1,000 or fraction thereof, up to and including $100,000~~
~~$100,000 to $500,000~~	~~$1,027 for the first $100,000; plus $7 for each additional $1,000 or fraction thereof, up to and including $500,000~~
~~$500,001 to $1,000,000~~	~~$3,827 for the first $500,000; plus $5 for each additional $1,000 or fraction thereof, up to and including $1,000,000~~
~~$1,000,001 to $5,000,000~~	~~$6,327 for the first $1,000,000; plus $3 for each additional $1,000 or fraction thereof, up to and including $5,000,000~~
~~$5,000,001 and over~~	~~$18,327 for the first $5,000,000; plus $1 for each additional $1,000 or fraction thereof~~

APPENDIX AM
HOME DAY CARE—R-3 OCCUPANCY

Deleted.

~~*The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.*~~

~~**User note:**~~

~~***About this appendix:*** Appendix AM is intended to apply to scenarios where day care is provided to more than five children in dwellings that are under the scope of this code. The International Building Code® considers such structures R-3 residential occupancies and allows them to be constructed in accordance with this code. Although there are many general provisions in the body of the code that apply to home day care as well as other occupancies, this appendix contains the provisions that are specific to home day care.~~

~~SECTION AM101~~
~~GENERAL~~

~~**AM101.1 General.** This appendix shall apply to a home day care operated within a *dwelling*. It is to include buildings and structures occupied by persons of any age who receive custodial care for less than 24 hours by individuals other than parents or guardians or relatives by blood, marriage, or adoption, and in a place other than the home of the person cared for.~~

~~SECTION AM102~~
~~DEFINITION~~

~~**AM102.1 General.** The following term shall, for the purposes of this appendix, have the meaning shown herein.~~

~~**EXIT ACCESS.** That portion of a means of egress system that leads from any occupied point in a building or structure to an exit.~~

~~SECTION AM103~~
~~MEANS OF EGRESS~~

~~**AM103.1 Exits required.** If the occupant load of the residence is more than nine, including those who are residents, during the time of operation of the day care, two exits are required from the ground-level *story*. Two exits are required from a home day care operated in a *manufactured home*, regardless of the occupant load. Exits shall comply with Section R311.~~

~~**AM103.1.1 Exit access prohibited.** An exit access from the area of day care operation shall not pass through bathrooms, bedrooms, closets, garages, fenced rear yards or similar areas.~~

~~**Exception:** An exit may discharge into a fenced yard if the gate or gates remain unlocked during day care hours. The gates may be locked if there is an area of refuge located within the fenced yard and more than 50 feet (15 240 mm) from the *dwelling*. The area of refuge shall be large enough to allow 5 square feet (0.5 m^2) per occupant.~~

~~**AM103.1.2 Basements.** If the *basement* of a *dwelling* is to be used in the day care operation, two exits are required from the *basement* regardless of the occupant load. One of the exits may pass through the *dwelling* and the other shall lead directly to the exterior of the *dwelling*.~~

~~An emergency and escape window used as the second means of egress from a *basement* shall comply with Sections R310 and AM103.1.1.~~

~~**AM103.1.3 Yards.** If the yard is to be used as part of the day care operation it shall be fenced.~~

~~**AM103.1.3.1 Type of fence and hardware.** The fence shall be of durable materials and be not less than 6 feet (1529 mm) tall, completely enclosing the area used for the day care operations. Each opening shall be a gate or door equipped with a self-closing and self-latching device to be installed at not less than 5 feet (1528 mm) above the ground.~~

~~**Exception:** The door of any *dwelling* that forms part of the enclosure need not be equipped with self-closing and self-latching devices.~~

~~**AM103.1.3.2 Construction of fence.** Openings in the fence, wall or enclosure required by this section shall have intermediate rails or an ornamental pattern that do not allow a sphere 4 inches (102 mm) in diameter to pass through. In addition, the following criteria must be met:~~

1. ~~The maximum vertical clearance between *grade* and the bottom of the fence, wall or enclosure shall be 2 inches (51 mm).~~
2. ~~Solid walls or enclosures that do not have openings, such as masonry or stone walls, shall not contain indentations or protrusions, except for tooled masonry joints.~~
3. ~~Maximum mesh size for chain link fences shall be $1^{1}/_{4}$ inches (32 mm) square, unless the fence has slats at the top or bottom that reduce the opening to not more than $1^{3}/_{4}$ inches (44 mm). The wire shall be not less than 9 gage [0.148 inch (3.8 mm)].~~

~~**AM103.1.3.3 Decks.** Decks that are more than 12 inches (305 mm) above *grade* shall have a *guard* in compliance with Section R312.~~

~~**AM103.2 Width and height of an exit.** The minimum width of a required exit is 36 inches (914 mm) with a net clear width of 32 inches (813 mm). The minimum height of a required exit is 6 feet 8 inches (2032 mm).~~

~~**AM103.3 Type of lock and latches for exits.** Regardless of the occupant load served, exit doors shall be openable from the inside without the use of a key or any special knowledge or effort. Where the occupant load is 10 or less, a night latch, dead bolt or security chain may be used, provided that such devices are openable from the inside without the use of a key or tool, and are mounted at a height not to exceed 48 inches (1219 mm) above the finished floor.~~

~~**AM103.4 Landings.** Landings for *stairways* and doors shall comply with Section R311, except that landings shall be required for the exterior side of a sliding door where a home day care is being operated in a Group R-3 occupancy.~~

~~SECTION AM104~~
~~SMOKE DETECTION~~

~~**AM104.1 General.** Smoke detectors shall be installed in *dwelling units* used for home day care operations. Detectors shall be installed in accordance with the approved manufacturer's instructions. If the current smoke detection system in the *dwelling* is not in compliance with the currently adopted code for smoke detection, it shall be upgraded to meet the currently adopted code requirements and Section AM103 before day care operations commence.~~

~~**AM104.2 Power source.** Required smoke detectors shall receive their primary power from the building wiring where that wiring is served from a commercial source and shall be equipped with a battery backup. The detector shall emit a signal when the batteries are low. Wiring shall be permanent and without a disconnecting switch other than those required for overcurrent protection. Required smoke detectors shall be interconnected such that if one detector is activated, all detectors are activated.~~

~~**AM104.3 Location.** A detector shall be located in each bedroom and any room that is to be used as a sleeping room, and centrally located in the corridor, hallway or area giving access to each separate sleeping area. Where the *dwelling unit* has more than one *story*, and in *dwellings* with *basements*, a detector shall be installed on each *story* and in the *basement*. In *dwelling units* where a *story* or *basement* is split into two or more levels, the smoke detector shall be installed on the upper level, except that where the lower level contains a sleeping area, a detector shall be installed on each level. Where sleeping rooms are on the upper level, the detector shall be placed at the ceiling of the upper level in close proximity to the stairway. In *dwelling units* where the ceiling height of a room open to the hallway serving the bedrooms or sleeping areas exceeds that of the hallway by 24 inches (610 mm) or more, smoke detectors shall be installed in the hallway and the adjacent room. Detectors shall sound an alarm audible in all sleeping areas of the *dwelling unit* in which they are located.~~

APPENDIX AN

VENTING METHODS

This appendix is informative and is not part of the code. This appendix provides examples of various venting methods.

~~**User note:**~~

~~***About this appendix:*** *Venting for plumbing systems is often best understood using diagrams such as isometrics. Appendix AN illustrates a variety of venting methods indicated in Chapter 31 of this code.*~~

APPENDIX AO

AUTOMATIC VEHICULAR GATES

The provisions contained in this appendix are ~~not mandatory unless specifically referenced in the adopting ordinance.~~ adopted as part of this code.

~~**User note:**~~

~~***About this appendix:** Appendix AO provides requirements for automatic vehicular gates, including a definition of and references to standards that regulate such gates.*~~

APPENDIX AP

SIZING OF WATER PIPING SYSTEM

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

~~**User note:**~~

~~***About this appendix:*** *Chapter 29 has the basic information to begin sizing of a water service and water distribution piping system. Appendix AP provides several methods that can be used to complete pipe sizing for a building.*~~

APPENDIX AQ
TINY HOUSES

The provisions contained in this appendix are ~~not mandatory unless specifically referenced in the adopting ordinance.~~ adopted as part of this code.

~~**User note:**~~

~~***About this appendix:** Appendix AQ relaxes various requirements in the body of the code as they apply to houses that are 400 square feet in area or less. Attention is specifically paid to features such as compact stairs, including stair handrails and headroom, ladders, reduced ceiling heights in lofts and guard and emergency escape and rescue opening requirements at lofts.*~~

SECTION AQ107
SMOKE AND CARBON MONOXIDE DETECTORS

AQ107.1 Smoke and Carbon monoxide detectors. Smoke and carbon monoxide detectors shall be installed as required in Sections R314 and R315 and just below the highest point of any *loft*.

SECTION AQ107 FOUNDATION

AQ108.1 Foundation options. *Tiny Houses* are permitted to be constructed without a masonry or concrete foundation per Section AQ108.1.1 and AQ108.1.2, except in *coastal high hazard, ocean hazard* and *flood hazard areas.*

AQ108.1.1 Wood Foundation. The building shall be supported on a wood foundation of minimum 4-inch by 4-inch or 6-inch by 6-inch mudsill or runner of approved wood in accordance with Section R317. Structural floor systems that include joists and subfloor material shall also comply with Section R317.1, item #1.

AQ108.1.2. Anchorage. *Tiny houses* with wood foundations per AQ108.1.1 shall be designed and anchored to resist overturning and sliding.

> **Exception:** *Tiny houses* with no more than 12' vertical mean roof height shall be anchored to resist overturning and sliding by installing a minimum of one ground anchor at each corner of the building. The total resisting force of the anchors shall be equal to 20psf (958 Pa) times the plan area of the building.

APPENDIX AR
LIGHT STRAW-CLAY CONSTRUCTION

DELETED

~~The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.~~

~~**User note:**~~

~~***About this appendix:*** *While heavier forms of straw-clay construction have been used in various parts of the world for thousands of years, light forms of straw-clay construction began to appear in Europe in 1950 and in the United States in 1990. These lighter forms of straw-clay construction are intended as infill materials in nonload-bearing walls. The advantages of light straw-clay construction, such as regulated by Appendix AR, include thermal performance and low environmental impact.*~~

~~SECTION AR101~~
~~GENERAL~~

~~**AR101.1 Scope.** This appendix shall govern the use of light straw-clay as a nonbearing building material and wall infill system in *Seismic Design Categories* A and B. Use of light straw-clay in *Seismic Design Categories* C, D_0, D_1 and D_2 shall require an *approved* engineered design by a *registered design professional* in accordance with Section R301.1.3.~~

~~SECTION AR102~~
~~DEFINITIONS~~

~~**AR102.1 General.** The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 for general definitions.~~

~~**CLAY.** Inorganic soil with particle sizes of less than 0.00008 inch (0.002 mm) having the characteristics of high to very high dry strength and medium to high plasticity.~~

~~**CLAY SLIP.** A suspension of clay or clay subsoil particles in water.~~

~~**CLAY SUBSOIL.** Subsoil sourced directly from the earth or refined, containing clay and not more than trace amounts organic matter.~~

~~**INFILL.** Light straw-clay that is placed between the structural and nonstructural members of a building.~~

~~**LIGHT STRAW-CLAY.** A mixture of straw and clay slip compacted and dried to form insulation and plaster substrate between or around structural and nonstructural members in a wall.~~

~~**NONBEARING.** Not bearing the weight of the building other than the weight of the light straw-clay itself and its finish.~~

~~**STRAW.** The dry stems of cereal grains after the seed heads have been removed.~~

~~**VOID.** Any space in a light straw-clay wall wider than $^1/_4$ inch (6 mm), greater than 2 inches (51 mm) in horizontal length and greater than 2 inches (51 mm) in depth.~~

~~SECTION AR103~~
~~NONBEARING LIGHT STRAW-CLAY CONSTRUCTION~~

~~**AR103.1 General.** Light straw clay shall be limited to infill between or around structural and nonstructural wall framing members.~~

~~**AR103.2 Structure.** The structure of buildings using light straw-clay shall be in accordance with the *International Residential Code* or shall be in accordance with an *approved* design by a *registered design professional*.~~

~~**AR103.2.1 Number of stories.** Use of light straw-clay infill shall be limited to buildings that are not more than one *story above grade plane*.~~

~~**Exception:** Buildings using light straw-clay infill that are greater than one *story above grade plane* shall be in accordance with an *approved* design by a *registered design professional*.~~

~~**AR103.2.2 Bracing.** Bracing for buildings with light straw-clay infill shall be in accordance with Section R602.10. Walls with light straw-clay infill shall use Method LIB and shall not be sheathed with solid sheathing. Walls without light straw-clay infill shall comply with any bracing method prescribed by this code.~~

~~**AR103.2.3 Requirements and properties of light straw-clay mixtures.** The requirements and properties of light straw-clay mixtures shall be in accordance with Table AR103.2.3.~~

~~**AR103.2.4 Stabilization of light straw-clay.** Light straw-clay shall be stabilized as follows, or shall be in accordance with an *approved* design by a *registered design professional*:~~

1. ~~Vertical stabilization shall be of structural or nonstructural wood framing in accordance with Figure AR103.2.4(1), AR103.2.4(2) or AR103.2.4(3). Framing members that are both load-bearing and stabilization members shall meet the requirements of Section R602 and this section. Nonstructural stabilization members shall be not more than 32 inches (813 mm) on center.~~
2. ~~Horizontal stabilization shall be installed at not more than 24 inches (610 mm) on center and in accordance with Figure AR103.2.4(1), AR103.2.4(2) or AR103.2.4(3). Horizontal stabilization shall be of any of the following with the stated minimum dimensions: $^3/_4$-inch (19.1 mm) bamboo, $^1/_2$-inch (12.7 mm) fiberglass rod, 1-inch (25 mm) wood dowel or nominal 1-inch by 2-inch (25 mm by 51 mm) wood.~~

~~**AR103.3 Materials.** The materials used in light straw-clay construction shall be in accordance with Sections AR103.3.1 through AR103.3.3.~~

~~**AR103.3.1 Straw requirements.** Straw shall be stems of wheat, rye, oats, rice or barley, and shall be free of visible decay, insects and green plant material.~~

~~**AR103.3.2 Clay subsoil requirements.** Suitability of clay subsoil shall be determined in accordance with Table AR103.2.3.~~

~~**AR103.3.3 Light straw-clay mixture.** A light straw-clay mixture shall consist of loose straw mixed and coated with clay slip such that there is not more than 5 percent uncoated straw, and shall be in accordance with Table AR103.2.3.~~

~~**AR103.4 Wall construction.** Light straw clay wall construction shall be in accordance with the requirements of Sections AR103.4.1 through AR103.4.7.~~

~~**AR103.4.1 Light straw-clay maximum thickness.** The maximum thickness of light straw clay shall be in accordance with Table AR103.2.3.~~

~~**AR103.4.2 Distance above grade.** Light straw-clay and its exterior finish shall be not less than 8 inches (203 mm) above exterior finished *grade*.~~

~~**AR103.4.3 Moisture barrier.** An *approved* moisture barrier shall separate the bottom of light straw-clay walls from any masonry or concrete foundation or slab that directly supports the walls. Penetrations and joints in the barrier shall be sealed with an *approved* sealant.~~

~~**AR103.4.4 Contact with wood members.** Light straw-clay shall be permitted to be in contact with untreated wood members.~~

~~**AR103.4.5 Contact with nonwood structural members.** Nonwood structural members in contact with light straw-clay shall be resistant to corrosion or shall be coated to prevent corrosion with an *approved* coating.~~

~~**AR103.4.6 Installation.** Light straw-clay shall be installed in accordance with the following:~~

1. ~~Formwork shall be sufficiently strong to resist bowing where the light straw clay is compacted into the forms.~~
2. ~~Light straw-clay shall be uniformly placed into forms and evenly tamped to achieve stable walls free of voids. Light straw-clay shall be placed in lifts of not more than 6 inches (152 mm) and shall be thoroughly tamped before additional material is added.~~
3. ~~Temporary formwork shall be removed from walls within 24 hours after tamping, and walls shall remain exposed until moisture content is in accordance with Section AR103.5.1. Visible voids shall be filled with light straw-clay or other insulative material prior to plastering.~~

~~**AR103.4.7 Openings in walls.** Openings in walls shall be in accordance with the following:~~

1. ~~Rough framing for doors and windows shall be fastened to structural members in accordance with the *International Residential Code*. Windows and doors shall be flashed in accordance with the *International Residential Code*.~~
2. ~~An *approved* moisture barrier shall be installed at window sills in light straw-clay walls prior to installation of windows.~~

~~**AR103.5 Wall finishes.** The interior and exterior surfaces of light straw-clay walls shall be protected with a finish in accordance with Sections AR103.5.1 through AR103.5.5.~~

~~**AR103.5.1 Dimensional stability of light straw-clay prior to application of plaster finish.** Light straw-clay infill having a density of 30 pounds per cubic foot (480.6 kg/m^3) or greater shall be dry to a moisture content of not more than 20 percent at a depth of 4 inches (102 mm), as measured from each side of the wall. Light straw-clay infill having a density of less than 30 pounds per cubic foot (480.6 kg/m^3) shall be sufficiently dry such that the overall shrinkage of the light straw-clay is dimensionally stable.~~

~~**AR103.5.2 Plaster finish.** Exterior plaster shall be clay plasters or lime plasters. Interior plasters shall be clay plasters, lime plasters or gypsum plasters. Plasters shall be permitted to be applied directly to the surface of the light straw-clay walls without reinforcement, except that the juncture of dissimilar substrates shall be in accordance with Section AR103.5.4. Plasters shall have a thickness of not less than $^1/_2$ inch (12.7 mm) and not more than 1 inch (25 mm) and shall be installed in not less than two coats. Rain-exposed clay plasters shall be finished with a lime-based or silicate-mineral coating.~~

~~**AR103.5.3 Separation of wood and plaster.** Where wood framing occurs in light straw-clay walls, such wood surfaces shall be separated from exterior plaster with No.15 asphalt felt, Grade D paper or other *approved* material except where the wood is preservative treated or naturally durable.~~

~~**Exception:** Exterior clay plasters shall not be required to be separated from wood.~~

~~**AR103.5.4 Bridging across dissimilar substrates.** Bridging shall be installed across dissimilar substrates prior to the application of plaster. Acceptable bridging materials include expanded metal lath, woven wire mesh, welded wire mesh, fiberglass mesh, reed matting or burlap. Bridging shall extend not less than 4 inches (102 mm), on both sides of the juncture.~~

~~**AR103.5.5 Exterior cladding.** Exterior cladding shall be spaced not less than $^1/_2$ inch (12.7 mm) from the light straw-clay such that a ventilation space is created to allow for moisture diffusion. Furring strips that create this ventilation space shall be securely fastened to the stabilization members or framing. The cladding shall be fastened to the wood furring strips in accordance with the manufacturer's instructions. Insect screening shall be provided at the top and bottom of the ventilation space.~~

~~SECTION AR104~~
~~THERMAL PERFORMANCE~~

~~**AR104.1 Thermal characteristics.** Walls with light straw-clay infill of densities of greater than or equal to 20 pounds per cubic foot (480.6 kg/m^3) shall be classified as mass walls in accordance with Section N1102.2.5 (R402.2.5) and shall meet the *R*-value requirements for mass walls in Table N1102.1.3 (R402.1.2). Walls with light straw-clay infill of densities less than 20 pounds per cubic foot (480.6 kg/m^3) shall meet the *R*-value requirements for wood frame walls in Table N1102.1.3 (R402.1.2).~~

~~**AR104.2 Thermal resistance.** Light straw-clay shall be deemed to have a thermal resistance as specified in Table AR103.2.3.~~

~~SECTION AR105~~
~~REFERENCED STANDARDS~~

~~**AR105.1 General.** See Table AR105.1 for standards that are referenced in various section of this appendix. Standards are listed by the standard identification with the effective date, the standard title, and the section or sections of this appendix that reference this standard.~~

~~TABLE AR105.1~~

~~REFERENCED STANDARDS~~

~~STANDARD ACRONYM~~	~~STANDARD NAME~~	~~SECTIONS HEREIN REFERENCED~~
~~ASTM E2392/E2392M—10~~	~~*Standard Guide for Design of Earthen Wall Building Systems*~~	~~Table AR103.2.3~~

~~TABLE AR103.2.3~~

~~REQUIREMENTS AND PROPERTIES OF LIGHT STRAW-CLAY MIXTURES[a]~~

~~Density (pcf)~~	~~Straw (pcf)~~	~~Subsoil (pcf)~~	~~Water (gal/cf)[b]~~	~~Min. % clay in subsoil~~	~~Minimum clay: silt ratio~~	~~Subsoil testing method[c, d]~~	~~Max. wall thickness, inches~~	~~*R* value (hr/F°/cf/BTU/inch)~~
~~10~~	~~6.7~~	~~3.3~~	~~1.55~~	~~70~~	~~3.5:1~~	~~A~~	~~15~~	~~1.80~~
~~12~~	~~6.7~~	~~5.3~~	~~1.63~~	~~46~~	~~1.7:1~~	~~A~~	~~15~~	~~1.72~~
~~13~~	~~6.7~~	~~6.3~~	~~1.67~~	~~40~~	~~1.33:1~~	~~A~~	~~15~~	~~1.69~~
~~15~~	~~6.7~~	~~8.3~~	~~1.74~~	~~35~~	~~0.95:1~~	~~A~~	~~15~~	~~1.63~~
~~20~~	~~6.7~~	~~13.3~~	~~1.93~~	~~30~~	~~0.60:1~~	~~A~~	~~12~~	~~1.48~~
~~30~~	~~6.7~~	~~23.3~~	~~2.31~~	~~NA~~	~~NA~~	~~B~~	~~12~~	~~1.22~~
~~40~~	~~6.7~~	~~33.3~~	~~2.70~~	~~NA~~	~~NA~~	~~B~~	~~12~~	~~1.01~~
~~50~~	~~6.7~~	~~43.3~~	~~3.08~~	~~NA~~	~~NA~~	~~B~~	~~12~~	~~0.84~~

~~a. Interpolation permitted. Extrapolation not permitted.~~
~~b. Water mixed with subsoil equals clay slip.~~
~~c. Subsoil Testing Methods:~~
~~1. Lab test for percent of clay, silt and sand via hydrometer method.~~
~~2. The Figure 2 Ribbon Test and the Figure 3 Ball Test in the Appendix of ASTM E2392/E2392M.~~
~~d. Trace amounts of organic materials are acceptable.~~

APPENDIX AS

STRAWBALE CONSTRUCTION

DELETED.

~~*The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.*~~

~~**User note:**~~

~~***About this appendix:*** *The use of strawbale construction has steadily increased since the 1980s such that there are now buildings of strawbale construction in every state in the United States and in more than 50 countries around the globe. Estimates are that there are over 1,000 buildings of strawbale construction in California alone, including both residential and commercial buildings. Appendix AS provides prescriptive requirements for the construction of exterior and interior walls, both structural and nonstructural, in buildings that are under the scope of this code.*~~

~~SECTION AS101~~
~~GENERAL~~

~~**AS101.1 Scope.** This appendix provides prescriptive and performance-based requirements for the use of baled *straw* as a building material. Other methods of *strawbale* construction shall be subject to approval in accordance with Section R104.11 of this code. *Buildings* using *strawbale* walls shall comply with this code except as otherwise stated in this appendix.~~

~~**AS101.2 Strawbale wall systems.** *Strawbale* wall systems include those shown in Figure AS101.2 and *approved* variations.~~

~~SECTION AS102~~
~~DEFINITIONS~~

~~**AS102.1 Definitions.** The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 of the *International Residential Code* for general definitions.~~

~~**BALE.** Equivalent to *straw bale.*~~

~~BRACED WALL PANEL, STRAWBALE. **A *strawbale* wall designed and constructed to resist in-plane shear loads through the interaction of the stacked *straw bales*, the reinforced plaster and its connections to the top plate, sill plates and foundation. The panel's length meets the requirements for the particular wall type and contributes toward the total amount of bracing required along its braced wall line in accordance with Sections AS106.13 and R602.10.1.**~~

~~**CLAY.** Inorganic soil with particle sizes less than 0.00008 inch (0.002 mm) having the characteristics of high to very high dry strength and medium to high plasticity, used as the binder of other component materials in clay plaster and straw-clay.~~

~~**CLAY SLIP.** A suspension of clay or *clay subsoil* particles in water.~~

~~**CLAY SUBSOIL.** Subsoil sourced directly from the earth, containing *clay*, sand, silt and not more than trace amounts of organic matter.~~

~~**FINISH.** Completed combination of materials on the interior or exterior faces of stacked *bales*.~~

~~**FLAKE.** An intact section of compressed *straw* removed from an untied *bale*.~~

~~**LAID FLAT.** The orientation of a *bale* with its largest faces horizontal, its longest dimension parallel with the wall plane, its *ties* concealed in the unfinished wall and its *straw* lengths oriented predominantly across the thickness of the wall. See Figure AS102.1.~~

~~**LOAD-BEARING WALL.** A *strawbale* wall that supports more than 100 pounds per linear foot (1459 N/m) of vertical load in addition its own weight.~~

~~**MESH.** An openwork fabric of linked strands of metal, plastic, or natural or synthetic fiber.~~

~~**NONSTRUCTURAL WALL.** Walls other than *load-bearing* walls or *shear walls*.~~

~~**ON-EDGE.** The orientation of a *bale* with its largest faces vertical, its longest dimension parallel with the wall plane, its *ties* on the face of the wall and its *straw* lengths oriented predominantly vertically. See Figure AS102.1.~~

~~**ON-END.** The orientation of a *bale* with its longest dimension vertical. For use in *nonstructural strawbale* walls only. See Figure AS102.1.~~

~~**PIN.** A vertical metal rod, wood dowel or bamboo, driven into the center of stacked *bales*, or placed on opposite surfaces of stacked *bales* and through-tied.~~

~~**PLASTER.** Clay, soil-cement, gypsum, lime, clay-lime, lime-cement or cement plaster, as described in Section AS104.~~

~~**PRECOMPRESSION.** Permanent vertical compression of stacked *bales* before the application of finish.~~

~~**REINFORCED PLASTER.** A *plaster* containing mesh reinforcement.~~

~~ROOF-BEARING ASSEMBLY. **In load-bearing *strawbale* walls, a structural assembly at the top of the wall that bears and distributes roof loads to the wall.**~~

~~**RUNNING BOND.** The placement of *straw bales* such that the head joints in successive courses are offset not less than one-quarter the bale length.~~

~~**SHEAR WALL.** A *strawbale* wall designed and constructed to resist in-plane lateral seismic and wind forces in accordance with Section AS106.13. This term is synonymous with "Braced wall panel."~~

~~**SKIN.** The compilation of *plaster* and reinforcing, if any, applied to the surface of stacked *bales*.~~

~~**STACK BOND.** The placement of *straw bales* such that head joints in successive courses are vertically aligned.~~

~~**STRAW.** The dry stems of cereal grains after the seed heads have been removed.~~

~~**STRAW BALE.** A rectangular compressed block of *straw*, bound by *ties*.~~

~~**STRAWBALE.** The adjective form of *straw bale*.~~

~~**STRAW-CLAY.** Loose *straw* mixed and coated with *clay* slip.~~

~~**STRUCTURAL WALL.** A wall that meets the definition for a *load-bearing* wall or *shear wall*.~~

~~**TIE.** A synthetic fiber, natural fiber or metal wire used to confine a *straw bale*.~~

~~**TRUTH WINDOW.** An area of a *strawbale* wall left without its finish, to allow view of the *straw* otherwise concealed by its finish.~~

~~SECTION AS103~~
~~BALES~~

~~**AS103.1 Shape.** *Bales* shall be rectangular in shape, except for partial bales made to fill nonrectangular spaces in accordance with Section AS103.6.~~

~~**AS103.2 Size.** *Bales* shall have a height and thickness of not less than 12 inches (305 mm), except as otherwise permitted or required in this appendix. *Bales* used within a continuous wall shall be of consistent height and thickness to ensure even distribution of loads within the wall system. See Figure AS103.2 for approximate dimensions of common *straw bales*.~~

~~**AS103.3 Ties.** *Bales* shall be confined by synthetic fiber, natural fiber or metal *ties* sufficient to maintain required *bale* density. *Ties* shall be not less than 3 inches (76 mm) and not more than 6 inches (152 mm) from the two untied faces and shall be spaced not more than 12 inches (305 mm) apart. *Bales* with broken *ties* shall be retied with sufficient tension to maintain required bale density.~~

~~**AS103.4 Moisture content.** The moisture content of *bales* at the time of application of the first coat of *plaster* or the installation of another finish shall not exceed 20 percent of the weight of the *bale*. The moisture content of *bales* shall be determined with a moisture meter designed for use with *baled straw* or hay, equipped with a probe of sufficient length to reach the center of the *bale*. Not less than 5 percent and not fewer than 10 bales shall be randomly selected and tested.~~

~~**AS103.5 Density.** *Bales* shall have a dry density of not less than 6.5 pounds per cubic foot (104 kg/cubic meter). The dry density shall be calculated by subtracting the weight of the moisture in pounds (kg) from the actual *bale* weight and dividing by the volume of the *bale* in cubic feet (cubic meters). Not less than 2 percent and not fewer than five *bales* shall be randomly selected and tested on-site.~~

~~**AS103.6 Partial bales.** Partial *bales* made after original fabrication shall be retied with *ties* complying with Section AS103.3.~~

~~**AS103.7 Types of straw.** *Bales* shall be composed of *straw* from wheat, rice, rye, barley or oat. The dry stems of other cereal grains or similar crops shall be acceptable where *approved* by the *building official*. Bales shall not be composed of hay.~~

~~**AS103.8 Orientation of bales.** Straw bales shall be placed *laid flat*, *on edge* or *on end* in accordance with this appendix.~~

~~SECTION AS104~~
~~FINISHES~~

~~**AS104.1 General.** Finishes applied to *strawbale* walls shall comply with this section and with Chapters 3 and 7 unless stated otherwise in this section.~~

~~**AS104.1.1** Exterior wall finishes. Exterior wall finishes shall be plasters in accordance with Section AS104.4, or nonplaster exterior wall coverings in accordance with Section R703 and other finish systems complying with all of the following:~~

1. ~~*With* approved *specifications and details showing the finish system's means of attachment to the wall or its independent support, and a means of draining or evaporating water that penetrates the exterior finish to the exterior.*~~
2. ~~*The vapor permeance of the combination of finish materials shall be 5 perms or greater to allow the transpiration of water vapor through the wall.*~~
3. ~~*Finish systems with weights greater than 10 or less than or equal to 20 pounds per square foot (> 48.9 and ≤ 97.8 kg/m) of wall area require a factor of 1.2 for minimum total length of braced wall panels in Table AS106.13(3).*~~
4. ~~*Finish systems with weights greater than 20 pounds per square foot (97.8 kg/m) of wall area require an engineered design.*~~

~~AS104.2 Purpose, and where required. *Strawbale* walls shall be finished so as to provide mechanical protection, fire resistance and protection from weather and to restrict the passage of air through the *bales*, in accordance with this appendix and this code. Vertical *strawbale* wall surfaces shall receive a coat of *plaster* not less than $^{3}/_{8}$ inch (10 mm) thick, or greater where required elsewhere in this appendix, or shall fit tightly against a solid wall panel or dense-packed cellulose insulation with a density of not less than 3.5 pounds per cubic foot (56 kg/m^3) blown into an adjacent framed wall. The tops of *strawbale* walls shall receive a coat of *plaster* not less than $^{3}/_{8}$ inch (10 mm) thick or be tightly covered by gypsum board or a roof-bearing assembly.~~

~~Exception: *Truth windows* shall be permitted where a fire-resistance rating is not required. Weather-exposed *truth windows* shall be fitted with a weather-tight cover. Interior truth windows in Climate Zones 5, 6, 7, 8 and Marine 4 shall be fitted with an airtight cover.~~

~~AS104.3 Vapor retarders. Class I and II vapor retarders shall not be used on a *strawbale wall*, nor shall any other material be used that has a vapor permeance rating of less than 5 perms, except as permitted or required elsewhere in this appendix.~~

~~AS104.4 Plaster. *Plaster* applied to *bales* shall be any type described in this section, and as required or limited in this appendix. *Plaster* thickness shall not exceed 2 inches (51 mm).~~

~~AS104.4.1 Plaster and membranes. *Plaster* shall be applied directly to *strawbale* walls to facilitate transpiration of moisture from the *bales*, and to secure a mechanical bond between the *skin* and the *bales*, except where a membrane is allowed or required elsewhere in this appendix.~~

~~AS104.4.2 Lath and mesh for plaster. The surface of the *straw bales* functions as lath, and other lath or *mesh* shall not be required, except as required for out-of-plane resistance by Table AS105.4 or for structural walls by Tables AS106.12 and AS106.13(1).~~

~~AS104.4.3 Clay plaster. *Clay plaster* shall comply with Sections AS104.4.3.1 through AS104.4.3.6.~~

~~AS104.4.3.1 General. *Clay plaster* shall be any plaster having a clay or *clay subsoil* binder. Such plaster shall contain sufficient clay to fully bind the sand or other aggregate, and shall be permitted to contain reinforcing fibers. Acceptable reinforcing fibers include chopped straw, sisal and animal hair.~~

~~AS104.4.3.2 Clay subsoil requirements. The suitability of *clay subsoil* shall be determined in accordance with the Figure 2 Ribbon Test and the Figure 3 Ball Test in the appendix of ASTM E2392/E2392M.~~

~~AS104.4.3.3 Thickness and coats. *Clay plaster* shall be not less than 1 inch (25 mm) thick, except where required to be thicker for structural walls as described elsewhere in this appendix, and shall be applied in not less than two coats.~~

~~AS104.4.3.4 Rain-exposed. *Clay plaster,* where exposed to rain, shall be finished with lime wash, lime plaster, linseed oil or other *approved* erosion-resistant finish.~~

~~AS104.4.3.5 Prohibited finish coat. *Plaster* containing Portland cement shall not be permitted as a finish coat over *clay plasters*.~~

~~AS104.4.3.6 Plaster additives. Additives shall be permitted to increase *plaster* workability, durability, strength or water resistance.~~

~~AS104.4.4 Soil-cement plaster. Soil-cement plaster shall comply with Sections AS104.4.4.1 through AS104.4.4.3.~~

~~AS104.4.4.1 General. Soil-cement *plaster* shall be composed of *clay subsoil*, sand and not less than 10 percent and not more than 20 percent Portland cement by volume, and shall be permitted to contain reinforcing fibers.~~

~~AS104.4.4.2 Lath and mesh. Soil-cement *plaster* shall use any corrosion-resistant lath or *mesh* permitted by this code, or as required in Section AS106 where used on structural walls.~~

~~AS104.4.4.3 Thickness. Soil-cement *plaster* shall be not less than 1 inch (25 mm) thick.~~

~~AS104.4.5 Gypsum plaster. Gypsum *plaster* shall comply with Section R702.2.1. Gypsum *plaster* shall be limited to use on interior surfaces of *nonstructural* walls, and as an interior *finish* coat over a structural *plaster* that complies with this appendix.~~

~~AS104.4.6 Lime plaster. Lime *plaster* shall comply with Sections AS104.4.6.1 through AS104.4.6.3.~~

~~AS104.4.6.1 General. Lime *plaster* is any *plaster* with a binder that is composed of calcium hydroxide (CaOH) including Type N or S hydrated lime, hydraulic lime, natural hydraulic lime or slaked quicklime. Hydrated lime shall comply with ASTM C206. Hydraulic lime shall comply with ASTM C1707. Natural hydraulic lime shall comply with ASTM C141 and CEN EN 459. Quicklime shall comply with ASTM C5.~~

~~AS104.4.6.2 Thickness and coats. Lime *plaster* shall be not less than $^{7}/_{8}$ inch (22 mm) thick, and shall be applied in not less than three coats.~~

~~AS104.4.6.3 On structural walls. Lime *plaster* on *strawbale* structural walls in accordance with Table AS106.12 or AS106.13.1) shall use hydraulic or natural hydraulic lime.~~

~~**AS104.4.7 Clay-lime plaster.** *Clay-lime plaster shall be composed of refined clay or clay subsoil, sand, and lime, and shall be permitted to contain reinforcing fibers.*~~

~~**AS104.4.8** Cement-lime plaster. Cement-lime plaster shall be *plaster* mixes CL, F or FL, as described in ASTM C926.~~

~~**AS104.4.9** Cement plaster. Cement *plaster* shall conform to ASTM C926 and shall comply with Sections R703.7.4 and R703.7.5, except that the amount of lime in plaster coats shall be not less than 1 part lime to 4 parts cement to allow a minimum acceptable vapor permeability. The combined thickness of *plaster* coats shall be not more than $1^{1}/_{2}$ inches (38 mm).~~

~~SECTION AS105~~
~~STRAWBALE WALLS—GENERAL~~

~~AS105.1 General. *Strawbale walls* shall be designed and constructed in accordance with this section and with Figures AS105.1(1) through AS105.1(4) or an *approved* alternative design. *Strawbale structural walls* shall be in accordance with the additional requirements of Section AS106.~~

~~AS105.2 Building limitations and requirements for use of strawbale nonstructural walls. *Buildings* using *strawbale nonstructural walls* shall be subject to the following limitations and requirements:~~

1. ~~Number of stories: not more than one, except that two stories shall be allowed with an *approved* engineered design.~~
2. ~~*Building* height: not more than 25 feet (7620 mm), except that greater heights shall be allowed with an *approved* engineered design.~~
3. ~~Wall height: in accordance with Table AS105.4.~~
4. ~~Braced wall panel lengths: in accordance with Section R602.10.3, with the additional requirements that Table R602.10.3(3) shall apply to all *buildings* in *Seismic Design Category* C, and the minimum total length of braced wall panels in Table R602.10.3(3) shall be increased by 60 percent for *buildings* in *Seismic Design Categories* C,~~ ~~D_0, D_1 and D_2.~~

~~AS105.3 Sill plates. Sill plates shall be installed in accordance with Figure AS105.1(1) or AS105.1(2). Sill plates shall support and be flush with each face of the *straw bales* above and shall be of naturally durable or preservative-treated wood where required by this code. Sill plates shall be not less than nominal 2 inches by 4 inches (51 mm by 102 mm) with anchoring complying with Section R403.1.6 and the additional requirements of Table AS105.4, where applicable, and Sections AS106.13.2 and AS106.13.3 for strawbale braced wall panels.~~

~~AS105.3.1 Exterior sill plate flashing. Exterior sill plates shall receive flashing across the plate to slab or foundation joints.~~

~~AS105.4 Out-of-plane resistance methods and unrestrained wall dimension limits. *Strawbale* walls shall employ a method of out-of-plane load resistance in accordance with Table AS105.4, and comply with its associated limits and requirements.~~

~~AS105.4.1 Determination of out-of-plane loading. Out-of-plane loading for the use of Table AS105.4 shall be in terms of the ultimate design wind speed and seismic design category as determined in accordance with Sections R301.2.1 and R301.2.2. An engineered design in accordance with Section R301.2.1 shall be required where the building is located in a special wind region or where wind design is required in accordance with Figure R301.2(2) and Section R301.2.1.1, respectively.~~

~~AS105.4.2 Pins. *Pins* used for out-of-plane resistance shall comply with the following or shall be in accordance with an *approved* engineered design. *Pins* shall be external, internal or a combination of the two.~~

1. ~~*Pins* shall be~~ ~~$^1/_2$-inch-diameter (12.7 mm) steel,~~ ~~$^3/_4$-inch-diameter (19.1 mm) wood or~~ ~~$^1/_2$-inch-diameter (12.7 mm) bamboo.~~
2. ~~External *pins* shall be installed vertically on both sides of the wall at a spacing of not more than 24 inches (610 mm) on center. External *pins* shall have full lateral bearing on the sill plate and the top plate or roof-bearing element, and shall be tightly tied through the wall to an opposing *pin* with *ties* spaced not more than 32 inches (813 mm) apart and not more than 8 inches (203 mm) from each end of the *pins*.~~
3. ~~Internal *pins* shall be installed vertically within the center third of the *bales*, at spacing of not more than 24 inches (610 mm) and shall extend from top course to bottom course. The bottom course shall be connected to its support and the top course shall be connected to the roof- or floor-bearing member above with *pins* or other *approved* means. Internal *pins* shall be continuous or shall overlap through not less than one *bale* course.~~

~~AS105.5 Connection of light-frame walls to strawbale walls. *Light-frame* walls perpendicular to, or at an angle to a *strawbale* wall assembly, shall be fastened to the bottom and top wood members of the *strawbale* wall in accordance with requirements for wood or cold-formed steel *light-frame* walls in this code, or the abutting stud shall be connected to alternating *strawbale* courses with a~~ ~~$^1/_2$-inch diameter (12.7 mm) steel,~~ ~~$^3/_4$-inch diameter (19.1 mm) wood or~~ ~~$^5/_8$-inch-diameter (15.9 mm) bamboo dowel, with not less than 8-inch (203 mm) penetration.~~

~~AS105.6 Moisture control. *Strawbale* walls shall be protected from moisture intrusion and damage in accordance with Sections AS105.6.1 through AS105.6.9.~~

~~AS105.6.1 Water-resistant barriers and vapor permeance ratings. *Plastered bale* walls shall be constructed without any membrane barrier between *straw* and *plaster* to facilitate transpiration of moisture from the *bales*, and to secure a structural bond between *straw* and *plaster*, except as permitted or required elsewhere in this appendix. Where a water-resistant barrier is placed behind an exterior finish, it shall have a vapor permeance rating of not less than 5 perms, except as permitted or required elsewhere in this appendix.~~

~~AS105.6.2 Vapor retarders. Wall *finishes* shall have an equivalent vapor permeance rating of a Class III vapor retarder on the interior side of exterior *strawbale walls* in Climate Zones 5, 6, 7, 8 and Marine 4, as defined in~~

~~Chapter 11. *Bales* in walls enclosing showers or steam rooms shall be protected on the interior side by a Class I or Class II vapor retarder.~~

~~AS105.6.3 Penetrations in exterior strawbale walls. Penetrations in exterior *strawbale* walls shall be sealed with an *approved* sealant or gasket on the exterior side of the wall in all climate zones, and on the interior side of the wall in Climate Zones 5, 6, 7, 8 and Marine 4, as defined in Chapter 11.~~

~~AS105.6.4 Horizontal surfaces. *Bale* walls and other *bale* elements shall be provided with a water-resistant barrier at weather-exposed horizontal surfaces. The water-resistant barrier shall be of a material and installation that will prevent water from entering the wall system. Horizontal surfaces shall include exterior window sills, sills at exterior niches and buttresses. Horizontal surfaces shall be sloped not less than 1 unit vertical in 12 units horizontal (8-percent slope) and shall drain away from *bale* walls and elements. Where the water-resistant barrier is below the finish material, it shall be sloped not less than 1 unit vertical in 12 units horizontal (8-percent slope) and shall drain to the outside surface of the *bale* wall's vertical finish.~~

~~AS105.6.5 Separation of bales and concrete. A sheet or liquid-applied Class II *vapor retarder* shall be installed between bales and supporting concrete or masonry. The bales shall be separated from the vapor retarder by not less than $^3/_4$ inch (19.1 mm), and that space shall be filled with an insulating material such as wood or rigid insulation, or a material that allows vapor dispersion such as gravel, or other *approved* insulating or vapor dispersion material. Sill plates shall be installed at this interface in accordance with Section AS105.3. Where bales abut a concrete or masonry wall that retains earth, a Class II vapor retarder shall be provided between such wall and the bales.~~

~~AS105.6.6 Separation of bales and earth. *Bales* shall be separated from earth by not less than 8 inches (203 mm).~~

~~AS105.6.7 Separation of exterior plaster and earth. Exterior plaster applied to *straw bales* shall be located not less than 6 inches (102 mm) above earth or 3 inches (51 mm) above paved areas.~~

~~AS105.6.8 Separation of wood and plaster. Where wood framing or wood sheathing occurs at the exterior face of *strawbale* walls, such wood surfaces shall be separated from exterior plaster with two layers of Grade D paper, No. 15 asphalt felt or other *approved* material in accordance with Section R703.7.3, extending not less than 1 inch (25 mm) past the edges of the framing member.~~

~~Exceptions:~~

1. ~~Where the wood is preservative treated or *naturally durable* and is not greater than $1^1/_2$ inches (38 mm) in width.~~
2. ~~Clay plaster shall not be required to be separated from untreated wood that is not greater than $1^1/_2$ inches (38 mm) in width.~~

~~AS105.6.9 Separation of exterior plaster and foundation. Exterior plaster shall be separated from the building foundation with a moisture barrier.~~

~~AS105.7 Inspections. The *building official* shall inspect the following aspects of *strawbale* construction in accordance with Section R109.1:~~

1. ~~Sill plate anchors, as part of and in accordance with Section R109.1.1.~~
2. ~~Mesh placement and attachment, where mesh is required by this appendix.~~
3. ~~*Pins*, where required by and in accordance with Section AS105.4.~~

~~AS105.8 Voids and stuffing. Voids between *bales* and between *bales* and framing members shall not exceed 4 inches (102 mm) in width, and such voids shall be tightly stuffed with *flakes*, loose straw or *straw-clay* before application of finish.~~

~~SECTION AS106~~
~~STRAWBALE WALLS—STRUCTURAL~~

~~AS106.1 General. Plastered *strawbale* walls shall be permitted to be used as structural walls in accordance with the prescriptive provisions of this section.~~

~~AS106.2 Building limitations and requirements for use of strawbale structural walls. *Buildings* using strawbale *structural* walls shall be subject to the following limitations and requirements:~~

1. ~~Number of stories: Not more than one, except that two stories shall be allowed with an *approved* engineered design.~~

2. ~~*Building* height: Not more than 25 feet (7620 mm), except that greater heights shall be allowed with an *approved* engineered design.~~
3. ~~Wall height: In accordance with Table AS105.4, AS106.13(2) or AS106.13(3) as applicable, whichever is most restrictive.~~
4. ~~Braced wall panel lengths: The greater of the values determined in accordance with Tables AS106.13(2) and AS106.13(3) for *buildings* using strawbale braced wall panels, or in accordance with Item 4 of Section AS105.2 for *buildings* with *load-bearing strawbale walls* that do not use *strawbale* braced wall panels.~~

~~AS106.3 Loads and other limitations. Live and dead loads and other limitations shall be in accordance with Section R301. *Strawbale* wall dead loads shall not exceed 60 psf (2872 N/m²) per face area of wall.~~

~~AS106.4 Foundations. Foundations for plastered *strawbale* walls shall be in accordance with Chapter 4, Figure AS105.1(1), Figure AS105.1(2) or an *approved* engineered design.~~

~~AS106.5 **Orientation and** configuration of bales. *Bales* in *strawbale* structural walls shall be laid flat or on-edge and in a *running bond* or *stack bond*, except that bales in structural walls with unreinforced plasters shall be laid in a *running bond* only.~~

~~AS106.6 Plaster on structural walls. Plaster on *load-bearing* walls shall be in accordance with Table AS106.12. Plaster on *shear walls* shall be in accordance with Table AS106.13(1).~~

~~AS106.6.1 Compressive strength. For plaster on *strawbale* structural walls, the *building official* is authorized to require a 2-inch (51mm) cube test conforming to ASTM C109 to demonstrate a minimum compressive strength in accordance with Table AS106.6.1.~~

~~TABLE AS106.6.1~~

~~MINIMUM COMPRESSIVE STRENGTH~~
~~FOR PLASTERS ON STRUCTURAL WALLS~~

~~PLASTER TYPE~~	~~MINIMUM COMPRESSIVE STRENGTH (psi)~~
~~Clay~~	~~100~~
~~Soil-cement~~	~~1,000~~
~~Lime~~	~~600~~
~~Cement-lime~~	~~1,000~~
~~Cement~~	~~1,400~~

~~For SI: 1 pound per square inch = 6894.76 N/m².~~

~~AS106.7 Straightness of plaster. Plaster on *strawbale* structural walls shall be straight, as a function of the bale wall surfaces they are applied to, in accordance with all of the following:~~

1. ~~As measured across the face of a *bale*, *straw* bulges shall not protrude more than ³/₄ inch (19.1 mm) across 2 feet (610 mm) of its height or length.~~
2. ~~As measured across the face of a *bale* wall, *straw* bulges shall not protrude from the vertical plane of a *bale* wall more than 2 inches (51 mm) over 8 feet (2438 mm).~~
3. ~~The vertical faces of adjacent *bales* shall not be offset more than ³/₈ inch (9.5 mm).~~

~~AS106.8 Plaster and membranes **on structural walls**. *Strawbale* structural walls shall not have a membrane between straw and plaster, or shall have attachment through the *bale* wall from one plaster skin to the other in accordance with an *approved* engineered design.~~

~~AS106.9 Mesh. Mesh in plasters on *strawbale* structural walls, and where required by Table AS105.4, and where used to resist wind uplift in accordance with Section AS106.14, shall be installed in accordance with Sections AS106.9.1 through AS106.9.4.~~

~~AS106.9.1 Mesh laps. Mesh required by Table AS105.4 or AS106.12 shall be installed with not less than 4 inch (102 mm) laps. Mesh required by Table AS106.13(1) or in walls designed to resist wind uplift of more than 100 plf (1459 N/m) in accordance with Section AS106.14, shall run continuous vertically from sill plate to the top plate~~

~~or roof-bearing element, or shall lap not less than 8 inches (203 mm). Horizontal laps in such mesh shall be not less than 4 inches (102 mm).~~

~~AS106.9.2 Mesh attachment. Mesh shall be attached with staples to top plates or roof-bearing elements and to sill plates in accordance with all of the following:~~

1. ~~Staples. Staples shall be pneumatically driven, stainless steel or electro-galvanized, 16 gage with $1^{1}/_{2}$-inch (38 mm) legs, $^{7}/_{16}$-inch (11.1 mm) crown; or manually driven, galvanized, 15 gage with 1-inch (25 mm) legs. Other staples shall be as designed by a *registered design professional*. Staples into preservative-treated wood shall be stainless steel.~~
2. ~~Staple orientation. Staples shall be firmly driven diagonally across mesh intersections at the required spacing.~~
3. ~~Staple spacing. Staples shall be spaced not more than 4 inches (102 mm) on center, except where a lesser spacing is required by Table AS106.13(1) or Section AS106.14, as applicable.~~

~~AS106.9.3 Steel mesh. Steel mesh shall be galvanized, and shall be separated from preservative-treated wood by Grade D paper, No. 15 roofing felt or other *approved* barrier.~~

~~AS106.9.4 Mesh in plaster. Required mesh shall be embedded in the plaster except where staples fasten the mesh to horizontal boundary elements.~~

~~AS106.10 Support of plaster skins. Plaster *skins* on *strawbale* structural walls shall be continuously supported along their bottom edge. Acceptable supports include: a concrete or masonry stem wall, a concrete slab-on-grade, a wood-framed floor in accordance with Figure AS105.1(2) and an *approved* engineered design or a steel angle anchored with an *approved* engineered design. A weep screed as described in Section R703.7.2.1 is not an acceptable support.~~

~~AS106.11 Transfer of loads to and from plaster skins. Where plastered *strawbale* walls are used to support superimposed vertical loads, such loads shall be transferred to the plaster *skins* by continuous direct bearing in accordance with Figure AS105.1(3) or by an *approved* engineered design. Where plastered *strawbale* walls are used to resist in-plane lateral loads, such loads shall be transferred to the reinforcing mesh from the structural member or assembly above in accordance with Figure AS105.1(3) or AS105.1(4) and to the sill plate in accordance with Figure AS105.1(1) or AS105.1(2) and with Table AS106.13(1).~~

~~AS106.12 Load-bearing walls. Bearing capacities for plastered *strawbale* walls used as *load-bearing walls* in one-*story buildings* to support vertical loads imposed in accordance with Section R301 shall be in accordance with Table AS106.12.~~

~~AS106.12.1 Precompression of load-bearing strawbale walls. Prior to application of plaster, walls designed to be load-bearing shall be precompressed by a uniform load of not less than 100 plf (1459 N/m).~~

~~AS106.12.2 Concentrated loads. Concentrated loads shall be distributed by structural elements capable of distributing the loads to the bearing wall within the allowable bearing capacity listed in Table AS106.12 for the plaster type used.~~

~~AS106.12.3 Roof bearing assembly. Roof bearing assemblies shall be of nominal 2-inch by 6-inch (51 mm by 152 mm) lumber with $^{15}/_{32}$-inch (12 mm) plywood or OSB panels fastened with 8d nails at 6 inches (152 mm) on center in accordance with Figure AS105.1(3) and Items 1 through 6, or be of an *approved* engineered design.~~

1. ~~Assembly shall be a box assembly on the top course of *bales*, with the panels horizontal.~~
2. ~~Assembly shall be the width of the *strawbale* wall and shall comply with Section AS106.11.~~
3. ~~Discontinuous lumber shall be spliced with a metal strap with not less than a 500-pound (2224 N) allowable wind or seismic load tension capacity. Where the wall line includes a braced wall panel the strap shall have not less than a 2,000-pound (8896 N) capacity.~~
4. ~~Panel joints shall be blocked.~~
5. ~~Roof and ceiling framing shall be attached to the roof-bearing assembly in accordance with Table R602.3(1), Items 2 and 6.~~
6. ~~Where the roof-bearing assembly spans wall openings, it shall comply with Section AS106.12.3.1~~

~~AS106.12.3.1 Roof-bearing assembly spanning openings. Roof-bearing assemblies that span openings in *strawbale* walls shall comply with the following at each opening:~~

1. ~~Lumber on each side of the assembly shall be of the dimensions and quantity required to span each opening in accordance with Table R602.7(1).~~

~~2. The required lumber in the assembly shall be supported at each side of the opening by the number of jack studs required by Table R602.7(1), or shall extend beyond the opening on both sides a distance, D, using the following equation:~~

~~$D = S \times R/2 / (1-R)$~~ ~~**(Equation AS-1)**~~

~~where:~~

~~D = Minimum distance (in feet) for required spanning lumber to extend beyond the opening~~

~~S = Span in feet~~

~~R = B_L/B_C~~

~~B_L = Design load on the wall (in pounds per lineal foot) in accordance with Sections R301.4 and R301.6~~

~~B_C = Allowable bearing capacity of the wall in accordance with Table AS106.12~~

~~AS106.13 Braced wall panels. Plastered *strawbale* walls used as braced wall panels for one-story *buildings* shall be in accordance with Section R602.10 and Tables AS106.13(1), AS106.13(2) and AS106.13(3). Wind design criteria shall be in accordance with Section R301.2.1. Seismic design criteria shall be in accordance with Section R301.2.2. An *approved* engineered design in accordance with Section R301.2.1 shall be required where the building is located in a special wind region or where wind design is required in accordance with Figure R301.2(2) and Section R301.2.1.1, respectively.~~

~~AS106.13.1 Bale wall thickness. The thickness of *strawbale* braced wall panels without their plaster shall be not less than 15 inches (381 mm).~~

~~AS106.13.2 Sill plates. Sill plates shall be in accordance with Table AS106.13(1).~~

~~AS106.13.3 Sill plate fasteners. Sill plates shall be fastened with not less than $^5/_8$-inch-diameter (15.9 mm) steel anchor bolts with 3-inch by 3-inch by $^3/_{16}$-inch (76.2 mm by 76.2 mm by 4.8 mm) steel washers, with not less than 7-inch (177.8 mm) embedment in a concrete or masonry foundation, or shall be an *approved* equivalent, with the spacing shown in Table AS106.13(1). Anchor bolts or other fasteners into framed floors shall be of an *approved* engineered design.~~

~~AS106.14 Resistance to wind uplift forces. Plaster mesh in *skins* of *strawbale walls* that resist uplift forces from the *roof assembly*, as determined in accordance with Section R802.11, shall be in accordance with all of the following:~~

1. ~~Plaster shall be any type and thickness allowed in Section AS104.~~
2. ~~Mesh shall be any type allowed in Table AS106.13(1), and shall be attached to top plates or roof-bearing elements and to sill plates in accordance with Section AS106.9.2.~~
3. ~~Sill plates shall be not less than nominal 2-inch by 4-inch (51 mm by 102 mm) with anchoring complying with Section R403.1.6.~~
4. ~~Mesh attached with staples at 4 inches (51 mm) on center shall be considered to be capable of resisting uplift forces of 100 plf (1459 N/m) for each plaster skin.~~
5. ~~Mesh attached with staples at 2 inches (51 mm) on center shall be considered to be capable of resisting uplift forces of 200 plf (2918 N/m) for each plaster skin.~~

~~AS106.15 Post-and-beam with strawbale infill. Post-and-beam with *strawbale* infill systems shall be in accordance with Figure AS105.1(4) and Items 1 through 7, or be of an *approved* engineered design.~~

1. ~~Beams shall be of the dimensions and number of members in accordance with Table R602.7(1), where the space between posts equals the span in the table.~~
2. ~~Beam ends shall bear over posts not less than $1^1/_2$ inches (38 mm) or be supported by a framing anchor in accordance with Table R602.7(1).~~
3. ~~Discontinuous beam ends shall be spliced with a metal strap with not less than 1,000-pound (454 kg) wind or seismic load tension capacity. Where the wall line includes a braced wall panel, the strap shall have not less than a 4,000-pound (1814 kg) capacity.~~
4. ~~Each post shall equal NJ + 1 in accordance with Table R602.7(1), where the space between posts equals the span in the table.~~
5. ~~Posts shall be connected to the beam by an *approved* means.~~
6. ~~Roof and ceiling framing shall be attached to the beam in accordance with Table R602.3(1), Items 2 and 6.~~

7. ~~Posts shall be supported by the sill plate of the bale wall in accordance with Section AS105.3 or AS106.13.2, with fastening in accordance with Table R602.3(1), Item 16, or shall be supported and fastened at their base by an *approved* means.~~

~~SECTION AS107~~
~~FIRE RESISTANCE~~

~~AS107.1 Fire-resistance rating. *Strawbale* walls shall not be considered to exhibit a fire-resistance rating, except for walls constructed in accordance with Section AS107.1.1 or AS107.1.2. Alternately, fire-resistance ratings of strawbale walls shall be determined in accordance with Section R302.~~

~~AS107.1.1 One-hour rated clay plastered wall. One-hour fire-resistance-rated nonload-bearing clay plastered *strawbale* walls shall comply with all of the following:~~

1. ~~*Bales* shall be laid flat or on-edge in a *running bond*.~~
2. ~~*Bales* shall maintain thickness of not less than 18 inches (457 mm).~~
3. ~~*Bales* shall have a minimum dry density of 7.25 pounds per cubic foot (116 kg/m^3).~~
4. ~~Gaps shall be stuffed with *straw-clay*.~~
5. ~~*Clay* plaster on each side of the wall shall be not less than 1 inch (25 mm) thick and shall be composed of a mixture of 3 parts clay, 2 parts chopped straw and 6 parts sand, or an alternative *approved clay* plaster.~~
6. ~~Plaster application shall be in accordance with Section AS104.4.3.3 for the number and thickness of coats.~~

~~AS107.1.2 Two-hour rated cement plastered wall. Two-hour fire-resistance-rated nonload-bearing cement-plastered strawbale walls shall comply with all of the following:~~

1. ~~Bales shall be laid flat or on-edge in a *running bond*.~~
2. ~~Bales shall maintain a thickness of not less than 14 inches (356 mm).~~
3. ~~*Bales* shall have a minimum dry density of 7.25 pounds per cubic foot (116 kg/m^3).~~
4. ~~Gaps shall be stuffed with *straw-clay*.~~
5. ~~A single section of $^1/_2$-inch (38 mm) by 17-gage galvanized woven wire mesh shall be attached to wood members with $1^1/_2$-inch (38 mm) staples at 6 inches (152 mm) on center. 9 gage U-pins with not less than 8-inch (203 mm) legs shall be installed at 18 inches (457 mm) on center to fasten the mesh to the *bales*.~~
6. ~~Cement plaster on each side of the wall shall be not less than 1 inch (25 mm) thick.~~
7. ~~Plaster application shall be in accordance with Section AS104.4.9 for the number and thickness of coats.~~

~~AS107.2 Openings in rated walls. Openings and penetrations in *bale* walls required to have a fire-resistance rating shall satisfy the same requirements for openings and penetrations as prescribed in this code.~~

~~AS107.3 Clearance to fireplaces and chimneys. *Strawbale* surfaces adjacent to fireplaces or chimneys shall be finished with not less than $^3/_8$-inch-thick (10 mm) plaster of any type permitted by this appendix. Clearance from the face of such plaster to fireplaces and chimneys shall be maintained as required from fireplaces and chimneys to combustibles in Chapter 10, or as required by manufacturer's instructions, whichever is more restrictive.~~

~~SECTION AS108~~
~~THERMAL INSULATION~~

~~AS108.1 R-value. The unit *R*-value of a *strawbale* wall with bales laid flat is R-1.55 for each inch of *bale* thickness. The unit *R*-value of a *strawbale* wall with *bales* on-edge is R-1.85 for each inch of *bale* thickness.~~

~~AS108.2 Compliance with Section R302.10.1. *Straw bales* meet the requirements for insulation materials in Section R302.10.1 for flame spread index and *smoke-developed index* as tested in accordance with ASTM E84.~~

~~SECTION AS109~~
~~REFERENCED STANDARDS~~

~~AS109.1 General. See Table AS109.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, the standard title and the section or sections of this appendix that reference the standard.~~

~~TABLE AS109.1~~

~~REFERENCED STANDARDS~~

~~STANDARD ACRONYM~~	~~STANDARD NAME~~	~~SECTIONS HEREIN REFERENCED~~
~~ASTM C5—10~~	~~Standard Specification for Quicklime for Structural Purposes~~	~~AS104.4.6.1~~
~~ASTM C109/C109M—2015el~~	~~*Standard Test Method for Compressive Strength of Hydraulic Cement Mortars*~~	~~AS106.6.1~~
~~ASTM C141/C141M—14~~	~~*Standard Specification for Hydrated Hydraulic Lime for Structural Purposes*~~	~~AS104.4.6.1~~
~~ASTM C206—14~~	~~*Standard Specification for Finishing Hydrated Lime*~~	~~AS104.4.6.1~~
~~ASTM C926—15B~~	~~*Standard Specification for Application of Portland Cement Based Plaster*~~	~~AS104.4.8, AS104.4.9~~
~~ASTM C1707—11~~	~~*Standard Specification for Pozzolanic Hydraulic Lime for Structural Purposes*~~	~~AS104.4.6.1~~
~~ASTM E2392/ASTM E2392M—10~~	~~*Standard Guide for Design of Earthen Wall Building Systems*~~	~~AS104.4.3.2~~
~~CEN EN 459—2015~~	~~*Part 1: Building Lime. Definitions, Specifications and Conformity Criteria; Part 2: Test Methods*~~	~~AS104.4.6.1~~

~~TABLE AS105.4~~

~~OUT-OF-PLANE RESISTANCE METHODS AND UNRESTRAINED WALL DIMENSION LIMITS~~

~~METHOD OF OUT-OF-PLANE LOAD RESISTANCE~~[a]	~~FOR ULTIMATE DESIGN WIND SPEEDS (mph)~~	~~FOR SEISMIC DESIGN CATEGORIES~~	~~UNRESTRAINED WALL DIMENSIONS, H~~[b]		~~MESH STAPLE SPACING AT BOUNDARY RESTRAINTS~~
			~~Absolute limit in feet~~	~~Limit based on bale thickness T~~[c] ~~in feet (mm)~~	
~~Nonplaster finish or unreinforced plaster~~	~~≤ 130~~	~~A, B, C, D_0~~	~~$H \leq 8$~~	~~$H \leq 5T$~~	~~None required~~

~~Pins per Section AS105.4.2~~	~~≤ 130~~	~~A, B, C, D_0~~	~~$H \le 12$~~	~~$H \le 8T$~~	~~None required~~
~~Pins per Section AS105.4.2~~	~~≤ 140~~	~~A, B, C, D_0, D_1, D_2~~	~~$H \le 10$~~	~~$H \le 7T$~~	~~None required~~
~~Reinforced[d] clay plaster~~	~~≤ 140~~	~~A, B, C, D_0, D_1, D_2~~	~~$H \le 10$~~	~~$H \le 8T^{0.5}$ ($H \le 140T^{0.5}$)~~	~~≤ 6 inches~~
~~Reinforced[d] clay plaster~~	~~≤ 140~~	~~A, B, C, D_0, D_1, D_2~~	~~$10 < H \le 12$~~	~~$H \le 8T^{0.5}$ ($H \le 140T^{0.5}$)~~	~~≤ 4 inches[e]~~
~~Reinforced[d] cement, cement-lime, lime or soil-cement plaster~~	~~≤ 140~~	~~A, B, C, D_0, D_1, D_2~~	~~$H \le 10$~~	~~$H \le 9T^{0.5}$ ($H \le 157T^{0.5}$)~~	~~≤ 6 inches~~
~~Reinforced[d] cement, cement-lime, lime or soil-cement plaster~~	~~≤ 155~~	~~A, B, C, D_0, D_1, D_2~~	~~$H \le 12$~~	~~$H \le 9T^{0.5}$ ($H \le 157T^{0.5}$)~~	~~≤ 4 inches[e]~~
~~2×6 load-bearing wood studs[f] at max. 6′ o.c.~~	~~≤ 140~~	~~A, B, C, D_0, D_1, D_2~~	~~$H^g \le 9$~~	~~NA~~	~~None required~~
~~2×6 load-bearing wood studs[f] at max. 4′ o.c.~~	~~≤ 140~~	~~A, B, C, D_0, D_1, D_2~~	~~$H^g \le 10$~~	~~NA~~	~~None required~~
~~2×6 load-bearing wood studs[f] at max. 2′ o.c.~~	~~≤ 140~~	~~A, B, C, D_0, D_1, D_2~~	~~$H^g \le 12$~~	~~NA~~	~~None required~~
~~2×4 load-bearing wood studs[f] at max. 2′ o.c.~~	~~≤ 140~~	~~A, B, C, D_0, D_1, D_2~~	~~$H^g \le 10$~~	~~NA~~	~~None required~~
~~2×6 nonload-bearing wood studs[f] at max. 6′ o.c.~~	~~≤ 140~~	~~A, B, C, D_0, D_1, D_2~~	~~$H^g \le 12$~~	~~NA~~	~~None required~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s.~~

~~NA = Not Applicable.~~

~~a. Finishes applied to both sides of stacked bales. Where different finishes are used on opposite sides of a wall, the more restrictive requirements shall apply.~~

~~b. *H* = Stacked bale height in feet (mm) between sill plate and top plate or other approved horizontal restraint, or the horizontal distance in feet (mm) between *approved* vertical restraints. For load-bearing walls, *H* refers to vertical height only.~~

~~c. *T* = Bale thickness in feet (mm).~~

~~d. Plaster reinforcement shall be any mesh allowed in Table AS106.13(1) for the matching plaster type, and with staple spacing in accordance with this table. Mesh shall be installed in accordance with Section AS106.9.~~

~~e. Sill plate attachment shall be with $^5/_8$-inch anchor bolts or approved equivalent at not more than 48 inches on center where staple spacing is required to be ≤ 4 inches.~~

~~f. Bales shall be attached to the studs by an approved method. Horizontal framing and attachment at top and bottom of studs shall be in accordance with Section R602 or an approved alternative. Table R602.7(1) shall be used to determine the top framing member where load-bearing stud spacing exceeds 24 inches o.c.~~

~~g. *H* is vertical height only.~~

~~TABLE AS106.13(3)~~

~~BRACING REQUIREMENTS FOR STRAWBALE BRACED WALL PANELS BASED ON SEISMIC DESIGN CATEGORY~~

~~• SOIL CLASS D~~[f] ~~• WALL HEIGHT = 10 FEET~~[d] ~~• 15 PSF ROOF-CEILING DEAD LOAD~~[d] ~~• BRACED WALL LINE SPACING ≤ 25 FEET~~[d]			~~MINIMUM TOTAL LENGTH (FEET) OF STRAWBALE BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE~~[a, b, c, d]	
~~Seismic Design Category~~	~~Story location~~	~~Braced wall line length (feet)~~	~~Strawbale braced wall panel~~[e] ~~A2,~~ A3~~*g*,~~ ~~C1, C2, D1~~	~~Strawbale braced wall panel~~[e] ~~B, D2, E1, E2~~
~~C~~	~~One-story building~~	~~10~~	~~5.7~~	~~4.6~~
		~~20~~	~~8.0~~	~~6.5~~
		~~30~~	~~9.8~~	~~7.9~~

		~~40~~	~~12.9~~	~~9.1~~
		~~50~~	~~16.1~~	~~10.4~~
~~D_0~~	~~One-story building~~	~~10~~	~~6.0~~	~~4.8~~
		~~20~~	~~8.5~~	~~6.8~~
		~~30~~	~~10.9~~	~~8.4~~
		~~40~~	~~14.5~~	~~9.7~~
		~~50~~	~~18.1~~	~~11.7~~
~~D_1~~	~~One-story building~~	~~10~~	~~6.3~~	~~5.1~~
		~~20~~	~~9.0~~	~~7.2~~
		~~30~~	~~12.1~~	~~8.8~~
		~~40~~	~~16.1~~	~~10.4~~
		~~50~~	~~20.1~~	~~13.0~~
~~D_2~~	~~One-story building~~	~~10~~	~~7.1~~	~~5.7~~
		~~20~~	~~10.1~~	~~8.1~~
		~~30~~	~~15.1~~	~~9.9~~
		~~40~~	~~20.1~~	~~13.0~~
		~~50~~	~~25.1~~	~~16.3~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound per square foot = 0.0479 kPa.~~

~~a. Linear interpolation shall be permitted.~~

~~b. Braced wall panels shall be without openings and shall have an aspect ratio (H:L) ≤ 2:1.~~

~~c. Tabulated minimum total lengths are for braced wall lines using single braced wall panels with an aspect ratio (H:L) ≤ 2:1, or using multiple braced wall panels with aspect ratios (H:L) ≤ 1:1. For braced wall lines using two or more braced wall panels with an aspect ratio (H:L) > 1:1, the minimum total length shall be multiplied by the largest aspect ratio (H:L) of braced wall panels in that line.~~

~~d. Subject to applicable seismic adjustment factors associated with "All methods" in Table R602.10.3(4), except "Wall dead load."~~

~~e. Strawbale braced wall panel types indicated shall comply with Sections AS106.13.1 through AS106.13.3 and Table AS106.13(1).~~

~~f. Wall bracing lengths are based on a soil site class "D." Interpolation of bracing lengths between S_{ds} values associated with the seismic design categories is allowable where a site-specific S_{ds} value is determined in accordance with Section 1613.3 of the *International Building Code*.~~

~~g. Where using wall Type A3, the minimum total length of braced wall panels in this column shall be multiplied by 1.25.~~

~~TABLE AS106.12~~

~~ALLOWABLE SUPERIMPOSED VERTICAL LOADS (LBS/FOOT) FOR PLASTERED LOAD-BEARING STRAWBALE WALLS~~

~~WALL DESIGNATION~~	~~PLASTER[a] (both sides) Minimum thickness in inches each side~~	~~MESH[b]~~	~~STAPLES[c]~~	~~ALLOWABLE BEARING CAPACITY[d] (plf)~~
~~A~~	~~Clay 1½~~	~~None required~~	~~None required~~	~~400~~

~~B~~	~~Soil-cement 1~~	~~Required~~	~~Required~~	~~800~~
~~C~~	~~Limee 7/8~~	~~Required~~	~~Required~~	~~500~~
~~D~~	~~Cement-lime 7/8~~	~~Required~~	~~Required~~	~~800~~
~~E~~	~~Cement 7/8~~	~~Required~~	~~Required~~	~~800~~

~~For SI: 1 inch = 25.4 mm, 1 pound per foot = 14.5939 N/m.~~

~~a. Plasters shall conform to Sections AS104.4.3 through AS104.4.9, AS106.7 and AS106.10.~~

~~b. Any metal mesh allowed by this appendix and installed in accordance with Section AS106.9.~~

~~c. In accordance with Section AS106.9.2, except as required to transfer roof loads to the plaster skins in accordance with Section AS106.11.~~

~~d. For walls with a different plaster on each side, the lower value shall be used. For walls with plaster on only one side, half of the tabular value shall be used.~~

~~e. Shall use hydraulic or natural hydraulic lime.~~

~~TABLE AS106.13(1)~~
~~PLASTERED STRAWBALE BRACED WALL PANEL TYPES~~

~~WALL DESIGNATION~~	~~PLASTER[a] (both sides)~~		~~SILL PLATES[b] (nominal size in inches)~~	~~ANCHOR BOLT[c] SPACING (inches on center)~~	~~MESH[d] (inches)~~	~~STAPLE SPACING[e] (inches on center)~~
	~~Type~~	~~Thickness (minimum in inches each side)~~				
~~A1~~	~~Clay~~	~~1.5~~	~~2 × 4~~	~~32~~	~~None~~	~~None~~
~~A2~~	~~Clay~~	~~1.5~~	~~2 × 4~~	~~32~~	~~2 × 2 high-density polypropylene~~	~~2~~
~~A3~~	~~Clay~~	~~1.5~~	~~2 × 4~~	~~32~~	~~2 × 2 × 14 gage~~	4
~~B~~	~~Soil-cement~~	~~1~~	~~4 × 4~~	~~24~~	~~2 × 2 × 14 gage~~	~~2~~
~~C1~~	~~Limef~~	~~7/8~~	~~2 × 4~~	~~32~~	~~17 gage woven wire~~	~~3~~
~~C2~~	~~Limef~~	~~7/8~~	~~4 × 4~~	~~24~~	~~2 × 2 × 14 gage~~	~~2~~
~~D1~~	~~Cement-lime~~	~~7/8~~	~~4 × 4~~	~~32~~	~~17 gage woven wire~~	~~2~~
~~D2~~	~~Cement-lime~~	~~7/8~~	~~4 × 4~~	~~24~~	~~2 × 2 × 14 gage~~	~~2~~
~~E1~~	~~Cement~~	~~7/8~~	~~4 × 4~~	~~32~~	~~2 × 2 × 14 gage~~	~~2~~
~~E2~~	~~Cement~~	~~1.5~~	~~4 × 4~~	~~24~~	~~2 × 2 × 14 gage~~	~~2~~

~~For SI: 1 inch = 25.4 mm.~~

~~a. Plasters shall comply with Sections AS104.4.3 through AS104.4.9, AS106.7, AS106.8 and AS106.12.~~

~~b. Sill plates shall be Douglas fir-larch or southern pine and shall be preservative treated where required by the *International Residential Code*.~~

~~c. Anchor bolts shall be in accordance with Section AS106.13.3 at the spacing shown in this table.~~

~~d. Installed in accordance with Section AS106.9.~~

~~e. Staples shall be in accordance with Section AS106.9.2 at the spacing shown in this table.~~

~~f. Shall use hydraulic or natural hydraulic lime.~~

~~TABLE AS106.13(2)~~
~~BRACING REQUIREMENTS FOR STRAWBALE BRACED WALL PANELS BASED ON WIND SPEED~~

~~• EXPOSURE CATEGORY B[d]~~ ~~• 25-FOOT MEAN ROOF HEIGHT~~ ~~• 10-FOOT EAVE-TO-RIDGE HEIGHT[d]~~ ~~• 10-FOOT WALL HEIGHT[d]~~ ~~• 2 BRACED WALL LINES[d]~~	~~MINIMUM TOTAL LENGTH (FEET) OF STRAWBALE BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE[a, b, c, d]~~

~~Ultimate design windspeed (mph)~~	~~Story location~~	~~Braced wall line spacing (feet)~~	~~Strawbale braced wall panel[e] A2, A3~~	~~Strawbale braced wall panel[e] C1, C2, D1~~	~~Strawbale braced wall panel[e] B, D2, E1, E2~~
~~≤ 110~~	~~One-story building~~	~~10~~	~~6.4~~	~~3.8~~	~~3.0~~
		~~20~~	~~8.5~~	~~5.1~~	~~4.0~~
		~~30~~	~~10.2~~	~~6.1~~	~~4.8~~
		~~40~~	~~13.3~~	~~6.9~~	~~5.5~~
		~~50~~	~~16.3~~	~~7.7~~	~~6.1~~
		~~60~~	~~19.4~~	~~8.3~~	~~6.6~~
~~≤ 115~~	~~One-story building~~	~~10~~	~~6.4~~	~~3.8~~	~~3.0~~
		~~20~~	~~8.5~~	~~5.1~~	~~4.0~~
		~~30~~	~~11.2~~	~~6.4~~	~~5.1~~
		~~40~~	~~14.3~~	~~7.2~~	~~5.7~~
		~~50~~	~~18.4~~	~~8.1~~	~~6.5~~
		~~60~~	~~21.4~~	~~8.8~~	~~7.0~~
~~≤ 120~~	~~One-story building~~	~~10~~	~~7.1~~	~~4.3~~	~~3.4~~
		~~20~~	~~9.0~~	~~5.4~~	~~4.3~~
		~~30~~	~~12.2~~	~~6.6~~	~~5.3~~
		~~40~~	~~16.3~~	~~7.7~~	~~6.1~~
		~~50~~	~~19.4~~	~~8.3~~	~~6.6~~
		~~60~~	~~23.5~~	~~9.2~~	~~7.3~~
~~≤ 130~~	~~One-story building~~	~~10~~	~~7.1~~	~~4.3~~	~~3.4~~
		~~20~~	~~10.2~~	~~6.1~~	~~4.8~~
		~~30~~	~~14.3~~	~~7.2~~	~~5.7~~
		~~40~~	~~18.4~~	~~8.1~~	~~6.5~~
		~~50~~	~~22.4~~	~~9.0~~	~~7.1~~
		~~60~~	~~26.5~~	~~9.8~~	~~7.8~~
~~≤ 140~~	~~One-story building~~	~~10~~	~~7.8~~	~~4.7~~	~~3.7~~
		~~20~~	~~11.2~~	~~6.4~~	~~5.1~~
		~~30~~	~~16.3~~	~~7.7~~	~~6.1~~
		~~40~~	~~21.4~~	~~8.8~~	~~7.0~~
		~~50~~	~~26.5~~	~~9.8~~	~~7.8~~
		~~60~~	~~30.6~~	~~11.0~~	~~8.3~~

~~For SI: 1 foot = 305 mm, 1 mile per hour = 0.447 m/s.~~
~~a. Linear interpolation shall be permitted.~~
~~b. All braced wall panels shall be without openings and shall have an aspect ratio (H:L) ≤ 2:1.~~

c. ~~Tabulated minimum total lengths are for braced wall lines using single-braced wall panels with an aspect ratio (H:L) ≤ 2:1, or using multiple braced wall panels with aspect ratios (H:L) ≤ 1:1. For braced wall lines using two or more braced wall panels with an aspect ratio (H:L) > 1:1, the minimum total length shall be multiplied by the largest aspect ratio (H:L) of braced wall panels in that line.~~

d. ~~Subject to applicable wind adjustment factors associated with "All methods" in Table AS106.13(2)~~

e. ~~Strawbale braced panel types indicated shall comply with Sections AS106.13.1 through AS106.13.3 and with Table AS106.13(1).~~

APPENDIX AT [RE]

SOLAR-READY PROVISIONS—DETACHED ONE- AND TWO-FAMILY DWELLINGS AND TOWNHOUSES

The provisions contained in this appendix are ~~not mandatory unless specifically referenced in the adopting ordinance~~. adopted as part of this code.

~~**User note:**~~

~~***About this appendix:** Harnessing the heat or radiation from the sun's rays is a method to reduce the energy consumption of a building. Although Appendix AT does not require solar systems to be installed for a building, it does require the space(s) for installing such systems, providing pathways for connections and requiring adequate structural capacity of roof systems to support solar systems.*~~

~~Section numbers in parenthesis are those in Appendix RB of the residential provisions of the International Energy Conservation Code®.~~

APPENDIX AU

COB CONSTRUCTION (MONOLITHIC ADOBE)

DELETED.

~~*This appendix is informative and is not part of the code.*~~

~~**User note:**~~

~~***About this appendix:** Cob construction has been used for thousands of years around the world, notably in England and Northern Europe, the Middle East, West Africa, China and the Southwestern United States. An estimated 20,000 cob homes are still inhabited in the English county of Devon alone, some dating from the 15th century. The term "cob" derives from an Old English word for "lump," since historical structures were often constructed one handful at a time.*~~

~~SECTION AU101~~
~~GENERAL~~

~~**AU101.1 Scope.** This appendix provides prescriptive and performance-based requirements for the use of *natural cob* as a building material. Buildings using *cob* walls shall comply with this code except as otherwise stated in this appendix.~~

~~**AU101.2 Intent.** In addition to the intent described in Section R101.3, the purpose of this appendix is to establish minimum requirements for cob structures that provide flexibility in the application of certain provisions of the code, to permit the use of site-sourced and local materials, and to permit combinations of historical and modern techniques.~~

~~**AU101.3 Tests and empirical evidence.** Tests for an alternative material, design or method of construction shall be in accordance with Section R104.11.1, and the *building official* shall have the authority to consider evidence of a history of successful use in lieu of testing.~~

~~**AU101.4 Cob wall systems.** *Cob* wall systems include those shown in Figure AU101.4 and *approved* variations.~~

~~**AU101.5 Definitions.** The words and terms in Section AU102 shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 for general definitions.~~

~~SECTION AU102~~
~~DEFINITIONS~~

~~**BRACED WALL PANEL.** A *cob* wall designed and constructed to resist in-plane shear loads through the interaction of the cob material, its reinforcing and its connections to its bond beam and foundation. The panel's length meets the requirements for the particular wall type and contributes toward the total amount of bracing required along its braced wall line in accordance with Sections AU106.11 and R602.10.1.~~

~~**BUTTRESS.** A mass set at an angle to or bonded to a wall that it strengthens or supports.~~

~~**CLAY.** Inorganic soil with particle sizes less than 0.00008 inch (0.002 mm) and having the characteristics of high to very high dry strength and medium to high plasticity, used as the binder of other component materials in a mix of *cob* or of clay plaster.~~

~~**CLAY SUBSOIL.** Subsoil sourced directly from the earth, containing clay, sand and silt, and containing not more than trace amounts of organic matter.~~

~~**COB.** A composite building material consisting of refined *clay* or *clay subsoil* wet-mixed with loose straw and sometimes sand. Also known as "*Monolithic adobe*."~~

~~**COB CONSTRUCTION.** A wall system of layers or lifts of moist *cob* placed to create monolithic walls, typically without formwork.~~

~~**DRY JOINT.** The boundary between a layer of moist *cob* and a previously laid and significantly drier, nonmalleable layer of *cob* that requires wetting to achieve bonding between the layers.~~

~~**FINISH.** Completed combination of materials on the face of a *cob* wall.~~

~~**LIFT.** A layer of installed *cob*.~~

~~**LOAD-BEARING WALL.** A *cob* wall that supports more than 100 pounds per linear foot (1459 N/m) of vertical load in addition to its own weight.~~

~~**MONOLITHIC ADOBE.** See "*Cob*."~~

~~**NATURAL COB.** *Cob* not containing admixtures such as Portland cement, lime, asphalt emulsion or oil. Synonymous with "*Unstabilized cob*."~~

~~**NONSTRUCTURAL WALL.** Walls other than *load-bearing walls* or *shear walls*.~~

~~**PLASTER.** Clay, soil-cement, gypsum, lime, clay-lime, cement-lime or cement plaster as described in Section AU104.~~

~~**SHEAR WALL.** A *cob* wall designed and constructed to resist in-plane lateral seismic and wind forces in accordance with Section AU106.11. Synonymous with "*Braced wall panel*."~~

~~**STABILIZED.** *Cob* or other earthen material containing admixtures, such as Portland cement, lime, asphalt emulsion or oil, that are intended to help limit water absorption, stabilize volume, increase strength and increase durability.~~

~~**STRAW.** The dry stems of cereal grains after the seed heads have been removed.~~

~~**STRUCTURAL WALL.** A wall that meets the definition for a "*Load-bearing wall*" or "*Shear wall*."~~

~~**UNSTABILIZED.** A *cob* or other earthen material that does not contain admixtures such as Portland cement, lime, asphalt emulsion or oil.~~

~~**UNSTABILIZED COB.** See "*Natural cob*."~~

~~SECTION AU103~~
~~MATERIALS, MIXING AND INSTALLATION~~

~~**AU103.1 Clay subsoil.** *Clay subsoil* for a *cob* mix shall be acceptable if the mix it produces meets the requirements of Section AU103.4.~~

~~**AU103.2 Sand.** Sand or other aggregates such as, but not limited to, gravel, pumice and lava rock, when added to *cob* mixes, shall yield a mix that meets the requirements of Section AU103.4.~~

~~**AU103.3 Straw.** *Straw* for *cob* mixes shall be from wheat, rice, rye, barley or oat, or similar reinforcing fibers with similar performance. Before mixing, the straw or other reinforcing fibers shall be dry to the touch and free of visible decay.~~

~~**AU103.4 Mix proportions.** *Cob* mixes shall be of any proportions of refined *clay* or *clay subsoil*, added sand (if any) and straw that produce a dried mix that passes the shrinkage test in accordance with Section AU103.4.1, complies with the compressive strength requirements of Section AU106.6 and complies with the modulus of rupture requirements of Section AU106.7.~~

~~**AU103.4.1 Shrinkage test for cob mixes.** Each proposed *cob* mix of different mix proportions shall be placed moist to completely fill a 24-inch by $3^{1}/_{2}$-inch by $3^{1}/_{2}$-inch (610 mm by 89 mm by 89 mm) wooden form on a plastic or paper slip sheet and dried to ambient moisture conditions, or oven dried. The total shrinkage of the length shall not exceed 1 inch (25 mm), as measured from the dried edges of the material to the insides of the form. Cracks in the sample greater than $^{1}/_{16}$-inch (1.5 mm) shall first be closed manually. The shrinkage test shall be shown to the building official for approval before placement of the *cob* mix onto walls~~

~~**AU103.5 Mixing.** The *clay subsoil*, sand and straw for *cob* shall be thoroughly mixed by manual or mechanical means with water sufficient to produce a mix of a plastic consistency capable of bonding of successively placed layers or *lifts*.~~

~~**AU103.6 Installation.** *Cob* shall be installed on the wall in *lifts* of a height that supports itself with minimal slumping.~~

~~**AU103.7 Dry joints.** Each layer of *cob* shall be prevented from drying until the next layer is installed, to ensure bonding of successive layers. The top of each layer shall be kept moist and malleable with one or more of the following methods:~~

1. ~~Covering with a material that prevents loss of or holds moisture.~~
2. ~~Covering with a material that shades it from direct sun.~~
3. ~~Wetting.~~

~~Where *dry joints* are unavoidable, the previous layer shall be wetted prior to application of the next layer.~~

~~**AU103.8 Drying holes.** Where holes to facilitate drying are used, such holes shall be of any depth and not exceeding $^3/_4$ inch (19 mm) in diameter on the face of *cob* walls. Drying holes shall not be spaced closer than 10 hole diameters. Drying holes shall not be placed in *braced wall panels*. The design load on *load-bearing walls* with drying holes shall not exceed 90 percent of the allowable bearing capacity as determined in accordance with Section AU106.8. Drying holes shall be filled with *cob* before final inspection.~~

~~**AU103.9 Adding roof loads to walls.** Roof and ceiling loads shall not be added until walls are sufficiently dry to support them without compressing.~~

~~SECTION AU104~~
~~FINISHES~~

~~**AU104.1 General.** *Cob* walls shall not require a *finish*, except as required by Section AU104.2. *Finishes* applied to *cob* walls shall comply with this section and Chapters 3 and 7 unless stated otherwise in this section.~~

~~**AU104.1.1 Interior wall finishes.** Where installed, interior wall *finishes* and interior fire protection shall comply with the applicable provisions of Section R302, and shall be *plasters* in accordance with Section AU104.4 or nonplaster wall coverings in accordance with Section R702.~~

~~**AU104.1.2 Exterior wall finishes.** Where installed, exterior wall *finishes* shall be *plasters* in accordance with Section AU104.4, nonplaster exterior wall coverings in accordance with Section R703, or other *finish* systems in accordance with the following:~~

1. ~~Specifications and details of the *finish* system's means of attachment to the wall or its independent support and means of draining or evaporating water that penetrates the exterior finish shall be provided.~~
2. ~~The vapor permeance of the combination of *finish* materials shall be 5 perms or greater to allow the transpiration of water vapor from the wall.~~
3. ~~*Finish* systems with weights greater than 10 pounds per square foot (48.9 kg/m) and less than or equal to20 pounds per square foot (97.8 kg/m) of wall area shall require that the minimum total length of *braced wall panels* in Table AU106.11(3) be multiplied by a factor of 1.2.~~
4. ~~*Finish* systems with weights greater than 20 pounds per square foot (97.8 kg/m) of wall area shall require an engineered design.~~

~~**AU104.2 Where required.** *Cob* walls exposed to rain due to local climate, building design and wall orientation shall be *finished* or clad to provide protection from excessive erosion.~~

~~**AU104.3 Vapor retarders.** Class I and II vapor retarders shall not be used on *cob* walls, except at *cob* walls surrounding showers or as required or addressed elsewhere in this appendix.~~

~~**AU104.4 Plaster.** *Plaster* applied to *cob* walls shall be any type described in this section. *Plaster* thickness shall not exceed 3 inches (76 mm) on each face except where an *approved* engineered design is provided.~~

~~**AU104.4.1 Plaster and membranes.** *Plaster* shall be applied directly to *cob* walls to facilitate transpiration of moisture from the walls and to secure a mechanical bond between the *plaster* and the *cob*. A membrane shall not be located between the *cob* wall and the *plaster*.~~

~~**AU104.4.2 Plaster lath.** The surface of *cob* walls shall be permitted to function as lath for *plaster*, with no other lath required. Metal, plastic, and natural fiber lath shall be permitted to be used to limit *plaster* cracking, increase the *plaster* bond to the wall, or to bridge dissimilar materials.~~

~~**AU104.4.3 Clay plaster.** *Clay plaster* shall comply with Sections AU104.4.3.1 and AU104.4.3.2.~~

~~**AU104.4.3.1 General.** *Clay plaster* shall be any *plaster* having a *clay* or *clay subsoil* binder. Such *plaster* shall contain sufficient clay to fully bind the sand or other aggregate and any reinforcing fibers. Reinforcing fibers shall be chopped straw, sisal, hemp, animal hair or other similar approved fibers.~~

~~**AU104.4.3.2 Clay subsoil requirements.** The suitability of *clay subsoil* shall be determined in accordance with the Figure 2 Ribbon Test and the Figure 3 Ball Test in the appendix of ASTM E2392/E2392M.~~

~~**AU104.4.4 Soil-cement plaster.** Soil-cement *plaster* shall be composed of *clay subsoil*, sand, not more than 7 percent Portland cement by volume and, where provided, reinforcing fibers.~~

~~**AU104.4.5 Gypsum plaster.** Gypsum *plaster* shall comply with Section R702.2.1 and shall be limited to interior use.~~

~~**AU104.4.6 Lime plaster.** Lime *plaster* is any *plaster* with a binder composed of calcium hydroxide including Type N or S hydrated lime, hydraulic lime, natural hydraulic lime or slaked quicklime. Hydrated lime shall comply with ASTM C206. Hydraulic lime shall comply with ASTM C1707. Natural hydraulic lime shall comply with ASTM C141 and EN 459. Quicklime shall comply with ASTM C5.~~

~~**AU104.4.7 Clay-lime plaster.** Clay-lime *plaster* shall be composed of refined *clay* or *clay subsoil*, sand, lime and, where provided, reinforcing fibers.~~

~~**AU104.4.8 Cement-lime plaster.** Cement-lime *plaster* shall be plaster mix types CL, F or FL, as described in ASTM C926.~~

~~**AU104.4.9 Cement plaster.** Cement *plaster* shall have not less than 1 part lime to 4 parts cement and be not thicker than $1^1/_2$ inches (38 mm), to ensure minimum acceptable vapor permeability~~

~~SECTION AU105~~
~~COB WALLS—GENERAL~~

~~**AU105.1 General.** *Cob* walls shall be designed and constructed in accordance with this section and Figure AU101.4 or an *approved* alternative design. In addition to the general requirements for *cob* walls in this section, *cob structural walls* shall comply with Section AU106.~~

~~**AU105.2 Building limitations and requirements for cob wall construction.** *Cob* walls shall be subject to the following limitations and requirements:~~

1. ~~Number of stories: not more than one.~~
2. ~~Building height: not more than 20 feet (6096 mm).~~
3. ~~*Seismic design categories*: limited to use in *Seismic Design Categories* A, B and C, except where an approved engineered design is provided.~~
4. ~~Wall height: in accordance with Table AU105.3, and with Table AU106.11(1) for *braced wall panels*.~~
5. ~~Wall thickness, excluding *finish*, shall be not less than 10 inches (254 mm), not greater than 24 inches (610 mm) at the top two-thirds, not limited at the bottom third and, for structural walls, shall comply with Section AU106.2, Item 2. Wall taper is permitted in accordance with Section AU106.5, Item 1.~~
6. ~~Interior *cob* walls shall require an *approved* engineered design that accounts for the seismic load of the interior *cob* walls, except in Seismic Design Category A for walls with a height to thickness ratio less than or equal to 6.~~

~~**AU105.3 Out-of-plane resistance methods and unrestrained wall height limits.** *Cob* walls shall employ a method of out-of-plane load resistance in accordance with Table AU105.3, and comply with its associated height limits and requirements.~~

~~**AU105.3.1 Determination of out-of-plane loading.** Out-of-plane loading for the use of Table AU105.3 shall be in accordance with the ultimate design wind speed and seismic design category requirements of Sections R301.2.1 and R301.2.2, respectively. An *approved* engineered design shall be required where the building is located in a special wind region or where wind design is required in accordance with Figure R301.2.1.1.~~

~~**AU105.3.2 Bond beams for nonstructural walls.** Nonstructural *cob* walls shall be provided with a bond beam at the top of the wall that complies with Section AU106.9, except for requirements relating to roof and/or ceiling loads or *braced wall panels*.~~

~~**AU105.3.3 Lintels in nonstructural walls.** Door, window and other openings in nonstructural *cob* walls shall require a lintel in accordance with Section AU106.10, except for requirements relating to roof and/or ceiling loads or *braced wall panels*.~~

~~**AU105.3.4 Reinforcing at wall openings.** Reinforcing shall be installed at window, door, and similar wall openings and penetrations greater than 2 feet (610 mm) in width in accordance with Sections AU105.3.4.1 through AU105.3.4.3. Surface voids deeper than 25 percent of the wall thickness shall be considered an opening.~~

~~**AU105.3.4.1 Opening size limit.** Openings shall not exceed 6 feet (1829 mm) in width, and the height of the *cob* wall below openings shall not exceed 6 feet (1829 mm) above the top of the foundation.~~

~~**AU105.3.4.2 Horizontal reinforcing.** Two-inch by 2-inch (51 mm by 51 mm) 14-gage galvanized steel mesh shall be embedded 4 inches (102 mm) in the *cob* above the rough opening and below the rough opening for windows, and shall extend 12 inches (305 mm) beyond the sides of the opening. Walls below rough window openings greater than 4 feet 6 inches (1372 mm) in height shall be provided with additional horizontal reinforcing at midheight.~~

~~**AU105.3.4.3 Vertical reinforcing.** Full-height $^5/_8$-inch (16 mm) threaded rod shall be installed 4 inches (102 mm) from each side of the opening, centered in the thickness of the *cob* wall. The threaded rods shall be embedded 7 inches (178 mm) in the foundation, and 4 inches (102 mm) in concrete bond beams or shall penetrate through wood bond beams and be secured with a nut and washer. The threaded rods shall be embedded in concrete lintels or pass through a drilled hole in wood lintels.~~

~~**AU105.3.5 Minimum length of cob walls.** Sections of *cob* walls between openings shall be not less than 2 feet, 6 inches (762 mm) in length. Wall sections less than 4 feet (1219 mm) and not less than 2 feet, 6 inches (762 mm) in length shall contain vertical reinforcing in accordance with Section AU105.3.4.3.~~

~~**AU105.4 Moisture control.** *Cob* walls shall be protected from moisture intrusion and damage in accordance with Sections AU105.4.1 through AU105.4.5.~~

~~**AU105.4.1 Water-resistant barriers and vapor permeance.** *Cob* walls shall be constructed without a membrane barrier between the *cob* wall and *plaster* to facilitate transpiration of water vapor from the wall, and to secure a mechanical bond between the *cob* and *plaster*, except as otherwise required elsewhere in this appendix. Where a water-resistant barrier is placed behind an exterior *finish*, it shall be considered part of the *finish* system and shall comply with Item 2 of Section AU104.1.2 for the combined vapor permeance rating.~~

~~**AU105.4.2 Horizontal surfaces.** *Cob* walls and other *cob* elements shall be provided with a water-resistant barrier at weather-exposed horizontal surfaces. The water-resistant barrier shall be of a material and installation that will prevent erosion and prevent water from entering the wall system. Horizontal surfaces, including exterior window sills, sills at exterior niches and exterior buttresses, shall be sloped not less than 1 unit vertical in 12 units horizontal to drain away from *cob* walls or other *cob* elements.~~

~~**AU105.4.3 Separation of cob and foundation.** A liquid-applied or bituminous Class II vapor retarder shall be installed between *cob* and supporting concrete or masonry.~~

~~**Exception:** Where local climate, site conditions and foundation design limit ground moisture migration into the base of the *cob* wall, including but not limited to the use of a moisture barrier or capillary break between the supporting concrete or masonry and the earth.~~

~~**AU105.4.4 Separation of cob and finished grade.** *Cob* shall be not less than 8 inches (203 mm) above finished *grade*.~~

~~**Exception:** The minimum separation shall be 4 inches (102 mm) in dry climate zones as defined in Section N1101.7.2, and shall be 2 inches (51mm) on walls that are not weather exposed.~~

~~**AU105.4.5 Installation of windows and doors.** Windows and doors shall be installed in accordance with the manufacturer's instructions to a wooden frame of not less than nominal 2-inch by 4-inch (51 mm by 102 mm) wood members anchored into the *cob* wall with 16d galvanized nails half-driven at a maximum 6-inch (152 mm) spacing, with the protruding half embedded in the *cob*. The wood frame shall be embedded not less than $1^1/_2$ inches (38 mm) in the *cob* and shall be set in from each face of the wall not less than 3 inches (76 mm). Alternative window and door installation methods shall be capable of resisting the wind loads in Table R301.2.1(1). Windows and doors in *cob* walls shall be installed so as to~~

~~mitigate the passage of air or moisture into or through the wall system. Window sills shall comply with Section AU105.4.2.~~

~~**AU105.5 Inspections.** In addition to ensuring compliance with Section R109.1, the building official shall inspect the following aspects of *cob* construction:~~

1. ~~Anchors and vertical and horizontal reinforcing in *cob* walls, where required in accordance with Tables AU105.3 and AU106.11(1) and Sections AU105.3.4 through AU105.3.5.~~
2. ~~Reinforcing in any concrete bond beams or lintels, in accordance with Section AU106.9.2 and Table AU106.10.~~

~~SECTION AU106~~
~~COB WALLS—STRUCTURAL~~

~~**AU106.1 General.** *Cob* structural walls shall be in accordance with the prescriptive provisions of this section. Designs or portions of designs not complying with this section shall require an *approved* engineered design.~~

~~**AU106.2 Requirements for cob structural walls.** In addition to the requirements of Section AU105.2, *cob* structural walls shall be subject to the following:~~

1. ~~Wall height: shall be in accordance with Table AU105.3 for load-bearing *cob* walls or Table AU106.11(1) for *cob braced wall panels*, as applicable and most restrictive.~~
2. ~~Wall thickness: shall be in accordance with Sections AU105.2, Item 5 and Section AU106.8.1 for load-bearing *cob* walls or Table AU106.11(1) for *cob braced wall panels*, as applicable and most restrictive.~~
3. ~~*Braced wall panel* lengths: for buildings using *cob braced wall panels*, the greater of the values determined in accordance with Table AU106.11(2) for wind loads and Table AU106.11(3), AU106.11(4) or AU106.11(5) for seismic loads shall be used.~~

~~**AU106.3 Loads and other limitations.** Live and dead loads and other limitations shall be in accordance with Section R301, except that the dead load for *cob* walls shall be determined by Equation AU-1.~~

$$\cancel{CW_{DL} = (H \times T_{avg} \times D)} \qquad \textbf{(Equation AU-1)}$$

~~CW_{DL} = *Cob* wall dead load (in pounds per lineal foot of wall).~~

~~H = Height of *cob* portion of wall (in feet).~~

~~T_{avg} = Average thickness of wall (in feet).~~

~~D = Density of *cob* = 110 (in pounds per cubic foot), unless a lesser value at equilibrium moisture content is demonstrated to the building official.~~

~~**AU106.4 Foundations.** Foundations for *cob* walls shall be in accordance with Chapter 4. The width of foundations for *cob* walls shall be not less than the width of the *cob* at its base, excluding *finish*.~~

~~**AU106.5 Wall taper, straightness and surface voids for cob walls.** *Cob* walls shall be in accordance with the following:~~

1. ~~*Cob* structural and *nonstructural walls* shall be vertical or shall taper from bottom to top with the wall thickness in accordance with Section AU105.2, Item 5 and the wall height in accordance with Section AU105.2, Item 4.~~
2. ~~*Cob* structural and *nonstructural walls* shall be straight or curved. Curved *braced wall panels* shall be in accordance with Sections AU106.11.2 and AU106.11.3.~~
3. ~~Niches and other surface voids in *load-bearing walls* are limited to 12 inches (305 mm) in width and height and 25 percent of the wall thickness, and shall be located in the top two-thirds of the wall. Surface voids that exceed these limits shall be considered wall openings, and shall receive a lintel in accordance with Section AU106.10 and be reinforced in accordance with Section AU105.3.4. Surface voids are prohibited in *braced wall panels*.~~

~~**AU106.6 Compressive strength of cob structural and nonstructural walls.** All *cob* walls shall have a minimum compressive strength of 60 psi (414 kPa). *Cob* in walls used as *braced wall panels* shall have a minimum compressive strength of 85 psi (586 kPa).~~

~~**AU106.6.1 Demonstration of compressive strength.** The compressive strength of the *cob* mix to be used in structural walls and *nonstructural walls* as required in Section AU106.6 shall be demonstrated to the building official before the placement of *cob* onto walls, with compressive strength tests and an associated report by an *approved* laboratory or with an *approved* on-site test as follows:~~

1. ~~Five samples of the proposed *cob* mix shall be placed moist to completely fill a 4-inch by 4-inch by 4-inch (102 mm by 102 mm by 102 mm) form and dried to ambient moisture conditions.~~
2. ~~Samples shall not be oven dried.~~
3. ~~Any opposite faces shall be faced with plaster of paris if needed to achieve smooth, parallel faces, after which the sample shall reach ambient moisture conditions before testing.~~
4. ~~The horizontal cross section of the dried sample as tested, and the maximum applied load at failure shall be used to calculate the sample's compressive strength.~~
5. ~~The fourth-lowest value shall be used to determine the mix's compressive strength.~~

~~**AU106.7 Modulus of rupture of cob structural walls.** *Cob* in walls used as *braced wall panels* shall have a minimum modulus of rupture of 50 pounds per square inch (345 kPa).~~

~~**AU106.7.1 Demonstration of modulus of rupture.** The modulus of rupture of *cob* used in structural walls shall be demonstrated to the building official before the placement of *cob* onto walls, with modulus of rupture tests and an associated report by an *approved* laboratory or with an *approved* on-site test as follows:~~

1. ~~Five samples of the proposed *cob* mix shall be placed moist to completely fill a 6-inch by 6-inch by 12-inch (152 mm by 152 mm by 305 mm) form and dried to indoor ambient moisture conditions.~~
2. ~~Samples shall not be oven dried.~~
3. ~~Each sample shall be tested with the 12-inch (305 mm) dimension horizontal.~~
4. ~~The fourth-lowest value shall be used to determine if the mix meets the minimum required modulus of rupture.~~

~~**AU106.8 Bearing capacity.** The allowable bearing capacity for *cob load-bearing walls* supporting vertical roof and/or ceiling loads imposed in accordance with Section R301 shall be determined by Equation AU-2.~~

~~$BC = 144\ (C \times T_{min})/3 - (H \times T_{avg} \times D)$ **(Equation AU-2)**~~

~~BC = Allowable bearing capacity of wall (in pounds per lineal foot of wall).~~

~~C = Compressive strength (in psi) as determined in accordance with Section AU106.6.~~

~~T_{min} = Thickness of wall (in feet) at its minimum.~~

~~H = Height of *cob* portion of wall (in feet).~~

~~T_{avg} = Average thickness of wall (in feet).~~

~~D = Density of *cob* = 110 (in pounds per cubic foot), unless a lesser value at equilibrium moisture content is demonstrated.~~

~~**AU106.8.1 Support of uniform loads.** Uniform roof and/or ceiling loads shall be supported by *cob load-bearing walls* not exceeding their allowable bearing capacity, as demonstrated in accordance with Equation AU-3.~~

~~$BL \leq BC$ **(Equation AU-3)**~~

~~BL = Design load on the wall (in pounds per lineal foot) determined in accordance with Sections R301.4 and R301.6.~~

~~BC = Allowable bearing capacity of wall (in pounds per lineal foot of wall) determined in accordance with Section AU106.8.~~

~~**AU106.8.2 Support of concentrated loads.** Concentrated roof and ceiling loads shall be distributed by structural elements capable of distributing the loads to the *cob load-bearing wall* and within its allowable bearing capacity as determined in accordance with Section AU106.8. Concentrated loads over lintels or over bond beams spanning openings shall require an *approved* engineered design.~~

~~**AU106.9 Bond beams.** *Cob* structural walls shall require a bond beam at the top of the wall in accordance with Section AU106.9.1, AU106.9.2 or AU106.9.3, and shall be anchored to the *cob* below in accordance with Tables AU105.3, AU106.11(1) and AU106.12 as applicable and most restrictive. Bond beams spanning openings shall be in accordance with Section AU106.9.4.~~

~~**AU106.9.1 Wood bond beams.** Wood bond beams shall be not less than nominal 4 inches high by 8 inches wide and shall comply with Sections AU106.9.1.1 through AU106.9.1.3.~~

~~**AU106.9.1.1 Wood species and grade.** Wood bond beams shall be of a species with an extreme fiber in bending (F_b) of not less than 850 psi (5.9 MPa), a modulus of elasticity (E) of not less than 1,300,000 psi (8964 MPa), and No. 2 grade or better. Composite lumber bond beams shall have an F_b of not less than 850 psi (5.9 MPa), and an E of not less than 1,300,000 psi (8964 MPa).~~

~~**AU106.9.1.2 Discontinuity.** Discontinuous wood bond beams shall be spliced on top with a metal strap with not less than the allowable wind or seismic load tension capacity in accordance with the following, whichever is more restrictive:~~

1. ~~For *seismic design categories*: A, 2,500 pounds (11 kN); B, 4,500 pounds (20 kN); C, 6,000 pounds (26.7 kN).~~
2. ~~For braced wall line lengths, when wind governs: 10 feet, 2,500 pounds (11 kN); 20 feet, 3,400 pounds (15.1 kN); 30 feet, 5,000 pounds (22.2 kN).~~

~~**AU106.9.1.3 Corners and curved walls.** Wood bond beams at corners and discontinuities atop curved walls shall be connected across their exterior faces with a metal strap with a capacity of not less than that determined in accordance with Section AU106.9.1.2.~~

~~**AU106.9.2 Concrete bond beams.** Concrete bond beams shall be not less than 6 inches (152 mm) high by 8 inches (305 mm) wide. Concrete bond beams shall be reinforced with two No. 4 bars, 2 inches (51 mm) clear from the bottom and 2 inches (51 mm) clear from the sides. Lap splices shall comply with Table R608.5.4(1). Reinforcing at corners shall be in accordance with the horizontal reinforcing requirements in Section R608.6.4. The concrete shall have a compressive strength of not less than 2,500 pounds per square inch (17.2 MPa) at 28 days.~~

~~**AU106.9.3 Other bond beams.** Bond beams of other materials, including earthen materials, require an *approved* engineered design.~~

~~**AU106.9.4 Bond beams spanning openings.** Bond beams that support uniform roof and/or ceiling loads and span openings in *cob* walls shall be in accordance with Table AU106.10. Bond beams shall be continuous across the opening and not less than 1 foot (305 mm) beyond each side of the opening.~~

~~**AU106.9.5 Connection of roof framing to bond beams.** Roof and ceiling framing shall be attached to bond beams in accordance with Table R602.3(1), Items 2 and 6, and Figure AU106.9.5. Roof sheathing shall be attached to roof framing in accordance with Figure AU106.9.5. A minimum nominal 2-inch by 6-inch (51 mm by 152 mm) wood plate shall be installed on concrete bond beams with $^5/_8$-inch (16 mm) diameter anchor bolts with 5-inch (127 mm) embedment at 2 feet (610 mm) on center to allow the required fastening of roof and ceiling framing, including tension ties and straps.~~

~~**AU106.9.6 Bond beams and connections at gable and shed roof end walls.** Bond beams and connections at end walls of buildings with gable or shed roofs shall comply with Figure AU106.9.6 and the following:~~

1. ~~End walls shall not exceed 20 feet (6096 mm) in length.~~
2. ~~Bond beams shall be continuous and straight for the entire wall line.~~
3. ~~Wood bond beams shall comply with the following:~~
   - 3.1. ~~Not less than nominal 4 inches by 8 inches (102 mm by 203 mm) where wind design governs in accordance with Table AU106.11(2) and where seismic design governs in accordance with Table AU106.11(3), AU106.11(4) or AU106.11(5) for wall lengths less than or equal to 20 feet (6096 mm) in Seismic Design Category A or wall lengths less than or equal to 10 feet (3048 mm) in Seismic Design Categories B and C.~~
   - 3.2. ~~Not less than nominal 4 inches by 10 inches (102 mm by 254 mm) for wall lengths less than or equal to 20 feet (6096 mm) in Seismic Design Category B.~~

3.3. Not less than nominal 6 inches by 12 inches (152 mm by 305 mm) or 4 inches by 16 inches (102 mm by 406 mm) for wall lengths less than or equal to 20 feet (6096 mm) in Seismic Design Category C.

3.4. Corners shall be connected in accordance with Section AU106.9.3.

4. Concrete bond beams when used shall be in accordance with Section AU106.9.2 in Seismic Design Categories A, B and C and for ultimate design wind speeds less than or equal to 140 mph (63.6 m/s).

5. Walls between the bond beam and roof shall be of wood-framed construction in accordance with Section R602. The ratio of its greatest height to its length shall not exceed 1:2. The wall shall not contain openings.

AU106.10 Lintels. Door, window and other openings in load-bearing *cob* walls shall be provided with a lintel of wood or concrete in accordance with Table AU106.10.

AU106.11 Cob braced wall panels. *Cob braced wall panels* shall be in accordance with Section R602.10 and Tables AU106.11(1), AU106.11(2), AU106.11(3), AU106.11(4) and AU106.11(5). Wind design criteria shall be in accordance with Section R301.2.1. Seismic design criteria shall be in accordance with Section R301.2.2. An *approved* engineered design shall be required in accordance with Section R301.2.1 where the building is located in a special wind region or where wind design is required in accordance with Figure R301.2.1.1.

AU106.11.1 Nonorthogonal braced wall panels. *Braced wall panels* at an angle to the orthogonal *braced wall lines* shall be considered to contribute to the minimum total braced wall lengths in Tables AU106.11(2), AU106.11(3), AU106.11(4) and AU106.11(5), as follows:

1. A *braced wall panel* not more than 45 degrees and greater than 30 degrees to an adjacent orthogonal braced wall line shall contribute 50 percent of its length to that line.
2. A *braced wall panel* not more than 30 degrees to an orthogonal braced wall line shall contribute 65 percent of its length to that line.
3. A *braced wall panel* greater than 45 degrees and not more than 60 degrees to an orthogonal braced wall line shall contribute 35 percent of its length to that line.
4. The angle of a curved *braced wall panel* to a braced wall line shall be determined with the chord of that section of wall, connecting the end points of the arc at the center of the wall.

AU106.11.2 Braced wall lines for buildings with curved walls. Buildings with curved *cob* walls shall contain two *braced wall lines* in two orthogonal directions. The spacing of the *braced wall lines* for wind design in Table AU106.11(2) and the spacing and length of the *braced wall lines* for seismic design in Tables AU106.11(3), AU106.11(4) and AU106.11(5) shall be the maximum widths of the building in the two orthogonal directions.

AU106.11.3 Radius, thickness and length of curved braced wall panels. *Cob* curved *braced wall panels* shall have an inside radius of not less than 5 feet (1524 mm), shall be of the thickness required in Table AU106.11(1) and of the length determined in accordance with Section AU106.11. The length of the curved wall shall be considered to be the length of the arc at the center of the wall, in accordance with Figure AU106.11.3 and determined by Equation AU-4.

$$ARC_C = 0.0175\, R_C \times A \qquad \textbf{(Equation AU-4)}$$

ARC_C = Length of arc at center of wall (in feet).

R_C = Radius at center of wall = $R_i + 0.5T$ (in feet).

R_i = Inside radius of wall (in feet).

T = Thickness of wall without *finish* (in feet).

A = Angle of extent of *braced wall panel* from the center of the arc (in degrees).

AU106.12 Resistance to wind uplift forces. *Cob* walls that resist uplift forces from the *roof assembly*, as determined in accordance with Section R802.11, shall be in accordance with Table AU106.12.

AU106.13 Post-and-beam with cob infill. Post-and-beam with *cob* infill wall systems shall be in accordance with an *approved* engineered design.

~~**AU106.14 Buttresses.** *Cob buttresses* that are intended to provide out-of-plane wall bracing or additional capacity for *braced wall panels* shall be in accordance with an *approved* engineered design.~~

~~SECTION AU107~~
~~COB FLOORS~~

~~**AU107.1 Cob floors.** *Cob* floors supported by *grade* shall be in accordance with an *approved* specification. Straw shall not be required in the material mix.~~

~~SECTION AU108~~
~~FIRE RESISTANCE~~

~~**AU108.1 Fire-resistance rating.** *Cob* walls are not fire-resistance rated.~~

~~**AU108.2 Clearance to fireplaces and chimneys.** *Cob* walls or other *cob* surfaces shall not require clearance to fireplaces and chimneys, except where clearance to noncombustibles is required by the manufacturer's instructions.~~

~~SECTION AU109~~
~~THERMAL PERFORMANCE~~

~~**AU109.1 Thermal characteristics.** *Cob* walls shall be classified as mass walls in accordance with Section N1102.2.5 and shall meet the *R*-value requirements for mass walls in Table N1102.1.3.~~

~~**AU109.2 Thermal resistance.** The unit *R*-value for *cob* walls with a density of 110 pounds per cubic foot (1762 kg/m^3) shall be R-0.22 per inch of *cob* thickness. Walls that vary in thickness along their height or length shall use the average thickness of the wall to determine its *R*-value. The thermal resistance values of air films and finish materials or additional insulation shall be added to the *cob* wall's thermal resistance value to determine the *R*-value of the wall assembly.~~

~~**AU109.3 Additional insulation.** Where insulating materials are added to the face of a *cob* wall, the combination of additional insulation and any associated connecting, weather-resisting or protective materials shall comply with Section AU104.1.2, Items 1–4.~~

~~SECTION AU110~~
~~REFERENCED STANDARDS~~

~~**AU110.1 General.** See Table AU110.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, the standard title and the section or sections of this appendix that reference the standard.~~

~~***TABLE AU110.1***~~
~~***REFERENCED STANDARDS***~~

~~STANDARD ACRONYM~~	~~STANDARD NAME~~	~~SECTIONS HEREIN REFERENCED~~
~~ASTM C5—10~~	~~*Standard Specification for Quicklime for Structural Purposes*~~	~~AU104.4.6~~
~~ASTM C141/C141M—14~~	~~*Standard Specification for Hydrated Hydraulic Lime for Structural Purposes*~~	~~AU104.4.6~~
~~ASTM C206—14~~	~~*Standard Specification for Finishing Hydrated Lime*~~	~~AU104.4.6~~

~~ASTM C926~~	~~*Specification for Appliance of Portland Cement-based Plaster*~~	~~AU104.4.8~~
~~ASTM C1707—11~~	~~*Standard Specification for Pozzolanic Hydraulic Lime for Structural Purposes*~~	~~AU104.4.6~~
~~ASTM E2392/E2392M—10~~	~~*Standard Guide for Design of Earthen Wall Building Systems*~~	~~AU104.4.3.2~~
~~ASTM BS1, ASTM BS EN 459—2015~~	~~Part 1: *Building Lime. Definitions, Specifications and Conformity Criteria*; Part 2: *Test Methods*~~	~~AU104.4.6~~

~~TABLE AU105.3~~

~~OUT-OF-PLANE RESISTANCE METHODS AND UNRESTRAINED WALL HEIGHT LIMITS~~

~~WALL TYPE[a, g, h] AND METHOD OF OUT-OF-PLANE LOAD RESISTANCE~~	~~FOR ULTIMATE DESIGN WIND SPEEDS (mph)~~	~~FOR SEISMIC DESIGN CATEGORIES~~	~~UNRESTRAINED COB WALL HEIGHT H[b, c, h]~~		~~TOP ANCHOR[e] SPACING (inches)~~	~~TENSION TIE[f] SPACING (inches)~~
			~~Absolute Limit (feet)~~	~~Limit Based on Wall Thickness T[d] (feet)~~		
~~Wall 1[i]: no anchors, no steel wall reinforcing~~	~~≤ 110~~	~~A~~	~~$H \leq 8$~~	~~$H \leq 6T$~~	~~None~~	~~48~~
~~Wall 2: top anchors[j], continuous vertical 6″ × 6″ × 6″ gage steel mesh in center of wall embedded in foundation 12 inches~~	~~≤ 140~~	~~A, B, C~~	~~$H \leq 8$~~	~~$H \leq 8T$~~	~~12~~	~~24~~
~~Wall A[i]: top anchors, no vertical steel reinforcing~~	~~≤ 120~~	~~A, B~~	~~$H \leq 8$~~	~~$H \leq 6T$~~	~~12~~	~~48~~
~~Wall B[i]: top and bottom anchors, no vertical steel reinforcing~~	~~≤ 130~~	~~A, B~~	~~$H \leq 8$~~	~~$H \leq 6T$~~	~~12~~	~~48~~
~~Wall C: top and bottom anchors, continuous vertical threaded rod at 4 feet on center embedded in foundation and connected to bond beam~~	~~≤ 140~~	~~A, B, C~~	~~$H \leq 8$~~	~~$H \leq 8T$~~	~~12~~	~~24~~
~~Wall D: continuous vertical threaded rod at 1 foot on center embedded in foundation and connected to bond beam~~	~~≤ 140~~	~~A, B, C~~	~~$H \leq 8$~~	~~$H \leq 8T$~~	~~N/A~~	~~24~~
~~Wall E: top anchors, continuous vertical 6″ × 6″ × 6″ gage steel mesh 2 inches from each face of wall embedded in foundation~~	~~≤ 140~~	~~A, B, C~~	~~$H \leq 8$~~	~~$H \leq 8T$~~	~~12~~	~~24~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s.~~

~~N/A = Not Applicable~~

~~a. See Table AU106.11(1) for reinforcing and anchorage specifications for wall Types A, B, C, D and E.~~

~~b. H = height of the cob portion of the wall only. See Figure AU101.4. The maximum H is the absolute limit or the limit based on wall thickness, whichever is more restrictive.~~

~~c. Bond beams or other horizontal restraints are capable of separating a wall into more than one unrestrained wall height with an approved engineered design.~~

~~d. *T* = Cob wall thickness (in feet) at its minimum, without plaster.~~

~~e. $^5/_8$-inch threaded rod anchors at prescribed spacing with 12-inch embedment in cob, full embedment in concrete bond beams or full penetration in wood bond beam with a nut and washer.~~

~~f. Attach rafters to bond beam with 4-inch by 3-inch by 3-inch by 18 gage tension tie angles at prescribed spacing. See Figure AU106.9.5. Where rafters are attached to tension ties, roof sheathing shall be edge nailed.~~

~~g. All walls shall be tested for compressive strength in accordance with Section AU106.6.~~

~~h. For curved walls with an arc length to radius ratio of 1.5:1 or greater, the *H*/*T* factor shall be increased by 1, and the absolute height limit by 1 foot.~~

~~i. Wall type requires a modulus of rupture test in accordance with Section AU106.7.~~

~~j. See wall Type A in Table AU106.11(1) for top anchor requirements.~~

~~*FIGURE AU106.9.5*~~
~~CONNECTION OF ROOF FRAMING TO BOND BEAMS~~

~~*TABLE AU106.10*~~
~~*LINTELS AND BOND BEAMS SPANNING OPENINGS*~~

GROUND SNOW LOAD ≤ 30 PSF			WOOD: • F_b ≥ 850 psi • E ≥ 1,300,000 psi • No. 2 Grade or better • Oriented flat • 1 piece or 2 equal-width pieces • Extend 1 foot beyond opening sides		CONCRETE: • 2500 psi compressive strength • Height = 6 inches • Extend 1 foot beyond opening sides • Reinforcement two No. 4 bars[a] • 2 inches clear from bottom • 2 inches clear from sides[a]	
Building Width (feet)	Cob above Lintel (feet)	Total Cob Wall and Plaster Thickness (inches)	Size of Wood Lintel or Bond Beam – *H* × *W* (nominal inches)		Width of Concrete Lintel or Bond Beam (inches)	
			For Span ≤ 4 ft	For Span ≤ 6 ft	For Span ≤ 6 ft	For Span ≤ 8 ft
10	0	≤ 27	4 × 8	4 × 8	8	8
10	1	15	4 × 12	4 × 12	12	12
10	1	19	4 × 16	4 × 16	16	16
10	1	27	4 × 24	4 × 24	24	24
10	2	15	4 × 12	6 × 12	12	12
10	2	19	4 × 16	6 × 16	16	16
10	2	27	4 × 24	4 × 24	24	24
20	0	≤ 27	4 × 8	6 × 8	8	8
20	1	15	4 × 12	6 × 12	12	12
20	1	19	4 × 16	6 × 16	16	16
20	1	27	4 × 24	4 × 24	24	24
20	2	15	4 × 12	6 × 12	12	NP
20	2	19	4 × 16	6 × 16	16	NP
20	2	27	4 × 24	6 × 24	24	NP

~~30~~	~~0~~	~~≤ 27~~	~~4 × 8~~	~~6 × 8~~	~~8~~	~~NP~~
~~30~~	~~1~~	~~15~~	~~4 × 12~~	~~6 × 12~~	~~12~~	~~NP~~
~~30~~	~~1~~	~~19~~	~~4 × 13~~	~~6 × 16~~	~~16~~	~~NP~~
~~30~~	~~1~~	~~27~~	~~4 × 24~~	~~6 × 24~~	~~24~~	~~NP~~
~~30~~	~~2~~	~~15~~	~~4 × 12~~	~~6 × 12~~	~~12~~	~~NP~~
~~30~~	~~2~~	~~19~~	~~4 × 16~~	~~6 × 16~~	~~16~~	~~NP~~
~~30~~	~~2~~	~~27~~	~~4 × 24~~	~~6 × 24~~	~~24~~	~~NP~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895 kPA.~~

~~*NP = Not Permitted.*~~

~~a. Concrete bond beams spanning openings, and lintels greater than 16 inches in width, shall have an additional No. 4 bar in the center of their width.~~

~~*TABLE AU106.11(1)*~~
~~*COB BRACED WALL PANEL TYPES*~~

~~WALL TYPE[a] DESIGNATION~~	~~ANCHORS TO FOUNDATION[b]~~	~~ANCHORS TO BOND BEAM[c]~~	~~VERTICAL STEEL REINFORCING[b, c]~~	~~HORIZONTAL STEEL REINFORCING~~	~~MAXIMUM HEIGHT *H*[d] (in feet)~~	~~MAXIMUM ASPECT RATIO (*H:L*)~~
~~A~~	~~none~~	~~5/8″ threaded rod @ 12″; 4″ from wall ends; 12″ embedment in cob~~	~~none~~	~~none~~	~~7[e]~~	~~1:1~~
~~B~~	~~#5 bar @ 12″; 16″ embedment in cob~~	~~5/8″ threaded rod @ 12″; 4″ from wall ends; 16″ embedment in cob; 2″ × 2″ × 1/4″ washer and nut at cob end~~	~~none~~	~~2″ × 2″ × 14 gage welded wire mesh[f] @ 18″; 6″ from foundation and bond beam~~	~~7[e]~~	~~1:1~~
~~C~~	~~#5 bar @ 12″; 16″ embedment in cob~~	~~5/8″ threaded rod @ 12″; 16″ embedment in cob~~	~~5/8″ threaded rod; 4″ from each end of braced wall panel; continuous from foundation to bond beam~~	~~2″ × 2″ × 14 gage welded wire mesh[f] @ 18″; 6″ from foundation and bond beam~~	~~7[e]~~	~~2:1~~
~~D~~	~~(see vertical steel reinforcing)~~	~~(see vertical steel reinforcing)~~	~~5/8″ threaded rod; 4″ from each end of braced wall panel and @ 12″; continuous from foundation to bond beam~~	~~2″ × 2″ × 14 gage welded wire mesh[f] @ 18″; 6″ from foundation and bond beam~~	~~7[e]~~	~~2:1~~
~~E~~	~~6″ × 6″× 6 gage welded wire mesh; 12″ embedment in foundation~~	~~5/8″ threaded rod @ 12″; 4″ from wall ends; 12″ embedment in cob~~	~~6″ × 6″ × 6 gage welded wire mesh; 2″ from each wall face~~	~~none~~	~~7.5~~	~~1:1~~

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

~~a. Braced wall panel Types A, B, C and D shall be not less than 16 inches thick. Braced wall panel Type E shall be not less than 12 inches thick. All braced wall panels shall be not greater than 24 inches thick.~~

~~b. Not less than 8-inch embedment into foundation, unless otherwise stated.~~

~~c. Not less than 4-inch embedment into concrete bond beams. Full penetration through wood bond beam, secured with nut and washer.~~

~~d. *H* = height of the cob portion of the wall only. See Figure AU101.4.~~

~~e. Maximum height shall be 8 feet when wall thickness is increased to 18 inches.~~

~~f. Galvanized mesh.~~

~~*TABLE AU106.11(2)*~~

~~*BRACING REQUIREMENTS FOR COB BRACED WALL PANELS BASED ON WIND SPEED*~~

~~EXPOSURE CATEGORY B~~[d] ~~25-FOOT MEAN ROOF HEIGHT~~ ~~10-FOOT EAVE-TO-RIDGE HEIGHT~~[d] ~~10-FOOT WALL HEIGHT~~[d] ~~2 BRACED WALL LINES~~[d]			~~MINIMUM TOTAL LENGTH (FEET) OF COB BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE~~[a, b, c, d]			
~~Ultimate Design Wind Speed (mph)~~	~~Story Location~~	~~Braced Wall Line Spacing (feet)~~	~~Cob Braced Wall Panel~~[e] ~~A; (aspect ratio *H:L* ≤ 1:1)~~	~~Cob Braced Wall Panel~~[e] ~~B; (aspect ratio *H:L* ≤ 1:1)~~	~~Cob Braced Wall Panel~~[e] ~~C, D; (aspect ratio *H:L* ≤ 2:1)~~	~~Cob Braced Wall Panel~~[e] ~~E; (aspect ratio *H:L* ≤ 1:1)~~
~~≤ 110~~	~~One-story building~~	~~10~~	~~6.0~~	~~6.0~~	~~3.7~~	~~6.0~~
~~≤ 110~~	~~One-story building~~	~~20~~	~~7.9~~	~~7.4~~	~~7.4~~	~~6.0~~
~~≤ 110~~	~~One-story building~~	~~30~~	~~11.8~~	~~11.0~~	~~11.0~~	~~6.9~~
~~≤ 115~~	~~One-story building~~	~~10~~	~~6.0~~	~~6.0~~	~~4.1~~	~~6.0~~
~~≤ 115~~	~~One-story building~~	~~20~~	~~8.7~~	~~8.1~~	~~8.1~~	~~6.0~~
~~≤ 115~~	~~One-story building~~	~~30~~	~~13.0~~	~~12.1~~	~~12.1~~	~~7.6~~
~~≤ 120~~	~~One-story building~~	~~10~~	~~6.0~~	~~6.0~~	~~4.4~~	~~6.0~~
~~≤ 120~~	~~One-story building~~	~~20~~	~~9.4~~	~~8.8~~	~~8.8~~	~~6.0~~
~~≤ 120~~	~~One-story building~~	~~30~~	~~14.1~~	~~13.1~~	~~13.1~~	~~8.3~~
~~≤ 130~~	~~One-story building~~	~~10~~	~~6.0~~	~~6.0~~	~~5.1~~	~~6.0~~
~~≤ 130~~	~~One-story building~~	~~20~~	~~11.0~~	~~10.3~~	~~10.3~~	~~6.5~~
~~≤ 130~~	~~One-story building~~	~~30~~	~~16.5~~	~~15.4~~	~~15.4~~	~~9.7~~
~~≤ 140~~	~~One-story building~~	~~10~~	~~6.0~~	~~6.0~~	~~5.9~~	~~6.0~~
~~≤ 140~~	~~One-story building~~	~~20~~	~~12.7~~	~~11.9~~	~~11.9~~	~~7.5~~
~~≤ 140~~	~~One-story building~~	~~30~~	~~19.1~~	~~17.8~~	~~17.8~~	~~11.2~~

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

~~a. Linear interpolation shall be permitted.~~

~~b. Braced wall panels shall be without openings.~~

~~c. Braced wall panel Types A, B and E shall have an aspect ratio (*H:L*) ≤ 1:1. Braced wall panel Types C and D shall have an aspect ratio (*H:L*) ≤ 2:1.~~

~~d. Subject to applicable wind adjustment factors associated with Items 1 and 2 of Table R602.10.3(2).~~

e. Cob braced wall panel types indicated shall comply with Section AU106.11 and Table AU106.11(1).

TABLE AU106.11(3)
BRACING REQUIREMENTS FOR COB BRACED WALL PANELS BASED ON SEISMIC DESIGN CATEGORY A

• SOIL CLASS D[f] • TOTAL WALL HEIGHT = 10 FEET (INCLUDING STEM WALL AND BOND BEAM) • COB WALL HEIGHT PER TABLE AU106.11(1) • 15 PSF ROOF-CEILING DEAD LOAD[d] • STORY LOCATION: ONE-STORY BUILDING • SEISMIC DESIGN CATEGORY A • 1.5″ PLASTER THICKNESS EACH SIDE[g]				MINIMUM TOTAL LENGTH (FEET) OF COB BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE[a, b, c, d, e]		
Braced Wall Line Spacing (feet)	Braced Wall Line Length (feet)	Min. Braced Wall Line % Openings	Min. Perpendicular Braced Wall Line % Openings	Cob Braced Wall Panel[e] A, B	Cob Braced Wall Panel[e] C, D	Cob Braced Wall Panel[e] E
10	30	0	0	—	3.4	6.0
20	20	0	0	—	3.5	6.0
20	30	0	0	—	4.5	6.0
30	30	0	0	—	5.6	6.0

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

a. Interpolation is not permitted.

b. Braced wall panels shall be without openings.

c. Braced wall panel Types A, B and E shall have an aspect ratio (H:L) ≤ 1:1. Braced wall panel Types C and D shall have an aspect ratio (H:L) ≤ 2:1.

d. Subject to applicable seismic adjustment factors associated with Item 5 in Table R602.10.3(4).

e. Cob braced wall panel types indicated shall comply with Section AU106.11 and Table AU106.11(1).

f. Wall bracing lengths are based on a soil site class D. Interpolation of bracing lengths between S_{DS} values associated with the seismic design categories is allowable where a site-specific S_{DS} value is determined in accordance with Section 1613 of the *International Building Code*.

g. For total plaster thickness between 3 inches and 6 inches, the minimum total length of braced wall panels shall be multiplied by 1.2.

TABLE AU106.12
ANCHORAGE OF BOND BEAMS FOR WIND UPLIFT

ANCHORS: • 5/8″ ALL THREAD AT 12″ O.C.[a, b] • 2″ × 2″ × 1/4″ WASHERS AND NUT AT END IN COB • 4″ EMBEDMENT IN CONCRETE BOND BEAMS • FULL PENETRATION THROUGH WOOD BOND BEAMS WITH 2″ × 2″ × 1/4″ WASHER AND NUT			
WIND UPLIFT FORCE FROM TABLE R802.11 (PLF)	ANCHORAGE DEPTH IN INCHES, PER WALL WIDTH AND WIND UPLIFT FORCE		
	≤ 12″ Wall Width[c]	≤ 16″ Wall Width[c]	≤ 24″ wall width[c]
< 75	16	12	12
< 100	24	16	12
< 150	48 o.c. continuous from foundation to bond beam[d]	24	16
< 200	48 o.c. continuous from foundation to bond beam[d]	48 o.c. continuous from foundation to bond beam[d]	24

For SI: 1 inch = 25.4 mm.

a. For wood bond beams a maximum of 6 inches from bond beam ends.

b. For minimum 6-inch by 8-inch concrete bond beams, at 18″ o.c. for wind uplift forces less than 75 pounds per linear foot, and at 16″ o.c. for wind uplift forces less than 100 pounds per linear foot.

c. Excluding finishes.

~~d. With 7-inch embedment in foundation, 4-inch embedment in concrete bond beam or full penetration through wood bond beam with 2-inch by 2-inch by 1/4-inch washer and nut.~~

~~TABLE AU106.11(4)~~

~~BRACING REQUIREMENTS FOR COB BRACED WALL PANELS BASED ON SEISMIC DESIGN CATEGORY B~~

• ~~**SOIL CLASS D**[f]~~ • ~~**TOTAL WALL HEIGHT = 10 FEET (INCLUDING STEM WALL AND BOND BEAM)**~~ • ~~**COB WALL HEIGHT PER TABLE AU106.11(1)**~~ • ~~**15 PSF ROOF-CEILING DEAD LOAD**[d]~~ • ~~**STORY LOCATION: ONE-STORY BUILDING**~~ • ~~**SESIMIC DESIGN CATEGORY B**~~ • ~~**1.5″ PLASTER THICKNESS EACH SIDE**[g]~~				~~MINIMUM TOTAL LENGTH (FEET) OF COB BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE[a, b, c, d, e]~~		
~~Braced Wall Line Spacing (feet)~~	~~Braced Wall Line Length (feet)~~	~~Min. Braced Wall Line % Openings~~	~~Min. Perpendicular Braced Wall Lines % Openings~~	~~Cob Braced Wall Panel[e] A, B~~	~~Cob Braced Wall Panel[e] C, D~~	~~Cob Braced Wall Panel[e] E~~
~~10~~	~~10~~	~~0~~	~~0~~	~~6.0~~	~~3.2~~	~~6.0~~
~~10~~	~~20~~	~~0~~	~~0~~	~~6.0~~	~~4.9~~	~~6.0~~
~~10~~	~~20~~	~~50~~	~~0~~	~~6.0~~	~~3.5~~	~~6.0~~
~~10~~	~~30~~	~~0~~	~~0~~	~~7.1~~	~~6.6~~	~~6.0~~
~~10~~	~~30~~	~~50~~	~~0~~	~~6.0~~	~~4.5~~	~~6.0~~
~~20~~	~~10~~	~~0~~	~~0~~	~~6.0[h]~~	~~4.9[h]~~	~~6.0~~
~~20~~	~~10~~	~~0~~	~~50~~	~~6.0~~	~~3.5~~	~~6.0~~
~~20~~	~~10~~	~~50~~	~~0~~	~~NP~~	~~4.2~~	~~NP~~
~~20~~	~~10~~	~~50~~	~~50~~	~~NP~~	~~3.0~~	~~NP~~
~~20~~	~~20~~	~~0~~	~~0~~	~~7.4~~	~~6.9~~	~~6.0~~
~~20~~	~~20~~	~~0~~	~~50~~	~~6.0~~	~~5.5~~	~~6.0~~
~~20~~	~~20~~	~~50~~	~~0~~	~~6.0~~	~~5.5~~	~~6.0~~
~~20~~	~~20~~	~~50~~	~~50~~	~~6.0~~	~~4.1~~	~~6.0~~
~~20~~	~~30~~	~~0~~	~~0~~	~~9.4~~	~~8.8~~	~~6.0~~
~~20~~	~~30~~	~~0~~	~~50~~	~~7.9~~	~~7.4~~	~~6.0~~
~~20~~	~~30~~	~~50~~	~~0~~	~~7.2~~	~~6.7~~	~~6.0~~
~~20~~	~~30~~	~~50~~	~~50~~	~~6.0~~	~~5.3~~	~~6.0~~
~~30~~	~~10~~	~~0~~	~~0~~	~~7.1~~	~~6.6~~	~~6.0~~
~~30~~	~~20~~	~~0~~	~~0~~	~~9.4~~	~~8.8~~	~~6.0~~
~~30~~	~~20~~	~~0~~	~~50~~	~~7.2~~	~~6.7~~	~~6.0~~
~~30~~	~~20~~	~~50~~	~~0~~	~~7.9~~	~~7.4~~	~~6.0~~
~~30~~	~~30~~	~~0~~	~~0~~	~~11.8~~	~~11.0~~	~~6.0~~
~~30~~	~~30~~	~~0~~	~~50~~	~~9.5~~	~~8.9~~	~~6.0~~
~~30~~	~~30~~	~~50~~	~~0~~	~~9.5~~	~~8.9~~	~~6.0~~
~~30~~	~~30~~	~~50~~	~~50~~	~~7.3~~	~~6.8~~	~~6.0~~

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

NP = Not Permitted.

a. Interpolation is not permitted.

b. Braced wall panels shall be without openings.

c. Braced wall panel Types A, B and E shall have an aspect ratio (*H*:*L*) ≤ 1:1. Braced wall panel Types C and D shall have an aspect ratio (*H*:*L*) ≤ 2:1.

d. Subject to applicable seismic adjustment factors associated with Item 5 in Table R602.10.3(4).

e. Cob braced panel types indicated shall comply with Section AU106.11 and Table AU106.11(1).

f. Wall bracing lengths are based on a soil site class D. Interpolation of bracing lengths between S_{DS} values associated with the seismic design categories is allowable where a site-specific S_{DS} value is determined in accordance with Section 1613 of the *International Building Code*.

g. For total plaster thicknesses 3 inches to 6 inches, the minimum total length of braced wall panels shall be multiplied by 1.2.

h. Total plaster thicknesses shall be not greater than 3 inches. Substitute $^{15}/_{32}$″ roof sheathing and 10d at 6″ edge nailing for requirements in Table R602.3(1).

TABLE AU106.11(5)
BRACING REQUIREMENTS FOR COB BRACED WALL PANELS BASED ON SEISMIC DESIGN CATEGORY C

• SOIL CLASS D[f] • TOTAL WALL HEIGHT = 10 FEET (INCLUDING STEM WALL AND BOND BEAM) • COB WALL HEIGHT PER TABLE AU106.11(1) • 15 PSF ROOF-CEILING DEAD LOAD[d] • STORY LOCATION: ONE-STORY BUILDING • SESIMIC DESIGN CATEGORY C • 1.5″ PLASTER THICKNESS EACH SIDE[g]				MINIMUM TOTAL LENGTH (FEET) OF COB BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE[a, b, c, d, e]		
Braced Wall Line Spacing (feet)	Braced Wall Line Length (feet)	Min. Braced Wall Line % Openings	Min. Perpendicular Braced Wall Lines % Openings	Cob Braced Wall Panel[e] A, B	Cob Braced Wall Panel[e] C, D	Cob Braced Wall Panel[e] E
10	10	0	0	8.3[h]	7.8[h]	6.0
10	10	0	50	6.5	6.1	6.0
10	10	25	0	7.4[h]	6.9[h]	6.0
10	10	50	50	NP	4.4	6.0
10	15	0	0	10.6	9.9	6.0
10	15	0	50	8.7	8.2	6.0
10	15	50	0	NP	7.3	6.0
10	15	50	50	6.0	5.6	6.0
10	20	0	0	12.8	11.9	6.0
10	20	0	50	11.0	10.2	6.0
10	20	50	0	9.1	8.5	6.0
10	20	50	50	7.3	6.8	6.0
15	10	25	0	NP	NP	6.0[h]
15	10	0	50	7.8	7.3	6.0
15	10	50	0	NP	NP	NP
15	10	50	50	NP	NP	NP
15	15	0	0	12.9	12.1	6.0
15	15	0	50	10.2	9.5	6.0
15	15	50	0	NP	NP	6.0
15	15	50	50	7.5	7.0	6.0
15	20	0	0	15.3	14.3	6.0

15	20	0	50	12.6	11.7	6.0
15	20	50	0	NP	NP	6.0
15	20	50	50	8.9	8.3	6.0
20	10	**25**	0	NP	NP	NP
20	10	0	50	9.1	8.5	6.0
20	10	50	0	NP	NP	NP
20	10	50	50	NP	NP	NP
20	15	0	0	NP	14.3[h]	6.0[h]
20	15	0	50	11.7[h]	10.9[h]	6.0
20	15	50	0	NP	NP	6.0[h]
20	15	50	50	NP	NP	6.0
20	20	0	0	17.8	16.7	6.9
20	20	0	50	14.2	13.3	6.0
20	20	50	0	NP	NP	6.0
20	20	**50**	50	NP	9.9	6.0

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

NP = Not Permitted.

a. Interpolation is not permitted.

b. Braced wall panels shall be without openings.

c. Braced wall panel Types A, B and E shall have an aspect ratio (*H:L*) ≤ 1:1. Braced wall panel Types C and D shall have an aspect ratio (*H:L*) ≤ 2:1.

d. Subject to applicable seismic adjustment factors associated with Item 5 in Table R602.10.3(4).

e. Cob braced panel types indicated shall comply with Section AU106.11 and Table AU106.11(1).

f. Wall bracing lengths are based on a soil site class D. Interpolation of bracing lengths between S_{DS} values associated with the seismic design categories is allowable where a site-specific S_{DS} value is determined in accordance with Section 1613 of the *International Building Code*.

g. For total plaster thicknesses 3″ to 6″, multiply the minimum total length of braced wall panels by 1.2.

h. Total plaster thickness shall not be greater than 3 inches. Substitute $^{15}/_{32}''$ roof sheathing and 10d at 6″ edge nailing for requirements in Table R602.3(1).

APPENDIX AV

BOARD OF APPEALS

DELETED.

~~*The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.*~~

~~User Note:~~

~~**About this appendix:** *Appendix AV provides criteria for Board of Appeals members. Also provided are procedures by which the Board of Appeals should conduct its business.*~~

~~SECTION AV101~~
~~GENERAL~~

~~**AV101.1 Scope.** A board of appeals shall be established within the *jurisdiction* for the purpose of hearing applications for modification of the requirements of this code pursuant to the provisions of Section R112. The board shall be established and operated in accordance with this section, and shall be authorized to hear evidence from appellants and the *building official* pertaining to the application and intent of this code for the purpose of issuing orders pursuant to these provisions.~~

~~**AV101.2 Application for appeal.** Any person shall have the right to appeal a decision of the *building official* to the board. An application for appeal shall be based on a claim that the intent of this code or the rules legally adopted hereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an equally good or better form of construction is proposed. The application shall be filed on a form obtained from the *building official* within 20 days after the notice was served.~~

~~**AV101.2.1 Limitation of authority.** The board shall not have authority to waive requirements of this code or interpret the administration of this code.~~

~~**AV101.2.2 Stays of enforcement.** Appeals of notice and orders, other than Imminent Danger notices, shall stay the enforcement of the notice and order until the appeal is heard by the board.~~

~~**AV101.3 Membership of board.** The board shall consist of five voting members appointed by the chief appointing authority of the *jurisdiction*. Each member shall serve for [**INSERT NUMBER OF YEARS**] years or until a successor has been appointed. The board member's terms shall be staggered at intervals, so as to provide continuity. The *building official* shall be an ex officio member of said board but shall not vote on any matter before the board.~~

~~**AV101.3.1 Qualifications.** The board shall consist of five individuals, who are qualified by experience and training to pass on matters pertaining to building construction and are not employees of the *jurisdiction*.~~

~~**AV101.3.2 Alternate members.** The chief appointing authority is authorized to appoint two alternate members who shall be called by the board chairperson to hear appeals during the absence or disqualification of a member. Alternate members shall possess the qualifications required for board membership, and shall be appointed for the same term or until a successor has been appointed.~~

~~**AV101.3.3 Vacancies.** Vacancies shall be filled for an unexpired term in the same manner in which original appointments are required to be made.~~

~~**AV101.3.4 Chairperson.** The board shall annually select one of its members to serve as chairperson.~~

~~**AV101.3.5 Secretary.** The chief appointing authority shall designate a qualified clerk to serve as secretary to the board. The secretary shall file a detailed record of all proceedings which shall set forth the reasons for the board's decision, the vote of each member, the absence of a member and any failure of a member to vote.~~

~~**AV101.3.6 Conflict of interest.** A member with any personal, professional or financial interest in a matter before the board shall declare such interest and refrain from participating in discussions, deliberations and voting on such matters.~~

~~**AV101.3.7 Compensation of members.** Compensation of members shall be determined by law.~~

~~**AV101.3.8 Removal from the board.** A member shall be removed from the board prior to the end of their term only for cause. Any member with continued absence from regular meeting of the board may be removed at the discretion of the chief appointing authority.~~

~~**AV101.4 Rules and procedures.** The board shall establish policies and procedures necessary to carry out its duties consistent with the provisions of this code and applicable state law. The procedures shall not require compliance with strict rules of evidence, but shall mandate that only relevant information be presented.~~

~~**AV101.5 Notice of meeting.** The board shall meet upon notice from the chairperson, within 10 days of the filing of an appeal or at stated periodic intervals.~~

~~**AV101.5.1 Open hearing.** All hearings before the board shall be open to the public. The appellant, the appellant's representative, the *building official* and any person whose interests are affected shall be given an opportunity to be heard.~~

~~**AV101.5.2 Quorum.** Three members of the board shall constitute a quorum.~~

~~**AV101.5.3 Postponed hearing.** When five members are not present to hear an appeal, either the appellant or the appellant's representative shall have the right to request a postponement of the hearing.~~

~~**AV101.6 Legal counsel.** The *jurisdiction* shall furnish legal counsel to the board to provide members with general legal advice concerning matters before them for consideration. Members shall be represented by legal counsel at the *jurisdiction*'s expense in all matters arising from service within the scope of their duties.~~

~~**AV101.7 Board decision.** The board shall only modify or reverse the decision of the *building official* by a concurring vote of three or more members.~~

~~**AV101.7.1 Resolution.** The decision of the board shall be by resolution. Every decision shall be promptly filed in writing in the office of the *building official* within 3 days and shall be open to the public for inspection. A certified copy shall be furnished to the appellant or the appellant's representative and to the *building official*.~~

~~**AV101.7.2 Administration.** The *building official* shall take immediate action in accordance with the decision of the board.~~

~~**AV101.8 Court review.** Any person, whether or not a previous party of the appeal, shall have the right to apply to the appropriate court for a writ of certiorari to correct errors of law. Application for review shall be made in the manner and time required by law following the filing of the decision in the office of the chief administrative officer.~~

APPENDIX AW

3D-PRINTED BUILDING CONSTRUCTION

The provisions contained in this appendix are ~~not mandatory unless specifically referenced in the adopting ordinance.~~ *adopted as part of this code.*

~~User Note:~~

~~***About this appendix:*** Appendix AW provides for the design, construction and inspection of 3D building construction. UL 3401 was developed to evaluate critical aspects of this construction process to result in consistent 3D-printed building techniques that comply with a level of safety and performance equivalent to legacy construction techniques currently in the code.~~

APPENDIX NC-A

SWIMMING POOLS, SPAS AND HOT TUBS

This appendix is a North Carolina addition and not part of the 2021 *International Residential Code*. There will be no underlined text.

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

SECTION NCA101
GENERAL

NCA101.1 General. The provisions of this appendix shall control the design and construction of swimming pools, spas and hot tubs installed in or on the *lot* of a one- or two-family dwelling.

NCA101.2 Pools in flood hazard areas. Pools that are located in flood hazard areas established by Table R301.2(1), including above-ground pools, on-ground pools and in-ground pools that involve placement of fill, shall comply with Section NCA101.2.1 or NCA101.2.2.

Exception: Pools located in riverine flood hazard areas that are outside of designated floodways.

NCA101.2.1 Pools located in designated floodways. Where pools are located in designated floodways, documentation shall be submitted to the *building official*, which demonstrates that the construction of the pool will not increase the design flood elevation at any point within the *jurisdiction*.

NCA101.2.2 Pools located where floodways have not been designated. Where pools are located where design flood elevations are specified but floodways have not been designated, the applicant shall provide a floodway analysis that demonstrates that the proposed pool will not increase the design flood elevation more than 1 foot (305 mm) at any point within the *jurisdiction*.

SECTION NCA102
DEFINITIONS

NCA102.1 General. For the purposes of these requirements, the terms used shall be defined as follows and as set forth in Chapter 2.

ABOVE-GROUND/ON-GROUND POOL. See "Swimming pool."

BARRIER. A permanent fence, wall, building wall or combination thereof that completely surrounds the swimming pool and
obstructs access to the swimming pool.

HOT TUB. See "Swimming pool."

IN-GROUND POOL. See "Swimming pool."

RESIDENTIAL. That which is situated on the premises of a detached one- or two-family dwelling or a one-family *townhouse* not more than three stories in height.

SPA, NONPORTABLE. See "Swimming pool."

SPA, PORTABLE. A nonpermanent structure intended for recreational bathing, in which all controls, water-heating and water-circulating *equipment* are an integral part of the product.

SWIMMING POOL. Any structure intended for swimming or recreational bathing that contains water over 24 inches (610 mm) deep. This includes in-ground, above-ground and on-ground swimming pools, hot tubs and spas.

SWIMMING POOL, INDOOR. A swimming pool which is totally contained within a structure and surrounded on all four sides by the walls of the enclosing structure.

SWIMMING POOL, OUTDOOR. Any swimming pool which is not an indoor pool.

SECTION NCA103
SWIMMING POOLS

NCA103.1 In-ground pools. In-ground pools shall be designed and constructed in conformance with ANSI/APSP/ICC 5 as listed in Section NCA107.

NCA103.2 Above-ground and on-ground pools. Aboveground and on-ground pools shall be designed and constructed in conformance with ANSI/APSP/ICC 4 as listed in Section NCA107.
NCA103.3 Pools in flood hazard areas. In flood hazard areas established by Table R301.2(1), pools in coastal high hazard areas shall be designed and constructed in conformance with ASCE 24.

SECTION NCA104
SPAS AND HOT TUBS

NCA104.1 Permanently installed spas and hot tubs. Permanently installed spas and hot tubs shall be designed and constructed in conformance with ANSI/APSP/ICC 3 as listed in Section NCA107.

NCA104.2 Portable spas and hot tubs. Portable spas and hot tubs shall be designed and constructed in conformance with ANSI/APSP/ICC 6 as listed in Section NCA107.

SECTION NCA105
BARRIER REQUIREMENTS

NCA105.1 Application. The provisions of this chapter shall control the design of barriers for residential swimming pools, spas and hot tubs. These design controls are intended to provide protection against potential drownings and near drownings by restricting access to swimming pools, spas and hot tubs.

NCA105.2 Outdoor swimming pools and spas. An outdoor swimming pool, including an in-ground, above-ground or on-ground pool, hot tub or spa shall be surrounded by a barrier that complies with **Sections NCA105.2.1** through **NCA105.7**.
NCA105.2.1 Barrier height and clearances. Barrier heights and clearances shall be in accordance with all of the following:

1. The top of the barrier shall be not less than 48 inches (1219 mm) above grade where measured on the side of the barrier that faces away from the pool or spa. Such height shall exist around the entire perimeter of the barrier and for a distance of 3 feet (914 mm) measured horizontally from the outside of the required barrier.
2. The vertical clearance between grade and the bottom of the barrier shall not exceed 2 inches (51 mm) for grade surfaces that are not solid, such as grass or gravel, where measured on the side of the barrier that faces away from the pool or spa.
3. The vertical clearance between a surface below the barrier to a solid surface, such as concrete, and the bottom of the required barrier shall not exceed 4 inches (102 mm) where measured on the side of the required barrier that faces away from the pool or spa.
4. Where the top of the pool or spa structure is above grade, the barrier shall be installed on grade or shall be mounted on top of the pool or spa structure. Where the barrier is mounted on the top of the pool or spa, the vertical clearance between the top of the pool or spa and the bottom of the barrier shall not exceed 4 inches (102 mm).

NCA105.2.2 Openings. Openings in the barrier shall not allow passage of a 4-inch-diameter (102 mm) sphere.

NCA105.2.3 Solid barrier surfaces. Solid barriers that do not have openings shall not contain indentations or protrusions that form handholds and footholds, except for normal construction tolerances and tooled masonry joints.

NCA105.2.4 Mesh fence as a barrier. <u>**Deleted.**</u> ~~Mesh fences, other than chain link fences in accordance with **Section NCA105.2.7**, shall be installed in accordance with the manufacturer's instructions and shall comply with the following:~~

1. ~~The bottom of the mesh fence shall be not more than 1 inch (25 mm) above the deck or installed surface or grade.~~
2. ~~The maximum vertical clearance from the bottom of the mesh fence and the solid surface shall not permit the fence to be lifted more than 4 inches (102 mm) from grade or decking.~~
3. ~~The fence shall be designed and constructed so that it does not allow passage of a 4-inch (102 mm) sphere under any mesh panel. The maximum vertical clearance from the bottom of the mesh fence and the solid surface shall be not greater than 4 inches (102 mm) from grade or decking.~~

4. ~~An attachment device shall attach each barrier section at a height not lower than 45 inches (1143 mm) above grade. Common attachment devices include, but are not limited to, devices that provide the security equal to or greater than that of a hook-and-eye-type latch incorporating a spring-actuated retaining lever such as a safety gate hook.~~
5. ~~Where a hinged gate is used with a mesh fence, the gate shall comply with **Section NCA105.3**.~~
6. ~~Patio deck sleeves such as vertical post receptacles that are placed inside the patio surface shall be of a nonconductive material.~~
7. ~~Mesh fences shall not be installed on top of onground residential pools.~~

NCA105.2.4.1 Setback for mesh fences. The inside of a mesh fence shall be not closer than 20 inches (508 mm) to the nearest edge of the water of a pool or spa.

NCA105.2.5 Closely spaced horizontal members. Where the barrier is composed of horizontal and vertical members and the distance between the tops of the horizontal members is less than 45 inches (1143 mm), the horizontal members shall be located on the pool or spa side of the fence. Spacing between vertical members shall not exceed 13/4 inches (44 mm) in width. Where there are decorative cutouts within vertical members, spacing within the cutouts shall not exceed 13/4 inches (44 mm) in width.

NCA105.2.6 Widely spaced horizontal members. Where the barrier is composed of horizontal and vertical members and the distance between the tops of the horizontal members is 45 inches (1143 mm) or more, spacing between vertical members shall not exceed 4 inches (102 mm). Where there are decorative cutouts within vertical members, the interior width of the cutouts shall not exceed 1 3/4 inches (44 mm).

NCA105.2.7 Chain link dimensions. The maximum opening formed by a chain link fence shall be not more than 1 3/4 inches (44 mm). Where the fence is provided with slats fastened at the top and bottom that reduce the openings, such openings shall be not greater than 1 3/4 inches (44 mm).

NCA105.2.8 Diagonal members. Where the barrier is composed of diagonal members, the maximum opening formed by the diagonal members shall be not greater than 1 3/4 inches (44 mm). The angle of diagonal members shall be not greater than 45 degrees (0.79 rad) from vertical.

NCA105.2.9 Clear zone. Where equipment, including pool equipment such as pumps, filters and heaters, is on the same lot as a pool or spa and such equipment is located outside of the barrier protecting the pool or spa, such equipment shall be located not less than 36 inches (914 mm) from the outside of the barrier.

NCA105.3 Doors and gates. Doors and gates **in barriers** shall comply with the requirements of **Sections NCA105.3.1** through **NCA 105.3.3** and shall be equipped to accommodate a locking device. Pedestrian access **doors and** gates shall open outward away from the pool or spa, shall be self-closing and shall have a self-latching device.
NCA105.3.1 Utility or service doors and gates. Gates **Doors and gates** not intended for pedestrian use, such as utility or service **doors and** gates, shall remain locked when not in use.
NCA105.3.2 Double or multiple doors and gates. Double **doors and** gates or multiple **doors and** gates shall have not fewer than one leaf secured in place and the adjacent leaf shall be secured with a selflatching
device.
NCA105.3.3 Latches release. For doors and gates in barrier, the door and gate latch release mechanisms shall be in accordance with the following**:**

1. Where door and gate latch release mechanisms are accessed from the outside of the barrier and are not of the self-locking type, such mechanism shall be located above the finished floor or ground surface not less 54 inches (1372 mm).

2. Where door and gate latch release mechanisms are of the self-locking type such as where the lock is operated by means of a key, an electronic opener or the entry of a combination into an integral combination lock, the lock operation control and the latch release mechanism shall be located above the finished floor or ground surface not greater than 54 inches (1372 mm).

3. Where the only latch release mechanism of a self-latching device for a gate is located on the pool and spa side of the barrier, the release mechanism shall be located at a point that is at least 3 inches (76 mm) below the top of the gate.

NCA105.3.4 Barriers adjacent to latch release mechanisms. Where a latch release mechanism is located on the inside of a barrier, openings in the door, gate and barrier within 18 inches (457 mm) of the latch shall not be greater than 1/2 inch (12.7 mm) in any dimension**.**

NCA105.4 Structure wall as a barrier. Where a wall of a dwelling or structure serves as part of the barrier and where doors**, gates** or windows provide direct access to the pool or spa through that wall, one of the following shall be required:
1. Operable windows having a sill height of less than 48 inches (1219 mm) above the indoor finished floor **, doors and** doors **gates** shall have an alarm that produces an audible warning when the window, door or their screens are opened. The alarm shall be listed and labeled as a water hazard entrance alarm in accordance with UL 2017.
2. The operable parts of the alarm deactivation switches shall be located **at not less than** 54 inches (1372 mm) above the finished floor.
3. A safety cover that is listed and labeled in accordance with **ASTM F1346** is installed for the pools and spas.
4. An approved means of protection, such as self-closing doors with self-latching devices, is provided. Such means of protection shall provide a degree of protection that is not less than the protection afforded by Item 1 or 2.

NCA105.5 Onground residential pool structure as a barrier. An onground residential pool wall structure or a barrier mounted on top of an onground residential pool wall structure shall serve as a barrier where all of the following conditions are present:

1. Where only the pool wall serves as the barrier, the bottom of the wall is on grade, the top of the wall is not less than 48 inches (1219 mm) above grade for the entire perimeter of the pool, the wall complies with the requirements of **Section NCA105.2** and the pool manufacturer allows the wall to serve as a barrier.
2. Where a barrier is mounted on top of the pool wall, the top of the barrier is not less than 48 inches (1219 mm) above grade for the entire perimeter of the pool, and the wall and the barrier on top of the wall comply with the requirements of **Section NCA105.2**.

3. Ladders or steps used as means of access to the pool are capable of being secured, locked or removed to prevent access except where the ladder or steps are surrounded by a barrier that meets the requirements of **Section NCA 105**.

4. Openings created by the securing, locking or removal of ladders and steps do not allow the passage of a 4-inch (102 mm) diameter sphere.

5. Barriers that are mounted on top of onground residential pool walls are installed in accordance with the pool manufacturer's instructions.

NA105.6 Natural barriers. In the case where the pool or spa area abuts the edge of a lake or other natural body of water, public access is not permitted or allowed along the shoreline, and required barriers extend to and beyond the water's edge not less than 18 inches (457 mm), a barrier is not required between the natural body of water shoreline and the pool or spa.

NCA105.7 Natural topography. Natural topography that prevents direct access to the pool or spa area shall include but not be limited to mountains and natural rock formations. A natural barrier approved by the governing body shall be acceptable provided that the degree of protection is not less than the protection afforded by the requirements of **Sections NCA105.2** through **NCA105.5**.

NCA105.8 Indoor swimming pool. Walls surrounding an indoor swimming pool shall comply with Section NCA105.2, Item 9.

NCA105.9 Prohibited locations. Barriers shall be located to prohibit permanent structures, equipment or similar objects from being used to climb them.

NCA105.10 Barrier exceptions. Spas or hot tubs with a safety cover that complies with ASTM F1346, as listed in Section NCA107, shall be exempt from the provisions of this appendix.

SECTION NCA106
ENTRAPMENT PROTECTION FOR SWIMMING POOL AND SPA SUCTION OUTLETS

NCA106.1 General. Suction outlets shall be designed and installed in accordance with APSP 7(ANSI/PHTA/ICC 7).

SECTION NCA107
REFERENCE STANDARDS

APSP
Pool & Hot Tub Alliance (formerly The Association of Pool &
Spa Professionals)
2111 Eisenhower Avenue, Suite 500
Alexandria, VA 22314

ANSI/APSP/ICC 3—2014 American National Standard for Permanently Installed Residential Spas and Swim Spas
NCA104.1

ANSI/APSP/ICC 4—2012 American National Standard for Aboveground/Onground Residential Swimming Pools—Includes Addenda A Approved April 4, 2013
NCA103.2

ANSI/APSP/ICC 5—2011 American National Standard for Residential Inground Swimming Pools
NCA103.1

ANSI/APSP/ICC 6—2013 American National Standard for Residential Swimming Pool and Spa
NCA104.2

ANSI/PHTA/ICC 7—2020 American National Standard for Suction Entrapment Avoidance in Swimming Pools, Wading Pools, Spas, Hot Tubs, and Catch Basins
NCA106.1

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ASCE/SEI

American Society of Civil Engineers Structural Engineering Institute
1801 Alexander Bell Drive
Reston, VA 20191-4400

ASCE 24—14 Flood Resistant Design & Construction
NCA103.3

ASTM
ASTM International
100 Barr Harbor, P.O. Box C700
West Conshohocken, PA 19428-2959

F1346—1991(2018) Standard Performance Specification for Safety Covers and Labeling Requirements for All Covers for Swimming Pools, Spas and Hot Tubs
NCA105.1, **NCA105.4**

ICC

International Code Council, Inc.
500 New Jersey Avenue, NW
6th Floor
Washington, DC 20001

ISPSC—21 International Swimming Pool and Spa Code

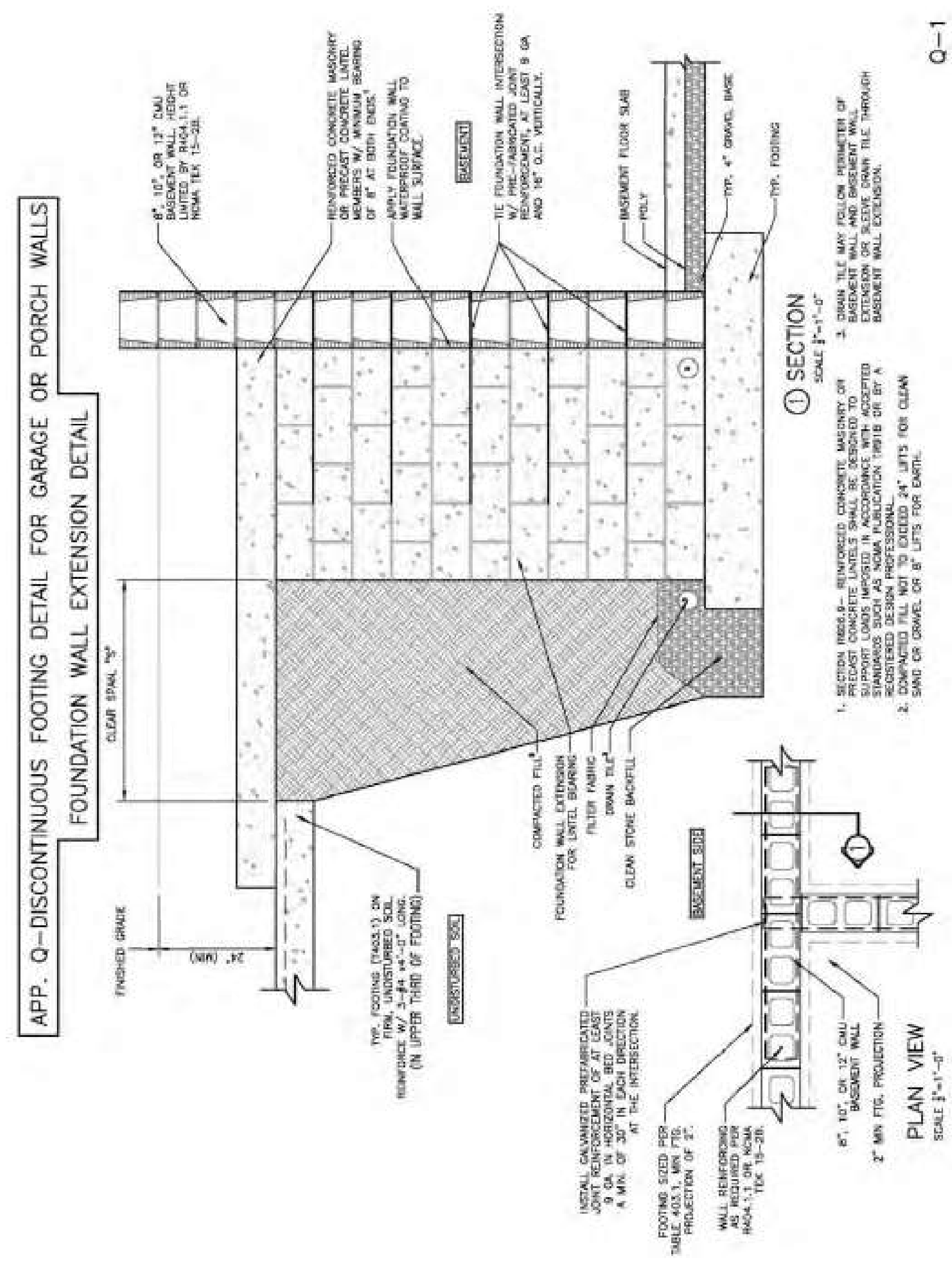
UL

UL LLC
333 Pfingsten Road
Northbrook, IL 60062

2017—2008 General-purpose Signaling Devices and Systems—with revisions through January 2018
NCA105.4

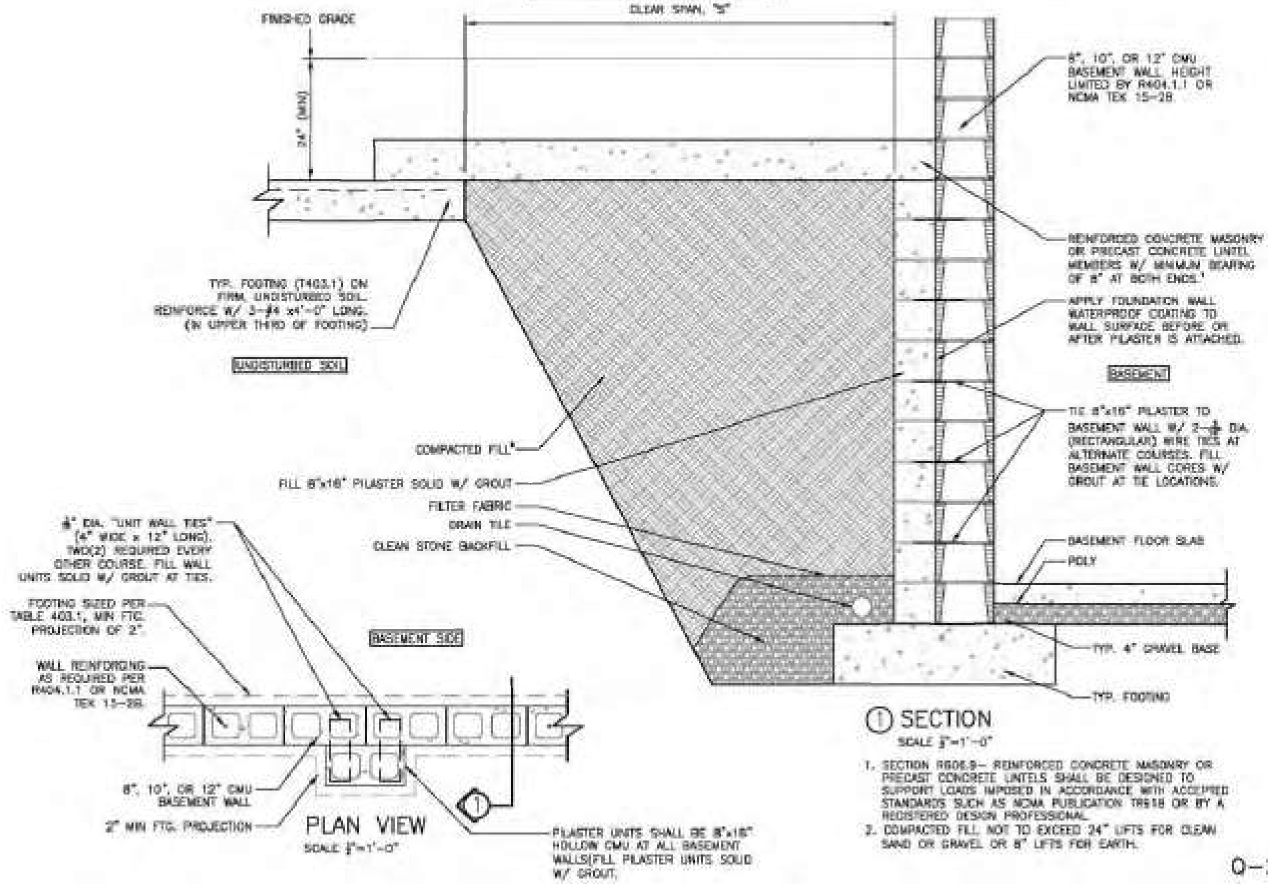
APPENDIX NC-B

This appendix is a North Carolina addition to the 2021 International Residential Code.
There will be no underlined text.
(The provisions contained in this appendix are adopted as part of this code.)



APP. Q–DISCONTINUOUS FOOTING DETAIL FOR GARAGE OR PORCH WALLS

PILASTER DETAIL

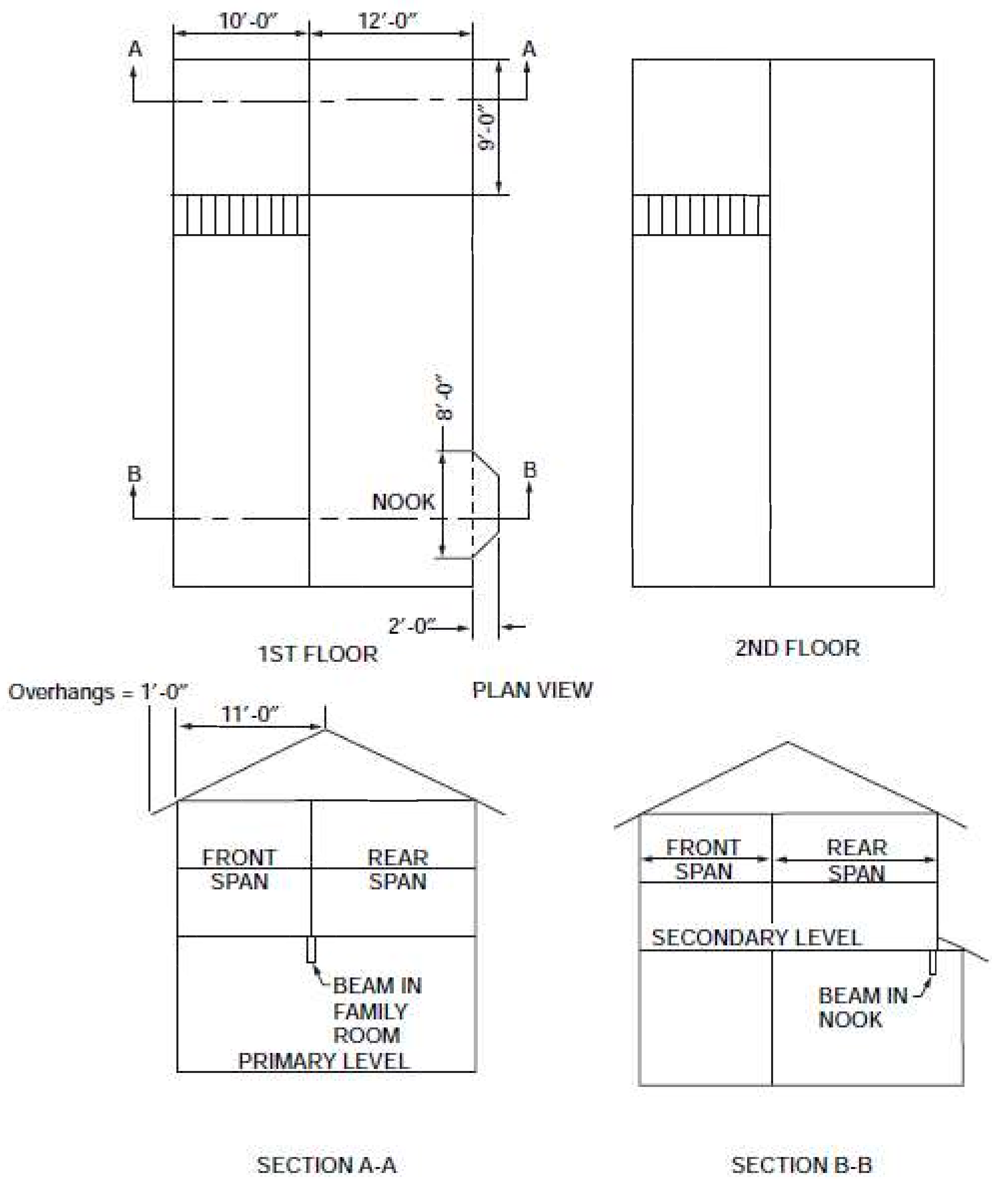


1. SECTION R606.9– REINFORCED CONCRETE MASONRY OR PRECAST CONCRETE LINTELS SHALL BE DESIGNED TO SUPPORT LOADS IMPOSED IN ACCORDANCE WITH ACCEPTED STANDARDS SUCH AS NCMA PUBLICATION TR918 OR BY A REGISTERED DESIGN PROFESSIONAL.
2. COMPACTED FILL NOT TO EXCEED 24" LIFTS FOR CLEAN SAND OR GRAVEL OR 8" LIFTS FOR EARTH.

APPENDIX W
BASIC LOAD ESTIMATING

This appendix is a North Carolina addition and not part of the 2021 International Residential Code. There will be no underlined text.

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



For SI: 1 inch = 25.4, 1 foot = 304.8 mm, 1 square foot = 0.0929m2.

ASSUMPTIONS (sleeping area live load; roof or stick frame rafters with no interior bearing):

Loads

Secondary floor level is 30# L.L. + 10# D.L. = 40#/sq. ft.

Attic level is 20# live load + 10# dead load = 30#/sq. ft.
Nook ceiling is 10# dead load (No attic storage) = 10#/sq. ft.
Wall load
Studs @ 16", 1/2" gypsum = 8#/sq. ft.
Roof load
20# live load + 10# dead load = 30#/sq. ft.

EXAMPLE OF LOAD ESTIMATING
LOAD ON BEAM IN FAMILY ROOM

Loads in Section A - A as follows: **Total Loads**
(in pounds/linear foot)

$$\text{2nd floor load} = \frac{(\text{front joist span} + \text{rear joist span})}{2} \times \text{2nd floor (dead load + live load)} = \text{LOAD/linear ft}$$

$$= \frac{(10 + 12)}{2} \times (10 + 30) = \frac{(22)}{2} \times (40) = 11 \times 40 = \mathbf{440} \text{ pounds/linear ft}$$

Interior wall load = Wall Weight per Square foot x Wall Height = LOAD/linear foot

= 8 pounds/sq. ft. × 8ft. = = **64** pounds/linear ft
(Wall weight can vary. Verify actual weight of materials used)

$$\text{Attic load} = \frac{(\text{front joist span} + \text{rear joist span})}{2} \times \text{attic (dead load + live load)} = \text{LOAD/linear ft}$$

$$= \frac{(10 + 12)}{2} \times (10 + 20) = \frac{(22)}{2} \times (30) = 11 \times 30 = \underline{\mathbf{330}} \text{ pounds/linear ft}$$

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

Total Load on Beam in Family Room = **834** pounds/1ft.

Beam span in family room is 9 feet and total estimated load is 834#/linear foot:

By using Table W-1, the required beam is 4 @ 2 × 12 ~~SYP or~~ SPF

OR

By using Table W-2, the required minimum flitch beam is 2@2 × 8 with ~~1/2~~5/8″×7″ steel plate bolted with 1/2″ bolts spaced at 2′ o.c.

EXAMPLE OF LOAD ESTIMATING
LOAD ON BEAM IN NOOK AREA

Loads in Section B - B as follows: **Total Loads**
(in pounds/linear foot)

$$\text{2nd floor load} = \frac{(\text{front joist span} + \text{rear joist span})}{2} \times \text{2nd floor (dead load + live load)} = \text{LOAD/linear ft}$$

$$= \frac{(0 + 12)}{2} \times (10 + 30) = \frac{(12)}{2} \times (40) = 6 \times 40 = \mathbf{240} \text{ pounds/linear ft}$$

Exterior wall load = Wall Weight per Square foot x Wall Height = LOAD/linear foot

= 8 pounds/sq. ft. × 8ft. = = **64** pounds/linear ft
(Wall weight can vary. Verify actual weight of materials used)

$$\text{Attic load} = \frac{(\text{front joist span} + \text{rear joist span})}{2} \times \text{attic (dead load + live load)} = \text{LOAD/linear ft}$$

$$= \frac{(0 + 12)}{2} \times (10 + 20) = \frac{(12)}{2} \times (30) = 6 \times 30 = \mathbf{180} \text{ pounds/linear ft}$$

$$\text{Roof load} = \frac{(\overset{\text{front}}{\text{rafter span}} + \overset{\text{rear}}{\text{rafter span}})}{2} + \text{overhang} \times \text{roof(dead load+live load)=LOAD/linear ft}$$

$$= \left(\frac{(11+11)}{2}+1\right) \times (10 + 20) = \left(\frac{(22)}{2}+1\right) \times (30) = 12 \times 30 = \mathbf{360} \text{ pounds/linear ft}$$

$$\text{Nook Ceiling load} = \frac{(\text{joist span} + \text{joist span})}{2} \times \text{ceiling(dead load+live load)=LOAD/linear ft}$$

$$= \frac{(0+2)}{2} \times (10 + 0) = \frac{(2)}{2} \times (10) = 1 \times 10 = \mathbf{10} \text{ pounds/linear ft}$$

$$\text{Nook Roof load} = \frac{(\text{rafter span} + \text{rafter span})}{2} \times \text{roof(dead load+live load)=LOAD/linear ft}$$

$$= \frac{(0+2)}{2} \times (10 + 20) = \frac{(2)}{2} \times (30) = 1 \times 30 = \underline{\mathbf{30}} \text{ pounds/linear ft}$$

Total Load on Beam in Nook = **884** pounds/1ft.

Beam span in nook is 8 feet and total estimated load is 884#/linear foot:

By using Table W-1, the required beam is ~~3~~4 @ 2 × 12 Southern pine or 4 @ 2 × 12 Spruce-pine-fir

OR
By using Table W-2, the required minimum flitch beam is 2@2 × 8 with ~~3/8~~1/2″×7″ steel plate bolted with 1/2″ bolts spaced at 2′ o.c.

TABLE W-1
WOOD BEAMS AND GIRDERS ALLOWABLE LOADS
IN POUNDS PER LINEAR FOOT [1, 2, 3, 4]

2X8 (1 ½" X 7 ¼")						
Span L [6] (feet)	Spruce-Pine-Fir [5]			Southern Pine		
	2 ply	3 ply	4 ply	2 ply	3 ply	4 ply
3	1305	1956	2610	1692	2538	3383
4	979	1468	1958	1013	1519	2026
5	736	1104	1472	648	972	1296
6	511	767	1022	450	675	900
7	375	563	751	331	496	661
8	287	431	575	253	380	506
9	227	341	454	200	300	400
10	184	276	368	162	243	324
12	114	172	228	113	169	225
14	72	108	144	72	108	144

2X10 (1 ½" X 9 ¼")						
Span L [6] (feet)	Spruce-Pine-Fir [5]			Southern Pine		
	2 ply	3 ply	4 ply	2 ply	3 ply	4 ply
3	1665	2498	3330	2158	3238	4317
4	1249	1873	2498	1426	2139	2852
5	999	1499	1998	913	1369	1825
6	763	1144	1525	634	951	1268
7	560	840	1120	466	698	931
8	429	643	858	357	535	713
9	339	508	678	282	423	563
10	275	412	549	228	342	456
12	191	286	381	158	238	317
14	140	210	280	116	175	233

2X12 (1 ½" X 11 ¼")						
Span L [6] (feet)	Spruce-Pine-Fir [5]			Southern Pine		
	2 ply	3 ply	4 ply	2 ply	3 ply	4 ply
3	2025	3038	4050	2625	3938	5250
4	1519	2278	3038	1969	2953	3938
5	1215	1823	2430	1266	1898	2531
6	1013	1519	2025	879	1318	1756
7	753	1130	1507	646	969	1291
8	577	856	1154	494	742	989
9	456	684	911	391	586	781
10	369	554	738	316	475	633
12	256	385	513	220	330	439
14	188	283	377	161	242	323

Table W-1 Notes:

1. Lumber grade is #2 intended for an in-service moisture content of 19% or less.
2. Deflection is limited to L/360.
3. Load duration factor used in calculations is 1.0.
4. Adequate bearing and lateral support for the member must be provided. Support for the member ends must provide a continuous load path from the bearing to the foundation.
5. Values tabulated are for Spruce-Pine-Fir, not Spruce-Pine-Fir (South). Values tabulated for Southern Pine are based on design values published by the American Wood Council in an addendum to NDS dated March 2013.
6. Span, L, is clear span. Effective span for bending and deflection is clear span plus 3 inches.

Table W-2
FLITCH PLATE BEAM ALLOWABLE LOADS IN POUNDS PER LINEAR FOOT [1,2,3,4,5]

(2) 2x6 with Plate Indicated					
Span (ft.)[6]	Plate Size / (Beam Weight per Foot)				
	¼"x5" Plate (8 lb./ft.)	3/8"x5" Plate (10 lb./ft.)	½"x5" Plate (13 lb./ft.)	5/8"x5" Plate (15 lb./ft.)	¾"x5" Plate (17 lb./ft.)
6'-0"	643	825	1006	1188	1370
7'-0"	473	606	739	873	1006
8'-0"	362	464	566	668	771
9'-0"	272	348	425	502	579
10'-0"	198	254	310	366	422
11'-0"	149	191	233	275	317
12'-0"	115	147	179	212	244

(2) 2x8 with Plate Indicated					
Span(ft.)[6]	Plate Size / (Beam Weight per Foot)				
	¼"x7" Plate (11 lb./ft.)	3/8"x7" Plate (14 lb./ft.)	½"x7" Plate (17 lb./ft.)	5/8"x7" Plate (20 lb./ft.)	¾"x7" Plate (23 lb./ft.)
6'-0"	1150	1499	1849	2199	2549
7'-0"	845	1102	1359	1615	1872
8'-0"	647	843	1040	1237	1434
9'-0"	511	666	822	977	1133
10'-0"	414	540	666	792	917
11'-0"	342	446	550	654	758
12'-0"	287	375	462	550	637
13'-0"	230	300	369	439	509
14'-0"	184	240	296	352	408
15'-0"	150	195	240	286	331
16'-0"	123	161	198	236	273

(2) 2x10 with Plate Indicated					
Span (ft.)	Plate Size / (Beam Weight per Foot)				
	¼"x9" Plate (14 lb./ft.)	3/8"x9" Plate (18 lb./ft.)	½"x9" Plate (22 lb./ft.)	5/8"x9" Plate (26 lb./ft.)	¾"x9" Plate (30 lb./ft.)
6'-0"	1642	2145	2649	3153	3657
7'-0"	1206	1576	1946	2317	2687

8’-0”	923	1207	1490	1774	2057
9’-0”	730	954	1177	1401	1625
10’-0”	591	772	954	1135	1317
11’-0”	488	638	788	938	1088
12’-0”	410	536	662	788	914
13’-0”	350	457	564	672	779
14’-0”	302	394	487	579	672
15’-0”	263	343	424	504	585
16’-0”	231	302	373	443	514
17’-0”	204	267	330	393	456
18’-0”	182	238	294	350	406
19’-0”	155	203	250	298	345
20’-0”	133	174	214	255	296

(2) 2x12 with Plate Indicated					
Span (ft.)	**Plate Size / (Beam Weight per Foot)**				
	¼”x11” Plate (18 lb./ft.)	**3/8”x11” Plate (22 lb./ft.)**	**½”x11” Plate (27 lb./ft.)**	**5/8”x11” Plate (32 lb./ft.)**	**¾”x11” Plate (36 lb./ft.)**
6’-0”	2297	3006	3715	4425	5134
7’-0”	1688	2209	2730	3251	3772
8’-0”	1292	1691	2090	2489	2888
9’-0”	1021	1336	1651	1966	2282
10’-0”	827	1082	1338	1593	1848
11’-0”	683	894	1105	1316	1527
12’-0”	574	752	929	1106	1283
13’-0”	489	640	791	943	1094
14’-0”	422	552	682	813	943
15’-0”	367	481	594	708	821
16’-0”	323	423	522	622	722
17’-0”	286	374	463	551	639
18’-0”	255	334	413	492	570
19’-0”	229	300	371	441	512
20’-0”	207	271	334	398	462
21’-0”	188	245	303	361	419
22’-0”	171	224	276	329	382
23’-0”	156	205	253	301	349
24’-0”	140	183	226	269	312

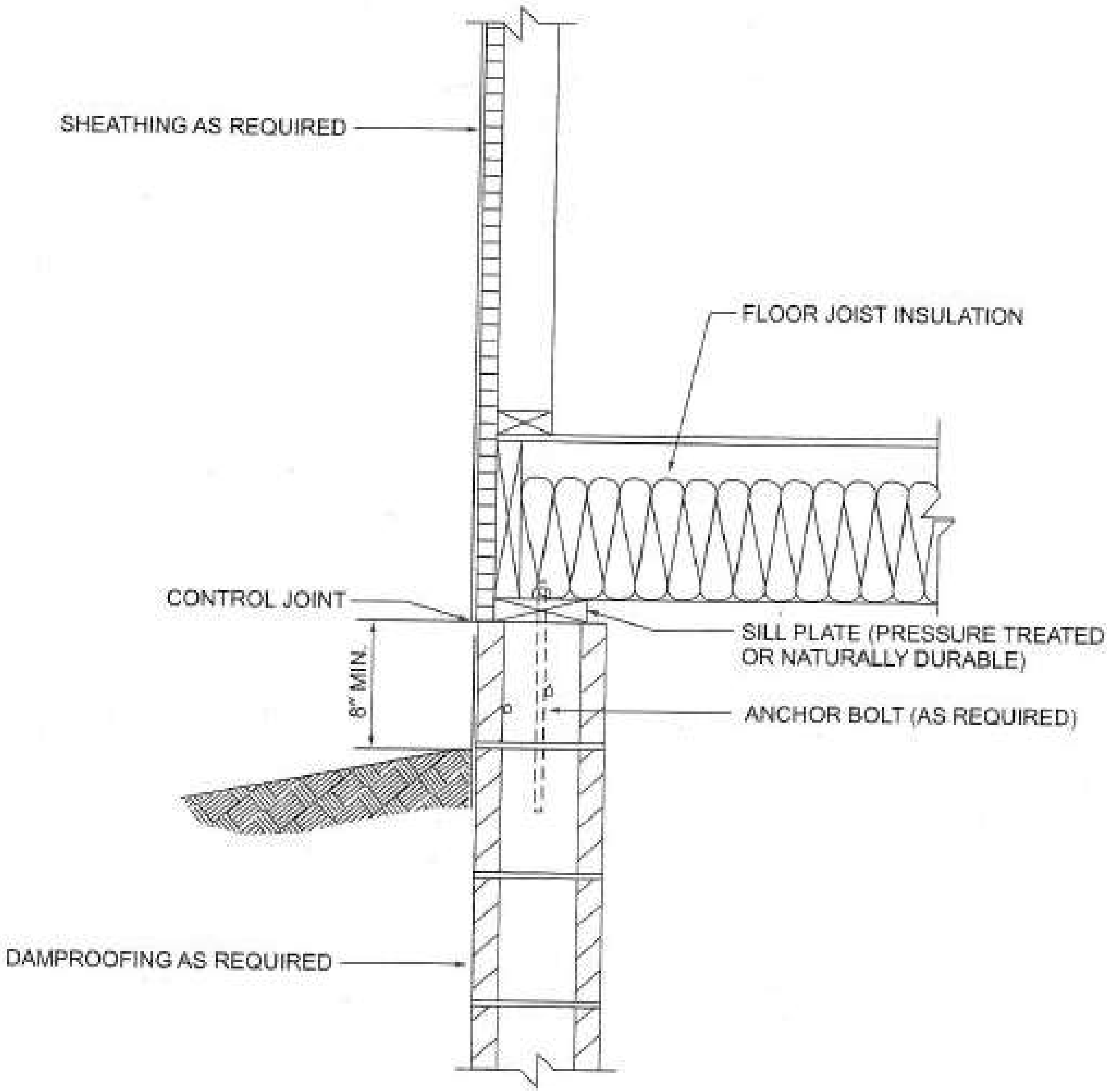
Table W-2 Notes

1. Lumber species and grade is #2 Southern Pine intended for an in-service moisture content of 19% or less. Design values used were published by the American Wood Council in an addendum to NDS dated March 2013. For Spruce-Pine-Fir lumber using the tabulated flitch plate allowable loads will be slightly conservative.
2. Tabulated values are based on ASTM A36 structural steel plate.
3. Deflection is limited to L/360.
4. Load duration factor used in calculations is 1.0.
5. Adequate bearing and lateral support for the member must be provided. Support for the member ends must provide a continuous load path from the bearing to the foundation.

Span, L, is center to center of supports. Wood side plates and steel flitch plates shall be continuous throughout the span.

APPENDIX NC-D
<u>FOAM PLASTIC DIAGRAMS</u>

This appendix is a North Carolina addition to the 2021 International Residential Code.
There will be no underlined text.
(The provisions contained in this appendix are adopted as part of this code.)



<u>FIGURE NCD-1</u>
<u>Foundation Wall</u>

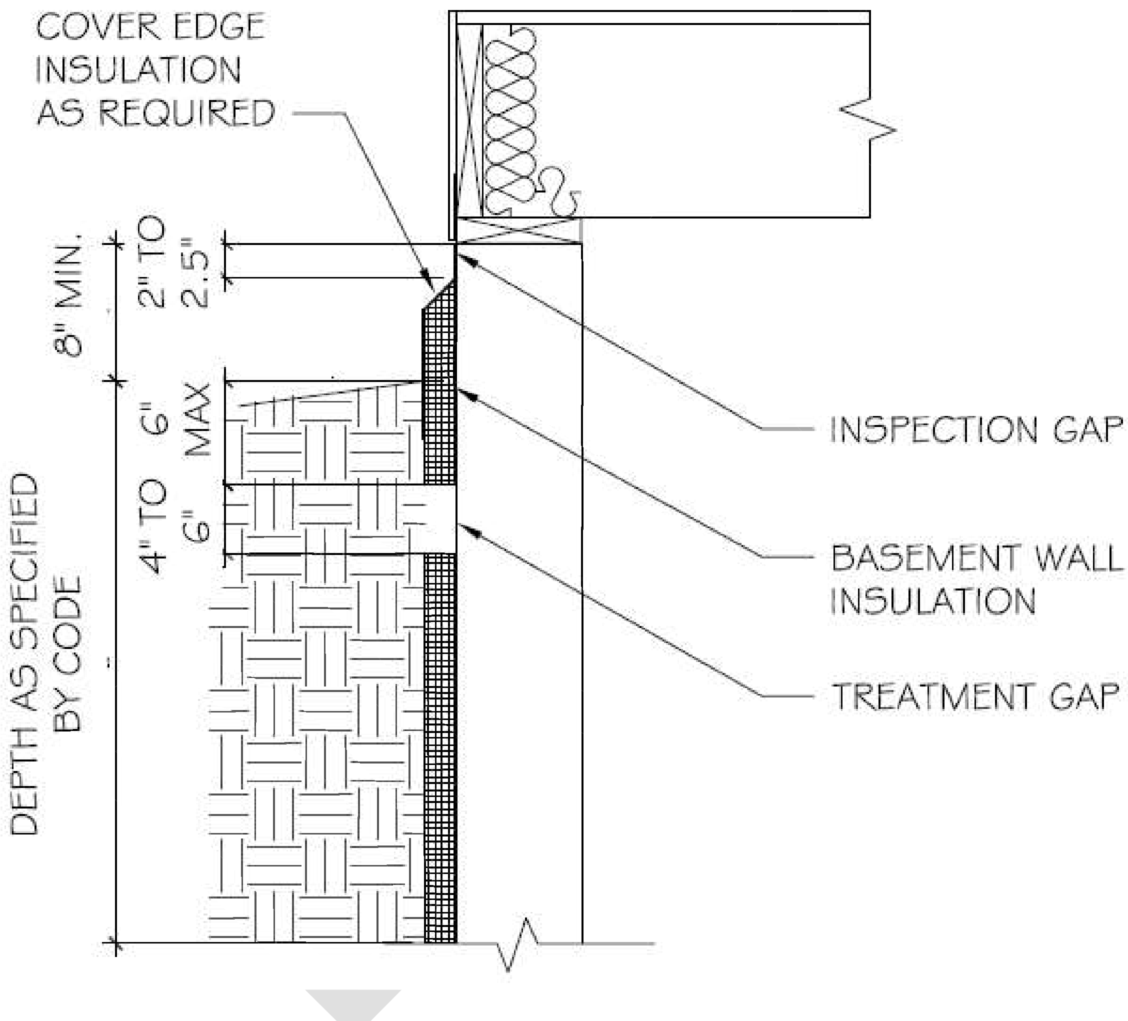
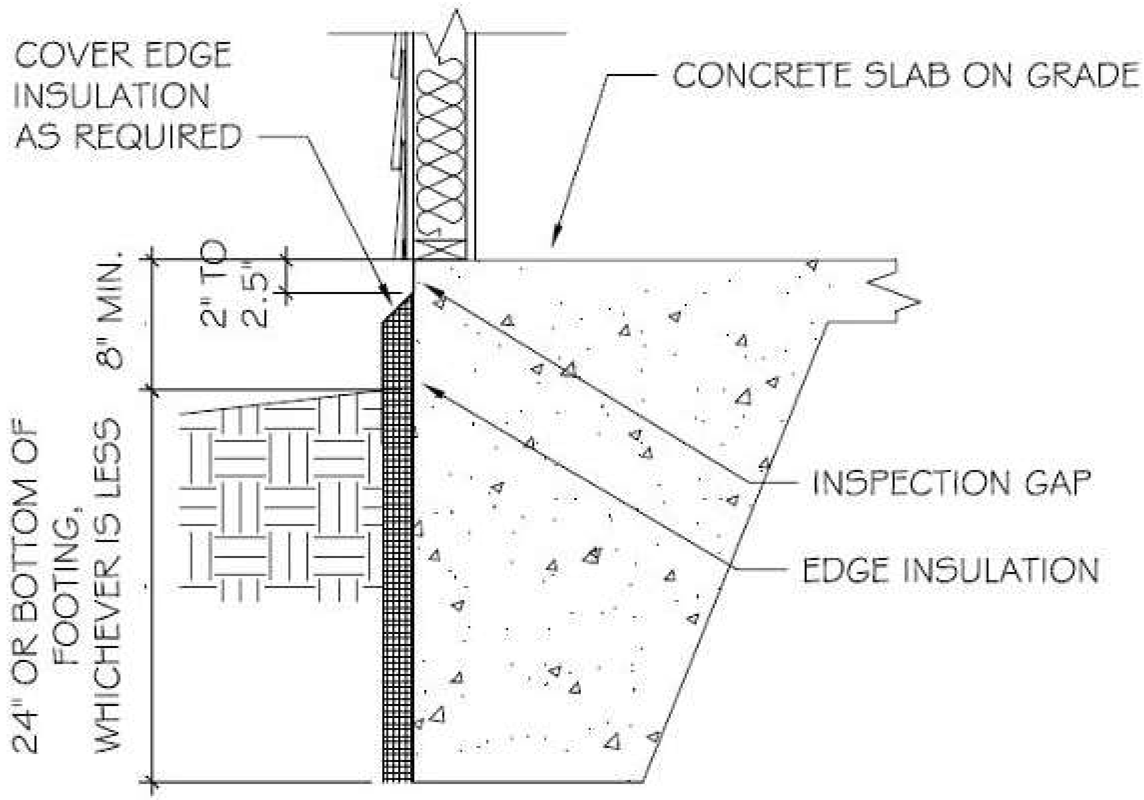


FIGURE NCD-2
BASEMENT WALL

N1102.2.9 Basement walls with exterior foam insulation. Insulation illustrations – Section view of exterior foam insulation location for basement walls (Includes detailing from N1102.2.11)



SECTION VIEW OF MONOLITHIC SLAB-ON-GRADE INSULATION

FIGURE NCD-3
FRAME WALL

N1102.2.10 Slab insulation details. Insulation illustrations

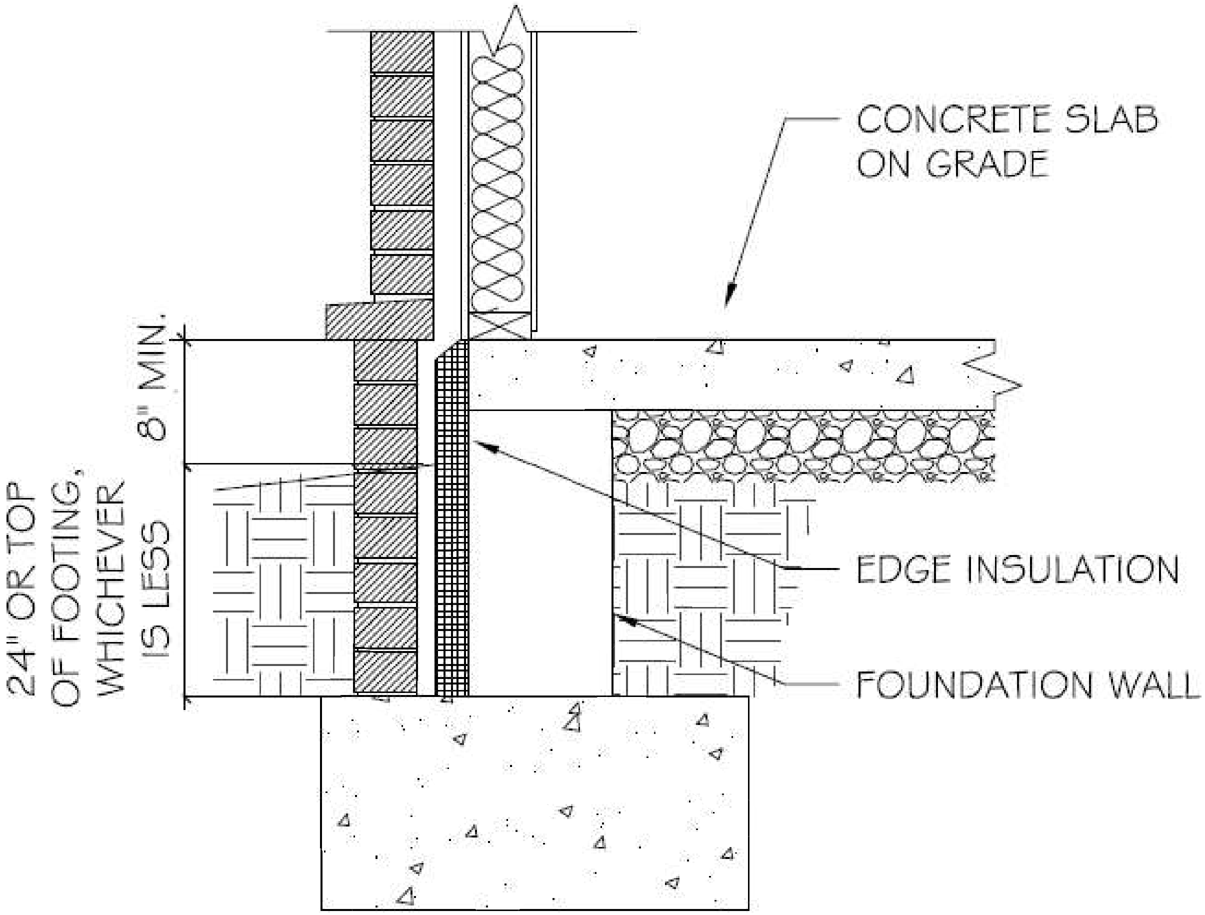


FIGURE NCD-4
FRAME WALL

N1102.2.10 Slab insulation details. Insulation illustrations - Example for slab edge insulation location behind brick, stone, or masonry facing (Other options may also compliant)

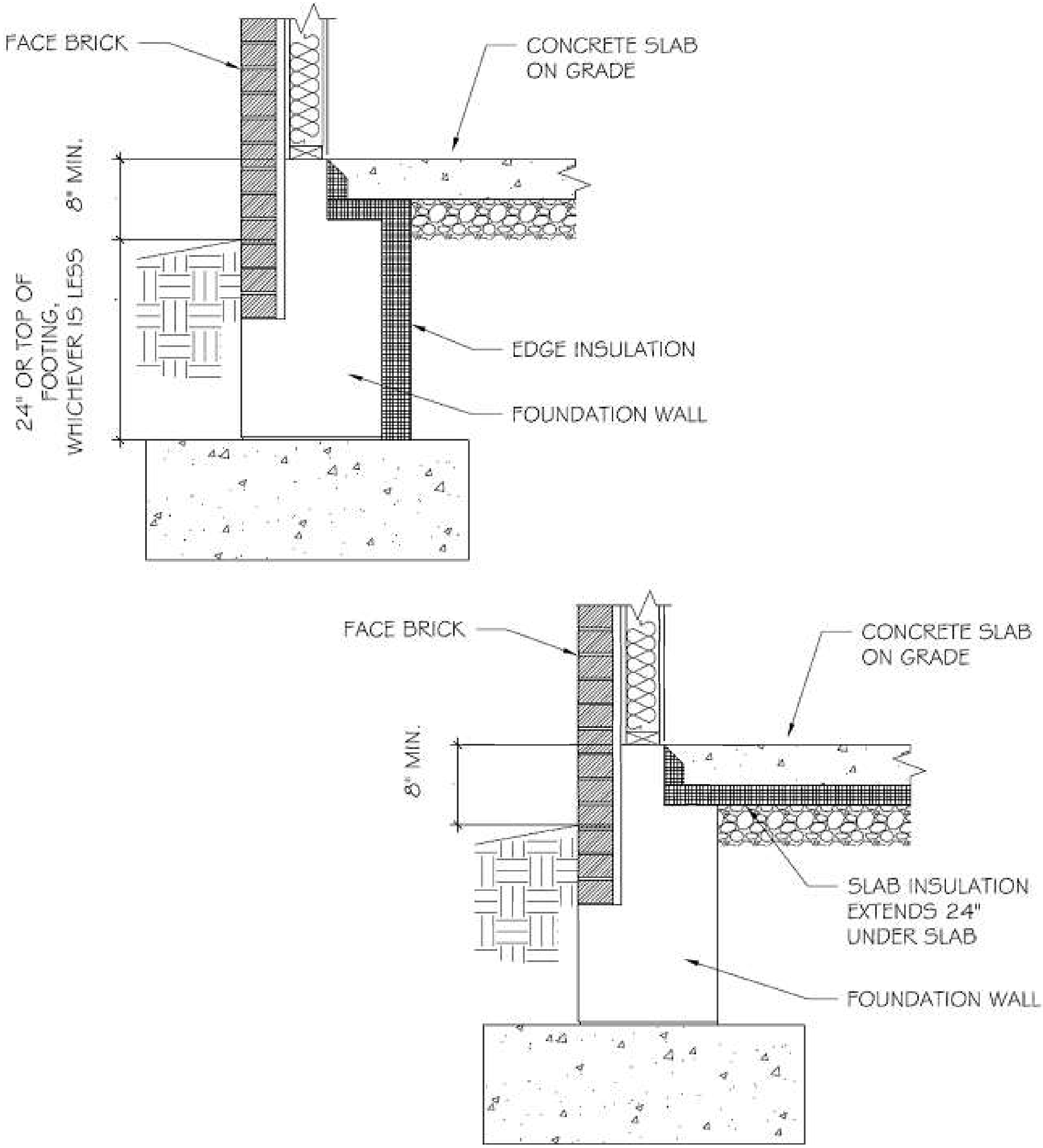


Figure NCD-5
Frame Wall

N1102.2.10 Slab insulation details. Insulation illustrations – Examples for slab insulation location for floating slab with stem wall